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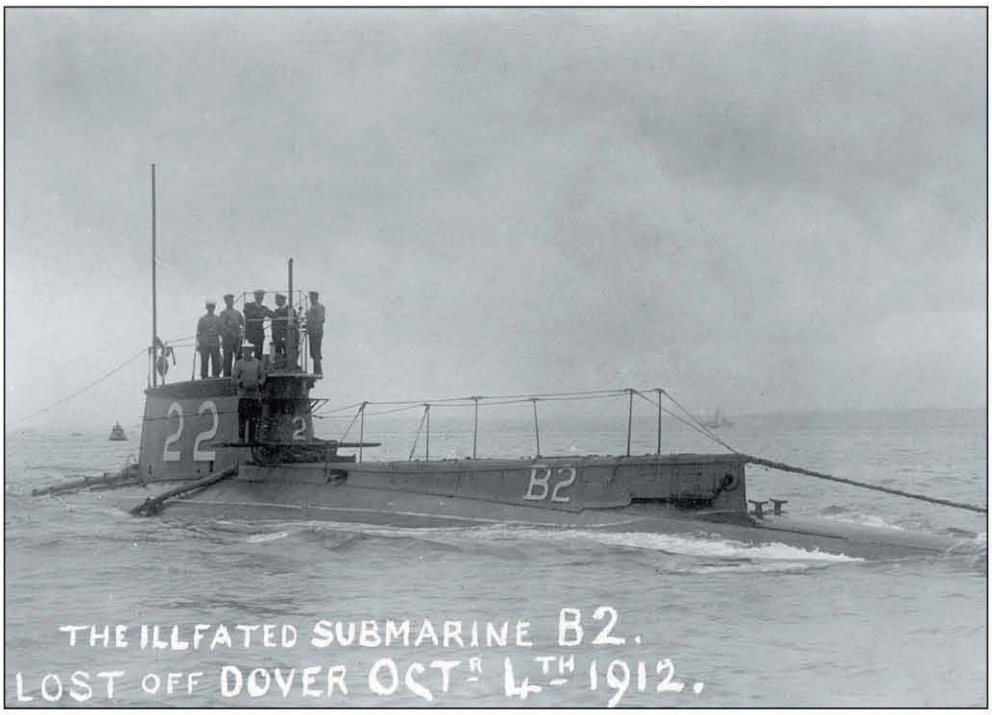
Archaeological Services in Relation to Marine Designation

HMS B2

Archaeological Report



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ARCHAEOLOGICAL SERVICES IN RELATION TO MARINE DESIGNATION

HMS *B2*
DOVER APPROACHES

ARCHAEOLOGICAL REPORT

Prepared for:
English Heritage

Prepared by:
Wessex Archaeology
Portway House,
Old Sarum Park
Salisbury
WILTSHIRE
SP4 6EB

www.wessexarch.co.uk

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DISCLAIMER

HMS *B2*
Dover Approaches

ARCHAEOLOGICAL REPORT

Contents

Figures

HMS *B2*
Dover Approaches

ARCHAEOLOGICAL REPORT

Summary

Wessex Archaeology was commissioned by English Heritage (EH) to undertake an Undesignated Site Assessment of the wreck site of HMS *B2*, lost off Dover on 4th October 1912. The work was undertaken as part of the Heritage at Risk (HAR) contract for archaeological services in relation to marine designation.

The assessment of the site was undertaken as part of a two stage investigation. Stage one consisted of a geophysical survey and stage two consisted of a diver survey of the site.

The geophysical survey aimed to locate the wreck and inform the diving investigation, whilst the diving investigation resulted in a video survey of the wreck site. The survey informed an assessment of the state and conditions of the submarine, a measured plan of the remains and the identification of prominent features.

The site has been assessed against the non-statutory criteria for scheduling and recommended for designation. HMS *B2* is the last surviving example of B-Class and it was observed as being in good condition although evidence of anthropogenic disturbance by trawlers and possibly unauthorised salvage was found.

Risk is assessed as medium. The risk to the site is principally associated with the lack of protection, which leaves the site exposed to impacts such as trawling, and potentially unauthorised salvage activities. Natural and irreversible decay is also expected, but does not constitute an urgent threat.

No management actions are recommended although it is advised that informal monitoring reporting and activities by local divers/groups are encouraged in order to reduce the risk of unauthorised salvage and monitor the site's evolution.

HMS *B2*
Dover Approaches

ARCHAEOLOGICAL REPORT

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The investigation was commissioned by English Heritage, and the assistance provided by Mark Dunkley, Terence Newman and Alison James of English Heritage is gratefully acknowledged.

Wessex archaeology is also grateful for the information and assistance provided by:

- George Malcolmson, archive officer at the Royal Navy Submarine Museum in Portsmouth
- Stephen Courtney, curator of images at National Museum of the Royal Navy in Portsmouth

Fieldwork was carried out by a Wessex Archaeology team comprising Graham Scott, Andrea Hamel, Peta Knott, Michael Murray and Paolo Croce. Graham Scott supervised the diving. Paolo Croce supervised the fieldwork. David Howell and Rachel Chester (both Wessex Archaeology) carried out the acquisition and interpretation of geophysical data.

This report was compiled by Paolo Croce, with assistance from other members of the dive team. Dave Howell provided additional advice concerning the Stage 1 and 2 geophysical data interpretation and Will Foster prepared the illustrations. The project was managed for Wessex Archaeology by Toby Gane, who also carried out quality assurance.

HMS *B2*
Dover Approaches

ARCHAEOLOGICAL REPORT

1 INTRODUCTION

1.1 Assessment Background

1.1.1 Wessex Archaeology was commissioned by English Heritage (EH) to undertake an Undesignated Site Assessment of the wreck site of the HMS *B2* (UKHO wreck No. 15080), located *c.* 5 nautical miles (9.3km) E of Dover Harbour. The wreck is charted as that of the British B-Class Coastal Defence Submarine *B2*, and is recorded as being lost on the 4th October 1912 after being struck by the liner SS *Amerika* in the Straits of Dover.

1.1.2 The work was undertaken as part of the Heritage at Risk (HAR) Contract for archaeological services in relation to Marine Designation and consisted of a geophysical survey, diving survey and associated archaeological assessment of the wreck site.

1.1.3 The work was conducted in accordance with a written brief and agreed scope of work (EH 2013).

2 ASSESSMENT AIMS AND OBJECTIVES

2.1.1 The overall aim of the project was to carry out an undesignated site assessment. This was broken down into the following primary and secondary objectives (EH 2014):

Primary Objectives

- Contact the Receiver of Wreck to gain a list of droits relating to the site;
- Obtain documentary evidence of the HMS *B2*;
- Undertake geophysical survey (side-scan & magnetometer only) to assess the presence/absence of heritage assets, and to establish extent, stability and character;
- Undertake a diver survey of the exposed remains. Confirm position, extent, stability and character (plotted by tracked diver survey) of the site;
- Locate and accurately position (plotted by tracked diver survey and probing as appropriate) any additional archaeological material;
- Produce a structured record of field observations; preferably including a photographic record of the site and a basic site plan. Key artefacts are to be subject to detailed examination and recording (position by tracked diver survey, taped measurements, photographs and video and written database entries);

Secondary Objectives

- Supplement the recording of the core of the site by recording profiles across the main axis of the site;
- Establish links with local divers, dive groups and skippers to enable future site management options.

2.1.2 The level of site investigation required by English Heritage was defined using WA's proprietary Level of Recording system. A Level 3a approach was requested (diagnostic). This approach requires a detailed record to be taken of selected elements of the site.

3 METHODOLOGY

3.1 General

3.1.1 All fieldwork procedures and standards complied with the relevant guidance produced by the Chartered Institute for Archaeologists (CIfA) including: *Standard and Guidance for nautical archaeological recording and reconstruction*, *Standard and Guidance for the archaeological investigation and recording of standing buildings* or structures.

3.2 Stage 1: Geophysical Survey

3.2.1 The geophysical data acquired consisted of sidescan sonar and marine magnetometer data acquired by WA during July 2014 using the survey vessel MV *Assassin*. The data were acquired as part of a survey program which also included the acquisition of geophysical data at the site of the wreck of the submarine *UB-31*, located off Folkestone (WA report ref. 83803.33).

3.2.2 A survey area comprised a 200m by 200m box was centred on the recorded location. Main survey lines were orientated NE-SW into the tide to minimise layback errors due to the strong tidal currents over the Site. Cross lines were orientated NW-SE (**Figure 1**).

Geophysical Data – Technical Specifications

3.2.3 The sidescan sonar data were acquired using a Klein 3900 system. The system was operated at 445kHz with a range of 40m per channel. An initial line spacing of 30m was used, with additional lines run if necessary to provide full data coverage. Towfish positioning information was provided by manual layback during processing. Data was recorded digitally using SonarPro software as *.xtf* files.

3.2.4 The marine magnetometer data were acquired using a Geometrics G-882 Caesium Vapour magnetometer operating at a frequency of 10Hz, towed directly behind the sidescan sonar fish on a 10m cable. The data was digitally logged in Geometrics MagLog Lite software as *.GEOMAG* files, and later converted to *.txt* files for processing and interpretation.

3.2.5 Positioning for the survey was provided by a Hemisphere R131 DGPS Receiver system, with the navigation data recorded using HyPack navigation software. All positions for the survey were recorded and expressed as WGS84 UTM31N.

Geophysical Data – Data Quality

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

Data Quality	Description
Good	Data which are clear and unaffected by weather conditions or sea state. The dataset is suitable for the interpretation of standing and partially buried metal wrecks and their character and associated debris field. These data also provide the highest chance of identifying wooden wrecks and debris.
Average	Data which are affected by weather conditions and sea state to a slight or moderate degree. The dataset is suitable for the identification and partial interpretation of standing and partially buried metal wrecks, and the larger elements of their debris fields. Wooden wrecks may be visible in the data, but

	their identification as such is likely to be difficult.
Variable	This category contains datasets with the quality of individual lines ranging from good to average to below average. The dataset is suitable for the identification of standing and some partially buried metal wrecks. Detailed interpretation of the wrecks and debris field is likely to be problematic. Wooden wrecks are unlikely to be identified.

Table 2: Criteria for assigning data quality rating

3.2.7 The sidescan sonar data have been rated as "Average" using the above criteria. Some snatching due to tidal currents and weather are visible within the data, but does not detrimentally affect the data to a large degree. The positioning accuracy of the sonar towfish was relatively poor due to a combination of strong tidal currents experienced during the survey and the length of towed cable used (itself a function of water depth and current strength). However, these positioning errors were rectified during data processing.

3.2.8 The marine magnetometer data have been rated as "Good" using the above criteria. The data were clear with very little spiking or background noise, however, some of the positioning uncertainties affecting the sidescan sonar also applied to the marine magnetometer. Again, these were rectified during processing.

Geophysical Data – Processing

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

3.2.10 A mosaic of the sidescan sonar data is produced during this process to assess the quality of the sonar towfish positioning. The survey lines are smoothed, and the navigation corrected by applying individual fixed laybacks as recorded during the survey. This allows the position of anomalies to be checked between different survey lines and for the layback values to be further refined if necessary.

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

3.2.12 The magnetometer data were processed using Geometrics MagPick software in order to identify any discrete magnetic contacts which could represent buried metallic debris or structures. The software enables both the visualisation of individual lines of data and gridding of data to produce a magnetic anomaly map.

3.2.13 The data were loaded into MagPick and laybacks added as with the sidescan sonar data. The data were then smoothed, a trend fitted to the results, and then the trend values subtracted from the smoothed values. This was carried out in an attempt to remove natural variations in the data (such as diurnal variation in magnetic field strength and changes in geology). The processed data were then gridded to produce a map of magnetic anomalies, and individual anomalies tagged and images taken in a similar process to that undertaken for the sidescan sonar data.

3.2.14 The form and size of a magnetic anomaly is a guide to its potential to be an anthropogenic feature. Generally single magnetic amplitudes of over 5nT identified along a short distance are interpreted to be of anthropogenic origin.

Geophysical Data – Anomaly Grouping and Discrimination

3.2.15 The previous section describes the initial interpretation of all available geophysical data sets. This inevitably leads to the possibility of any one object being the cause of numerous anomalies in different data sets and apparently overstating the number of archaeological features around the wreck sites.

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

3.2.17 Once all the geophysical anomalies have been grouped, a discrimination flag is added to the record in order to discriminate against those which are not thought to be of an archaeological concern. These flags are ascribed as follows:

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

Table 3: Criteria for discriminating archaeological importance of features

3.2.18 All the anomalies that have been identified from around the wreck sites are presented in **Appendix I** and discussed in this report.

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

3.3 Stage 2: Diving Survey

3.3.1 WA's Surface Supplied Dive (SSD) team was deployed from MV *Assassin*; a 30 ton/13m MCA coded workboat, operating out of Dover Harbour. A two anchor point system was used to position the vessel on site. The US Navy Standard Air Decompression Tables (Rev. 6) and associated diving procedures were used.

3.3.2 All diving operations complied with the Diving at Work Regulations 1997 and the associated Scientific and Archaeological Approved Code of Practice (ACOP). Diving operations were conducted during daylight hours only, on a single shift system by a four person team. Since the site is located in the proximity of the Dover-Calais ferry route a notice to Mariners was issued by Dover Harbour Commissioners.

3.3.3 The survey methods employed on site consisted of general and close visual inspection with integrated on-site recording, acoustic tracking and video survey. The video system consisted of a helmet mounted single chip Colourwatch Digital Inspection Camera recording onto MiniDV tape and housed video and still photography. Light levels were limited and therefore a helmet mounted light and two LED torches were carried.

3.3.4 The survey was recorded in DIVA, WA's proprietary MS Access recording database. All diver descriptions, still and video photography and tape measurements of archaeological and environmental features and operational events are recorded in the database as 'Observation Points' and linked to positions shown in the ArcGIS interface in positions generated using the USBL system. The system works as both a real time and post-dive recording system..

3.3.5 The SSS tiled image produced during Stage 1 was used as a background map for the driver tracking display to navigate the diver around the site. Positions for all environmental and archaeological features and dive events recorded during the survey and navigational information for the divers were generated using USBL acoustic positioning system (internal instruments) and Hemisphere R101 dGPS system, linked to DIVA database. The position data recorded has been used to improve the positioning of the SSS mosaic and provide an accurate averaged site position.

3.3.6 Video photography used a helmet-mounted Colourwatch Inspection Camera, a low light sensitive umbilical system and housed HD video cameras, including a GoPro system. Although the diver carried both helmet mounted and hand held lights, the ambient light was generally sufficient for inspection.

3.3.7 All archaeological material located was recorded using video, together with selected measurements. Positions were recorded using the USBL system and/or by distance and bearing to a shot position.

3.3.8 Post-survey all observations were compared with a copy of the original manufacturer's drawings and historical photographs for identification of the significant features and evaluation of the condition and processes affecting the wreck.

3.3.9 Video footage of the wreck supplied to WA by Canterbury Divers was used to inform the survey.

Existing data

3.3.10 The Royal Navy Submarine Museum (RNSM) had been contacted prior to the operation and plans and photographs relating to the submarine had been obtained in order to inform the survey.

3.3.11 Other sources used to inform the investigation prior to the diving survey included:

- UKHO record
- NRHE monument report (901840)
- Historical photographs
- Historical newspapers
- Dive guides and other secondary sources
- Avocational divers reports

4 RESULTS

4.1 Summary of Progress against Objectives

Primary Objectives	Progress
Contact the Receiver of Wreck to gain a list of droits relating to the site.	Contacted by email on 22nd August 2014. No reply received at time of writing.
Undertake a diver survey of the site	Partly achieved, a visual inspection was carried out on the conning tower, amidships, bows and starboard side of the sub. Material for the stern and propeller was acquired from different sources.
Locate any additional material	Partly achieved. Geophysical survey identified eight anomalies of archaeological interest. **7003** was positively identified and positioned through diver tracking. There is evidence of buried material both on the port side and starboard side although the nature of the debris in close proximity to the site is not fully understood.
Produce a structured record of field observations	Achieved.
Additional objective: Review the site against the non-statutory criteria for scheduling under the Ancient Monuments and Archaeological Areas Act 1979.	Achieved.
Secondary Objectives	**Progress**
Assess the likely depth of deposit	Achieved. The survey ascertained that the submarine is situated within a sand bank area and is partly buried towards the stern .The submarine appears to be well exposed at the bows and the propeller is visible. A large scour is visible on both sides exposing the underlying bedrock at some points.
Record profiles across the site	Partly achieved. Profiles of the starboard side and bow were carried out.
Record pH values at seabed level	Not achieved

Table 4: Summary of Progress Against Objectives

4.2 Geophysical Survey Results

4.2.1 A total of 26 sidescan sonar and 12 magnetic anomalies were identified within the geophysical data. Following the grouping and discrimination procedure outlined in **Section 3.2**, these were grouped to produce a list of 8 sites of potential archaeological interest within the Study Area which were characterised as follows:

Archaeological Discrimination	Number of Anomalies	Interpretation
A1	2	Anthropogenic origin of archaeological interest
A2	6	Uncertain origin of possible archaeological interest
Total	**8**	

Table 5: Geophysical anomalies of potential archaeological interest within the Study Area

4.2.2 The wreck of HMS *B2* is located in approximately 26m depth LAT (Lowest Astronomical Tide of water and has been identified at the recorded UKHO position. The main body of the wreck (**7002**) appears relatively intact and upright, and has been found orientated approximately NNW-SSE and measuring approximately 45.9m by 5.9m by 3.4m (**Fig 1** and **Fig 2**). Subsequent diver survey has indicated that the bow is located to the SE. A large shadow in the centre suggested the conning tower is intact and in place, the location of which is used here as the position of the wreck. The section aft of the conning tower appeared partially buried, although the stern of the ship was visible suggesting the fins, hydroplanes and rudder, are still in place (**Sheet 1**). The wreck is associated with a very large (14655nT) magnetic anomaly.

4.2.3 The wreck is situated within an extensive area of mobile seabed sediment, reported by the BGS as sand between 1m and 10m thick (BGS 1990) and characterised by sand ripples. However, the main wreck structure is located within a large, distinct scour, which extends to the NE and SW from both sides of the wreck (**Fig 3**), presumably along the dominant tide direction of the area. This thick deposit of mobile sand in the vicinity of the structure indicates it is likely to be periodically buried, although the height of the centre of the wreck suggests complete burial is less likely.

4.2.4 Since the wreck structure appears generally intact, relatively little debris has been identified within the vicinity. A small piece of debris (**7003**) has been identified within the seabed scour approximately 3m NE of the centre of the wreck. From the subsequent diver footage, this appears to be a piece of metal debris associated with the wreck. A further small, linear anomaly, interpreted as possible partially buried debris, (**7000**) has also been identified approximately 35m NW of the stern of the wreck.

4.2.5 Anomalies **7004**, **7006** and **7007** are all interpreted as dark reflectors, and are individual features without associated magnetic anomalies that are uncertain in nature. These could either be small pieces of debris, or natural features such as boulders.

4.2.6 Anomalies **7001** and **7005** are magnetic anomalies of 37nT and 58nT amplitude respectively, identified without any associated sidescan sonar contact. These are possibly pieces of buried ferrous debris, which are likely to be covered by the mobile sediment identified within the area. Due to this mobile sediment, it is also possible that other pieces of currently unidentified debris are buried within the vicinity of the wreck.

4.3 Data Audit

4.3.1 The NRHE records for monuments no. 1452602 and 901840 were accessed through PastScape[1] in August 2014. The record for the possible remains of HMS *B2* (901840) is *c.* 2.7 nautical miles NNE to the Site confirmed during diving operations and can be now rejected as the location of the submarine. Record no. 1452602 is the loss record. There is no NRHE record at the confirmed wreck location.

[1] www. www.pastscape.org.uk

4.3.2 The location for HMS *B2* in the UKHO record (wreck No. 15080) was confirmed as correct. The record also mentions that in 1994 a magnetic anomaly possibly associated with wreck's debris field was detected at 220 degrees at a distance of 32m and the presence of the anomaly has been confirmed by WA's geophysical survey (**7004)**.

4.3.3 The UKHO record also reports that bow, stern and conning tower were found exposed in 2005. The conning tower hatch is mentioned as "easy to open" and the control room sanded up. Also the submarine is reported as clear from nets and very clean and little growth. A diver report mentions that the submarine was filled with sand forward of the conning tower: "as if it was sitting on a sandy beach and some children have tried to bury it forward of the conning tower" (Young 2003: 275). WA's survey demonstrated that the site conditions have since changed.

4.3.4 The wreck site was identified as the HMS *B2* in 1999 (McCartney 2002). Wessex Archaeology believes this identification to be correct because the dimensions and general arrangement of the submarine's features closely match those illustrated in the original plans and historical photographs for the B-class. Also, the wreck location is broadly consistent with the well documented location reported for the loss, 4 miles NE of Dover.

4.3.5 The bronze propeller was located in August 2014 by divers from BSAC 510 (Folkestone) and BSAC 326 (Canterbury Divers) and appears to be exposed, still *in situ* and in very good conditions. The diver's reported that the propeller and rudder device were in an excellent state of preservation (Bryan Robinson pers..comm.) and this might indicate that they had been buried until recently.

4.3.6 Innes McCartney undertook a survey of HMS *B2* in August 2014 and photographs of HMS *B2*, including the propeller, are available - at the time of writing - online on a social media account[2].

4.4 Site position

4.4.1 The site is located approximately 5 nautical miles due east of Dover Harbour (**Fig 1**) and the conning tower coordinates are:

SITE CO-ORDINATES WGS 84			
UTM z31N		**DDM**	
Easting	392214 E	**Lat.**	51°07'.151
Northing	5664206 N	**Long.**	001°27'.596

Table 1: Coordinates of the Conning Tower

4.5 Operational Summary

4.5.1 A total of two dives were undertaken on 5th August 2014. Good weather conditions allowed the operations to be carried with no disruption, achieving a total of 31 minutes of bottom time at maximum depth of 33m (**Appendix II**). Visibility was good ranging from 3m up to 5m.

4.5.2 The survey was carried out as follows:

- The wreck was located and subject to general visual inspection to establish its extent, character and survival. Visibility was good (*c.* 3-5 m) and although some particulate

[2] https://www.facebook.com/innes.mccartney?fref=ts

was present in the water column the quality of the video captured is average/good, meaning that features are generally recognisable and the overall arrangement of the wreck discernible.

- The limited operational time available due to slack water windows resulted in the prioritisation of the inspection to the areas of the conning tower, the starboard side, mid-ship and the bows. Particular attention was dedicated to the documentation of areas of decay and identification of missing features.

- The survey was non-intrusive and no finds were moved or recovered. Some fishing nets were partly removed in order to allow access to features that would otherwise have been obscured. Entry through the conning tower was not attempted.

4.5.3 The wreck is open for diver penetration but penetration was not attempted during the survey due to safety considerations.

4.6 Seabed and Ecology

4.6.1 The seabed consists of exposed chalk bedrock (**Plate 1**) and derived chalk gravel and cobbles interspersed with large patches of gravelly sand, shells and sedimentary rock fragments. Around the wreck deposits of well sorted middle grained sand build up against the site. Scouring is visible on the portside particularly at the bow where the structure appears to be undercut whilst the section towards the stern immediately aft the coning tower is covered by sandy substrate of several centimetres. The propeller and steering mechanism are exposed.

4.6.2 The seabed appears to be characterised by regularly spaced sand ripples elongated in the SE to NW direction. At the time of the survey the overall sediment transport appeared to follow the NE-SW orientation.

4.6.3 Although the site acts like an artificial reef and a habitat for different species of animals the wreck is almost clear of marine growth, with the exception of some soft corals. Fishes, crabs, lobsters and starfish were observed by the divers.

4.7 Archaeological Results

General description

4.7.1 The wreck appears to be in good condition showing a continuous structure with the hull fairly intact. The boat lies relatively upright on the seabed listing *c*. 30 degrees to starboard. The hull stands out *c*. 1.5m from the seabed with the conning tower rising a further *c*. 2m above the deck. The stern and bow are exposed even though the section aft of the conning tower is covered by *c*. 100mm of sand amassed against the structure.

4.7.2 From the conning tower to the bow the wreck is *c*. 21 m long. As might be expected on an exposed site, large amounts of the deck plating and the upper casing has corroded and, together with many of the deck fixtures and fittings, is now missing.

4.7.3 At the time of the survey the submarine was draped by nets aft and forward of the conning tower that hid some of its features and further netting was found all around the site, but particularly on the portside. Even though some nets were lifted to reveal the features underneath no attempt to remove the bulk of the nets was made. The likelihood of debris associated with HMS *B2* wrapped in the netting around the wreck is very high.

4.7.4 For clarity the following paragraphs that outline the data gathered during the diving inspection are divided into six separate sections: bow, forward section, conning tower, aft section and stern.

Bow

4.7.5 At the time of the survey the bow was clear of sand and was undercut by scouring.

4.7.6 The bow appears to be exposed with the height of the hull at the bow section noted to be well over 2m. A hole on the upper part of the port side of the bow shows the operating crankshaft for the port side torpedo muzzle door (**Fig 5c, WA1205**). The opening is quite regular and measures *c.* 350mm in diameter. It shows a possible concreted external hinge or pad eye.

4.7.7 By peering into the opening, the space visible inside the pressure hull was observed to be filled almost completely with sediment.

Forward section

4.7.8 From the bow towards the conning tower the submarine hull is mostly intact although one section shows signs of damage with the casing appearing to be ripped open on top. It is possible that this is the location where the SS *Amerika* hit the submarine at the time of its sinking, confirming the contemporary description of the incident reported in the newspapers of the time. Associated debris was found partly buried on the port side.

4.7.9 Immediately aft of the bow are the forecastle pad eyes where the rigging was attached. Proceeding towards the conning tower, two large paired L shaped chocks run along the hull (**Fig 5c, WA1201**). From this point up to the damaged area before the conning tower the port side is upstanding (*c.* 2m) from the seabed and clear from marine growth or debris apart from some small strands of net.

4.7.10 On the starboard side some debris is visible. The nature of this debris is currently unclear but it is possible that is part of the upper casing re-deposited onto the seabed. Also visible and of uncertain identification is a cylindrical hollow feature, possibly part of a winch mechanism or a bollard.

4.7.11 Following the deck in a northerly direction towards the conning tower, the forward torpedo loading hatch is visible (**Fig 5c, WA1196**). The hatch is closed and in good condition. Associated with the hatch are two curved features that rise on the starboard side. It is likely that they were either hooks used during loading operations or hatch hinges.

4.7.12 Aft of the hatch a section of upper casing seems to have retained its position and shape (**Fig 5c, WA1195**). This might be particularly significant as it has been suggested that the B-class boats were the first submarines to be fitted with deck casings (Hool & Nutter, 2013) although this fact is not mentioned by any other sources. From this point on to the conning tower the foredeck is covered by netting and appears to be broken up.

4.7.13 On the port side at an approximate distance of 3m from the conning tower some flat plates protrude out of the seabed. They are entangled with nets and appear to be disconnected from the main body of the wreck. On closer inspection the plating seems to be attached together with a T-shaped support and shows some ribbing at the base. The feature's shape, dimension and location suggest the identification with a section of upper casing re-deposited from its original position.

4.7.14 Back towards the hull, close to the conning tower, is a small grate (**Fig 5c, WA1143**). The grate seems to be still *in situ* and therefore located on the side of the hull below the deck casing. A small flap and a rectangular opening are in the hull not far from the grating.

4.7.15 Approximately 4m forward of the conning tower a large amount of rolled netting hangs towards the portside. More netting hides two deck fittings just in front of the conning tower (**Fig 5c, WA1170**). The net closest to the conning tower was partly removed and some thick flat plate was revealed standing upright underneath it. This feature is not identified although its position would be consistent with the fore hydroplanes (also called conning tower planes) that are shown in the historical photographs. If this feature is identified as the fore hydroplanes it would be a significant find as these were first introduced in the B-Class (Akermann 1989). During the removal of one of the heaps of netting a modern ratchet strap lever was found trapped in the mesh of the net. Removing the nets also revealed a wedge shaped area of damage that is located in a position that corresponds to the one recorded in the contemporary accounts of the HMS *B2* accident.

4.7.16 A circular hole is located just forward to the conning tower. The purpose of the hole is not clear and it could be either due to corrosion, or it could be the slot for one of the deck fixtures.

4.7.17 Twisted metal debris corresponding with anomaly **7003** was found *c.* 3m NE of the conning tower **(Plate 3, WA1142)**.

Conning Tower

4.7.18 With its truncated conical shape the conning tower constitutes the most prominent feature of the wreck (**Fig 5c, WA1161**). It rises *c.* 2m from the foredeck and it lies at an angle, approximately 30 degrees to starboard. Its condition is notable and the conical hatchway connected to the pressure hull still retains its shape although the outer plating is missing and appears to have corroded away.

4.7.19 The conning tower upper hatch is open and the hatch door is *in situ* hinged towards the port side **(Fig 5c, WA1103)**. Concreted to the door there are two curved metal rods that form a semi-circular section above the conning tower entrance. The nature of these features around the tower is unclear but it is possible that they acted as a safety parapet around the submarine exit (**Fig 5c, WA1038**).

4.7.20 Divers reported the control room as being silted up with sand (Young & Armstrong, 2003). On top of the conning tower, in a forward and slightly starboard position, stands a pipe-like feature *c.* 0.5m long and 0.2m in diameter which is interpreted as a vent.

4.7.21 The periscope is missing and only a small hole suggests its possible previous location. However, it is unclear if it is that or a slot for a stanchion or pole to cover the conning tower bridge (**Fig 5c, WA1107**). In 1998 the periscope was reported by Bob Peacock (Diver Magazine November 1998) as “broken off by a trawl net and is lying to one side”. A large net that could conceal a pole-shaped feature of the dimensions of the periscope was found *c.* 4m to the port side of the conning tower (**Plate 4, WA1024**).

4.7.22 Immediately aft of the conning tower are two pipes (*c.* 2m long and 0.3m diameter) completely covered by colonies of bright white anemones (**Fig 5b WA1081**). They are symmetrically placed close to the centre line and rise from the aft deck level up to the first section of the conning tower (*c.* 2m). These features are identified as vents or engine exhausts and were once covered by the hood of the conning tower.

4.7.23 As illustrated in historical photographs of B class submarines (**Plate 5**) it is very likely that the three vents, two aft and one on top of the conning tower, were fitted with cowl heads and, together with the steering wheel and shafting above the bridge deck, were removed for diving. It is unclear if the absence of the cowl heads on HMS *B2* is due to corrosion, trawling, or salvage, or if they were simply not fitted at the time of the sinking.

4.7.24 On the stern side of the body of the conning tower, behind the two vent pipes, a rectangular scuttle is visible (**Fig 5b WA 1125**). At the bottom of the tower on the port side another small opening, possibly a scuttle or a drainage hole, is noticed.

Aft Section

4.7.25 Following the ventilators pipes down to the aft deck part of the railings and recesses for fitting the now missing superstructure/awning aft of the conning tower are visible (**Fig 4b WA1174**).

4.7.26 About 1m from the vents a stanchion *c.* 1.5m long by *c.* 70mm diameter is sharply bent towards the port quarter, in a northerly direction. Although covered by nets the feature is still attached to the deck centre-line at the base. On the top of the stanchion is a truncated cone joint (**Fig 5b WA1173-1174**). The pillar could be a shaft that was connected to the upper steering wheel installed on the aft end of the conning tower bridge, at the fore end of a small collapsible bridge platform located directly abaft the conning tower (BR3043 1979).

4.7.27 Nets are present aft of the conning tower and up to *c.* 4 meters in a northerly direction over the port side. At *c.* 1.5m from the port side of the submarine a cylindrical feature (300mm diameter x 1.5m length) with toothed indentations on one end seems to be entangled in the fishing gear (**Plate 6, WA1187**). The nature of this feature is unclear.

4.7.28 The compass binnacle which would have been located abaft the conning tower is missing even though an oval slot on the top of the hull may possibly indicate the position of its mounting. It is possible that it may have been impacted by fishing activity, contemporary or more recent salvage activity, or it may still be situated in the interior compartments since it may have been stowed in the vessel prior to the collision.

4.7.29 Proceeding north towards the stern at the level of the hull casing it is possible to see some elements related to the upper deck casing. A small rectangular hatch is visible at *c.* 2m from the conning tower base on the port side. The indentation that connected the upper casing to the pressure hull is present and also the drainage slots (holes of *c.* 150 x 60mm, spaced *c.* 0.3m) which run along the port side of the upper hull (**Fig 5b WA1183**), are visible.

4.7.30 At *c.* 7.7m from the conning tower, just aft of the mid-ship area, the submarine becomes increasingly buried in the substrate (*c.* 100-150mm of sand) as the wreck is partially covered by a small sand wave butting up against it.

Stern

4.7.31 Although WA did not dive this section during the survey, the description that follows is based on information and photographs available from local divers and other sources used to inform this assessment.

4.7.32 The stern is clear of sand, intact and with very little marine growth. The state of preservation is so good that it has been suggested that it is periodically buried and only

recently exposed although it is known that was uncovered in 2008 and 2012 (Canterbury Divers Dive Report).

4.7.33 The bronze tri-bladed propeller is still *in situ* as are the hydroplanes and the single steering rudder with the driving rods still attached.

5 DISCUSSION

5.1 Type and Size of Site

5.1.1 The wreck appears relatively intact and upright, with the conning tower slightly over to starboard, and measures approximately 45.9m x 5.9m x 3.4m. The wreck was found to be in good condition with little marine growth and only limited corrosion. The main body appears to be intact although it is very likely that some upper plating and other fittings are dispersed in the proximity of the wreck. The upper deck is completely exposed apart from a section partly buried aft of the conning tower. The diver survey ascertained the presence of material detached from the main body of the wreck on both port and starboard sides.

5.1.2 Remains of trawl nets suggest that some of the deck fittings were carried away from the main body by the action of trawling activities and the geophysics survey also indicates the presence of buried material possibly associated with the wreck up to *c.* 30m from the main site (**7000**).

5.2 Circumstances of Loss

5.2.2 The recorded date and time of loss for HMS *B2* is *c.* 05:30 on 4th of October 1912.

5.2.3 The accident is reported in several newspapers of the time. The *Western Times* 8 October 1912 gives a description of the accident: “the purser aboard the *Amerika* stated that the accident occurred about a quarter past six off Dover. It was, he said, a bright clear morning, with absence of fog. A submarine, one of the flotilla manoeuvring off the coast, crossed the *Amerika*’s bows about sixty feet in front. Only her conning tower was showing, and she was going from eight to ten knots an hour, whilst the liner, perhaps, was making seventeen knots. The peril of the submarine was discovered on the bridge too late to avoid a catastrophe, and although the order “Full steam astern” was given, and the engines reversed, the liner had too much headway on, and crashed into the tiny craft. The submarine was struck almost amidships, and sank like a stone”.

5.2.4 The submarine was manoeuvring with the Section 1 of the Home Fleet Submarine Flotilla off the South Foreland and sunk following collision with the German liner SS *Amerika* with the loss of all hands but one, Lt Richard Bulleyne, the bridge officer. He was on the bridge with a petty officer and even though he went down with the boat he managed to reach the surface after the boat struck the bottom. He was found floating in the sea by HMS *B16*.

5.2.5 Salvage operations were later attempted and the area of damage, a great hole near the conning tower, was located. However the lifting of the boat was abandoned for it was thought that the submarine could break into two parts (*Kalgoorlie Miner* 11 October 1912, *Register* 28 March 1913, *Western Times* 7 October 1912) and the crowded fairway considered too dangerous.

5.2.6 The funeral service for the victims of HMS *B2* was held out by the Goodwin, off the South Foreland and it is reported by The *Whitstable Times* and *Herne Bay Herald* on 19 October 1912: “The siren of the South Goodwin lightship sounded a weird knell over the steel hull, which, a hundred feet down, formed the coffin of Lieut. Brien and the 14 men of his crew. Presently many other syrens were heard sounding a strange requiem, and out of the mist,

grim and ghost-like, loomed the shapes of the cruisers *Forth*, *Minerva*, and *Adamant*, and the gunboat *Hebe*, following each of which were destroyers and submarines. The burial service was read on the deck of each of the larger vessels, the crews mustering in review uniform, a notable exception being that the crews of the submarines were in grey working dress. Steaming over the ocean grave three volleys were fired from the ships, and the buglers sounded the "Last Post." Relatives of the deceased were among those who attended the unique and impressive obsequies, and the Dover Harbour tug, *Lady Crundall*, flying the German ensign at half-mast, had on board representatives of the Hamburg-Amerika Line, whose vessel, the *Amerika*, collided with the *B2* on Friday morning, October 4th".

5.2.7 The owners of the liner were ordered to pay the Admiralty 95 percent of the loss and meet the claims for compensation of the relatives of the officers and crew (The *Advertiser*, 17 December 1912).

5.3 Identification

5.3.1 The survey confirmed the identification of the wreck site as HMS *B2* and its position.

5.3.2 The wreck was charted as such by the UKHO and has been reported in dive guides since 2002. General dimensions and features of the wreck correspond with the technical drawing for the B-Class.

5.3.3 The Location of the wreck and the damaged area of the hull are consistent with the information on the collision event described in the primary sources.

5.4 Overall Characterisation

5.4.1 The overall character of the exposed material on the seabed can be summarised as follows, using the Build/Use/Loss/Survival/Investigation (BULSI) method of 'shipwreck biography'.

Built	HMS *B2* was built by Vickers at Barrow yard No. 320 and launched on 19 August 1905. Completed on 09 December 1905 at Barrow. The displacement almost doubled from the A-Class providing the class with more buoyancy reserve although no internal bulkheads were fitted. Retrofitting of hydroplanes forward as well as aft increased underwater stability.
Use	The *B2* was a coastal defence submarine and was built for defensive purpose only. It was assigned to 3rd division of the Home fleet and mainly employed for home water defence. Eleven examples were built from 1904 to 1906 but they were considered obsolete at the outset of WW1.
Loss	HMS *B2* was lost in a collision when rammed and sunk by the German liner SS *Amerika* off Dover on 4 October 1912 with the loss of 15 lives, 1 saved.

<table>
<tr><td></td><td>The following list contains the names of the submariners that died in HMS B2:

<table><tr><th>Name</th><th>Rank</th></tr><tr><td>Andrews, Richard</td><td>Able Seaman</td></tr><tr><td>Baratt, Sidney</td><td>Able Seaman</td></tr><tr><td>Douglas, Alexander</td><td>Petty Officer Stoker</td></tr><tr><td>Bryant, James</td><td>Stoker</td></tr><tr><td>House, Walter</td><td>Able Seaman</td></tr><tr><td>Keast, Herbert</td><td>Leading Seaman</td></tr><tr><td>Lancey, William</td><td>Leading Seaman</td></tr><tr><td>Ledo, William</td><td>Leading Seaman</td></tr><tr><td>Lee, Eneas</td><td>Able Seaman</td></tr><tr><td>Millar, William</td><td>Engine R. Artificer</td></tr><tr><td>O'Brien, Percy</td><td>Lieutenant</td></tr><tr><td>Reid, William</td><td>Engine R. Artificer</td></tr><tr><td>Rivers, Walter</td><td>Petty Officer</td></tr><tr><td>Russel, Frank</td><td>Leading Stoker</td></tr><tr><td>Sherrel, William</td><td>Able Seaman</td></tr></table></td></tr>
<tr><td>Survival</td><td>The wreck is mostly intact and with little marine growth although parts of the fixtures of the deck and conning tower, including the casing, are missing or corroded. There is evidence that some wreck material is re-deposited and buried in the proximity.</td></tr>
<tr><td>Investigation</td><td>Identified in 1999, the Site is well known and frequented by diving clubs of the Kent area. The site has been mentioned by diver guides since 2002 and has been recently surveyed by submarine expert Innes McCartney.</td></tr>
</table>

5.5 Summary

5.5.1 The Site is identified as the wreck of the HMS *B2*, early pre-WWI submarine and the last surviving example of B-Class submarines. It was on exercise when a liner collided with it off Dover in October 1912.

5.5.2 The HMS *B2*, as the only B Class example, must be considered particularly significant and it is a strong candidate for designation.

5.5.3 The wreck is well preserved and still retains its shape and main features. The improvements of the B Class over the A Class and the general arrangement of the early submarines are visible and recognisable amongst the different features.

5.5.4 Although HMS *B2* is not particularly historically significant in itself and made no contribution to WWI, the B-Class includes one of the most historically significant British submarines of WWI, HMS B11.

5.5.5 The site demonstrates high value in the categories of Period, Rarity and Survival/Condition. Therefore, according to the non-statutory criteria assessment and the recommendation that the site demonstrates high value in two criteria (EH 2012) HMS *B2*

is considered a strong candidate for scheduling under the *Ancient Monuments and Archaeological Areas Act 1979*.

6 RECOMMENDATIONS

6.1.1 The site is the only surviving B-Class British submarine in the world. Its potential significance as a heritage asset is undoubtedly high. Its uniqueness and relatively good state of preservation make it a strong candidate for scheduling.

6.1.2 WA could find no historical evidence that the casualties of the HMS *B2* were recovered hence the wreck is thought to contain the remains of most, if not all of the 15 navy submariners that died. However, HMS *B2* cannot be classified as a protected place by the MoD as it sank before 4 August 1914. As in the B-class there were no internal bulkheads to delineate the space within the hull.

6.1.3 Its position, just at the edge of shipping channel, limits the accessibility to the Site. Nonetheless the Site is frequented by divers and there are reports of propellers that have been removed from other WWI submarines in the area.

6.1.4 Moreover, the diving observations suggest that there is potential for significant buried material around the wreck and considering the mobility of the sediment at the Site location it is possible that further remains are at risk of exposure in the next 5-10 years. The diving survey also highlighted the possibility of post-depositional disturbance on the Site connected with fishing activities.

6.1.5 The submarine appears to be in relatively good condition and the structure presents a relatively high level of robustness being mostly made of steel. However, although the submarine itself is not made of particularly fragile material the unauthorised removal of elements of it is a risk. The site is also potentially at risk from being snagged by trawl gear.

6.1.6 As the Site is frequently dived by local dive clubs it is recommended that informal monitoring and reporting by local divers/groups and the examination of any updated geophysical data that becomes available is encouraged.

6.1.7 It is recommended that the NRHE is updated with the insertion of the confirmed HMS B2 site into the existing data, and records no 901840, 1452602 are amended.

7 ARCHIVE

7.1.1 The project archive consists of hard copy file and computer records and is currently stored at WA under project code 83803. The project will be transferred to EH on completion, to the relevant data standards.

8 REFERENCES

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Young, R., & Armstrong, P., 2003, *Silent Warriors*, Vol 1. Tempus.

Contemporary Sources (in chronological order):

The *Western Times*, 7 October 1912

The *Western Times*, 8 October 1912

Kalgoorlie Miner, 11 October 1912,

The *Whitstable Times and Herne Bay Herald*, 19 October 1912

The *Advertiser*, 17 December 1912

The *Register*, 28 March 1913,

9 APPENDICES

APPENDIX I: ANOMALIES OF ARCHAEOLOGICAL POTENTIAL

WA_ID	Classification	Easting	Northing	Archaeological Discrimination	Length (m)	Width (m)	Height (m)	Magnetic Amplitude (nT)	Notes
7000	Debris	392181	5664258	A2	3.6	0.1	0.1	-	Short, linear dark reflector with small shadow but no associated magnetic anomaly. Located in an area of relatively thick mobile sediment, and could be a piece of partially buried debris.
7001	Magnetic	392171	5664240	A2	-	-	-	37	Irregular magnetic anomaly without an associated sidescan sonar contact, located away from the main anomaly associated with the wreck of HMS *B2* (**7002**). Possibly indicates a piece of ferrous debris buried in the mobile sediment identified within the survey area.

WA_ID	Classification	Easting	Northing	Archaeological Discrimination	Length (m)	Width (m)	Height (m)	Magnetic Amplitude (nT)	Notes
7002	Wreck	392214	5664206	A1	45.9	5.9	3.4	14655	Wreck of the submarine HMS *B2*, located approximately at the recorded UKHO location orientated approximately NNW-SSE. The wreck appears upright and relatively intact, with the central section, interpreted as the conning tower, exhibiting significant height. The structure does, however, appear to be bent and potentially damaged along a section of the northern edge, with a separate piece of debris (**7003**) identified immediately towards the northwest. The NW end of the structure appears partially buried, and the wreck is situated within a well-defined scour visible on either side trending approximately NE-SW. No significant debris field has been identified, though due to the large amount of mobile seabed sediment in the area it is likely that all but the largest pieces of debris would be buried should any exist. The position given is interpreted as being the location of the conning tower.
7003	Debris	392217	5664209	A1	0.9	0.2	0.4	-	Dark reflector with shadow but no distinct associated magnetic anomaly, though any anomaly would be masked by the adjacent wreck of HMS *B2* (**7002**). Anomaly identified by diver survey as a piece of ferrous debris, likely associated with the wreck.

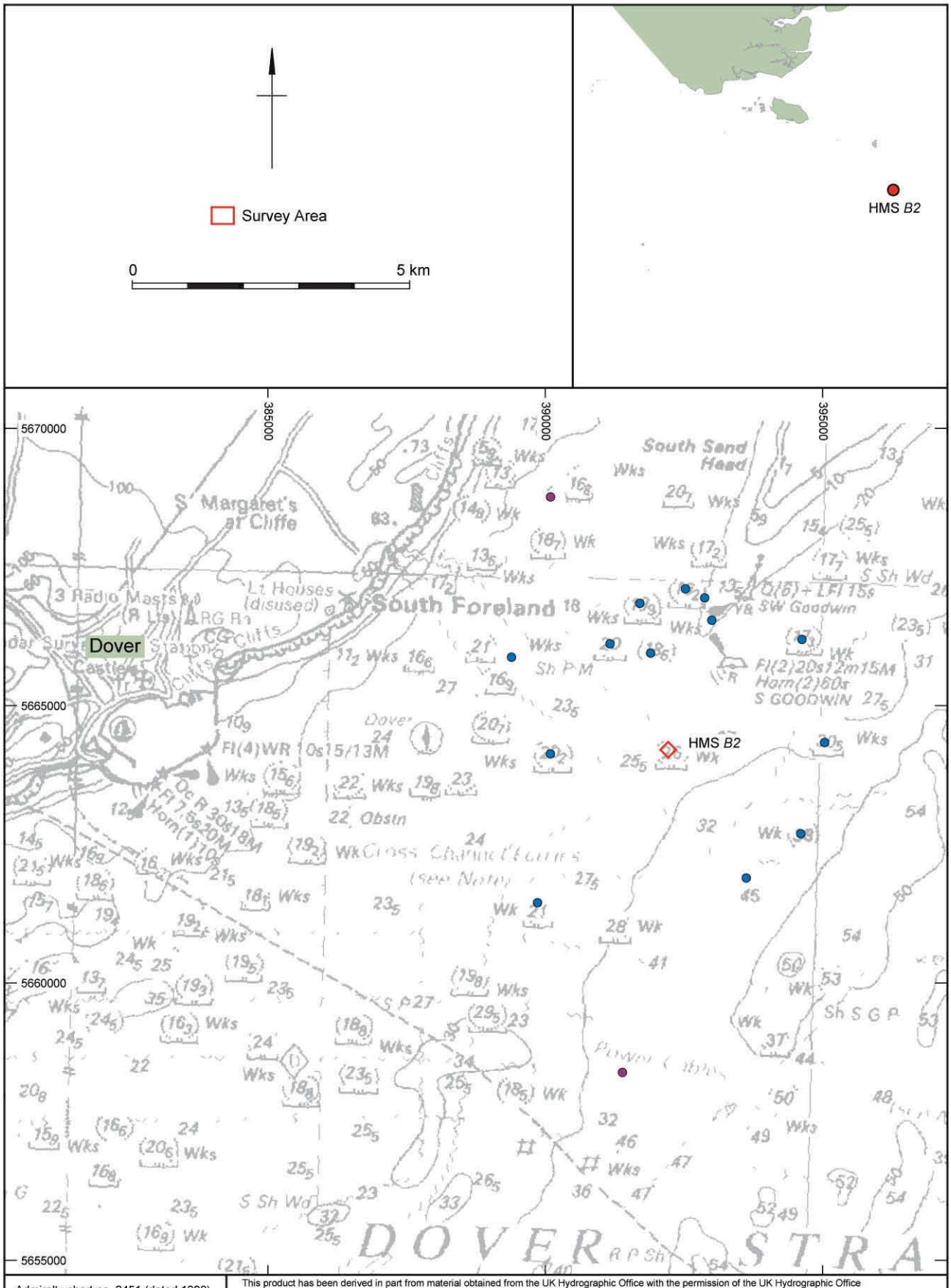
WA_ID	Classification	Easting	Northing	Archaeological Discrimination	Length (m)	Width (m)	Height (m)	Magnetic Amplitude (nT)	Notes
7004	Dark Reflector	392179	5664164	A2	0.4	0.3	0.6	-	Small dark reflector with shadow but no associated magnetic anomaly. Could be a natural feature or a piece of non-ferrous debris.
7005	Magnetic	392308	5664203	A2	-	-	-	58	Distinct magnetic anomaly without an associated sidescan sonar contact. Possible piece of ferrous debris buried within the mobile seabed sediment identified within the Study Area.
7006	Dark Reflector	392237	5664138	A2	0.6	0.2	0.3	-	Elongate dark reflector with shadow but without an associated magnetic anomaly. Could be a natural feature or a partially buried piece of non-ferrous debris. Located close to similar feature **7007**.
7007	Dark Reflector	392243	5664131	A2	1.5	0.5	0.2	-	Elongate dark reflector with shadow but without an associated magnetic anomaly. Could be a natural feature or a partially buried piece of non-ferrous debris. Located close to similar feature **7006**.

Notes

1. Co-ordinates are in WGS84 UTM31N
2. Positional accuracy estimated ±10m

APPENDIX II: DIVE LOG

Dive	Date	Start Time	Duration	Depth (m)	Diver
1	05/08/2014	10:07	18	32	Croce
2	05/08/2014	10:55	13	33	Murray



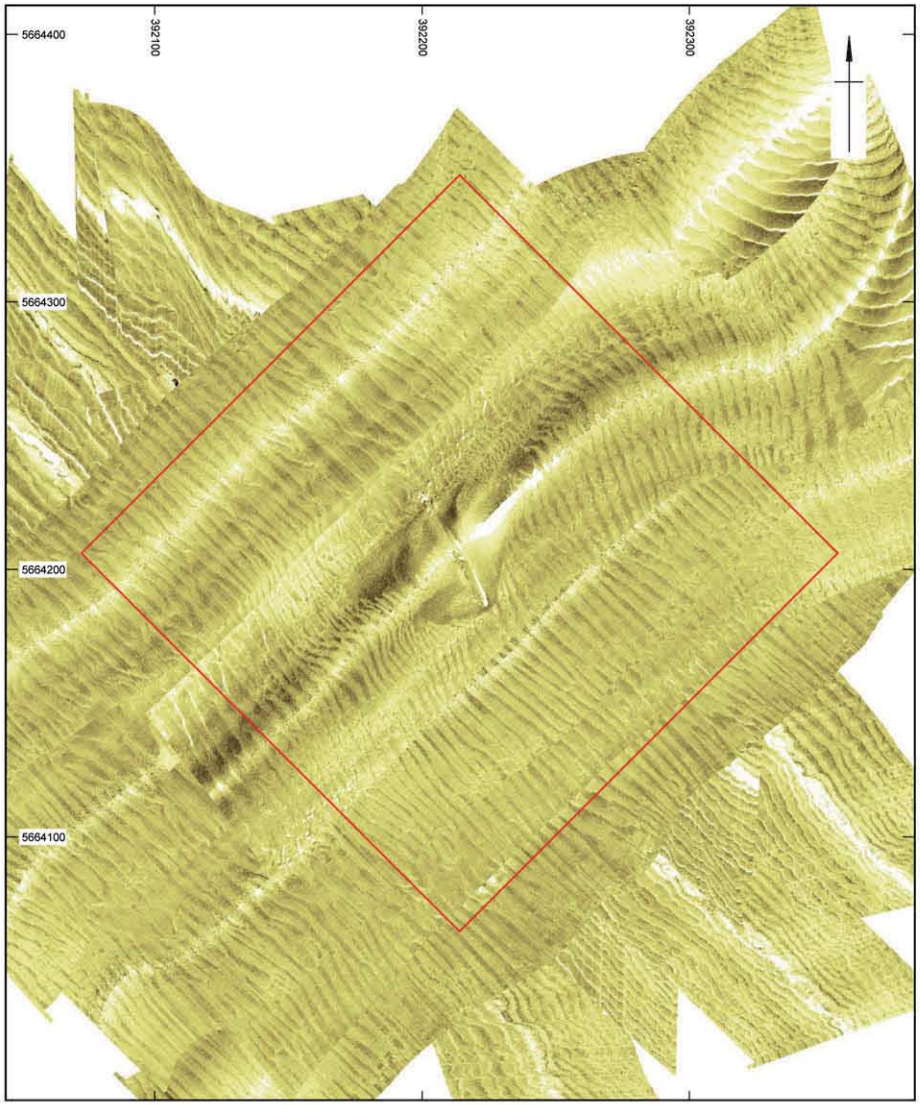
Admiralty chart no. 2451 (dated 1999)
Drawing projection UTM WGS84 z31N

- NRHE Records within 1km
- NRHE Records for HMS B2

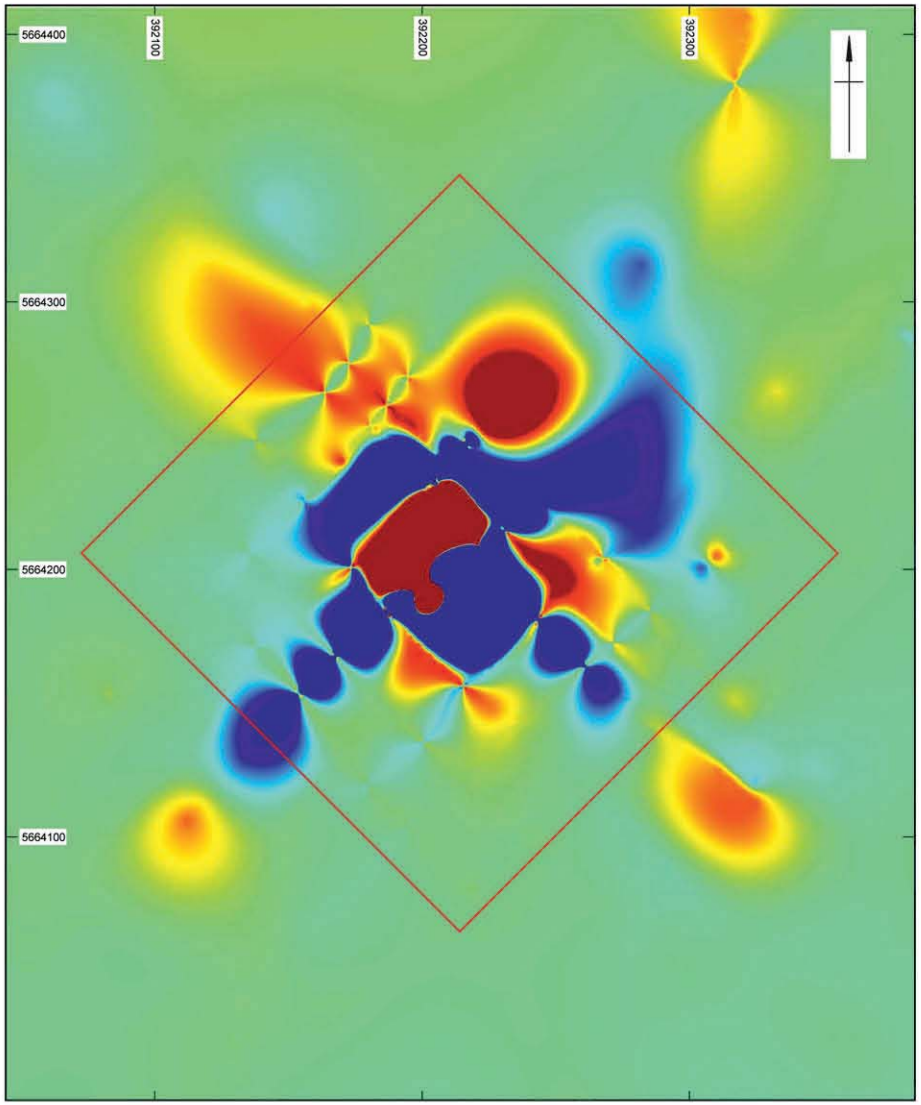
Date:	16/10/2014	Revision Number:	0
Scale:	1:100,000 @A4	Illustrator:	KJF/WAF
Path:	W:\Projects\PWA\Projects\83803\7 Drawing Office\HMS B2\2014_10_16		

Survey Area Location

Figure 1



Sidescan Sonar Mosaic



Gridded Magnetometer Data (+/-50nT)

Survey Area

0 100 m

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Scale:	1:2000 @A3	Illustrator:	KJF
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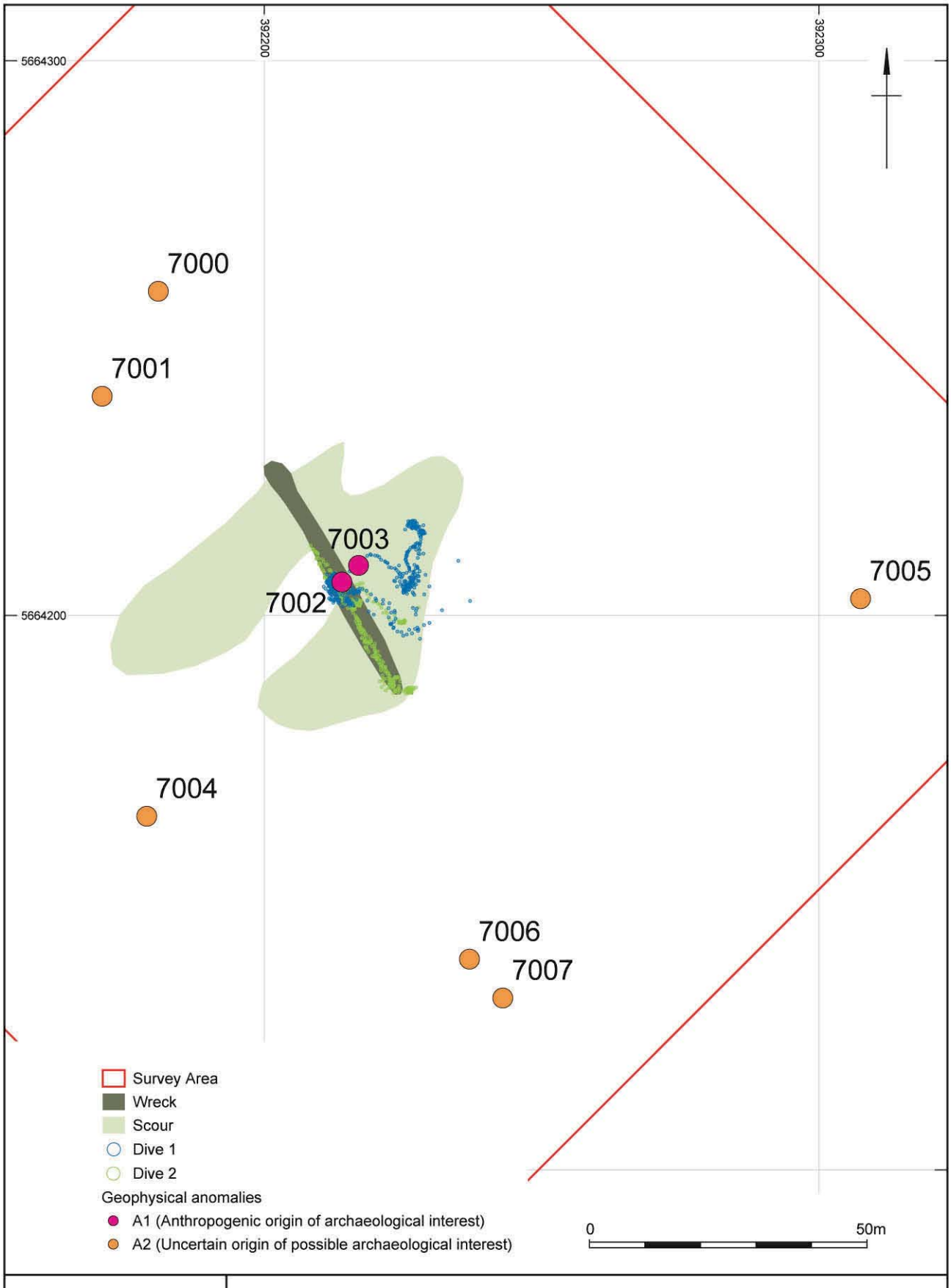
Sidescan Sonar Mosaic and Gridded Magnetometer Data

Figure 2



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Anomalies of Potential Archaeological Interest

Figure 3

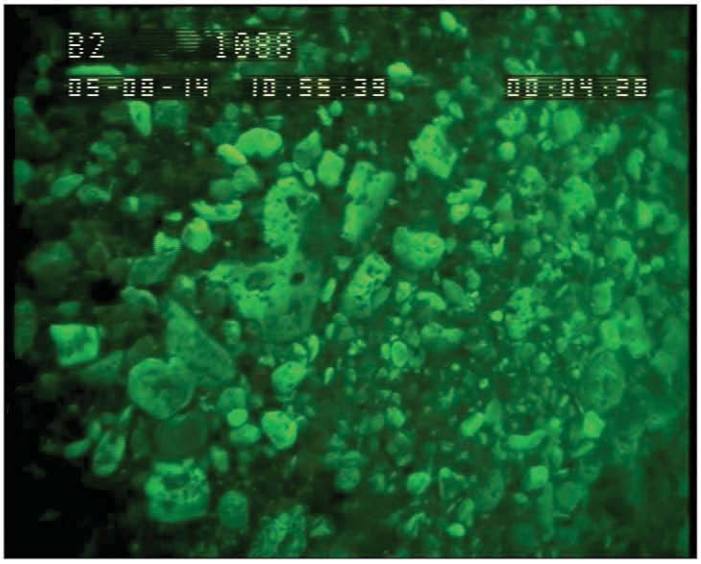

Plate 1: WA1139

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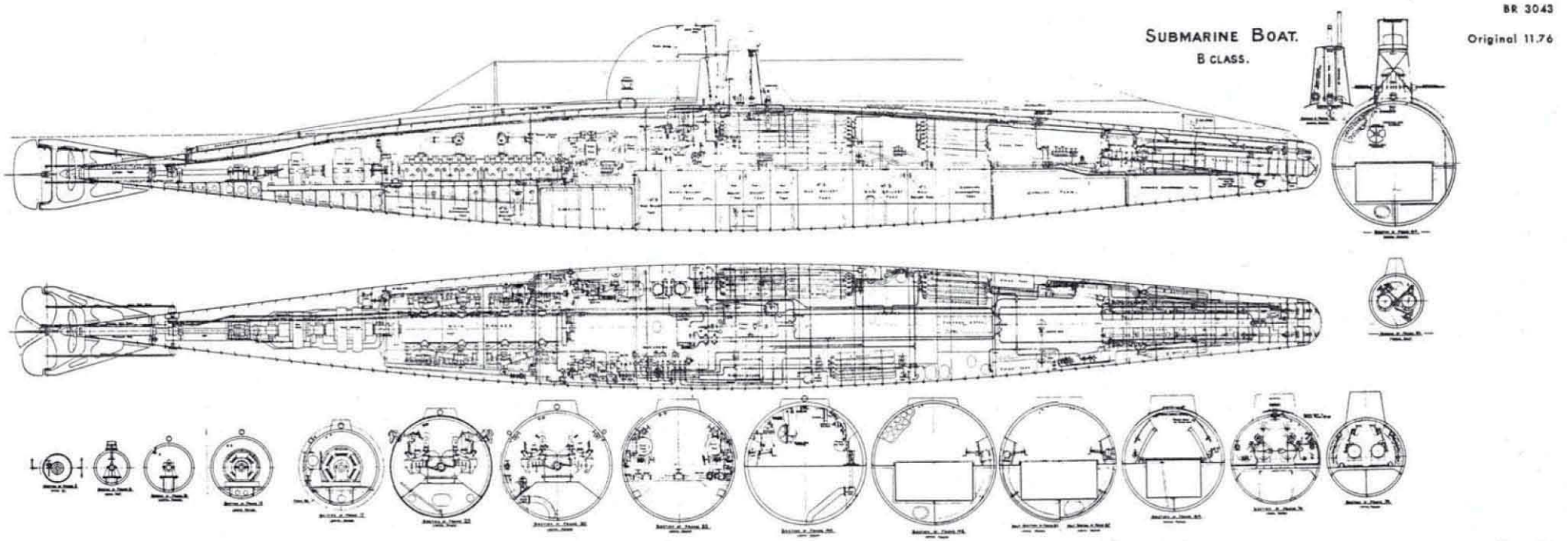

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Plate 2: Technical drawings of B-Class submarine

Figure 5a

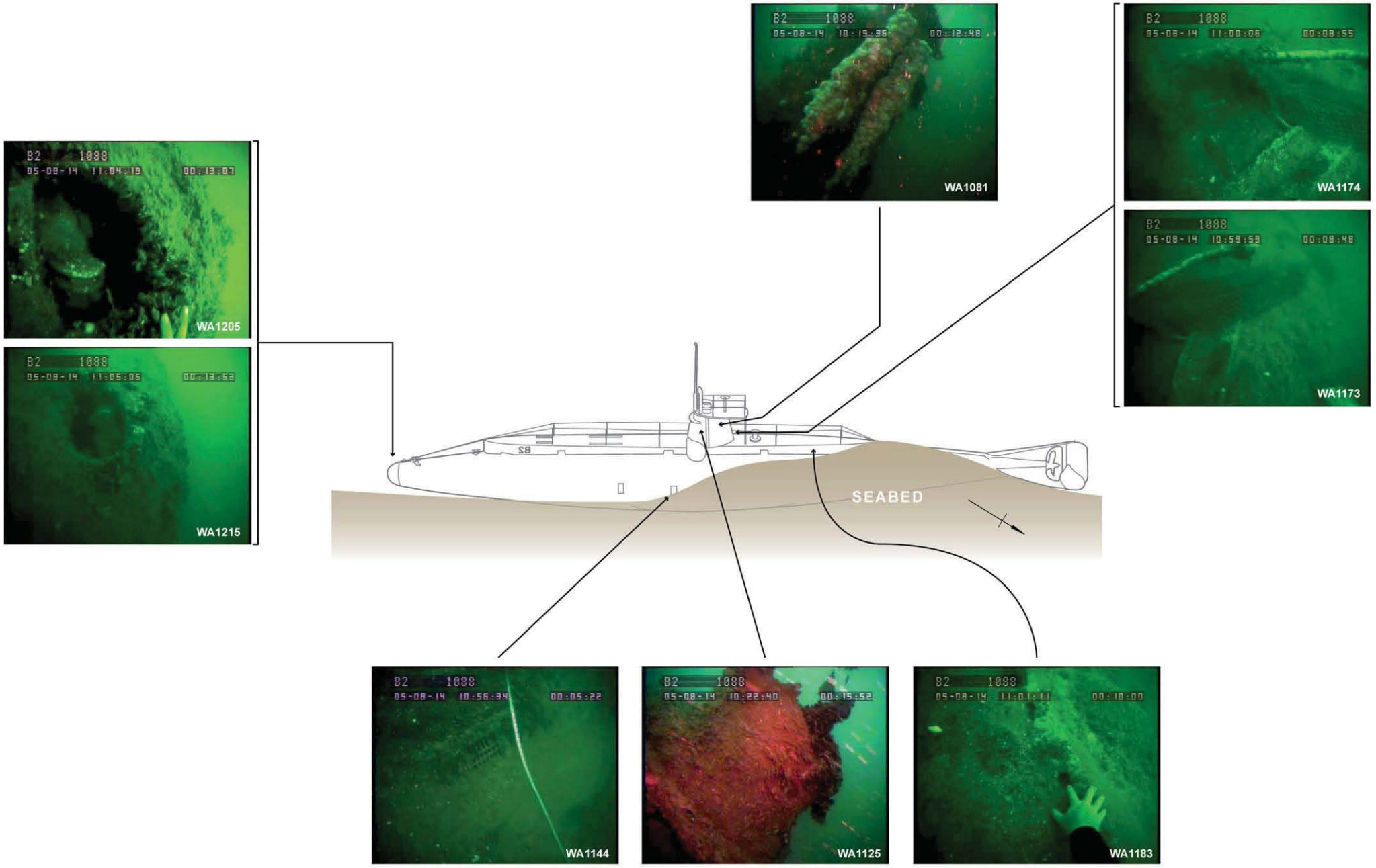

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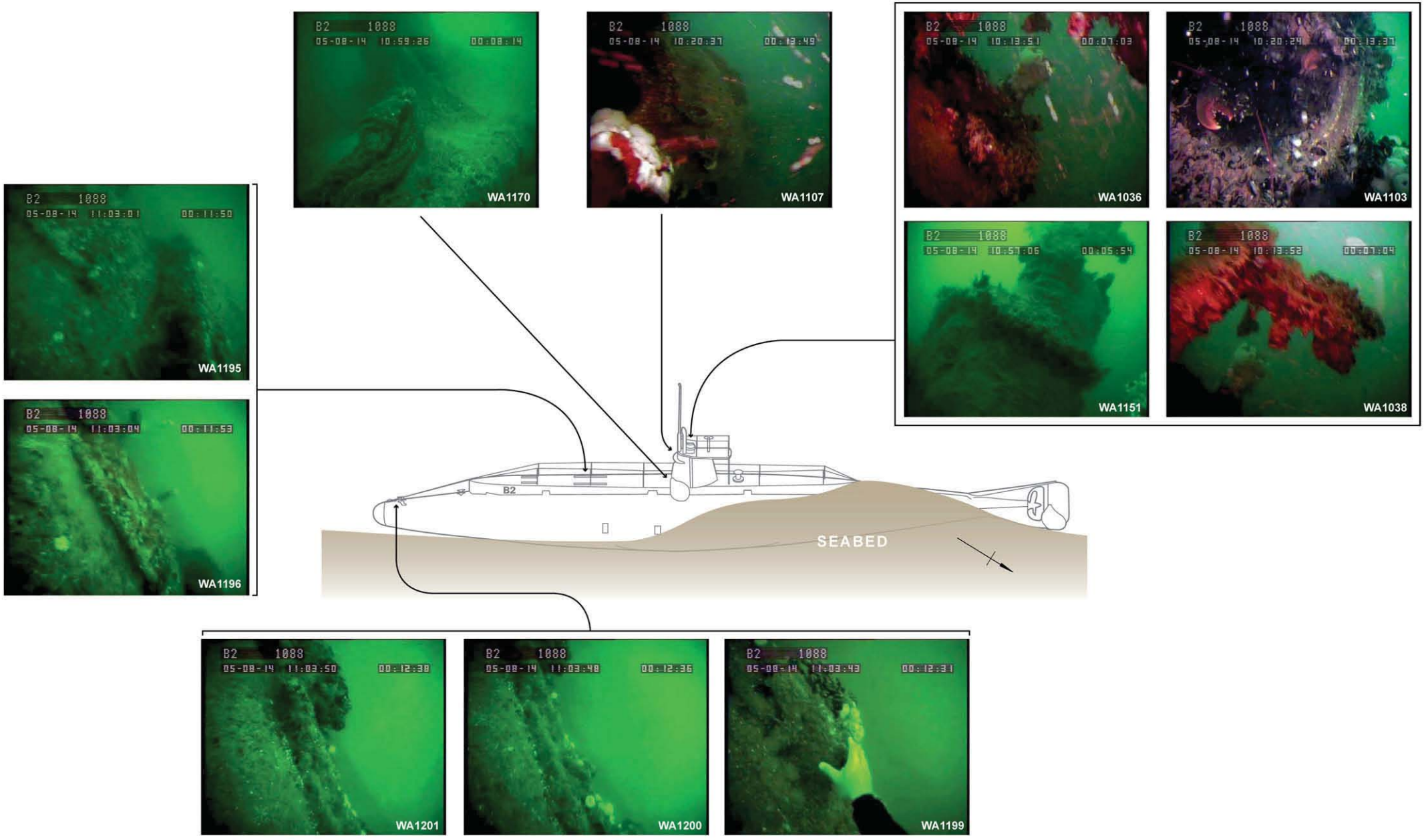
Figure 5b



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Scale:	NTS	Illustrator:	WAF
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Figure 5c

Plate 3: WA1142 – Anomaly 7003

Plate 4: WA1024

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Figure 6

Plate 5: B-Class Submarine in Plymouth

Plate 6: WA1187

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Scale:	n/a	Illustrator:	WAF
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Figure 7

Plate 7: HMS B2 stranded at Sandown, Isle of Wight

Date:	17/10/14	Revision Number:	0
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Figure 8

wessex archaeology

salisbury rochester sheffield edinburgh

Wessex Archaeology Ltd registered office Portway House, Old Sarum Park, Salisbury, Wiltshire SP4 6EB
Tel: 01722 326867 Fax: 01722 337562 info@wessexarch.co.uk www.wessexarch.co.uk