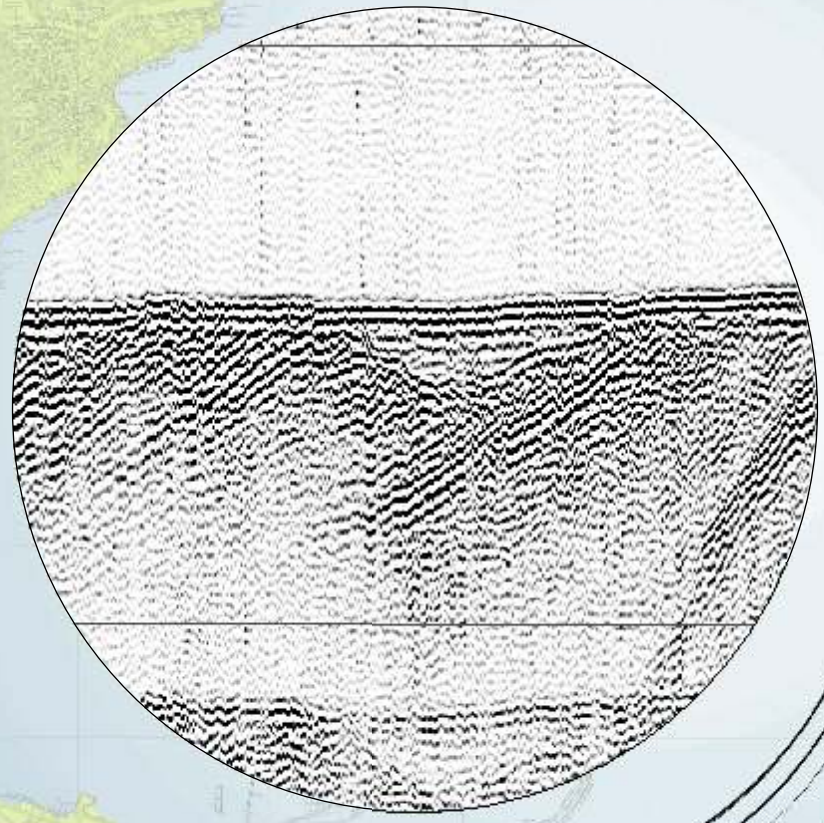
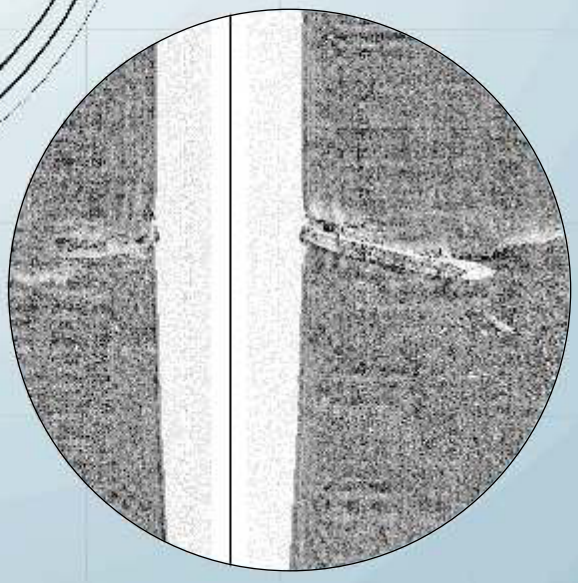
Wessex Archaeology

Blandford to Portland Gas Pipeline

Offshore Pipeline Route
Archaeological Assessment





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March 2007

BLANDFORD TO PORTLAND GAS PIPELINE

OFFSHORE PIPELINE ROUTE ARCHAEOLOGICAL ASSESSMENT

TECHNICAL REPORT

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March 2007

Ref: 60712.01

BLANDFORD TO PORTLAND GAS PIPELINE

OFFSHORE PIPELINE ROUTE
ARCHAEOLOGICAL ASSESSMENT

Summary

Wessex Archaeology was been commissioned by Portland Gas Limited to undertake an archaeological assessment of the offshore section of the proposed route of a gas pipeline and storage scheme that runs from Blandford to Portland. The route cuts the coast to the east of Redcliff Point, Weymouth, then crosses Weymouth Bay to a shore approach on the Isle of Portland just south of Portland Inner Harbour (371540E / 081820N to 370120E / 073720N).

This assessment has addressed the archaeology of only those elements of the scheme that lie below the high water mark. In addition to outlining the relevant legislation archaeological data has been generated by searching the UK Hydrographic Office wreck and historic chart records, the National Monuments Record, and the Dorset Historic Environment Record. Secondary sources were also consulted, and an archaeological analysis of marine geophysical data was conducted in order to attempt to identify sites currently visible on and under the seabed.

The archaeological heritage is discussed in the Baseline with particular reference to submerged prehistoric sites and landscapes, and maritime sites and finds of all periods after the Mesolithic. The known and potential archaeology identified in the Baseline may be summarised as follows:

- 28 wrecks (confirmed by geophysical and/or diver survey);
- 49 geophysical anomalies, of which 3 are possible wrecks and 3 are possibly modern;
- 8 obstructions (typically reported by fishermen);
- 17 dead or lifted wrecks;
- 2 anchorages;
- 193 recorded losses (for which there are no known seabed remains);
- 30 terrestrial sites and 15 find spots;
- The potential for further, as yet unknown wreck and wreck related material of all periods since the Palaeolithic;
- The potential for sites and derived artefacts from the prehistoric period, particularly within two submerged palaeo-valleys.

An assessment of significant effects has been conducted, and appropriate mitigation has been proposed.

BLANDFORD TO PORTLAND GAS PIPELINE

OFFSHORE PIPELINE ROUTE
ARCHAEOLOGICAL ASSESSMENT

Acknowledgements

This report was commissioned by Portland Gas Limited. Wessex Archaeology are grateful to the staff of that organisation for their assistance during the compilation of this report.

Data was provided by the UK Hydrographic Office, the National Monuments Record, the Receiver of Wreck and the Dorset Sites and Monuments Record. The Ministry of Defence was also consulted regarding Protected Places and Controlled Sites under the Protection of Military Remains Act 1986. We are grateful to the staff of these organisations for their co-operation.

Wessex would also like to extend special thanks to Gordon LePard and Claire Pinder of Dorset County Council and David Carter of the Weymouth Lunar Society for their help and assistance during the compilation of this report.

Graham Scott carried out the assessment and compiled this report, with contributions from Victoria Cooper, Stephanie Arnott and Jack Russell. Stephanie Arnott undertook the review of geophysical data and Kitty Brandon prepared the illustrations. Steve Webster managed the project for Wessex Archaeology.

Data Licences

Details of archaeological sites within the study area were received from the National Monuments Record and the Dorset SMR. Copyright restrictions apply to this data.

The digital use of UKHO data, including the use of Chart 2255 in **Figure 1** was made under licence (ref. HO 820/020220/11). The following notice applies:

Chart 2255 has been added to Schedule 1 Annex A of the above licence.

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OFFSHORE PIPELINE ROUTE
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1. PROJECT BACKGROUND

1.1. INTRODUCTION

1.1.1. Wessex Archaeology (WA) was been commissioned by Portland Gas Limited to undertake an archaeological assessment of the offshore section of the proposed route of a gas pipeline and storage scheme that runs from Blandford to Portland. The proposed route cuts the coast to the east of Redcliff Point, Weymouth, then crosses Weymouth Bay to a shore approach on the Isle of Portland just south of Portland Inner Harbour (**Figure 1**).

1.2. PROJECT AIMS AND OBJECTIVES

1.2.1. The aim of this desk-based study is to provide an archaeological assessment of the likely effects of the pipe-laying and associated operations. This assessment will inform the Environmental Impact Assessment for the scheme.

1.2.2. The overall objectives are:

- To set out the statutory, planning and policy context relating to the marine element of the historic environment within the footprint of the scheme;
- To provide an overview of the development of the marine element of the historic environment within the footprint of the scheme based on existing archaeological records and secondary sources;
- To highlight known sites that may be impacted by the scheme, with particular reference to:
    - Located marine sites;
    - Recorded shipping losses;
- To summarise the potential for the presence of hitherto unknown sites that may be impacted by the proposal, with particular reference paid to evidence for:
    - Lower, Middle and Early Upper Palaeolithic human activity;
    - The development of the landscape/seascape and its inhabitation during the Late Upper Palaeolithic and Mesolithic;
    - Seafaring and other maritime activity;
- To comment on the importance of known and potential sites that may be impacted by the scheme.

1.2.3. Further details of objectives set for the review of geophysical and geotechnical data and for the assessment of significant effects are given in the relevant methodology sections below.

1.3. RELEVANT LEGISLATION

1.3.1. Sites and finds within the Study Area located above within the intertidal zone fall under the remit of Planning and Policy Guidance (PPG16 and PPG20) and the Ancient Monuments and Archaeological Areas Act (1979). Legislation relating to archaeological remains below Mean Low Water include the Protection of Wrecks Act (1973), the Merchant Shipping Act (1995) and Protection of Military Remains Act (1986). Local planning policy is set out in the *Bournemouth, Dorset and Poole Structure Plan* and the *Weymouth and Portland Local Plan*. In addition, English Heritage provides additional guidance on the following relevant topics:

- England's Coastal Heritage;
- Identifying and Protecting Palaeolithic Remains: Archaeological Guidance for Planning Authorities and Developers;
- Military Aircraft Crash Sites: archaeological guidance on their significance and future management.

Planning Policy Guidance

1.3.2. The Secretary of State's policy on archaeological remains is set out in Archaeology and Planning (PPG16 1990). It recognises the remains as an irreplaceable and finite resource that should be preserved in their settings. In situations where preservation *in situ* is not justified, the developer is to make provision for appropriate excavation and recording of these remains. Planning and Policy Guidance: Coastal Planning (PPG20 1992) is relevant above the Low Water Mark (LWM).

Ancient Monuments and Archaeological Areas Act (1979)

1.3.3. Sites of national importance are protected under the Ancient Monuments and Archaeological Areas Act (1979). The Act also makes provision for the investigation, preservation and recording of sites of archaeological and historical significance and for the regulation of all operations and activities that may affect them or their settings. Wrecks below Mean Low Water may also be designated under this act. There are currently no scheduled monuments within the Study Area.

Protection of Wrecks Act (1973)

1.3.4. Wrecks of national importance are protected under the Protection of Wrecks Act (1973). It is an offence to carry out certain activities in a defined area surrounding a wreck that has been designated, unless a license for those activities has been obtained from the Government. There are currently no protected wrecks within the Study Area. However, if a wreck of historical, archaeological or artistic importance were to be discovered in the course of construction, then it would be possible for it to be designated at very short notice, irrespective of any inconvenience to construction activities. Therefore early identification and avoidance of any potentially important wreck sites may be seen as essential to avoid disruption at a late stage in the planning of the development.

1.3.5. There are no sites presently designated under this legislation within the development area. However, if any important wreck or ship borne artefact is discovered before or during construction, the designation of an area around the find remains a possibility.

Merchant Shipping Act (1995)

1.3.6. Within the context of the Merchant Shipping Act (1995), 'wreck' refers to flotsam, jetsam, derelict and lagan found in or on the shores of the sea or any tidal water. It includes a ship, aircraft or hovercraft, parts of these, their cargo or equipment. It may be of antique or archaeological value such as gold coins, or a yacht or dinghy abandoned at sea or items such as drums of chemicals or crates of foodstuffs (Definition from the Receiver of Wreck).

1.3.7. The ownership of underwater finds that turn out to be 'wreck' is decided according to procedures set out in the Merchant Shipping Act. If any such finds are brought ashore the salvor is required to give notice to the Receiver that he has found or taken possession of it and, as directed, either hold it to the Receiver's order or deliver it to the Receiver. This applies whether material has been recovered from within or outside UK Territorial Waters, unless the salvor can prove that title to the property has been vested in him (e.g. by assignment to him/her of rights devolving from the owner of the vessel or its contents at the time of loss). Even if ownership can be proved the salvor is still required to notify the Receiver.

1.3.8. The Crown makes no claim on wreck found outside UK Territorial Waters that remains unclaimed at the end of the statutory one-year and the property is returned to the salvor. Ownership of unclaimed wreck from within Territorial Waters lies in the Crown or in a person to whom rights of wreck have been granted.

1.3.9. The Receiver of Wreck has a duty to ensure that finders who report their finds as required receive an appropriate salvage payment. In the case of material considered being of historic or archaeological importance, a suitable museum is asked to buy the material at the current valuation and the finder receives the net proceeds of the sale as a salvage payment. If the right to, or the amount of, salvage cannot be agreed, either between owner and finder or between competing salvors, the Receiver of Wreck will hold the wreck until the matter is settled, either through amicable agreement or by court judgement.

Protection of Military Remains Act (1986)

1.3.10. The Protection of Military Remains Act (1986) is administered by the Ministry of Defence and provides for the protection of military remains of any nationality in UK waters. Under Act, all aircraft that have crashed in military service are protected, and the Ministry of Defence has powers to protect vessels that were in military service when they were wrecked. The Ministry of Defence can designate named vessels as 'protected places' even if the position of the wreck is not known. In addition, the Ministry of Defence can designate 'controlled sites' around wrecks whose position is known. In the case of 'protected places', the vessel must have been lost after 4 August 1914, whereas in the case of a wreck protected as a 'controlled site' no more than 200 years must have elapsed since loss.

1.3.11. In neither case is it necessary to demonstrate the presence of human remains. Diving is not prohibited at a 'protected place' but it is an offence to tamper with, damage, move or remove sensitive remains. However, diving, salvage and excavation are all prohibited on 'controlled sites', though licences for restricted activities can be sought from the Ministry of Defence. Additionally, it is an offence carry out unauthorised excavations for the purpose of discovering whether any place in UK waters

comprises any remains of an aircraft or vessel which has crashed, sunk or been stranded while in military service.

1.3.12. In November 2001, the MoD reported on the Public Consultation on Military Maritime Graves and the Protection of Military Remains Act 1986. The report recommended that a rolling programme of identification and assessment of vessels against the criteria be established to designate all other British vessels in military service when lost, as Protected Places.

1.3.13. Within the MSA HMS *Hood* (**6059**) is designated as a protected place. In addition, all military aircraft are automatically protected under this act and it is an offence to carry out any unauthorised excavations within the immediate vicinity of any such remains.

Local Planning Policy

1.3.14. Policy EN. Q of the *Bournemouth, Dorset and Poole Structure Plan* states that:

'The architectural and historic heritage of Dorset should be safeguarded through the preservation of listed buildings and their settings, and the preservation or enhancement of the character and appearance of areas and features of special architectural or historic interest'.

1.3.15. The *Weymouth and Portland Local Plan* has recently been subject to review. The Local Plan Review states that development will not be permitted which would have an adverse effect upon exceptionally important archaeological remains and their settings. Proposals for development affecting the sites of local high archaeological importance are required to consider:

- the intrinsic importance of the remains and their settings;
- the need for the development and availability of alternatives sites;
- the opportunities for mitigating measures and whether the remains are preserved in situ, and;
- the potential benefits, particularly to education, recreation and tourism.

1.3.16. With regard to areas of high potential the plan requires that the impacts of the proposals on the site's archaeological importance are examined and evaluated and the results presented prior to, or as part of, the planning application. The plan also states that:

'In the event of development affecting a site of archaeological interest, adequate provision must be made for preserving either in situ or by record (whichever is the more appropriate for the preservation of the archaeological interest) the archaeology of the site'.

2. METHODOLOGY

2.1. APPROACH

2.1.1. The methodology adopted reflects best practice in carrying out archaeological desk-based assessments, as set out by the Institute of Field Archaeologists (IFA) Standards and Guidance for Archaeological Desk-based Assessment (IFA 2001), and the Joint

Nautical Archaeology Policy Committee Code of Practice for Seabed Developers (JNAPC 2006).

2.1.2. The methodology reflects the requirements of Environmental Impact Assessment arising from European Council Directive 85/337/EEC as amended by Directive 97/11/EC.

2.1.3. A Maritime Study Area has been set up to include the pipeline route and its immediate vicinity (see **Figure 1** and section 2.2 below).

2.1.4. Geotechnical and geophysical data was subject to archaeological analysis and considered in conjunction with readily available geological, palaeo-environmental and geo-archaeological sources to address the likely development of the palaeo-geography of the Maritime Study Area.

2.1.5. To assess the potential for prehistoric sites the palaeo-geography has been compared with models of sea-level change in the Dorset area in order to establish periods when the area is likely to have been habitable. These have then been compared to patterns of human occupation and activity during the relevant periods, derived from known sites in the region.

2.1.6. Records of known maritime sites and casualty positions within the Maritime Study Area have been collated and the known maritime history of the region has been reviewed in order to establish the potential for uncharted sites within the area.

2.1.7. Scheme-related impacts upon the known and potential archaeological heritage have been identified. The significance of the effects of such impacts is considered, taking into account previous disturbance and the importance of the known and potential archaeological heritage. Proposals for strategies to mitigate significant adverse effects are also made.

2.2. STUDY AREAS

2.2.1. The route of the proposed pipeline is shown in **Figure 1**. In order to conduct searches for maritime sites and finds a Marine Study Area (MSA) was established around the cardinal extents of the route. The co-ordinates of the MSA are as follows:

Corner of Study Area	Easting	Northing
NE	374500	82100
NW	368500	82100
SE	374500	72100
SW	368500	72100
Projection: OSGB36 British National Grid		

2.2.2. Searches were conducted within this box and the resulting data set was then cropped to remove data that lay above the Mean High Water Mark (MHWM) from the resulting gazetteer.

2.3. SOURCES

2.3.1. The MSA defined above has been used to define the search areas for archaeological and related data.

2.3.2. The principle sources consulted in this assessment are as follows:

- Archaeological records for the MSA held nationally in the maritime section of the National Monuments Record (NMR);
- Archaeological records for the MSA held locally in the Dorset County Council Historic Environment Register (DHER);
- Records of wrecks and obstructions collated by the UK Hydrographic Office (UKHO);
- Records of Protected and Controlled Sites under the Protection of Military Remains Act held by the MoD (Naval Staff Directorate);
- Records of salvage droits held by the Receiver of Wreck (RoW) for the relevant area;
- Various secondary sources relating to the palaeo-environment and to the Palaeolithic and Mesolithic archaeology of Northern Europe, as well as those relating to known and potential wreck sites and casualties;
- Historic charts held by the UKHO;
- Geophysical and geotechnical data collected by Titan;
- Shipwreck Index of the British Isles (Larn and Larn 1997) and other secondary sources relating to wrecks and the maritime environment.

2.4. RECORD MANAGEMENT

2.4.1. In order to assess the maritime archaeological resource within the MSA, records of wrecks, casualties and seabed features were collated from the NMR, the UKHO, the RoW, MoD, DHER and secondary sources. These records were viewed in a GIS to enable duplicate records (i.e. sites that appeared in more than one data set) to be combined, and for sites that lay above the MHWM to be removed. The resulting list was combined with the results of the geophysical data analysis (see section 2.5 below), with duplicate records again being combined, and the resulting list was given a unique ID in a sequences starting at **6000** (in bold in the text).

2.4.2. A full gazetteer of wrecks, casualties and obstructions within the MSA is presented in **Appendix I** and illustrated in Figure 2.

2.4.3. The UKHO is considered to be the primary record for wrecks and obstructions on the seabed. The following definitions describe the state of the wreck and obstruction records held by the UKHO, and which have been used to classify some of the sites in the gazetteer:

- ABEY: Previously reported but not detected by survey, leading to doubts about its reported position or existence;
- DEAD: Not detected by repeated surveys, therefore considered not to exist;
- LIFT: A salvaged wreck;
- LIVE: All wrecks and anomalies found by UKHO survey.

2.4.4. Many of the records in the NMR and DHER can be termed 'recorded losses'. These records refer to casualties for which there are no currently known/confirmed seabed remains. Casualty positions are often based on descriptive definitions or dead reckoning and therefore tend to be much less precise and reliable for older shipwrecks. The records are based on the recording practice of 'Named Locations', such as 'off Portland' whereby records are assigned to an arbitrary position not directly related to their point of loss, but within the general area.

2.4.5. Recorded losses 'attached' to the named locations that fall within the MSA have not been included in the gazetteer. Rather the data has been used qualitatively within the discussion of maritime archaeological potential (section 3.6).

2.5. ARCHAEOLOGICAL ANALYSIS OF MARINE GEOPHYSICAL DATA

Objectives

2.5.1. The objectives of the review of geophysical data were as follows:

- To confirm the presence of previously known marine sites and to comment on their apparent character;
- To identify, locate and characterise hitherto unrecorded marine sites;
- To identify the presence of sedimentary deposits of archaeological potential;
- To integrate the results within the Baseline Study.

Technical Specifications

2.5.2. **Survey area.** The geophysical survey was undertaken by Titan Environmental Surveys Limited between 10th and 21st August 2006, aboard the vessel *Boy Brendan* (Titan 2006). The survey was to consist of a 500m wide corridor, providing information on bathymetry, surface sediments, shallow geology and seabed hazards with the aim of providing information suitable for aiding both engineering design and environmental impact assessment.

2.5.3. Sidescan sonar, magnetometer, swathe bathymetry and sub-bottom profiler (both boomer and pinger) data were to be collected from all lines. The survey area consisted of a corridor 500m wide and approximately 8km long. This was divided into a 500m wide corridor running from the landfall site near Redcliffe Point 5.5km south to the point where the pipeline route divided into different options, and an area approximately 10km^2 which covered the numerous variations at the Portland end of the route. The line spacing used was 50m for the main lines, with cross-lines spaced at 500m. Within the 10km^2 main area, the line orientation was approximately southwest to northeast. Line orientation within the 500m corridor was approximately northwest to southeast for the first 2km from the northern end then north to south for the remaining 3.5km.

2.5.4. Although the intention had been to collect all forms of data from each survey line, in practice this was not achieved for several reasons. The magnetometer failed on the 14th August near the start of the day and although a new unit was procured for the following day, 13 lines in the southern area have no magnetometer data. The navigation information recorded with the sidescan sonar data on all 16 lines run on this day was also corrupt. The data could be processed but not positioned. Nine more lines in this area were not run when the survey was concluded early owing to a poor

weather forecast. By this stage the seabed within the survey area had been covered at least once by sidescan sonar (although some lines did not have usable navigation information) and swathe bathymetry. Out of 65 main lines in the southern area, 25 do not have usable sidescan sonar data, 22 have no magnetic data and nine were not run with any instrument.

2.5.5. The line spacing achieved was therefore not 50m. In addition to missing lines of data most survey lines are not straight. Fishermen were not aware that the survey was taking place and fishing gear proved a significant hindrance. Geophysical instruments became snagged on several occasions, some resulting in damage, and lines had constantly to divert around static fishing gear or vessels.

2.5.6. **Navigation.** A CSI Vector GPS receiver was used as the primary navigation system. Trimble's HYDRO*pro* software was used to collect navigation data and output position information and fix marks to the sidescan sonar and sub-bottom profiler systems.

2.5.7. **Magnetometer.** The magnetometer data were collected using a Geometrics GS882 Caesium Magnetometer, towed 50m astern of the survey vessel. The instrument has an operating range of 20,000 to 100,000nT with an accuracy of <3nT throughout. Both the horizontal offsets of the magnetometer tow-point from the primary navigation system and the sensor layback were input to HYDRO*pro*. The magnetometer data were also edited through HYDRO*pro* prior to production of ASCII text files for processing, with spikes and dropouts being removed. Wessex therefore received de-spiked data with layback included.

2.5.8. **Sidescan Sonar.** Sidescan sonar data were collected using a C-Max CM2 dual frequency digital sidescan sonar, capable of operating at either 100 or 325kHz. The higher frequency option was employed throughout the survey. A range of 75m was used and the fish towed behind the vessel with a layback of 5 – 60m depending on water depth. Data were recorded as both paper records and digital data. The digital data were acquired using C-Max acquisition software, with the fish position provided via HYDRO*pro* using the software towline estimation utility. The data were recorded as cm2 files and converted to xtf files. Wessex therefore received xtf files with layback included.

2.5.9. **Boomer.** Boomer data were collected using an Applied Acoustics Surface Tow Boomer system and an Octopus 760 data acquisition and processing system. HYDRO*pro* was used to input the position information and fix marks. Data were also output to an EPC chart recorder to produce paper records. Wessex received the raw digital data. The boomer system used a power output of 100 Joules and a pulse rate of 500ms. The boomer catamaran and hydrophone were towed astern of the vessel with a separation of approximately 7m and a layback of 30m. The offsets of the mid-point between boomer and hydrophone from the primary navigation system were measured for use in data interpretation.

Data Processing

2.5.10. Wessex Archaeology processed and archaeologically interpreted all the magnetometer and sidescan sonar data and a selection of the boomer data. Titan collected all data in WGS84 co-ordinates. The magnetic data were converted to OSGB36 datum by Titan before they were received by Wessex but the sidescan

sonar and boomer data were still in WGS84, which was displayed as projection UTM Zone 30N.

2.5.11. Titan originally analysed the magnetic data by displaying it graphically in Excel. Wessex used Geometrics MagPick magnetic processing software to display the data both as an interpolated colour map and as individual profiles. The regional magnetic field was removed and anomalies greater in total amplitude than 5nT were picked and output as a table with their amplitude and position. They were then given **4000** series anomaly identification numbers.

2.5.12. The sidescan sonar data were processed and interpreted using Coda Geosurvey software. This allows data to be replayed and the gain settings adjusted to optimise the image quality. Anomalous features in the data of possible anthropogenic origin were tagged, given a **3000** series number and annotated with dimensions and a description. Positions were automatically recorded. The tags were exported as a text file and converted from UTM Zone 30N into British National Grid using Quest Geodetic Calculator.

2.5.13. As the sidescan data recorded on the 14th August all contained corrupt navigation information but the boomer data contained good navigation, strenuous efforts were made both by Wessex and by CodaOctopus to extract the good navigation from the boomer data and apply it to the sidescan data. Unfortunately it proved in the end too difficult to achieve in the short timeframe within which Wessex were working on this project. Although anomalies in these 16 lines of data were tagged and measured they do not have any position other than the number of the survey line on which the data were recorded.

2.5.14. The output tables of the magnetic and sidescan sonar anomalies were incorporated into the project GIS to determine any correlation between anomalies in order to produce a consolidated gazetteer of features, given **6000** numbers. The admiralty chart of the area (No. 2255) was also consulted to establish whether any of the features were charted wrecks or obstructions. This data set was then merged with the site list produced by the desk-based assessment as described in 2.4 above.

2.5.15. Wessex processed and interpreted the boomer data using the same software as the sidescan sonar data and a similar procedure. In addition to adjusting the gain settings the dataset was also filtered to maximise the quality of the images and clarity of reflectors. The data were examined for the palaeo-channels noted by Titan. Five lines over each channel were processed and the clearest sections were interpreted.

2.6. ASSESSMENT OF SIGNIFICANT EFFECTS

Objectives

2.6.1. The objectives of the Assessment of Significant Effects were as follows:

- To summarise the operational impacts (including indirect, secondary and cumulative effects) of the development that are relevant to the archaeological heritage;
- To assess the effects upon the archaeological heritage of impacts attributable to the development;
- To comment on the significance of the effects upon the archaeological heritage;

- To identify data gaps and outline such further investigations as might be required to resolve those gaps;
- To propose mitigation measures to reduce or remove significant adverse effects.

Methodology

2.6.2. Effects upon the archaeological heritage were assessed by comparing the footprint of the MSA with known and potential archaeological sites, and sedimentary deposits of archaeological interest identified during the assessment.

2.6.3. The significance of these effects was then assessed by gauging the degree to which they would be sustained, both in relation to individual sites and to the archaeological heritage of the region as a whole.

2.6.4. In the event of considerable uncertainty remaining about the possible coincidence of scheme impacts and known/potential sites, the methodology provided for the highlighting of data gaps and the outlining of options for further investigation.

2.6.5. The Assessment sets out recommendations in respect of mitigating any significant adverse effects, to include, as appropriate, protocols for intercepting involuntary discoveries in the course of dredging and monitoring.

2.7. CHRONOLOGY

2.7.1. The archaeological dating of remains relies on three distinct chronologies. These are as follows:

- Absolute (or calendar) dates, which are suffixed with **BC** (**B**efore **C**hrist), generically known as **big BC**. Such dates can be considered as part of our present day calendar, i.e. a date of 3,523 BC occurred 5,530 years ago.
- Calibrated radiocarbon dates, which are either related to our modern calendar as BC (**calBC**) dates, or presented as **BP** (before present) dates. BP dates are calculated in years before 1950, and take into account the increased radioactivity background count following the proliferation of nuclear testing after this date. Therefore, a calibrated date of 4,557 BP indicates a point in time 4,556 years before today (i.e. 2,550 BC).
- Uncalibrated radiocarbon dates, which are suffixed with **bc** (i.e. **little bc**), and are the original radiocarbon determinations based on the half-life of C14 without compensating for changes in the background count.

2.8. MAPPING AND DATUMS

2.8.1. The co-ordinate system used in the report is the Ordnance Survey (OS) National Grid based on the OSGB 1936 datum. Where applicable, co-ordinates have been translated using Quest Geodetic Calculator by Quest Geo Solutions Ltd.

2.8.2. Unless otherwise stated, all depths are given in metres and relate either to the Chart Datum (CD) as stated on UKHO chart 2255 or to the Ordnance Datum (OD), Newlyn. The difference between CD and OD at Portland is -2.62m, i.e. CD Portland is 2.62m below OD (Newlyn).

2.9. SEA-LEVEL CHANGE MODEL

2.9.1. This project has used the coarse model of sea-level change that was developed for the Dorset Phase 1 Rapid Coastal Zone Assessment Survey (WA 2004). It assumes a constant 5m tidal range, based upon the current range recorded at Lyme Regis (Featherstone and Lee-Elliot 2004: 232), and does not take crustal subsidence into account.

2.10. DATA HANDLING AND ARCHIVING

2.10.1. A Geographical Information System (GIS) using ArcGIS 9 has been built to store mappable data for the MSA. Data that is not mappable has been compiled in a project archive and used qualitatively.

3. BASELINE CONDITIONS

3.1. INTRODUCTION

3.1.1. The potential for the presence of submerged prehistoric archaeology within the MSA is dependent upon the date and nature of the sedimentary units present, and is closely related to relative sea-level change through time. Therefore section 3.2 presents an outline of the relevant known shallow geological, sea-level, topographical and climate change data relating to the MSA and the impact that they are likely to have on archaeological potential.

3.1.2. The assessment of the geophysical and geotechnical evidence has been used to supplement and substantiate information gathered from published sources. An assessment of sea-level is important because at various times during pre-history the sea-level will have been low enough for the MSA to have been dry land, and therefore available for exploitation by hominids. This occurred when water that would otherwise be held in oceans and seas was locked into ice sheets during periods of glaciation.

3.1.3. Archaeological sites can appear in primary contexts, where the spatial relationship between finds has not altered since deposition, and in secondary contexts, where artefacts have been 'derived' or moved from their original positions. Secondary context sites can be associated with fluvial re-deposition, glacial processes and marine transgression.

3.1.4. Secondary context sites are particularly significant where sufficient time has elapsed for these processes to impact upon primary contexts, for example Palaeolithic and Mesolithic sites. Recent work has shown that this type of site has the potential to yield important information on patterns of human land use and demography rather than just providing a source for the typological comparison of un-dateable artefacts (Hosfield and Chambers 2004).

3.2. SHALLOW GEOLOGY

Solid Geology

3.2.1. According to British Geological Survey (BGS) mapping, the solid geology of the MSA is Jurassic in date. The major feature is the Weymouth anticline, with

Kimmeridge Clay, a brown-weathering bluish black clay with thin bands of shale and limy mudstone, occurring to the south. The older Oxford Clay, a brown and bluish grey clay, occurs in the north of the MSA. Corallian deposits, which tend to occur as sandy clays, cross-bedded sands, marls or limestones, occurs between them (BGS 1983b).

3.2.2. Several seabed ridges that have been observed in the north and central part of the geophysical survey area have been interpreted as the Oxford Clay and Corallian formations (Titan 2006: 19). These ridges appear to be orientated east to west in the northern part of the survey area and northwest to southeast in the southern part (Titan 2006: Charts 3A-C). Prominent ridges in the south of the geophysical survey area are interpreted as the shale, mudstone, limestone and dolomite bands of the Kimmeridge Clay formation (Titan 2006: 19).

Surface Sediments

3.2.3. According to BGS mapping, sediment thickness within the MSA is less generally than 0.5m, although significant local variation is likely to occur because of the presence of the breakwaters. Outcrops of bedrock are recorded within the MSA, although the BGS mapping reviewed by WA is not sufficiently detailed to determine exactly where (BGS 1983a).

3.2.4. Sediment types within the Inner Harbour do not appear to have been mapped by BGS (BGS 1983a). Sediment types in this area are predominantly sandy (Bastos and Collins 2002). Along the pipeline route sediment is mapped as slightly gravelly muddy sand, becoming gravelly sand as the route moves northeast and then turns north. Sediment type then reverts to slightly gravelly muddy sand, before becoming muddy sand and then exposed bedrock in the far north close to or at the shore approach (BGS 1983a).

3.2.5. Grab sampling along the proposed route has suggested the presence of a veneer of silty gravelly sand in the north, changing to sandy silt in the central and southern parts of the route. Bedrock at or near the surface is suggested for the far north of the route close to the shore approach, across the Portland shore approach and generally to the south of the route (Titan 2006: 19 and Charts 3A-C).

3.2.6. Sidescan results from the geophysical survey area appear to show areas of seabed rippling. These have been interpreted as representing areas of clay with a thin veneer of sand. Occasional boulders have also been observed (Titan 2006: 16).

Geomorphology and Hydrology

3.2.7. According to House, the form of the Dorset hills is evidence of a series of erosion surfaces that indicate a progressive drop in sea level from the late Tertiary. This process was reversed during the Flandrian transgression, which elsewhere resulted in the flooding of Christchurch Bay and Poole Harbour (House 1989: 36).

3.2.8. Weymouth Bay is a headland-controlled embayment occupied by a barrier beach and a partly in-filled estuary. The estuary is a later manifestation of the Wey palaeo-River and the MSA therefore contains the inundated and partly eroded remains of this palaeo-valley system (SCOPAC 2003: 2). The barrier beach (Chesil Beach) was formed by the landward migration of sediments combed up during the Holocene sea level rise (SCOPAC 2003: 2).

3.2.9. The boomer data shows two channels crossing the survey area. Both are likely to have formed as a result of fluvial action since the Devensian glacial maximum (c.18,000 BP). The channels have been in-filled by fluvial sediments, and they are overlain by an overburden of modern sediments to a depth of approximately 1m.

3.2.10. The larger of the two channels was recorded running roughly southeast to northwest across the centre of the geophysical survey area (**Figure 4**). This feature is up to 8m deep and up to 1.5km wide in the centre of the area. It narrows and shallows to the south, where it is up to 6m deep and 150m to 300m wide. The edges of this feature are clearly defined and within the channel there is what has been interpreted as a second smaller and rather diffuse channel, possibly in-filled with a deposit of coarse in-fill material, possibly gravel (**Figure 4**). Running lengthways along the channel, this deposit has a maximum width of c.220m in the west, which reduces to c.90m at its eastern end.

3.2.11. The second channel was recorded running east to west across the northern part of the survey area (**Figure 4**). This feature is up to 4m deep. There is some doubt as to whether it is a channel or simply an area of sediment in-filling, as the edges of the feature are not very clearly defined.

3.2.12. As noted above, seabed ridges have been observed in the north and south of the geophysical survey area. The ridges to the south are cut at right angles by what appear to be relict furrows possibly associated with quaternary ice movements.

3.2.13. Weymouth Bay is a low energy environment. Tidal circulation is anti-clockwise to the east of the Isle of Portland and tidal currents are of low velocity. The Bay is protected from Atlantic swells by the depth of its indentation and the protection provided by Chesil Beach, the Isle of Portland and the shoals and banks east and west of Portland Bill (including Portland Bank, Shambles Bank and Adomant Shoal). The most important fetch direction is to the south-southeast. However, storm waves rarely exceed 2m in height, although 100-year occurrence of 6m to 7m waves is predicted (HR Wallingford 1998: 6).

3.2.14. It has been suggested that there has been a general gradual lowering of the seabed surface of the Bay, but this has not been substantiated by research (Brampton 1996). Both Weymouth Bay and Portland Harbour operate as weak sediment sinks accumulating sediments primarily from offshore sources. SCOPAC has suggested that much of the existing sediment is relic, having been supplied during periods of rising sea level in the late Holocene when the Bay may have been a stronger sink (SCOPAC 2003: 12). Net deposition and shallowing has taken place in the southern half of the Bay, producing an intertidal zone over 1000m wide and a total shoreface approaching 1400m (SCOPAC 2003: 10).

3.2.15. The Bay has been significantly altered during the 19th century by the building of Portland Harbour and its confining breakwaters. This has had the effect of dividing the Bay into two distinct hydraulic units, and has resulted in a reduction of the effect of refracted waves from the southwest and west, and has increased the influence of waves generated over easterly and southeasterly fetches (SCOPAC 2003: 7). In response the coastal planform has been realigned and this has resulted in the impact of storm-waves being increased in the north of the MSA (Joliffe 1976). The impact has been sufficient to cause public concern about the amount of shingle being

deposited from a seaward direction onto Weymouth beach from 1910 onwards (SCOPAC 2003).

Bathymetry

3.2.16. A bathymetry survey of the geophysical survey area was carried out by Titan Environmental Surveys Ltd (Titan 2006: Chart 5). Maximum water depth below Lowest Astronomical Tide (LAT) Portland recorded along the proposed route did not exceed a maximum of 22.5m (a correction of -1.13m from OD Newlyn was applied).

3.2.17. Depth increases away from the coast and to the south, with a maximum depth of 43m LAT being recorded in the south of the geophysical survey area (Titan 2006: 16).

3.2.18. The seabed is described as being generally flat and featureless, except where the bathymetry follows exposed ridges in the north and south of the geophysical survey area. The southern ridges are most pronounced, standing up to 4.5m above adjacent troughs (Titan 2006: 16).

Sea-level Change

3.2.19. **Table 1** below provides an approximate indication of relative sea-level variations within the English Channel region since the Lower Palaeolithic (OIS stages 3-17). It is based on several references: The Oxygen Isotope Stages are from Wymer (1999: table 2), which is a simplified version of Shackelton and Opdyke (1973). The sea levels are drawn from Wenban-Smith (2001: 15-17 and Figure 6), Jelgersma (1979) and Coles (1998).

Approximate Age		Relative Sea Level	Oxygen Isotope Stage	Comments
	2,400 BC	-2 m	-	Early Bronze Age
5,000 BP	*c.* 3750 BC	-5 m		Early Neolithic period
c. 6,500 BP	*c.* 5,400 BC	-10 m	-	Late Mesolithic period
7,500 BP	*c.* 6,300 BC	-15 m	-	Beginning of the Late Mesolithic period, land-bridge to the continent finally removed.
8,000 BP	*c.* 7,000 BC	-20 m	-	Mid Mesolithic period
c. 9,000 BP	*c.* 8,000 BC	-45m	-	Early Mesolithic period.
c. 9,450 BP	*c.* 8,500 BC	*c.* –50 m	1	Beginning of true Early Mesolithic period
c. 10,000 BP	*c.* 9,500 BC	-65 m	1	Late Upper Palaeolithic/Early Mesolithic, transition between Loch Lomond Stadial and Flandrian Interglacial.
c. 11,000 BP	*c.*11,000 BC		1	Late Upper Palaeolithic period, during the Loch Lomond Stadial.
c. 12,000 BP		-90 m	1	Late Upper Palaeolithic, middle of the Late Glacial/Windermere Interglacial.
c. 13,500 BP			2	Mid to late Upper Palaeolithic period, within the Devensian Glaciation / Dimlington Stadial Biozone.
c. 18,000 BP		-120 m	2	Early to mid Upper Palaeolithic period, following the Devensian glaciation.
c. 40,000 BP		-50 m	3	Late Middle Palaeolithic period. Devensian Chronozone, during the Upton Warren/ Chelford Interglacial. Britain probably not occupied.
c. 122,000 BP		+5 m	5e	Early Middle Palaeolithic period. Ipswichian interglacial, raised beaches laid down inland from the present day south coast.

Approximate Age	Relative Sea Level	Oxygen Isotope Stage	Comments
c. 128,000 BP	Low?	6	
c. 186,000 BP	High?	7	Interglacial.
c. 250,000 BP	Low?	8	
c. 300,000 BP	High?	8	Interglacial.
c. 340,000 BP	High?	10-11	Hoxnian interglacial.
c. 425,000 BP	-120 m+?	12	Anglian glaciation, resulting in first breach of continental land-bridge. Sea level probably at its lowest recorded level around the British Isles.
c. 480,000 BP	+5-10 m?	13	Cromerian interglacial. Raised beaches laid down inland from present day south coast.

Table 1: Relative Sea-level Changes

3.3. LOWER, MIDDLE AND EARLY UPPER PALAEOLITHIC (C.780,000-12,000 BP)

Climate and Sea-level

3.3.1. The pattern of marine transgression and regression during the Cromerian is complex, but it appears that there were at least two glacial phases (OIS 14 and 16). It is not known whether the MSA was covered by ice sheets during these phases but the area is likely to have been above sea-level during the lead up to, during and for a time after these episodes. If the subsequent Anglian glaciation covered the MSA, then the Cromerian surface geology is likely to have been substantially modified.

3.3.2. Following the Cromerian, the Northern European landscape was shaped by three major glaciations, and the associated marine transgressions and regressions. The glaciations are referred to as the Anglian (480,000-425,000 BP), Wolstonian (380,000-130,000 BP) and Devensian (70,000-12,000 BP). Although the full extent of the Wolstonian ice sheet is not clear, the MSA does not appear to have been covered during any of these glacial phases (Wymer 1999: 116).

Suitability for Hominid Occupation

3.3.3. The Lower and Middle Palaeolithic landscape of Britain is difficult to reconstruct. The climate during the Cromerian stage (OIS 13 to 17) alternated between cold and warm phases. At least six distinct temperate phases have been recognised, between approximately 450,000 and 780,000 BP (Preece 2001). Given that evidence of a hominid presence has been found in South Wales a few kilometres from an ice front (Woodcock 2000: 404), it is very likely that the climate was favourable for hominid occupation whenever the MSA was not covered by ice or submerged.

3.3.4. The climate of the MSA is likely to have remained favourable to hominid occupation throughout the Middle and Early Upper Palaeolithic. During cold periods the MSA is likely to have been either polar desert or steppe-like tundra. During warmer periods in which the MSA was not submerged woodland is likely to have predominated. Periods of coastal vegetation and salt marsh or other wetland are also likely.

Archaeological Potential

3.3.5. An assessment of the archaeological potential of the MSA must take into account the more general records of Lower, Middle and Early Upper Palaeolithic human occupation of Britain as well as local climatic and geological conditions.

3.3.6. As noted above, the environment of the MSA is likely to have been attractive to hominids during at least the temperate phases of the Cromerian and during all periods since. Recent work at the terrestrial site at Pakefield, Suffolk, (Parfitt *et al*. 2005) has produced lithic evidence of hominid activity in an interglacial environment that dates to about 700,000 BP (OIS 17 or earlier). This has pushed back the earliest date for a hominid presence in Britain by about 200,000 years. There is therefore potential for the terrestrial presence of hominid in the MSA since at least 700,000 BP.

3.3.7. Firm evidence for occupation occurs from about 500,000 BP when Britain was still connected to mainland Europe (Wymer 1999: 31-32). The Lower Palaeolithic (prior to the discovery at Pakefield defined as 500,000 to 300,000BP) is characterised by the simplest tool manufacture and the development of more sophisticated core tools such as hand-axes. The Middle Palaeolithic (300,000 to 40,000BP) is characterised by flake tools.

3.3.8. This potential is limited to periods in which the MSA was not submerged. This is difficult to accurately define because the depth of submerged areas of the MSA and of the proposed pipeline route varies greatly. It can however be generally stated that the potential is probably limited to OIS stages 2, 3, 6, 8, 10, 12 and at various times between 13 and 17.

3.3.9. One terrestrial find spot is known from this period, a Lower Palaeolithic handaxe recovered as a terrestrial find from Purbeck beds on Portland (NMR SY67 SE96 / SMR 4 001 377). It is not known whether this artefact comes from a primary or secondary context, but it does demonstrate the probable presence of hominids within or near the MSA during this period. Given that artefacts of this period are extremely unusual survivals, it is not possible to use their numbers or distribution to indicate the spatial distribution or intensity of that hominid presence.

3.4. LATE UPPER PALAEOLITHIC AND MESOLITHIC (12,000 BP-4,000 BC)

Climate and Sea-level

3.4.1. Possible sea level change within the MSA was modelled as part of the RCZAS for Dorset (WA 2004). The Late Upper Palaeolithic/Early Mesolithic coastline is modelled in **Figure 2**. Sea-level began to rise after the end of the Devensian glacial maximum (c.18,000 BP), slowly at first but with increasing rapidity after the Loch Lomond Stadial (c.12,000 BP).

3.4.2. Within the MSA the water depth varies between 28m and 0m CD with a tidal range of 0.1m to 2.1m. At Portland CD is 2.62m below OD, therefore at high tide the water line at Portland is c.0.5m below OD. This, coupled with the information from the regional sea-level curve suggests that the transgression will have begun to affect the southeastern corner of the MSA during the Mesolithic between 8,000 and 7,000 BC (see **Table 1** above).

3.4.3. By 7,000 BC those areas of the proposed pipeline route to the south and east of Portland Harbour in 18m to 20m (CD) of water would have begun to inundate and between c.6,000 BC and 0 AD the 2.5km stretch to the south of Redcliff Point would have been progressively covered by the sea.

3.4.4. It should be noted that the above dates for inundation assume that the current seabed surface is broadly consistent with the vertical elevation of the land surface at the time. The model does not differentiate relatively recent marine topography such as sandbanks from the prehistoric landscape surface, so some caution is required in its interpretation.

Topography and Climate

3.4.5. Once the post-Devensian period is reached more specific topographic characterisation is possible. The gradual inundation of the MSA during the Mesolithic is demonstrated in **Figure 2**.

3.4.6. Following the last glacial warming, around 12,000 BP, the MSA would probably have been slowly transformed from periglacial or steppe-like tundra to open vegetation with minimal forest development. Mean temperatures rose by 9° - 10° C to a maximum of 17°C (Atkinson *et al*. 1987), although winter conditions remained cold (Barton 2005: 29). In the second half of the Windermere Interstadial an increase of woodland vegetation is associated with a slight cooling (Barton 1998). This general cooling culminated in the Loch Lomond Stadial.

3.4.7. At the beginning of the Flandrian Interstadial, around 10,000 BP, temperatures appear to have risen very rapidly (Barton 2005: 29). This is the climate change that caused the last marine transgression. As climate improved vegetation within the MSA would have become increasingly temperate. Although temperatures continued to rise, the ensuing period (to the present or near past) has been one of overall climatic stability (Barton 2005: 29).

3.4.8. As sea levels rose the coastline would have moved across the MSA, broadly speaking from south to north and from east to west. The estuaries of the existing fluvial system are likely to have retreated north or north westwards across the MSA. The palaeo-channels recorded in the boomer data (see 3.2 above) may be submerged elements of the current River Wey and the Fleet (now trapped behind Chesil Beach) that were inundated during the Mesolithic. However, as there is currently no dating evidence for the in-fill deposits within these features, one or both of the features may relate to an earlier river system.

Archaeological Potential

3.4.9. At the beginning of the last glacial warming (c.13,000 BP) Britain, which was still connected to the continent, was slowly re-colonised. Direct evidence of re-colonisation, although poorly dated, is available in the form of butchered or worked animal bones trawled from the North Sea (Coles 1998: 60). Re-colonisation is likely to have comprised of an initial ‘pioneer’ phase when a few hunting parties moved to explore the previously unpopulated area, followed by a later ‘residential’ phase (Housley *et al*. 1997).

3.4.10. Some of the earliest finds from this period in mainland Britain date to 12,800 BP (Gough's Cave, Somerset) but an earlier human presence in the MSA cannot be excluded.

3.4.11. Upper Palaeolithic and Mesolithic activity in southwestern England is evidenced by finds, principally from cave sites in Somerset and Devon and the open-air site at Hengistbury Head in Dorset.

3.4.12. Three terrestrial find spots of artefacts from these periods have been recorded within the terrestrial element of the MSA. Upper Palaeolithic 'artefacts' have been recovered from near the Verne on Portland. In addition to this a Mesolithic flint scraper has been recovered from Jordan Hill in the north of the MSA. Mesolithic flints have also been found to the east of Easton Street on Portland. There are also a number of find spots or sites from this period on Portland outside of the MSA.

3.4.13. These find spots demonstrate the presence of a human population within or near the MSA during these periods, although they do not prove continuous presence. As with evidence from earlier periods, little can be said about the spatial distribution or intensity of that presence.

3.4.14. WA understands, anecdotally, that far more Palaeolithic and Mesolithic material has been recovered from the Dorset coast than has been recorded to date in the SMR. This material appears to comprise both flint and greensand chert tools and derives from *in situ* contexts, possibly primary, that are subject to cliff erosion. It is also understood that the number of find spots/sites may be in the order of up to ten times greater than that currently recorded. The material appears to be in private hands and its publication is uncertain. It is not known what proportion if any has been found within the MSA.

3.4.15. Any activity sites within the MSA will have been subject to considerable disturbance during the marine transgression. This is likely to have resulted in *in situ* material being reduced to collections of derived artefacts unless the sites lay in locations sheltered from the effects of the transgression or covered by more than just topsoil.

3.4.16. The most likely agents for this sort of preservation are the two palaeo-channels. They also contain within their fills the potential for the preservation of fine-grained deposits that might provide palaeo-environmental evidence for the area. Pollen, diatoms, foraminifera and ostracods, if preserved within the in-fills would enable a re-construction of the changes in vegetation through time, and of the onset of fully marine conditions.

3.5. MARITIME SITES - KNOWN

Summary

3.5.1. A gazetteer of the known archaeological sites within the MSA is included in **Appendix I**. The gazetteer includes both marine and inter-tidal sites, but excludes those sites that are terrestrial or which will not be impacted by the scheme. It also excludes those sites within the NMR that are only listed at Named Locations (see section 2.4 above).

3.5.2. For the purposes of this discussion, only those known sites outside of the Portland Harbour breakwaters and within 1km of the proposed route have been discussed in detail, other sites are listed in **Appendix 1**. The full list of sites and geophysical anomalies may be summarised as follows:

Site Type	Number (within MSA)
Wrecks	28
Geophysical anomaly – possible wreck	3
Geophysical anomaly	43
Geophysical anomaly – possibly modern	3

Site Type	Number (within MSA)
Obstruction	8
Lifted/dead wreck	17
Anchorage	2
Recorded loss not at an NLO	25
Recorded loss at an NLO	168
Site	30
Find spot	15
Total	**342**

Table 2: Sites within the MSA (below the HWM)

Wrecks Close to the Proposed Route

3.5.3. There are six charted wrecks and two obstructions within 1km of the route, and ten DHER records for this same area. There are no sites known sites directly on the line of the route itself (**Figure 2**).

3.5.4. The wreck of HMS *Hood* (**6059**), the third ship to bear that name, lies across the southern entrance to Portland Harbour between the Inner and Outer Breakwaters, approximately 600m northwest of the route (**Figure 2**). Sunk as a blockship, the vessel rolled over as it sank and now lies inverted with its bottom less than two metres from the surface at low water (Hinchcliffe 1999: 111). Its bow lies to the west (NAS 2007).

3.5.5. Formerly a popular recreational diving site, in recent years diving has been banned by the Portland Harbour Authority because of fears over its stability. A multibeam swath bathymetry survey carried out on behalf of the Nautical Archaeology Society (NAS 2007) appears to confirm that it is breaking up, with frames or bulkheads and internal machinery visible through huge gaps in the vessel hull (McDonald, web site).

3.5.6. Commissioned in 1893, the *Hood* was a twin screw First Class (pre-dreadnought) battleship. It was a one-off modification of the *Royal Sovereign* class. Displacing 14,500 tons, the ship was 380ft (116m) long, with a beam of 75ft (22m) and a draught of 27 ft (8m). Main armament was four 13.5-inch guns in two double turrets. Secondary armament was ten six-inch Armstrong quick firing guns.

3.5.7. The *Royal Sovereign* class was laid down as a result of the Naval Defence Act of 1889. Their design benefited from extensive trials conducted by the Royal Navy in the 1880s. Their most significant and successful departure from previous designs was the high freeboard, which gave them good seaworthiness. As a result, the class as a whole was very successful.

3.5.8. By contrast the *Hood* was not a success. To help avoid stability problems with top weight, the main guns of the *Royal Sovereign* class were mounted in open barbettes. However, under pressure from the First Sea Lord, Admiral Hood, who still favoured the previous trend for heavily armoured, low freeboard turret ships, HMS *Hood* was built with turrets. To avoid stability problems caused by the extra weight, the design was reduced by one deck fore and aft. This reduced the height of the gun axis above the water from 23ft to 17ft. As a result she seems to have been significantly less seaworthy, with the guns unable to fire in heavy seas. In addition reducing the freeboard does not appear to have had the desired effect in terms of stability (Roberts 1992: 116).

3.5.9. Dispatched to the generally calmer waters of the Mediterranean, the ship's service life was not distinguished. Despite assisting in the 'pacification' of Crete in 1896, its guns never fired a shot in anger. Due to its poor sea-keeping it seems to have been disliked by its crews. It was described by one naval captain following its eventful sinking as 'A bitch to the last!' (McDonald, web site).

3.5.10. After nine years 'up the Straits', the *Hood* returned to the Home Fleet. Placed in reserve in 1905, in 1910 the vessel became the receiving ship at Queenstown and flagship of the Senior Officer, Coast of Ireland. In 1913 she was transferred to Portsmouth and put up for sale.

3.5.11. In November 1914 it was decided to use the *Hood* as a blockship in the South Ship Channel because it was realised that ships at anchor in Portland Harbour were vulnerable to attack by U-boats firing torpedoes through the Channel. The ship was deliberately sunk on the 4th November. With its guns removed, it was towed into position and its seacocks opened. The ship took longer to sink than expected and the tide turned, pulling it out of position. Explosives were used to quickly bow a hole in its side. This had the effect of allowing the water to enter too quickly and the ship turned over to port and sank inverted (McDonald, web site).

3.5.12. Despite the precarious state of the wreck, the *Hood* is a very unusually, perhaps uniquely well preserved wreck of a Pre-Dreadnought battleship. Its continued usefulness as a blockship through much of the 20th century has meant that it has not been salvaged or dispersed, and its relatively sheltered location has meant that it has thus far remained relatively intact. As such it is of national importance. The site does not appear to have been subject to a thorough archaeological survey.

3.5.13. Immediately to the south of the *Hood* are two rows of mound-like features (**6174)** discovered during geophysical survey in 2004 (**Figure 2**). It is not known whether they have been visually inspected since. These are believed to be the remains of two rows of pilings that ran across the South Ship Channel and supported the railway line used in the construction of the Outer Breakwater in the 19th century. Although these features are not currently protected, they are of high archaeological significance because of their association with one of the major civil engineering projects of the century (see below).

3.5.14. The charted position of the wreck of the early 18th century English East India Company ship *Earl of Abergavenny* (**6053**) lies approximately 970m west of the route. Bound for the Far East and carrying 400 passengers and crew, the *Earl of Abergavenny* sank in Weymouth Bay on 5th February 1805. In poor weather an incompetent Weymouth pilot had sailed the ship into the Shambles Bank to the south of the MSA, badly holing the vessel. An attempt was made to beach the vessel on Weymouth sands but the ship sank about a mile and a half short. Despite the presence of rescue vessels, about 350 people died. Amongst the dead was the captain John Wordsworth, brother of poet William Wordsworth.

3.5.15. Sidescan and magnetometer (Cumming 2002) and multibeam swath bathymetry (NAS 2007) surveys of the site have been carried out. It does not appear to be a dispersed site. However, a large section of the side of the ship was removed by salvors in 1806 and moved to a new position 'well away to the southwest'

(Braithwaite 1806). The fate and perhaps current whereabouts of this section of hull is unknown. It may have survived if it was subsequently buried by natural processes.

3.5.16. The *Earl of Abergavenny* has been subject to organised excavation and research by a group of avocational archaeologists and divers for more almost three decades. Interim results were published in 2002 (Cumming 2002). Although not currently protected, the site appears to be subject to active local stewardship. The detailed study of the site has clearly enhanced its archaeological value and it is of regional and possibly national importance. In addition the site appears to have achieved a very prominent local profile.

3.5.17. Site **6010** is the wreck of the motor cruiser *Terrapin*, lost in 2000 as a result of a fire, and site **6060** is the wreck of a small bucket dredger. It is lying in two sections at the base of the outer face of the Inner Breakwater wall, approximately 525m northwest of the proposed route. Neither site appears, on the basis of the recorded information, to be of archaeological interest.

3.5.18. Site **6018** is the charted position of a Second World War 'bombardon'. The UKHO chart position is approximately 237m southwest of the proposed route. A bombardon was a large floating breakwater in the form of a hollow steel cruciform tube about 200ft (60m) long by 25ft (7.6m) high. They were designed to reduce the height of waves, and formed the outer breakwater of the temporary Mullberry Harbours used on the invasion beaches of Normandy in 1944 (Hartcup 1977).

3.5.19. This bombardon is one of two that are reported to lie about 150yds (137m) apart on a northwest to southeast axis. The DHER position for what is believed to be the other bombardon (WX4488) is approximately 140m to the north, which corresponds very approximately with the reported distance between the two units. It lies approximately 210m southeast of the proposed route. However, the geophysical data analysed by WA did not show any anomaly at this point. There are a number of sidescan anomalies to the south and east of **6018**, but no magnetic anomaly of sufficient strength.

3.5.20. Although more than 1600m away from the buffer zone, the uncharted wreck known as the 'Portland Stone Barge' (**6172**) has been included in this section because it is potentially of high archaeological importance. It is currently subject to intrusive archaeological investigations by the same avocational group that has investigated the *Earl of Abergavenny*.

3.5.21. This site, which covers an area of about 25m by 15m is believed to be that of the wreck of an early-mid 18th century vessel carrying a cargo of 65-75 tons of cut Portland stone. Two stone arches and a number of small finds have been recovered (Weymouth Lunar Society web site). The investigating group have apparently also located three sidescan anomalies between 55m and 48m away from the site to the south and southeast which they believe are associated with it and suggestive of a debris trail (David Carter e-mail). Although results from the site have not been published, if this identification can be substantiated then the site potentially has high archaeological importance.

3.5.22. There appears to be a significant degree of local sensitivity about this site, for reasons that are unclear. The investigating group have provided WA with a site

position on the basis that it will not be forwarded to another person or body or recorded on a database without their permission (David Carter e-mail). The position appears to be over 100m away from the position recorded for this site in the DHER, suggesting that the DHER position may be incorrect. The position given by Mr Carter is slightly further away from the route.

Geophysical Anomalies Close to the Proposed Route

3.5.23. Although **6033**, a broken up wreck lies approximately 1400m from the buffer zone (**Figure 2**) it is discussed here because it is uncharted and potentially of high archaeological value. The wreck covers an area measuring 24.3m by 13.3m (42m by 28m including nearby debris) and has a magnetic anomaly measuring 166.26nT. This strongly suggests that this wrecked ship was of wooden construction, rather than of iron or steel. This anomaly can be classified as being of anthropogenic origin and of definite archaeological interest. Archaeological importance is unknown but potentially high.

3.5.24. Closer to the route, there are four anomalies: **6012**, **6016**, **6045** and **6049**. These are discussed in an approximate north - south order.

3.5.25. Anomaly **6016** is an area of debris 2.9m long by 2.3m wide by 0.5m high. It is the easternmost of a group of three anomalies all within 30m of each other (the others being **6014** and **6015**). All of these anomalies lie within the charted bad weather refuge anchorage to the east of Weymouth Road, and therefore may represent debris from anchored vessels. All of these anomalies can be classified as being of uncertain origin but of possible archaeological interest.

3.5.26. Anomaly **6012** is categorised as a seafloor disturbance, approximately 52.3m long by 5.6m wide, with no discernible height. It is of uncertain origin but of possible archaeological interest.

3.5.27. **6049** is a very small magnetic anomaly measuring 22.15nT. It is less than two metres east of the proposed route. It is also of uncertain origin but has possible archaeological interest.

3.5.28. Anomaly **6011** is a bright reflector that is 5.2m long by 2.1m wide. It has no discernible height. It is of uncertain origin but possible archaeological interest.

3.5.29. Anomalies **6017, 6021** and **6022** are all classed as debris. **6017** is 5.8m long, 1.8m wide and 0.3m high. **6021** is 8.3m long by 0.3m wide and 0.1m high. **6022** is similarly long and thin, being 7m long, 0.2m wide and 0.3m high. They are also of uncertain origin but of possible archaeological interest.

3.5.30. **6043** is a large magnetic anomaly measuring 74,070nT. It is almost certainly of anthropogenic origin and has been classified as modern on the basis of its size.

3.5.31. Anomalies **6023**, **6025** and **6028** are loosely grouped debris. **6023** is 8m long, 0.2m wide and 0.3m high. **6028** 3.6m long, 0.4m wide and 0.3m high. Both are classified as being of uncertain origin but of possible archaeological significance. **6025** is 1.5m long, 1m wide and 1.4m high and may be a geological feature such as a boulder.

3.5.32. The nearby anomaly **6026** is a dark reflector, 2.3m long by 2.1m wide. No height was apparent. It is classified as being of uncertain origin but possible archaeological interest.

3.5.33. No anomaly was detected at the position of charted obstruction **6070**. Similarly no anomaly appears to have been detected at the position recently recorded by DHER for **6173**, an unidentified Second World War aircraft.

3.5.34. **6041**, **6042** and **6044** are loosely grouped very small magnetic anomalies. They are classified as being of uncertain origin but possible archaeological interest.

3.5.35. **6024** is another magnetic anomaly, corresponding with the position of the buoy marking the northeast corner of the naval noise range. As such it has been classified as a known non-archaeological feature.

3.5.36. **6045** and **6046** are two very small magnetic anomalies at the southern end of the proposed route. They are classified as of uncertain origin but of possible archaeological interest.

3.6. MARITIME SITES - POTENTIAL

3.6.1. The potential exists for archaeological evidence of maritime sites of all periods from the Mesolithic to the present day to be recoverable from within the MSA. Maritime sites consist of either vessels (wrecks) or debris accidentally or deliberately lost overboard from a vessel.

3.6.2. This potential cannot be reliably quantified at the present time, although it is reasonable to expect it to be related to the number of vessel movements during any particular period, the length of time that the evidence is likely to survive and the likelihood of the evidence being discovered. The potential for evidence of maritime activity from the Post-medieval and Modern periods can be expected to be greatest because of the increasing volume of trade and other marine activities in the area during these periods, and because of the relatively short period of time since its deposition on the seabed. Potential for the survival of evidence of medieval or earlier date is likely to be low, although certain classes of evidence, such as stone ballast, can be expected to survive for very long periods and the survival of more vulnerable organic material can occur in the right circumstances.

3.6.3. When dealing with shipwrecks it is very important to take into account historical variations in UK wreck recording. Many vessels will have been lost with no record being made. This is particularly and very obviously true of Prehistoric losses. Roman loss records are extremely unusual and early medieval records are rare and often un-informative. Medieval records, particularly prior to the 13th century, are also unusual.

3.6.4. True systematic loss recording only commenced in the 18th century with Lloyd's List. Furthermore it cannot be relied upon as a comprehensive record until well into the 19th century, and then only for larger vessels. Prior to that most references to losses occur in the records of court proceedings concerning salvage rights and com-pensation or occasionally correspondence involving government officials. The records of such proceedings and correspondence survive only partially and are often

very limited in their usefulness, particularly with regard to exactly where the losses occurred.

3.6.5. 'Best guesses' for the volume of shipping losses around the coast of the UK estimate eight to 40 wrecks for every mile of coastline. This does not include losses in open water, which are particularly difficult to quantify. Records of shipping such as Lloyd's Lists, dating back to the 1750s, contain many references to ships that are 'overdue' and for which no knowledge of their fate has ever been recovered.

3.6.6. As a result the currently known casualties probably only represent a small percentage of actual losses. The positions of losses are often vague or inaccurate, and hence require interpretation. It is perhaps reasonable to assume that Post-medieval wreck recording close to important ports such as Weymouth and Portland will be more reliable, but nevertheless it is likely to be far from complete.

3.6.7. The nature of the loss record also means that it is heavily weighted towards 19th and 20th century wrecks. Whilst it is undoubtedly the case that there was an increase in vessel numbers using the MSA during this period, the record is almost certainly misleading in this respect. The record is also likely to be weighted towards larger vessels, with this bias continuing into the 20th century.

3.6.8. It is also important to remember in assessing potential that Portland represents both a maritime hazard that juts out into historically important coastal shipping lanes and a place of refuge from prevailing south westerly storms. A proportion of the vessels lost within the MSA will not therefore have been planning to call there. The *Earl of Abergavenny* (see above) is a good example of such a vessel.

3.6.9. Within the Study Area there are 193 documented losses that the NMR records at Named Locations (see section 2.4 above). These are summarised in **Table 3** below. They include vessels lost between 1366 and 2001 and consist primarily of merchant ships, fishing vessels and WWII aircraft. Some of these may relate to unidentified wrecks or obstructions within the MSA. However, it is likely that the remains of a number of vessels that were lost in or close to the MSA are yet to be discovered. The unusually high number of records within the MSA is due to the fact that the 'Off Weymouth' Named Location lies within the search area.

3.6.10. The recorded losses are as follows:

Date of loss	Type	Number
1300-1349	Cargo vessel	1
1650-1699	Cargo vessel Pink Privateer Ship-of-the-line	8 1 1 1
1700-1749	Cargo vessel Craft Cutter Leisure craft Tender	3 1 1 1 1

Date of loss	Type	Number
1750-1799	Brig	1
	Cargo vessel	7
	Craft	8
	Frigate	1
	Hoy	1
	Sloop	8
1800-1849	Barque	1
	Brig	1
	Brigantine	1
	Cargo vessel	3
	Collier brig	1
	Craft	15
	Galliot	1
	Passenger vessel	1
	Revenue Cutter	1
	Sailing vessel	1
	Smack	4
1850-1899	Barge	1
	Barque	2
	Brig	2
	Brigantine	3
	Cargo vessel	4
	Craft	3
	Cutter	3
	Hulk	1
	Ketch	1
	Launch	2
	Schooner	9
	Sloop	2
	Smack	4
	Steam launch	1
	Steamer	4
	Yacht	1
	Yawl	1
1900-1914	Cargo vessel	1
	Cutter	2
	Pilot vessel	1
	Schooner	3
	Steamer	4
	Yacht	1
	Yawl	1
WWI	Barque	1
	Brigantine	1
	Craft	1
	Ketch	1
1919-1938	Aircraft	1
	Barge	1
	Cruiser	1
	Cutter	1
	Drifter	1
	Oil tanker	1
	Paddle steamer	1
	Submarine	2
WWII	Aircraft	36
	Landing craft	1
	Motor tug	1
	Patrol boat	1
	Torpedo boat	1

Date of loss	Type	Number
Post-WWII	Battleship	1
	Cargo vessel	1
	Catamaran	1
	Craft	3
	Fishing vessel	1
	Motor cruiser	1
	Motor vessel	1
	Total	**193**

Table 3: Recorded Shipping Losses

Evidence for Early Seafaring in the Vicinity of the MSA

3.6.11. Settlement patterns in Northwest Europe suggest that sea voyages were conducted as early as 7000 BC, during the Mesolithic (8500-4000 BC). However, it is not known what type of craft was used or how extensive a use was made of sea routes and fishing grounds.

3.6.12. No archaeological remains of vessels have been found in Western Europe that pre-date the Mesolithic. This may reflect the very low probability of organic remains of this type surviving for so long, or alternatively it may be because seafaring did not occur at this time. However, the simple technology required to construct a small boat will almost certainly have existed.

3.6.13. The Mesolithic record currently consists exclusively of log boats. The oldest log boat in Europe is dated to 7920 BC-6470 BC, and was found in Pesse in the Netherlands (McGrail 2004). Hide boats were used during later periods and there seems no reason why the concept would not have occurred to Mesolithic peoples. However, such vessels are more ephemeral and therefore much less likely to survive in the archaeological record.

3.6.14. Log boats were probably primarily used for transport or fishing in inland and sheltered waters, and are generally considered to be unsuited to the open sea. However, there is a wealth of ethnographic evidence that suggests that simple log boats can be modified for use at sea, and the Weymouth Bay area would have provided a relatively sheltered fishing area at this time. No such modified craft have been found along the Atlantic seaboard of Europe, but this may well be an accident of survival.

3.6.15. Extensive coastal and continental trade and sea fishing increased during the Neolithic, Bronze Age and Iron Ages. Small ports or anchorages developed as the scale of this activity grew. Log boats, hide boats and plank boats were all used and there is evidence of significant advances in technology and vessel size from the Bronze Age onwards.

3.6.16. Some of the earliest Bronze Age watercraft in Northern Europe have been found in Britain, notably in the Humber estuary. The Kilnsea fragment dates back to 1870-1670 BC (Van der Noort *et al.* 1999). The Ferriby boats were built between 1400 and 1000 BC (McGrail 2004). Although these craft are likely to have been designed for riverine and estuarine use, it is clear that the builders had the technical skills to construct robust, seaworthy craft. The remarkable Bronze Age vessel found at Dover was certainly seaworthy (Clark 2004; Crumlin-Pedersen 2006). Iron Age coin evidence, the writings of Caesar and the recovery of a sophisticated anchor off

Dorset all suggest that the Iron Age peoples of Southern Britain constructed plank-built ships capable of sea crossings.

3.6.17. Evidence of possible Bronze Age cargoes have been found in marine contexts on the south coast, in Kent at Langdon Bay and at Moor Sand near Salcombe in Devon (recent work suggests that there may be two wrecks in that vicinity). Metalwork has been recovered from both sites dating from the 13th century BC. The Moor Sands assemblage contains a metal object from Sicily (Parham et al 2006).

3.6.18. In addition to this there is evidence for the use of both Poole Harbour and Christchurch Harbour as ports during this period. Poole Harbour is thought to have contained an Iron Age port (Markey 2002) and a substantial 10m long logboat dating to about 295 BC has been found in Poole Harbour off Brownsea Island. The evidence from Poole, in the form of the mole-like 'Green Island Causeway' at Cleavel Point, indicates that quays or harbour works of some form were being built at this early date.

3.6.19. The use of the harbour at Christchurch is probably associated with the settlement at Hengistbury Head, where Neolithic goods imported from Devon and France have been found (Cunliffe 1987). The port there seems to have assumed considerable importance by the Iron Age, with wine, tools and pottery being imported from as far away as Italy. It would be surprising if the sheltered waters and the potential access to inland waterways offered by Weymouth Bay had not been taken advantage of, by at least the Bronze Age.

3.6.20. Artefacts recovered from both marine and terrestrial contexts, and the evidence of harbours in the region, suggest that there is potential for the presence of archaeological evidence of prehistoric seafaring within the MSA. This potential cannot be reliably quantified at the present time, although it is possible to give some indication of probability. There is a fundamental improbability of the largely organic evidence for very early vessels surviving this long. When the probably relatively low levels of prehistoric vessel movements and the small size of the MSA are also considered, the potential for the presence of evidence of prehistoric vessels must be considered to be low.

Evidence for Romano-British Seafaring in the Vicinity of the MSA

3.6.21. The Romano-British period (43-410 AD) probably saw an increase in trade between the southern coast of Britain and the Continent. Whilst the Roman invasion caused some initial dislocation and refocusing of trade routes and nodes (Hengistbury Head seems to have gradually declined), substantial ports such as Londinium were developed and there is indisputable artefactual and literary evidence for very extensive cross-channel trade and movement along the south coast. Improved links with the Mediterranean probably means that long distance trading voyages grew in frequency.

3.6.22. Locally, a Roman amphora was recovered from Weymouth Bay in 1888. This may or may not indicate the presence of a wreck. A shale table leg dating from this period has been recovered from off the Dorset coast, although again there is no evidence that a wreck has been found. A Roman coin has been found off Lulworth Cove, east of the MSA, leading to speculation that there was a port there (Dorset Coast Forum website).

3.6.23. It is probable that Weymouth Bay was traversed by trading and fishing vessels throughout this period. The extent to which this occurred is not however known. Vessels may have used the area in order to sail up the River Wey as far as Radipole, from where goods bound for the regional capital of Dorchester (Durnovaria) could be unloaded. Although no evidence of a harbour of this period has been located in the bay area, vessels may also have been brought ashore to load or unload cargo.

3.6.24. What is known about the development of seafaring during these periods suggests that there is potential for the presence of archaeological evidence of Roman period seafaring within the MSA. As with earlier periods, this potential cannot be reliably quantified at the present time, although it is possible to give some indication of probability. There is a fundamental improbability of the largely organic evidence for very early vessels surviving this long. When the probably relatively low levels of Roman vessel movements and the small size of the MSA are also considered, the potential for the presence of evidence of vessels of this period must be considered to be low. However, the recovery of the amphora and the other artefacts recovered from maritime contexts in the region emphasises the increased artefactual signature of the period, and indicates that wrecks of this period would be easier to find and identify.

Evidence for Early Medieval Seafaring in the Vicinity of the MSA (410-1066)

3.6.25. The first recorded Norse raid on mainland Britain appears to have taken place in Dorset, probably in Weymouth Bay, in 787 or 789. Three ships from Hordaland were involved. The Anglo-Saxon Chronicle records that the king's reeve from Dorchester, Beaduheard, was killed when he attempted to collect customs dues. The official presumably mistook the raiders for peaceful merchants, however they were eventually driven off (Swanton 1996: 55).

3.6.26. During this period customs dues were often collected from traders at a public meeting with the king's reeve. However, the Chronicle gives us no indication as to how frequently traders arrived in Weymouth Bay. There is no archaeological evidence that there was a port in the vicinity of the MSA at this time, although small-scale facilities may nevertheless have existed in the area. It seems likely that the main focus of Anglo-Saxon maritime activity were the important towns of Bridport to the northwest and Wareham to the east.

3.6.27. The Isle of Portland became a manor during this period. As well as agriculture, there is evidence that Portland stone was being quarried and exported. This would necessarily have required some form of port facility. This has not been found and evidence for it may have been removed by subsequent activity or natural processes. The Isle is known to have been attacked by Viking raiders. In 837 or 840 a Danish army defeated the local earldorman, Wulfheard (Swanton 1996: 62). A further small-scale raid involving three ships took place in 982 (Williamson 1998: 30).

3.6.28. There does not appear to be any direct archaeological evidence for maritime activity within the MSA during this period. There is historic evidence for maritime activity, but this is for exceptional and unusual events and not for the ordinary activities of trade. Nevertheless such maritime activity related to trade is likely to have occurred on a routine basis and imported goods found on archaeological sites in Dorset may have been imported through the MSA. There likely to have been shore landings at Portland or the mouth of the River Wey and vessels of this period may have used the MSA as a sheltered anchorage. In addition there may have been fishing activity.

Therefore the potential for wrecks dating from this period is low-moderate. However, the probability of finding evidence of vessels of this period is probably low.

Evidence of Medieval Seafaring in the Vicinity of the MSA (1066-1539)

3.6.29. The MSA seems to have acquired increasing importance during the medieval period. Ports at the mouth of the River Wey, Weymouth and the neighbouring Melcombe Regis, are first mentioned in 1100 when they were granted to the convent and Prior of St. Swithin of Winchester. Subsequently a local charter mentions the port at Weymouth in 1252.

3.6.30. In 1280 and 1318 Melcombe Regis and Weymouth were granted borough status respectively. This strongly suggests that they had become important as trading ports. Trade will have been with the Continent and other English ports, with the principle export being wool and imports including grain and wine. In 1324 Weymouth supplied four ships for the king's service ranging from 120 to 200 tons and Melcombe two ships of 110 and 120 tons (Williamson 1998: 57). These tonnages indicate that these were substantial vessels suited to long distance open water trading. By 1347 Weymouth was sufficiently rich to supply 15 ships and 263 seamen for the siege of Calais. At the same time Melcombe was a customs port.

3.6.31. Melcombe Regis is famous for being the port where bubonic plague, the 'Black Death', first arrived in England in 1348. Although Melcombe was made a staple port for wool in 1364, it seems that neither port made a full recovery. Melcombe and presumably Weymouth both suffered from the general insecurity of the French wars. Portland had been attacked by the French in 1340 (Rodger 1997: 100). Melcombe was attacked and burnt in 1377 and again in 1380. The Calendar of the Patent Rolls for 1433 (HMSO 1906) records that:

'Whereas the port of Melcombe is not sufficiently strong or populous for the protection of goods and merchandise brought thither against the King's enemies whereby merchants and notably John Roger, have suffered heavy loss, so that they are afraid to ship there and the king's customs suffer…and orders that Melcombe shall remain a port until next Hilary next and after shall be no port but a creek as it was before.'

3.6.32. Weymouth may have fared better at this time. Evidence from medieval port books indicates that there was still a substantial trade with the Continent. In 1487-8 for example, 29 trading vessels arrived from Brittany and four from Normandy, in addition to two from the Channel Islands, nine from local ports and 16 from other English ports (Williamson 1998: 108).

3.6.33. There is no direct archaeological evidence for maritime activity in the MSA, in the form of shipwrecks or seabed debris. However, the historical and terrestrial archaeological evidence is plentiful. It is therefore highly probable that a moderate level of maritime activity has taken place within the MSA during this period. This activity would have included vessels using port facilities at Weymouth and Melcombe Regis and using the MSA as a sheltered anchorage. In addition the MSA may have been used for fishing.

3.6.34. As a result of this increased maritime activity, the probability of wreck and artefactual evidence in the MSA at this time is probably low-medium, with the probability of find spots likely to be greater than that for wrecks.

Evidence of Post-medieval and Modern Seafaring in the Vicinity of the MSA (1540-present day)

3.6.35. At various times during the Post-medieval period the trade of Weymouth and Melcombe involved fish, fruit, sugar, tobacco and timber. In 1538 a vessel from Weymouth was with Sir Humphrey Gilbert when he discovered Newfoundland. Newfoundland trade and fishing became an important part of the town's activities, although the focus of this activity eventually shifted to Poole.

3.6.36. Weymouth and Melcombe Regis were officially united in 1571 when Elizabeth I granted a Royal Charter to the new Borough of Weymouth and Melcombe Regis. This union finally settled the long running dispute about the ownership of the harbour and theoretically ended centuries of competition between the two close neighbours.

3.6.37. Six ships and over 200 Weymouth mariners sailed with the English fleet against the Spanish Armada in 1588. The Armada vessel *San Salvador* was captured during the engagement between the fleets off Portland and briefly taken into Weymouth, where its guns were unloaded. A large iron chest currently in the Time Walk Museum in Weymouth is reputed to be from the *San Salvador*. The damaged vessel was subsequently lost, off Studland, whilst under tow to Portsmouth.

3.6.38. Although it was soon eclipsed in importance by Plymouth and Bristol, a significant number of the early emigrant ships for the new English colonies of North America sailed from Weymouth. Weymouth's role followed the failure of a fishing enterprise off the Massachusetts coast and was largely due to the efforts of one energetic man, the Reverend John White of Dorchester. A passenger aboard the *Abigail* bound for New England in 1628 was John Endicott, the future first governor of Massachusetts.

3.6.39. Weymouth was heavily involved in the English Civil War; with Parliamentary warships used the Bay as an anchorage. In 1653, during the Republic, Admiral Robert Blake commanding the English fleet fought a three day battle with a returning Dutch convoy under Tromp as it attempted to force a passage up the English Channel. Although the initial encounter to the south of Portland Bill was indecisive, the Dutch eventually suffered a heavy defeat off Beachy Head. The battle occurred well to the south of the MSA and no losses relating to the battle appear to have occurred there.

3.6.40. In the 18th and early 19th centuries, smuggling is likely to have accounted for some of the maritime activity in the MSA. The significance of this activity to the local economy is perhaps indicated by the decision of the jury at the inquest of the smuggler William Lewis of Weymouth in 1822. Lewis had been struck and killed by a shot from a Revenue vessel whilst attempting to escape in his own vessel. Despite this the jury decided that he had been murdered.

3.6.41. By the mid 18th century legal trade into and out of Weymouth was suffering from competition, particularly from Southampton, because the port lacked adequate railway connections. It was not until 1889 when it suddenly burgeoned as a railway

steamer port that this decline was reversed. Holiday passengers and vegetables started to move in quantity between the port the Channel Islands. As a result tonnage handled by the port grew by 1,077% between 1890-4 and 1910-3, the second largest growth amongst the country's older ports (Jackson 1983: 118). Between 1910 and 1913 the net tonnage of vessels clearing Weymouth for foreign destinations was 1,299,000, some 1.7% of the UK total. A very slightly higher tonnage was handled inbound (Jackson 1983: 139).

3.6.42. George III famously stayed in Weymouth, and during the 19th and 20th centuries the town transformed itself into a thriving tourist resort. Although the tourism industry tends to have a small maritime footprint offshore, several small paddle steamers have been lost off the Dorset coast. One, the *Bournemouth*, was wrecked in fog on the west side of Portland in 1886 (Le Pard 2007). The coastal excursion business still operates, all be it on a much reduced scale. In the late 20th century the MSA has seen increasing use by recreational boats, with marina and launch facilities being added in Weymouth and Portland Harbours.

3.6.43. Since the 1800s the harbour at Weymouth has been altered by various reclamation schemes that have increased its size at the seaward end. The harbour has also been extensively dredged, principally to ensure its continued use by recreational boats.

3.6.44. As noted above, the east side of Portland has always offered a natural anchorage. However, this anchorage acquired much greater strategic significance in the mid-19th century with the expansion of the French naval base at Cherbourg. In addition to Verne Citadel, huge enclosing breakwaters were built between 1854 and 1894, together with a naval dockyard. At the time it was the largest and most expensive civil engineering project in Europe. As previously noted, evidence of the piling for the railway that was built on the breakwater during construction has been found in the South Ship Channel of the breakwater (Le Pard 2007). Debris from the construction and later use of the breakwaters can be expected to be present on the seabed in their immediate vicinity. The improved shelter meant that the harbour became an increasingly popular anchorage, particularly for the Channel Fleet.

3.6.45. The continued use of the sheltered anchorage to the east and north-east of Portland appears to have prompted Henry VIII to construct Portland Castle, a small fort built in 1540 at a cost of £5000 to accommodate artillery to defend the anchorage. The layout of the fort suggests that it was specifically built to defend the anchorage and that it could not have withstood a serious assault from elsewhere. The fort was one of a number of artillery specific forts built to defend harbours and anchorages during the wars against France in the 1540s. Although it was strengthened during the late 16th century because of the threat from Spain, it never saw serious action beyond skirmishes during the Civil War (Robertson 1992: 30).

3.6.46. By the mid-1900s the role of defending the anchorage had been taken over by Verne Citadel, a large Palmerstonian fort, one of a chain again built to ward off the threat of French attack. Covering a massive 56 acres and situated in a more elevated and therefore commanding position, the fort was armed with rifled 38-ton guns with a maximum range of 10 miles (Robertson 1992: 30).

3.6.47. During the 17th century the stone trade from Portland was extensively developed. Most of the stone was transported to its destination by sea and the remains of quay facilities survive, most notably at Durdle Quay on the west side of Portland.

3.6.48. In the two decades before the outbreak of war in 1914, Portland was an important and intensively used naval base. New developments including torpedoes were trialled off Portland Bill and Robert Whitehead, the first successful commercial manufacturer of torpedoes, built a factory at Ferrybridge in 1891 and operated testing ranges. In 1912 one of the most significant events in modern naval history occurred, the first launch of an aircraft at sea, from the battleship HMS *Hibernia*.

3.6.49. The outbreak of the war saw both the Grand Fleet and the Reserve Fleet assembling at Portland prior to their departure for war stations. During the war the harbour was a base for anti-submarine patrols and reconnaissance seaplanes, the latter role leading to the establishment of Portland as an important naval air station. Portland's key role in the development of naval technology continued with the testing of the Fish hydrophone, the forerunner of modern sonar. During WWI HMS *Hood* was deliberately sunk in the South Ship Channel to help defend the harbour against submarine attack.

3.6.50. In the inter-war years Portland continued to be an important hub of the Royal Navy. The harbour was a favoured assembly point for the Atlantic and Home Fleets and an anti-submarine warfare school was opened.

3.6.51. The use of Portland Harbour during the WWII was even more intensive. In 1939 the Reserve Fleet once again gathered in anticipation of war. The intended use of the harbour as a training area and operations base was temporarily frustrated by the fall of France in 1940. The harbour came within 20 minutes flight time of Luftwaffe bases in France and temporarily became almost untenable. The anti-aircraft ship HMS *Foylebank* was sunk in the harbour in July. However, the German invasion of Russia in 1941 and the consequent transfer of much of the Luftwaffe's strength to this new front meant that Portland could once more take on an offensive role.

3.6.52. Commando raids were carried out on the French coast from Portland and in 1944 the harbour area was the main assembly point for the American forces attacking Omaha Beach on D-Day. Subsequently large numbers of reinforcing troops and supplies were moved through the harbour. Evidence for this vital role has already been found on the seabed within the MSA, in the form of the bombardon units.

3.6.53. Largely due to its front-line position in the early years of the war, a significant number of aircraft appear to have been lost in the vicinity of the MSA. These include at least seven recorded losses of both German and British aircraft and at least one maritime crash site (**6173**).

3.6.54. Post-1945 Portland remained an important naval base for the Home Fleet. Important testing and training facilities were also operated there. The harbour became the testing ground for the navy's new helicopters and the first ship landing trials took place in 1946. Ships of a number of Western navies were worked up to operational level by the FOST training facility. However, post-Cold War budget reorganisation meant that most of the naval facilities had been closed by 1999. Nevertheless some

research work is still carried out there and the harbour facilities are still used by Royal Navy and Fleet Auxiliary vessels.

3.6.55. Despite the provision of a lighthouse on Portland in 1716 and the building of Portland Harbour in the 19th century, vessels in the MSA and east of Portland have not proved to be immune to the forces of nature, particularly when exposed to gales from the east or south and in fog. Numerous losses have been recorded. Notable amongst these was the *Meteor*, the first steamship to sink off the Dorset coast in 1830. However, perhaps the most famous loss is that of the *Earl of Abergavenny*, which is discussed above. Perhaps one of the most extraordinary was in 1899 when the steamship *Stuart* was lost after apparently being washed over one of the breakwaters in a severe gale. The loss of this vessel (**6139**) clearly demonstrates that despite the building of the breakwaters, ships could still be lost to the weather.

3.6.56. Commercial ferry and freight traffic has been important to the harbours of Weymouth and Portland since the mid-19th century. Extension of the railway to Weymouth harbour in the 1880s allowed trade with the Channel Islands to flourish in particular. In addition to this commercial fishing has always been a key activity. The withdrawal of the Royal Navy in the late 20th century has resulted in a diversification of commercial activity in Portland docks, and activity now includes basing for ocean cable laying ships, marina facilities for recreational boats and ship repair.

3.6.57. Due to the increasingly intense use of the MSA during the Post-medieval and Modern periods, it is highly probable that as yet unknown sites are present within the MSA. The apparently unknown wreck discovered during geophysical survey (**6033**) demonstrates this clearly. In addition to this there appears to be a medium-high probability that archaeological evidence of crashed aircraft survives in the MSA.

4. IMPACT ASSESSMENT

4.1. OFFSHORE PIPELINE SPECIFICATIONS AND IMPACT

4.1.1. WA understands that a single 36-inch diameter pipeline will be laid along the offshore route. It is assumed that the pipeline will be laid directly on the seabed but it is not known whether it will be trenched (typically to a depth of about 1m) or alternatively buried. The shore approaches will be directionally drilled.

4.1.2. Marine oil and gas pipelines are usually laid either by anchored or dynamically positioned pipelay barges, commonly called ‘laybarges’. Sections of steel pipe, normally concrete coated, are welded together to form the pipeline on the barge and are then lowered onto the seabed as a continuous pipeline as the barge progresses along the pipeline route. Alternatively a prefabricated pipeline is laid from a large reel mounted on a dynamically positioned ship or is floated into position in one or more complete sections and then sunk. The proposed method of construction is unknown, but it is assumed for the purposes of this report that the diameter of pipe proposed and the length of the route makes it unsuitable for reel deployment or floating out in a single unit.

4.1.3. Large diameter pipelines such as this are normally laid directly onto the surface of the seabed, except at shore approaches where they are trenched. However, due to the

potentially vulnerable inshore location, the whole length of this pipeline may be trenched or alternatively buried.

4.1.4. Unless the pipeline is laid by an anchored barge, the direct effects of pipelay upon exposed or shallow buried archaeological material, in the form of impact damage or seabed scarring is likely to be confined to a narrow strip of seabed along the route, possibly not exceeding a few metres width. However, if the pipeline is laid by an anchored vessel, there are likely to be additional impacts.

4.1.5. These vessels may deploy an array of up to 12 anchors, which are redeployed in sequence during pipelay. Anchor type depends upon a number of factors but may typically be either 12 tonne high efficiency seabed penetrating anchors or 20-25 tonne stockless anchors. These are attached to the barge by steel cables, typically 75mm diameter. One half to one third of the length of the cable will be in catenary contact with the seabed.

4.1.6. The anchors are normally deployed and repositioned by anchor handling vessels and are dropped in a corridor up to 2km to 3km wide. Each anchor may typically be advanced up to 650m (resulting in 24 anchor drops being made for each 1300m advanced). Once dropped the anchor cable is hauled in until a good hold is achieved, typically dragging the anchor along the seabed for 5m to 50m depending upon anchor type. The barge then uses the anchor spread to pull itself along as pipe is laid. As a result the catenary cable is dragged across the seabed, causing cable scrape. Sediment mounds of up to 2m high can be formed by this process, particularly in clay or mud seabeds.

4.1.7. The extent and seriousness of this seabed scarring and disturbance depends upon a number of factors including:

- Laybarge type;
- The anchor type, size and weight;
- The nature of the seabed sediments;
- The load placed upon the barge and hence the anchors by the prevailing weather and currents;
- Barge and anchor handler crew skill.

4.1.8. Seabed scarring is likely to have a negative impact upon any archaeological material that is exposed on the seabed and possibly upon material that is only shallowly buried. This material is likely to be damaged, displaced and possibly destroyed. The extent of the damage will depend upon a number of factors, including the size, age and type of material. In addition displacement may result in accelerated erosion and biological or chemical decay.

4.1.9. Anchor impacts are likely to seriously damage or destroy exposed or shallow buried material. The extent of the damage will depend upon the size and type of anchor and the nature and depth of burial of the archaeological material.

4.1.10. An alternative to the use of a laybarge is the floating out and sinking of the pipe. For this method the pipe is prefabricated in one or more sections and then towed out to the route, where it is sunk into position. The impact of this type of operation can vary

considerably depending upon the exact method and equipment used, but it is likely to impact upon a smaller area of seabed than the use of an anchored laybarge.

4.1.11. Following pipelay, the only impact of the pipeline upon nearby archaeological material is likely to be scouring caused by changes in the flow of water in the vicinity of the buried or exposed pipe.

4.1.12. If the pipeline is not trenched, scouring of nearby archaeological sites may occur. This could have an extremely negative impact upon exposed or shallow-buried archaeological material and possibly upon more deeply buried material if the scouring is severe. Archaeological deposits are very fragile and therefore particularly vulnerable to scouring.

4.1.13. Scouring is most likely to impact upon sites that are very close to the pipeline. As there is only a single geophysical anomaly in the immediate vicinity of the proposed route, significant impact from scouring appears to be unlikely. In addition anti-scouring measures may be taken at vulnerable locations. However, the scale of impact and the extent of the area likely to be affected are hard to predict and WA does not have the necessary data to reach any firm conclusions.

4.1.14. A trenched pipeline is unlikely to cause scouring. If however some form of gravity trenching is employed, whereby the pipeline is allowed to bury or part-bury itself under its own weight, then short term scouring can occur.

4.1.15. Trenching itself can have an impact. The scale and extent of this impact will depend upon when it is carried out and the method used. Other forms of pipeline protection and stabilisation, such as gravel dumping, mattressing or ground anchors could impact upon archaeological deposits in the immediate vicinity.

4.2. SUMMARY OF SIGNIFICANT EFFECTS

Lower, Middle and Early Upper Palaeolithic

5.1.1 **Summary of Baseline: Known**. There are no known *in situ* or derived sites or artefacts of Lower, Middle and Early Upper Palaeolithic date within the maritime component of the MSA. However, significant numbers of artefacts from this period have been recovered from nearby terrestrial and inter-tidal contexts.

5.1.2 **Summary of Baseline: Potential**. Although there is potential for *in situ* archaeological material and artefacts in secondary context, it is presently not possible to quantify this potential, as the palaeo-topography of the MSA cannot be accurately reconstructed.

5.1.3 Modern seabed sediments overlying the above mentioned sediments have the potential to contain derived material from this period.

5.1.4 **Previous Disturbance**. Glaciation processes, and marine transgressions and regressions would have caused considerable reworking of the Lower, Middle and Early Upper Palaeolithic landscapes and any archaeological remains. The potential for *in situ* remains is therefore very low.

5.1.5 **Importance**. Any Palaeolithic material found within the MSA would have to be considered of very high national and international importance on the basis of the age and rarity of such finds underwater, or indeed in any context. Finds of similar age to those at Pakefield would undoubtedly be of high international importance.

5.1.6 **Scheme Impacts.** Pipe-laying operations will impact upon any archaeological material under and possibly in the immediate vicinity of the laid pipe and in any areas affected by anchor impacts or cable drag.

5.1.7 If the pipeline is trenched or directionally drilled, then within the area affected known artefact types of Palaeolithic date, such as stone tools and flakes, would be damaged or destroyed and removed from their primary or secondary contexts. They may then be lost within the volume of spoil, unless it is actively searched.

5.1.8 Anchor impacts are likely to damage and destroy artefactual evidence under and in the immediate vicinity. They are also likely to result in disturbance to contexts and a loss of contextual information. Cable drag is likely to destroy shallow contexts and remove and disperse artefactual evidence.

5.1.9 If scouring is caused, then disturbance of primary and secondary contexts and the possible loss or dispersal of artefacts can be expected.

5.1.10 **Significance.** The presence of artefacts is unproven and the potential for their presence cannot be reliably quantified. If present even derived artefacts of this date would be of high importance, however the scale of the impact is unlikely to affect any sediments containing material of this date. Therefore the significance of the effect upon Lower, Middle and Early Upper Palaeolithic landscapes and artefacts is likely to be low.

Late Upper Palaeolithic and Mesolithic

5.2.1 **Summary of Baseline: Known.** There are no known *in situ* or derived sites or artefacts of Late Palaeolithic or Mesolithic date within the MSA. However, Palaeolithic and Mesolithic material has been recovered from nearby terrestrial and intertidal contexts.

4.2.1. **Summary of Baseline: Potential.** Although there is potential for *in situ* archaeological material and derived artefacts, it is presently not possible to quantify this potential, because the palaeo-topography of the MSA cannot be accurately reconstructed.

4.2.2. However, the two palaeo-channels located during the geophysical survey have the potential to contain artefactual evidence of this period in either primary or secondary contexts, particularly in the possible gravel deposit that has been identified. Further these deposits may contain palaeo-environmental evidence that would be an important aid to the reconstruction of the changing landscape and vegetation and the process of inundation.

4.2.3. Modern seabed sediments overlying the above mentioned sediments have the potential to contain derived material from this period. In addition it is conceivable that material relating to Mesolithic maritime use of the MSA could be present.

5.2.2 **Previous Disturbance.** The main processes militating against the survival of prehistoric land surfaces and any associated archaeological material are the reworking of those deposits during the course of marine transgression. Wave and tidal action are likely to have eroded exposed surfaces, washing out fine sediments and abrading artefacts. Organic materials would also have been exposed to chemical and biological decay.

5.2.3 Furthermore there has been considerable subsequent intrusive use of the seabed in the MSA, particularly since the late 19th century. Considerable disturbance is likely to have been caused, particularly in the vicinity of the breakwaters.

5.2.4 **Importance.** Due to its age and the rarity, particularly underwater, Late Upper Palaeolithic or Mesolithic material within the MSA is likely to be of high national and possibly international importance.

5.2.5 **Scheme Impacts.** Probable impacts are likely to be similar or identical to those on any earlier material. The deeper the trenching, the more likely it is that material from this period will be impacted. The greatest potential for impact occurs where the route crosses the two palaeo-valleys.

5.2.6 **Significance.** The presence of sites and/or artefacts is unproven and the potential for their presence cannot be reliably quantified. If present even derived artefacts of this date would be of high importance. The scale of the impact is not clear, but is most likely to be high where the route crosses the two palaeo-valleys. Therefore the significance of the effect upon Lower, Middle and Early Upper Palaeolithic landscapes and artefacts is likely to be low for much of the route increasing, maybe to high in the area around the palaeo-valleys.

Maritime

5.3.1 **Summary of Baseline: Known.** The known and recorded maritime archaeological resource within the MSA comprises 342 sites and geophysical anomalies. This represents a very high density, even for a large historic harbour.

5.3.2 **Summary of Baseline: Potential.** In addition to the known maritime sites, there is potential for unknown and undocumented wrecks, dating back as far as the Mesolithic and, theoretically to the Palaeolithic.

5.3.3 This potential cannot be reliably quantified at the present time, although it is reasonable to expect it to be related to the number of vessel movements during any particular period, the length of time that the evidence is likely to survive, the size of the area likely to be impacted and the likelihood of the evidence being discovered. **Table 4** represents an approximate assessment of this potential and assumes that the area impacted by the pipeline will be no wider than the 100m buffer zone.

Period	Potential
Prehistoric (Palaeolithic –Iron Age)	Low
Romano-British	Low
Early Medieval	Low
Medieval	Low-moderate
Post-Medieval	Moderate
Modern	Moderate-High

Table 4: Summary of Maritime Potential

5.3.4 The potential for evidence of maritime activity of the Post-medieval and Modern periods can be expected to be greatest because of the increasing volume of trade and naval activities in the area during these periods, the impact of large civil engineering works and because of the relatively short period of time since its deposition on the seabed.

5.3.5 Potential for the presence of medieval or earlier wreck material is likely to be low due to the lower level of activity, and the further potential for the survival of evidence is also limited although certain classes of evidence, such as stone ballast, can be expected to survive for very long periods. Exceptional survivals of more vulnerable organic material can occur in the right circumstances.

5.3.6 **Previous Disturbance.** For shipwrecks, the main source of previous disturbance is likely to be the wrecking incident itself. For example, a vessel breaking up as it sinks is likely to produce a more scattered site. Post-depositional processes include large-scale sediment movements, abrasive scouring, trawling and dredging.

5.3.7 Sediment movements may take the form of a cycle of exposure and reburial events. The cycle is likely to include periodic steep increases in the curves of physical, biological and chemical decay before reburial slows the rate once more. A significant part of this process is scouring. Objects on the seabed interrupt water flows and create eddies that focus water forces to weaken structures and remove protective overburden.

5.3.8 Trawling and dredging also has a significant effect, often resulting in considerable damage and even movement of large sections of shipwreck structure. However, it is not thought that dredging has been a significant activity outside of the breakwaters and associated channels.

5.3.9 The large civil engineering projects associated with the MSA will undoubtedly have disturbed any archaeological material within their footprint, as will any previous cable or pipe laying operations. The regular use of the MSA as a refuge anchorage, possibly by large numbers of vessels, will also have led to some disturbance from anchors and cables.

5.3.10 **Importance.** At least two sites of national importance have been identified within the MSA outside of the breakwaters (**6059** and **6053**). There are a number of other significant sites and the potential exists for others of all periods. The Portland Stone Wreck (**6172**) is of undoubted local significance and may have national significance as well. Any wreck site of medieval or earlier date would almost certainly be of high archaeological importance.

5.3.11 **Scheme Impacts.** Impacts are likely to be similar to those of earlier periods. However, as these sites may be considerably younger, larger, more numerous and shallow buried or exposed, the actual impact may be greater.

4.2.4. **Effects.** The available data suggests that significant impact upon any known site, other than the geophysical anomalies identified in the buffer zone is probably very unlikely, unless the footprint of the pipelay operations extends beyond the buffer zone.

5.3.12 However, the density of sites that the MSA is believed to contain suggests that there is a high probability of archaeological material relating to maritime activity of all periods being encountered within the buffer zone. The significance of the effect of pipe-laying operations on this material will depend upon its nature and thus needs to be assessed on a site by site basis as sites/material are found.

5. MITIGATION

5.1. GENERAL PRINCIPLES

5.1.1. The key concepts behind archaeological mitigation are prevention or avoidance, reduction of impacts, remedying and offsetting. The choice of mitigation is informed by the archaeological assessment.

5.1.2. The preferred means of mitigation is to preserve archaeological material *in situ* and to take avoidance measures. Preservation *in situ* is also advantageous in that it tends to reduce costs by obviating the need for expensive site investigations. Preservation *in situ* is generally achieved by means of construction exclusion zones. The choice of exclusion zone is generally informed by the archaeological assessment.

5.1.3. Even though precautions can be taken to avoid known archaeological material, the risk of encountering previously unknown archaeological material can never be excluded. Such encounters have the potential to result in costly delays. It is therefore important that marine projects should plan for this eventuality. This can best be done by putting in place measures to ensure that unexpected archaeological material receives rapid and cost-effective archaeological attention. These impact reducing measures can include monitoring procedures such as watching briefs.

5.1.4. In some cases it is not possible to avoid a known site by design or the implementation of an exclusion zone. In these circumstances the archaeological impact of the scheme can be remedied by prior excavation and recording. Although all or part of a site may subsequently be destroyed, the information that it contains will nevertheless be 'preserved by record'. Intrusive investigations require careful planning to avoid unnecessary expense or delays and therefore may be undertaken in several incremental stages. Other forms of remedying can include stabilisation, either before or after the impact has occurred. In some cases unavoidable damage to a site can be offset by detailed analysis and safeguarding of comparable sites elsewhere – i.e. offsetting by compensatory works.

5.2. RECOMMENDATIONS

5.2.1. Although the proposed route appears to be well sited from the point of view of minimising archaeological impact, this assessment has identified a number of geophysical anomalies of possible anthropogenic origin and possible archaeological interest that lie within the 100m buffer zone. It has also identified a number of important archaeological sites and unidentified anomalies within the broader MSA that have some potential to be impacted, depending upon the exact nature of the pipelay operations. Furthermore the assessment of the potential for submerged prehistoric landscape sites and unknown shipwreck and aircraft sites has

demonstrated that there is a potential for archaeological sites to be impacted by the scheme.

5.2.2. It is therefore recommended that an archaeological Written Scheme of Investigation (WSI) should be prepared for the approval of the English Heritage Maritime Team and the Local Government Archaeological Advisory Services (e.g. Dorset County Council). This will set out how the actual and potential archaeological impact of the scheme will be managed. It will consider and propose a range of phased mitigation measures, that may include:

- Precautionary exclusion zones around significant known sites, such as the *Earl of Abergavenny*, HMS *Hood* and the nearby bridge pilings, the Portland Stone Barge and the bombardon unit;
- A protocol for the identification, reporting and subsequent management of any archaeological material that comes to light during the course of pre-construction and construction works;
- Archaeological assessment of the impact of the pipe-laying procedures to be adopted;
- Details for archaeological involvement in any further geophysical survey, allowing for archaeological input into the specification, attendance, processing and interpretation of the data;
- Archaeological inspection of geophysical anomalies within the buffer zone around the construction route;
- Details for archaeological involvement in any geotechnical survey, allowing for archaeological input into the specification, attendance, recording and interpretation of the data;
- Archaeological participation or watching brief during swim over survey operations (possibly combined with the inspection of anomalies, depending upon the scheme schedule);
- Archaeological watching brief during pipe-laying operations and possibly subsequent inspection of any sites that lie close to the route;
- Measures to deal with unexpected archaeological discoveries that may require recording, excavation and recovery by suitably qualified diving archaeologists;
- Full reporting of all archaeological works, and provision for the archives to be consolidated (according to current professional standards) and deposited with an appropriate museum.

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APPENDIX I: GAZETTEER OF SITES AND FINDS

WA ID	Name/Type	NGR E	NGR N	Description	Source	Ref
6000	Debris	372508	79699	Near end of a long bright reflector (5.5x2.5x1m), which is probably a geological feature. Possibly comprises more than one object.	3000	
6001	Debris	372077	81120	Isolated object, possibly a boulder (2.3x1.4x0.8m)	3001	
6002	Debris	372087	81150	Isolated object, possibly a boulder (3.1x2.3x0.6m)	3002	
6003	Seafloor disturbance	372629	79484	Bright and dark reflectors in what appears to be an isolated patch of ripples (42.1x17.4x0m)	3003	
6004	Dark reflector	372590	79210	Dark reflector (3.9x1.8x0m)	3005	
6005	Dark reflector	372594	79228	Dark reflector (3.5x3.4x0m)	3006	
6006	Debris	372593	79538	Possible wreck measuring 12.7x2.2x0.0m. Elliptical outline dark reflector. Other items of debris nearby.	3007; 3008	
6007	Debris	372428	80045	Possible wreck . Similar appearance to 6006. Patch of objects with 2 linear features extending to starboard and off edge of range. Covers and area 29.5x17.1x0m.	3009	
6008	Rope/chain	372407	79998	Possibly fishing gear (19.7x1.7x0m).	3010	
6009	Debris	372532	79112	Debris (6.7x0.9x0.1m)	3011	
6010	Wreck	372340	79457	Group of linear dark reflectors with height. At position of charted wreck of motor cruiser Terrapin that sank in 2000 (9.2x2.9x0.3m).	3012	58492
6011	Bright reflector	372337	76849	Bright reflector (5.3x2.1x0m)	3013	
6012	Seafloor disturbance	372303	78185	Seafloor disturbance (52.3x5.6x0m)	3014	
6013	Debris	372056	79688	With small scour around object. Possibly geological (1.5x0.6x0.3m).	3015	
6014	Debris	372115	79578	Debris (5.2x0.8x0.6m)	3016	
6015	Debris	372098	79575	Debris (1.9x1.2x0.2m)	3017	
6016	Debris	372126	79589	Debris (2.9x2.3x0.5m)	3018	
6017	Debris	372030	76052	Debris (5.8x1.8x0.3m)	3019	
6018	Wreck	371591	80771	Charted wreck of a WWII Bombardon unit measuring 29.2x4.7x1.0m. Small object of debris measuring 2.3x0.2x0.4m situated next to SW side of wreck. Debris field measuring 37.7x17.6x0.0m located 10m to the NW of the wreck. Associated magnetic anomaly measuring 1600.87nT.	3020; 3021; 3022; 4013	18682
6019	Debris	371628	80629	Debris (4.6x1.8x0.9m)	3023	
6020	Debris	371715	80672	Patch of several intersecting curvilinear features (21.1x13.1x0m).	3024	
6021	Debris	372383	76222	Debris (8.3x0.3x0.1m)	3029	
6022	Debris	372858	76277	Debris (7x0.2x0.3m)	3031	
6023	Debris	372329	74960	Debris (8x0.2x0.3m)	3032	

WA ID	Name/Type	NGR E	NGR N	Description	Source	Ref
6024	Mooring/buoy	371652	73619	Buoy marking SE corner of Noise Range (14.5x0.2x0m).	3034	
6025	Debris	372587	74876	Possibly geological (1.5x1x1.4m).	3035	
6026	Dark reflector	372859	74817	Dark reflector (2.3x2.1x0m)	3036	
6027	Debris	373500	75762	Debris (3.8x0.2x0.3m)	3037	
6028	Debris	372916	74863	Debris (3.6x0.4x0.3m)	3038	
6029	Debris	372369	73866	Debris (2.6x0.4x0.4m)	3039	
6030	Bright reflector	372306	73770	There may be a shadow but it is not clear whether an object is present (5.5x3.2x0m)	3040	
6031	Debris	371721	72853	Patch of dark and bright reflectors, some structure. Possible wreck (32.7x13.9x1.4m).	3041	
6032	Debris	372574	74109	Debris (5x2.5x0.5m)	3042	
6033	Wreck	372323	73343	Uncharted broken up wreck measuring 24.3x13.3x1.5m. Three nearby objects of debris and an associated magnetic anomaly measuring 166.26nT cover an area measuring 42x28m.	3045; 3046; 3047; 3048; 4006	
6034	Debris	372193	72908	Possibly geological (1.5x1.5x0.6m).	3049	
6035	Debris	372177	72883	Possibly geological (4.3x0.3x0.4m).	3050	
6036	Debris	371905	71654	Possibly geological (3.6x3.3x0.6m).	3052	
6037	Debris	373141	73704	Large item that extends beyond end of line. Length is therefore definitely underestimated and other dimensions may be as well (18x0.2x0.7m).	3053	
6038	Debris	373164	73425	Debris (2.5x2.2x0.4m)	3054	
6039	Debris	371622	71161	Debris (4.8x0.2x0.7m)	3055	
6040	Magnetic anomaly	370593	73156	Magnetic anomaly measuring 17.56nT	4000	
6041	Magnetic anomaly	371456	74759	Magnetic anomaly measuring 25.51nT	4001	
6042	Magnetic anomaly	371449	74737	2 magnetic anomalies on the same survey line, located 3m apart. Measuring 19.36nT and 14.65nT.	4002; 4003	
6043	Magnetic anomaly	372250	75659	Modern/artefact measuring 74070nT	4004	
6044	Magnetic anomaly	371793	74594	Magnetic anomaly measuring 13.63nT	4005	
6045	Magnetic anomaly	370330	73732	Magnetic anomaly measuring 10.41nT	4007	
6046	Magnetic anomaly	370525	74092	Magnetic anomaly measuring 19.82nT	4008	
6047	Magnetic anomaly	370230	74162	Magnetic anomaly measuring 35.51nT	4009	
6048	Magnetic anomaly	371747	80773	2 magnetic anomalies on the same survey line, located 5m apart. Measuring 74.2nT and 59.07nT.	4010; 4011	
6049	Magnetic anomaly	372205	77966	Magnetic anomaly measuring 22.15nT	4012	
6050	Magnetic anomaly	371441	81350	Large positive single pole, no dipole. Measuring 64.03nT	4014	
6051	Magnetic anomaly	371783	80486	Magnetic anomaly measuring 34.47nT	4015	

WA ID	Name/Type	NGR E	NGR N	Description	Source	Ref
6052	Countess Of Erne	370388	76398	Remains of British paddle-steamer which ended its life as a coal hulk in Portland harbour. In 1935, she broke adrift from her moorings and struck the harbour arm and sank against the wall. The wreck is well silted up and lying parallel to the harbour wall	2001	18664
6053	*Earl of Abergavenny*	371134	78155	Remains of wreck of English East Indiaman, built in 1789 and grounded and foundered 2 miles off Portland Bill in 1805 while on voyage from London via Portsmouth to the East Indies with passengers and cargo. The vessel later broke up and sank. The cargo was salvaged.	2002	18672
6054	Enecuri	370692	75714	The *Enecuri* was a Spanish steamship which sank in 1900 after drifting onto the Portland breakwater. The wreck is broken in two and is reported as an iron hull listing to starboard, broken amidships with a distinguishable bow and stern and iron propeller.	2003	18654
6055	Forester	370615	74868	Remains of a British collier which parted from her moorings in a westerly gale and drove through the Atlantic Fleet which was also at anchor. She crashed onto the stonework of the breakwater, slid off, capsized and sank in 1930.	2004	18643
6056	*Hartlepool*	369969	78856	Remains of English cargo vessel torpedoed by a German E-Boat in 1941. In 1941 the bow was salvaged and a new stern fitted. The remaining wreckage was dispersed with explosives. The wreck consists of the old stern section and scattered wreckage and lies in two distinct areas - see also 6057.	2005	18673
6057	*Hartlepool*	369497	78781	Remains of English cargo vessel torpedoed by a German E-Boat in 1941. In 1941 the bow was salvaged and a new stern fitted. The remaining wreckage was dispersed with explosives. The wreck consists of the old stern section and scattered wreckage and lies in two distinct areas - see also 6056.	2006	18675
6058	*Himalaya*	368724	75536	The *Himalaya* was a P&O 3-masted steamship built in 1853 and used in the Crimean war as a troopship. She was converted to a coal hulk and used in the Medway in 1894. When she was built *Himalaya* was the largest vessel in the world. In June 1940 she was bombed and sunk by German JU88 aircraft. After the war she was dispersed with explosives and the superstructure was removed in 1967. The wreckage consists of ship plates, beams, teak planking and coal with some parts standing 5 ft above the seabed. Sonar survey in 1990 revealed that the wreck is in six main pieces with outlying scattered wreckage.	2007	18649
6059	HMS *Hood*	370235	74450	Remains of a British battleship built in 1891 at Chatham and sunk as a blockship at the entrance of Portland Harbour at the outbreak of the first world war in 1914. The wreck is inverted and collapsed. Bollards and companionways are still visible and the engine room may still be accessible. In 2004 reports that the vessel is collapsing led to a total ban on diving on the wreck.	2008	18634
6060	Bucket dredger	369969	74328	Wreck of a bucket dredger that sank in 1982, now badly broken up and approximately 40ft long and 15ft wide. The wreck lies in two parts at the base of the breakwater slope.	2010	18706
6061	Unknown wreck	373049	81557	Stranded wreck reported to be a small craft with piping (thought to be an exhaust system). The remains show approximately 0.6m at mean low water.	2011	18815

WA ID	Name/Type	NGR E	NGR N	Description	Source	Ref
6062	Bombardon	374417	81374	Stranded wreck reported as the remains of a Bombardon unit which had previously sunk off Redcliff point. Remains of a metal barge lying on its starboard side very broken with little other than starboard plates, some ribs and bollards remaining. Wreck drie	2013	18686
6063	Unknown wreck	373928	81379	Stranded wreck. Metal wreckage lying approximately 35 meters offshore with the bow towards the north east. The ribs show near the stern and bow. The highest part dries to approximately 4m.	2014	18687
6064	Unknown wreck	373923	72397	Three isolated obstruction examined by sonar in 1990 with a height of 1.1m in a general depth of 27.4m. Possibly indicative of wreckage or submerged features.	2026	18769
6065	Unknown wreck	373923	72397	Three isolated obstruction examined by sonar in 1990 with a height of 1.1m in a general depth of 27.4m. Possibly indicative of wreckage or submerged features.	2027	18769
6066	Unknown obstruction	369157	74459	Fouls shown on Portland dockyard berthing plan. In 1981 the area was dredged to 7.7.m. Possibly indicative of a wreck or submerged feature.	2028	18633
6067	Unknown obstruction	372089	81964	Unidentified seabed obstruction. Possibly indicative of wreckage or a submerged feature.	2029	18691
6068	Unknown wreck	368536	79173	Portland Stone blocks reportedly the remains of deck cargo lost from a barge in the early 1970s. A mooring chain is secured to the blocks.	2030	18789
6069	Unknown obstruction	373923	72397	Three isolated obstruction examined by sonar in 1990 with a height of 1.1m in a general depth of 27.4m. Possibly indicative of wreckage or submerged features.	2031	18769
6070	Unknown obstruction	373048	75303	20 x 0.5m man-made, pipe like obstruction reported by fishermen. Possibly indicative of wreckage or a submerged feature.	2032	18778
6071	Unknown obstruction	368500	74503	Obstruction shown on a photoplot. Possibly indicative of wreckage or a submerged feature, possibly a diffuser situated at the end of the outfall.	2033	18787
6072	Dead wreck	369815	76077	Remains of landing barge charted 2400ft from Able Head light, eastern breakwater. Not found in 1985 and amended to ABEY.	2034	18655
6073	Lifted wreck	371473	80731	Remains of a Bombardon (steel structures built to constitute part of floating breakwaters to be used in conjunction with Mulberry harbours used during the invasion of France in 1944) projecting above high water and on the foreshore recorded in the 1940s.	2035	18683
6074	Lifted wreck	369236	74505	Fouls recorded on the Portland Dockyard berthing plan. In 1981 record amended to LIFT.	2036	18635
6075	Dead wreck	368630	75158	Stranded wreck Haytain charted 3.51 cables from Castletown Pier Light. In 1943 the wreck was deleted from charts and amended to DEAD.	2037	18644
6076	Dead wreck	370320	74762	Wreck of a British cargo vessel which was attacked by aircraft and foundered at moorings in Portland Harbour. She was built by Harland and Wolff and was originally owned by the Bank Line until she was commissioned as HMS *Foylebank* an anti-aircraft vessel in 1940. Now listed as DEAD.	2038	18640

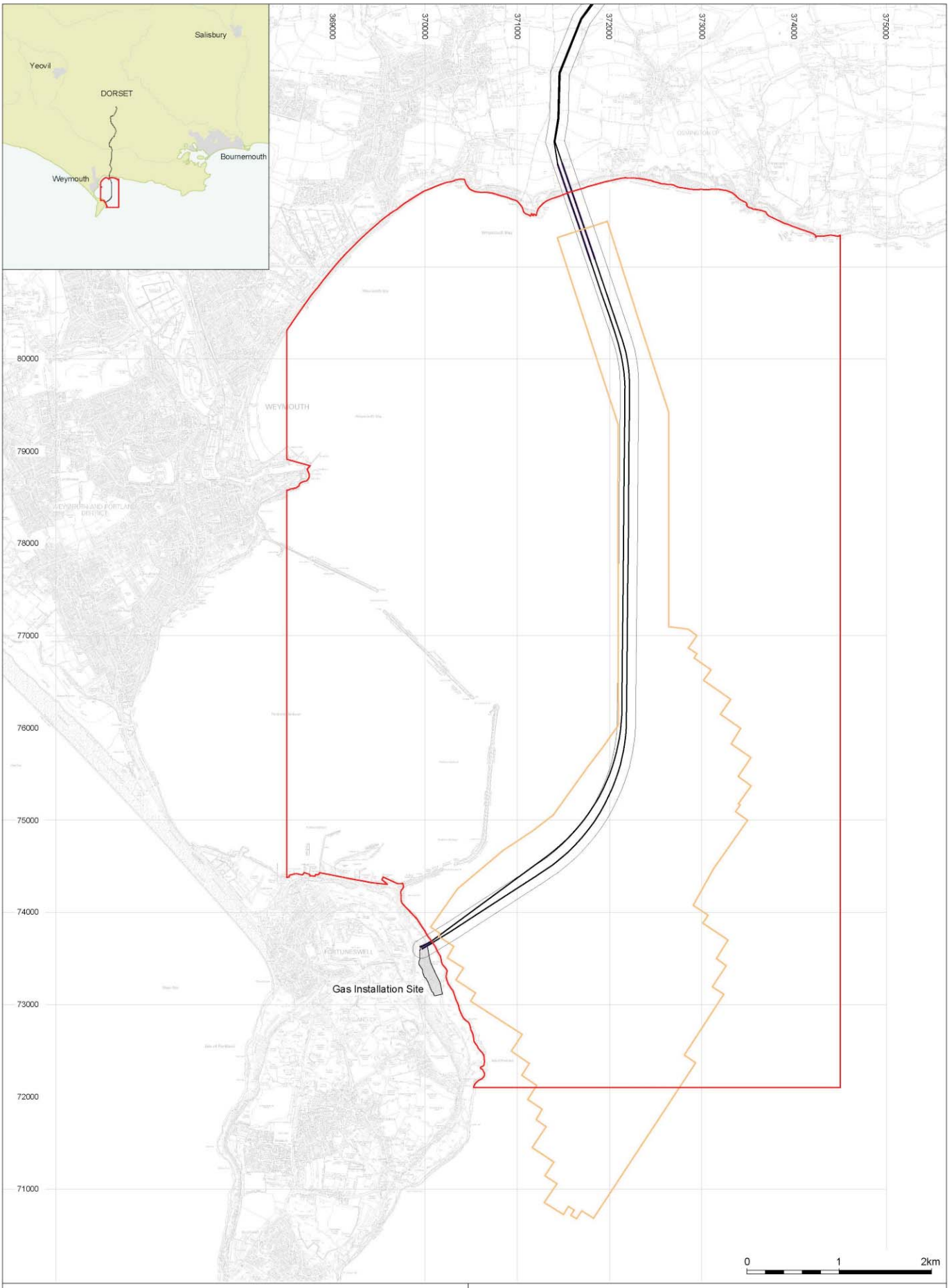
WA ID	Name/Type	NGR E	NGR N	Description	Source	Ref
6077	Dead wreck	374443	81334	Fishing vessel Sir Percival which capsized and drifted ashore. The vessel was extensively damaged and missing an engine. The wreck was not found during a coastline check in 1990 and was amended to DEAD.	2039	18734
6078	Dead wreck	368567	74509	Dangerous wreck charted at this point. In 1956 the area was swept and the record was amended to DEAD.	2040	18636
6079	Lifted wreck	368638	77801	Barge sunk accidentally during shock trials. Lies on its side with its mooring buoys on the seabed in an area used only by small craft. Consideration was given to refloating but it is not recorded whether or not this took place.	2041	18790
6080	Dead wreck	368547	74448	Stranded wreck. Deleted and amended to DEAD in 1964.	2042	18632
6081	Dead wreck	370752	81785	Stranded wreck. Insufficient remains to warrant inclusion on charts. Nothing found during 1991 and amended to DEAD.	2043	18689
6082	Dead wreck	371007	81691	Stranded wreck. Insufficient remains to warrant inclusion on charts. Nothing found during 1991 and amended to DEAD.	2044	18688
6083	Dead wreck	370407	76383	Dangerous wreck charted 0.7 cables from the light on the south end of the north east breakwater. Wreck not found in 1950 and amended to DEAD.	2045	18661
6084	Dead wreck	371950	81841	Stranded wreck. Nothing found during 1991 and amended to DEAD.	2046	18690
6085	Battery Observation Post	370500	76350	Battery observation post.		WX1359
6086	Battery Observation Post	370220	76770	Battery observation post.		WX1360
6087	Coast Artillery Searchlight	370720	75700	Coast artillery searchlight.		WX1370
6088	Coast Artillery Searchlight	370750	75970	Coast artillery searchlight.		WX1371
6089	Coastal Battery Observation Post	369580	77230	Battery observation post.		WX1373
6090	Coast Artillery Battery	369480	77490	Coast artillery battery.		WX1375
6091	Coast Artillery Battery	369560	77260	Coast artillery battery.		WX1376
6092	Inner Pier Head Fort	370180	74460	Coast artillery battery.		WX1378
6093	New Breakwater 'A' Pier Head	370520	76320	Coast artillery battery.		WX1379
6094	Breakwater Fort	370770	76220	Coast artillery battery.		WX1380

WA ID	Name/Type	NGR E	NGR N	Description	Source	Ref
6095	Petroleum Warfare Site	369480	77490	Petroleum warfare site - flame thrower.		WX1396
6096	Petroleum warfare site	370520	76320	Petroleum warfare site - 4 flame throwers.		WX1397
6097	Pillbox	370800	76200	Naval design of pillbox on Portland Breakwater.		WX1482
6098	Spigot Mortar Emplacement	369000	77710	A 29mm Spigot mortar plinth.		WX1491
6099	Torpedo Station	369560	77260	Torpedo Station.		WX1492
6100	Torpedo Station	370520	76320	Torpedo Station used during both World Wars.		WX1493
6101	Spigot Mortar Emplacement	370600	76300	A 29mm Spigot mortar plinth.		WX1500
6102	Spigot Mortar Emplacement	370310	76530	A 29mm Spigot mortar plinth.		WX1501
6103	Spigot Mortar Emplacement	369800	77050	A 29mm Spigot mortar plinth.		WX1502
6104	Spigot Mortar Emplacement	369600	77400	A 29mm Spigot mortar plinth.		WX1503
6105	Unknown possible wreck	373923	72398	Unidentified seabed obstruction reported by fishermen. Possibly indicative of wreckage or a submerged feature.		WX2120
6106	Unknown possible wreck	373928	72385	Unidentified seabed obstruction reported by fishermen. Possibly indicative of wreckage or a submerged feature.		WX2123
6107	Unknown possible wreck	373901	72372	Unidentified seabed obstruction reported by fishermen. Possibly indicative of wreckage or a submerged feature.		WX2124
6108	Spitfire MK I N3023	371783	77330	British fighter, lost 27/7/40		WX2141
6109	Find spot	370058	78804	Artefact recovered from the wreck of the *Hartlepool* - sunk 1940.		WX2495
6110	Find spot	368824	75494	Items recovered from Hulk C60 (ex *Himalaya*).		WX2514
6111	Find spot	370173	74682	Collection of artefacts recovered from the North of southern entrance of Portland Harbour - known locally as 'bottle site'.		WX2532
6112	Find spot	369000	79000	Assorted isolated artefacts recovered from various locations (mainly out of Weymouth) and reported to the Receiver of Wreck.		WX2582
6113	Find spot	369000	79000	An undated sounding lead recovered 'off Weymouth'		WX2585
6114	Bottle Bank Wreck	370173	74682	Finds recovered from a wreck known as the 'Bottle Bank'.		WX2588
6115	Find spot	369004	78999	A collection of artefacts recovered outside of Weymouth Harbour on drift dive. The fins have been reported to the Receiver of Wreck.		WX2619

WA ID	Name/Type	NGR E	NGR N	Description	Source	Ref
6116	Find spot	368582	74606	Part of a bronze bolt found partially buried on the south shore of Portland Harbour. This interesting find has been reported to the Receiver of Wreck.		WX2625
6117	Find spot	369000	80000	One shell case, detonator not fired and intact. - base stamped 1955 recovered under the cliffs to the east of Weymouth beach (found during drift dive) and reported to the Receiver of Wreck.		WX2640
6118	Find spot	369000	79000	A copper whistle recovered from Weymouth Harbour and reported to the Receiver of Wreck.		WX2654
6119	Find spot	370938	73814	Items recovered from Grove Point, Portland.		WX2690
6120	Find spot	370585	74001	A white glass bottle inscribed Youngs and sons Ltd brewers of Portsmouth, recovered from the seabed in Balaclava Bay, Portland.		WX2764
6121	Find spot	370400	81800	Unidentified (eighteenth century?) flint artefact recovered from Bowleaze Cove, Weymouth.		WX2802
6122	Weymouth Harbour Boom Wreck	368800	79000	Wreck marking the location of a boom across the entrance to Weymouth Harbour.		WX3137
6123	Portland Road: anchorage	369138	75080	Anchorage in Portland Road.		WX4325
6124	Weymouth Road: anchorage	369327	78724	Anchorage in Weymouth Road.		WX4326
6125	Long range torpedo pier	368767	77850	Long range torpedo pier marked on the second edition of OS map		WX4412
6126	HMP *Weare*	369400	74400	Weare was originally known as *Bibby Resolution*, a barge to accommodate troops after the Falklands conflict of 1982. The *Bibby Resolution* was brought from the Falkland Islands to New York for use as a floating detention facility to house prisoners.		WX445
6127	Bombardon Unit	370767	74803	Bombardon Unit, Portland Harbour.		WX4486
6128	Bombardon Unit	371567	80915	Bombardon Unit, Redcliff Point.		WX4488
6129	Find spot	373182	81586	Belarmine Jar, found in Weymouth Bay by Weymouth and Portland BSAC.		WX4505
6130	Find spot	370520	79901	An Amphora recovered from Weymouth Bay in 1888.		WX4515
6131	Halifax A	371088	79558	A Halifax aircraft lost in Weymouth Bay in 1942		WX4532
6132	German Aircraft	369940	76762	A German Aircraft off Portland Breakwater, lost on 11/7/40		WX4540
6133	M. E. 110	369685	81378	An M.E. 110 lost near Bowleaze Cove, 7/10/40		WX4561
6134	Mulberry Harbour	368730	74680	Two Phoenix units of a World War II floating harbour which were produced to assist in the Normandy Invasion of 1944. Constructed from reinforced concrete, eight of these units were located in Portland Harbour in 1946 to provide protection for the construction of the breakwater.		WX457
6135	Hurricane P2978	371437	78777	Hurricane P2978, lost east of Weymouth, 11/8/40		WX4605
6136	Hurricane V7250	371771	75106	Hurricane V7250, lost near Portland, 25/8/40		WX4609
6137	Hurricane P2766	371771	75106	Hurricane P2766, lost near Portland, 25/8/40		WX4611
6138	Devonia	371000	76000	The Devonia was rammed by the steamer Darlington at Portland Breakwater in 1884.		WX4875

WA ID	Name/Type	NGR E	NGR N	Description	Source	Ref
6139	Lifted wreck	371000	81000	The steamship Stuart was washed over Portland Breakwater in a gale in 1899.		WX4878
6140	Lifted wreck	371794	81742	The Evening Echo on the 18/8/1999 and 3/9/1999 (also with an observation) noted that the Bard ran aground in Osmington Bay in bad weather on 17/8/1999. She was recovered on 26/8/1899.		WX4958
6141	Lifted wreck	371000	78000	In 1937 the Glasgow went aground one and a half miles from the northern entrance to Portland Harbour. The ship was later refloated and moved to an anchorage in Portland.		WX4996
6142	Commodore	373574	81490	Nineteenth century ship lost off Osmington		WX5025
6143	*Devonian*	370588	74495	Schooner which sank after a collision with HMS Conflict.		WX5030
6144	*Foam*	368847	79571	Yacht lost on Weymouth beach in 1874.		WX5059
6145	*Foylebank*	370412	74706	Royal Navy anti-aircraft ship sunk in Portland Harbour during an air attack in 1940.		WX5062
6146	*Harriet*	369090	80681	Schooner lost in 1860 near Weymouth		WX5076
6147	*Hi-Life*	373613	81398	Diesel engine motor cruiser that went down off Osmington in 2000		WX5080
6148	*Joanah*	369090	80681	Ship from Lisbon that sank near Weymouth in 1707		WX5092
6149	Landing Craft 'A'	369682	77119	A Royal Navy landing craft that sank between 1940 and 1944 at Portland Breakwater		WX5111
6150	Landing Craft 'F i'	369900	76024	A Royal Navy landing craft that sank off Portland Breakwater between 1940 to 1944		WX5117
6151	Landing Craft 'G ii'	369900	76024	A Royal Navy landing craft that sank off Portland Breakwater between 1940 and 1944.		WX5118
6152	Lilly	369621	77435	A pilot cutter that sank at Portland Harbour in 1927		WX5128
6153	Breakwater Fort	370750	76200	Sea fort, part of Portland harbour defences. Originally intended as a casemented granite work following the 1859 Commission Report on the Defence of England, it was eventually constructed as an iron fort astride a granite base housing fourteen 12.5 guns		WX513
6154	Maren	369090	80681	A Danish Brigantine that sank in Weymouth Bay in 1887.		WX5136
6155	*Minx*	373926	81277	A steam powered coal barge that sank off Ringstead in 1927.		WX5147
6156	Outer Breakwater	370750	76200	Part of the Portland Breakwater constructed 1872.		WX515
6157	Outer Breakwater	370750	76200	Part of the Portland Breakwater constructed 1872.		WX515
6158	Morehouse	368960	78767	A sloop that sank at the Mixen, Weymouth, in 1858.		WX5152
6159	*Noontide*	368960	78767	A fishing drifter that sank on the Mixen Rocks in 1930.		WX5155
6160	*Otto*	369940	81603	A Russian brigantine that sank at Preston Beach.		WX5161
6161	*Sea Otter*	371682	76107	A fishing vessel that sank at Chequer Fort Harbour in 1993		WX5186
6162	*Silverdial*	370194	74497	A motor tug sunk in Portland Harbour by enemy aircraft fire in 1940.		WX5192
6163	Ulva	369443	80679	A steam launch that sank after a collision with another vessel.		WX5202
6164	Vigiland	369087	80688	A sailing vessel that sank near Weymouth in 1835.		WX5216
6165	*Barge*	370596	74498	A sprit sailed barge found by Weymouth and Portland BSAC inside Portland Harbour.		WX5220
6166	*Weymouth*	369087	80688	A revenue cutter that sank in a storm near Weymouth in 1701.		WX5226
6167	Lifted wreck	369937	81607	A Dutch ketch, Zwaatje Cornelia, wrecked at Preston Beach in 1915, may have been recovered.		WX5231
6168	Find spot	370000	81000	Romano-British iron dagger		WX536

WA ID	Name/Type	NGR E	NGR N	Description	Source	Ref
6169	Blackhead Beacon site	372000	81000	Beacon (site of) at Blackhead, Osmington.		WX549
6170	Breakwater Railway	370160	74420	Built 1878, now dismantled.		WX68
6171	Breakwater Railway	370160	74420	Built 1878, now dismantled.		WX68
6172	Portland Stone Barge'	373925	75900	Wreck of an early 18th century vessel carrying Portland stone.		
6173	Unidentified aircraft	373213	75163	1939-45.		
6174	Bridge pilings	370260	74455	Wooden pilings associated with a former bridge crossing the South Ship Channel and carrying a railway line used in the construction of the Outer Breakwater.		



Portland Gas Storage

Wessex Archaeology

— Route of proposed pipeline
— 100m buffer
— Horizontal directional drill
Data Search Area
Geophysical Survey Area

Date:	12/03/07	Revision Number:	0
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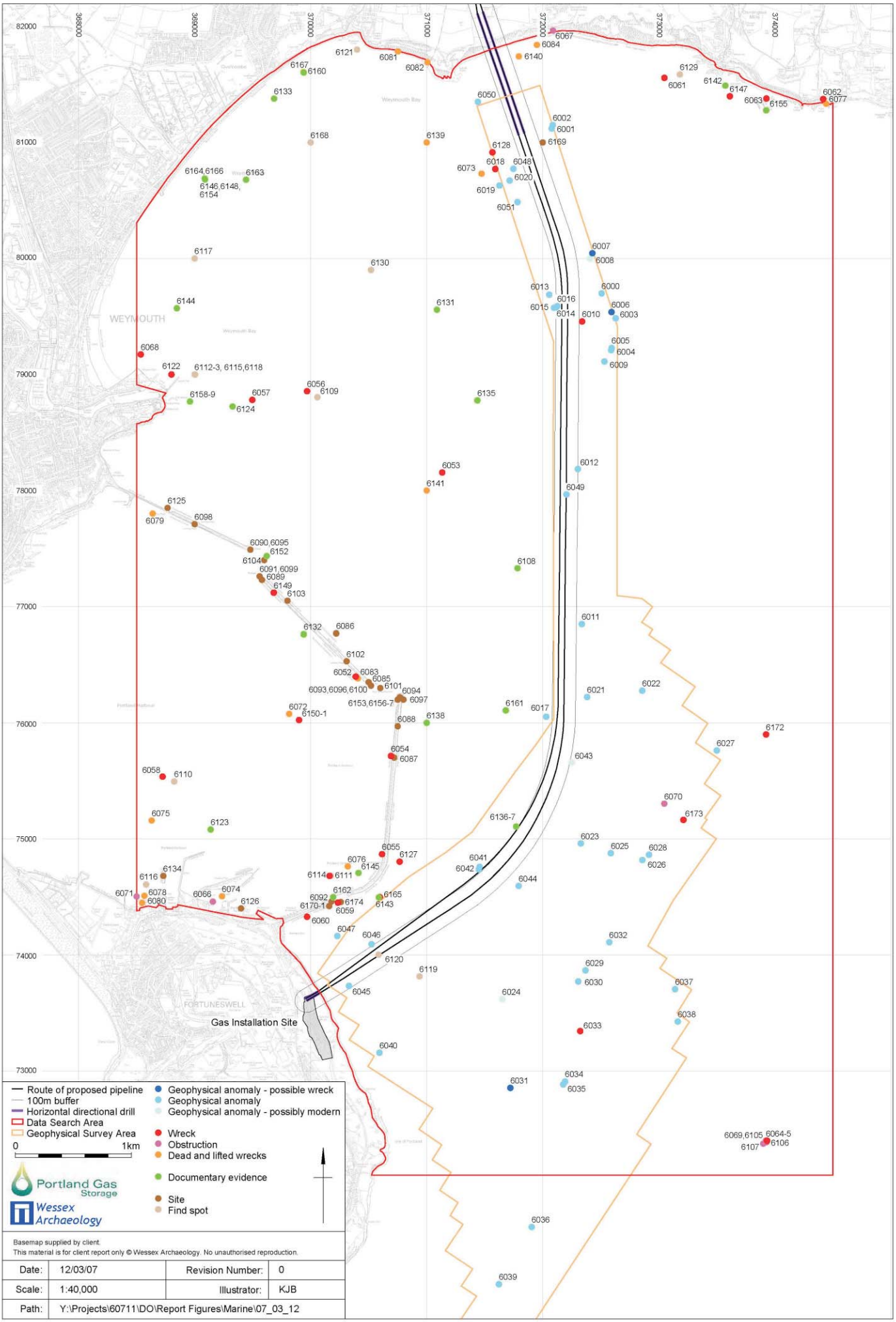
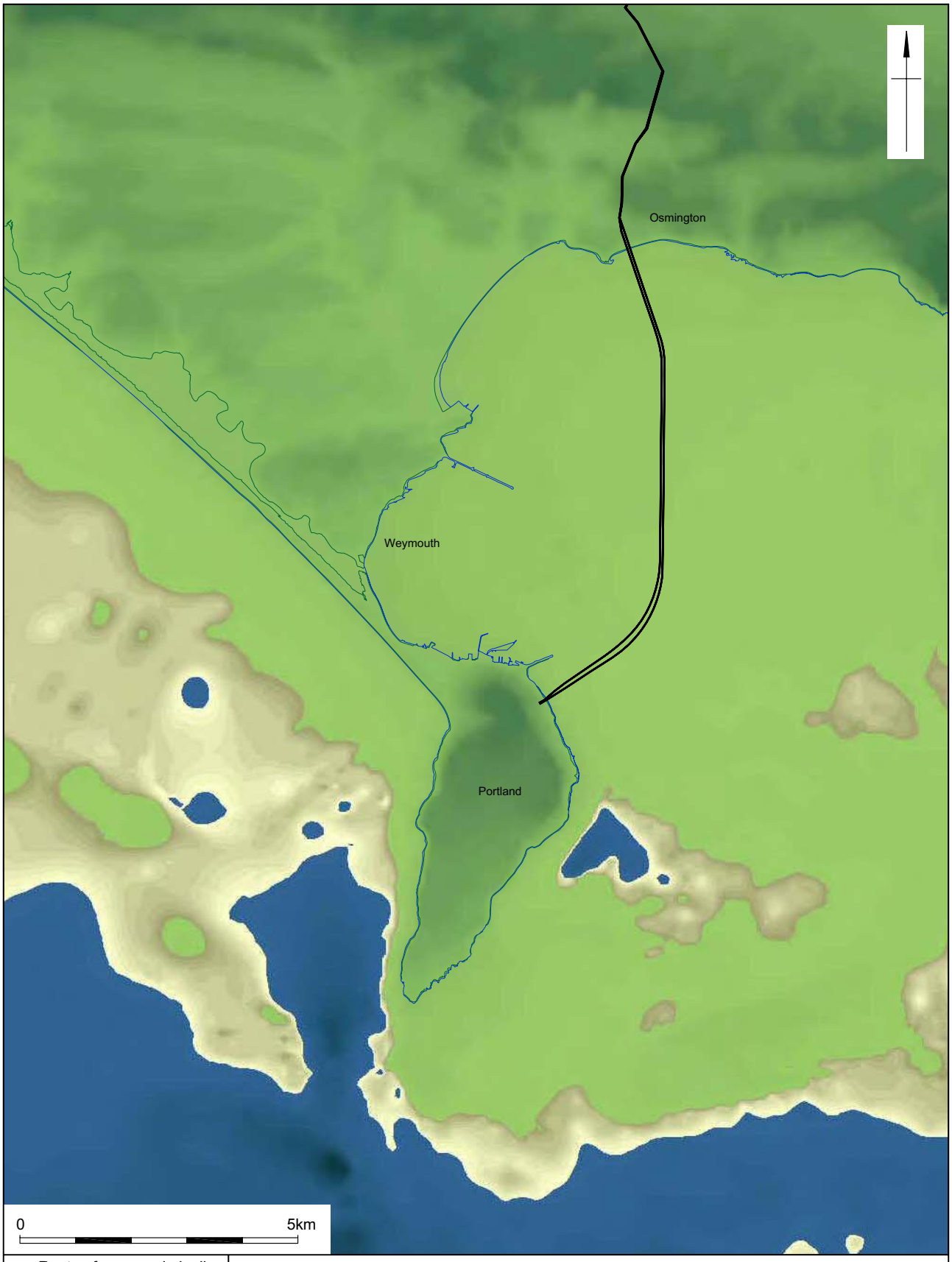
Site location

Figure 1



Maritime sites and finds

Figure 2



Route of proposed pipeline
Current Mean High Water
Current Mean Low Water

Portland Gas Storage
Wessex Archaeology

Date:	15/03/07	Revision Number:	0
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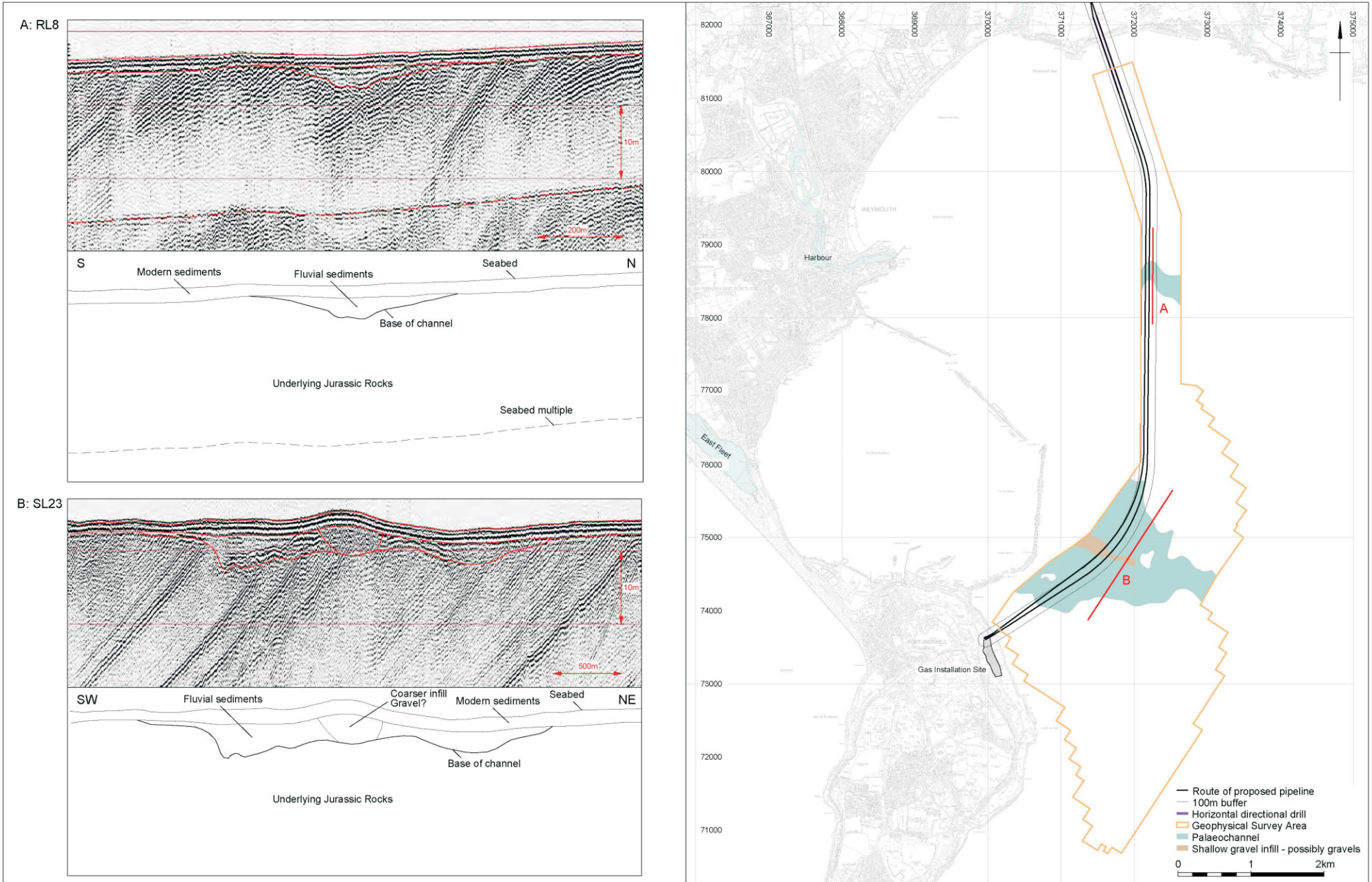
Late Upper Palaeolithic Shoreline (at - 30m RSL) Figure 3



Wessex Archaeology

Portland Gas Storage

Basemap supplied by client.

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Scale:	Seismic sections 1:500 vertical, Plan 1:50,000	Illustrator:	KJB
Path:	Y:\Projects\60711\Drawing Office\Report Figures\Marine		

Palaeochannels

Figure 4

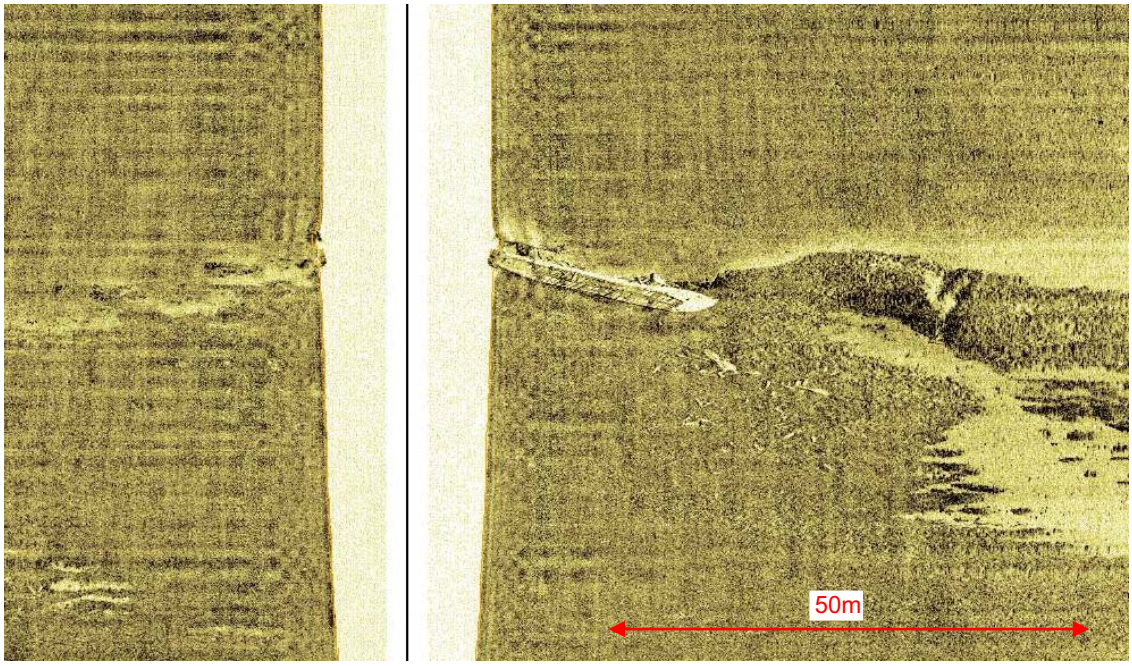

Plate 1. 6018 Bombardon Unit

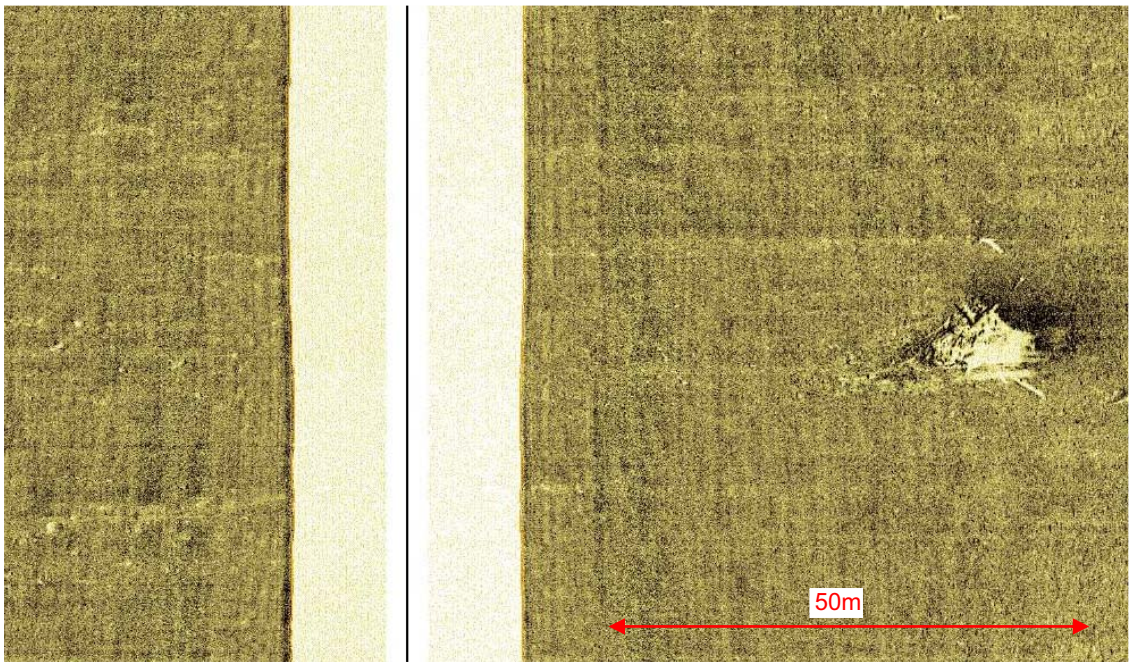

Plate 2. 6033 Wreck

Wessex Archaeology	Date:	15/03/07	Illustrator:	KJB
	Path:	Y:\Projects\60711\Drawing Office\Report Figures\Marine\07-03-15		

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