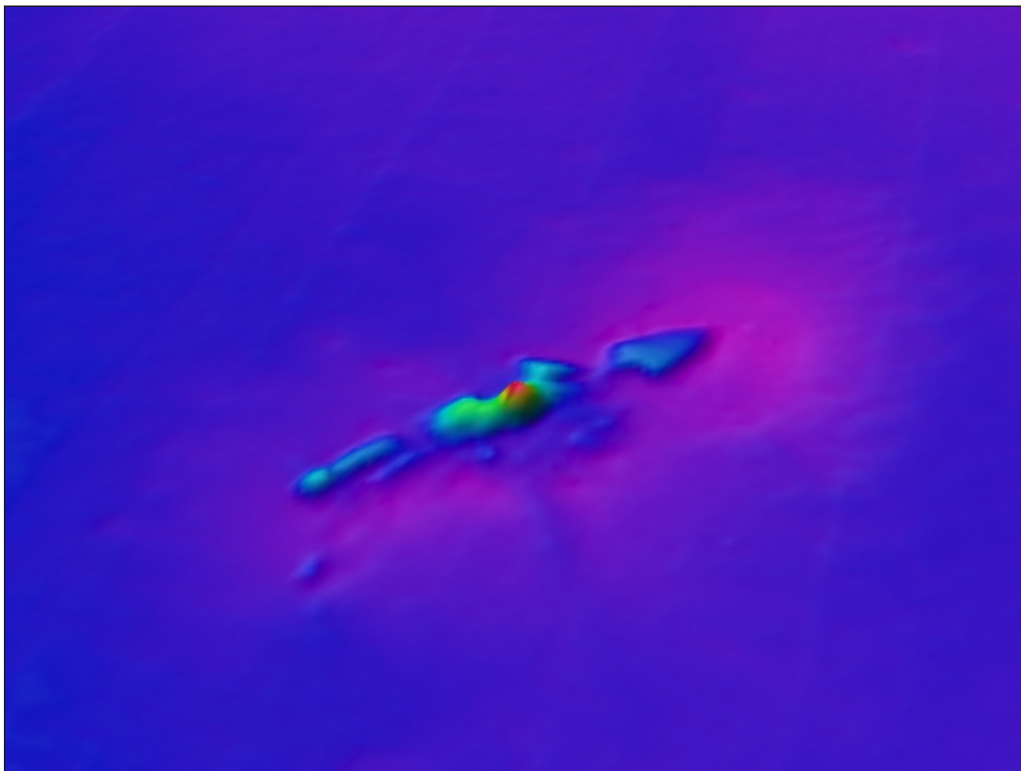




Tolmount Pipeline – Easington Route

Archaeological assessment of marine geophysical data



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Summary

Wessex Archaeology was commissioned by Xodus Group on behalf of Premier Oil E&P UK Limited to undertake an archaeological assessment of marine geophysical data for the Easington route option for the Tolmount pipeline. This was undertaken as part of an Environmental Statement prior to the Easington pipeline route installation.

The report consists of an assessment of geophysical survey data comprising sub-bottom profiler, multibeam echosounder and backscatter data, sidescan sonar and marine magnetometer data sets, acquired during different stages and over a number of years.

This assessment was undertaken in order to assess the presence of palaeogeographic features and seabed features of archaeological potential within the study area. The results of this assessment were then compiled with the results of the archaeological assessment of data acquired over the Dimlington route option.

Palaeogeographic features

No new individual palaeogeographic features of archaeological potential were identified within the study area. However, three features (**7501-7503**) that were previously identified in the assessment of the Dimlington route data are located within the study area. However, these were not seen to continue within the Easington route option dataset.

Of these, only one (**7502**) has been discriminated as P1; feature of probable archaeological interest, either because of its palaeogeography or likelihood for producing palaeoenvironmental material. It is considered to be of high potential from both an archaeological and palaeoenvironmental perspective, due to its size, age, and potential connection with the buried landscape identified during the North Sea Palaeolandscapes Project.

Features **7501** and **7503** have been classified as simple cut and fill features and have been discriminated P2; feature of possible archaeological interest.

The very shallow depth of the features (up to 2.0 m below seabed) indicates that pipeline emplacement across them is likely to remove all sediment from within the features at the crossing points. However, lateral impact to these features from such a linear scheme is expected to be small.

It is recommended that, should future geotechnical investigation be undertaken along the proposed route, any samples acquired containing material of archaeological potential, particularly those within the interpreted Pleistocene/early Holocene features, be made available for geoarchaeological assessment.

Seabed features

A total of 104 seabed features of archaeological potential were identified within the study area.

Six anomalies (**7005**, **7006**, **7007**, **7008**, **70039** and **70040**) were assigned an A1 archaeological rating; anthropogenic origin of archaeological interest.

Two of these anomalies (**7006** and **70039**) have been classified as wrecks; the remaining four A1 anomalies have been classified as individual pieces of debris pertaining to these wrecks.

Anomaly **7006** has been previously classified as a wreck with three surrounding anomalies (**7005**, **7007** and **7008**) debris anomalies. These anomalies have an existing 50 m Archaeological Exclusion Zone around each feature already in place and it is recommended that this be maintained.



Anomaly **70039** has been newly identified and classified as a wreck with one anomaly (**70040**) classified as possible surrounding debris. It is recommended that a 50 m Archaeological Exclusion Zone be placed around the extents of each of these anomalies

A total of seven records (**7000**, **70026**, **70031**, **70033**, **70038**, **70042** and **70044**) were identified within the study area and assigned an A3 archaeological discrimination; historic record of possible archaeological interest with no corresponding geophysical anomaly.

Five of these (**7000**, **70026**, **70031**, **70033** and **70038**) were classified as recorded wrecks. Four of these records (**7000**, **70031**, **70033** and **70038**) were not covered by any geophysical dataset but are located within the study area and so the existing 100 m Archaeological Exclusion Zone is recommended to be retained around previously identified record (**7000**) and a 100 m Archaeological Exclusion Zone is recommended to be placed around each of these newly identified recorded positions.

Record **70026**, located approximately 75 m from the Easington pipeline route, was covered by the geophysical data but was not observed in any dataset. Therefore, a 50 m Archaeological Exclusion Zone is recommended to be placed around this recorded position.

Two records (**70042** and **70044**) have been classified as recorded obstructions. Both were covered only by the 2015 multibeam echosounder and backscatter datasets but nothing was observed at these locations. Therefore a 30 m Archaeological Exclusion Zone is recommended to be placed around these recorded positions.

The remaining 91 anomalies have been discriminated as A2- Uncertain origin of possible archaeological interest; uncertain origin of possible archaeological interest.

These anomalies do not require any mitigation although avoidance of these features by micro-siting is recommended if they are proposed to be directly impacted by the proposed pipeline.

If any material of possible archaeological potential is recovered during any groundwork operations it is recommended that they be reported using an appropriate protocol. This will establish whether the recovered objects are of archaeological interest and recommend appropriate mitigation measures.



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Tolmount Pipeline - Easington route

Archaeological assessment of marine geophysical data

1 INTRODUCTION

1.1 Project background

- 1.1.1 Wessex Archaeology was commissioned by Xodus Group on behalf of Premier Oil E&P UK Limited (Premier) to undertake an archaeological assessment of marine geophysical data for the Easington route option of the proposed Tolmount pipeline. This was undertaken as part of an Environmental Statement (ES) prior to the installation of the Easington pipeline route. The ES focuses on a 2 km buffer centred along the route, hereafter called the 'ES study area' (fig. 1).
- 1.1.2 The Easington pipeline route option is approximately 48.4 km long and lies between the Tolmount offshore platform and the landfall at Easington natural gas terminal; located on the coast at the town of Easington in the East Riding of Yorkshire.
- 1.1.3 The pipeline is within a Project Development Area (PDA) which covers the route of the pipeline option and comprises a 500 m buffer centred on the pipeline route, hereafter called 'the [focused] study area' (fig. 1).
- 1.1.4 This study will support plans to install an export pipeline from the Tolmount gas field facility to bring gas to shore to the existing gas terminal at Easington.

1.2 Previous work

- 1.2.1 Wessex Archaeology has previously undertaken a Marine Archaeological Desk-Based Assessment (ADBA) (Wessex Archaeology 2017) of the Dimlington pipeline route option.

1.3 Scope of document

- 1.3.1 The report consists of an assessment of geophysical survey data comprising sub-bottom profiler (SBP), multibeam echo sounder (MBES) and backscatter data, sidescan sonar (SSS) and marine magnetometer (Mag.) data sets acquired during different stages and over a number of years.
- 1.3.2 The geophysical data assessed were acquired in different stages; data covering the Dimlington and Easington pipeline route options were acquired by Fugro Geoconsulting Limited (Fugro) in 2014 and 2015, and by Horizon Geosciences (Horizon) in 2016, with a further survey undertaken by Horizon in 2018 covering the Easington pipeline route only. The survey in 2014 included SBP, MBES, SSS and Mag. data. A second survey was undertaken in 2015 to extend some of the pipeline route corridors, which included parametric sonar (PS), MBES and backscatter data. A further survey was undertaken in 2016 to increase the data coverage at the offshore end of the routes, which included SBP, MBES, SSS and Mag. datasets. A final survey was undertaken in 2018, along the Easington pipeline route option only, which comprised SBP, MBES, SSS and Mag. datasets (fig 2).



1.3.3 As such, the complete data set comprises a number of different, overlapping data sets acquired using different equipment in different years, which also differ in the extents of their coverage.

1.3.4 The study area of this assessment is defined as a 500 m buffer centred on the Easington route option of the Tolmount pipeline (see fig. 1). It should be noted that not all the seabed in this area was covered by geophysical data, and parts of the route are not covered by all geophysical data types (fig. 2).

1.4 Aims and objectives

1.4.1 The aims and objectives of this assessment are:

- identify any buried palaeolandscape features of possible archaeological potential;
- confirm the presence of known or previously located marine sites of archaeological potential and to comment on their apparent character;
- identify, locate and characterise hitherto unrecorded marine sites of archaeological potential;
- provide recommendations for archaeological mitigation.

1.5 Co-ordinate system

1.5.1 The survey data was acquired in European Datum 1950 UTM zone 31N and the results are presented in this coordinate system.

2 METHODOLOGY

2.1 Data sources

2.1.1 A number of data sources were consulted during this assessment, including:

- Geophysical survey data acquired by Fugro in 2014 and 2015, and Horizon in 2016 and 2018, and their associated reports (Fugro 2015a – 2015f, 2017a – 2017c);
- The results from the previous geophysical assessment of the Dimlington route where the study areas overlap (Wessex Archaeology 2017);
- United Kingdom Hydrographic Office (UKHO) wreck and obstruction database for records of known shipwrecks and navigational hazards from historic and modern charts;
- Relevant Admiralty Charts for the study area, provided by MarineFind;

2.2 Geophysical data – technical specifications

2.2.1 The geophysical data were acquired in four different stages in four different years; between August and October 2014 (Fugro), June and July 2015 (Fugro), November 2016 (Horizon) and July 2018 (Horizon). The data were acquired using different systems on board different survey vessels. Further details on the equipment used is in Table 1.



Table 1 Summary of survey equipment

Survey company	Year and Area	Survey vessel	Data type	Equipment	Data format	
Fugro	2014 Nearshore (WE3)	Fugro Seeker	SBP	C-Products C-Boom surface towed boomer with C-Phone trailing hydrophone Hull-mounted STR Digital Pinger transducer	.sgy	
			MBES	Dual head Teledyne Reson Seabat 7125	.xyz	
			SSS	Edgetech 4200 (120 / 410 kHz) (Range: 50 – 75 m depending on depth) Towfish positioning: a moon-pool mounted Nexus Easytrak Ultra Short Base Line (USBL) acoustic positioning system	.xtf	
			Mag.	Geometrics G-882 (towed)	.xls	
			Positioning	Fugro StarFix DGNSS (primary) POS MV 320 DGNSS (secondary)	N/A	
	2014 Offshore (WE2)	Fugro Galaxy	SBP	C-Products C-Boom surface towed boomer and Applied Acoustics S-Boom Boomer	.sgy	
				Edgetech 3300 hull-mounted Chirp	.sgy	
			MBES	Kongsberg EM710	.xyz	
			SSS	Edgetech 4200 (120 / 410 kHz) (Range: 50 – 75 m depending on depth) Towfish positioning: Kongsberg HiPAP 500 USBL system	.xtf	
			Mag.	Geometrics G-882 (towed)	.INT	
	2015 Extended nearshore (WE10)	Fugro Valkyrie	SBP	Innomar SES-2000 PS system (100 kHz) (Heave compensated)	.sgy	
			MBES and backscatter	Dual head Teledyne Reson Seabat 7125	.xyz	
			Positioning	Unknown	N/A	
	Horizon	2016 Offshore DIM	Kommand or Stuart	SBP	Hull -mounted 3 x 3 Geoacoustics GeoPulse pinger array (3.5 kHz)	.sgy
				MBES	Dual head Teledyne Reson Seabat 7125	.xyz
SSS				Edgetech 4200 (120 / 410 kHz, 75m range)	.xtf	
Mag.				Geometrics G-882 (towed)	.csv	
Positioning				Unknown	N/A	
2018 Easington route		Unknown	SBP	Unknown pinger	.sgy	
			MBES	Unknown	.txt	
			SSS	Edgetech 4200 (120 / 410 kHz) – assumed 80 m range USBL	.xtf	
			Mag.	Geometrics G-882 (assumed)	.csv	
			Positioning	Unknown	N/A	

2.3 Geophysical data – processing

2.3.1 A number of datasets were assessed over the study area, each dataset was processed separately using the following software (Table 2).

Table 2 Software used for geophysical assessment

Dataset	Processing Software	Interpretation and rationalisation
SBP	CodaOctopus Survey Engine v5.5	ArcMap v10.5
MBES/Backscatter	QPS Fledermaus v7.7.5	
SSS	CodaOctopus Survey Engine v5.5	
Mag.	MagPick v3.25	

- 2.3.2 All the geophysical data available were assessed for this report, except the 2014 and 2015 inshore data and the 2016 offshore Dimlington route option data, which were assessed previously (Wessex Archaeology 2017). However, the results from the previous 2017 assessment were grouped with the results of this Easington route assessment and form part of the gazetteer where the two study areas overlap.
- 2.3.3 The SBP and MBES data were used as the primary datasets for the palaeogeographic assessment and SSS, MBES and magnetometer datasets were used for the seabed features assessment.
- 2.3.4 The SBP data were processed using CodaOctopus Survey Engine Seismic+ software. This software allows the data to be visualised with user selected filters and gain settings in order to optimise the appearance of the data for interpretation. The software then allows an interpretation to be applied to the data by identifying and selecting sedimentary boundaries and shallow geological features that might be of archaeological interest.
- 2.3.5 The SBP data were interpreted with a two-way travel time (TWTT) along the z-axis. In order to convert from TWTT to depth, the velocity of the seismic waves was estimated to be 1,600 ms⁻¹. This is a standard estimate for shallow, unconsolidated sediments. Initially, 75% of the SBP data were assessed to give an overview of the shallow geology of the area, with additional lines interpreted around any identified features of archaeological potential for added detail.
- 2.3.6 The SBP data can also be used to record small reflectors which appear to be buried material such as a wreck site covered by sediment, the position and dimensions of any such objects noted in a gazetteer, and an image of each anomaly acquired. It should be noted that anomalies of this type are rare, as the sensors must pass directly over such an object in order to produce an anomaly.
- 2.3.7 The MBES data were analysed to identify any unusual seabed structures that could be shipwrecks or other anthropogenic debris. The data were gridded at 0.5 m and 1 m (depending on acquisition) and analysed using QPS Fledermaus software, which enables a 3-D visualisation of the acquired data and geo-picking of seabed anomalies. The MBES data were also used in the palaeogeographic assessment.
- 2.3.8 The backscatter data were gridded, and analysed using QPS Fledermaus software, which enables visualisation of the acquired data and geo-picking of seabed anomalies. The gridded data were exported as an ArcGrid file and imported into ArcGIS and the resulting picked anomalies from the two visualisations were compared.
- 2.3.9 The *.xtf* SSS data files were processed using CodaOctopus Survey Engine Sidescan+ software. This allowed the data to be replayed with various gain settings in order to optimise the quality of the images. The data were interpreted for any objects of possible anthropogenic origin. This involves creating a database of anomalies within Coda by

tagging individual features of possible archaeological potential, recording their positions and dimensions, and acquiring an image of each anomaly for future reference.

- 2.3.10 A mosaic of the SSS is produced during this process to assess the quality of the sonar towfish positioning. This process allows the position of anomalies to be checked between different survey lines and for the positioning to be further refined if necessary.
- 2.3.11 The form, size and/or extent of an anomaly is a guide to its potential to be an anthropogenic feature and therefore of archaeological interest. A single small but prominent anomaly may be part of a much more extensive feature that is largely buried. Similarly, a scatter of minor anomalies may define the edges of a buried but intact feature, or it may be all that remains as a result of past impacts from, for example, dredging or fishing.
- 2.3.12 The magnetometer data were processed using Geometrics MagPick software in order to identify any discreet magnetic contacts which could represent buried metallic debris or structures such as wrecks.
- 2.3.13 The software enables both the visualisation of individual lines of data and gridding of data to produce a magnetic anomaly map. The data were first smoothed to try and eliminate any spiking. A trend was then fitted to the resulting data, and the trend values subtracted from the smoothed values. This was carried out in an attempt to remove natural variations in the data (such as diurnal variation in magnetic field strength and changes in geology). The processed data were then gridded to produce a map of magnetic anomalies, and individual anomalies tagged based on the grid and individual profile lines. Images are taken in a similar process to that of the SSS data.

2.4 Geophysical data – data quality

- 2.4.1 Once processed, the geophysical data sets were individually assessed for quality and their suitability for archaeological purposes, and rated using the following criteria (Table 3).

Table 3 Criteria for assigning data quality rating

Data quality	Description
Good	Data which are clear and unaffected or only slightly affected by weather conditions, sea state, background noise or data artefacts. Seabed datasets are suitable for the interpretation of upstanding and partially buried wrecks, debris fields, and small individual anomalies. The structure of wrecks is clear, allowing assessments on wreck condition to be made. Subtle reflectors are clear within SBP data. These data provide the highest probability that anomalies of archaeological potential will be identified.
Average	Data which are moderately affected by weather conditions, sea state and noise. Seabed datasets are suitable for the identification of upstanding and partially buried wrecks, the larger elements of debris fields and dispersed sites, and larger individual anomalies. Dispersed and/or partially buried wrecks may be difficult to identify. Interpretation of continuous reflectors in SBP data is problematic. These data are not considered to be detrimentally affected to a significant degree.
Below Average	Data which are affected by weather conditions, sea state and noise to a significant degree. Seabed datasets are suitable for the identification of relatively intact, upstanding wrecks and large individual anomalies. Dispersed and/or partially buried wrecks, or small isolated anomalies may not be clearly resolved. Small palaeogeographic features, or internal structure may not be resolved in SBP data.
Variable	This category contains datasets where the individual lines range in quality. Confidence of interpretation is subsequently likely to vary within the study area.

- 2.4.2 Due to the number of datasets the data quality ratings have been summarised in the table below (Table 4) and these ratings are qualified below.



Table 4 Summary table of data quality for multiple datasets

Survey Details			Data Quality				
Operator and Year	Area	Vessel	SBP	MBES	Backscatter	SSS	Mag.
Fugro 2014	Nearshore WE3	<i>Fugro Seeker</i>	Average	Good	N/A	Average	Average
Fugro 2014	Offshore WE2	<i>Fugro Galaxy</i>	Average	Good	N/A	Average	Average
Fugro 2015	Extended nearshore WE10	<i>Fugro Valkyrie</i>	Good	Good	Variable	N/A	N/A
Horizon 2016	Offshore DIM	<i>Kommandor Stuart</i>	Average	Good	N/A	Average	Good
Horizon 2018	Easington route	Unknown	Average	Good	N/A	Average	Average

- 2.4.3 The 2014 SBP data were rated as 'Average' using the above criteria (Table 3). Relatively good penetration was achieved considering the geology of the area, but the data were heavily affected by swell. However, this was mostly rectified during processing and the data are deemed suitable for archaeological assessment. The nearshore data were also heavily affected by seabed multiples, although this is a function of the water depths within this part of the Study Area and so is a known limitation of the survey.
- 2.4.4 The 2014 MBES data were rated as 'Good' using the above criteria, with relatively small anomalies clearly resolved and relatively little environmental effects visible.
- 2.4.5 The 2014 SSS data were rated as 'Average' using the above criteria. Seabed features were generally clearly visible, although the data were affected by cable snatching in some areas and some navigational issues. However, this was not deemed to detrimentally affect the data to a significant degree, and it is considered suitable for archaeological interpretation.
- 2.4.6 The 2014 magnetometer data were rated as 'Average' using the above criteria. Small anomalies were generally visible. However, the data were generally affected by sea state with an amount of cable snatching visible, navigational issues and some background noise visible along the route. The natural background data does increase in the nearshore area but is likely a function of water depth and shallow geology. However, this was not deemed to detrimentally affect the data to a significant degree, and it is considered suitable for archaeological interpretation.
- 2.4.7 The 2015 SBP data were rated as 'Good' using the above criteria. Very little environmental effects were observed in the data, and shallow reflectors were clearly visible. The record length was relatively short in some areas, although this was not deemed to detrimentally affect the data to a significant degree.
- 2.4.8 The 2015 MBES data were rated as 'Good' using the above criteria, with relatively small anomalies clearly resolved and relatively little environmental effects visible.
- 2.4.9 The 2015 backscatter data were rated as 'Variable' using the above criteria. The data set itself was relatively good, however, small features of archaeological potential may not be identifiable in backscatter data. Larger features, however, such as large pieces of debris were visible within the data. As such, it cannot be guaranteed that all anomalies of archaeological potential have been identified within the area covered solely by backscatter data.

- 2.4.10 The 2018 SBP data were rated as 'Average' using the above criteria. Relatively good penetration by the pinger system (an average of 3.5 m) was achieved considering the geology of the area. The data were heavily affected by sea swell. However, this was mostly rectified during processing and the data are deemed suitable for archaeological assessment.
- 2.4.11 The 2018 MBES data were rated as 'Good' using the above criteria, with relatively small anomalies clearly resolved and relatively little environmental effects visible.
- 2.4.12 The 2018 SSS data were rated as 'Average' using the above criteria. Seabed features were generally clearly visible, although the data were generally affected by sea state and cable snatching and some navigational issues. The wide range of 80 m means smaller anthropogenic features were harder to identify. However, this was not deemed to detrimentally affect the data to a significant degree, and it is considered suitable for archaeological interpretation.
- 2.4.13 The 2018 magnetometer data were rated as 'Average' using the above criteria. Small anomalies were generally visible. However, the data were generally affected by sea state with an amount of cable snatching visible, some navigational issues and some background noise. However, this was not deemed to detrimentally affect the data to a significant degree, and it is considered suitable for archaeological interpretation.

2.5 Geophysical data – anomaly grouping and discrimination

- 2.5.1 The previous section describes the initial interpretation of all available geophysical datasets which were conducted independently of one another. This inevitably leads to the possibility of any one object being the cause of numerous anomalies in different datasets and apparently overstating the number of archaeological features in the study area.
- 2.5.2 To address this fact the anomalies were grouped together; allowing one ID number to be assigned to a single object for which there may be, for example, a UKHO record and multiple SSS anomalies.
- 2.5.3 At this point the gazetteers of anomalies created during the previous phase of work on the Dimlington pipeline route were also grouped with the data interpretation (Wessex Archaeology 2017).
- 2.5.4 Any sites located outside of the defined study area, either previously recorded in known databases (e.g. UKHO) or identified during this or previous geophysical assessments, are deemed beyond the scope of the current project and are subsequently not included in this report.
- 2.5.5 During grouping of the interpretation results with the results of previous phases of work, any identified anomaly from the current 2018 dataset that matches a previously identified feature retains the original anomaly number assigned for the previous Wessex Archaeology report. However, positions and dimensions are updated to reflect the more recent data. Newly identified anomalies have been assigned a new ID number beginning with 70000.
- 2.5.6 Once all the geophysical anomalies and desk-based information have been grouped, a discrimination flag is added to the record in order to discriminate against those which are not thought to be of an archaeological concern. For anomalies located on the seabed, these flags are ascribed as follows (Table 5).

Table 5 Criteria discriminating relevance of identified features to proposed scheme

Overview classification	Discrimination	Criteria	Data type
Archaeological	P1	Feature of probable archaeological interest, either because of its palaeogeography or likelihood for producing palaeoenvironmental material	SBP, MBES
Archaeological	P2	Feature of possible archaeological interest	SBP, MBES
Archaeological	A1	Anthropogenic origin of archaeological interest	MBES, SSS, Mag.
Archaeological	A2	Uncertain origin of possible archaeological interest	MBES, SSS, Mag.
Archaeological	A3	Historic record of possible archaeological interest with no corresponding geophysical anomaly	MBES, SSS, Mag.

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

3 PALAEOGEOGRAPHIC ASSESSMENT

3.1 Geological baseline

3.1.1 The general geological baseline of this area, and the archaeological baseline of the Dimlington route has been assessed as part of the Tolmount Area Development ADBA (Wessex Archaeology 2017) and has not been repeated here. The archaeological potential of the Easington pipeline route has been assessed and the report is forthcoming.

3.2 Palaeogeographic assessment results

3.2.1 Comprehensive 2014 boomer and 2018 pinger SBP data coverage was achieved along the Easington option pipeline route, allowing for analysis of palaeolandscape features within the study area.

3.2.2 No features of palaeogeographic interest were identified in the 2018 pinger data. There were some faint internal reflectors, observed in the 2014 boomer data, within the interpreted Bolders Bank Formation (as identified in Wessex Archaeology 2017) which may have been caused by small scale, ice sheet retreat and re-advance. These are not of archaeological interest, and as such, no new individual palaeogeographic features of archaeological potential were identified within the study area.

3.2.3 Three features (**7501-7503**) that were previously identified in the assessment of the Dimlington route data (Wessex Archaeology 2017) are located within the study area and have been presented in Appendix I and in fig. 3. However, these features were not seen in the 2014 boomer and 2018 pinger data covering the Easington route option. There is a gap of 153 m between the data coverage of the Dimlington route and the Easington route options, and as these features were not seen to extend into the data limits of the Easington route option, these features are therefore assumed to end within this gap.

- 3.2.4 Channel feature **7502** is the largest of these, and potentially comprises two separate phases of cut and fill. This feature has been discriminated as P1; feature of probable archaeological interest, either because of its palaeogeography or likelihood for producing palaeoenvironmental material.
- 3.2.5 Features (**7501** and **7503**) have been classified as simple cut and fill features and have been discriminated P2; feature of possible archaeological interest.
- 3.2.6 These three features (**7501-7503**) have been identified cut into the surface of the Bolders Bank Formation and are generally very shallow (extending down to 2.0 m below seabed (BSB)) with a distinct basal reflector and acoustically unstructured fill.
- 3.2.7 These features are interpreted as the remnants of the Early Holocene (Mesolithic) landscape, which developed post-Last Glacial Maximum but prior to the Holocene marine transgression. Feature **7502** approximately correlates with the location of a fluvial feature identified during the North Sea Palaeolandscapes Project (NSPP) (Fitch *et al.* 2005, Gaffney *et al.* 2007). As such, these features are considered to be of medium to high archaeological potential (depending on their size and apparent survival), and have the potential to contain both in-situ and derived archaeological artefacts, alongside preserved organic material of palaeoenvironmental importance.

4 SEABED FEATURES ASSESSMENT

- 4.1.1 The geophysical data were assessed to identify features of archaeological potential relating to maritime and aviation activity. The results of this assessment are collated in gazetteer format detailed in Appendix II, and their distribution is presented in Figs. 4a-c. Where overlap has occurred between the different stages of survey; anomalies within this overlap will only be discussed once in the report, and overlapping datasets have been recorded in the gazetteer.
- 4.1.2 After the grouping and discrimination phases as outlined in Section 2.5, including the results from the previous phase of work, a total of 104 anomalies of archaeological potential have been identified within the Easington pipeline route study area.
- 4.1.3 To aid in the identification of anomalies that may be impacted by the installation of the Easington route option, a 41 m 'worst case scenario' buffer was created around the proposed pipeline route shapefile, called the 'potential 41 m impact zone'. Anomalies located within this buffer may be impacted by the pipeline installation. It assumed that anomalies outside this buffer are unlikely to be impacted unless otherwise stated.
- 4.1.4 The identified seabed features are discriminated as shown in Table 6.

Table 6 Seabed features of archaeological potential within the study area

Archaeological discrimination	Quantity	Number within 41 m impact zone	Interpretation
A1	6	0	Anthropogenic origin of archaeological interest
A2	91	17	Uncertain origin of possible archaeological interest
A3	7	1	Historic record of possible archaeological interest with no corresponding geophysical anomaly
Total	104	18	

4.1.5 Furthermore, these features can be classified by probable type, which can further aid in assigning archaeological potential and importance (Table 7).

Table 7 Types of seabed feature identified within the study area

Anomaly classification	Definition	Quantity	Number within 41 m impact zone
Wreck	Areas of coherent structure including wrecks of ships, submarines and some aircraft (where coherent structure survives)	2	0
Debris	Distinct objects on the seabed, generally exhibiting height or with evidence of structure, that are potentially anthropogenic in origin	12	1
Seabed disturbance	An area of disturbance without individual, distinct objects. Potentially indicates wreck debris or other anthropogenic features buried just below the seabed.	1	0
Rope/chain	Curvilinear dark reflectors, often with a small amount of height, indicating rope or chain (if ferrous)	4	1
Bright reflector	Individual objects or areas of low reflectivity, characteristic of materials that absorb acoustic energy, such as waterlogged wood or synthetic materials. Precise nature is uncertain	2	0
Dark reflector	Individual objects or areas of high reflectivity, displaying some anthropogenic characteristics. Precise nature is uncertain	24	4
Mound	A mounded feature with height not considered to be natural. Mounds may form over wreck sites or other debris.	2	0
Magnetic	No associated seabed surface expression, and have the potential to represent possible buried ferrous debris or buried wreck sites	50	11
Recorded wreck	Position of a recorded wreck at which previous surveys have identified definite seabed anomalies, but for which no associated feature has been identified within the current data set.	5	1
Recorded obstruction	Position of a recorded obstruction (e.g. foul ground, fisherman's fastener recorded by the UKHO), but for which no associated feature has been identified within the current data set	2	0
Total		104	18

4.1.6 Six anomalies (**7005**, **7006**, **7007**, **7008**, **70039** and **70040**) have been discriminated as A1 – Anthropogenic origin of archaeological interest.

4.1.7 Of these, two anomalies (**7006** and **70039**) have been classified as wrecks; the remaining four anomalies have been classified as individual pieces of debris pertaining to these wrecks.

4.1.8 Wreck anomaly **7006** was previously identified (Wessex Archaeology 2017) in the SSS data only, measuring 29.1 x 3.3.x 0.3 m, and was not covered by MBES or Mag. data. It was interpreted as an unknown wreck and is located approximately 300 m from the proposed Easington pipeline route.

4.1.9 Anomalies **7005**, **7007** and **7008** have been classified as individual pieces of debris and are interpreted to pertain to wreck anomaly **7006**.

4.1.10 This wreck anomaly and associated debris anomalies have an existing 50 m Archaeological Exclusion Zone (AEZ) around the observed extents of these features (fig. 4a).



- 4.1.11 These locations were not covered by any data assessed for this report and so no further comments can be made on their current state.
- 4.1.12 This wreck is located approximately 52 m south-east of a UKHO position (anomaly **7000**, see section 4.1.36-37) and may represent the wreck noted in the UKHO record or may be related debris (fig. 4a).
- 4.1.13 Wreck anomaly **70039** has been newly identified in the 2014, 2015 and 2018 datasets. It was observed on the edge of the 2018 SSS and MBES datasets and so was not observed in full. It was identified as an area of numerous dark reflectors measuring 39.6 x 16.6 x 3.8 m. It was also observed within the 2015 MBES and backscatter datasets measuring 54.3 x 8.0 x 3.8 m and appears upright, broken-up and partially buried within the surrounding seabed sediments. However, the SSS is considered a higher resolution data set relative to the MBES and backscatter, and so the SSS measurements have been retained in the gazetteer. This location has not been covered by Mag. data at any stage of this assessment and so it is not possible to determine whether this wreck feature is comprised of ferrous material without further investigation. The wreck is located approximately 150 m south-east of the proposed pipeline route (fig 4b; Sheet 1).
- 4.1.14 This wreck has an associated UKHO record (82907), which represents an unknown wreck reported as previously observed in 2016, measuring 66.2 x 13.5 x 5.0 m. The wreck is recorded as upright but broken-up, disintegrated or buried, which is consistent with the appearance of the wreck identified within the geophysical data.
- 4.1.15 A separate anomaly (**70040**), located approximately 38 m south-west of the centre-point of wreck **70039**, has been classified as an individual piece of debris thought to be associated with this wreck. It was observed in full within the 2018 SSS data measuring 7.6 x 0.5 x 2.2 m. This location was also not covered by Mag. data (fig 4b; Sheet 1).
- 4.1.16 A total of 91 anomalies have been discriminated as A2 - Uncertain origin of possible archaeological interest.
- 4.1.17 Eight anomalies (**7002**, **7010**, **7013**, **7014**, **7024**, **7042**, **70010** and **70030**) have been classified as individual pieces of debris.
- 4.1.18 Two anomalies (**7010** and **70010**) have an associated magnetic anomaly and are interpreted as possible pieces of ferrous debris.
- 4.1.19 Anomaly **7010** was observed in the 2018 data measuring 1.8 x 1.5 x 2.3 m with an associated magnetic anomaly of 379 nT. It was previously observed as three adjacent objects each measuring 1.3 x 0.8 x 2.4 m within a depression. This object appears to be ferrous debris, but is possibly modern in origin.
- 4.1.20 Anomaly **70010** was observed in the 2018 data as a magnetic only anomaly, but this grouped with a previously identified object from 2016 data measuring 3.8 x 1.0 x 0.1 m, and is interpreted to be possible ferrous debris that may have become buried.
- 4.1.21 The remaining six debris anomalies (**7002**, **7013**, **7014**, **7024**, **7042** and **70030**) range in size from 1.3 x 0.3 x 0.1 m (**7013**) up to 4.9 x 4.5 x 3.6 m (**7042**). None of these have an associated magnetic anomaly and are interpreted to be possible non-ferrous debris.



- 4.1.22 Anomaly **7024** is located within the potential impact zone; approximately 14 m north-west of the proposed pipeline route. This anomaly has been identified as an angular object measuring 5.6 x 3.0 x 0.5 m.
- 4.1.23 One anomaly (**70032**) has been classified as a seabed disturbance and was observed in the 2014, 2015 and 2018 datasets measuring 20.1 x 3.5 x 1.1 m, with a distinct large dark reflector measuring 4.3 x 1.0 x 1.1 m. There are several surrounding natural magnetic responses, but no associated magnetic anomaly indicating the presence of ferrous material. This has been interpreted as possible natural bedrock or as a discrete area of non-ferrous debris.
- 4.1.24 Four anomalies (**7019**, **70023**, **70049** and **70050**) have been classified as possible lengths of rope or chain. Anomaly **7019** was observed in the 2016 data only as an intermittent linear dark reflector measuring 79.6 x 0.4 x 0.2 m, aligned NNW-SSE, with no associated magnetic anomaly, and was interpreted as a possible partially buried length or rope or chain. This anomaly is located within the potential impact zone and appears to transect the proposed pipeline route; with the central position approximately 22 m to the south-east (fig 4a).
- 4.1.25 Anomaly **70023** was observed in the 2018 data only as a curvilinear dark reflector measuring 39.2 x 0.2 x 0.1 m with no associated magnetic anomaly, and was interpreted as a possible partially buried length or rope or chain. This feature is located approximately 17 m from two anomalies (**70024** and **70025**) classified as dark reflectors (section 4.1.28).
- 4.1.26 Anomaly **70049** was observed in the 2014 data only as a curvilinear dark reflector measuring 29.0 x 0.2 x 0.1 m, and was interpreted as a possible partially buried length or rope or chain. However, this anomaly is located close to existing cables and pipelines in the area and so may be related, but cannot be determined for certain from this dataset. In addition, any associated magnetic anomaly may be masked by the responses of these existing cables and pipelines.
- 4.1.27 Anomaly **70050** was observed in the 2014 data only as a curvilinear dark reflector measuring 22.0 x 0.4 x 0.1 m, and was interpreted as a possible partially buried length or rope or chain. However, this anomaly is located close to the landfall of existing cables and pipelines in the area and so may be related but cannot be certain from this dataset. In addition, any associated magnetic anomaly may be masked by the responses of these existing cables and pipelines.
- 4.1.28 Two anomalies (**7015** and **7016**) have been classified as bright reflectors and may represent non-ferrous debris of acoustically absorbent material. These anomalies are located adjacent to each other and spaced about 3 m apart. Both were observed in the 2016 SSS dataset only and measure 1.7 x 1.3 m and 1.6 x 1.0 m respectively, each with no apparent height.
- 4.1.29 A total of 24 anomalies (for full list see Appendix II) have been classified as dark reflectors.
- 4.1.30 These anomalies in range in size from 1.0 x 0.3 x 0.3 m (**70024**) up to 30.4 x 6.6 m (**70034**) and all are interpreted as possible non-ferrous debris or natural features.
- 4.1.31 Four anomalies (**7020**, **7026**, **7029** and **70002**) are located within the potential impact zone. One anomaly (**7026**) is located approximately 3 m north-west from the proposed pipeline route.

- 4.1.32 Two anomalies (**7036** and **70043**) have been classified as mounds and are interpreted as possible natural features or possible non-ferrous debris.
- 4.1.33 Anomaly **7036** was identified in the 2016 dataset only as an irregular seabed disturbance measuring 7.3 x 4.0 x 0.4 m with no associated magnetic anomaly.
- 4.1.34 Anomaly **70043** was covered by the 2015 MBES and backscatter data only and was observed in the MBES data as a small mound within a scour measuring 12.6 x 5.2 x 0.2 m. This feature was also associated with a large angular bright anomaly observed in the backscatter data.
- 4.1.35 A total of 50 anomalies (for full list see Appendix II) have been classified as magnetic only anomalies with no SSS or MBES contacts definitively associated from any dataset. All are interpreted to represent possible ferrous debris, either buried or with no seabed surface expression.
- 4.1.36 These magnetic anomalies range in size from 5 nT (**70008**) up to 6856 nT (**7017**). However, anomaly **7017** is very anomalous (three anomalies have a recorded magnetic amplitude over 100 nT; **7017**; 6856 nT, **7018**; 107 nT and **70041**; 119 nT), and therefore may be a data artefact with anthropogenic characteristics.
- 4.1.37 Eleven of these anomalies (**7022**, **7025**, **70009**, **70012**, **70017**, **70027**, **70038**, **70029**, **70035**, **70037** and **70047**) are located within the potential 41 m impact zone. One anomaly (**70035**; 18 nT) is located approximately 2 m east of the proposed pipeline route.
- 4.1.38 Seven anomalies (**7000**, **70026**, **70031**, **70033**, **70038**, **70042** and **70044**) have been discriminated as A3 - Historic record of possible archaeological interest with no corresponding geophysical anomaly.
- 4.1.39 Five of these anomalies (**7000**, **70026**, **70031**, **70033** and **70038**) have been classified as recorded wrecks and represent UKHO recorded wreck positions.
- 4.1.40 Four of these records (**7000**, **70031**, **70033** and **70038**) were not covered by any geophysical dataset but are located within the study area and so have been retained in the gazetteer (fig. 4a-c).
- 4.1.41 Record **70026** (UKHO 9081) represents the position for a wreck previously dived in 1990 but not observed in subsequent 2016 survey, located approximately 75 m from the proposed Easington pipeline route. This position has been covered by 2018 SSS, MBES and Mag. Datasets, and was also covered by the 2014 SSS data, but no anomalies interpreted to represent a wreck site were observed in any of these datasets.
- 4.1.42 It is unlikely that a wreck would be completely buried in the marine seabed sediments in this area, and it is possible that the diving position from 1990 is not reliable. Therefore, it is possible that the associated wreck may be located elsewhere.
- 4.1.43 Two of these anomalies (**70042** and **70044**) have been classified as a recorded obstruction and represent UKHO recorded obstruction positions (UKHO 9132 and 9133, respectively).
- 4.1.44 Both these recorded positions were reported during fishing activity and have not been observed since. Both anomalies were covered only by the 2015 MBES and backscatter datasets. These anomalies were not observed in any geophysical dataset.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Palaeogeographic features

- 5.1.1 The assessment of the geophysical data within the study area resulted in no new features of palaeogeographic interest being identified.
- 5.1.2 Three features (**7501-7503**) that were previously identified in the assessment of the Dimlington route data (Wessex Archaeology 2017) are located within the study area. However, these features were not seen in the 2014 boomer and 2018 pinger data covering the Easington route option. There is a gap of 153 m between the data coverage of the Dimlington route and the Easington route options, and as these features were not seen to extend into the data limits of the Easington route option, these features are therefore assumed to end within this gap.
- 5.1.3 Of these, only one (**7502**) has been discriminated as P1; feature of probable archaeological interest, either because of its palaeogeography or likelihood for producing palaeoenvironmental material. It is considered to be of high potential from both an archaeological and palaeoenvironmental perspective, due to its size, age, and potential connection with the buried landscape identified during the NSPP.
- 5.1.4 Features (**7501** and **7503**) have been classified as simple cut and fill features and have been discriminated P2; feature of possible archaeological interest.
- 5.1.5 None of these features are within the potential 41 m impact zone. Should this be subject to change, the very shallow depth of the features (up to 2.0 m BSB) indicates that pipeline emplacement across them is likely to remove all sediment from within the features at the crossing points. However, lateral impact to these features from such a linear scheme is expected to be small.
- 5.1.6 It is recommended that, should future sampling (e.g. vibrocoring) be undertaken along the proposed route, any samples acquired containing material of archaeological potential, particularly those within the interpreted Pleistocene/early Holocene features, be made available for geoarchaeological assessment.

5.2 Seabed features

- 5.2.1 This assessment of the geophysical data, including the compilation of previously identified anomalies from the 2017 assessment of the Dimlington route (Wessex Archaeology 2017), has resulted in a total of 104 anomalies identified as being of possible archaeological interest within the Easington pipeline route study area.
- 5.2.2 A total of six anomalies (**7005**, **7006**, **7007**, **7008**, **70039** and **70040**) were assigned an A1 archaeological rating; anthropogenic origin of archaeological interest.
- 5.2.3 Two of these anomalies (**7006** and **70039**) have been classified as wrecks; the remaining four A1 anomalies have been classified as individual pieces of debris pertaining to these wrecks.
- 5.2.4 Anomaly **7006** has been previously classified as a wreck with three surrounding anomalies (**7005**, **7007** and **7008**) debris anomalies. These anomalies have an existing 50 m AEZ around each feature already in place and it is recommended that this be maintained (Table 8).



- 5.2.5 Anomaly **70039** has been newly identified and classified as a wreck with one anomaly (**70040**) classified as possible surrounding debris. It is recommended that a 50 m AEZ be placed around the extents of each of these anomalies (Table 8).
- 5.2.6 A total of seven records (**7000**, **70026**, **70031**, **70033**, **70038**, **70042** and **70044**) were identified within the study area and assigned an A3 archaeological discrimination; historic record of possible archaeological interest with no corresponding geophysical anomaly.
- 5.2.7 Five of these (**7000**, **70026**, **70031**, **70033** and **70038**) were classified as recorded wrecks. Four of these records (**7000**, **70031**, **70033** and **70038**) were not covered by any geophysical dataset but are located within the study area, and so the existing 100 m AEZ is recommended to be retained around previously identified record (7000), and a 100 m AEZ is recommended to be placed around each of these newly identified recorded positions (Table 8).
- 5.2.8 Record **70026**, located approximately 75 m from the proposed Easington pipeline route, was covered by the geophysical data but was not observed in any dataset. Therefore, a 50 m AEZ is recommended to be placed around this recorded position (Table 8). This recommended AEZ is then impacted by the potential 41 m impact zone.
- 5.2.9 Two records (**70042** and **70044**) have been classified as recorded obstructions. Both were covered only by the 2015 MBES and backscatter datasets but nothing was observed at these locations. Therefore a 30 m AEZ is recommended to be placed around these recorded positions (Table 8).

Table 8 Recommended AEZs within the study area

ID	Classification	Original Assessment	Position (ED50 UTMz31N)		Status	Exclusion Zone
			Easting	Northing		
7000	Recorded wreck	111460.02	332111	5991287	Reviewed - retained unchanged	100 m around recorded position
7005, 7006, 7007 and 7008	Wreck and Debris	111460.02	332158	5991253	Reviewed - retained unchanged	50 m buffer around current feature extents
70026	Recorded wreck	N/A	324799	5976492	New	50 m around recorded position
70031	Recorded wreck	N/A	321148	5968958	New	100 m around recorded position
70033	Recorded wreck	N/A	320473	5968056	New	100 m around recorded position
70038	Recorded wreck	N/A	319387	5963612	New	100 m around recorded position
70039 and 70040	Wreck and Debris	N/A	318773	5962820	New	50 m around current feature extents
70042	Recorded obstruction	N/A	318511	5961821	New	30 m around recorded position
70044	Recorded obstruction	N/A	318130	5960969	New	30 m around recorded position



- 5.2.10 The remaining 91 anomalies have been discriminated as A2- Uncertain origin of possible archaeological interest; uncertain origin of possible archaeological interest.
- 5.2.11 Seventeen of these A2 anomalies (for full list see Appendix II) are located within the potential 41 m impact zone. However, only three of these anomalies (**7019**, **7026** and **70035**) are located within 5 m of the proposed pipeline route.
- 5.2.12 These anomalies do not require any mitigation at this time, although avoidance of these features by micro-siting is recommended if they are proposed to be directly impacted by the proposed pipeline.
- 5.2.13 If any material of possible archaeological potential is recovered during any groundwork operations it is recommended that they be reported using an appropriate protocol. This will establish whether the recovered objects are of archaeological interest and recommend appropriate mitigation measures.

6 REFERENCES

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APPENDICES

Appendix I Palaeogeographic features of archaeological potential

ID	Classification	Archaeological Discrimination	Description	Within potential 41 m impact zone
7501	Simple Cut and Fill	P2	Very small, very shallow cut and fill feature cut into Bolders Bank Formation. Well-defined basal reflector with a single phase of acoustically unstructured fill. Possibly remnant of a fluvial feature, possibly originally part of feature 7502. Depth range: 0.4 - 0.8 m BSB.	-
7502	Channel	P1	Possible shallow, relatively poorly defined channel feature Cut into Bolders Bank Formation. Identified on a number of survey lines. Poorly defined basal reflector with single phase of acoustically unstructured fill. Possible remnant fluvial feature, correlates approximately with a fluvial feature identified during the North Sea Palaeolandscapes Project. Depth range: 0.3 - 2.0 m BSB.	-
7503	Simple Cut and Fill	P2	Very small, very shallow cut and fill feature cut into Bolders Bank Formation. Well-defined basal reflector with a single phase of acoustically unstructured fill. Possibly remnant of a fluvial feature, but could be a localised accumulation of seabed sediment. Depth range: 0.3 - 1.1 m BSB.	-



Appendix II Seabed features of archaeological potential

ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
7000	Recorded wreck	332111	5991287	A3	-	-	-	-	Recorded location of an unidentified wreck (UKHO 6685) surveyed on numerous occasions between 1986 and 2009 but located outside of the area covered by any of the survey data associated with the current development. Previous surveying details suggest the wreck measures approximately 55.0 m x 5.0 m x 6.0 m, is probably of steel construction, and that the bow and stern appear badly damaged. Diver survey suggests a possible cargo of copper boxes. Located approximately 38 m outside of the current Study Area, but any associated AEZ would encroach upon the Study	-	-	UKHO 6685



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									Area. Debris recorded 60 m south-west and 200 n East. Neither location covered by Easington data.			
7002	Debris	332297	5991384	A2	3.8	0.5	0.4	-	Previously observed as two short, adjacent linear dark reflectors with small shadow, but without an associated magnetic anomaly. Located in area of mobile seabed sediments, possibly partially buried non-ferrous debris. Not covered by the most recent dataset.	-	2016	-
7003	Magnetic	332292	5991359	A2	-	-	-	68	Previously identified as a distinct magnetic anomaly observed only on one line, without any definitively associated SSS or MBES contacts. Possible buried ferrous debris. May be related to fishing gear identified within the area, but this is uncertain. Not	-	2016	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									covered by the most recent dataset.			
7004	Dark reflector	332243	5991271	A2	5.8	1.2	0.3	-	Previously observed as three immediately adjacent small dark reflectors with bright shadow, but without an associated magnetic anomaly. Shape irregular and indistinct. Data stretched at this location, which may exaggerate along track dimensions. Could be a natural feature or non-ferrous debris. Not covered by the most recent dataset.	-	2016	-
7005	Debris	332174	5991268	A1	9.5	0.4	0.2	-	Previously observed as a short, linear dark reflector with small shadow situated approximately 30 m north-east of potential wreck 7006. Location is not covered by magnetometer data, and so it cannot be determined whether	-	2016	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									the object is ferrous. Possible wreck debris. Not covered by the most recent dataset.			
7006	Wreck	332149	5991251	A1	29.1	3.3	0.3	-	Previously observed as a very distinct dark reflector with shadow located at the edge of the SSS range. Poorly defined due to location at the edge of the range, and so no real detail can be seen. Both the shadow and the lateral extents of the feature extend beyond the coverage of the SSS data, so the dimensions should be treated as a minimum. Location not covered by magnetometer data, so it is not possible to determine whether the feature is ferrous. Located approximately 52 m south-east of recorded wreck 7000 and may represent	-	2016	UKHO 6685



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									the wreck itself or associated debris. Other items of debris likely to be associated (7005 , 7007 and 7008) are situated within the immediate vicinity. A small scour may also surround the feature, but the location is not covered by MBES data and so this cannot be investigated further. Not covered by the most recent dataset.			
7007	Debris	332158	5991243	A1	5.4	1.5	0.6	-	Previously observed as an indistinct dark reflector with bright shadow, located approximately 12 m south-east of possible wreck 7006 , and adjacent to similar feature 7008 . Location not covered by magnetometer data, and so it is not possible to determine whether the feature is ferrous. Possible wreck debris. Not	-	2016	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									covered by the most recent dataset.			
7008	Debris	332156	5991238	A1	3.2	1.8	0.8	-	Previously observed as an indistinct dark reflector with bright shadow, located approximately 15 m south-east of possible wreck 7006 , and adjacent to similar feature 7007 . Location not covered by magnetometer data, and so it is not possible to determine whether the feature is ferrous. Possible wreck debris. Not covered by the most recent dataset.	-	2016	-
7009	Dark reflector	332233	5991222	A2	2.2	0.4	0.5	-	Previously observed as an elongate dark reflector with shadow but without an associated magnetic anomaly. Located in an area of mobile seabed sediment. Possible natural feature or partially buried non-ferrous debris. Not	-	2016	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									covered by the most recent dataset.			
7010	Debris	332419	5991198	A2	1.8	1.5	2.3	379	Observed as a distinct dark reflector with large associated height, isolated in an area of sand waves and in the MBES data as a small rounded mound within a depression (4.1 x 3.5 x 0.4 m). Associated with large magnetic anomaly. Previously observed as three adjacent dark reflectors within a depression, all with tall bright shadows, and each measuring approximately 1.3 x 0.8 x 2.4 m. Two of these may now be buried. Appears to be ferrous debris but possibly modern in origin.	-	2014, 2015, 2016, 2018	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
7011	Dark reflector	332155	5991183	A2	5.8	0.2	0.1	-	Previously observed as an elongate dark reflector with small shadow. Location not covered by magnetometer data, so it is not possible to tell whether the object is ferrous. Located in an area of mobile seabed sediment, possible natural feature or partially buried debris. Not covered by the most recent dataset.	-	2016	-
7012	Dark reflector	332133	5991164	A2	4.8	0.9	0.4	-	Previously observed as an elongate dark reflector with distinct shadow. Location not covered by magnetometer data, so it is not possible to tell whether the object is ferrous. Located in an area of mobile seabed sediment, possible natural feature or partially buried debris. Not covered by the most recent dataset.	-	2016	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
7013	Debris	332156	5991079	A2	1.3	0.3	0.1	-	Previously observed as a curved, elongate dark reflector with small shadow, but without an associated magnetic anomaly. One of two similar adjacent objects within an area of mobile seabed sediment. Possible partially buried non-ferrous debris. Not covered by the most recent dataset.	-	2016	-
7014	Debris	332157	5991082	A2	1.3	0.6	0.2	-	Previously observed as a curved, elongate dark reflector with small shadow, but without an associated magnetic anomaly. One of two similar adjacent objects within an area of mobile seabed sediment. Possible partially buried non-ferrous debris. Not covered by the most recent dataset.	-	2016	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
7015	Bright Reflector	332183	5991016	A2	1.7	1.3	0.0	-	Previously observed as a relatively indistinct bright reflector located close to the SSS fish track, without shadow or associated magnetic anomaly. One of two closely adjacent similar anomalies. Located in an area of mobile seabed sediment and could be a natural feature or partially buried non-ferrous debris. Not covered by the most recent dataset.	-	2016	-
7016	Bright Reflector	332182	5991013	A2	1.6	1.0	0.0	-	Previously observed as a relatively indistinct bright reflector located close to the SSS fish track, without shadow or associated magnetic anomaly. One of two closely adjacent similar anomalies. Located in an area of mobile seabed sediment and could be a natural feature or partially buried	-	2016	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									non-ferrous debris. Not covered by the most recent dataset.			
7017	Magnetic	331815	5990088	A2	-	-	-	6856	Previously observed as a very large positive magnetic anomaly, only identified on one survey line and without an associated SSS or MBES contact. Possible significant piece of buried ferrous debris, although could be a data artefact.	-	2016	-
7018	Magnetic	331460	5989552	A2	-	-	-	107	Previously observed as a large magnetic anomaly, only identified on one survey line and without an associated SSS or MBES contact. Possible significant piece of buried ferrous debris.	-	2016	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
7019	Rope/chain	330747	5988316	A2	79.6	0.4	0.2	-	Previously observed as an intermittent linear dark reflector with small shadow, but without an associated magnetic anomaly. Located in an area of mobile seabed sediment, possible partially buried length of rope or chain.	Yes; 22 m south-east; linear transects pipeline	2016	-
7020	Dark reflector	330752	5988304	A2	1.3	0.5	0.2	-	Previously observed as a small dark reflector with a slight shadow and some scour, but without an associated magnetic anomaly. Could be a natural feature or non-ferrous debris, possibly related to rope / chain 7019 .	Yes; 32 m south-east	2016	-
7021	Magnetic	330588	5988218	A2	-	-	-	24	Previously observed as a magnetic dipole only observed on one survey line, and without an associated SSS or MBES contact. Possible piece of buried ferrous debris.	-	2016	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
7022	Magnetic	330173	5987314	A2	-	-	-	22	Small asymmetric dipole identified over two lines. Observed in previous dataset as a small anomaly of 8 nT. May represent possible ferrous debris.	Yes; 11 m north-west	2016, 2018	-
7023	Dark reflector	330004	5986757	A2	1.8	0.3	0.4	-	Small dark reflector with associated height, possibly natural isolated on the seabed. Previously observed as a small curved object measuring 2.4 x 0.7 x 0.2 m.	-	2016, 2018	-
7024	Debris	329861	5986739	A2	5.6	3.0	0.5	-	Faint angular dark reflector with associated height, isolated on the seabed. Previously observed as an elongate dark reflector measuring 5.6 x 2.5 x 0.5 m and classified as a piece of possible debris.	Yes; 14.5 m north-west	2016, 2018	-
7025	Magnetic	329574	5986100	A2	-	-	-	9	Previously observed as a small but distinct magnetic anomaly, only identified on one survey line and without an	Yes; 34 m south-east	2016	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									associated SSS or MBES contact. Possible small piece of buried ferrous debris.			
7026	Dark reflector	329345	5985750	A2	6.4	5.5	0.3	-	Elongated mound isolated on the seabed in MBES data, possible natural. Previously observed in the SSS data as an irregular dark reflector measuring 4.6 x 3.8 x 0.7 m. No associated magnetic anomaly. Possible non-ferrous debris or a natural feature.	Yes; 2.5 m north-west	2014, 2015, 2016, 2018	-
7027	Magnetic	329007	5985210	A2	-	-	-	39	Previously observed as a distinct negative magnetic anomaly, only identified on one survey line and without an associated SSS or MBES contact. Possible piece of buried ferrous debris, although could be a data artefact.	-	2016	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
7028	Magnetic	328696	5984804	A2	-	-	-	12	Previously observed as a small but distinct magnetic anomaly, only identified on one survey line and without an associated SSS or MBES contact. Possible small piece of buried ferrous debris.	-	2016	-
7029	Dark reflector	328604	5984403	A2	6.4	2.0	0.6	-	Faint angular dark reflector with associated height, isolated in an area of sand waves. Previously observed as a sub-angular dark reflector measuring 5.6 x 4.2 x 0.6 m. Also previously observed in the MBES data.	Yes; 20 m north-west	2016, 2018	-
7030	Dark reflector	328018	5983495	A2	2.1	0.5	0.4	-	Small dark reflector with associated height, located in an area of indistinct sand waves. Previously observed as a square dark reflector with no obvious height measuring 3.4 x 2.4 m. No associated	-	2018	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									magnetic anomaly. Possible non-ferrous debris or a natural feature.			
7031	Dark reflector	327408	5982362	A2	3.5	1.6	0.6	-	Previously observed as a distinct elongate dark reflector with distinct shadow, located within a small depression / scour. Identified in the MBES data as a small object but within a poorly defined depression. No associated magnetic anomaly. Possible natural feature but could be non-ferrous debris.	-	2016	-
7032	Magnetic	327379	5982258	A2	-	-	-	10	Previously observed as a small but distinct magnetic anomaly, only identified on one survey line and without an associated SSS or MBES contact. Possible small piece	-	2016	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									of buried ferrous debris.			
7033	Magnetic	327084	5981717	A2	-	-	-	6	Previously observed as a small but distinct magnetic anomaly, only identified on one survey line and without an associated SSS or MBES contact. Possible small piece of buried ferrous debris.	-	2016	-
7034	Magnetic	327095	5981639	A2	-	-	-	14	Previously observed as a small but distinct magnetic anomaly, only identified on one survey line and without an associated SSS or MBES contact. Possible small piece of buried ferrous debris.	-	2016	-
7035	Magnetic	326904	5981470	A2	-	-	-	10	Previously observed as a small but distinct magnetic anomaly, only identified on one survey line and without an	-	2016	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									associated SSS or MBES contact. Possible small piece of buried ferrous debris.			
7036	Mound	326623	5980893	A2	7.3	4.0	0.4	-	Previously observed as an irregular area of seabed disturbance with small shadow and observed as a small double mound in the MBES data and may be two closely adjacent features. No associated magnetic anomaly. Could be a natural seabed feature, or a mound of non-ferrous debris partially covered in seabed sediment.	-	2016	-
7037	Magnetic	326498	5980564	A2	-	-	-	68	Previously observed as a distinct magnetic anomaly without an associated SSS or MBES contact, possible piece of buried ferrous debris. Located close to smaller magnetic anomaly	-	2016	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									7038 and may be related.			
7038	Magnetic	326490	5980551	A2	-	-	-	9	Previously observed as a small but distinct magnetic anomaly, only identified on one survey line and without an associated SSS or MBES contact. Possible small piece of buried ferrous debris. Located close to larger magnetic anomaly 7037 and may be related.	-	2016	-
7039	Magnetic	326194	5980046	A2	-	-	-	6	Previously observed as a small but distinct magnetic anomaly, only identified on one survey line and without an associated SSS or MBES contact. Possible small piece of buried ferrous debris.	-	2016	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
7040	Magnetic	325972	5979696	A2	-	-	-	11	Previously observed as a small but distinct magnetic anomaly, only identified on one survey line and without an associated SSS or MBES contact. Possible small piece of buried ferrous debris.	-	2016	-
7041	Magnetic	325922	5979543	A2	-	-	-	9	Previously observed as a small but distinct magnetic anomaly, only identified on one survey line and without an associated SSS or MBES contact. Possible small piece of buried ferrous debris.	-	2016	-
7042	Debris	325633	5979089	A2	4.9	4.5	3.6	-	Previously observed as a small but distinct dark reflector with a slight scour and slight surrounding seafloor disturbance. Very tall, distinct shadow, but without an associated magnetic anomaly. Does not	-	2014, 2016	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									appear to extend full width but could be rope for a buoy or other marker extending up from seabed. Observed in data from both 2014 and 2016 data sets, appearing larger and more distinct in the 2014 data. Shadow appears to traverse the width of the SSS channel in the 2016 data, possibly suggesting a rope for a buoy, but this is not the case in the 2014 data. Observed in the MBES data as an elongate mound with a rounded depression to the immediate west. Possible partially buried non-ferrous debris. Recorded dimensions are a maximum combined from all years.			
7043	Magnetic	325621	5978990	A2	-	-	-	25	Previously observed as a distinct magnetic anomaly without an associated SSS or	-	2016	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									MBES contact, possible piece of buried ferrous debris.			
7046	Magnetic	324595	5977025	A2	-	-	-	30	Previously observed as a distinct magnetic anomaly without an associated SSS or MBES contact, possible piece of buried ferrous debris.	-	2016	-
7105	Magnetic	309868	5950408	A2	-	-	-	13	Previously observed as a small but distinct magnetic anomaly, only identified on one survey line and without an associated SSS or contact. Possible small piece of buried ferrous debris, although could be related to the surrounding pipelines.	-	2014	-
7106	Magnetic	309989	5950373	A2	-	-	-	11	Previously observed as a small but distinct magnetic anomaly, only identified on one survey line and without an	-	2014	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									associated SSS or contact. Possible small piece of buried ferrous debris, although could be related to the nearby pipelines.			
70000	Magnetic	332684	5991426	A2	-	-	-	32	Small dipole identified on one line. Possibly related to 70001 but unclear if the same feature. Not definitively associated with any seabed features. May represent possible ferrous debris.	-	2018	-
70001	Magnetic	332677	5991370	A2	-	-	-	14	Small dipole identified on one line. Possibly related to 70000 but unclear if the same feature. Not definitively associated with any seabed features. May represent possible ferrous debris.	-	2018	-
70002	Dark reflector	331918	5990465	A2	1.8	0.8	0.4	-	Small dark reflector with height, located near to a line of rocks but appears to be unrelated. No associated magnetic	Yes; 30 m south-east	2018	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									anomaly so could be non-ferrous debris.			
70003	Magnetic	331157	5989278	A2	-	-	-	8	Small dipole identified on one line. Could represent possible ferrous debris.	-	2018	-
70004	Dark reflector	331077	5988542	A2	1.6	0.9	1.3	-	Sub-angular object with very bright shadow, tagged due to height of shadow, even though slightly tapered. Could be possible debris or a natural feature.	-	2016	-
70005	Dark reflector	330785	5988206	A2	1.8	0.3	0.4	-	Small dark reflector with irregular height, isolated in an area of sand waves. Could be small rock but potential debris	-	2018	-
70006	Dark reflector	329997	5987907	A2	2.2	1.0	0.0	-	Small rounded object with a slight scour and no visible shadow, located close to 70007 and may be debris or a natural feature.	-	2016	-
70007	Dark reflector	330005	5987901	A2	1.2	0.9	0.0	-	Small rounded object with a slight scour and no visible shadow, located close to 70006 and	-	2016	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									may be debris or a natural feature.			
70008	Magnetic	329914	5986647	A2	-	-	-	5	Small monopole, identified on one line. Could represent possible ferrous debris.	-	2018	-
70009	Magnetic	329169	5985441	A2	-	-	-	14	Small dipole identified on one line. Could represent possible ferrous debris.	Yes; 12 m north-west	2018	-
70010	Debris	329245	5985386	A2	3.8	1.0	0.1	8	Small monopole, identified on one line. Could be natural but possible ferrous debris. Associated with a dark reflector previously identified but without a previous magnetic anomaly (straight object measuring 3.8 x 1.0 x 0.1 m)	-	2016, 2018	-
70011	Dark reflector	327800	5983101	A2	3.5	1.2	0.0	-	Dark reflector with no discernible height, isolated in an area of indistinct sand waves.	-	2018	-
70012	Magnetic	327352	5981910	A2	-	-	-	9	Small negative monopole, identified on one line. Possibly	Yes; 32 m WNW	2018	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									represents buried ferrous debris.			
70013	Magnetic	327396	5981758	A2	-	-	-	16	Small dipole identified in two data blocks. Possibly represents buried ferrous debris.	-	2018	-
70014	Magnetic	327261	5981504	A2	-	-	-	12	Small magnetic dipole observed on one line in previous dataset and could represent possible ferrous debris	-	2016	-
70015	Magnetic	327392	5981438	A2	-	-	-	14	Small magnetic dipole observed on one line in previous dataset and could represent possible ferrous debris	-	2016	-
70016	Magnetic	326917	5981097	A2	-	-	-	8	Small dipole likely natural. Identified on one line. Could represent possible ferrous debris.	-	2018	-
70017	Magnetic	326802	5980725	A2	-	-	-	7	Small positive monopole, identified on one line. Could represent possible ferrous debris.	Yes; 34m north-west	2018	-
70018	Magnetic	326726	5980654	A2	-	-	-	12	Small positive monopole, identified on one line. Could represent possible ferrous debris.	-	2018	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
70019	Magnetic	326743	5980353	A2	-	-	-	15	Small negative monopole, identified on one line. Could represent possible ferrous debris.	-	2018	-
70020	Magnetic	325949	5978645	A2	-	-	-	17	Small asymmetric dipole identified on two lines. Could represent possible ferrous debris.	-	2018	-
70021	Magnetic	325882	5978504	A2	-	-	-	21	Small asymmetric dipole identified on two lines. Could represent possible ferrous debris.	-	2018	-
70022	Magnetic	325636	5978375	A2	-	-	-	6	Small magnetic anomaly identified on one line and may represent possible ferrous debris	-	2016	-
70023	Rope/chain	324854	5976620	A2	39.2	0.2	0.1	-	Curvilinear dark reflector with height which loops back on itself. Located on an area of flat seabed near to several objects.	-	2018	-
70024	Dark reflector	324871	5976616	A2	1.0	0.3	0.3	-	Dark reflector with height, adjacent to another similar item on the seabed and near a linear object. Further indistinct possible surrounding debris. Retained due	-	2018	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									to proximity to linear debris.			
70025	Dark reflector	324870	5976615	A2	1.1	0.3	0.4	-	Dark reflector with height, adjacent to another similar item on the seabed and near a linear object. Further indistinct possible surrounding debris. Retained due to proximity to linear debris.	-	2018	-
70026	Recorded wreck	324799	5976492	A3	-	-	-	-	Recorded position for a UKHO recorded wreck. Noted to have been dived on in 1990 but no other information within record. Not located by survey in 2016. Recommended to be amended to 'Dead'. This location was covered by the most recent dataset but was not observed.	No, but recommended AEZ would encroach to 23 m WNW	-	UKHO 9081
70027	Magnetic	324657	5976053	A2	-	-	-	23	Small dipole identified on one line. Could represent possible ferrous debris.	Yes; 18.5 m north-west	2018	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
70028	Magnetic	324605	5975938	A2	-	-	-	33	Small dipole identified over two lines. Could represent possible ferrous debris.	Yes; 17 m north-west	2018	-
70029	Magnetic	324195	5975057	A2	-	-	-	27	Small dipole identified on one line. Could represent possible ferrous debris.	Yes; 20 m north-west	2018	-
70030	Debris	323479	5973223	A2	3.3	0.9	0.4	-	Debris consisting of an irregular dark reflector with height, isolated on the seabed.	-	2018	-
70031	Recorded wreck	321148	5968958	A3	-	-	-	-	Wreck as possible obstruction reported in 1980. Nothing seen since, and surveys carried out in 1982 and 2016. Not covered by the geophysical data so presence at this location cannot be confirmed.	-	-	UKHO 9001



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
70032	Seabed disturbance	321020	5968320	A2	20.1	3.5	1.1	-	Large irregular dark reflector measuring 4.3 x 1.0 m with numerous small dark reflectors forming a wider disturbance. Several surrounding objects that may or may not be natural. Could be natural bedrock poking through seabed as surrounding mag anomalies indicate geology but could be non-ferrous debris. Also observed in the MBES data and the backscatter. Not directly covered by mag data.	-	2014, 2015, 2018	-
70033	Recorded wreck	320473	5968056	A3	-	-	-	-	Recorded position of a wooden boat (8.8 x 2.2 x 0.8 m) and last observed in 1982. Not covered by the geophysical data so presence at this location cannot be confirmed.	-	-	UKHO 8991
70034	Dark reflector	319605	5965295	A2	30.4	6.6	-	-	Elongate dark reflector isolated on seabed observed in the backscatter data only. May be natural	-	2015	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									or may be non-ferrous debris. Not directly covered by Mag. data.			
70035	Magnetic	319691	5965269	A2	-	-	-	18	Small positive monopole identified on one line. Could represent possible ferrous debris.	Yes; 2.5 m ESE	2018	-
70036	Magnetic	319149	5964377	A2	-	-	-	12	Small asymmetric dipole identified on one line. Could represent possible ferrous debris.	-	2018	-
70037	Magnetic	319205	5964300	A2	-	-	-	9	Small positive monopole identified on one line. Could represent possible ferrous debris.	Yes; 32 m north-west	2018	-
70038	Recorded wreck	319387	5963612	A3	-	-	-	-	Recorded position of wreck in sonar (27.0 x 7.6 x 2.6 m) small wreck, boiler and engine high point with gun on the stern. Not covered by the geophysical data so presence at this location cannot be confirmed.	-	-	UKHO 8917



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
70039	Wreck	318774	5962828	A1	39.6	16.6	3.8	-	Wreck on the seabed near a separate piece of debris. Wreck consists of numerous dark reflectors with associated height, stretched in the data window. Observed in both the MBES datasets and backscatter data (54.3 x 8.0 x 3.8 m). Not covered by Mag. data. at the location of a UKHO record for unknown wreck. Previously recorded in UKHO report as 66.2 x 13.5 x 5.0 m and recorded as very broken up.	-	2014, 2015, 2018	UKHO 82907
70040	Debris	318745	5962803	A1	7.6	0.5	2.2	-	Debris which is stretched in the data window, seen as a distinct dark reflector with height. Likely wreck debris due to proximity to a wreck on the seabed. Also observed in the MBES and backscatter data.	-	2018	UKHO 82907



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									Not covered by Mag. data.			
70041	Magnetic	318630	5962639	A2	-	-	-	119	Large dipole identified on one line. Possibly represents buried ferrous debris.	-	2018	-
70042	Recorded obstruction	318511	5961821	A3	-	-	-	-	Recorded position of an obstruction (lost trawl). Nothing located. Only covered by 2014/2015 MBES data and nothing observed at this location.	-	-	UKHO 9132
70043	Mound	318091	5961003	A2	12.6	5.2	0.2	-	Irregular anomaly observed in the MBES data only as a small mound within a depression. Only covered by the 2015 MBES and backscatter data. Large angular bright reflector observed at this location in backscatter.	-	2014, 2015,	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
70044	Recorded obstruction	318130	5960969	A3	-	-	-	-	Recorded position of an obstruction assumed wreck. Nothing located in subsequent surveys. Only covered by 2014/2015 MBES data and nothing observed at this location but may be related to 70043 .	-	-	UKHO 9133
70045	Magnetic	316878	5955731	A2	-	-	-	19	Possibly spurious but looks real in part so picked in retrospect. Spike at top of dipole so not maximum value picked.	-	2014	-
70046	Magnetic	315200	5953976	A2	-	-	-	6	Small sharp dipole visible on one line. Could represent possible ferrous debris.	-	2014	-
70047	Magnetic	314868	5953684	A2	-	-	-	25	Sharp dipole, observed strongly on one line and weaker on adjacent lines. Could represent possible ferrous debris.	Yes; 9 m SSE	2014	-
70048	Dark reflector	311062	5950128	A2	14.0	0.4	0.1	-	Curvilinear object with some slight bright shadow, could be related to nearby	-	2014	-

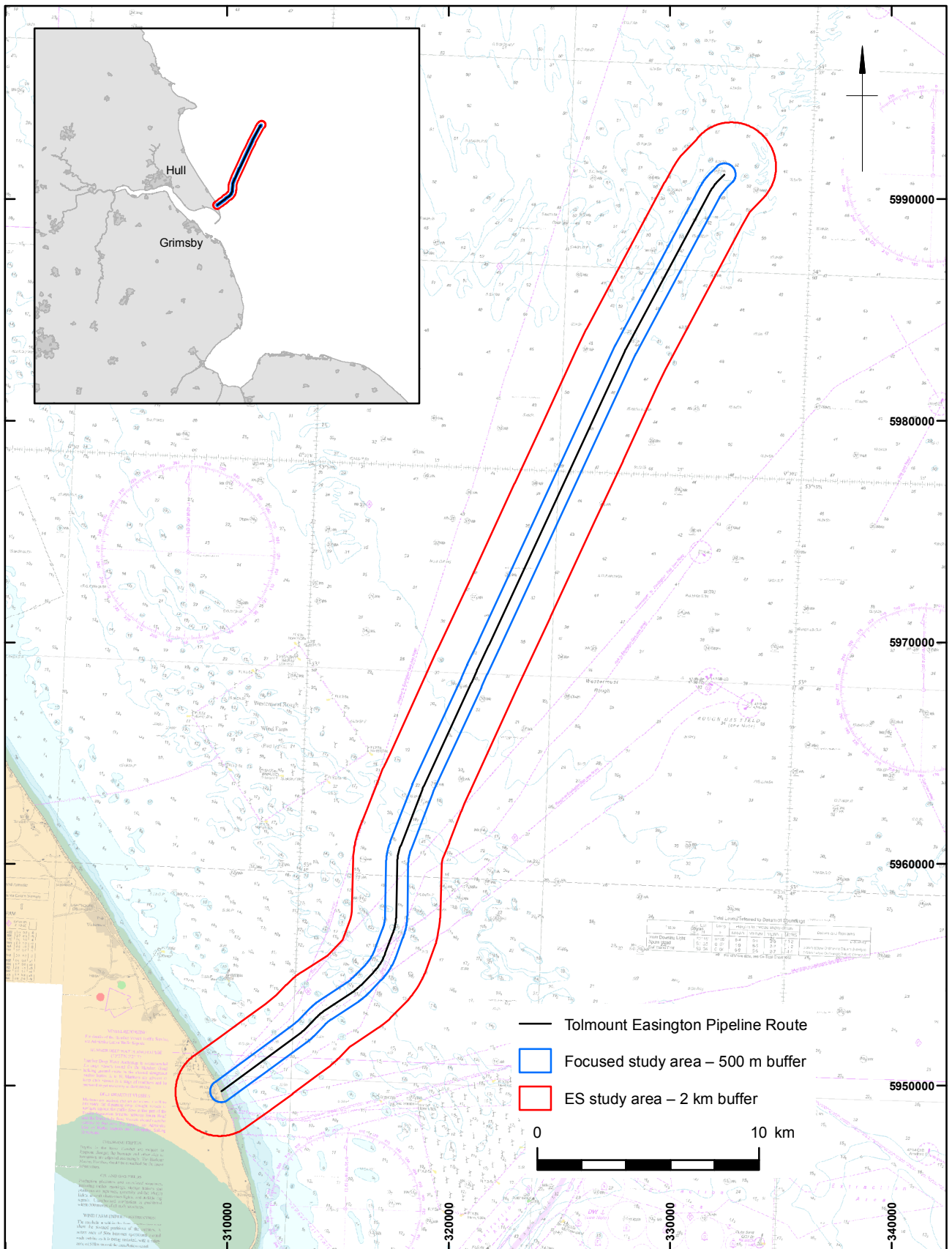


ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
									cables but cannot be certain			
70049	Rope/chain	311061	5950107	A2	29.0	0.2	0.1	-	Curvilinear dark reflector with slight bright shadow, could be related to nearby cables but cannot be certain.	-	2014	-
70050	Rope/chain	310802	5950217	A2	22.0	0.4	0.1	-	Curvilinear object with some slight shadow. Could be related to landfall of adjacent existing cables and pipelines but cannot be certain.	-	2014	-
70051	Dark reflector	310591	5950211	A2	10.8	5.2	0.7	-	Small collection of objects with bright shadow, could be related to nearby cables but cannot be certain.	-	2014	-
70052	Dark reflector	310594	5950203	A2	10.1	6.1	0.8	-	Area of small rounded objects with bright shadow, could be related to nearby cables but cannot be certain.	-	2014	-
70053	Magnetic	310530	5950048	A2	-	-	-	18	Small broad dipole observed between two cables. Could represent possible ferrous debris.	-	2014	-



ID	Classification	Easting	Northing	Archaeological discrimination	Length (m)	Width (m)	Height (m)	Magnetic amplitude (nT)	Description	Within potential 41 m impact zone	Data acquisition date	External references
70054	Dark reflector	310487	5950772	A2	6.2	0.8	0.4	-	Short thin linear with some scour and some shadow that is stretched. Could be related to landfall of adjacent existing cables and pipelines but cannot be certain.	-	2014	-
70055	Magnetic	310172	5949947	A2	-	-	-	8	Small sharp dipole observed between two cables. Could represent possible ferrous debris.	-	2014	-
70056	Magnetic	310102	5950332	A2	-	-	-	7	Small broad dipole observed between two cables. Could represent possible ferrous debris.	-	2014	-
70057	Dark reflector	309971	5950097	A2	4.4	3.9	0.0	-	Perpendicular object with scour but no obvious height shadow. Could be related to landfall of adjacent existing cables and pipelines but cannot be certain.	-	2014	-

1. Co-ordinates are in European Datum 1950 UTMz31N
2. Positional accuracy estimated ± 10 m



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Date: 11/10/2018

Revision Number: 1

Scale: 1:250,000 @A4

Illustrator: KJF

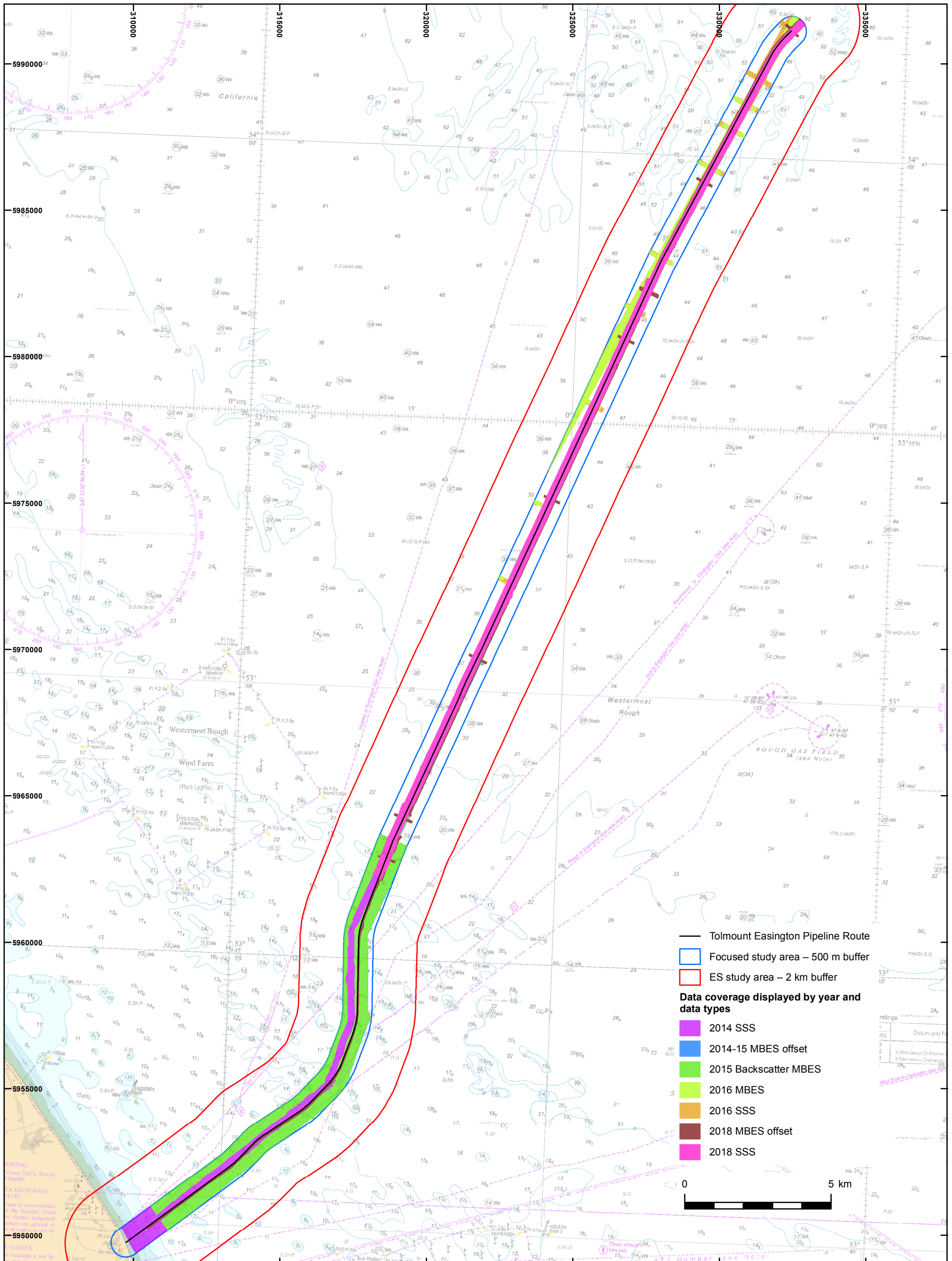
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Coordinate system:
ED50 UTM 31N

Location map

Figure 1



- Tolmount Easington Pipeline Route
 - Focused study area – 500 m buffer
 - ES study area – 2 km buffer
- Data coverage displayed by year and data types**
- 2014 SSS
 - 2014-15 MBES offset
 - 2015 Backscatter MBES
 - 2016 MBES
 - 2016 SSS
 - 2018 MBES offset
 - 2018 SSS



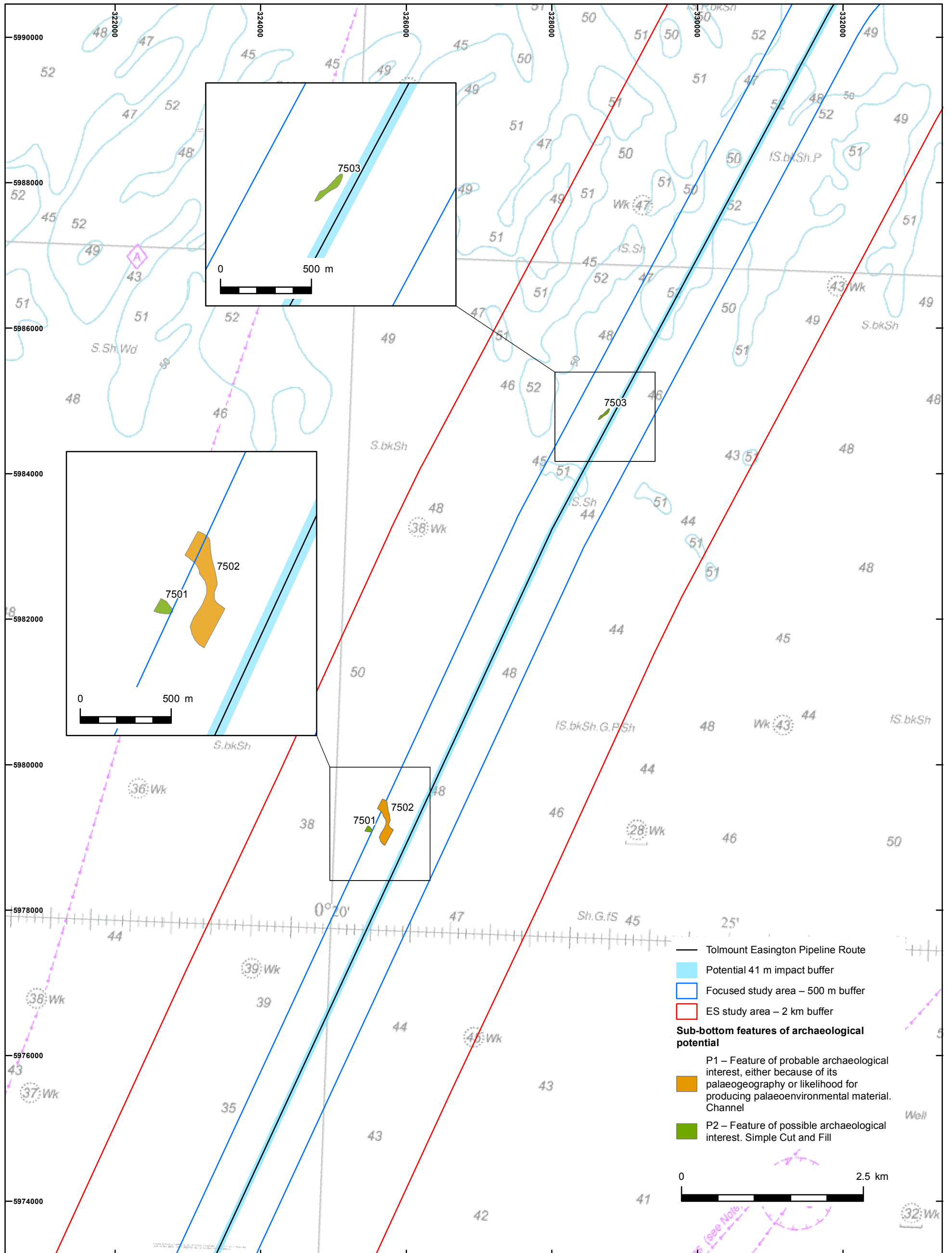
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Coordinate system:
ED50 UTM 31N

Data coverage of Easington pipeline route

Figure 2



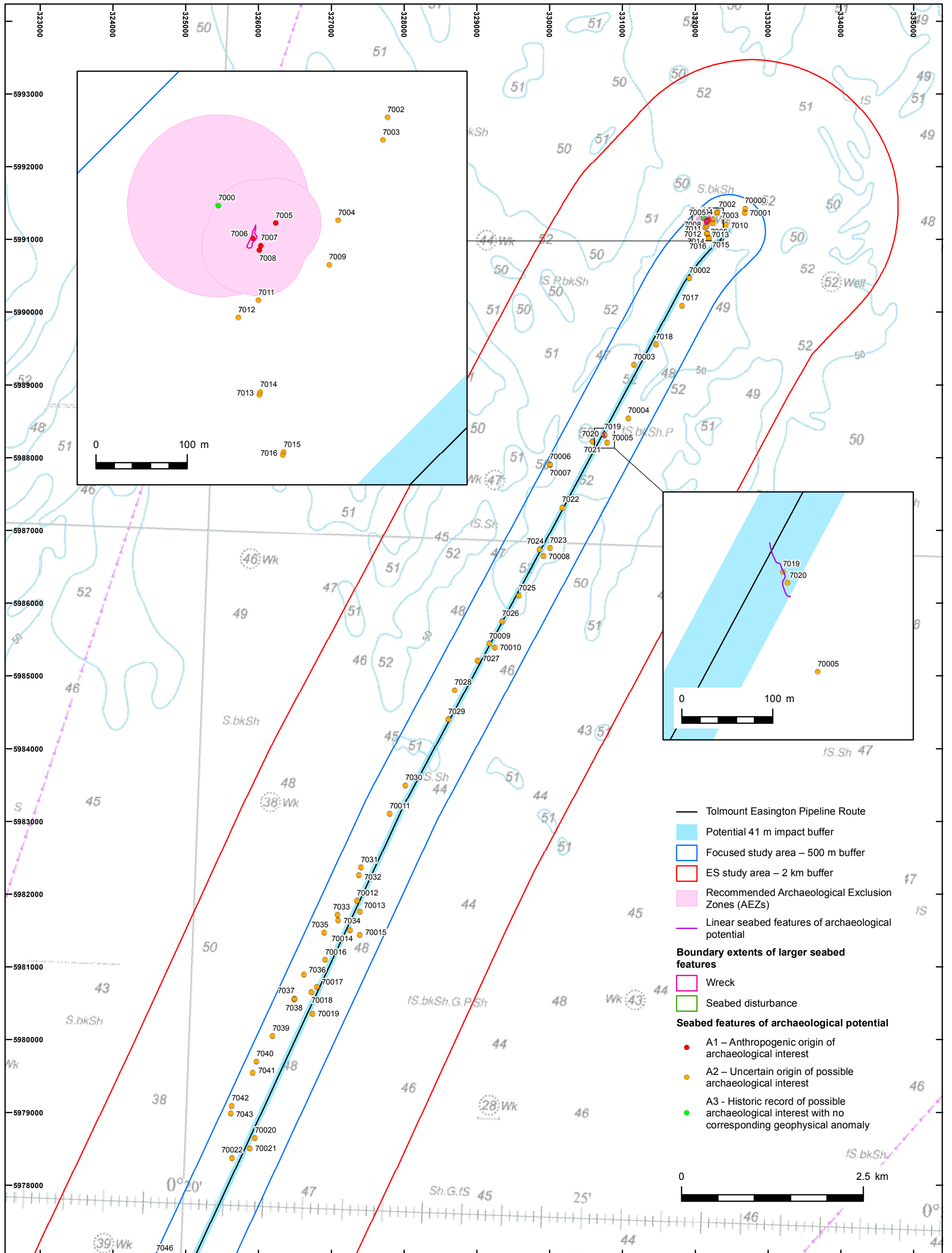
Coordinate system:
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Path:	W:\Projects\111462\GIS\FigsMXD\ES Addendum\2018_10_02		

Sub-bottom features within study area

Figure 3



- Tolmount Easington Pipeline Route
 - Potential 41 m impact buffer
 - Focused study area – 500 m buffer
 - ES study area – 2 km buffer
 - Recommended Archaeological Exclusion Zones (AEZs)
 - Linear seabed features of archaeological potential
- Boundary extents of larger seabed features**
- Wreck
 - Seabed disturbance
- Seabed features of archaeological potential**
- A1 – Anthropogenic origin of archaeological interest
 - A2 – Uncertain origin of possible archaeological interest
 - A3 - Historic record of possible archaeological interest with no corresponding geophysical anomaly



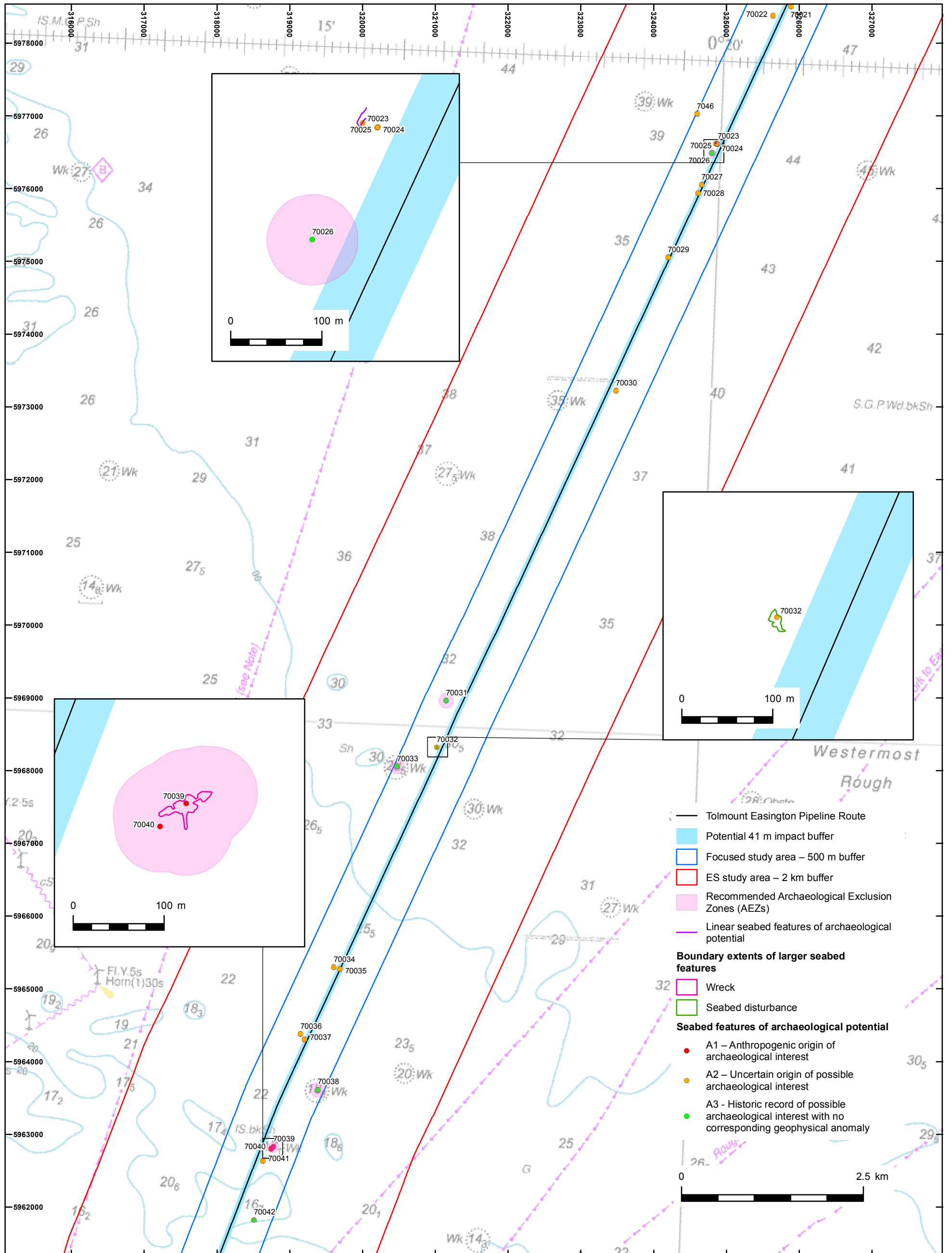
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Seabed feature anomalies and exclusion zones

Figure 4a



- Tolmount Easington Pipeline Route
 - Potential 41 m impact buffer
 - Focused study area – 500 m buffer
 - ES study area – 2 km buffer
 - Recommended Archaeological Exclusion Zones (AEZs)
 - Linear seabed features of archaeological potential
- Boundary extents of larger seabed features**
- Wreck
 - Seabed disturbance
- Seabed features of archaeological potential**
- A1 – Anthropogenic origin of archaeological interest
 - A2 – Uncertain origin of possible archaeological interest
 - A3 - Historic record of possible archaeological interest with no corresponding geophysical anomaly

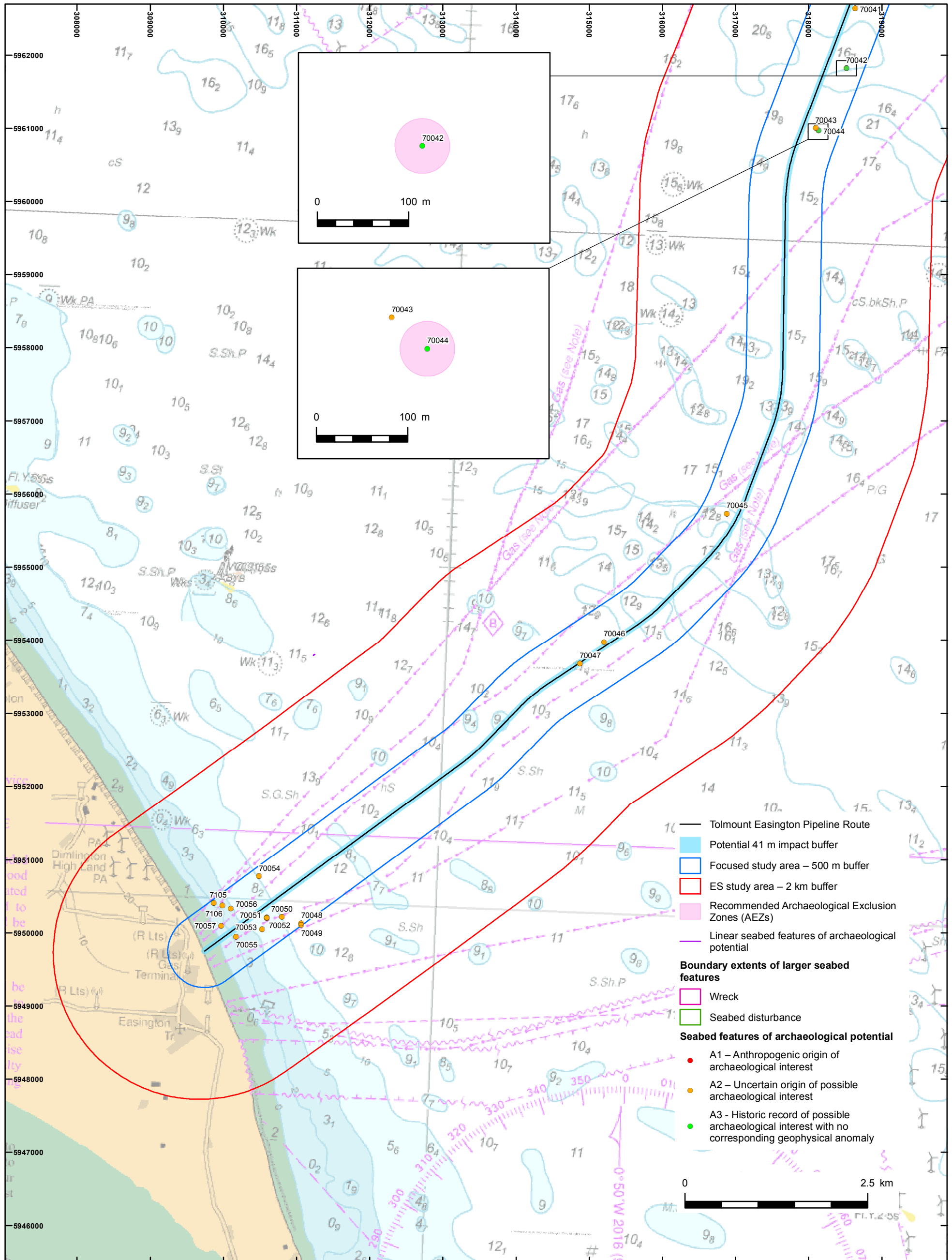
Coordinate system:
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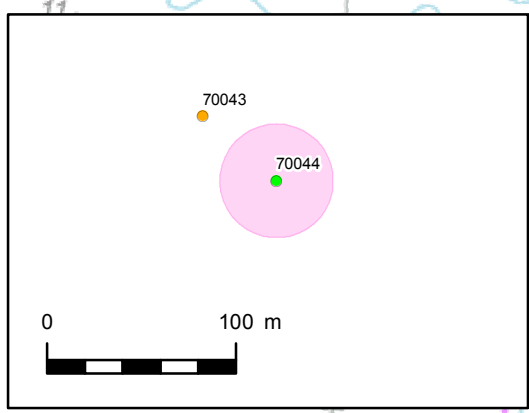
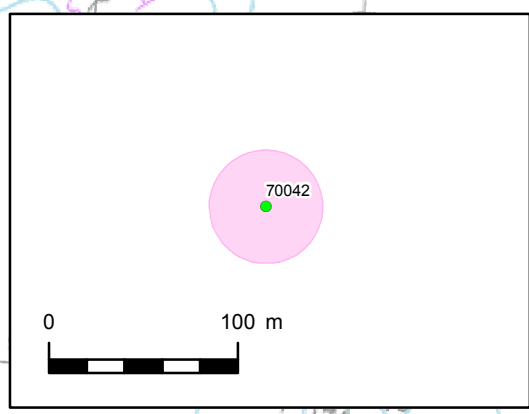
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Seabed feature anomalies and exclusion zones

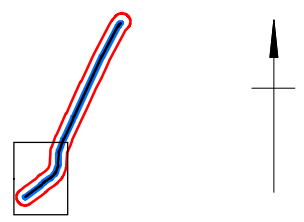
Figure 4b



- Tolmount Easington Pipeline Route
 - Potential 41 m impact buffer
 - Focused study area – 500 m buffer
 - ES study area – 2 km buffer
 - Recommended Archaeological Exclusion Zones (AEZs)
 - Linear seabed features of archaeological potential
- Boundary extents of larger seabed features**
- Wreck
 - Seabed disturbance
- Seabed features of archaeological potential**
- A1 – Anthropogenic origin of archaeological interest
 - A2 – Uncertain origin of possible archaeological interest
 - A3 - Historic record of possible archaeological interest with no corresponding geophysical anomaly



Coordinate system:
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Seabed feature anomalies and exclusion zones

Figure 4c

ID 70039 – Unknown – UKHO 82907

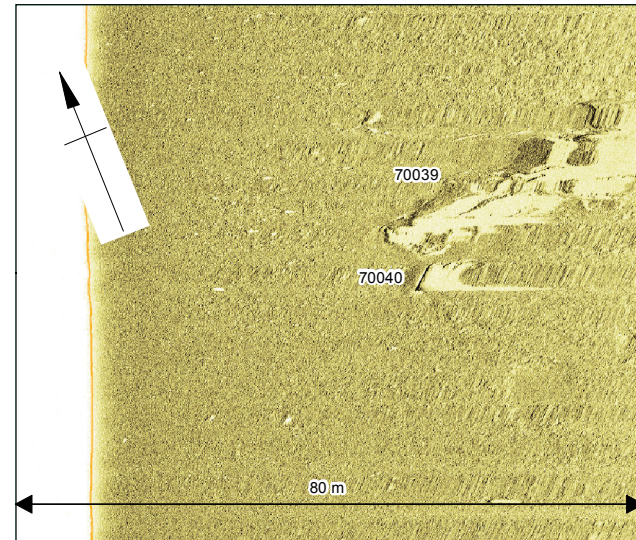
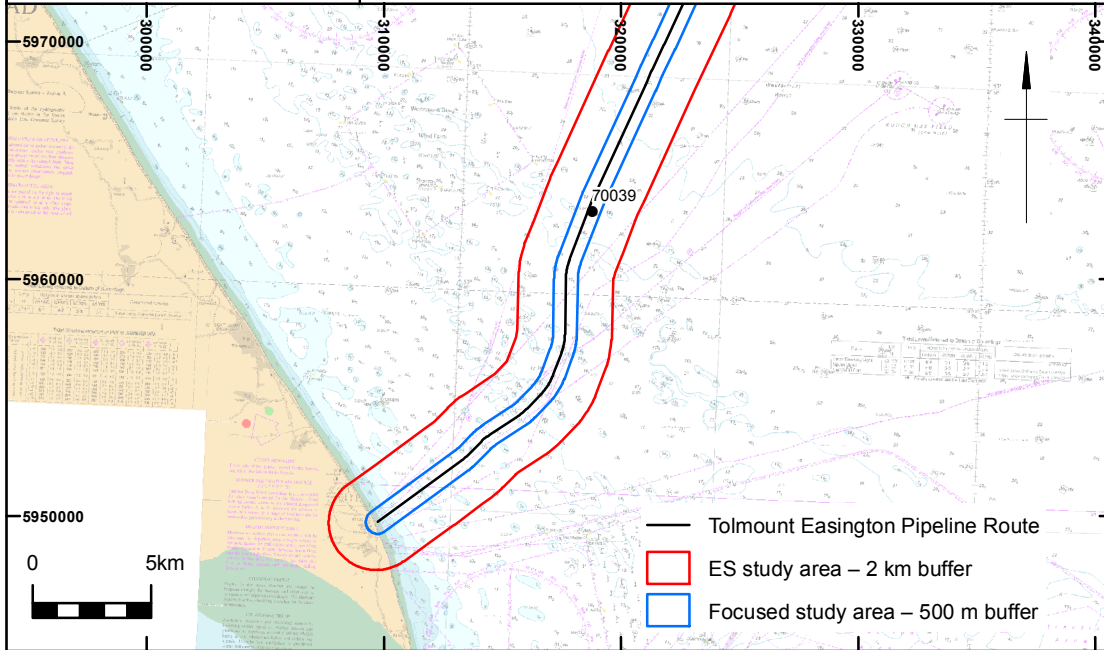
Location	318774 E, 5962828 N (ED50 UTMz31N)	Area	Easington route
Archaeological Importance	High		
Geophysical survey dimensions and notes	<p>Dimensions: 39.6 x 16.6 x 3.8 m (2018 SSS) 54.3 x 8.0 x 3.8 (2015 MBES)</p> <p>Partially covered by 2018 dataset and was observed in the SSS data as a discrete area of dark reflectors with the appearance of some internal structure. Appears upright, partially buried and broken-up.</p> <p>Observed in the 2015 MBES dataset as an irregular but compact area of large mounds, aligned north-east to south-west, apparently upright with some structure. Bow possibly at north-east end.</p> <p>This location was not covered by Mag. data and therefore cannot comment on presence or absence of ferrous material.</p> <p>This location is associated with UKHO record 82907, which represents an unknown wreck; reported as previously observed in 2016, measuring 66.2 x 13.5 x 5.0 m, and recorded as upright, but broken-up, disintegrated or buried.</p>		

Build	Type	Unknown
	Construction	Unknown
	Dimensions	Unknown
	Shipyard	Unknown
Loss	Cause	Unknown

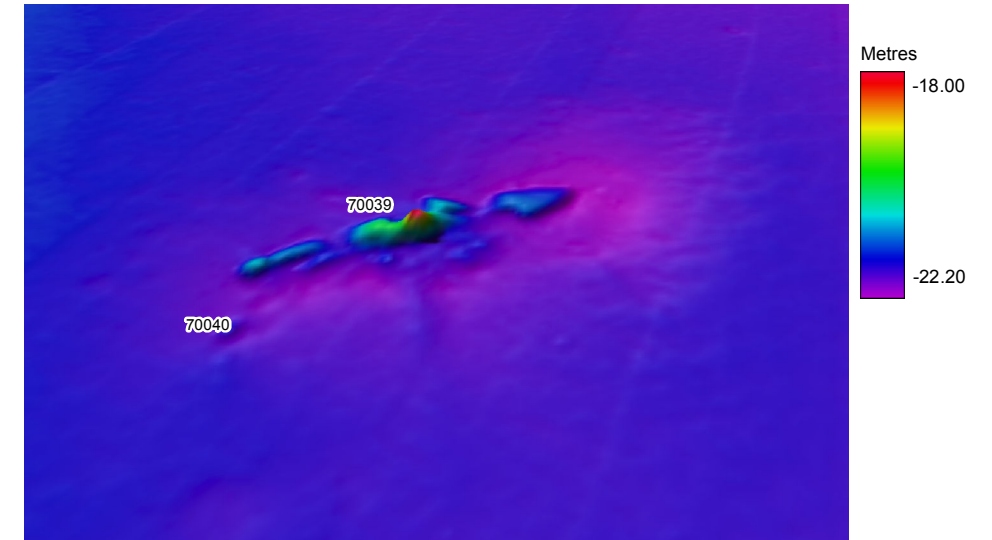
Extent of Survival

The wreck appears to be upright and may be disintegrating or may be partially buried in sediment with shallow surrounding scour. Some surrounding debris is visible, including debris anomaly **70040**, which was identified 38 m south-west of the central wreck position.

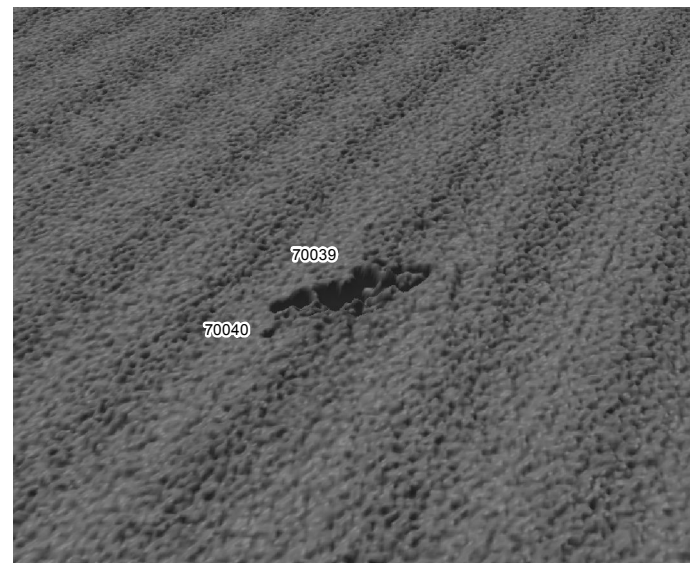
The seabed sediments and surrounding scour are likely to obscure identification of further surrounding debris.



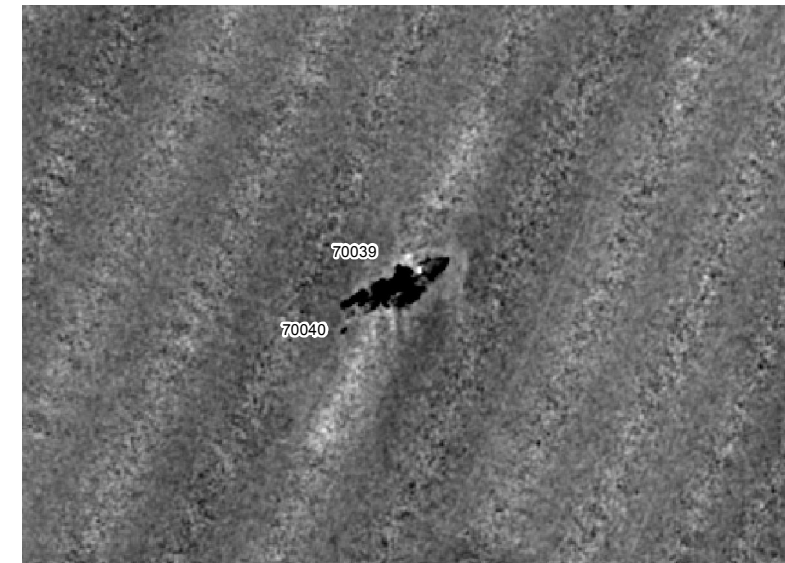
Sidescan sonar waterfall image showing part of wreck **70039** (2018 data), facing NNE, measuring 39.6 x 16.6 x 3.8 m



Multibeam echosounder image of wreck **70039** (2015 data), facing north, x1 vertical exaggeration



Backscatter (gridded) image showing wreck **70039** (2015 data), facing north, x1 vertical exaggeration



Backscatter (Arcgrid) image showing wreck **70039** (2015 data), facing north, x1 vertical exaggeration

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