FIRTH OF FORTH ROUND 3 OFFSHORE WIND FARM

PHASE 1

MARITIME CULTURAL HERITAGE BASELINE TECHNICAL REPORT

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CONTENTS

Figures

Tables

Firth of Forth Round 3 Offshore Wind Farm, Phase 1: Maritime Cultural Heritage Baseline Technical Report

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Executive Summary

This technical report presents the results of a Maritime Cultural Heritage Assessment, incorporating an archaeological desk-based assessment; archaeological assessment of geophysical data; an archaeological assessment of geotechnical data; and an assessment of the 'setting' of the development on key onshore and island cultural heritage receptors for Phase 1 of the Firth of Forth Round 3 Offshore Wind Farm (OWF) Project Alpha and Project Bravo and Transmission Assets Project (Seagreen Projects). The assessment was undertaken by Headland Archaeology (UK) Ltd. on behalf of Seagreen Wind Energy Ltd. The purpose of the report is to outline the archaeological potential of the marine environment and identify any sites and areas of archaeological significance within and in proximity to the proposed Seagreen Projects.

The assessment has established that there are no Designated Wrecks or other cultural heritage assets with legal designations within the Seagreen Projects. The report identified two 'Dead' wrecks (HA 1004 and HA 1008) and one 'Lift' wreck (HA 1005) within the Project Alpha 1km Outer Study Area zone. No cultural heritage remains were identified in the Project Alpha Inner Study Area. Two 'Live' wrecks (HA1001 and HA 1004) and two 'Dead' wrecks (HA 1002 and HA 1003) were identified from the Seazone dataset within the Project Bravo site Inner Study Area. No cultural heritage remains were identified in the Outer Study Area.

In the Transmission Assets Project four 'Live' wrecks and one 'Dead' wreck were identified within the Inner Study Area and three 'Live' wrecks and four 'Dead' wrecks in the Outer Study Area from the SeaZone dataset. In addition, a large number of sites recorded in the National Monument Record of Scotland for the study area without precise locations. As such, there is a moderate potential for the discovery of unexpected remains to be discovered within the development.

The archaeological geophysical assessment identified five targets of High archaeological potential and eighteen targets of Medium archaeological potential within Projects Alpha and Bravo. In Project Alpha nine targets of Medium archaeological potential were identified in the Inner Study Area and three targets of medium archaeological potential in the Outer Study Area. In Project Bravo four targets of high archaeological potential and four targets of medium archaeological potential were identified in the Inner Study Area and one target of high archaeological potential and two targets of medium archaeological potential in the Outer Study Area.

In the Transmission Assets Project nine targets of high archaeological potential have been identified and eighteen targets of Medium archaeological potential. Eight targets of high archaeological potential and twelve targets of medium archaeological potential have been identified in the Transmission Assets Project Inner Study Area. One target of high

archaeological potential and six targets of medium archaeological potential have been identified in the Outer Study Area.

The geoarchaeological assessment and assessment of geotechnical data has established that the Seagreen Projects area is likely to have been either under ice or submerged throughout the late Glacial/early Holocene. This has resulted in a lack of organic sediments of palaeoenvironmental interest from this period, such as peats present within the geotechnical data. The potential for the discovery of relict land surface deposits and features of archaeological interest therefore is regarded as low. Despite this, there is the potential for the discovery of residual artefacts in the Holocene marine sediments such as lithics.

The assessment of key onshore receptors has identified 25 scheduled monuments, 21 Category A listed buildings, one inventory historic garden and design landscape and three conservation areas within the 25km study area. Within the 35 km study area there are 80 scheduled monuments, 21 Category A listed buildings, five historic gardens and designed landscapes and six conservation areas.

ABBREVIATIONS

AD	Anno Domini
BGS	British Geological Survey
BC	Before Christ
BP	Before Present
CD	Chart Datum
COWRIE	Collaborative Offshore Wind Research into the Environment
CPT	Piezocone penetration test
EIA	Environmental Impact Assessment
GIS	Geographical Information System
DGPS	Digital Global Positioning System
Historic MPA	Historic Marine Protected Area
IfA	Institute for Archaeologists
JNAPC	Joint Nautical Archaeology Policy Committee
NMRS	National Monument Records of Scotland
OD	Ordnance Datum
PAN	Planning Advice Note
RCAHMS	Royal Commission on the Ancient and Historical Monuments of Scotland
SeaZone	SeaZone Solutions Ltd
SPP	Scottish Planning Policy
UKHO	United Kingdom Hydrographic Office

1. INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Seagreen Wind Energy Ltd (Seagreen) to prepare a Maritime Cultural Heritage Baseline Technical Report which incorporates an archaeological desk-based assessment; archaeological assessment of geophysical data; an archaeological assessment of geotechnical data; and an assessment of the 'setting' of the development on key onshore and island cultural heritage receptors in advance of a proposed wind farm development in the outer Firth of Forth and North Sea basin off the east coast of Scotland. The report outlines the archaeological potential of the marine environment and includes information on sites and areas of archaeological significance identified within and in proximity to the Seagreen Project.

2. PROJECT BACKGROUND

Firth of Forth is a Round 3 offshore wind farm development by Seagreen, a partnership between Scottish and Southern Energy plc and Fluor Limited, the UK operating arm of Fluor Corporation. The Firth of Forth Zone is situated off the eastern coast of Scotland and lies approximately 25km offshore east of Fife Ness and 25km northeast of the Isle of May immediately outside Scottish territorial waters. The proposed wind farm covers an area of 2,852 square km. The development zone is planned to comprise up to 3.5GW offshore wind capacity in up to 7 separate project areas comprising Wind Turbine Generators (WTGs), Met Masts, Metocean Buoys, Offshore Substation Platforms (OSPs) and submarine cables.

3. METHODOLOGY

3.1 Desk- Based Survey

The desk-based assessment is a documentary and cartographic search utilising a number of sources in order to locate all known cultural heritage assets within the constraints area and within the general location of the proposed development, and to identify the archaeological potential of the area, in this case the outer Firth of Forth in the North Sea. Sources used for this assessment include:

- Databases of designated cultural heritage assets maintained by Historic Scotland including designated wrecks;
- Maritime records held by the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS);
- UK Hydrographic Office Wrecks and Obstructions Database (SeaZone);
- National Library (for historic charts and maps only);
- Ministry of Defence (military remains only);
- Receiver of Wreck (ROW);
- Relevant SEA reports and Coastal Survey Assessment reports; and
- Other readily available published sources and grey literature e.g. marine geophysical and geotechnical survey reports.

3.1.1 Site Visit and Walkover

A site visit was undertaken at the Carnoustie Transmission Assets Project landfall option in October 2011 to verify the findings of the desk-based element of the study and gather information to identify any factors that might affect the archaeological potential of the Transmission Assets Project landfall site. No previously unrecorded sites were identified.

The site visit was also undertaken in connection with the 'setting' impacts of the development on onshore cultural heritage assets. During consultation, eight sites had been identified by Historic Scotland, all of which were visited during the course of the site visit (except Bell Rock). The baseline condition of each monument was noted, as were key views from each location.

3.2 Assessment of Marine Geophysical Survey Data

All survey data supplied by Seagreen was reviewed in its 'raw' digital state with appropriate software. This allowed for the data to be replayed and interrogated in order to effectively assess the position, extent and nature of identified targets. All information with regard to the survey conditions was provided by Seagreen in order to gauge the quality of the data for the identification of potential cultural heritage assets.

The data was subject to an initial scan for any targets of potential cultural heritage interest, after which the data was assessed in detail to:

- familiarise the maritime archaeologist with the survey area;
- correlate anomalies with previously recorded sites;
- identify the absence of anomalies in the vicinity of previously recorded sites;
- identify anomalies indicative of hitherto unrecorded sites;
- check the accuracy of the position, nature and extent of known wrecks; and
- locate and assess unrecorded targets identified by the survey contractors.

All targets were 'tagged' and then assessed as to their archaeological potential. The initial potential of identified targets was gauged using a ranking system (see Table 1 below) as a means of prioritising potential assets in order to inform upon subsequent interpretation. It must be stressed that the ranking system is only seen as a guide and is not used as a substitute for professional judgment.

Table 1: Criteria for Identifying Archaeological Potential of Targets

Potential of asset	Character of anomaly
HIGH	A target that is identified as a known archaeological asset or in the vicinity of such; or a target that is clearly recognisable as a well preserved feature or maritime loss such as a vessel or aircraft (or parts of) and any associated debris
MEDIUM	A target that exhibits characteristics likely to represent the remains of a feature or maritime loss such as a vessel or aircraft including any associated debris; or fragments of the same
LOW	An isolated or fragmentary target that is recognised to be of some interest but may represent a particularly small or fragmentary archaeological, or natural feature

The position and dimensions of identified targets along with any additional anomalies were recorded into a gazetteer (Appendix 4) and sample images of targets were acquired (Figures 6, 7 & 15). The data was cross-referenced with the anomalies identified by GEMS for Project Alpha and Project Bravo and Osiris Projects for the ECR. The position of identified sites and geophysical targets were mapped in ArcGIS (see Figures 4, 5 & 14), all positions are given in Eastings and Northings.

3.3 Assessment of marine Geotechnical Survey Data

The results from the logs of the CPTs and Vibrocores were assessed in order to gauge whether the acquired deposits contained any sediments of palaeoenvironmental or archaeological potential; in particular peats or sediments with high organic contents such as organic silts. The information for the borehole logs has been supplied by GEMS Survey Limited and Osiris Projects.

4. LEGISLATIVE FRAMEWORK AND GUIDANCE

This assessment takes account of the following legislative procedures and guidelines:

- Marine (Scotland) Act 2010
- Protection of Wrecks Act 1973
- The Protection of Military Remains Act 1986
- Ancient Monuments and Archaeological Areas Act 1979
- Merchant Shipping Act 1995
- Valetta Convention
- ICOMOS
- UNESCO

- Ancient Monuments and Archaeological Areas Act 1979
- Scottish Planning Policy (2010)
- Listed Buildings and Conservation Areas (Scotland) Act 1997
- Planning Advice Note 2/2011

Full details of these legislative and guidance procedures is given in Appendix 6.

The Desk-top baseline study and assessment has been compiled in line with industry best practice and the relevant offshore renewables and marine historic environment guidance. These include:

- Institute for Archaeologists (IfA) guidelines: Standard & Guidance for Archaeological Desk Based Assessment (2008);
- Joint Nautical Archaeology Policy Committee (JNAPC) Code of Practice for Seabed Development (2008);
- COWRIE Historic Environment Guidance for the Offshore Renewable Energy Sector (2007);
- COWRIE Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore renewable Energy (2008);
- COWRIE Guidance for Offshore Geotechnical Investigations and Historic Environment Analysis: guidance for the renewable energy sector (forthcoming);
- The Crown Estate (2010). Offshore Renewables Protocol for Archaeological Discoveries;
- The Crown Estate (2010). Round 3 Offshore Renewables Projects Model Clauses for Archaeological Written Schemes of Investigation; and
- Towards a Strategy for Scotland's Marine Historic Environment (Historic Scotland 2009)

5. BASELINE ENVIRONMENT

5.1 Study Area

The Study Area for this cultural heritage technical report includes the proposed Phase 1 Development Area Projects Alpha and Bravo and Offshore Transmission Assets (Seagreen Projects) referred to as the 'Inner Study Area' and a 1km buffer zone referred to as the 'Outer Study Area'. A further arbitrary 5km buffer zone around the Seagreen Projects was appraised in order to identify the archaeological potential of the main study area. All cultural heritage assets are given Headland Archaeology (HA) numbers; and in the case of geophysical targets for the Offshore Transmission Assets, Cable Route (CR) numbers. Full details of each entry where available are given in Appendices 3 & 4.

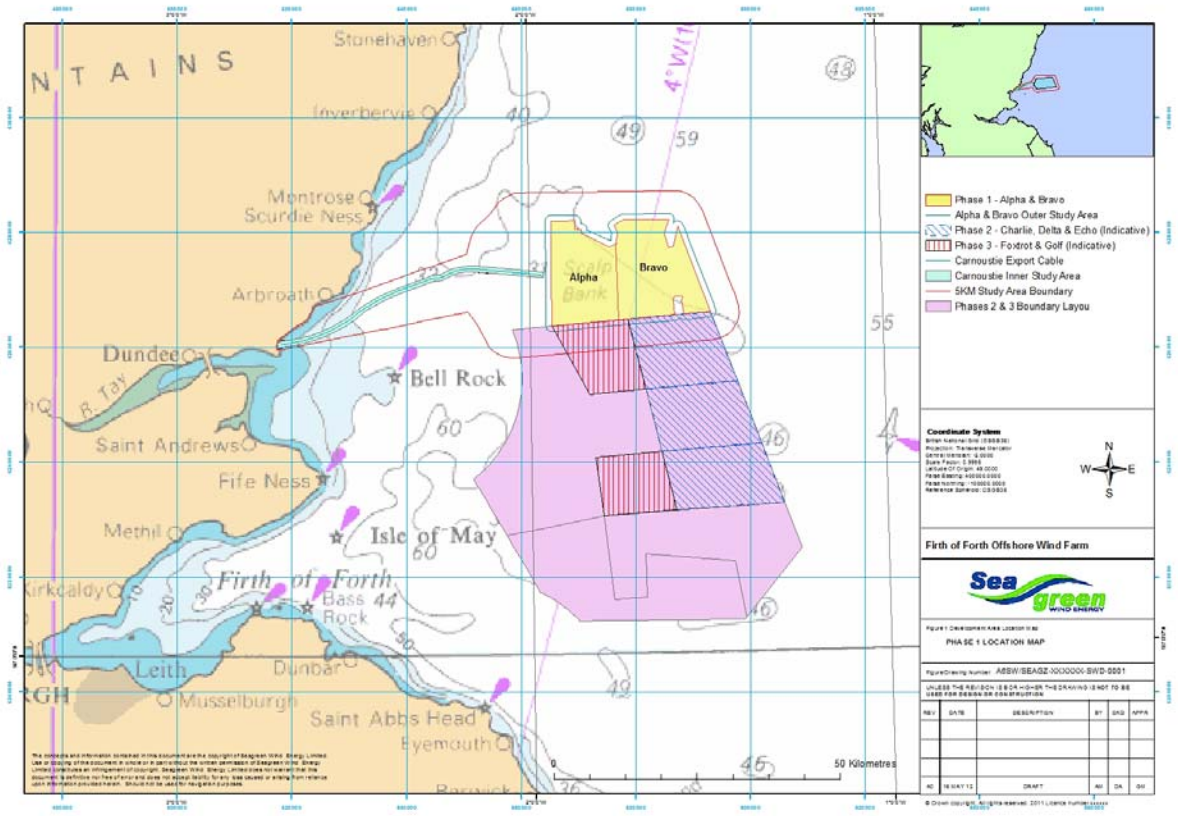


Figure 1. Firth of Forth Round 3 Offshore Wind Farm Site Location

5.2 Bathymetry, Geology, Geomorphology & Sedimetology

5.2.1 Bathymetry

Project Alpha & Bravo: Project Alpha & Project Bravo: A geophysical survey (Gems Survey Limited, 2010) established that the maximum depth across the site was in the northwest area of Project Alpha (86.2 LAT) where a deep channel cuts into the seabed. The shallowest areas were identified across the Scalp Bank feature orientated northeast to southwest. The majority of the ISA lie within 40m – 60m LAT (Chapter 6 - Physical Processes). In the northern section seabed levels dip irregularly from west to east while in the southern section seabed levels dip to the south east across an undulating seabed. There are limited areas of steeply sloping seabed associated with the channel feature but the majority of the site can be summarised as having a slightly sloping gradient.

Sand ridges 0.3m to 1.2m high and associated shallow troughs are identified throughout the survey area. Megaripples are the predominant feature across the site with isolated sandwaves present in Project Alpha. Both isolated boulders and clustered boulder fields are also evident across the development area (for further detail see Chapter 6 – Physical Processes). All of these are formed by erosion resultant of currents and waves moving over the seabed. The majority of the Project Alpha & Project Bravo sites is level or undulating with occasional linear sediment waves.

Offshore Transmission Assets: A geophysical survey carried out by Osiris Projects in 2011 established that the depths ranged from 3.0m above LAT to approximately 69.0m

below LAT in the extreme north of the corridor in close proximity to the Projects Alpha and Bravo. Seabed levels within the central section of the Southern Route corridor undulate between 39.0m below LAT and 69.0m below LAT, as the route crosses a series of frequently broad, steeply-sided (≤2.6o) ridges or mounds of gravelly sands/sandy gravels (Chapter 6 - Physical Processes).

The sediments across the Transmission Assets Project are highly variable but generally comprised of fine, granular sediments with occasional patches of outcropping rock. These sediments are interpreted as ranging from very silty fine to coarse grained sands, with variable shell content, to coarser grained sandy gravels, with occasional cobbles and (generally small) boulders. Irregular patches of coarser grained sands are also present, exhibiting a degree of bathymetric relief and attaining elevations up to 20m above the surrounding seabed, with the finer grained materials between the coarser patches with mobile megaripples.

5.2.2 Geology, Geomorphology and sedimentology

The Seagreen Projects lie within the Outer Forth Estuary of the North Sea Basin. Here thick sequences of Quaternary sediments of up to 1000m have been deposited, which contain evidence of at least five major glacial episodes over a period of two millennia (Sutherland, 1984). There are four main geological units identified within the proposed development: Holocene sediments, the Forth Formation, the Wee Bankie/Marr Bank Formation and the Aberdeen Ground Formation.

Recent geological investigations have shown that the Holocene sediments range in depth from 0.5m to in excess of 20m in the area of the outer Forth, although differentiating between the Holocene and underlying Forth formation has proved extremely difficult in some locations and thus there may be some mixing of units within these deeper sequences. These Holocene sediments were found to consist mainly of sands (GEMS, 2010) and would have been deposited over the past 10,000 years. Some disturbance to these sediments has also been observed from the bathymetry survey with evidence of trawling scars removing the Holocene deposits and exposing the underlying Quaternary deposits (GEMS, 2010). Shallow Holocene deposits (1-2m) consisting principally of silts and sands have also been recorded in the onshore and inner estuary area, such as the Inner Forth (e.g. Robinson, 1982; Barras and Paul, 2000).

The Forth Formations were seen to extend to 35m in depth across the area and consisted mainly of sands, with some mud and silt deposits towards the base of the formation. Underlying the Forth Formation was the Wee Bankie/Marr Bank Formation. The Wee Bankie Formation is present mainly in the western area of the site, extending to 63m and the Marr Bank Formation to the east, extending to 38m (GEMS, 2010). The Wee Bankie Formation then defines the terminus of the western end of the Marr Bank Beds (Holmes, 1977). These formations have different lithostratigraphic components with the Wee Bankie Formation consisting of boulder clay, while the Marr Bank Formation principally consists of sand. These deposits are both thought to be of contemporaneous Devensian Age (Thomson, 1978; Sutherland, 1984) and have been radiocarbon dated to the Late Devensian period, c. 21,000 to 17,000 BP (Sutherland, 1984).

In the eastern area of the site sandwiched between the overlying Marr Bank Formation and the underlying Triassic bedrock is the Aberdeen Ground Formation. This deposit represents a former channel, which consists of inter-bedding layers of muds and sands extending to depths of 85m (GEMS, 2010). Palaeomagnetic studies of this formation have given an Early to Middle Pleistocene age for these sediments (Stoker *et al*, 1983).

The solid geology beneath the proposed Offshore Transmission Assets comprises a thick sequence of sandstones, siltstones and mudstones of Lower (Emsian) and Upper (Famennian) Devonian ages. To the east of approximately KP15.5 these Devonian rocks are, in turn, overlain by undifferentiated Permo-Triassic rocks. These rocks are overlain by Pleistocene deposits of Quaternary age, comprising variable materials ranging from soft clayey silts/silty clays of the Forth Formation to possibly hard gravelly clays/clayey gravels of the Wee Bankie Formation, which can be up to 40m thick. These deposits are more prevalent in the western sections of the route. In contrast hard gravelly clays/clayey gravels, likely to be representative of glacial tills and are generally present throughout the cable route, reaching thicknesses of up to 40m in places. These Quaternary deposits are frequently overlain by very thin finer grained surface sediments, generally less than 2.0m thick. These materials comprise gravelly sands/sandy gravels or clayey gravelly sands, which may exhibit very little variation in character with the underlying Quaternary strata (Osiris Projects 2011b).

Table 2: Archaeological and Geological Chronology

Age in years BP / BC / AI	British Stages	Archaeological Period
42AD - Present Day	Holocene	Roman; Early Medieval/Medieval; F Medieval to Modern
700BC - 42AD		Iron Age
2,500BC - 700 BC		Bronze Age
4,000 BC – 2,500AD		Neolithic
9,000 BC – 4,000BC		Mesolithic
10.000 BP	Younger Dryas (Loch Lomond Stadial)	Palaeolithic
11,000 BP	Windermere Interstadial	
13,000 BP	Dimlington Stadial	
70,000 BP–16,000 BP	Devensian	
110,000BP	Ipswichian	
339,000BP – 130,000BP	Wolstonian	
380,000BP	Hoxnian	
423,000BP	Anglian	
860,000BP – 478,000BP	Cromerian Complex	

5.3 Potential for Submerged Archaeology and Palaeolandscapes

5.3.1 Relative sea-level change

The outer Forth Estuary is an area of Scotland that has been submerged since approximately 9,300 BP, around the end of the last Glacial period; the Devensian Period (Shennan et al, 2000; Flemming, 2004). The proposed development is within an area of Scotland that is currently still undergoing isostatic rebound from this period (Smith *et al*, 1999). Smith *et al* (1999) have recorded that this area has undergone between 4-6m of uplift since approximately 6,850 BP. Recent studies have shown that the area is still rising (readjusting) at a rate of over 1mm per year (Woodworth *et al*, 2009).

Holocene relative sea-level change has been investigated across sites in east Scotland and show a broad trend of falling sea-level from the Late Glacial Maximum of c. 15,000 BP to around 10,000 BP to levels below that of present day sea-level; the early-Holocene minimum (Shennan *et al*, 2000; Shennan and Horton, 2002). This is followed by a period of sea-level rise, which peaked at approximately 7,000BP in the Inner Forth (Robinson, 1993) and culminated by around 4,000BP across the east coast of Scotland, when sea-level began to fall (Smith *et al,* 1999), with this trend continuing in the area to the present (Shennan and Horton, 2002).

5.3.2 The potential for palaeoenvironmental and archaeological study

The Holocene sediments present within the Outer Forth have been identified as principally consisting of sands and gravels. These sediment types offer limited palaeoenvironmental potential in terms of micro and macro-fossil study with preservation of such material generally extremely poor within these deposit types. The reworking and in places removal of Holocene sediments from dredging activity (GEMS, 2010) also reduces the potential of the sediments to offer accurate information. Palaeoenvironmental work across this area of eastern Scotland has mainly focused on investigating relative sea-level change (e.g. Whittington *et al*, 1991; Robinson, 1993; Smith *et al*, 1999) and has taken place inland or in the inner areas of the estuaries (Tay and Forth); although the number of studies is still relatively small in comparison to the western coast of Scotland (Whittington *et al*, 1991). Within these areas there is a higher potential for sediments such as peats and estuarine silts to be present, which have greater potential for the preservation of ecofacts, such as pollen and diatoms. Thus there may be some opportunities for palaeoenvironmental study in the near shore area.

The Devensian and Pleistocene deposits also have some limited potential for palaeoenvironmental study with previous work showing the presence of partially lignitised wood remains within the Aberdeen Ground Formation (Holmes, 1977). The dating of these later formations such as the Aberdeen Ground Formation is still not completely understood (GEMS, 2010) and the presence of these formations within the study area provides an opportunity to gain further dating information.

That the Outer Forth area has been submerged throughout the Holocene and prior to this covered by an ice-sheet during the Devensian, the potential for archaeological study is limited. That the area was flooded around 9,300 BP and before this covered by ice provides a limited window of opportunity for humans to have populated this area. This means that the

potential for prehistoric finds such as Mesolithic flint scatters is likely to be low from this area. Palaeolithic artefacts may be present in such off shore areas, as noted by Astill *et al* (2008) and although the potential for random spot finds, such as Palaeolithic tools is still low, the recovery of such items would be of national significance. Within this area artefacts would also have had to survive the presence of ice sheets and associated glacial activity together with the changes in sea-level.

The oscillations in relative sea-level (see above) would have had an effect on any populations settling along the eastern coast line. However, archaeological and palaeoenvironmental evidence have shown that inter-tidal areas were attractive to prehistoric communities (e.g. Bell, 2007) suggesting areas along the coastal margins have the potential to contain prehistoric archaeology. The finding of a stone axe-head at Arbirlot, near Arbroath (Stevenson, 1953), which is probably of a early prehistoric date also indicates that there is potential for artefacts to be recovered in the coastal area.

5.4 The Potential for Unrecorded Maritime Cultural Heritage Assets

5.4.1 Palaeolithic (70000BP to 9000BC)

The Palaeolithic covers the time from the initial occupation of what is now recognised as mainland Britain believed to have been c. 70000BP to10000BP. During this time there have been a number of environmental changes and cycles, glaciations, changes in sea level, and much of the offshore area we are to examine for this report was for long periods exposed as dry land, offering the possibility to examine palaeoenvironmental evidence as well as material culture. While there have been no reported Palaeolithic finds or deposits of archaeological significance from the study area, the discovery of an array of flint tools and associated faunal remains believed to have been deposited during the Devensian Ice Age c.100000BP were uncovered after offshore dredging works eight miles east of Great Yarmouth in Norfolk (Wessex, 2007). This demonstrates the potential for Palaeolithic evidence to survive in offshore submerged contexts. Elsewhere in the British Isles Palaeolithic cave sites on the Welsh coast are well documented (Lynch *et al,* 2000), a cluster of which occur at Colwyn Bay including Pontnewyyd Cave which contained the remains of at least three individuals. Similarly, a late Palaeolithic site from coastal England is known at Blackpool (Manley, 1989: 19).

5.4.2 Mesolithic/ Neolithic (9000BC- 2500BC)

Mesolithic sites can be difficult to locate and identify but are known from coastal locations on the Scottish coast, such as the sites discovered in the Western Isles (Bonsall, 2009: 70-77) and Northern Isles (Melton & Nicholson, 2004), and on the east coast near the study area. A shell midden recorded at the Stannergate at Dundee adjacent to the Tay Estuary 10 m from the High Water mark (HWM) had Neolithic layers overlying Mesolithic deposits and evidence suggests was at one time much closer to the shoreline (Dunwell and Ralston, 2008: 28-29). The earliest known remains of human settlement in Scotland to date have been uncovered at Cramond near Edinburgh where stone tools, debotage and hazelnut shells from what was believed to be a Mesolithic hunting camp overlooking the Forth Estuary have been radiocarbon dated to about 8500 BC (Telford, 2002). While this evidence does not provide definitive proof, coastal habitation does suggest the possible use of maritime transport at this time (Johnstone, 1980). While there is no evidence for Mesolithic activity identified in

immediate proximity to the study area, evidence such as the remains excavated at Fife Ness does suggest potential for the discovery of sites dating to this period along the coastal margins (Andrew *et al*, 2008). The dearth of evidence in the marine zone in the northern North Sea is the isolated discovery of a flint scraper recovered from a borehole core sample on the Viking Bank in the North Sea further demonstrates that prehistoric deposits can survive within submerged landscape contexts (Fleming, 2004).

Neolithic sites are known from coastal locations on the east coast of Scotland including a large number of examples from the Angus coastal fringes (Jones, 1996: 91-97). Evidence for maritime travel is demonstrated through a number of examples of sea- faring vessels have been identified and recovered from coastal locations throughout British Isles. This includes an example from the east of Ireland which was recovered under 2 metres of sand during offshore trenching at a landfall site at Gormanstown, County Meath (Brady, 2002). The author suggested that this example was modified with outriggers to accommodate long distance sea travel (*ibid*.). Trade of goods, common ritual ideas and possible migrations are the other main indications of maritime contact during the Neolithic period.

5.4.3 Bronze Age (2500BC – 700BC)

Archaeological evidence from throughout the British Isles provides us with examples of the continued use of logboats during the Bronze Age and also of the use of small coracle type boats made from leather skins. More than 150 logboats have been recovered in Scotland (Mowat, 1996) and a number of examples are known from Bronze Age contexts including one from the intertidal zone of the Tay estuary near Newburgh that has been radiocarbon-dated to 1130-970 BC (Strachan, 2010; Andrian, 1994: 87) Advances in boat building technology during the Bronze Age demonstrates the ability for long distance maritime travel and is best witnessed by the Dover boat discovered in September 1992 between Dover and Folkestone. The boat is c. 3,500 years old and was damaged but may have originally measured 18 metres long and 2.4 metres wide, making it capable of crossing the channel and carrying a substantial cargo. The boat was made up of at least six oak timbers strewn together with yew wood, with all the joints reinforced with a thin lath of oak, covering moss pushed into the joint. The two central planks are joined by the use of wedges pushed through a central rail and a series of cleats (Clark, 2002). Other similar type of boats recovered from this period include three examples discovered at North Ferriby on the Humber near Hull, however no examples of this type of craft have ever been recovered from the Firths of Forth and Tay or the North Sea in the area of the proposed development.

5.4.4 Iron Age & Roman (700BC – 410AD)

The archaeological evidence for maritime travel is evident in the common culture and traditions across much of Europe and the British Isles. We know that Wales, Scotland, the Isle of Man and Ireland adopted a Celtic culture at this time and this could not have occurred without maritime travel. The type of craft used for travel at this time is known to have evolved to that known as the Romano-Celtic type, similar to one discovered in the Severn Estuary (Lawer & Nayling, 1993). However it is likely that skin covered vessels and dugout canoes continued to be used. A gold ornament representing a boat discovered as part of an Iron Age hoard in Co. Derry in Northern Ireland is generally accepted to represent the type of vessel in use at that time. The detail includes a mast and yard arm, 18 miniature oars and rower's benches, a type of rudder or steering oar, a grappling hook and other tools (Rafferty,

2008: 152). According to Rafferty it gives us a unique insight into the type of vessel used for deep sea and ocean travel but the one detail that cannot be discerned is whether the vessel was intended to represent a boat of hide or of timber (*ibid*.).

Archaeological and documentary evidence for Roman occupation in Scotland is well documented and discussion with regards the utilization of the sea around Scotland has also been postulated (Martin, 1991). There is no question that both military and merchant maritime traffic would have been extensively employed during this period, connecting with the many Roman fort and settlement networks on the major east coast Firths; notably Cramond on the Forth and Carpow on the Tay. Although archaeological evidence for Roman maritime activity is yet to be forthcoming, it has to be a distinct possibility that evidence of such activity may well survive within the vicinity of the study area.

5.4.5 Early Medieval and Medieval (410AD – 1550AD)

The Early Medieval Period witnessed increasing contact between cultural groups throughout the British Isles, particularly between Ireland and Scotland. The Dalriadic Scots integrated and settled among the native groups of the west coast of Scotland and this interaction is embodied in maritime contact, evidence for which is suggested in pictorial graffiti, such as that discovered at the early Christian site on Inchmarnock opposite the Isle of Bute (Atkinson, 2008). The depiction of vessels on stones discovered at the site suggests evidence for the potential admixture of maritime boatbuilding traditions during this period. Elsewhere the east of Scotland was dominated by the Pictish tradition and in the absence of archaeological evidence for maritime activity we also rely on sculptural depictions of craft types, such as that noted on the Cossan's Stone in Angus. Despite the lack of archaeological evidence for vessel remains, there is still the potential for such discoveries in the future.

Maritime links assumed renewed importance in the Early Medieval period, especially in relation to the spread of Christian culture and the written record from this period makes constant reference to journeys undertaken by those involved with the church between Scotland and Ireland, Wales, Cornwall and Brittany. Well documented voyages include those of Colm Cille, who travelled with a group of monks from Northern Ireland to set up a monastery in Iona and Columbanus who travelled to Gaul (Ó Cróinín, 2005). The medieval text *Navigatio Sancti Brendani Abbatis* (The Voyage of St Brendan the Abbot) tells how a group of 6th century monks built a leather skinned 'curragh' type boat and set sail west over the ocean. Evidence of similar early religious centres on the east coast of Scotland is well represented, for example St Andrews in Fife and Arbroath in Angus, opposite the study area.

Documentary sources tell us state that the North Sea was frequently navigated by Danish and Norse Vikings, Orkney becoming a base in their expansion south and west from Norway (Ó Cróinín, 2005; Ritchie 1993). The Annals of Ulster report of intermittent raids being carried out by the Norse at monastic sites on the west coast of Scotland at Iona and Northern England at Lindisfarne in 793AD. Evidence of Viking contact near the study area is evident in the remains of placenames, the location of Viking coin hoards, and hogback tombstones located along the Fife and Lothian coast and Forth and Tay estuaries (Owen 1999). The Viking longship, clinker built type vessels, was a major factor in the success of their raids and voyages as they were suited to rough seas but also with the ability to navigate shallow estuaries and waterways (Greenhill and Morrison, 1998). Evidence for

Viking vessels has been found on Orkney, the Isle of Man, at Portrush in County Antrim and on Rathlin Island off the coast of County Antrim. There are a number of accounts of maritime travel by the Vikings from Orkney, including an account from the 13th century when King Haakon Haakonson arrived in Orkney with a fleet of over 100 ships (Ó Cróinín, 2005).

During the medieval period it was military campaigns, migration and consequent commercial expansion that accounted for much of the sea travel of the time. During this time the English, Spanish and French had significant naval forces. The importance of ports grew, as did significant populations, prompting an expansion in seaborne trade and commerce. Custom accounts from the 15th century provide evidence of a thriving import and export industry (Rodger, 1997).

5.4.6 Post- Medieval- Modern (1550-Present)

The post-medieval period saw a steady increase in coastal activity where military activity and the expansion of world-wide trade meant further growth in the volume of shipping. From the 18th century onwards comprehensive records of ship losses became widespread and from the middle of the 19th century these records became far more comprehensive. This is reflected in the NMRS data collected that shows over 1500 wrecks in the Firth of Forth and Tay / North Sea area alone. Many of the recorded losses occurred during major storms, including the Great Storm of 1800 and other famous storms in 1852, 1874, 1875 and 1876. In the 1875 storm at least 15 vessels were lost and in 1876 there appears to have been at least 31 sinking's (Ferguson, 1991: 58). So severe were these losses that they encouraged the adoption of steam power for cargo vessels and by the end of WWI most of the larger vessels in the area were steam powered. Fishing has also been a significant industry in the area, with the rise of numerous fishing settlements along the Scottish east coast during the 18th and 19th centuries with major increases in the population - driven mainly by the growth of the herring fishing. It is not surprising therefore, that many of the reported losses in this area are of smaller fishing vessels of various designs. It was not until the 20th century that metal hulls came into use in the herring trade and many of the earlier losses of wooden vessels are likely to be highly degraded and difficult to detect.

5.4.7 Military Remains

Vessel losses: The majority of identified shipwrecks in the seas opposite the Firth of Forth and Firth of Tay are the result of military activity during WWI and WWII. Initial losses during WWI were caused by the extinguishing of coastal lights which resulted in numerous wrecks concentrated along the shoreline. In the latter half of 1917 a submarine offensive was launched by the German Navy which resulted in the sinking of a large number of vessels in the Outer Tay and Forth and North Sea basin; in addition to a number of U-Boat losses (Ferguson, 1991: 97). Records for shipping casualties are somewhat incomplete between 1939 and 1945 due to censorship but approximately 50 merchant vessels were sunk off the north-east coast as well as numerous military boats, ships, submarines and Allied and German aircraft losses.

Aviation losses: There is a moderate concentration of offshore aircraft losses along the north-east coast of Scotland resulting from military operations. A number of air bases are located in the vicinity of the proposed development, including the operational base at Leuchars and the former base at Crail, both operational since World War 1 and throughout the 20th century as military training bases. On the 16 October 1939, 12 Luftwaffe Junkers Ju

88's attacked the Royal Navy in the Firth of Forth, one of which was the first German aircraft to be shot down over British territory since WWII (http://www.military-aircraft.org.uk/ww2 - accessed July 2011).

6. RECORDED MARITIME CULTURAL HERITAGE

6.1 Limitations of data

One of the greatest limitations when researching known and potential offshore cultural heritage is the difficulty of locating recorded maritime losses. For many losses the location of the sinking of the vessel can be in the form of a general area description, as in 'off Firth of Forth' or 'North Sea', which is not practically useful for the purpose of accurate assessment, except to show the potential exists to encounter cultural remains. Recorded losses are far more numerous than confirmed wrecks but are usually very poorly located and as such are useful only to characterise the type of shipwrecks in the area and assess the potential for further discoveries. Other wrecks have been identified through sonar survey but this too presents difficulties as many of these wrecks have been located using GPS, which until relatively recently were only accurate to 100m (Baird, 2009: viii) or by DECCA which can give locations accurate to only a kilometre. Another important point about the recorded maritime losses is that they are heavily biased towards 19th and 20th century losses when more comprehensive records of losses began to be compiled by the UK Hydrographic Office.

The details for specific offshore cultural heritage assets are derived from two main sources, the National Monuments Record of Scotland held by the Royal Commission on Ancient and Historic Monuments of Scotland (RCAHMS) and SeaZone Hydrospatial Data (itself largely derived from UK Hydrographic Office data). These databases are both derived in turn from a variety of sources including various published lists of marine losses and marine surveys (eg. Baird, 2009; Larne and Larne, 1998; Nash, 2009). There is consequently a large overlap between the datasets (Figure 2).

The discussion and tables below covers all UKHO entries within the Seagreen Projects including dead entries. This is due to the fact that while in some cases there may be vessels which have failed to show up on recent geophysical surveys the locations may still contain remains of cultural heritage interest. In other cases, however, it is clear from the details of the entry that there is no reason to believe that there are now or ever have been archaeological remains. These entries have also been included in the text and illustrations and are discussed on a case by case basis below (see Figures 3 & 4).

All known cultural heritage assets and events within the study area, including undesignated assets, have been assigned Headland Archaeology (HA) numbers and a full gazetteer with concordance is provided in Appendix A.

6.2 Projects Alpha & Bravo

6.2.1 Cultural heritage assets within Projects Alpha & Bravo

There are no Designated Wrecks or other cultural heritage assets with legal designations within Projects Alpha & Bravo. Definitions of the state of wrecks and obstructions are as follows:

- DEAD: Not detected by repeated surveys, therefore considered not to exist

- LIFT: A salvaged wreck
- LIVE: All wrecks and anomalies found by UKHO survey

The desk based assessment established that there are no Designated Wrecks or other cultural heritage assets with legal designations within the Project Alpha study area. Two 'Dead' wrecks (HA 1004 and HA 1008) and one 'Lift' wreck (HA 1005) were identified within the Project Alpha Outer Study Area zone. No cultural heritage remains were identified in the Project Alpha Inner Study Area (Figure 3).

Table 3. Offshore cultural heritage assets within the Project Alpha with known locations including UKHO 'dead' entries.

HA No.	Name	UKHO No.	NMRS No.	DD Long/DD Lat	Status
HA1004	Unknown	070465	-	-1.740144 56.52029783	Dead
HA1005	ESKDENE	065458	-	-1.84254333 56.66985833	Lift
HA1008	Unknown	03161	-	-1.82330566 56.50991467	Dead

The desk based assessment established that there are no Designated Wrecks or other cultural heritage assets with legal designations within the Project Bravo site. Two 'Live' wrecks (HA1001 and HA 1004) and two 'Dead' wrecks (HA 1002 and HA 1003) were identified from the SeaZone dataset within the Project Bravo site Inner Study Area. No cultural heritage remains were identified in the Outer Study Area (Figure 3).

Table 4. Offshore cultural heritage assets within the Project Bravo with known locations including UKHO 'dead' entries.

HA No.	Name	UKHO No.	NMRS No.	DD Long/DD Lat	Status
HA1001	**HMS St BRIAC**	070459	-	-1.5570335 56.55454667	Live
HA1002	HMS EXMOUTH (POSSIBLY)	065549	-	-1.63035166 56.55523333	Dead
HA1003	MICHAEL SCOTT	03164	-	-1.69107666 56.67224167	Dead
HA1004	**Unknown**	070465	-	-1.740144 56.52029783	Live

6.2.3 Cultural heritage assets within the Phase 1 Development 5 km Buffer Area

There are no Designated Wrecks or other cultural heritage assets with legal designations with the OWF 5km Buffer Zone.

There are **eight** entries in the SeaZone wreck and obstructions database that fall within the OWF 5km Buffer Zone (Table 5). Of these **six** are 'Live' wrecks and **two '**Dead' wrecks.

Table 5: Offshore cultural heritage assets within the Seagreen Projects 5km Buffer with known locations including UKHO 'dead' entries (those in bold are live).

HA No.	Name	UKHO No.	NMRS No.	DD Long/DD Lat	Status
HA1033	***GRENMAR (POSSIBLY)***	03027	-	-2.07179433 56.47551617	Live
HA1034	***GRENMAR (POSSIBLY)***	00168	-	-2.07076 56.47580333	Live
HA1035	***Unknown***	070461	-	-1.559348 56.50996083	Live
HA1036	***HMS NORDHAV II (POSSIBLY)***	03051	-	-2.05927933 56.70224683	Live
HA1037	***HMS NORDHAV II (PART OF)(POSSIBLY)***	03052	-	-2.086798167 56.69231767	Live
HA1038	***Unknown***	070428	-	-2.08991716 56.68834517	Live
HA1039	*NAILSEA RIVER*	03045	-	-2.09307333 56.6765915	Dead
HA1041	*Unknown*	03167	-	-1.89339333 56.693257	Dead

6.3 Transmissions Asset Projects

6.3.1 Cultural heritage assets within the Transmissions Asset Project with known locations including UKHO 'dead' entries (those in bold are live).

There are no Designated Wrecks or other cultural heritage assets with legal designations within the Transmissions Asset Projects.

The desk based assessment established that there are seven 'Live' wrecks and five 'Dead' wrecks from the SeaZone dataset identified within the Carnoustie transmission asset project (Tables 6 & 7, Figure 4).

Table 6: Offshore cultural heritage assets within the Transmissions Asset Projects Inner Study Area with known locations including UKHO 'dead' entries.

HA No.	Name	UKHO No.	NMRS No.	DD Long/DD Lat	Status
HA1011	***Unknown***	**03041**	**-**	**-2.154062667 56.5929865**	**Live**
HA1015	*PRIMROSE*	03040	-	-2.259386667 56.59079083	Dead
HA1021	***MARGARET RAE***	**057569**	**-**	**-2.3702925 56.57412333**	**Live**
HA1025	***Unknown***	**071939**	**-**	**-2.500793333 56.53509817**	**Live**
HA1027	***HOCHE***	**03032**	**102787**	**-2.605916667 56.5024885**	**Live**

Table 7: Offshore cultural heritage assets within the Transmissions Asset Projects Outer Study Area with known locations including UKHO 'dead' entries.

HA No.	Name	UKHO No.	NMRS No.	DD Long/DD Lat	Status
HA1012	*Unknown*	00189	102794	-2.152751833 56.5922455	Live
HA1016	*Unknown*	00195	-	-2.295231667 56.57659767	Live
HA1020	*Unknown*	00171	-	-2.37642 56.55993783	Live
HA1023	*CANGINIAN*	03038	102791	-2.376046667 56.576593	Dead
HA1028	*ANU*	03030	-	-2.676745 56.50126333	Dead
HA1029	Aircraft	03031	-	-2.692401667 56.493278	Dead
HA1040	*Obstruction/ Aircraft*	03179	-	-1.99317166 56.57658933	Dead

6.4 Results of the Archaeological Assessment of Geophysical Survey Data

6.4.1 Introduction

This assessment presents the results of an archaeological assessment of marine geophysical survey data acquired for the Seagreen Projects and provides baseline information to inform the presence of sites and features of archaeological and cultural heritage interest (see Figure 2).

6.4.2 Aims

The principle aim of this marine geophysical assessment is to identify any cultural heritage assets recorded from the surveyed area and to inform the baseline study and Environmental Impact Assessment for the proposed development. This assessment is intended to be read in conjunction with GEMS Geophysical Results Report (2010) and Osiris Projects Report (2011a & b).

The specific objectives are:

- to confirm the presence of previously identified marine sites and to comment on their apparent character;
- to identify, locate and characterise hitherto unrecorded marine sites;
- to review available data in respect of seabed and sub-seabed deposits likely to be of archaeological interest; and
- to present mitigation measures in concert with the results of the desk-based study and impact assessment.

Appendix 3 provides detail on the survey specifications and suitability of the data for archaeological purposes.

6.4.3 Results

6.4.3.1 GEMS targets identified in Projects Alpha and Bravo

GEMS identified 2306 sidescan anomalies in the surveyed area, the majority of which were classified as boulders of likely natural origin. Targets identified by GEMS not within boulder fields are identified as ‘sonar contacts’ of possible human source (GEMS, 2010). Further assessment of these large and small boulder targets by Headland Archaeology has established the nature of these anomalies and confirms their likely natural origin. This is based on their characteristics and in many cases the position of targets within areas of seabed dominated by geological ‘features’. These targets are regarded to be of either low archaeological potential or not rated due to their likely natural origin.

GEMS also identified 16 magnetic anomalies within the surveyed area. All magnetic and sonar targets have been cross referenced to see if there was any correlation between the two. This was the case at a number of wreck sites as well as some low and medium potential targets. A large number of magnetic anomalies are likely to relate to the underlying geology within the site.

6.4.3.2 Sidescan targets located within Projects Alpha and Bravo

The archaeological geophysical assessment identified 9 targets of medium archaeological potential within the Project Alpha site Inner Study Area and 3 targets of medium archaeological potential within the Outer Study Area (Tables 8 & 9, Figure 5)

Table 8: Targets of high and medium archaeological potential identified in the Project Alpha Inner Study Area.

HA	Site Description	Sidescan Potential	UTM30NmE	UTM30NmN
25	Debris	Medium	565718.98	6281505.01
43	Buried debris	Medium	567246.73	6280890.19
77	Debris on seabed	Medium	569722.63	6277630.92
106	Debris	Medium	566228.85	6271992.94
112	Linear Debris	Medium	556104.07	6276064.55
132	Debris	Medium	573786.36	6270058.43
133	Debris	Medium	575864.53	6270475.34
225	Linear debris	Medium	568335.4	6279640.77
365	Linear debris	Medium	567112	6274882

Table 9: Targets of high and medium archaeological potential identified in the Project Alpha Outer Study Area.

HA	Site Description	Sidescan Potential	UTM30NmE	UTM30NmN
14	Group possible debris	Medium	567477.73	6282035.68
47	Possible debris	Medium	569961.47	6281210.53
248	Linear debris	Medium	564456.01	6278243.98

The archaeological geophysical assessment identified five targets of High archaeological potential and four targets of medium archaeological potential, all of which are located within the Project Bravo site and Outer Study Area (Tables 10 & 11, Figure 5).

Table 10. Targets of high and medium archaeological potential identified in the Project Bravo Inner Study Area.

HA	Site Description	Sidescan Potential	UTM30NmE	UTM30NmN
101	Debris	Medium	585928.96	6276472.87
118	Debris	Medium	579224.22	6272921.09
175	Wreck	High	588375.5	6268388.08
176	Wreck	High	588437.29	6268346.22
177	Wreck debris	High	588437.29	6268286.98
230	Linear debris	Medium	583235.78	6282260.33
268	Debris	Medium	583478.73	6281600.38
409	Wreck	High	577240.12	6264891.10

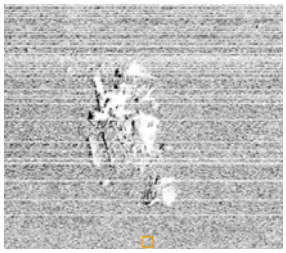
Table 11. Targets of high and medium archaeological potential identified in the Project Bravo Outer Study Area.

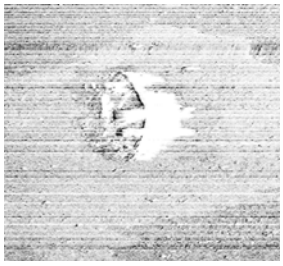
HA	Site Description	Sidescan Potential	UTM30NmE	UTM30NmN
81	Curvilinear feature	Medium	587741.81	6280532.51
88	Aircraft	High	589107.53	6277960.21
133	Debris	Medium	575865	6270475

6.4.3.2.1 Anomalies with High Archaeological Potential

Five targets of high archaeological potential have been identified within Projects Alpha and Bravo (HA 88, 175, 176, 177 and 409), some of which can be grouped as the same wreck remains (Figure 7).

Table 12. Projects Alpha and Bravo targets of high archaeological potential

HA Number	Dimensions (m)	Representative Target photograph	Description
88	15.29m x 8.14m x 0.56m		HA88 has been identified as the remains of a possible aircraft. The debris is located in Project Bravo outer study area at coordinate's 589107.53mE and6277960.21mN. The aircraft has geophysical dimensions of 15.29m in width which may well represent the aircraft wingspan, 8.14m length and a maximum geophysical height of 0.56m. The remains appear to be partially buried and appear to be relatively well broken up on the

			seabed (see Figure 6). The remains are visible in the multibeam bathymetry; however this is very faint and as stated the debris lies very close to the seabed and thus has minimal visible height. There is a slight magnetic fluctuation that could be associated with the debris on line transect number SEG-Line 164 50m, although this is unconfirmed.
175	36m x 4.33m x 0.71m		HA175, HA176 and HA177 are all remains of a wreck located in Project Bravo's inner study area at coordinates 588375.5mE and 6268388.08mN. The wreck is located in close proximity (within 50m) to SeaZone entry UKHO-WO-70459 recorded as being a Live wreck, HMS ST BRIAC (HA1001). The wreck has geophysical dimensions of 36m length, 4.33m width and height of 0.71m and is broken in two. There is an associated magnetic anomaly in the vicinity of the wreck and it is also visible on the multibeam data, though partially covered by the sands and gravels. This wreck also has two magnetic targets in close proximity to it (within 20m) namely MA35 and MA45.
409	30m x 7.32m x 1.80m		HA409 is a high potential target located in the southern area of Project Bravo's inner study area. The wreck is a dark and light reflector and has dimensions of 30m length, 7.32m width and maximum height of 1.80m which suggest that it is a medium sized fishing vessel. The vessels form, dimensions, and appearance indicates that it is a typical East Coast late 19th/early 20th century fishing boat such as a Fifie Herring sailing drifter. The wreck is located at coordinates 577240.12mE and 6264891.10mM. There is no noticeable change in relief on the multibeam data, though there is a magnetic anomaly located on the wreck namely MA36. Seazone entry UKHO-WO-70465 (HA 1004) is located within 7m of this wreck first identified by multibeam data.

6.4.3.2.2 Anomalies with Medium Archaeological Potential

HA14 is a group of linear debris remains located at coordinates 567477.73mE and 6282035.68mN in Project Alpha's outer study area. The dimensions recorded for the largest linear debris is 3.65m length, 0.85m width and a geophysical height of 0.57m. The debris remains are located in an area of the seabed with large groups of boulder remains visible on the seabed.

HA25 represents linear debris located at coordinates 565718.98mE and 6281505.01mN in Project Alpha's inner study area. The debris has dimensions of 2.9m length, 1.35m width and a maximum height of 1.10m and is a light and dark reflector in the sidescan image in the northern area of the development site.

HA43 looks to be partially buried debris remains in a predominately sandy area of the development area. The debris remains have dimensions of 16.78m length, 1.19m width and a maximum height of 0.37m. The debris is recorded at coordinates 567246.73mE and 6280890.19mN in Project Alpha's inner study area.

HA47 represents debris remains recorded at coordinates 569961.47mE and 6281210.53mN located in Project Alpha's outer study area. The debris is quite fragmented on the seabed and has dimensions of 7.26m length, 1.10m width and a maximum height of 052m.

HA77 has been identified as debris remains on the seabed with dimensions of 4.54m length, 3.12m width and a maximum height of 0.05m being a dark reflector in the sidescan data. The debris is located at coordinates 569722.63mE and 6277630.92mN in Project Alpha's inner study area.

HA81 comprises curvilinear debris located at coordinates 587741.81mE and 6280532.51mN in Project Bravo's outer study area. It has dimensions of 18.96m length, 1.09m width and a maximum height of 0.56m. HA101 is a long, thin right angled target on the sea bed with dimensions of 9.08m length, 0.46m width and a maximum height of 0.05m being a dark reflector in the sidescan data. The debris is located at coordinates 585928.96mE and 6276472.87mNin Project Bravo's inner study area.

HA106 represents irregular shaped debris located at coordinates 566228.85mE and 6271992.94mN in Project Alpha's inner study area. The debris has dimensions of 4.30m length, 0.47m width and a maximum height of 0.62m. There is a magnetic target MA22 located within 50m of this debris and is likely to be associated.

HA112 is a dark reflecting debris that appears to be almost 'anchor' shaped on the seabed located at coordinates 565864.76mE and 6271195.92mN in Project Alpha's inner study area. The debris has dimensions of 2.86m length, 10.1m width and a maximum height of 0.04m.

HA118 is a small group of linear debris on the seabed with dimensions of 6.86m length, 0.26m width and a maximum height of 0.67m. The group of debris are located at coordinates 579224.22mE and 6272921.09mN in Projects Bravo's inner study area.

HA132 is irregular shaped debris located at coordinates 573786.36mE and 6270058.43mN in Projects Alpha's inner study area. The debris has dimensions of 10.05m length, 1.80m width and 0.45m maximum height.

HA133 comprises circular shaped debris located at coordinates 575864.53mE and 6270475.34mN in Project Alpha's inner study area and project Bravo's outer study area. The debris has dimensions of 7.58m length, 0.70m width and a maximum height of 0.23m. There are no associated magnetic anomalies with this target.

HA225 represents linear debris remains identified at coordinates 568335.40mE and 6279640.77mN in Project Alpha's inner study area. The dark and light reflector has dimensions of 7.98m length, 5.12m width and 0.79m height. There are no magnetic anomalies in the vicinity.

HA230 represents large curvilinear debris with dimensions of 7.09m length, 2.74m width and height of 1.12m.This is located in Project Bravo's inner study area at coordinates 583235.78mE and 6282260.33mN and there are no associated targets or magnetic fluctuations.

HA248 comprises irregular shaped debris with measurements of 7.58m length, 3.16m width and 1.26m height. The debris is located at coordinates 564456.01mE and 6278243.98mN in Project Alpha's outer study area.

HA268 is curvilinear shaped debris which appears to be partially buried in fine grained sediments. The debris has measurements of 6.17m length, 2.05m width and height of 1.21m. The coordinates of the debris are 583478.73mE and 6281600.38mN in Project Bravo's inner study area.

HA365 comprises small linear debris spread with measurements of 9.04m length, 0.71m width and 1.30m maximum height. The debris is located at coordinates 567111.50mE and 6274881.67mN in Project Alpha's inner study area.

6.4.4.2.3 Anomalies with Low Archaeological Potential

In total there are 369 targets identified as being of low archaeological potential in the survey area. These are likely to be of natural origin located in areas of the seabed with commonplace boulder fields and outcropping bedrock.

6.4.3.3 Magnetometer targets located within Project Alpha and Bravo

The magnetometer data was assessed in order to identify possible targets of cultural heritage interest. A total of 49 magnetic anomalies have been identified in the Phase 1 development area. These were all cross referenced with the sidescan, sub-bottom and multibeam geophysical datasets. Of the 49 magnetic anomalies identified 15 are possibly associated with sidescan sonar anomalies and SeaZone entries. The remaining isolated anomalies without any associated sidescan contatcs are likely to be related to possible buried ferrous debris or the underlying geology of the site where the shallow sediment veneers in many areas of the seabed are predominant. Uneven seabed surfaces identifiable in the multibeam data and changing geological substrata deposits can cause fluctuations in the magnetic field. Some magnetic contacts however do correspond with sidescan anomalies as noted above (Figure 5).

6.4.3.4 Geological Data within Project Alpha and Bravo

The nature of the seabed morphology and geology as indicated in the geotechnical report produced by GEMS (2010). This is largely confirmed in the results of the sub-bottom profiler data. The sub-bottom data was assessed using the Chirp source as this data was regarded as the most useful in identifying targets or objects at an appropriate resolution to the depths

most likely to reveal features such as relict landscape deposits, palaeo-features, and wreck remains including associated debris.

The results of the geotechnical assessment carried out by Headland Archaeology's geoarchaeologist has highlighted that the potential discovery of palaeotopographical features and the presence of relict submerged landscape surfaces and deposits within the development area is unlikely.

6.4.3.4.1 Shallow seismic survey

From an archaeological point of view, it is important to note that palaeotopographical features represent both zones of potential human habitation and areas of potential for the survival of evidence. The edges of palaeo-channels are likely to accumulate fluvial gravels that early humans would regularly exploit and where the remains of tool making activities may reside.

No objects or debris of archaeological significance were identified in the sub-bottom profiling geophysical data. Borehole evidence taken from piezocone penetration tests (CPT) and vibrocores within the proposed development area indicate that there is little potential for palaeoenvironmental evidence such as organic materials e.g. peats and organic muds to have survived.

6.4.3.5 Multibeam Data within Project Alpha and Bravo

The processed sunshaded bathymetric data has enabled the cross referencing of geophysical targets identified by both GEMS and Headland Archaeology as well as providing a good illustration of the relief of the seabed within the development. The multibeam data has been particularly useful in identifying the relationship between identified targets and areas of the seabed highlighting clear geological characteristics or, indeed, targets of potential cultural heritage interest. Large trough and channel features are also present across the development zone such as the Scalp Bank feature in the mid-west area of the development.

Seabed areas with characteristics such as sand ripples, mega ripples and outcropping bedrock have been identified across the site and show the area to be relatively dynamic. Sediment movement on the seabed could result in the burial or uncovering of potential features of cultural heritage interest.

6.4.3.6 Osiris Projects targets identified within the Transmissions Asset Project

Osiris Projects (2011b) identified 456 sidescan anomalies along the Transmissions Asset Project, the majority of which were classified as boulders or features of likely natural origin. Further assessment of these large and small boulder targets by Headland Archaeology has established the nature of these anomalies and confirms their likely natural origin. This is based on their characteristics and in many cases the position of targets within areas of seabed dominated by geological 'features'. These targets are regarded to be of either low archaeological potential or not rated due to their likely natural origin. Osiris projects also identified 72 magnetic anomalies within the development area. All magnetic and sonar targets have been cross referenced to see if there was any correlation between the two. This was the case at a number of wreck sites as well as some medium potential targets. A large

number of magnetic anomalies can also be associated with the underlying geology of the site.

6.4.3.7 Sidescan targets located within the Transmissions Asset Project

The archaeological geophysical assessment identified nine targets of High archaeological potential and eighteen targets of Medium archaeological potential, all of which are located within the Transmissions Asset Project Inner and Outer Study Area (Tables 13 & 14, Figure 6).

Table 13. Headland High and Medium targets recorded in the Transmissions Asset Projects Inner Study Area.

CR	Site Description	Sidescan Potential	UTM30NmE	UTM30NmN
6	Debris	Medium	538510.2	6269456.11
12	Wreck	High	551826.17	6273287.3
18	Wreck	High	530669.2	6265811.37
19	Debris	High	530805.7	6265914.47
28	Wreck	High	530747.42	6265805.99
31	Debris	Medium	524010.79	6262232.56
32	Debris	Medium	524068.68	6262282.91
34	Debris	Medium	524104.61	6262314.77
35	Debris	High	524056.05	6262263.51
36	Debris	Medium	523983.19	6262262.32
37	Debris	Medium	523993.65	6262292.03
38	Debris	Medium	524032.2	6262305.3
47	Wreck	High	530758.55	6265890.88
56	Debris	Medium	524363.24	6262074.76
57	Debris	Medium	523998.22	6262258.12
60	Wreck	High	530759.19	6265889.58
61	Debris	Medium	528447.65	6264285.94
62	Debris	High	524042.78	6262277.85
65	Debris	Medium	524025.09	6262247.04
345	Linear Debris	Medium	558535	6273536

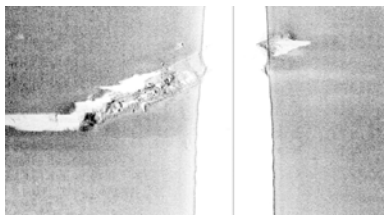
Table 14. Headland High and Medium targets recorded in the Transmissions Asset Projects Outer Study Area.

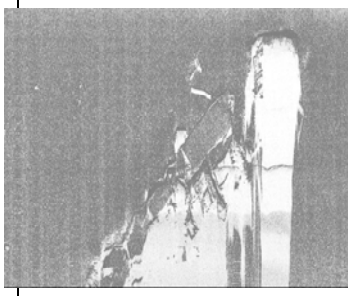
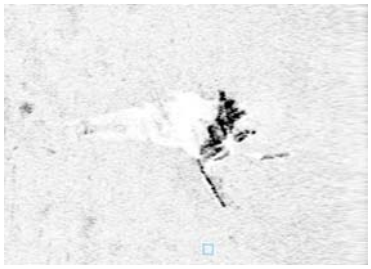
CR	Site Description	Sidescan Potential	UTM30NmE	UTM30NmN
9	Wreck	Medium	551769.77	6273083.08
10	Wreck	High	551845.58	6273040.08
26	Debris	Medium	530682.63	6265931.99
29	Debris	Medium	524017.46	6262695.21
30	Debris	Medium	524017.93	6262306.05
306	Linear Debris	Medium	556786	6274000
340	Linear Debris	Medium	558720	6273883

6.4.4.7.1 Anomalies with High Archaeological Potential

In total Headland has identified nine targets that have been classified as being of high archaeological potential, namely CR10, CR12, CR18, CR19, CR28, CR35, CR47, CR60 and CR62. These can all likely be grouped into associations with three identified wreck remains (Figure 8).

Table 15. Headland High and Medium targets recorded in the Transmissions Asset Projects Outer Study Area.

CR No	Dimensions (m)	Representative Target photograph	Description
10	81.15m x 24.61m x 2.60m		Target CR10 has been identified to be wreck remains from the sidescan survey image; the wreck has dimensions of 81.15m length, 24.61m width and a maximum height of 2.6m. The wreck is a dark and light reflector in the sidescan sonar image and is located at coordinates 551686.06mE and 6273060.88mN in the outer survey area. CR10 is located 100m from a recorded SeaZone wreck entry UKHO-WO-3041 (HA1011) that was identified from a scour mark on the multibeam data, meaning its precise location may not be accurate. There is an associated magnetometer target located in the vicinity of the wreck, namely CR88.

12	118.64m x 27.29m x 1m		Target CR12 is also located within 200m of the SeaZone wreck and appears to be a large area of wreck debris remains located on the seabed. The debris area has dimensions of 118.64m length, 27.29m width and a height of 1m. There is a large amount of scattering across this area of the seabed which appears to be of a sandy composition, this is likely related to CR10. The central coordinate for these remains is 551826.17mE and 6273287.30mN.
18	14.9m x 7.73m x 0.8m		CR18 is a small wreck identified in the southern corridor extent at coordinates 530669.20mE and 6265811.37mN. The wreck is a dark and light reflector in the sidescan sonar image with dimensions of 14.9m length, 7.73m width and 0.8m height. The wreck has associated magnetic anomalies and is visible in the multibeam data. High potential targets CR19, CR28, CR47 and CR60 are all likely to be the same wreck target recorded over different survey lines. SeaZone wreck UKHO-WO-71939 is located within the centre of these targets; this has been confirmed in the multibeam survey data (HA 1025).
62	19.83m x 5.07m x 5.63m		CR62 has been identified as wreck debris remains on the seabed located at coordinates 524042.78mE and 6262277.85mN located in close proximity to SeaZone recorded wreck UKHO-WO-3032 (HA 1027). The debris has dimensions of 19.83m length, 5.07m width and a maximum height of 5.63m. The wreck remains has associated debris surrounding it namely medium potential targets CR29 CR30, CR31, CR32, CR34, CR36, CR57 and CR65. There is also an associated magnetic fluctuation present in the vicinity of the wreck (CA82 and CA97).

35	33.4m x 9.11m x 4.19m		CR35 appears to be the wreck remains of CR62 covered in another geophysical survey line with dimensions of 33.4m length, 9.11m width and height of 4.19m. The debris is located within 20m of CR62 at coordinates 524056.05mE and 6262263.51mN. There are no close magnetic fluctuations associated with this target.

6.4.3.7.2 Anomalies with Medium Archaeological Potential

CR6 has been identified to be of medium archaeological potential, the target has anthropogenic characteristics and is located close to a SeaZone recorded wreck UKHO-WO-57569 (HA1021), as well as being close to a magnetic anomaly. The debris has dimensions of 13.14m length, 11.25m width and height of 1m. The target is located at coordinates 538510.20mE and 6269456.11mN in the Inner Study Area.

CR9 is located in the Transmissions Asset Projects Outer Study Area. The sidescan sonar image displays likely evidence of wreck remains represented by a light and dark reflector. The target has dimensions of 53.51m length, 21.4m width and 0.03m height. The debris remains display anthropogenic characteristics and are located approximately 200m from a recorded wreck (SeaZone UKHO-WO-3041).

CR26 is located to the north of wreck debris CR18. It is a dark and light reflector in the sidescan survey data with dimensions of 19.54m length, 14.74m width and 1.2m height. The target is located at coordinates 530682.63mE and 6265931.99mN, in the Transmissions Asset Projects Outer Study Area and is likely associated wreck debris from target CR62.

CR29 is wreck debris from CR62 and is located in the Outer Study Area at coordinates 524017.46mE and 6262695.21mN. The debris is linear in shape and appears to be partially buried under sand on the seabed. The debris has dimensions of 9.79m length, 2.22m width and 0.08m height.

CR30 is again associated wreck debris from CR62, the debris is comprised of a number of individual elements causing a spread on the seabed and has dimensions of 36.05m length, 2.37m width and a height of 0.9m. This is a dark and light reflector in the sidescan sonar data and has a central coordinate of 524017.93mE and 6262306.05mN in the Outer Study Area.

CR31 appears to be wreck debris remains from CR62 located at coordinates 524010.79mE and 6262232.56mN in the Inner Study Area. The debris is long and thin with dimensions of 2.85m length, 0.72m width and height of 2.3m.

CR32 represents possible rope or chain debris located in the Inner Study Area at coordinates 542068.68mE and 6262282.91mN in the cable corridor, likely associated with CR62. The debris has measurements of 16.47m length, 0.91m width and 0.15m height and is a dark and light reflector in the sidescan data.

CR34 has dimensions of 13.67m length, 2.34m width and height of 0.35m, the debris has individual components and is likely associated with wreck remains CR62. The debris is located at coordinates 524104.61mE and 6262314.77mN in the Transmissions Asset Projects Inner Study Area.

CR36 is a medium potential target located at coordinates 523983.19mE and 6262262.32mN again within the vicinity of wreck CR62 in the Inner Study Area. The debris is a dark and light reflector and an irregular linear shape in the sidescan data, with dimensions of 35.47m length, 3.19m width and height of 2.39m.

CR37 represents large irregular shaped debris with dimensions of 5.71m length, 2.76m width and a height of 0.97m. The debris is within wreck CR62 on the seabed located at coordinates 523993.65mE and 6262292.03mN in the Transmissions Asset Projects Inner Study Area.

CR38 represents medium potential debris remains likely associated with wreck CR62. The debris has measurements of 12.89m length, 2.67m width and measurable height of 0.40m. The debris coordinates are 524032.2mE and 6262305.3mN, again in close proximity to wreck CR62 in the Inner Study Area.

CR56 represents linear debris with dimensions of 55.61m length, 0.87m width and no measurable height being a dark reflector in the sidescan sonar data. This is located at coordinates 524363.24mE and 6262074.76mN in the Inner Study Area.

CR57 is associated debris from wreck CR62 located at coordinates 523998.22mE and 6262258.12mN in the Inner Study Area. The debris has dimensions of 41.51m length, 2.03m width and 0.63m height and is a dark and light reflector in the sidescan data.

CR61 are linear debris remains located in the Transmissions Asset Projects Inner Study Area at coordinates 528447.65mE and 6264285.94mN. The debris has dimensions of 79.2m length and 1.49m width with a geophysical height of 0.24m. There are no other targets within its location.

CR65 appears to be partially buried debris remains associated with wreck CR62 in the Inner Study Area at coordinates 524025.09mE and 6262247.04mN. The debris looks to be partially broken on the seabed and has dimensions of 30.55m length, 5.19m width and a geophysical height of 0.33m.

CR306 are linear debris remains identified in the GEMS survey that are within the Outer Study Area at coordinates 556785.56mE and 6273999.58mN. The debris has dimensions of 9.62m length, 3.90m width and 1.26m height.

CR340 are linear debris remains identified in the GEMS survey that are within the Outer Study Area at coordinates 558720.49mE and 6273883.33mN. The remains have geophysical dimensions of 11.74m length, 3.92m width and height of 0.26m

CR345 are linear debris remains identified in the GEMS survey that are within the Iinner Study Area at coordinates 558534.54mE and 6273536.41mN. The debris has dimensions of 5.69m length, 2.08m width and a maximum height of 0.91m

6.4.3.7.3 Anomalies with Low Archaeological Potential

In total 40 targets identified to be of low archaeological potential have been identified in the Transmissions Asset Project survey area. These targets are likely to be of natural origin and thus will not be discussed further.

6.4.3.8 Magnetometer Targets within the Transmissions Asset Project

The magnetometer data was assessed in order to identify possible targets of cultural heritage interest. A total of 113 magnetic anomalies were identified in the Transmissions Asset Project survey area, a number of which related to other geophysical targets identified by Headland Archaeology such as wrecks and possible ferrous debris or object remains. There is also evidence of a possible buried feature orientated NNW to SSE crossing the Northern and Southern part of the survey corridor. For the majority of magnetic anomalies however the natural underlying geology has likely caused the magnetic fluctuations identified in the data (Figure 6).

6.4.3.9 Geological Data within the Transmissions Asset Project

Along the Transmissions Asset Project the sub-bottom profiler data showed for the majority of the route that the seabed and underlying geology is chiefly comprised of solid bedrock. The Firth of Forth geological background has been widely documented (Shennan et al, 2000 Smith et al, 2010) and the typical geological stratigraphy is summarised above in section 5.2.2.

6.4.3.9.1 Seismic Sub-bottom Profiler Data

No objects or debris of archaeological significance were identified in the sub-bottom profiling geophysical data. Features such as the St Abbs Formation displaying sandy deposits through the 2D sub-bottom data were identified along the export cable route along with outcropping Forth Formation and the Wee Bankie exposure being a glacial till of Late Devensian Age. These features have become visible through the uppermost Holocene sediment deposits. The age of the exposed units and their sandy and gravelly composition means that there is little likelihood for the presence of organic archaeological material within them. Any potential deposits that have survived with palaeoenvironmental remains are likely to have been re-deposited through glacial movement and thus will not survive in a primary context.

Further borehole study will allow for a more definitive account of the sediment composition. It is thought that targeting those areas where the thin Holocene deposits are exposed as well as older formations and thus possible fluvial or terrestrial past landscape surfaces would be the best direction for further analysis (Gribble and Leather, 2011). It is in these past landscapes where the potential evidence for human exploitation and occupation lies.

6.4.3.9.1 Multibeam Data within the Transmissions Asset Project

The processed sunshaded bathymetric data has enabled the cross referencing of geophysical targets identified by both Osiris Projects and Headland Archaeology as well as providing a good illustration of the relief of the survey site area. The multibeam data has been particularly useful in identifying the relationship between identified targets and areas of

the seabed highlighting clear geological characteristics or, indeed, targets of potential cultural heritage interest.

6.4.3.10 Recommendations for Mitigation

The mitigation strategy for the Project Alpha and Bravo and Transmissions Asset Project will chiefly be discussed in the Environmental Statement. Points to remember are that prevention and avoidance are key factors when considering the potential survival of archaeological remains. The preferred method of mitigation for archaeological remains is preservation *in situ* where possible and the implementation of exclusion zones.

The archaeological geophysical assessment identified five targets of High archaeological potential and eighteen targets of Medium archaeological potential within Projects Alpha and Bravo. In Project Alpha nine targets of Medium archaeological potential were identified in the Inner Study Area and three targets of medium archaeological potential in the Outer Study Area. In Project Bravo four targets of high archaeological potential and four targets of medium archaeological potential were identified in the Inner Study Area and one target of high archaeological potential and two targets of medium archaeological potential in the Outer Study Area.

In the Transmission Assets Project nine targets of high archaeological potential have been identified and eighteen targets of Medium archaeological potential. Eight targets of high archaeological potential and twelve targets of medium archaeological potential have been identified in the Transmission Assets Project Inner Study Area. One target of high archaeological potential and six targets of medium archaeological potential have been identified in the Outer Study Area.

Any high or medium potential targets located in Projects Alpha and Bravo and the Transmission Assets Project could be subject to potential impacts from adverse direct and secondary effects such as the installation of the cable and associated activities such as vessel anchoring activities. As such, and pending further investigation, it is recommended that temporary exclusion zones should be implemented for all anomalies of high and medium archaeological potential. It is recommended that those targets identified as exhibiting medium potential be furnished with a 50m exclusion zone and those of high archaeological potential with a 100m exclusion zone. Although some recorded wrecks and obstructions identified in the SeaZone data were not located in the sidescan or magnetometer survey data they should not be totally discounted and should be included as at least potential anomalies pending further investigation, particularly where remains may be buried in the marine sediments.

6.5 Results of the Archaeological Assessment of Geotechnical Survey Data

6.5.1 Introduction

The following presents the results of an archaeological and palaeoenvironmental assessment of marine geotechnical survey data in connection with the Firth of Forth Round 3 Offshore Wind Farm Phase 1 Projects Alpha and Bravo. At present, the results do not include the Transmission Assets Project, pending the acquisition of geotechnical data from this area.

6.5.2 Aims and Objectives

The aim of the assessment is to provide an archaeological assessment of the palaeoenvironmental and archaeological potential of sediments affected by the proposed Projects Alpha and Bravo construction. This will be undertaken through the examination of the geotechnical data; namely piezocone penetration testing, borehole and vibrocore logs that have been taken. This assessment will provide specific site data that will add to the findings of the desk based assessment and aid in identifying potential impacts of the scheme on any sediments of palaeoenvironmental and archaeological interest.

The specific objectives of the assessment are:

- to review available data in respect of seabed and sub-seabed deposits likely to be of palaeoenvironmental and archaeological interest;
- to identify any deposits of palaeoenvironmental potential, particularly within the Wee Bankie and Forth Formations and their interface; and
- to present mitigation measures where appropriate to the findings of the assessment

In order to place the results of the geo-technical report into the wider context of the palaeoenvironment of the Firth of Forth and North Sea basin it is important to consider the previous work done in this area. A brief overview of such work is given above in 5.2.2.

6.5.3 Results

6.5.3.1 Offshore Geotechnical Data Assessment

The offshore geotechnical data comes from the borehole results.

6.5.3.2 Borehole results

Seventeen boreholes were taken at ten locations within Projects Alpha and Bravo (see Figure 9). The boreholes reached maximum depths of between 10.5m (BH04) and 60.3m (BH04B) in the western area and between 4.4m (BH05) to 60.3m (BH08B) in the eastern area of the site. The sediments within the boreholes comprised mainly of minerogenic materials of sands, silts and clays. No organic materials such as peats were recorded in any of the borehole records.

The boreholes can loosely be divided into two main areas based on where the Wee Bankie Formation and Marr Bank Formation adjoin; a western and eastern area. Boreholes BH01 to BH04B are present in the western area of the site while boreholes BH05 to BH010 are within the eastern area of the site. The borehole data from the western area shows that the Holocene sediments (including the Forth Formation) and comprise mainly of sands underlain by clays, with occasional gravel inclusions in each, which is consistent with the findings of the geophysics survey (GEMS, 2010). The borehole depths indicate that they penetrated the Wee Bankie Formation, with records from BH01-BH04B showing associated sediments consisting of sands, silts, gravels and clays. These records also infer that these sediments are extremely variable between boreholes (even those taken in the same location), with little uniformity of lithological units seen across these boreholes. The Wee Bankie Formation has

been described in the literature (e.g. Sutherland, 1984) as comprising mainly of boulder clay. The borehole results show this to some extent with BH02B, BH03A and BH4B all containing significant clay units, with gravels observed within clay layers in BH02B. The borehole results also indicate that the clays of the Wee Bankie Formation contain bands of sands and silts; these are particularly well illustrated within Borehole BH02. The underlying Triassic Beds were not penetrated by the boreholes taken in this area.

In the eastern area of the site the Holocene (and Forth Formation) deposits have been recorded as thinning out eastwards where they adjoin the Marr Bank Formation deposits (GEMS, 2010). The Holocene and Forth Formations in this area consist mainly of sands, with clays and gravels also recorded in one borehole (BH07). Underlying the Holocene sediments in this area is the Marr Bank Formation, which has been described as comprising mainly of sands (Sutherland, 1986; GEMS, 2010). The borehole data shows this to be true to the far western area of the site, where five boreholes (BH08 to BH10) can be seen to record the presence of mainly sands at depths consistent with the Marr Bank Formation. There is some variation with the eastern edge of the western area (BH05 to BH07A), which record principally siltstone at these depths, with inclusions of sandstone. Below the Marr Bank Formation deposits is the Aberdeen Ground Formation, described as inter-bedding layers of muds and sands. The borehole records from BH08B to BH10 record deposits relating to this formation as layers of clays and sands and is thus consistent with the descriptions given (e.g. Sutherland, 1984; Gems, 2010). The boreholes only reach the uppermost part of this sequence, which can extend to depths of 85m and thus only inform on the layering present at the top of the formation; however, even this can be seen to vary between borehole locations. Again the underlying Triassic Beds were not penetrated by the boreholes taken in this area.

6.5.5.3 Palaeoenvironmental and archaeological potential of the material

The results of the BH records from this part of the Outer Forth Estuary show a depositional sequence spanning a depth of approximately 78.5m. The sequences from both western and eastern areas were found to consist principally of sands, clays and silt (including siltstone) deposits. The depths reached by the borehole sampling indicate they contain both Holocene and Quaternary sequences. The deepest boreholes to the east of the site penetrated the upper levels of the Aberdeen Ground Formation and thus it can roughly be inferred the borehole sequences contain material dating from the Early Pleistocene (Stoker *et al*, 1983). The sequences encountered within the development area include both the Wee Bankie and Marr Bank Formations and indicate that this area contains sediments both within and outside of the Devensian ice sheet limits.

The sedimentary sequences recorded from the Outer Forth hold low potential for palaeoenvironmental reconstruction. The dominance of sands, clays and silts within the area means that conditions for the preservation of microfossils such as pollen and macrofossils such as seeds and fruits are not ideal and there is also the potential for significant reworking of materials. There is some potential for the presence of micro-fauna such as ostracods to be present within the sands and clays, while shell fragments were also observed in ten boreholes, particularly in the uppermost (Holocene to modern) parts of the sequences. Such fossil marine fauna can provide palaeoclimate data (e.g. temperature) from glacial and interglacial events. This data then has potential to provide such information for the

Devensian and Early Pleistocene and may for comparison with fauna from other such deposits around the Scottish coastline, such as the Errol Beds (Peacock, 1975).

The potential for archaeological study and the presence of material of archaeological significance is also suggested to be low for the offshore area of the development. This area has been shown from previous studies (e.g. Sutherland, 1984) to have areas both within and outside of the limits of the Devensian ice sheet. The area of the Outer Forth became a full marine environment following the end of the Devensian. Therefore there has been little opportunity for this area to have been colonised by humans in the last 125,000 years. While Astill *et al* (2008) note that Palaeolithic artefacts may be present in such offshore areas, the potential for random spot finds, such as Palaeolithic tools is still considered to be low. There is higher potential for archaeological materials and deposits to be present in the onshore areas of the development. Previous archaeological finds near the onshore area has shown the presence of occasional spot finds including stone axes (e.g. Stevenson, 1953). There is also potential for the occurrence of occupation evidence from features such as shell middens, which have been recorded in areas of the Inner Forth (e.g. MacKie, 1972; Robinson, 1993).

6.5.5.4 Conclusion

- The BH records from the Outer Forth Estuary show a sedimentary sequence dominated by sands, clays and silts (including siltstone) with occasional bands of gravels. No organic material was recorded.
- The borehole records have been seen to penetrate Holocene, Forth Formation, Wee Bankie Formation, Marr Bank Formation and Aberdeen Ground Formation deposits. Indicating they reached deposits of Early Pleistocene Age.
- The borehole records compare favourably to the recorded descriptions of these formations but do show variability between borehole locations.
- Palaeoenvironmental potential is low across the area and in particular for Holocene dated sediments. Quaternary sediments are present from the Wee Bankie and Marr Bank Formations indicating there may be some potential to gain palaeoenvironmental and palaeoclimate data from areas both within and outside of the Devensian ice sheet limit.
- There is no information yet on the potential of the Transmission Assets Project.

6.6 Cultural heritage onshore key receptors

The potential for the Projects Alpha and Bravo and Transmission Assets Project development to have operational impacts on the setting of designated on-shore cultural heritage assets has been considered. A large number of designated assets lie within the preliminary zone of theoretical visibility (ZTV) of the Projects Alpha and Bravo (see Figure 10). Three study areas based on distance from the Phase 1 boundary have been used: 25 km, 35 km and over 35 km. For the latter study area only those assets raised by consultees have been considered. Appendix 5 presents all the key receptors identified in this assessment.

Within the 25km study area there are 25 scheduled monuments (SMs), 21 Category A listed buildings (LBs), one inventory historic garden and design landscape (HGDL) and three conservation areas (CAs) within the ZTV (27 SMs, 21 A LBs, 1HGDL and 4 CAs were identified within the study area).

Within the 35 km study area there are 80 scheduled monuments, 21 Category A listed buildings, five historic gardens and designed landscapes and six conservation areas within the ZTV (120 SMs, 46 A LBs, 6 HGDLs and 7 CAs were identified within the study area). While two of the scheduled monuments within the 35km study area; Arbroath Abbey (SM90018) and St Vigean's Museum, symbol stones (SM90272) are also Properties in Care, neither of these lie within the ZTV and therefore will not be affected by the proposed development.

While many of these assets have views of the sea or are visible form the sea, the seascape is relevant to the setting of just a limited number of assets, where it contributes to their cultural significance. These assets include the Iron Age promontory forts that are located along the Angus coast; West Mains of Ethie (SM5586), Ethie Mains Fort (SM5611), Prail Castle Fort (SM5587), Buckiemill Fort (SM5591), Maiden Castle Fort (SM2872), Lud Castle (SM2876), Castle Rock Fort Auchmithie (SM2875); all of which are scheduled monuments. Also within the 25 km buffer is the Category A-listed Bell Rock Lighthouse (LB45197) built on a rock approximately 17km from the coast, where the setting of this asset is dominated by the surrounding seascape. These eight assets all lie within the ZTV of the proposed development and therefore there is potential for impacts on their setting to arise during operation. The remaining cultural heritage assets which lie within the ZTV of the proposed windfarm do not have as fundamental a relationship with the seascape. It is therefore proposed that detailed assessments will only be carried out for these eight cultural heritage assets which have particular associations with the seascape, namely SM5586, SM5611, SM5587, SM5591, SM2872, SM2876, SM2875 and LB45197.

7. CONCLUSIONS

The assessment has established that there are no Designated Wrecks or other cultural heritage assets with legal designations within the Seagreen Projects. The report identified two 'Dead' wrecks (HA 1004 and HA 1008) and one 'Lift' wreck (HA 1005) within the Project Alpha 1km Outer Study Area zone. No cultural heritage remains were identified in the Project Alpha Inner Study Area. Two 'Live' wrecks (HA1001 and HA 1004) and two 'Dead' wrecks (HA 1002 and HA 1003) were identified from the Seazone dataset within the Project Bravo site Inner Study Area. No cultural heritage remains were identified in the Outer Study Area.

In the Transmission Assets Project four 'Live' wrecks and one 'Dead' wreck were identified within the inner study area and three 'Live' wrecks and four 'Dead' wrecks in the Outer Study Area from the SeaZone dataset. In addition, a large number of sites recorded in the National Monument Record of Scotland for the study area without precise locations. As such, there is a moderate potential for the discovery of unexpected remains to be discovered within the Seagreen Projects.

The archaeological geophysical assessment identified five targets of High archaeological potential and eighteen targets of Medium archaeological potential within Projects Alpha and

Bravo. In Project Alpha nine targets of Medium archaeological potential were identified in the Inner Study Area and three targets of medium archaeological potential in the Outer Study Area. In Project Bravo four targets of high archaeological potential and four targets of medium archaeological potential were identified in the Inner Study Area and one target of high archaeological potential and two targets of medium archaeological potential in the Outer Study Area.

In the Transmission Assets Project nine targets of high archaeological potential have been identified and eighteen targets of Medium archaeological potential. Eight targets of high archaeological potential and twelve targets of medium archaeological potential have been identified in the Transmission Assets Project Inner Study Area. One target of high archaeological potential and six targets of medium archaeological potential have been identified in the Outer Study Area.

The geoarchaeological and geotechnical assessment has established that the area of the proposed development within the outer Firth of Forth and north Sea Basin has been either under ice or submerged throughout the late Glacial/early Holocene. This has resulted in a lack of organic sediments of palaeoenvironmental interest from this period such as peats have been able to form. The potential for the discovery of relict land surface deposits and features of archaeological interest therefore is regarded as low. Despite this, there is the potential for the discovery of residual artefacts in the marine sediments such as lithics.

The assessment of key onshore receptors has identified 25 scheduled monuments, 21 Category A listed buildings, one inventory historic garden and design landscape and three conservation areas within the 25km study area. Within the 35 km study area there are 80 scheduled monuments, 21 Category A listed buildings, five historic gardens and designed landscapes and six conservation areas. It is proposed that detailed assessments will only be carried out for these eight cultural heritage assets which have particular associations with the seascape, namely SM5586, SM5611, SM5587, SM5591, SM2872, SM2876, SM2875 and LB45197.

8.0 SOURCES CONSULTED

8.1 Published & Unpublished Sources

Astill M, Firth A and Gribble J 2008 *UKCS Offshore Oil and Gas and Wind Energy Strategic Environmental Assessment: Archaeological Baseline* Wessex Archaeology, Unpublished Client Report.

Atkinson D 2008 *APPENDIX 3: THE INCHMARNOCK BOAT AND SHIP GRAFFITI* in Lowe C. *INCHMARNOCK An early historic island monastery and its archaeological landscape* Society of Antiquaries of Scotland, Edinburgh

Bacon M, Simm R and Redshaw T 2007 *3-D Seismic Interpretation* Cambridge University Press.

Baird B 2009 *Shipwrecks of the Forth and Tay* Dunbeath.

Baird B 1993 *Shipwrecks of the Forth: including wrecks from Berwick on Tweed to Stonehaven* Glasgow.

Barras B F and Paul M A 2000 'Post-reclamation changes in estuarine mudflat sediments at Bothkennar, Grangemouth, Scotland' in Pye K and Allen J R L (eds.) *Coastal and estuarine environments : sedimentology, geomorphology and geoarchaeology* Geological Society Special Publications 175, London, Geological Society 187-199

Bell M G (ed.) 2007 *Prehistoric Coastal Communities: the archaeology of Western Britain 6000-3000 Cal. BC* CBA Research Report 149. Council for British Archaeology, York

Bonsall C 2009 *A Mesolithic site at Kilmore, near Oban, western Scotland*

Carter R W G, Devoy R J N and Shaw J 1989 *Late Holocene sea-levels in Ireland* Journal of Quaternary Science 4 7-24.

Dunwell A and Ralston I 2008 *Archaeology and Early History of Angus* Tempus

The Crown Estate (2010a) *Offshore Renewables Protocol for Archaeological Discoveries*

The Crown Estate (2010b) *Round 3 Offshore Renewables Projects Model Clauses for Archaeological Written Schemes of Investigation*

Edwards K 1996 'A Mesolithic of the Western and Northern Isles of Scotland? Evidence from pollen and charcoal' in Pollard T & Morrison A (eds.) *The Early Prehistory of Scotland*, pp. 23-38. Edinburgh: Edinburgh University Press.

English Heritage, 2006. *MoRPHE. Marine Archaeological Geophysical Survey.*

Ferguson D M 1991 *Shipwrecks of North-East Scotland 1444-1990* Aberdeen

Flemming N C 2004 *The scope of Strategic Environmental Assessment of North Sea Area SEA5 in regard to prehistoric archaeological remains* Department of Trade and Industry

GEMS 2010 *Geophysical Results Report, Phase 1. Firth of Forth Offshore (Round 3) Windfarm, Development Project* Unpublished report prepared for Seagreen Wind Energy Limited.

Greenhill B and Morrison J 1998 *The Archaeology of Boats and Ships: An Introduction* Conway Maritime press

Gribble J and Leather S for EMU Ltd 2011 *Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector* COWRIE Ltd

Historic Scotland 2009 *Towards a Strategy for Scotland's Marine Historic Environment*

Holmes R. 1977 *Quaternary deposits of the central North Sea, 5. The Quaternary geology of the UK sector of the North Sea between 56° and 58°N* Report of the Insitute of Geological Sciences No. 77/14.

Holmes R, Bulat J, Henni P, Holt J, James C, Kenyon N, Leslie A, Long D, Morri C, Musson R, Pearson S and Stewart H 2004 *DTI Strategic Environmental Assessment Area 5 (SEA5): Seabed and Superficial Geology and Processes*. Commercial Report CR/04/064N

ICOMOS 1996 *Charter on the Protection and management of Underwater Cultural Heritage*.

Institute for Archaeologists (IfA) 2008 *Guidelines: Standard & Guidance for Archaeological Desk Based Assessment.*

Joint Nautical Archaeology Policy Committee (JNAPC) 2008 *Code of Practice for Seabed Development.*

Johnstone, P. 1980 *The Seacraft of Prehistory* London

Jones 1996 'Food For Thought' in Pollard, T. & A. Morrison (eds.) *The Early Prehistory of Scotland* pp. 23-38. Edinburgh: Edinburgh University Press.

Larne R and Larne B 1998 *Shipwreck Index of the British Isles – Volume IV - Scotland* London.

Lavery B 2008 *Maritime Scotland* Historic Scotland.

Lawer and Nayling 1993 'Investigations at Barland's Farm, Magor' in Bell, M. (Ed) *Archaeology in the Severn Estuary*. Annual Report of the Severn estuary Levels Research Committee 109 - 113

Lynch F, Aldhouse- Green S and Davies J L 2000 *Prehistoric Wales*. Sutton Publishing.

MacKie E W 1972 *Radiocarbon dates for two Mesolithic shell middens and a Neolithic axe factory in Scotland* Proceedings of the Prehistoric Society **38** 412-416.

Martin C. 1991 'Water Transport and the Roman occupation of Britain' in Smout T.C. (Ed) *Scotland and the Sea*. Barnes & Noble

Manley J 1989 *Atlas of Prehistoric Britain* Phaidon. Oxford.

McGee B 2003 http://casualtylist.tripod.com/ Accessed 06/06/2011

Melton N D and Nicholson R A 2004 *The Mesolithic in the Northern Isles: the preliminary evaluation of an oyster midden at West Voe, Sumburgh, Shetland, U.K*. Antiquity Vol. 78: No 299.

Military Aircraft http://www.military-aircraft.org.uk/ww2 Accessed 24/07/2011

Mowat R J C 1996 *The logboats of Scotland* Oxbow Monograph in Archaeology No.68

Nash N S 2009 *K Boat Catastrophe: Eight Ships and Five Collisions: The Full Story of the 'Battle' of the Isle of May* Barnsley

NSA 1837 *New Statistical Account of Scotland* Edinburgh

Ó Cróinín D 2005 *New History of Ireland, Vol. 1, Prehistoric & Early Medieval Ireland*. Royal Irish Academy. Oxford University Press.

Osiris Projects 2011a *Firth of Forth Offshore Wind Farm Export Cable, Geophysical Survey. Volume 1 – Operations Report*. Unpublished report prepared for Seagreen Wind Energy Limited.

Osiris Projects 2011b *Firth of Forth Offshore Wind Farm Export Cable, Geophysical Survey. Volume 2 – Report*. Unpublished report prepared for Seagreen Wind Energy Limited.

Owen O 1999 *The Sea Road: A Viking Voyage Through Scotland* Historic Scotland

Plets R, Quinn R, Forsythe W, Westley K, Bell T, Benetti S, McGrath F, and Robinson R 2011 *Using Multibeam Echo-Sounder to Identify Shipwreck Sites: archaeological assessment of the Joint Irish Bathymetric Survey Data* The International Journal of Nautical Archaeology. Vol 40. Number 1.

Raftery B 1994 *Pagan Celtic Ireland: the enigma of the Irish Iron Age* London

Ritchie A 1993 *Viking Scotland* Historic Scotland

Robinson M 1982 *Diatom analysis of Early Flandrian lagoon sediments from East Lothian Scotland*. Journal of Biogeography 9 207-221.

Robinson M 1993 *Microfossil analyses and radiocarbon dating of depositional sequences related to Holocene sea-level change in the Forth Valley, Scotland*. Transactions of the Royal Society of Edinburgh: Earth Sciences 84 1-60.

Rodger N A M 1997 *The Safeguard of the Sea: A Naval History of Britain, Vol. 1: 660 – 1649* London

Shennan I, Lambeck K, Horton B, Innes,J B, Lloyd J, McArthur J.J, Purcell T and Rutherford M M 2000 *Late Devensian and Holocene records of relative sea-level changes in northwest Scotland and implications for glacio-hydro-isostatic modelling.* Quaternary Science Reviews 19 1103-1135.

Smith D E, Harrison S, Firth C R and Jordan J 2011 *The early Holocene sea level rise*. Quaternary Science Reviews **30** 1846-1860.

Smith D E, Firth C R, Brooks C L, Robinson M and Collins P E F 1999 *Relative sea-level rise during the Main Postglacial Transgression in NE Scotland, U.K*. Transactions of the Royal Society of Edinburgh: Earth Sciences. 90 1-27.

Smith D E, Davies M H, Brooks C L, Mighall T M, Dawson S, Rea B R, Jordan J T and Holloway L K 2010 Holocene *relative sea levels and related prehistoric activity in the Forth lowland, Scotland, United Kingdom*. Quaternary Science Reviews **29** 2382-2410.

Stevenson R B K 1958 *A stone axe-head found near Arbirlot by Dr Dewar in 1931 is in Arbroath Museum* National Museum of Antiquities of Scotland (NMAS).

Strachan D 2010 *The Carpow Logboat: A Bronze Age Vessel Brought to Life* Perth and Kinross Heritage Trust.

Strachan D 2004 *A Late Bronze Age logboat from the Tay estuary at Carpow, Perth and Kinross* Tayside Fife Archaeol Journal, vol.10

Stoker M S, Skinner A C, Fyfe J A and Long D 1983 *Palaeomagnetic evidence for early Pleistocene in the central and northern North Sea.* Nature **304** 332-334.

Sutherland D G 1984 *The Quaternary deposits and landforms of Scotland and the neighbouring shelves: a review.* Quaternary Science Reviews **3** 157-254.

Telford D 2002. *The Mesolithic inheritance: contrasting Neolithic monumentality in eastern and western Scotland* Proceedings of the Prehistoric Society, vol.68.

Thomson M E 1978 *IGS studies of the geology of the Firth of Forth and its approaches*. Report of the Institute of Geological Sciences No. 77/17.

The War Graves Photographic Project http://twgpp.org/information.php?id=767103 Accessed 06/06/2011

UNESCO 2001 *The UNESCO Convention on the Protection of Underwater Cultural Heritage*. UNESCO General Conference 31.C.

Wessex Archaeology Ltd. 2007 *Historical Environment Guidance for the Offshore Renewable Energy Sector*. COWRIE Ltd.

Wessex Archaeology Ltd. 2009 *UKCS Offshore Oil and Gas and Wind Energy Stratagic Environmental Assessment: Archaeological Baseline*. Prepared by the Department of Energy and Climate Change.

Westley K, Quinn R, Forsythe W, Plets R, Bell T, Benetti T, McGrath S F and Robinson R 2011 *Mapping Submerged Landscapes Using Multibeam Bathymetric Data: a case study from the north coast of Ireland*. The International Journal of Nautical Archaeology. Vol 40. Number 1.

Whittaker I G 1998 *Off Scotland: a comprehensive record of maritime and aviation losses in Scottish waters* Edinburgh

Whittington G, Edwards K J and Caseldine C.J 1991 *Late and post-glacial pollen-analytical and environmental data from a near-coastal site in north-east Fife, Scotland*. Review of Palaeobotany and Palynology **68** 65-85.

Woodworth P L, Terferle F N, Bingley R M, Shennan I and Williams S D P 2009 *Trends in UK mean sea level revisited*. Geophysical Journal International 176 19-30.

Databases of Maritime Cultural Heritage Assets Consulted

Designated wreck data was downloaded from Historic Scotland's website © Historic Scotland

Offshore Sites and Monuments Record information derived from NMRS data (dated 15/02/2011) © Crown Copyright RCAHMS

Wrecks and Obstructions information derived from SeaZone data © Copyright UKHO

APPENDIX 1 - GAZETTEER AND CONCORDANCE OF CULTURAL HERITAGE ASSETS WITH KNOWN LOCATIONS WITHIN THE OFFSHORE STUDY AREA.

HA	Name	SeaZone ID	NMRS ID	Status	Description	DD Long/ DD Lat	UTM30NmE/ UTM30NmN
HA1001	HMS ST BRIAC	070459		Live	LEAST M/B DEPTH 51.0 IN GEN DEPTH 58MTRS. SCOUR 2.7MTRS DEEP EXTENDS 10MTRS TOWARDS 330 DEGS. LENGTH 115.0MTRS, WIDTH 23.3MTRS, HT 7.0MTRS. LIES 145/325 DEGS WITH BOWS NW. UPRIGHT. BROKEN INTO TWO PIECES. DEBRIS FIELD EXTENDS 27MTRS E. (GARDLINE, HI 1152). INS AS WK 51MTRS. BR STD. **15.1.09 WK LOCATED & DIVED. IDENTIFIED AS HMS ST BRIAC. BELL RECOVERED. (I EASINGWOOD, E-MAIL DTD 13.1.09) NCA. **5.3.09 SHOWN AS WK 50MTRS IN DIGITAL BATHY DATA FOR HI 1152. AMEND WK 50MTRS. BR STDTS FAA TARGET VESSEL,Found by multibeam in gen depth of 56 m. DEBRIS CLOSE,MAGANY Moderate E12/03/1942	-1.5570335 56.55454667	588428.678 6268305.197
HA1002	HMS EXMOUTH (POSSIBLY)	065549		Dead	Destroyer	-1.630351667 56.55523333	584998.964 6268184.513
HA1003	MICHAEL SCOTT	03164		Dead	Trawler??/??/1904	-1.691076667 56.67224167	580592.561 6281040.664

HA1004	Unknown	070465		Live	Found by multibeam	-1.740144 56.52029783	577238.547 6264883.335
HA1005	ESKDENE	065458		Lift		-1.842543333 56.66985833	571402.351 6280874.228
HA1006	Unknown	03036	102789	Dead	The wreck length is 180 feet (54.8 metres) and its height about seabed 24 feet (7.3 metres). The vessel's keel lies on an orientation of direction 180/000 degrees. Source; Rosyth 24 March 1945.No located by subsequent survey 1969	-2.0892565 56.5716195	555711.5 6270432.003
HA1007	Unknown	070435		Live	Found by multibeam	-2.120211167 56.571484	553891.593 6270363.405
HA1008	Unknown	03161		Live	found by multi-beam	-1.823305667 56.50991467	572131.741 6264184.754
HA1009	Unknown	071834		Live	found by multi-beam	-2.119362833 56.62024717	553926.02 6275723.616
HA1010	HMS BRACONBURN (POSSIBLY)	03043	102796	Live	found by multi-beam, slight magnetic signitature(61 metres) long and stands 15 feet (4.5 metres) high. Its keel lies on the the orientation of 000/180 in a shallow bowl 370 metres across. The least depth by echosounder was 55.7 in 61 metres30/07/1944	-2.165906667 56.620536	551992.018 6275756.329

HA1011	Unknown	03041		Live	found by multi-beam	-2.154062667 56.5929865	551769.957 6273112.164
HA1012	Unknown	00189	102794	Live		-2.152751833 56.5922455	551913.651 6272979.152
HA1013	HMS BRACONBURN	03037	102790	Dead		-2.176226667 56.576593	551085.831 6271302.558
HA1014	Unknown	03034	102788	Dead		-2.143273333 56.54327683	553183.935 6267618.074
HA1015	PRIMROSE	03040		Dead		-2.259386667 56.59079083	545957.163 6272634.83
HA1016	Unknown	00195			Not found by multibeam	-2.295231667 56.57659767	543909.243 6271225.137
HA1017	AURORA	03115		Live	found by multi-beam	-2.291431 56.55853033	543216.614 6269096.73
HA1018	Unknown	071168		Live	Partial Wreck found by multi-beam	-2.33414	540979.555

						56.54219017	6267281.271
HA1019	VALHALLAH	03139		Live	03/06/1995	-2.3233325 56.5202965	541358.406 6264460.076
HA1020	Unknown	00171		Live		-2.37642 56.55993783	538822.535 6269315.113
HA1021	MARGARET RAE	057569		Live	TECSOU found by multi-beam07/07/1999	-2.3702925 56.57412333	538552.629 6269461.008
HA1022	Unknown	03039		Live	found by multi-beam	-2.356190833 56.58651267	539286.194 6271778.793
HA1023	CANGINIAN	03038		Dead	17/11/1916	-2.376046667 56.576593	538806.384 6271170.941
HA1024	DAYSPRING	03128		Dead	10/08/1992	-2.408886667 56.52480333	535982.88 6265241.083
HA1025	Unknown	071939		Live	found by multi-beam	-2.500793333 56.53509817	530772.577 6265872.635
HA1026	ANNETTE MARY	068711		Live	dangerous wreck02/11/2006	-2.538533333	528157.971

						56.54283533	6267297.358
HA1027	HOCHE	03032		Live	dangerous wreck29/10/1915	-2.605916667 56.5024885	524015.747 6262260.324
HA1028	ANU	03030		Dead	dangerous wreck06/02/1944	-2.676745 56.50126333	520433.043 6261770.133
HA1029	Aircraft	03031		Dead	CESSNA 320 AIRCRAFT04/02/1970	-2.692401667 56.493278	519402.343 6261762.128
HA1030	Unknown	03033		Live		-2.243098667 56.51889567	546168.937 6264251.667
HA1031	Unknown	071165		Live	found by multi-beam	-2.203972167 56.52148783	548808.426 6264761.694
HA1032	Unknown	03035		Dead		-2.503593833 56.569087	530354.576 6269709.059
HA1033	GRENMAR (POSSIBLY)	03027		Live	found by multi-beam	-2.071794333 56.47551617	556956.97 6260043.801

HA1034	GRENMAR (POSSIBLY)	00168		Live		-2.07076 56.47580333	557061.241 6260083.255
HA1035	Unknown	070461		live	found by multi-beam	-1.559348 56.50996083	588261.095 6264499.819
HA1036	HMS NORDHAV II (POSSIBLY)	03051		Live	found by multi-beam, BOW LIES 30MTRS NE10/03/1945	-2.059279333 56.70224683	557221.258 6284798.065
HA1037	HMS NORDHAV II (PART OF)(POSSIBLY)	03052		Live	found by multi-beam10/03/1945	-2.086798167 56.69231767	555780.271 6284173.775
HA1038	Unknown	070428		Live	found by multi-beam	-2.089917167 56.68834517	555472.901 6283432.16
HA1039	NAILSEA RIVER	03045		Dead	15/09/1940	-2.093073333 56.6765915	556057.672 6282496.04
HA1040	Obstruction/ Aircraft	03179		Dead		-1.993171667 56.57658933	562347.127 6271452.401
HA1041	Unknown	03167		Dead		-1.893393333	568275.882 6284533.256

						56.693257	
HA1042	Unknown	064046		Live			

APPENDIX 2 – RECORDS OF MARITIME LOSSES

Maritime losses recorded in the National Monument Record of Scotland (NMRS) dataset within the application boundary. Any sites in this database with known locations have been included in the gazetteer of sites and are shown on Illus. 1. Therefore these tables are intended to provide a general picture of the type of losses within the offshore study area rather than a list of confirmed remains. Please note that the mapped position of most losses recorded in the NMRS databases ranges from exact to 'essentially arbitrary'.

Name	NMRS ID	Date Lost or Reported	Type	Location	Description
CITY OF ABERDEEN	255966	20 January 1871	Steamship	'At Portlethen, 7 Miles South Of Aberdeen'	Classified as iron steamship, with general cargo: date of loss cited as 20 January 1871). City of Aberdeen: [this vessel was] wrecked at Portlethen. Capt. Marchant. Registration: Aberdeen. Built 1865. 682grt. Length: 69m. Beam: 9m. (Location of loss cited as N57 3.50 W2 6.50). I G Whittaker 1998. The location assigned to this record is essentially tentative.
Hms Blackmore Vale	201642	01/15/1918	Fishing trawler	Montrose, Scurdie Ness, 10.5 miles SE	Requisitioned in 1917 this steam trawler was lost after she detonated a German mine off Montrose. The wreck is believed to lie in a general depth of 55 m and 3 m proud of the seabed. Larn and Larn, R and B (1998) Shipwreck index of the British Isles: volume 4, Scotland, London
Unknown	102776	04/12/1917	CRAFT (20TH CENTURY	17 miles SSW from Tod Head	The vessel was mined. 9 people were killed including the skipper. The site was not found by HMS BEAGLE during a

Name	NMRS ID	Date Lost or Reported	Type	Location	Description
					general sonar search of area. Hydrographic Office, 1995.
Dewdrop	197207	06/01/1854	Brig	Abroath, Harbour	Brig, 250 ton, 10 men, Hartlepool to London, coals, wind SE force 8, squally rain, value #1800, insured at Whitby, cargo #700. 1 dead. Wrecked. At Arbroath, by stress of weather. The crew, except one, saved by Manby's apparatus. The vessel went to pieces. Larn and Larn, R and B (1998) Shipwreck index of the British Isles: volume 4, Scotland, London
Unknown	195787	11/11/1760	CRAFT (18TH CENTURY)	Between Toy and Abroath	A new ship of 250 tons ran ashore 'betwixt' Toy and Abroath where she lay scuttled. Larn and Larn, R and B (1998) Shipwreck index of the British Isles: volume 4, Scotland, London
Agnes	290262	27/02/1869	Sloop (19th Century)	Arbroath; East Haven; Elliot; 'North Of Dundee'	Sloop: no cargo specified, but date of loss cited as February 1869). Agnes: this vessel was wrecked at Cove, North of Dundee. Capt. Galloway. crew saved. The location assigned to this record is essentially arbitrary
Au Fait	200736	20/01/1907	Ketch (20th Century)	4 miles W of Arbroath	Classified as wooden ketch, in ballast: date of loss cited as 20 January 1907). Au Fait: this vessel stranded 4

Name	NMRS ID	Date Lost or Reported	Type	Location	Description
					miles W of Arbroath. Capt. Feller. The location assigned to this record is essentially tentative
Aid	262693	26/05/1873	Smack(19th Century)	near Easthaven	The AID (smack), of Glasgow, slate laden, has stranded near Easthaven: lies on her beam ends, and will become a wreck: cargo may be saved. The loss of this vessel is not cited by I G Whittaker (1998), possibly on grounds of her successful recovery.
Elizabeth	276662	18/11/1845	Schooner (19th Century)	3 miles West of Arbroath	Classified as schooner, with cargo of coal: date of loss cited as 18 November 1845 went on shore on the rocks The classification, cargo and location of loss cited by Whittaker remain unverified. This stranding may have occurred around NO 60 36, between East Haven [name: NO 590 362] and Elliott [name: NO 621 393]. Information from RCAHMS (RJCM), 14 November 2005.
Genise	200655	14/04/1905	Schooner (20th Century)	Westhaven	Wooden schooner built in 1865, stranded and lost at the entrance to Westhaven. Larn and Larn, R and B (1998) Shipwreck index of the British Isles: volume 4, Scotland, London
Rachel	247557	19/11/1850	Sloop (19th Century)	Westhaven	Sloop, 59 tons, 4 crew, Dundee to Alloa in ballast, SE

Name	NMRS ID	Date Lost or Reported	Type	Location	Description
					force 9, heavy. 8.30 am 14 fall, no exams, 65 years old, value #350 insured for + where #300 Limekilns (forth). Easthaven-Montrose, wrecked ? m W of. Stress of weather no light seen head have 10, 15, 20 minute intervals casts 15 to 10 fathoms. Had the light been seen they might have got into the Tay. (Lt at Westhaven Station). Total wreck.
Otto	260902	13/01/1833	Brig (19th Century	Westhaven Coast Guard Station	OTTO, 15 yrs old, of Sweden, wooden brig, 262 tons, 8 crew, Master R. Beronius, Owner L. O. Asberg, Stromstad, Sweden, departed Dunkirk for Stromstad, in ballast, wind E. by S.9, stranded, total loss, near Westhaven Coast Guard Station, Co. Forfar. Crew of eight saved by rocket apparatus
Emma Maria	264395	26/02/1874	Schooner (19th Century)	'About 500 Yards South East Of Westhaven'	Classified as schooner, with cargo of black oats: date of loss cited as 26 February 1874). This vessel was wrecked at Carnoustie. Capt.
Isabella	255686	31/12/1865	Schooner (19th Century)	Panbride, West Haven, 1 mile N of Carnoustie	The ISABELLA, of Liverpool, Scott, from Seaham to Dundee, with coal, was totally wrecked five miles to the Westward: master and mate saved, three hands drowned.
Louisa	272414	21/03/1829	Schooner (19th Century)	near West Haven	The LOUISA, from North Shields to Dundee, was totally

Name	NMRS ID	Date Lost or Reported	Type	Location	Description
					wrecked near West Haven, Arbroath. The crew and materials saved.'
Pilot cutter No. 2	286341	04/08/1866	Cutter (19th Century)	on the low water rocks off West haven	The Pilot cutter No. 2 went ashore on the low water rocks off Westhaven and broke up: crew saved.

APPENDIX 3- GEOPHYSICAL SURVEY SPECIFICATIONS & SUITABILITY FOR ARCHAEOLOGICAL ASSESSMENT

The following outlines the methodology used by GEMS during the survey of the wind farm development area AND Osiris Projects for the Export Cable Route.

Main Development Area

GEMS Methodology and Specifications

The geophysical survey was acquired between 18th June and the 27th July 2010. The geodetic parameters used throughout the survey were WGS84 UTM zone 30 North with the time data being logged as Coordinated Universal Time (UTC). The techniques employed included side scan sonar, magnetometer, sub-bottom profiler and multi-beam bathymetry.

Survey parameters

The marine geophysical survey undertaken by GEMS was initiated with a view to satisfying a number of requirements (e.g. geological, engineering etc.) of the proposed development.

The phases of works comprised

- A geophysical survey within the proposed Phase 1 development area.
- Line spacing of 100m and lines started and ended 200m beyond the area of full data overlap.
- Cross lines of 2000m in the east and 1000m in the west of the survey area.
- Bathymetric mapping using multibeam echo sounding equipment (MBES).
- Reflection seismic profiling of the seabed and interpretation performed with sub-bottom profiler (SBP).
- High-resolution side scan sonar (SSS) survey and interpretation with a dual channel side scanning transmitter/receiver system.

Potential obstructions and wrecks were identified before the commencement of the survey. The development contains many maritime losses and the proposed wind farm is designed to avoid as many of these as possible. However the development area does cover a number of recorded wreck sites identified in the SeaZone database. More details of these wrecks can be found in the Archaeological Desk Based Assessment report (Appendix A). Headland Archaeology has identified six of these maritime losses in the geophysical dataset.

Primary positioning

The primary positioning used by GEMS was a DGPS Differential Global Positioning System.

Sidescan Sonar

The sidescan sonar equipment used by GEMS was the Edgetech MP4200 sonar system throughout the survey, this is a dual frequency 100/400KHz receiver. The side scan deck unit controls and conditions the signals from a towfish. The power, control and return signals are multiplexed onto a standard armoured coaxial cable. This model of side scan sonar uses EdgeTech's Full Spectrum® CHIRP technology providing high resolution imagery at ranges

20-30% greater than none—CHIRP systems allowing a larger area to be surveyed in a shorter timeframe. FOSAE experienced no problems with the equipment during the survey.

Sound bursts are beamed from the transducers and produce echoes from points on the seabed which are then picked up by sensors and relayed to the transceiver unit. These signals are processed and made into sonar images. Harder objects give stronger reflective signals and softer sediments weaker return signals thus giving classifications of seabed. The data was recorded in high frequency mode to enable optimal imagery of the seabed.

Magnetometer

A Marine Magnetic SeaSpy magnetometer was used during the survey towed 10m behind the sidescan sonar towfish. This magnetometer equipment has a high accuracy of 0.1nT. This survey method detects variations in the total magnetic field of the underlying seafloor and sub-seabed geology on the basis of anomalies in the Earth's magnetic field. Materials high in ferrous or ferric compounds will be detected by the magnetometer.

Sub-bottom Profiler

GEMS used a Sub-bottom Pinger and Surface towed sparker to collect the sub-bottom profiler dataset. The seabed structures are delineated using reflections from a selectable single frequency multi-cycle high power signal, producing a pseudo cross-section of the subsurface of the sea floor.

Archaeological suitability of the survey methodology and specifications

The following assesses the suitability of the specifications for each survey method for archaeological assessment and takes into consideration the guidelines presented by the English Heritage 'Marine Archaeological Geophysical Survey Note 1' (2006).

After reviewing the methods of data collection utilised by GEMS it is thought that the survey 'tracks' or 'lines' are sufficient enough to provide accurate coverage of the proposed wind farm development area. The survey techniques and equipment employed on site were again found to be of a high standard for the acquisition of survey data needed to complete a proficient marine geophysical survey assessment. Where equipment was found not to be satisfactory it was soon rectified. The GPS was operated in conjunction with all the survey techniques described above and as such provided accurate and true track co-ordinate information.

Sidescan Sonar

The sidescan sonar data was rated with regard to its suitability for the purpose of identifying and interpreting cultural heritage remains. Data of high frequency and short range will better distinguish structure of any identified maritime losses such as wrecks and aircraft and may enable the discrimination between geological and archaeological features. However, data acquired at low frequency at larger ranges may only identify the outline of wrecks and may not be able to distinguish the presence of any associated debris.

Sidescan data taken along the proposed cable route has been rated as moderate quality for the identification of any visible cultural heritage remains on the seabed such as wreck remains or objects (typically >2m). The system is capable of a minimum of 100kHz and a

maximum of 400 kHz and was operated in dual frequency. The survey lines and spacing's have encompassed the entire wind farm area and buffer zone, which was covered by at least one survey line and often more than one.

The main challenge faced during a marine geophysical survey assessment is the problem of accuracy. The survey was conducted using DGPS and corrected navigation was available to the archaeological reviewers. However there remain some inherent difficulties when using certain geophysical techniques which do not give precise measurements even when the location of the survey instrument has been precisely established. This can be demonstrated on known wreck anomalies where on different survey lines the wreck appears in slightly different locations. This kind of inaccuracy is partly due to perspective shifts between playbacks as the sonar receiver will sense the wrecks from different angles during different playbacks. However, given the size of these wreck sites this level of accuracy is deemed sufficient for locational purposes and any possible construction exclusion zones which might be put in place by way of mitigation.

Magnetometer

The magnetometer data was taken with a Marine Magnetic SeaSpy magnetometer across all tracks in the survey towed at a known distance behind the sidescan sonar fish. The data quality and results were found to be good for this geophysical survey assessment

While the quality of the magnetometer data was seen to be sufficient, data was only acquired along the survey tracks and in areas where the location of existing sub-sea cables required clarification. In light of this, it is apparent that magnetometer data was not collected in between all survey tracks which may have resulted in the non-identification of metal and ferrous objects of cultural heritage interest within the remainder of the survey area. It has also limited the cross referencing of the identified sidescan sonar targets with possible metallic targets. Despite this, the magnetometer data acquired along the proposed cable route did correspond with potential targets of cultural heritage interest such as identified sidescan sonar targets in addition to the locations of charted and uncharted cable and pipeline routes.

Shallow Seismic Data

The seismic data collected during the survey was found to be of good quality for archaeological geophysical assessment purposes. Again the survey was taken along each individual transect in order to give a good representation of the geological sediments and any evidence of archaeological remains on or beneath the seabed.

Echo Sounder/Multibeam Echo Sounder

The multibeam data for the proposed cable route corridor has been rated as good for the purposes of geophysical data assessment characterising the relief of the seabed and any potential archaeological remains there-on.

Export Cable Geophysical Survey

The following outlines the methodology used by Osiris Projects during the survey of the Firth of Forth Offshore Wind Farm Export Cable Route Corridor.

Osiris Projects Methodology and Specifications

The geophysical survey was undertaken on two survey vessels, the MV Freja that surveyed the inshore area and the SV Chartwell that survey the offshore cable route between June 22nd and July 5th 2011. The geodetic parameters used during the survey were WGS84 UTM zone 30 North with the time and date being logged as Coordinated Universal Time (UTC). The techniques employed included side scan sonar, magnetometer, sub-bottom profiler and multi-beam bathymetry.

Survey Parameters

The marine geophysical survey was undertaken by Osiris Projects was initiated with a view to satisfying a number of requirements (e.g. geological, engineering etc.) of the proposed development.

The phases of work comprised:

- The geophysical survey of the export cable route and corridor with a total of 11 longitudinal lines at 100m line spacing creating a 1km buffer corridor.
- 50m line spacing from inshore of the 20m contour for multibeam coverage, where required.
- The projection of two survey lines 200m into the development area to ensure adequate survey data overlap.
- The Southern Route corridor overlapped into the northern corridor by 200m bar for the centreline which was extended to the common offshore point.
- Measure seabed topography and morphology and identify the nature of the seabed sediments.
- Undertake shallow geophysical surveys using sub-bottom profiler to identify sub-seabed geology, to provide data for the design of a subsequent programme of geotechnical sampling, in particular to derive cable burial assessment.
- Identify the location, extent and nature of any impediments to the installation of the export cables such as wrecks, sea floor debris, rock outcrops and other cables/pipelines.

Potential obstructions and wrecks were identified before the commencement of the survey. The development contains many maritime losses and the proposed wind farm is designed to avoid as many of these as possible. However the development area does cover a number of recorded wreck sites identified in the SeaZone database. More details of these wrecks can be found in the Archaeological Desk Based Assessment report (Appendix A). Headland Archaeology has identified six of these maritime losses in the geophysical dataset, the Largo (Possibly), the Stonedale 2 (Possibly) and four unnamed wrecks and obstructions.

Primary positioning

The primary positioning used by Osiris Projects was a DGPS Differential Global Positioning System

Sidescan Sonar

The sidescan sonar equipment used was a GeoAcoustics SS941 side scan sonar system, together with a 159D dual frequency tow fish. This system offers a selectable frequency operation (110 or 410 kHz), enabling long range, low-resolution scanning and short range, high-resolution investigations.

Short, high frequency, high intensity sound bursts are beamed from transducers, which are mounted either side of the fish. This results in echoes, returned from points on the seabed abeam of each transducer. Once detected by sensors within the transducers these echoes are relayed to the transceiver unit, via the tow cable, and the signals are processed, line by line, to produce a sonar image.

Multibeam Echo Sounder

MV Freja

Onboard the MV Freja the GeoAcoustics GeoSwath was used, this is a high-frequency (250 kHz) interferometric swathe bathymetry system is specifically designed for shallow water (<100m) and, under 16 optimum conditions, enables bathymetry coverage of a swath width approximately 10 times water depth. The simultaneously acquires high resolution, high density bathymetry and side scan sonar data. A Knudsen 320M single beam echo sounder was utilised to provide a QC check on the multibeam data to resolve any fixed offset busts.

SV Chartwell

A Reson Seabat 7101 high resolution multi-beam echo sounder system was used onboard the SV Chartwell to collect a high density bathymetry data set within the survey area. This is a beam-forming system, i.e. the receiver forms a set of virtual ‘beams’ mathematically and detects the range to the seabed for each beam operating a transmit frequency of 240kHz. A Knudsen 320M single beam echo sounder was utilised to provide a QC check on the multibeam data to resolve any fixed offset busts.

Magnetometer

Osiris Projects used a Geometrics G882 caesium vapour marine magnetometer onboard both survey vessels. The system incorporates a towed ‘fish’, which houses a total magnetic field sensor and CM221 Larmor counter. The unit provides absolute readings of total magnetic field, with a resolution of 0.004nT/Hz rms. The magnetometer is used to detect variations in the total magnetic field of the underlying seafloor and sub-seabed geology, on the basis of anomalies in the Earth’s magnetic field. These anomalies are caused by ferrous iron on or directly beneath the seabed such as wrecks, objects pipelines etc.

Sub-Bottom Profiler

The Applied Acoustics ‘Boomer’ sub-bottom profiling system comprised of an AA200 boomer plate, a CAT200 catamaran, a CSP300 (Freja) / 1200D (Chartwell) portable seismic energy source and an AAE 8 element hydrophone streamer. Short duration, high-power electrical pulses, generated by the shipboard CSP300 power supply, are discharged to the electrical

coil. The resultant magnetic field explosively repels the metal plate, generating a broadband acoustic pressure pulse in the water column. The frequency of this pulse is in the range 10 kHz to 500Hz, with the majority of the energy being directed vertically downwards at a maximum output of 300 joules per pulse (Osiris Projects, 2011a).

Archaeological suitability of the survey methodology and specifications

The following assesses the suitability of the specifications for each survey method for archaeological assessment and takes into consideration the guidelines presented by the English Heritage 'Marine Archaeological Geophysical Survey Note 1' (2006).

After reviewing the methods of data collection utilised by Osiris Projects it is thought that the survey 'tracks' or 'lines' are sufficient enough to provide accurate coverage of the proposed export cable route. The survey techniques and equipment employed on site were again found to be of a high standard for the acquisition of survey data needed to complete a proficient marine geophysical survey assessment. Where equipment was found not to be satisfactory it was soon rectified. The GPS was operated in conjunction with all the survey techniques described above and as such provided accurate and true track co-ordinate information.

Sidescan Sonar

The sidescan sonar data was rated with regard to its suitability for the purpose of identifying and interpreting cultural heritage remains. Data of high frequency and short range will better distinguish structure of any identified maritime losses such as wrecks and aircraft and may enable the discrimination between geological and archaeological features. However, data acquired at low frequency at larger ranges may only identify the outline of wrecks and may not be able to distinguish the presence of any associated debris.

Sidescan data taken along the proposed cable route has been rated as good quality for theidentification of any visible cultural heritage remains on the seabed such as wreck remains or objects (typically >2m). The system is capable of a minimum of 100kHz and a maximum of 400 kHz and was operated in dual frequency. The survey lines and spacing's have encompassed the entire export cable and buffer zone, which was covered by at least one survey line and often more than one.

The main challenge faced during a marine geophysical survey assessment is the problem of accuracy. The survey was conducted using DGPS and corrected navigation was available to the archaeological reviewers. However there remain some inherent difficulties when using certain geophysical techniques which do not give precise measurements even when the location of the survey instrument has been precisely established. This can be demonstrated on known wreck anomalies where on different survey lines the wreck appears in slightly different locations. This kind of inaccuracy is partly due to perspective shifts between playbacks as the sonar receiver will sense the wrecks from different angles during different playbacks. However, given the size of these wreck sites this level of accuracy is deemed sufficient for location purposes and for any possible construction exclusion zones which might be put in place by way of mitigation.

Magnetometer

The magnetometer data was taken with a Geometrics G882 caesium vapour marine magnetometer across all tracks in the survey and was towed at a known distance behind the sidescan sonar fish. The data quality and results were found to be good for this geophysical survey assessment.

Shallow Seismic Data

The seismic data collected during the survey was found to be of good quality for archaeological geophysical assessment purposes. Again the survey was taken along each individual transect in order to give a good representation of the geological sediments and any evidence of archaeological remains on or beneath the seabed.

Echo Sounder/Multibeam Echo Sounder

The multibeam data for the proposed cable route corridor has been rated as good for the purposes of geophysical data assessment characterising the relief of the seabed and any potential archaeological remains there-on.

APPENDIX 4- GEOPHYSICAL TARGETS IDENTIFIED BY HEADLAND ARCHAEOLOGY

Phase 1 Development Sidescan targets

ID	Site Description	Sidescan Potential	Geophys Length (m)	Geophys Width (m)	Geophys Height (m)	UTM30NmE	UTM30NmN
1	Possible Natural Feature	Low	4.46	0.5	3.71	568032.64	6281526.48
2	Possible natural feature	Low	3.97	1.23	0.71	560484.17	6281873.83
3	Possible natural feature	Low	6.89	0.71	0.54	560378.23	6281839.33
4	Possible natural feature	Low	2.8	0.74	1.7	560942.95	6281912.92
5	Possible natural feature	Low	3.59	1.22	4.94	561442.88	6282034.65
6	Possible natural feature	Low	3.28	0.96	0.66	560009.44	6281591.23
7	Possible natural feature	Low	4.47	1.42	1.48	561101.22	6281789.48
8	Possible natural feature	Low	2.96	0.58	0.95	562908.42	6282113.35
9	Possible natural feature	Low	1.76	1.64	1.45	559866.76	6281310.38
10	Linear debris	Medium	6.53	0.85	6.52	563903.62	6282107.83
11	Possible natural feature	Low	5.27	3.58	0.75	559891.28	6280994.51
12	Possible natural fetaure	Low	2.89	1.48	1.19	563963.79	6281858.35
13	Possible natural feature	Low	6.79	1.73	2.23	566249.84	6281920.82
14	Group possible debris	Medium	3.65	0.85	2.57	567477.73	6282035.68
15	Possible natural feature	Low	3.56	2.2	0.98	567309.52	6282139.66
16	Possible natural feature	Low	3.99	0.69	1.16	566602.98	6282013.75
17	Possible natural feature	Low	4.46	0.81	0.34	561710.1	6280931.56
18	Possible natural feature	Low	1.9	1.67	2.51	559433.23	6280556.82
19	Possible natural feature	Low	2.13	1.52	2.6	558903.1	6280448.56
20	Possible natural feature	Low	1.88	1.54	1.42	558194.21	6280270.1
21	Fishing debris	Medium	5.89	2.01	0.42	559877.44	6280525.35
22	Possible fishing debris	Medium	6.1	1.69	0.72	560603.48	6280588.27
23	Possible natural feature	Low	3.05	0.91	0.67	568120.94	6281976.62
24	Possible natural feature	Low	5.74	1.7	0.68	566616.77	6281693.95
25	Debris	Medium	2.9	1.35	1.1	565718.98	6281505.01
26	Possible natural feature	Low	4.8	3.38	1.35	558297.13	6280027.41
27	Fishing debris	Medium	4.4	1.85	1.11	559422.52	6280174.97

28	Possible natural feature	Low	9.86	1.54	0.7	560869.02	6280452.1
29	Possible natural feature	Low	7.28	4.28	0.71	561249.66	6280509.93
30	Possible natural feature	Low	4.54	0.94	0.42	562022.49	6280766.63
31	Possible natural feature	Low	4.44	0.62	0.28	565417.19	6281422.3
32	Possible natural feature	Low	13.13	0.83	0	558945.42	6280190.76
33	Possible natural feature	Low	9.52	1.26	0.44	568041.84	6281573.35
34	Possible natural feature	Low	9.11	5.49	0.59	553133.96	6211832.04
35	Possible natural feature	Low	11.09	1.79	0.66	567352.86	6281486.43
36	Possible natural feature	Low	5.12	4.87	0.81	557118.35	6279272.38
37	Possible natural feature	Low	6.31	0.86	0	559423.66	6279283.7
38	Possible natural feature	Low	9.1	8.88	0	569672.16	6281416.4
39	Possible natural feature	Low	1.67	1.67	0.9	559257.37	6279286.95
40	Possible natural feature	Low	3.18	0.51	0.12	560102.24	6279507.58
41	Possible natural feature	Low	2.67	0.88	0.31	561866.27	6279691.67
42	Possible natural feature	Low	3.36	0.95	0.46	564068.95	6280104.01
43	Buried debris	Medium	16.78	1.18	0.37	567246.73	6280890.19
44	Possible natural feature	Low	2.83	1.36	0.44	567683.3	6280732.36
45	Possible natural feature	Low	1.62	0.79	0.81	568378.75	6281055.3
46	Possible natural feature	Low	0.79	0.56	0.22	568985.31	6281225.59
47	Possible debris	Medium	7.26	1.1	0.52	569961.47	6281210.53
48	Possible natural feature	Low	2.65	0.87	0.42	571575.4	6281563.47
49	Possible natural feature	Low	2.13	0.46	0.2	564436.34	6280036.59
50	Debris on seabed	Medium	5.39	1.54	0.02	558441.21	6278827.72
51	Debris	Medium	4.63	1.86	0.25	556929.4	6278656.52
52	Possible natural feature	Low	2.2	0.91	1.1	572804.59	6281606.77
53	Possible natural feature	Low	3.18	4.93	0.45	567796.87	6280413.34
54	Possible object	Medium	5.9	4.24	0.56	556675.36	6278350.68
55	Possible natural feature	Low	4.81	0.73	0.28	560171.07	6278998.99
56	Linear debris	Medium	25.23	0.95	0.12	560923.55	6279163.9
57	Possible natural feature	Low	19.21	9.37	0.09	573399.78	6281441.18
58	Linear feature	Medium	25.42	2.75	1.12	560446.51	6279473.13
59	Possible natural feature	Low	3.42	1.22	0.56	558877.89	6278832.95

60	Possible natural feature	Low	11.26	1.44	0.64	564091.58	6282158.25
61	Possible natural feature	Low	7.15	5.05	0.17	557761.36	6279647.35
62	Buried objects	Medium	12.49	2.14	0.89	559720.87	6280015.19
63	Possible natural feature	Low	7.95	6.31	0.58	559210.6	6279776
64	Depression/buried ob	Medium	13	9.44	0	580679.98	6280616.45
65	Possible natural feature	Low	2.65	2.02	0.99	560651.38	6276671.56
66	Possible natural feature	Low	3.1	2.95	0.69	566641.5	6277625.63
67	Possible natural feature	Low	3.16	0.71	0.34	573011.32	6279012.17
68	Possible natural feature	Low	7.93	0.55	0.46	583664.95	6280943.39
69	Possible natural feature	Low	4.06	3.17	2.2	571690.33	6278537.02
70	Possible natural feature	Low	6.61	1.36	1.36	587350.16	6281348.43
71	Possible natural feature	Low	3.06	2.65	1.05	584124.11	6280819.92
72	Possible natural feature	Low	6.44	3.69	0.73	563409.12	6276442.75
73	Possible natural feature	Low	3.4	0.47	0.78	564518.59	6276449.47
74	Possible natural feature	Low	3.75	2.55	0.42	559104.61	6275348.76
75	Linear debris	Medium	14.6	0.88	0.6	557021.19	6274886.12
76	Possible natural feature	Low	7.39	2.58	0.09	563645.9	6276385.06
77	Debris on seabed	Medium	4.54	3.12	0.05	569722.63	6277630.92
78	Linear debris	Medium	23.03	0.75	0.15	556882.73	6274881.83
79	Possible natural feature	Low	4.98	3.59	0.27	563862.14	6276243.47
80	Possible natural feature	Low	7.77	2.12	0.44	567134.6	6276886.02
81	Curvilinear feature	Medium	18.96	1.09	0.56	587741.81	6280532.51
82	Possible natural feature	Low	20.42	0.74	0.09	575016.61	6277986.86
83	Possible natural feature	Low	5.32	0.71	0.46	556527.95	6273945.55
84	Possible natural feature	Low	15.22	3.09	0	567892.68	6276430.55
85	Possible naturalfeature	Low	4.8	1.04	0.18	564629.84	6273576.46
86	Possible natural feature	Low	5.39	1.1	1.06	564808.06	6273553.11
87	Possible natural feature	Low	23.22	2.73	1.35	564526.25	6273180.12
88	Possible Aircraft	High	15.29	8.14	0.56	589107.53	6277960.21
89	Possible natural feature	Low	3.69	0.98	0.7	561427.28	6272442.44
90	Possible natural feature	Low	3.82	1.03	0.5	585800.83	6277246.33

91	Possible natural feature`	Low	2.72	0.97	0.83	582777.67	6276400.23
92	Possible natural feature	Low	5.28	0.35	0.23	553865.78	6270899.89
93	Possible natural feature	Low	3.52	0.72	1.23	585137.21	6276759.93
94	Possible natural feature	Low	4.15	1.56	0.39	554267.98	6270764.46
95	Possible natural feature	Low	2.52	0.47	0.34	573009.54	6274249.91
96	Possible natural feature	Low	3.19	0.49	0.3	580031.17	6275741.48
97	Wreck	High	36.84	5.33	0.41	553914.28	6270402.37
98	Possible natural feature	Low	3.6	0.51	0.37	589208.53	6277305.67
99	Possible natural feature	Low	6.17	0.7	0.28	553285.25	6270358.11
100	Same as 97	High				553897.71	6270394.13
101	Debris	Medium	8.08	0.46	0.05	585928.96	6276472.87
102	Possible natural feature	Low	3.74	1.2	2.27	585927.91	6276463.64
103	Possible natural feature	Low	5.09	0.49	0.31	564504.51	6272042.93
104	Possible natural feature	Low	4.52	0.46	1.54	585917.62	6276474.6
105	Possible natural feature	Low	4.65	1.14	0.63	564178.04	6271567.42
106	Debris	Medium	4.3	0.47	0.62	566228.85	6271992.94
107	Possible natural feature	Low	8.08	0.79	0.21	584619.24	6275606.44
108	Possible natural feature	Low	4.71	1.3	0.56	557114.62	6270280.3
109	Possible natural feature	Low	11.75	0.73	0.93	564175.86	6271566.69
110	Possible natural feature	Low	6.25	1.12	1.28	564907.95	6271457.32
111	Possible natural feature	Low	6.93	0.35	0.94	572980.79	6272937.89
112	Possible Anchor	Medium	2.86	10.1	0.04	565864.76	6271195.92
113	Possible natural feature	Low	8.85	0.59	0.73	581546.77	6273932.26
114	Possible natural feature	Low	8.05	2.27	0	569317.24	6271417.15
115	Possible natural feature	Low	4.68	1.31	0.59	582799.3	6274005.9
116	Possible natural feature	Low	7.42	0.7	1.07	572726.16	6271791.37
117	Possible natural feature	Low	45.89	2.51	0.1	569418.95	6271261.3
118	Debris	Medium	6.86	0.26	0.67	579224.22	6272921.09
119	Possible natural feature	Low	6.94	1.6	0	557312.33	6268526.55
120	Possible natural feature	Low	15.83	0.92	0.33	576650.06	6272089.79
121	Possible natural feature	Low	4.78	0.49	0.44	556059.3	6266043.32
122	Possible natural feature	Low	7.28	2.05	0.27	575936.43	6269705.8

123	Possible natural feature	Low	10.6	2.04	0.6	571096.87	6270791.88
124	Possible natural feature	Low	12.98	0.84	0.66	569796.56	6270535.85
125	Possible natural feature	Low	9.58	1.33	0.84	579961.81	6272483.97
126	Possible natural feature	Low	10.96	1.82	0.56	582869.94	6272537.76
127	Possible natural feature	Low	30.04	17.71	0	573354.59	6270350.21
128	Possible natural feature	Low	15.15	0.76	0.27	590312.04	6273524.93
129	Possible natural feature	Low	7.08	0.59	0.49	556400.63	6266758
130	Possible natural feature	Low	27.81	0.96	0.76	556561.52	6268660.41
131	Possible natural feature	Low	3.26	3.01	0.1	572462.09	6269818.22
132	Debris	Medium	10.05	1.8	0.45	573786.36	6270058.43
133	Debris	Medium	7.58	0.7	0.23	575864.53	6270475.34
134	Possible natural feature	Low	23.11	7.3	0.8	566587.76	6268661.27
135	Possible natural feature	Low	9.5	0.89	0.51	574901.51	6270181.38
136	Possible natural feature	Low	6.99	0.94	0.72	577797.31	6270525.32
137	Possible natural feature	Low	6.02	1.63	0.45	570494.99	6268776.38
138	Possible natural feature	Low	7.69	0.73	1.19	575912.36	6269703.81
139	Possible natural feature	Low	5.39	1.98	0.27	588164.19	6271934.46
140	Possible natural feature	Low	6.95	0.6	0.53	578550.17	6269824.05
141	Possible natural feature	Low	7.4	0.83	0.84	561933.66	6266736.61
142	Structure	High	221.69	289.78	0.5	561691.74	6266568.57
143	Possible natural feature	Low	5.98	5.95	0.13	588163.08	6271921.89
144	Possible natural feature	Low	6.64	1.51	0.61	575933.42	6269700.31
145	Linear debris Same as 142	High	42.91	37.31	0.43	561676.51	6266646.33
146	Possible natural feature	Low	6.1	0.75	0.86	561918.46	6266739.38
147	Same as 142	High	405.72	242.58	0.28	561642.3	6266561.42
148	Possible natural feature	Low	3.79	0.85	0.21	588398.62	6271707.95
149	Possible natural feature	Low	5.02	1.48	0.32	582763.01	6270622.56
150	Same as 142	High				561719.2	6266522.13
151	Possible natural feature	Low	2.28	0.94	0.71	587474.03	6271092.47
152	Possible natural feature	Low	4.41	1.35	0.33	565379.07	6266648.02
153	Possible natural feature	Low	5.32	0.91	0.7	578078.02	6268846.92
154	Possible natural	Low	5.9	0.8	0.41	559122.5	6265176.41

	feature						
155	Possible natural feature	Low	4.81	1.08	0.44	584276.03	6269856.35
156	Possible natural feature	Low	5.2	0.91	0.57	563873.69	6265751.47
157	Possible natural feature	Low	2.88	0.59	0.59	572629.22	6267175.59
158	Possible natural feature	Low	3.98	0.8	0.5	572632.38	6267178.14
159	Possible natural feature	Low	4.16	0.53	0.39	576352.36	6267541.17
160	Possible natural feature	Low	4.66	2.78	0.49	577076.25	6267311.08
161	Debris	Medium	23.99	1.09	0.4	558124.35	6263680.93
162	Possible natural feature	Low	5.32	0.74	0.94	559400.76	6263783.32
163	Possible natural feature	Low	4.53	0.78	0.36	590923.51	6269975.61
164	Possible natural feature	Low	2.55	0.82	0.45	564981.33	6264861.82
165	Possible natural feature	Low	4.54	0.91	0.93	559428.31	6263777.68
166	Possible natural feature	Low	3.87	0.95	0.22	568958.88	6265596.69
167	Possible natural feature	Low	6.96	0.49	0.14	563749.14	6264158.88
168	Possible natural feature	Low	11.7	0.93	0.5	566490.68	6264871.94
169	Possible natural feature	Low	23.15	0.4	0.12	581433.13	6267506.64
170	Possible natural feature	Low	6.84	2.5	0.1	561005.44	6263536.8
171	Possible natural feature	Low	16.99	1.09	0.77	558006.23	6262560.36
172	Possible natural feature	Low	5.34	0.79	0	591821.8	6269270.76
173	Possible natural feature	Low	3.92	2.92	0.28	560540.34	6263176.99
174	Possible natural feature	Low	5.13	0.43	0.4	581307.56	6267020.73
175	Wreck	High	36	4.33	0.71	588375.5	6268388.08
176	Wreck	High	77.63	18.59	0.63	588437.29	6268346.22
177	Wreck debris	High	18.47	13.43	0.55	588437.29	6268286.98
178	Possible natural feature	Low	6.35	2.18	0	571810.88	6264697.39
179	Possible natural feature	Low	8.87	4.58	1.78	573213.92	6281281.33
180	Possible natural feature	Low	6.61	5.93	1.56	573184.62	6281425
181	Possible natural feature	Low	5.37	3.4	0.57	570576.22	6280746.46
182	Possible natural feature	Low	4.7	2.48	1.09	569118.17	6280584.05
183	Possible natural feature	Low	6.47	2.17	1.45	567806.53	6280333.78
184	Possible natural feature	Low	11.55	2.92	1.85	558997.32	6278528.84

185	Debris	Medium	6.7	2.7	0.89	557224.87	6278252.57
186	Possible natural feature	Low	4.54	2.23	0.23	557703.77	6278219.94
187	Possible natural feature	Low	7.56	2.86	0.88	559315.38	6278592
188	Possible natural feature	Low	7.13	4.87	1.36	569105.53	6280348.25
189	Possible natural feature	Low	8.06	1.14	0.57	572093.1	6280901.63
190	Possible natural feature	Low	5.98	2.85	1.6	572460.58	6280984.82
191	Possible natural feature	Low	4.7	1.78	1.55	573896.74	6281271.04
192	Possible natural feature	Low	8.42	1.67	0.93	573371.99	6281048.79
193	Possible natural feature	Low	5.26	2.41	2.57	572140.63	6280950.03
194	Possible natural feature	Low	5.37	5.61	1.51	570045.24	6280388.81
195	Possible natural feature	Low	6.92	2.02	2.19	557564.08	6277858.2
196	Possible natural feature	Low	6.62	1.98	2.72	557833.28	6277939.87
197	Possible natural feature	Low	6.01	5.42	1.28	559255.6	6278199.98
198	Possible natural feature	Low	7.9	1.55	1.49	563889.75	6279187.62
199	Possible natural feature	Low	9.67	2.24	3.02	569077.06	6280105.18
200	Possible natural feature	Low	6.52	2.87	2.52	573555	6281101.56
201	Possible natural feature	Low	8.78	2.73	2.53	574311.12	6281234.6
202	Possible natural feature	Low	5.34	1.27	2.02	570880.86	6280477.34
203	Possible natural feature	Low	5.14	3.51	2.35	562988.17	6278968.68
204	Possible natural feature	Low	10.96	1.24	1.87	560741.46	6278510.22
205	Possible natural feature	Low	5.49	3.35	1.61		
206	Possible natural feature	Low	6.1	1.03	2.56	558114.03	6277811.35
207	Possible natural feature	Low	7.4	3.13	0.9	559181.2	6278134.08
208	Possible natural feature	Low	11.86	3.78	2.61	569095.81	6280090.5
209	Possible natural feature	Low	4.56	3.51	0.45	571820.61	6280463.79
210	Possible natural feature	Low	6.66	1.83	1.63	579408.38	6282098
211	Possible natural feature	Low	8.19	2.65	2.71	574315.53	6280950.94
212	Linear debris	Medium	7.54	4.19	0.56	572268.74	6280430.78
213	Possible natural feature	Low	3.84	2.15	1.35	567279.8	6279413.87
214	Possible natural feature	Low	5.82	0.55	0.35	566037.68	6279350.1

215	Possible natural feature	Low	5.63	2.05	0.94	563542.6	6278872.03
216	Possible natural feature	Low	8.36	0.64	1.02	559768.91	6278032.13
217	Possible natural feature	Low	10.47	3.33	1.96	559126.58	6277944.8
218	Linear debris	Medium	7.6	1.78	1.17	558129.17	6277773.04
219	Possible natural feature	Low	7.15	2.02	1.79	572683.69	6280446.77
220	Possible natural feature	Low	12.51	4.81	1.48	579300.62	6281788.66
221	Possible natural feature	Low	11.75	1.74	1.96	581196.32	6282092.36
222	Possible natural feature	Low	11.41	4.73	4.34	581585.95	6282101.07
223	Possible natural feature	Low	8.02	2.62	1.42	572229.57	6280287.49
224	Possible natural feature	Low	2.98	2.52	1.93	568418.07	6279635.61
225	Linear debris	Medium	7.98	5.12	0.79	568335.4	6279640.77
226	Possible natural feature	Low	6.18	3.16	2.48	556773.37	6277301.82
227	Possible natural feature	Low	9.99	2.17	1.78	558856.53	6277638.39
228	Possible natural feature	Low	5.74	4.13	2.21	565978.18	6278899.75
229	Possible natural feature	Low	12.2	5.63	2.93	576890.82	6281022.31
230	Debris	Medium	7.09	2.74	1.12	583235.78	6282260.33
231	Possible natural feature	Low	6.86	3.96	1.45	567642.49	6279109.01
232	Possible natural feature	Low	7.83	3.97	1.13	555162.83	6276539.48
233	Possible natural feature	Low	6.79	3.81	1.07	556789.32	6277063.07
234	Possible natural feature	Low	7.09	4.24	1.67	566222.99	6278726.22
235	Possible natural feature	Low	3.59	2.18	1.33	576426.56	6280780.21
236	Possible natural feature	Low	6.91	2.44	1.23	578611.56	6281097.54
237	Possible natural feature	Low	9.23	5.39	1.88	577935.04	6280947.41
238	Possible natural feature	Low	6.93	5.34	1.14	572210.37	6280050.1
239	Possible natural feature	Low	8.94	3.93	1.12	571989.79	6279784.68
240	Possible natural feature	Low	13.1	3.38	1.15	565283.77	6278547.49
241	Possible natural feature	Low	6.65	2.78	1.87	565192.74	6278564.55
242	Possible natural feature	Low	5.86	2.84	2.02	559087.33	6277370.04
243	Possible natural feature	Low	8.17	5.88	1.18	558615.45	6277139.59
244	Possible natural feature	Low	8.98	4.69	0.43	556544.53	6276712.24
245	Possible natural	Low	2.23	1.62	1.11	555133.27	6276509.04

	feature						
246	Possible natural feature	Low	8.54	2.37	1.54	555941.86	6276641.57
247	Possible natural feature	Low	7.14	2.06	1.96	561493.91	6277950.68
248	Linear debris	Medium	7.58	3.16	1.26	564456.01	6278243.98
249	Possible natural feature	Low	8.59	2.48	1.54	566892.88	6278659.66
250	Possible natural feature	Low	6.66	1.58	1.21	568158.15	6278943.91
251	Possible natural feature	Low	4.42	2.63	2.01	568824.92	6279199.29
252	Possible natural feature	Low	6.6	2.04	1.97	569153.87	6279234.69
253	Possible natural feature	Low	8.44	4.81	1.79	578217.98	6281007.49
254	Possible natural feature	Low	8.27	3.51	2.85	578894.16	6281165.17
255	Possible natural feature	Low	7.8	6.22	1.38	582159.67	6281679.11
256	Possible natural feature	Low	9.72	2.2	1.64	585679.32	6282373.41
257	Possible natural feature	Low	8.98	2.62	2.43	579334.09	6281066.13
258	Debris	Medium	8.18	2.54	1.2	575382.31	6280256.91
259	Possible natural feature	Low	11.89	3.75	2.57	571247.82	6279442.08
260	Possible natural feature	Low	7.28	2.18	1.16	569722.31	6279272.32
261	Possible natural feature	Low	4.66	2.75	1.35	558620.65	6277123.09
262	Possible natural feature	Low	9.79	5.22	0.21	556550.22	6276700.11
263	Debris	Medium	5.73	4.81	1.65	557804.94	6276742.84
264	Possible natural feature	Low	11.06	2.75	1.4	564425.1	6278166.93
265	Possible natural feature	Low	5.39	3.52	1.59	583900.35	6281856.92
266	Possible natural feature	Low	5.55	2.12	1.52	585635.79	6282048.38
267	Possible natural feature	Low	6.37	2.61	1.88	584127.36	6281786.27
268	Debris	Medium	6.17	2.05	1.21	583478.73	6281600.38
269	Possible natural feature	Low	7.41	2.16	1.3	580201.35	6281135.9
270	Possible natural feature	Low	5.88	4.17	0.45	576725.57	6280492.02
271	Possible natural feature	Low	5.61	3.19	1.56	575950.19	6280262.33
272	Possible natural feature	Low	9.01	5.6	1.22	575409.44	6280166.15
273	Possible natural feature	Low	10.21	1.89	1.68	571257.99	6279375.53
274	Possible natural feature	Low	7.28	2.15	0.88	568243.98	6278635.38
275	Possible natural feature	Low	5.97	5.56	1.99	564086.58	6277763.87
276	Possible natural	Low	9.67	1.94	1.34	558399.22	6276689.75

	feature						
277	Possible natural feature	Low	8.04	4.97	1.36	558202.24	6276637.21
278	Linear debris	Medium	9.12	3.01	1.01	558027.01	6276632.18
279	Possible natural feature	Low	8.38	6.15	0.99	562725.58	6277578.92
280	Possible natural feature	Low	7.79	2.74	1.13	564805.09	6278000.77
281	Possible natural feature	Low	15.63	8.05	2.1	566422.52	6278149.44
282	Possible natural feature	Low	5.56	2.78	1.98	574797.26	6279974.56
283	Possible natural feature	Low	8.52	6.22	1.68	578709.51	6280583.98
284	Possible natural feature	Low	8.99	3.61	1.2	583466.71	6281622.82
285	Possible natural feature	Low	7.31	2.15	2.12	584487.19	6281857.32
286	Possible natural feature	Low	5.91	2.63	1.8	584686.87	6281668.06
287	Possible natural feature	Low	6.96	2.24	1.34	5700164.22	6278961.77
288	Possible natural feature	Low	6.5	2.49	2.86	564910.83	6277767.22
289	Linear debris	Medium	8.26	2.56	1.49	556104.07	6276064.55
290	Possible natural feature	Low	8.54	2.58	1.42	560893.61	6276886.96
291	Possible natural feature	Low	5.72	2.94	1.38	563708.66	6277587.86
292	Possible natural feature	Low	6.68	3.03	1.39	564729.31	6277684.97
293	Possible natural feature	Low	5.19	5.17	2.51	5866077.19	6278241.55
294	Possible natural feature	Low	5.2	1.97	2.52	579190.01	6276739.29
295	Possible natural feature	Low	7.85	2.87	0.8	577537.4	6276344.25
296	Possible natural feature	Low	6.14	3.32	0.09	563088.15	6273484.89
297	Possible natural feature	Low	5.6	1.91	2.03	556905.11	6272423.15
298	Possible natural feature	Low	7.06	3.12	1.35	556357.7	6272217.35
299	Possible natural feature	Low				556109.84	6272323.36
300	Possible natural feature	Low	7.46	3.62	1.4	555473.97	6272189.01
301	Possible natural feature	Low	5.57	3.82	2.76	554999.32	6272124.4
302	Possible natural feature	Low	7.36	2.55	1.85	583260.56	6279097.42
303	Possible natural feature	Low	6.13	2.96	1.93	579741.83	6278470.36
304	Possible natural feature	Low	7.38	2.12	1.53	570684.39	6276781.68
305	Possible natural feature	Low	6.73	2.77	1.86	553931.55	6273256.1
306	Linear debris	Medium	9.62	3.9	1.26	556785.56	6273999.58

307	Possible natural feature	Low	7.61	2.31	1.15	570533.26	6276593.26
308	Possible natural feature	Low	3.96	2.43	0.34	574069.51	6277209.13
309	Possible natural feature	Low	7.18	2.19	1.47	576912.86	6277920.41
310	Possible natural feature	Low	9.12	2.33	2.21	579247.3	6278238.82
311	Possible natural feature	Low	10.26	3.1	1.74	583897.29	6279169.33
312	Possible natural feature	Low	9.49	2.62	1.53	584380.65	6279280.96
313	Possible natural feature	Low	7.64	2.46	1.66	587886.11	6279868.49
314	Possible natural feature	Low	4.56	1.98	0.83	578175.14	6277922.38
315	Possible natural feature	Low	6.08	2.52	2.18	561009.16	6274604.6
316	Possible natural feature	Low	10.69	3.48	0.92	558152.37	6273982.05
317	Possible natural feature	Low	6.67	3.74	2.85	555910.98	6273734.05
318	Possible natural feature	Low	8.43	2.43	3.39	554955.61	6273335.72
319	Possible natural feature	Low	8.76	2.5	1.18	554553.79	6273306.5
320	Possible natural feature	Low	4.12	2.15	1.77	579109.53	6277985.66
321	Possible natural feature	Low	8.32	2.99	1.64	588022.94	6279781.44
322	Possible natural feature	Low	9.05	2.09	1.46	587725.27	6279753.71
323	Possible natural feature	Low	5.59	3.59	0.75	585408.36	6279148.67
324	Possible natural feature	Low	9.96	2.18	1.95	578059.66	6277870.98
325	Possible natural feature	Low	7.64	3.71	1.1	559977.29	6274135.19
326	Possible natural feature	Low	9.69	6.87	2.2	555141.16	6273215.18
327	Possible natural feature	Low	9.56	2.46	1.47	554969.54	6273296.21
328	Possible natural feature	Low	6.28	2.14	0.96	554535.43	6273261.33
329	Possible natural feature	Low	11.42	2.43	1.4	560864.76	6274331.31
330	Possible natural feature	Low	8.92	4.23	1.42	564196.02	6275063.22
331	Possible natural feature	Low	6.92	1.76	1.31	587228.21	6279573.87
332	Possible natural feature	Low	6.41	2.27	0.68	587997.85	6279607.1
333	Possible natural feature	Low	5.56	1.23	1.66	578788.03	6277808.92
334	Possible natural feature	Low	11.05	2.01	1.87	577188.86	6277333.24
335	Possible natural feature	Low	9.32	2.1	1.79	569382.46	6275943.17

336	Possible natural feature	Low	7.93	2.36	1.65	568829.84	6275820.69
337	Possible natural feature	Low	8.81	2.36	1.85	565055.95	6275080.43
338	Possible natural feature	Low	10.88	2.72	1.09	563401.85	6274624.47
339	Possible natural feature	Low	10.07	2.52	1.35	560289.2	6274166.48
340	Linear debris	Medium	11.74	3.92	0.26	558720.49	6273883.33
341	Possible natural feature	Low	9.76	3.58	0.91		
342	Possible natural feature	Low					
343	Possible natural feature	Low	4.88	2.32	1.43	556202.16	6273137.92
344	Possible natural feature	Low	11.5	3.93	1.83	558069.86	6273522.3
345	Linear debris	Medium	5.69	2.08	0.91	558534.54	6273536.41
346	Possible natural feature	Low	8.67	5.82	1.23	567545.2	6275335.22
347	Possible natural feature	Low	12.44	3.59	1.01	569675.49	6275948.2
348	Possible natural feature	Low	13.11	4.22	2.21	574058.27	6276579.45
349	Possible natural feature	Low	4.78	1.26	0.89	576404.04	6277058.6
350	Possible natural feature	Low	9.83	2.22	1.18	567029.59	6275312.94
351	Possible natural feature	Low	5.62	1.55	0.65	554369.9	6272596.89
352	Possible natural feature	Low	7.6	2.16	1.51	555208.14	6272703.98
353	Possible natural feature	Low	7.39	3.35	1.31	555787.19	6272982.5
354	Possible natural feature	Low	16.67	3.56	1.25		
355	Possible natural feature	Low	8.07	2.14	1.06	558522.92	6273552.45
356	Possible natural feature	Low	3.45	5.8	12.07	560741.89	6273946.36
357	Possible natural feature	Low	5.12	3.11	2.55	561221.62	6274055.72
358	Possible natural feature	Low	5.6		0.05	561561.19	6273930.71
359	Possible natural feature	Low	8.38	3.37	2.28	565188.53	6274670.29
360	Possible natural feature	Low	12.39	4.75	2.39	574051.84	6276588.93
361	Possible natural feature	Low	7.75	2.11	1.71	579778.08	6277665.92
362	Possible natural feature	Low	7.89	2.33	1.94	588551.55	6279247.09
363	Possible natural feature	Low	6.02	2.31	1.54	588499.73	6279143.72
364	Possible natural feature	Low	9.72	3.72	1.54	575412.46	6276591.02
365	Linear debris	Medium	9.04	0.71	1.3	567111.5	6274881.67
366	Possible natural	Low	4.93	0.58	0.2	572506.19	6276099.9

	feature						
367	Possible natural feature	Low	7.76	6.78	3.17	579227.34	6277390.13
368	Possible natural feature	Low	7.77	2.01	1.06	588198.38	6279163.83
369	Possible natural feature	Low	8.96	3.77	2.23	584163.43	6278056.72
370	Possible natural feature	Low	11.19	3.86	2.43		
371	Possible natural feature	Low	21.56	3.09	2.71	571834.97	6275856.21
372	Possible natural feature	Low	2.54	4.72	1.25	569687.74	6275436.99
373	Possible natural feature	Low	4.96	2.08	1.38	553515.75	6272156.91
374	Possible natural feature	Low	9.2	2.81	1.95	554242.61	6272129.79
375	Possible natural feature	Low	12.22	2.62	1.5	558561.52	6273138.47
376	Possible natural feature	Low	6.47	2.44	1.61	565867.9	6274549.39
377	Possible natural feature	Low	52.93	12.63	4.8	565846.47	6274495.93
378	Possible natural feature	Low	7.22	1.95	1.25	570988.77	6275543.33
379	Possible natural feature	Low	7.48	2.48	0.78	574047.3	6275975.6
380	Possible natural feature	Low	6.25	2.68	1.83	586095.56	6278298.87
381	Possible natural feature	Low	4.21	2.12	1.05	585436.02	6278276.3
382	Possible natural feature	Low	6.95	3.04	2.9	584128.36	6278048.63
383	Possible natural feature	Low	835	1.48	1.2	565879.77	6274272.12
384	Possible natural feature	Low	70.55	5.9	0.88	562614.72	6273777.4
385	Possible natural feature	Low	6.34	3.4	2.2	559573.17	6273049.05
386	Possible natural feature	Low	13.02	3.17	2.79	556283.17	6272463.53
387	Possible natural feature	Low	6.34	2.86	2.03	555004.56	6272163.07
388	Possible natural feature	Low	5.09	1.55	0.73	554779.19	6271993.4
389	Possible natural feature	Low	7.9	2.45	1.56	557672.54	6272746.61
390	Possible natural feature	Low	8.27	2.38	1.21	574029.3	6275958.14
391	Possible natural feature	Low	5.51	2.91	1.67	579217.7	6276941.29
392	Possible natural feature	Low	5.58	2.28	2.68	585587.87	6278074.8
393	Possible natural feature	Low	4.09	1.78	0.38	556385.21	6272109.65
394	Possible natural feature	Low	11.77	4.59	1.81	573032.21	6275581.38
395	Possible natural	Low	5.15	4.26	2.34	578316.63	6276446.37

	feature						
396	Possible natural feature	Low	3.35	1.25	0.11	585432.12	6278028.75
397	Possible natural feature	Low	7.92	2.44	1.07	5819929.7	6277033.28
398	Possible natural feature	Low	6.06	1.77	0.85	572381.38	6275296.8
399	Possible natural feature	Low	8.18	4.65	2.89	571642.16	6275034.92
400	Possible natural feature	Low	6.11	1.23	0.45	561420.83	6273028.24
401	Possible natural feature	Low	7.24	3.83	1.32	559494.34	6272653.25
402	Possible natural feature	Low	6.62	4.3	2.29	559110.4	6272514.22
403	Possible natural feature	Low	8.18	1.41	0.54	556344.75	6272164.83
404	Possible natural feature	Low	9.71	2.9	1.64	553786.1	6271524.02
405	Possible natural feature	Low	8.89	4.02	1.53	562882.12	6273171.6
406	Possible natural feature	Low	3.75	3.25	1.77	570008.13	6274608.12
407	Possible natural feature	Low	11.78	5.51	2.66	575131.29	6275588.59
408	Possible natural feature	Low	8.17	2.85	0.94	575404.14	6275815.33
409	Wreck	High	30	7.32	1.8	577240	6264891
410	Possible natural feature	Low	11.58	4.27	-1.48	573756.79	6265131.45
411	Possible natural feature	Low	11.9	1.41	0.41	573726.55	6265127.21
412	Possible natural feature	Low	2.18	0.72	0.46	590366.23	6268045.71
413	Possible natural feature	Low	4.25	2.55	0.59	571949.6	6264414.43
414	Possible natural feature	Low	3.26	3.4	1.09	571922.45	6264420.83
415	Possible natural feature	Low	4.02	0.57	0.32	574291.96	6265024.8
416	Possible natural feature	Low	4.4	0.7	0.42	590363.87	6268048.35
417	Possible natural feature	Low	4.05	1.19	0.63	578269.12	6265508.9
418	Possible natural feature	Low	2.61	0.6	0.67	571962.89	6264426.7
419	Possible natural feature	Low	11.98	0.78	0.94	583588.15	6266306.38
420	Possible natural feature	Low	3.61	0.8	0.06	591491.74	6267755.42
421	Possible natural feature	Low	4.46	0.58	0.39	584392.07	6266265.64

Phase 1 development Magnetometer Targets

MA	Site Description	Geophysics Source	Potential	UTM30NmE	UTM30NmN	Sidescan Target

1	Anomaly	Magnetometer	Low	559354.12	6281672.73	-
2	Anomaly	Magnetometer	Low	557678.88	6279697.57	-
3	Anomaly	Magnetometer	Low	557680.82	6279697.03	-
4	Large magnetic fluctuation 20m. Associated with GEMS1089	Magnetometer	Low	560450.86	6279448	-
5	Large magnetic fluctuation about 100m	Magnetometer	Low	561353.4	6279621.71	-
6	Large, gradual magnetic fluctuation	Magnetometer	Low	556981.41	6276254.28	-
7	Isolated Magnetic anomaly	Magnetometer	Low	562470.22	6273912.02	-
8	Isolated magnetometer target	Magnetometer	Low	561124.79	6273330.32	-
9	Isolated magnetic anomaly	Magnetometer	Low	557842.77	6272997.12	-
10	Isolated magnetic anomaly	Magnetometer	Low	556826.36	6272190.7	-
11	Isolated magnetic anomaly	Magnetometer	Low	565759.45	6273941.57	-
12	Magnetic fluctuations 60m	Magnetometer	Low	581163.55	6276935.62	-
13	Isolated magnetic anomaly	Magnetometer	Low	580692.35	6276236.69	-
14	Isolated magnetic anomaly	Magnetometer	Low	565759.45	6273941.57	-
15	Isolated magnetic anomaly	Magnetometer	Low	556826.36	6272190.7	-
16	Isolated magnetic anomaly	Magnetometer	Low	585246	6275314.12	-
17	Isolated magnetic anomaly	Magnetometer	Low	588726.1	6276417.58	-
18	Isolated magnetic anomaly	Magnetometer	Low	576277.2	6273365	-
19	Isolated	Magnetometer	Low	573528.86	6273220.41	-

	Magnetometer target					
20	ted magnetic anomaly	Magnetometer	Low	571128.75	6272534.9	-
21	Isolated magnetic anomaly	Magnetometer	Low	568007.97	6272157.88	-
22	Isolated magnetic anomaly	Magnetometer	Low	566288.3	6271997.38	-
23	Isolated magnetic anomaly	Magnetometer	Low	562543.6	6271477.91	-
24	Isolated magnetic anomaly	Magnetometer	Low	561080.38	6271188.35	-
25	Isolated magnetic anomaly	Magnetometer	Low	561317.14	6270953.98	-
26	Isolated magnetic anomaly	Magnetometer	Low	560438.49	6270430.22	-
27	Isolated magnetic anomaly	Magnetometer	Low	556189.51	6269589.41	-
28	Isolated magnetic anomaly	Magnetometer	Low	554600.43	6269404.48	-
29	Isolated magnetic anomaly	Magnetometer	Low	564952.22	6269079.21	-
30	Isolated magnetic anomaly	Magnetometer	Low	566607.36	6269221.68	-
31	Isolated magnetic anomaly	Magnetometer	Low	573964.95	6270472.75	-
32	Isolated magnetic anomaly	Magnetometer	Low	581344.76	6272325.48	-
33	Isolated magnetic anomaly	Magnetometer	Low	579248.95	6270067.68	-
34	Isolated magnetic anomaly	Magnetometer	Low	566381.34	6265312.19	-
35	Wreck Anomaly	Magnetometer	High	588435.69	6268326.42	-
36	Wreck anomaly	Magnetometer	High	577247.3	6264877.44	-
37	Anomaly	Magnetometer	Low	557103.97	6278344.17	-
38	Small magnetic fluctuation	Magnetometer	Low	556747.52	6278007.71	-

39	Isolated magnetic anomaly	Magnetometer	Low	553900.24	6270380.2	-
40	Isolated magnetic anomaly`	Magnetometer	Low	559166.06	6272652.73	-
41	Isolated magnetic anomaly	Magnetometer	Low	560928.98	6279172.13	-
42	Isolated magnetic anomaly	Magnetometer	Low	57188.05	6275131.73	-
43	Large area of magnetic fluctuation	Magnetometer	Low	574148.39	6280424.84	-
44	Isolated magnetic anomaly	Magnetometer	Low	575450.26	6275818.07	-
45	Isolated magnetic anomaly	Magnetometer	Low	588424	6268317	-
46	Isolated magnetic anomaly	Magnetometer	Low	556746	6278009	-
47	Isolated magnetic anomaly	Magnetometer	Low	560436	6279447	-
48	Isolated magnetic anomaly	Magnetometer	Low	561523	6266264	-

Export Cable Route Sidescan Targets

CR	Site Description	Sidescan Potential	Length (m)	Width (m)	Height (m)	UTM30NmE	UTM30NmN
1	Possible natural feature	Low	7.56	2.15	0	544054.21	6272491.07
2	Possible natural festure	Low	8.27	3.47	0	534919.53	6269108.3
3	Possible natural feature	Low	4.03	2.04	0.01	550806.87	6273953.96
4	Possible natural feature	Low	7.85	0.75	0	553219.77	6273841.72
5	Possible natural feature	Low	4.21	1.82	0.01	529868.4	6266268.07
6	Debris	Medium	13.14	11.25	1	538510.2	6269456.11
7	Possible natural	Low	6.76	3.71	0.27	541312.41	6270771.5

	feature						
8	Possible natural feature	Low	8.77	0.74	0.01	548504.7	6272671.63
9	Wreck?	Medium	53.51	21.4	0.03	551769.77	6273083.08
10	Wreck	High	81.15	24.61	2.6	551845.58	6273040.08
11	Possible natural feature	Low	11.04	0.99	0.25	551271.94	6273456.19
12	Wreck	High	118.64	27.29	1	551826.17	6273287.3
13	Possible natural feature	Low	6.06	3.21	0.38	553271.21	6273635.08
14	Possible natural feature	Low	2.76	1.01	0.73	532005.74	6267052.43
15	Possible natural feature	Low	6.66	5.63	0	532583.16	6266664.11
16	Possible natural feature	Low	6.58	4.39	0.02	533715.12	6267408.95
17	Possible natural feature	Low	9.95	4.54	0.45	530808.44	6265929.21
18	Wreck	High	14.9	7.73	0.3	530669.2	6265811.37
19	Debris	High	21.03	8.79	0.07	530805.7	6265914.47
20	Possible natural feature	Low	5.91	3.67	0.08	535361.87	6268349.53
21	Possible natural feature	Low	7.99	6.78	0	535551.4	6268360.87
22	Possible natural feature	Low	10.46	6.33	0.01	534103.12	6268588.61
23	Possible natural feature	Low	10.68	4.91	0.11	533129.78	6266640.08
24	Possible natural feature	Low	9.65	8.27	0	531941.18	6266555.01
25	Possible natural feature	Low	11.58	9.88	0.01	531203.1	6265146.41
26	Debris	Medium	19.54	14.74	1.2	530682.63	6265931.99
27	Possible natural feature	Low	9.48	3.96	0.36	530240.39	6266438.2

28	Wreck	High	20.38	5.85	0.03	530747.42	6265805.99
29	Debris	Medium	9.79	2.22	0.08	524017.46	6262695.21
30	Debris	Medium	36.05	2.37	0.9	524017.93	6262306.05
31	Debris	Medium	2.85	0.72	2.3	524010.79	6262232.56
32	Debris	Medium	16.47	0.91	0.15	524068.68	6262282.91
33	Possible natural feature	Low	4.29	1.36	0.3	524159.89	6262235.59
34	Debris	Medium	13.67	2.34	0.35	524104.61	6262314.77
35	Debris	Medium	33.4	9.11	4.19	524056.05	6262263.51
36	Debris	Medium	35.47	3.19	2.39	523983.19	6262262.32
37	Debris	Medium	5.71	2.76	0.97	523993.65	6262292.03
38	Debris	Medium	12.89	2.67	0.04	524032.2	6262305.3
39	Possible natural feature	Low	27.01	2.26	0	531158.6	6265395.05
40	Possible natural feature	Low	21.99	4.03	0.13	529526.87	6264011
41	Possible natural feature	Low	34.99	0.84	0.12	526921.05	6262534.74
42	Possible natural feature	Low	10.49	7.64	0.01	517787.3	6260478.47
43	Possible natural feature	Low	21.45	2.02	0.27	529473.76	6263713.47
44	Possible natural feature	Low	6.33	4.81	0.23	529304.16	6263635.06
45	Possible natural feature	Low	5.04	4.03	0.57	525690.26	6262190.67
46	Possible natural feature	Low	35.53	0.64	0.01	526968.62	6262558.37
47	Wreck	High	14.45	7.76	0.02	530758.55	6265890.88
48	Possible natural feature	Low	17.7	4.65	0.32	528153.21	6265304.08
49	Possible natural feature	Low	23.74	5.85	0.33	526289.53	6265088.81

50	Depression?	Medium	23.31	21.99	0	527623.81	6265501.07
51	Possible natural feature	Low	4.94	1.33	0	529917.04	6266284.2
52	Possible natural feature	Low	9.97	2.86	0	526873.57	6262646.29
53	Possible natural feature	Low	5.16	1.08	0.01	530658.09	6266984.79
54	Possible natural feature	Low	11.3	1.47	0.02	525354.28	6265420.87
55	Possible natural feature	Low	13.36	2.56	0.01	523118.02	6261251.29
56	Debris	Medium	55.61	0.87	0	524363.24	6262074.76
57	Debris	Medium	41.51	2.03	0.63	523998.22	6262258.12
58	Possible natural feature	Low	7.01	5.09	0.46	525802.89	6263022.57
59	Possible natural feature	Low	3.64	3.48	1.33	526270.4	6262471.93
60	Wreck	High	14.75	3.53	1.71	530759.19	6265889.58
61	Debris	Medium	79.2	1.49	0.24	528447.65	6264285.94
62	Debris	High	19.83	5.07	5.63	524042.78	6262277.85
63	Possible natural feature	Low	14.15	10.08	1.65	521011.16	6261443.74
64	Possible natural feature	Low	4.58	2.72	0	530756.47	6265880.98
65	Debris	Medium	30.55	5.19	0.33	524025.09	6262247.04

Export Cable Route Magnetometer Targets

CA	Site Description	Geophysics Source	Potential	UTM30NmE	UTM30NmN	Sidescan Target
1	Isolated magnetic anomaly	Magnetometer	Low	6260282.6	517727.8	-
2	Isolated magnetic anomaly	Magnetometer	Low	6260936.6	517778.2	-
3	Isolated magnetic anomaly	Magnetometer	Low	6260503.3	517792.2	-
4	Isolated magnetic anomaly	Magnetometer	Low	6260965.5	517792.6	-
5	Isolated magnetic anomaly	Magnetometer	Low	6260497.7	517891.7	-
6	Isolated magnetic anomaly	Magnetometer	Low	6261942	517956.1	-
7	Isolated magnetic anomaly	Magnetometer	Low	6260839.6	519709.1	-
8	Isolated magnetic anomaly	Magnetometer	Low	6261171.5	520792.7	-
9	Isolated magnetic anomaly	Magnetometer	Low	6260641.7	520891.4	-
10	Isolated magnetic anomaly	Magnetometer	Low	6260851.8	520987.4	-
11	Isolated magnetic anomaly	Magnetometer	Low	6260875.2	521101.8	-
12	Isolated magnetic anomaly	Magnetometer	Low	6260713.1	521244	-
13	Isolated magnetic anomaly	Magnetometer	Low	6260624.2	521301.6	-
14	Isolated magnetic anomaly	Magnetometer	Low	6260657.2	521341.7	-
15	Isolated magnetic anomaly	Magnetometer	Low	6260742.1	521380.9	-
16	Isolated magnetic anomaly	Magnetometer	Low	6261053.3	521398.9	-
17	Isolated magnetic	Magnetometer	Low	6260758.1	521455	-

	anomaly					
18	Isolated magnetic anomaly	Magnetometer	Low	6260403.3	521469	-
19	Isolated magnetic anomaly	Magnetometer	Low	6261584.6	521537.3	-
20	Isolated magnetic anomaly	Magnetometer	Low	6260658.7	521554.7	-
21	Isolated magnetic anomaly	Magnetometer	Low	6261092.2	521576.3	-
22	Isolated magnetic anomaly	Magnetometer	Low	6261356.2	521651.2	-
23	Isolated magnetic anomaly	Magnetometer	Low	6260687.8	521673.9	-
24	Isolated magnetic anomaly	Magnetometer	Low	6261117.4	521688.4	-
25	Isolated magnetic anomaly	Magnetometer	Low	6261023.9	521797.3	-
26	Isolated magnetic anomaly	Magnetometer	Low	6261145.5	521826.2	-
27	Isolated magnetic anomaly	Magnetometer	Low	6260724.1	521848.6	-
28	Isolated magnetic anomaly	Magnetometer	Low	6261184.9	521970.4	-
29	Isolated magnetic anomaly	Magnetometer	Low	6261105.3	522121.7	-
30	Isolated magnetic anomaly	Magnetometer	Low	6261669.1	522205.6	-
31	Isolated magnetic anomaly	Magnetometer	Low	6260813.6	522215	-
32	Isolated magnetic anomaly	Magnetometer	Low	6261541.8	522429.9	-
33	Isolated magnetic anomaly	Magnetometer	Low	6261581.5	523115.3	-
34	Isolated magnetic anomaly	Magnetometer	Low	6261936.7	523239	-
35	Isolated magnetic anomaly	Magnetometer	Low	6262060.6	523324.2	-

36	Isolated magnetic anomaly	Magnetometer	Low	6265213.7	523326.3	-
37	Isolated magnetic anomaly	Magnetometer	Low	6261040.8	523350.6	-
38	Isolated magnetic anomaly	Magnetometer	Low	6265393.4	523402.1	-
39	Isolated magnetic anomaly	Magnetometer	Low	6260935.7	523430.9	-
40	Isolated magnetic anomaly	Magnetometer	Low	6265387.1	523449.9	-
57	Isolated magnetic anomaly	Magnetometer	Low	6265424.2	524005.1	-
60	Isolated magnetic anomaly	Magnetometer	Low	6261528.7	524320	-
61	Isolated magnetic anomaly	Magnetometer	Low	6265651.5	524367	-
62	Isolated magnetic anomaly	Magnetometer	Low	6265999.4	524418.9	-
63	Isolated magnetic anomaly	Magnetometer	Low	6266137.9	524701.3	-
64	Isolated magnetic anomaly	Magnetometer	Low	6266033.4	524737.8	-
65	Isolated magnetic anomaly	Magnetometer	Low	6265514.2	525237.1	-
66	Isolated magnetic anomaly	Magnetometer	Low	6265626.9	525412.9	-
67	Isolated magnetic anomaly	Magnetometer	Low	6265626.4	525436.6	-
68	Isolated magnetic anomaly	Magnetometer	Low	6266367.2	525601.4	-
69	Isolated magnetic anomaly	Magnetometer	Low	6266305	525601.5	-
70	Isolated magnetic anomaly	Magnetometer	Low	6266102.7	525653.5	-
71	Isolated magnetic anomaly	Magnetometer	Low	6265988.1	525992.9	-
72	Isolated magnetic	Magnetometer	Low	6262309.4	526486.7	-

	anomaly					
73	Isolated magnetic anomaly	Magnetometer	Low	6266145.3	526567.4	-
74	Isolated magnetic anomaly	Magnetometer	Low	6265138.4	526582.1	-
76	Isolated magnetic anomaly	Magnetometer	Low	6263015.7	526958.7	-
77	Isolated magnetic anomaly	Magnetometer	Low	6266296.1	527579.1	-
78	Isolated magnetic anomaly	Magnetometer	Low	6266269.2	527859.3	-
79	Isolated magnetic anomaly	Magnetometer	Low	6266358.2	528167.3	-
80	Isolated magnetic anomaly	Magnetometer	Low	6266549.9	528459.4	-
81	Isolated magnetic anomaly	Magnetometer	Low	6266855	529525.9	-
82	Isolated magnetic anomaly	Magnetometer	Low	6265883	530737.9	CR47, CR64
83	Isolated magnetic anomaly	Magnetometer	Low	6267203	531040.3	-
84	Isolated magnetic anomaly	Magnetometer	Low	6266692.9	531418.9	-
85	Isolated magnetic anomaly	Magnetometer	Low	6267765.4	533919.5	-
86	Isolated magnetic anomaly	Magnetometer	Low	6269331.5	537443.7	-
87	Isolated magnetic anomaly	Magnetometer	Low	6269056.1	537552.8	-
88	Isolated magnetic anomaly	Magnetometer	Low	6273129.5	551785.5	CR9, CR10, CR12
89	Isolated magnetic anomaly	Magnetometer	Low	6272841.5	551729.53	-
90	Isolated magnetic anomaly	Magnetometer	Low	6273173.33	554642.15	-
91	Isolated magnetic anomaly	Magnetometer	Low	6273023.69	547142.28	-

92	Isolated magnetic anomaly	Magnetometer	Low	6270415.44	540243.25	-
93	Isolated magnetic anomaly	Magnetometer	Low	6269975.82	539084.89	-
94	Isolated magnetic anomaly	Magnetometer	Low	6269470.89	538539.57	-
95	Isolated magnetic anomaly	Magnetometer	Low	6269622.95	538943.12	-
96	Isolated magnetic anomaly	Magnetometer	Low	6265037.4	531177.63	-
97	Isolated magnetic anomaly	Magnetometer	Low	6265785.01	530670.11	-
98	Isolated magnetic anomaly	Magnetometer	Low	6265651.05	530829.34	-
99	Isolated magnetic anomaly	Magnetometer	Low	6265501.79	530965.1	-
100	Isolated magnetic anomaly	Magnetometer	Low	6265339.13	531088.95	-
101	Isolated magnetic anomaly	Magnetometer	Low	6265193.24	531225.09	-
102	Isolated magnetic anomaly	Magnetometer	Low	6265109.16	531272.95	-
103	Isolated magnetic anomaly	Magnetometer	Low	6266420.65	530394.51	-
104	Isolated magnetic anomaly	Magnetometer	Low	6266813.15	530283.53	-
105	Isolated magnetic anomaly	Magnetometer	Low	6262298.11	524117.37	CR34
106	Isolated magnetic anomaly	Magnetometer	Low	6262027.03	524016.08	-
107	Isolated magnetic anomaly	Magnetometer	Low	6265755.01	524499.59	-
108	Isolated magnetic anomaly	Magnetometer	Low	6265714.52	523540.74	-
109	Isolated magnetic anomaly	Magnetometer	Low	6265349.61	524668.17	-
110	Isolated magnetic	Magnetometer	Low	6267157.73	530052.92	-

	anomaly					
111	Isolated magnetic anomaly	Magnetometer	Low	6267430.07	531957.81	-
112	Isolated magnetic anomaly	Magnetometer	Low	6266943.61	533526.41	-
113	Isolated magnetic anomaly	Magnetometer	Low	6273262.48	552383.27	-

APPENDIX 5- KEY ONSHORE RECEPTORS

Scheduled Monuments in 25k buffer

INDEX NO	NAME	NGR	In ZTV
985	Benholm Castle, tower	380409, 770428	n
5918	Anniston Mill, unenclosed settlement	368270, 748403	Mostly n
161	St Murdoch's Chapel	370319, 747955	y
547	Gourdon Hill, long cairn	381808, 770657	y
2862	Corbie Knowe, cairn	369186, 748916	y
2875	Castle Rock, fort, Auchmithie	368195, 744157	y
2876	Lud Castle, fort	368029, 743424	y
2925	Red Castle, Lunan Bay	368780, 751073	y
5143	The Cloch, cairn	378120, 767942	y
5318	Bridgeton Hill, cairn	378140, 767473	y
5586	West Mains of Ethie, fort	369274, 746003	y
5587	Prail Castle, fort	369681, 746437	y
5591	Buckiemill, fort	369657, 752564	y
5611	Ethie Mains, fort	370129, 747399	y
5913	Newbarns, enclosures, souterrains and ring ditches	368440, 749313	y
5914	Newbarns Cottages, enclosure, pits and cropmarks	367935, 749272	y
5915	Newbarns, settlement	368759, 748869	y
5916	Newbarns, settlement	368486, 748885	y
5917	Newbarns, enclosure and cropmarks	368204, 748755	y
6104	Fisherhills, barrow cemetery	372864, 762165	y
6217	Newbarns, settlement, souterrains and cursus	368718, 749439	y
6218	West Mains, enclosure	368322, 750810	y
6361	Newbarns Smithy, settlement, souterrain and cropmarks	368026, 749006	y
6404	Red Castle, barrows	368730, 750863	y
9743	St Cyrus, Old Parish Church	375047, 764778	y

5912	Newbarns, square barrow, enclosure and cropmarks	368234, 749115	y

Category A Listed Buildings in 25km Buffer

HBNUM	Address	NGR	In ZTV
2807	Benholm Castle	380405, 770430	n
11278	Ethie Castle	368736, 746844	n
2805	Mill Of Benholm	380621, 769077	y
2813	Kirktown Of Benholm, Former Parish Church Including Graveyard, Boundary Walls, Gatepiers And Gates	380438, 769251	y
4964	Usan House	372210, 755227	y
4972	Dunninald Castle	370343, 754271	y
4979	Kirkton Of Craig, Kirk Tower House	370369, 755785	y
11273	Red Castle - Enceinte	368783, 751079	y
11274	Red Castle - Keep.	368783, 751079	y
35070	Old Bervie Bridge Over Bervie Water	383151, 772909	y
38041	174 High Street (Holly House) Including Boundary Walls	371404, 757765	y
38046	190 High Street, The Retreat, Including Boundary Walls	371395, 757733	y
38051	214 And 216 High Street, Public Library Including Boundary Walls	371370, 757674	y
38083	High Street, Town House	371452, 757791	y
38084	High Street, Montrose Parish Church (Church Of Scotland), Including Churchyard, Boundary Walls And Gatepiers	371465, 757756	y
38095	10 Castle Place, Straton House Including Boundary Walls	371421, 757602	y
38112	Bridge Street, Montrose Infirmary, Including Ancillary Structures To North, And Boundary Walls And Gatepiers To Bridge Street	371044, 757439	y
38195	1-8 (Inclusive Nos) Panmure Terrace Including Boundary Walls	371647, 757767	y
38204	Provost Scott's Road, St Mary's And St Peter's Episcopal Church Including Churchyard, Boundary	371729, 757772	y

	Walls, Gatepiers And Gates.		
38212	Eastern Road And Paton's Lane, Chapel Works Or Bond (Centre Buildings) To Paton's Lane	371871, 757735	y
38228	Montrose Air Station Building 48	371764, 759263	y
45197	Bell Rock Lighthouse	376165, 726808	y

Historic gardens and designed landscapes in 25km buffer

HGDL ID	Site Name	In ZTV
157	Dunninald	y

Conservation Areas in 25km buffer

Name	NGR	In ZTV
Johnshaven	379711, 767081	y
Auchmithie	368112, 744322	y
Ferryden	371884, 756720	n
Montrose	371635, 757940	y

Scheduled Monuments in 35km buffer

INDEX NO	NAME	NGR	In ZTV
145	Arbirlot, symbol stone, The Manse	360130, 740378	y
155	Kinnell, symbol stone	360898, 750249	n
166	Braikie Castle	362850, 750892	y
862	Gallows Knowe, cairn	367077, 759539	y
986	Dunnottar Castle	388107, 783875	y
2231	Fordoun, homestead moat	373548, 777030	n

2834	Drumnagair, ring enclosure	368335, 768333	n
2872	Maiden Castle, fort	366890, 742032	y
2873	Maryton Law, cairn	368165, 755567	y
2874	Dickmount Law, cairn	365481, 743557	y
2989	Church of Pert	364983, 766055	n
3313	Canterland, cairn	370602, 765343	y
3339	Cairn of Arthurhouse	376132, 774752	n
4317	North Water Bridge, Bridgend	365269, 766131	n
4376	Dun, Roman Camp	368876, 759551	y
4509	Blackhill Wood, long cairn and cairn	379627, 781771	n
4534	Hillhead, long cairn	379559, 776807	y
4545	Fordhouse, barrow	366581, 760521	y
4574	Bruxie Hill, long cairn	382325, 780542	y
4681	Glenskinno, burial mound	368174, 760873	y
4754	Montgoldrum, cairns & hut circle	381701, 777204	y
4820	Montgoldrum, cairn	382018, 777352	n
4823	Witch Hillock, burial mound and stone setting	364408, 767336	y
4849	Gallow Hill, cairn	386438, 784866	n
5168	Erskine's Knap, burial mound	373798,	n

		773454	
5315	Cairn of Shiels, cairn	374742, 771754	y
5449	Kirktown of Fetteresso, settlement	385206, 786236	n
5555	St Ciaran's Church,old parish church, Fetteresso	385290, 785660	n
5584	Cowie Chapel, chapel	388427, 787312	y
5936	Marykirk, old parish church and burial ground	368652, 765548	n
5948	Bryanton, enclosure	365558, 748490	y
5978	Priestfield, palisaded homestead and ring ditches	367337, 748899	y
5979	Ironshill, palisaded enclosure	367503, 749531	y
5980	Ironshill, settlement and enclosures	367281, 750061	y
5981	Ironshill, palisaded enclosures and cropmarks	367756, 750292	y
5983	Douglasmuir, ring ditch, enclosure and pits	360837, 749274	y
5984	Boysack, barrow cemetery	361798, 749400	n
5985	Invergighty Cottage, barrow cemetery N of Boysack	362079, 749583	n
5986	Boysack, enclosures, ring ditches and souterrains	361954, 748909	y
5987	Chapelton, settlement	362133, 748437	mostly n
5988	Leys of Boysack, ring ditch	361545, 747429	n
5989	Leys of Boysack, palisaded enclosure	361816, 747498	n
5990	Templeton, ring ditches	362048, 747223	n

5991	Templeton, palisaded enclosure	362274, 747129	n
5998	Damside Cottages, pit circle and pit alignments	357764, 749411	n
6041	Balneaves Cottage, cursus and funerary remains	360694, 749558	mostly y
6042	Hatton Mill, ring ditch and souterrains	361743, 750123	n
6055	Ironshill, ring ditch	366909, 749893	y
6056	Ironshill, enclosures, ring ditches and cropmarks	367065, 750003	y
6057	Ironshill, palisaded homesteads, enclosures and ring ditches	367302, 749708	y
6089	Damside Cottages, souterrain	357915, 749621	n
6090	Damside Cottages, settlement	358088, 749587	n
6091	Pitmuies Mill Farm, ring ditch	358563, 749940	y
6092	Friock Mains, enclosure and pit alignment	358591, 749344	mostly n
6093	Cairn Knap, cairn	359317, 749012	y
6094	Balwyllo, enclosures and cropmarks	365201, 758779	y
6095	Gilrivie, unenclosed settlement	368222, 759510	y
6096	Gilrivie, enclosures	368616, 759726	y
6097	Gilrivie, enclosure and barrow	368493, 759938	y
6098	Pugeston, unenclosed settlement	368837, 759965	y
6099	Newbigging, unenclosed settlement and palisaded enclosure	369565, 759609	y
6100	Newbigging, enclosures, ring ditches and souterrain	369311,	y

		759515	
6101	Newbigging, ring ditches	369807, 759327	y
6102	Little Kinnaber, palisaded enclosure	372595, 762095	y
6103	Fisherhills, fort	372755, 762188	mostly n
6117	Powis, cursus, barrows and enclosures	366356, 757051	mostly y
6118	Powis Farm, barrows	366367, 756807	mostly n
6119	Old Montrose, enclosure and ring ditches	366595, 756744	n
6120	Dun Mill, palisaded enclosure and ring ditch	366263, 759536	y
6121	West Broomley, ring ditches	367370, 759621	y
6124	West Mains of Colliston, enclosure	360609, 746295	n
6125	Colliston Castle, enclosure, souterrain, ring ditches & pit alignment	360913, 746477	n
6126	Templeton, ring ditch and cropmarks	362058, 746686	n
6130	West Mains of Colliston, enclosure	360168, 746282	y
6131	Newton of Boysack, ring ditches, pit circle and souterrain	360908, 746723	n
6132	Dubton, unenclosed settlement	370251, 760668	mostly y
6133	Dubton, unenclosed settlement	370520, 760712	y
6134	Dryleys, souterrain	370652, 760869	y
6135	Dryleys, ring ditch	370504, 761054	y
6237	Denhead Cottage, enclosure	368879, 755466	y

6282	Milton of Guthrie, cursus	359052, 750016	y
6283	Hawkhill Quarry, ring ditches	367655, 751960	y
6312	Kinnells Mill, cairn	360484, 750189	n
6317	Hatton Mill, enclosure	361075, 750216	n
6362	Arrat, Hospital of St Mary Magdalene	364809, 759020	y
6363	Arrat's Mill, ring ditches	364739, 758860	y
6378	Brae of Pert, ring ditch	364372, 764444	y
6392	Brae of Pert, enclosure	363946, 765190	n
6395	Balbirnie Mill, enclosure	363503, 758594	y
6396	Kincraig, enclosure and ring ditch	362994, 758855	y
6397	Wood Cottage, unenclosed settlement	362689, 757522	y
6398	Kinnaird Castle, enclosure	363143, 757271	y
6399	Arrat's Mill, settlement	364640, 758584	y
6400	Powmouth, settlement	364906, 757536	n
6435	Tower of Johnston, cairn and tower	372672, 769181	y
6611	West Scryne, settlement	357586, 736603	y
6612	Craigmill, enclosures	357679, 736119	y
6614	Craigmill, enclosure	357921, 736007	y
6615	East Scryne Hall, rectangular enclosure	358579,	y

		736623	
6616	East Scryne, souterrain	358409, 737340	y
6617	Hatton Farm, unenclosed settlement	358663, 737530	y
6618	Hatton House, ring ditches	359149, 736863	y
6619	Mains of Kelly, souterrain	359103, 739151	y
6620	Mains of Kelly, enclosures	359215, 739357	y
6621	Mains of Kelly, enclosure	359611, 739078	y
6622	Mains of Kelly, enclosures and souterrain	359881, 738875	y
6623	Nether Kelly, ring ditch	359939, 738511	y
6624	Nether Kelly, unenclosed settlement	359681, 738177	y
6625	Kellyfield, palisaded enclosure	358453, 740431	y
6641	Eastern Cemetery, Arbroath, souterrain	364391, 742275	y
6648	Peasiehill, souterrains Bank	360758, 740457	y
6649	David's Hill, enclosure	363135, 743872	n
7068	Cotton of Balcathie, unenclosed settlement	360085, 738887	y
7071	Cotton of Balcathie, unenclosed settlement	360304, 738838	y
7072	Grahamston Cottages, souterrains	360000, 739778	y
8943	Arbroath, Hospitalfield, site of Hospital of St John the Baptist	362569, 740288	y
9742	Castle of Cowie	388374, 787148	y

10344	Church of Logie, 210m NE of Mains of Logie	370557, 763517	50/50
90018	Arbroath Abbey and associated buildings, including the Abbot's House	364332, 741290	n
90272	St Vigean's Museum, symbol stones	363828, 742942	n

Listed Buildings in 35km

HBNUM	Address	NGR	In ZTV
31	Arbuthnott House, North Bridge Over Arbuthnott Burn	379504, 775146	n
2876	Arbuthnott Parish Kirk	380155, 774645	n
2880	Arbuthnott House	379498, 775071	n
4770	St. Vigeans Parish Kirk	363842, 742912	n
11165	Gallery	367319, 765612	n
11170	Upper North Water Bridge	365271, 766139	n
11177	Marykirk Bridge	368597, 765008	n
11178	Marykirk Bridge, Tollhouse.	368549, 764977	n
11497	Farnell Parish Kirk	362738, 755425	n
11501	Farnell Castle	362429, 755488	n
12325	Braikie Castle	362846, 750893	n
13891	Marykirk Bridge Over River North Esk	368597, 765008	n
13892	Upper North Water Bridge	365271, 766139	n
16278	Balmanno House, Including Outbuildings Garden Walls And	369137,	n

	Coachhouse	766508	
17762	House Of Kinnaber	372560, 761751	n
21131	Arbroath Abbey - Conventual Building	364277, 741297	n
21132	Arbroath Abbey - Pend	364236, 741299	n
21133	Arbroath Abbey - Regality Tower	364210, 741286	n
21134	Arbroath Abbey - Abbot's House	364276, 741275	n
21141	Dens Road, Baltic Works (Former Arbroath Warehouse Limited Bond Number 1)	363947, 741474	n
41552	Arbuthnott Street, St James The Great Episcopal Church Including Boundary Walls, Gatepiers And Gates	387332, 785710	n
41576	Bath Street, Fetteresso (Church Of Scotland)	386902, 786388	n
41593	85 Cameron Street, Carronbank House Including Terraced Garden, Boundary Walls, Gatepiers And Gates	386750, 785714	n
41638	Keith Place, Rivendell, Former Textile Yard Including Sea Wall	387721, 785557	n
41655	Old Pier, Old Tolbooth Of Stonehaven Including Boundary Walls And Gates	387804, 785521	n
50209	Logie Schoolhouse, Former U.F. Church	369808, 763554	n
2878	Allardyce Castle	381736, 773947	y
2879	Allardyce Castle - Gate Piers	381729, 773932	y
2898	Dunnottar Castle - Keep	388047, 783857	y
2919	Dunnottar Castle - Entrance Gateway And Guardrooms	388038, 783883	y
2920	Dunnottar Castle - Benholms Lodgings	388028, 783884	y
4677	Bridge Of Dun	366272, 758424	y

4691	House Of Dun (Hotel)	367043, 759881	y
4692	House Of Dun Court Of Offices	366984, 759872	y
4984	Craig House	370285, 756243	y
4985	Craig House - Entrance Gateway	370333, 756217	y
6753	Castle Of Fiddes	382427, 781286	y
9371	Fetteresso Castle - Doocot	384386, 785391	y
16289	Inglismaldie Castle, Dovecot	364228, 766573	y
16328	Forebank House Including Steading Outbuildings, Garden Walls Railings And Gates	370095, 764722	y
16330	Lower North Water Bridge Over North Esk, Including Approaches	372458, 762178	y
21130	Arbroath Abbey - Abbey Church And Precincts	364311, 741334	y
21230	Ladyloan, Bell Rock Lighthouse Signal Tower And Entrance Lodges	364051, 740447	y
21250	The Elms	363205, 741750	y
21252	Mortuary Chapel - Western Cemetery	362480, 741770	y
21253	Hospital Field	362583, 740431	y

APPENDIX 6- LEGISLATIVE FRAMEWORK AND GUIDANCE

Marine (Scotland) Act 2010

The Marine Scotland Act 2010 contains a new power which allows Scottish Ministers to designate Marine Protected Areas (MPAs). This provides greater flexibility for Ministers to use area-based measures to conserve marine biodiversity as well as nationally important historic assets such as historic shipwrecks. The new power broadens the scope of what types of historic asset can be protected if they are of national importance and allows Scottish Ministers to target protection and management according to the preservation objectives of each Historic MPA.

Protection of Wrecks Act 1973

The *Protection of Wrecks Act 1973* enables the Secretary of State to protect wreck sites from unauthorized interference if they are of historic, archaeological or artistic importance. Under the Act it is an offence to carry out certain activities in a defined area surrounding the site, unless a license for those activities has been obtained from the Government. Section One of the PWA is administered by Historic Scotland (HS) in Scottish territoraial waters. This *Act also* provides protection for wrecks that are designated as dangerous due to their contents and is administered by the Maritime and Coastguard Agency (MCA) through the Receiver of Wreck (ROW). It is possible that a dangerous wreck designated under this section might also be of archaeological or historic interest.

The Protection of Military Remains Act 1986

Under the *Protection of Military Remains Act 1986* the Ministry of Defence has powers to protect vessels that were in military service when they were wrecked. The MOD can designate named vessels as Protected Places even if the position of the wreck is not known. In addition, the MOD can designate Controlled Sites around wrecks whose position is known. In the case of Protected Places, the vessel must have been lost after the 4th August 1914, whereas in the case of a wreck protected as Controlled Sites, no more than 200 years must have elapsed since loss (MOD 2001).It is an offence to tamper with, damage, move or remove sensitive remains. However, diving, salvage and excavation are all prohibited on Controlled Sites, although licences for restricted activities can be sought from the MOD. Additionally, it is an offence to carry out unauthorized excavations for the purpose of discovering whether any place in UK waters contains remains of a vessel which has crashed, sunk or been stranded while in military service. It is worth noting that under the *Protection of Military Remains Act 1986*, all aircraft that have crashed in military service automatically constitute a Protected Place.

Merchant Shipping Act 1995

The *Merchant Shipping Act 1995* (MSA 1995) is used to regulate the reporting and disposal of wreck, including wreck of archaeological interest found or recovered from UK waters, or found or recovered outside UK waters but brought within those waters. Within the context of the MSA 1995, wreck refers to flotsam, jetsam, derelict and lagan found in or on the shores of the sea or any tidal water. It includes ships, aircraft and hovercraft, parts of these, their cargo and equipment. All wreck that is found or taken into possession must be notified to the

Receiver of Wreck by the finder. The wreck is then delivered to the Receiver, or, more commonly, held by the finder to the order of the Receiver. The ownership and disposal of wreck is decided according to procedures contained within the MSA 1995. Provision is made for original owners to come forward to claim their property. Ownership of unclaimed wreck from within territorial waters lies with the Crown or in a person to whom rights of wreck have previously been granted by the Crown. The Receiver has a duty to ensure that finders who report their finds as required receive an appropriate salvage payment. In the case of material considered to be of historic or archaeological importance, a suitable museum is asked to buy the material at the current valuation and the finder receives the net proceeds of the sale as a salvage payment. If the right to, or the amount of salvage cannot be agreed, either between owner and finder or between competing salvors, the Receiver will hold the wreck until the matter is settled, either through amicable agreement or by court judgement.

Code of Practice for Seabed Development produced by The Joint Nautical Archaeology Policy Committee (Joint Nautical Archaeology Policy Committee, 2008)

Produced by The Joint Nautical Archaeology Policy Committee this document sets out a best practice model for seabed development in the UK, both within and beyond the remit of the formal Environmental Impact Assessment process.

Protocol for Archaeological Discoveries. Offshore Renewable Projects (The Crown Estate and Wessex Archaeology, 2011)

Based on a model developed and used by the marine aggregates industry in England since 2005, this Protocol sets in place a mechanism for reporting archaeological material found during offshore renewable energy development in the UK. Protocols for archaeological discoveries are recommended as a system for monitoring archaeological finds or those unexpected or incidental finds relating to the historic environment. The relevant regulator and archaeological curator for notifications of archaeological finds in Scottish waters is Historic Scotland

Ancient Monuments and Archaeological Areas Act 1979

The main legislation concerning archaeological remains in the UK is the *Ancient Monuments and Archaeological Areas Act 1979*. This Act primarily deals with land sites but there is provision to designate sites of vessels in territorial waters as Scheduled Monuments. Monuments are defined by the AMAA 1979 as including buildings, structures, works, caves, excavations, vehicles, vessels, aircraft or other movable structures. Monuments can only be scheduled if they are of national importance. Section 53extends the AMAA 1979 to monuments situated in, on or under the seabed within UK territorial waters. Once a monument has been scheduled, visiting or diving on the site is not necessarily restricted. It is, however, an offence to demolish, destroy, alter or repair the monument without prior authorisation, in the form of Scheduled Monument Consent.

Scottish Planning Policy (2010)

Scottish Planning Policy is a statement of the Scottish Government's policy on nationally important land use and planning matters and supersedes and consolidates National Planning Policy Guidelines, including Planning Advice Note 42: Archaeology and Planning and SPP 23 – Planning and the Historic Environment. The 2010 SPP encompasses a broad

range of planning matters including coastal planning and renewable energy. In regard to archaeology it specifically states that,

Archaeological sites and monuments are an important, finite and non-renewable resource and should be protected and preserved in situ wherever feasible. The presence and potential presence of archaeological assets should be considered by planning authorities when allocating sites in the development plan and when making decisions on planning applications. Where preservation in-situ is not possible planning authorities should, through the use of conditions or a legal agreement, ensure that developers undertake appropriate excavation, recording, analysis, publication and archiving before and/or during development. If archaeological discoveries are made during any development, a professional archaeologist should be given access to inspect and record them.

Conserving the Underwater Heritage. Historic Scotland Operational Policy Papers (Historic Scotland, 1999)

Historic Scotland is responsible for archaeological and built heritage matters with a remit which includes the seabed to the limit of territorial waters (12 nautical miles). Conserving the Underwater Heritage sets out Historic Scotland's key policies and objectives in regard to the protection of underwater heritage and its long term future. The document is aimed at those in the planning and development industry who may already be aware of the standards expected for terrestrial archaeology.

Listed Buildings and Conservation Areas (Scotland) Act 1997

Listed Buildings are defined as buildings of special architectural or historic interest in the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 (as amended). The Act states that "the planning authority, in determining any application for planning permission for development that affects a listed building or its setting, is required to have special regard to the desirability of preserving the building, or its setting, or any features of special architectural or historic interest which it possesses." (Section 59(1)).

Planning Advice Note 2/2011

PAN 2/2011 provides advice regarding archaeology and the planning process. It highlights that archaeology is a finite resource that is important because of its potential to aid our understanding of the past and its contribution to the quality of everyday life. It provides information on the types of information that may be required in order to support a planning application. The document indicates that preservation in situ is the preferred option, but that the desirability of this must be weighed against all other material considerations in determining the planning application; where preservation in situ is not possible preservation by record should be secured through a planning condition.

International and European Legislation for Marine Cultural Heritage

International law is represented by customary law and the conventions to which the UK are party. The United Nations Convention on the Law of the Sea 1982 (UNCLOS 1982), the European Convention on the Protection of the Archaeological Heritage (Revised) 1992 (the Valletta Convention) and the UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001 (UNESCO 2001) are all relevant in this regard.

UNCLOS 1982 was ratified the UK in 1997. Article 303 stipulates that 'states have the duty to protect objects of an archaeological and historical nature found at sea and shall co-operate for this purpose'. Article 303 also provides for coastal states to exert a degree of control over the archaeological heritage to 24 nautical miles, though no measures have been introduced to implement this right.

The Valletta Convention, ratified by the UK in 2000 and brought into force in 2001, bounds Scotland to implement protective measures for archaeological heritage within the Scottish jurisdiction, including sea areas. Insofar as the state exerts jurisdiction over the Continental Shelf, then it would appear that the provisions of the Valletta Convention apply to those jurisdictions.

The UNESCO Convention 2001 is a comprehensive attempt to codify the law internationally in respect of the underwater archaeological heritage. Although the UK abstained in the vote on the final draft of the Convention, it has stated that it supports most of the articles, particularly the provisions in the Annex governing the conduct of archaeological investigations.

The International Council on Monuments and Sites (ICOMOS) Charter on the Protection and Management of Underwater Cultural Heritage 1996 (the Sofia Charter) includes a series of statements regarding best practice, intending 'to ensure that all investigations are explicit in their aims, methodology and anticipated results so that the intention of each project is transparent to all'. The UK is a member of ICOMOS.