Awel y Môr Offshore Wind Farm

Category 6: Environmental Statement

Volume 2, Chapter 11: Offshore Archaeology and Cultural Heritage

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Glossary of terms

TERM	DEFINITION
Significance	Significance is the value of a heritage asset to this and future generations because of its heritage interest, which may be archaeological, architectural, artistic or historic.
Setting	The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance, or may be neutral.
Adaptability	The degree to which a receptor can avoid or adapt to an effect.
Tolerance	The ability of a receptor to accommodate temporary or permanent change without significant adverse impact.
Recoverability	The temporal scale over and extent to which a receptor will recover following an effect.
Value	A measure of the receptor's importance, rarity and worth.
Physical surroundings and Views	Physical surroundings and Views include the physical presence of the asset on the seabed, its surroundings, and relationship with other assets and navigational hazards in the immediate area. Views to and from the asset, and how the asset is experienced in its immediate physical surroundings are also considered.
Non-visual factors	Non-visual factors include the way the asset is appreciated in a broader historical, artistic and

TERM	DEFINITION
	intellectual capacity, and the asset's associations. Typically, we would contend that where scheme infrastructure such as turbines and their foundations are not intervisible with the asset due to turbidity then anyone diving on the asset would not experience a material change in the setting of that asset.

Abbreviations and acronyms

TERM	DEFINITION
AyM	The Project. Referred to as Awel y Môr Offshore Wind Farm (AyM OWF) and AyM thereafter.
AEZ	Archaeological Exclusion Zone
AfL	Agreement for Lease
AoS	Area of Search
AONB	Area of Outstanding Natural Beauty
BEIS	Department for Business, Energy and Industrial Strategy
Cadw	National Agency for Conservation of the Historic Environment (NB: this is not an acronym so is not capitalised).
CCBC	Conwy County Borough Council
CEA	Cumulative Effects Assessment
CIfA	Chartered Institute for Archaeologists
CO_2	Carbon dioxide
DCC	Denbighshire County Council

TERM	DEFINITION
DCLG	Former Department of Communities and Local Government. Now the Ministry of Housing, Communities and Local Government (MHCLG).
Defra	Department for Environment, Food and Rural Affairs.
DfT	Department for Transport
DTI	Department of Trade and Industry
ECC	Export Cable Corridor
ECR	Export Cable Route (either offshore ECR or onshore ECR).
HER	Historic Environment record
HSC	Historic Seascape Characterisation
LGM	Last Glacial Maximum
MCA	Marine Character Area
MCAA	Marine and Coastal Access Act (2009)
MDS	Maximum Design Scenario
MHCLG	Ministry of Housing, Communities and Local Government (formerly DCLG)
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MoD	Ministry of Defence
NMRW	National Monuments Record of Wales
NRW	Natural Resources Wales
NSIP	Nationally Significant Infrastructure Project

TERM	DEFINITION
OnSS	Onshore Substation
ORPAD	Offshore Renewables Protocol for Archaeological Discoveries
OSP	Offshore Substation Platform
PAD	Protocol for Archaeological Discoveries
PINS	The Planning Inspectorate
SAR	Search and Rescue (not SaR)
TJB	Transition Joint Bay
UKHO	United Kingdom Hydrographic Office
UXO	Unexploded Ordnance (not UXB)
WSI	Written Scheme of Investigation
WTG	Wind Turbine Generator

11 Offshore Archaeology and Cultural Heritage

11.1 Introduction

1 This Chapter of the Environmental Statement (ES) presents the results of the Environmental Impact Assessment (EIA) of the offshore elements of the Awel y Môr Offshore Wind Farm (hereafter referred to as 'AyM') relevant to offshore archaeology and cultural heritage during its construction, Operation & Maintenance (O&M) and decommissioning. A separate assessment has been undertaken for the archaeological assessment of the onshore development, as detailed in Volume 3, Chapter 8: Onshore Archaeology and Cultural Heritage (application ref: 6.3.8). This chapter should be read in conjunction with the scheme description provided in:

- Volume 2, Chapter 1: Offshore Project Description (application ref: 6.2.1);
- Volume 1, Chapter 3: EIA Methodology (application ref: 6.1.3);
- Volume 2, Chapter 3: Marine Water and Sediment Quality (application ref: 6.2.3);
- Volume 3, Chapter 8: Onshore Archaeology and Cultural Heritage (application ref: 6.3.8);
- Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1)[1];
- Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes Technical Annex (application ref: 6.2.2); and
- Volume 2, Chapter 10: SLVIA (application ref: 6.2.10).

[1] Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1) is as submitted at PEIR and as such includes illustrations of the Order Limits as presented at that time; the final Order Limits are as presented in this chapter.

2 The marine archaeological technical report comprises a desk-based study of the environmental baseline for offshore archaeology within the study area, which encompasses the proposed development footprint, as well as an archaeological assessment of geophysical and geotechnical data.

3 This chapter provides a summary of the technical report, and covers the submerged cultural heritage resource, including palaeogeography, shipwrecks, aircraft, geophysical anomalies, Historic Seascape Characterisation (HSC), and the potential for previously unknown sites. It provides an assessment of the value and setting of the resource, as well as potential impacts and significance of effects. The marine element comprises the area offshore up to the Mean High Water Spring (MHWS) but the majority of the intertidal area will be dealt with by the Onshore chapter (Volume 3, Chapter 8: Onshore Archaeology and Cultural Heritage (application ref: 6.3.8).

11.2 Statutory and policy context

4 AyM OWF is located in Welsh territorial waters. Cadw is the Welsh Government's historic environment service and is responsible for the archaeological resource within Wales's Territorial Waters (from MLWS to the 12 nautical miles (NM) limit). A marine licence is required under the Marine and Coastal Access Act 2009 before carrying out any licensable marine activity. Under the devolution agreement, a marine licence must be applied for separately in Welsh waters (i.e. not deemed within the DCO). The responsibility for marine licencing in Wales lies with the Welsh Government, but day-to-day authority has been delegated to NRW. The marine licence application requires this EIA to be carried out under the Marine Works (EIA Regulations) 2007 (as amended).

5 Planning Policy Wales (2021) states that "*It is important that the planning system looks to protect, conserve and enhance the significance of historic assets. This will include consideration of the setting of an historic asset which might extend beyond its curtilage. Any change that impacts on an historic asset or its setting should be managed in a sensitive and sustainable way. It is the responsibility of all those with an interest in the planning system, including planning authorities, applicants, developers and communities, to appropriately care for the historic environment in their area. The protection, conservation and enhancement of historic assets is most effective when it is considered at the earliest stage of plan preparation or when designing new proposals.*"

6 The Government's policy for the delivery of major energy infrastructure is set out in the Overarching National Policy Statement for Energy (EN-1) (Department of Energy & Climate Change (DECC), 2011a), and the National Policy Statement for Renewable Energy Infrastructure (EN-3) (DECC, 2011b). These include statements about potential effects on cultural heritage.

7 In addition to the current NPS, draft NPSs were consulted upon by the Department for Business, Energy and Industrial Strategy (BEIS). The draft NPSs have been reviewed to determine the emerging expectations and changes from previous iterations of the NPSs. This includes the Draft Overarching NPS EN-1 (BEIS, 2021a) and EN-3 (BEIS, 2021b).

8 A more detailed explanation of how the revised NPSs are being dealt with across the ES can be found in Volume 1, Chapter 2: Policy and Legislation.

9 Specifically, the guidance within NPS EN-1 was considered, which identifies that the construction, operation and decommissioning of energy infrastructure has the potential to result in adverse impacts on the historic environment above, at and below the surface of the ground. The historic environment includes all aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, landscaped and planted or managed flora (paragraph 5.9.1 and paragraph 5.9.2 in the Draft NPS EN-1). The draft NPS (paragraph 5.9.5 in the Draft NPS EN-1 and paragraph 2.53.6 in the Draft NPS EN-3) specifically notes the following:

- The Secretary of State should also consider the impacts on other non-designated heritage assets on the basis of clear evidence that such heritage assets have a significance that merits consideration in that process, even though those assets are of lesser significance than designated heritage assets; and
- The ability of the applicants to microsite specific elements of the proposed development during the construction phase should be an important consideration by the Secretary of State when assessing the risk of damage to archaeology.

10 Relevant legislation and policy are outlined in Table 1.

Table 1: Legislation and policy context.

LEGISLATION/ POLICY	KEY PROVISIONS	SECTION WHERE COMMENT ADDRESSED
National Policy Statement (NPS) for Energy (EN-1)	Paragraph 5.8.8: The applicant should provide a description of the significance of the heritage assets affected by the proposed development and the contribution of their setting to that significance.	The significance of offshore heritage assets has been discussed in Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment, Section 5 (application ref: 6.4.11.1).
Draft NPS EN-1	Paragraph 5.9.11: The applicant should provide a description of the significance of the heritage assets affected by the proposed development and the contribution of their setting to that significance.	
NPS EN-1	Paragraph 5.8.9: Where a development site includes, or the available evidence suggests it has the potential to include, heritage assets with an archaeological interest, the applicant should carry out appropriate desk-based assessment and, where such desk-based research is insufficient to properly assess the interest, a field evaluation.	A desk-based assessment has been undertaken to assess the archaeological interest of offshore heritage interests (Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1)) and summarised in section 11.8 of this report.
Draft NPS EN-1	Paragraph 5.9.12: Where a development site includes, or the available evidence suggests it has the potential to include, heritage assets with an archaeological interest, the applicant should carry out appropriate desk-based assessment and,	

LEGISLATION/ POLICY	KEY PROVISIONS	SECTION WHERE COMMENT ADDRESSED
	where such desk-based research is insufficient to properly assess the interest, a field evaluation.	
NPS EN-1	Paragraph 5.8.10: The applicant should ensure that the extent of the impact of the proposed development on the significance of any heritage assets affected can be adequately understood from the application and supporting documents.	The significance of the offshore heritage assets is included in Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1). The impact of the development is discussed in sections 11.11 – 11.14 of this report.
Draft NPS EN-1	Paragraph 5.9.13: The applicant should ensure that the extent of the impact of the proposed development on the significance of any heritage assets affected can be adequately understood from the application and supporting documents.	
NPS EN-3	Paragraph 2.6.32: The Infrastructure Planning Commission (IPC) or Secretary of State (draft NPS) will need to be satisfied that the foundations will not have an unacceptable adverse effect on marine heritage assets.	In order to address potential adverse effects, mitigation measures have been designed to protect any marine archaeological receptors of interest. With the implementation of the mitigation measures all effects should be reduced to minor adverse significance or minor to moderate beneficial significance. Sections 11.11 to 11.13 and Table 9 of this report.
Draft NPS EN-3	Paragraph 2.57.8: The Infrastructure Planning Commission (IPC) or Secretary of State (draft NPS) will need to be satisfied that the foundations will not	

LEGISLATION/ POLICY	KEY PROVISIONS	SECTION WHERE COMMENT ADDRESSED
	have an unacceptable adverse effect on marine heritage assets.	
NPS EN-3	Paragraph 2.6.139: Heritage assets can be affected by Offshore Wind Farm (OWF) development in two principal ways: from the direct effect of the physical siting of the development itself and from indirect changes to the physical marine environment.	These potential effects have been assessed in sections to 11.13 of this report.
Draft NPS EN-3	Paragraph 2.32.3: Heritage assets can be affected by Offshore Wind Farm (OWF) development in two principal ways: from the direct effect of the physical siting of the development itself and from indirect changes to the physical marine environment.	
NPS EN-3	Paragraph 2.6.140: Consultation with relevant statutory consultees (including Cadw) should be undertaken by the applicants at an early stage of the development.	Consultation has been undertaken with Cadw. Table 2 of this report.
Draft NPS EN-3	Paragraph 2.32.4: Consultation with relevant statutory consultees (including Cadw) should be	

LEGISLATION/ POLICY	KEY PROVISIONS	SECTION WHERE COMMENT ADDRESSED
	undertaken by the applicants at an early stage of the development.	
NPS EN-3	Paragraph 2.6.141: Assessment should be undertaken as set out in Section 5.8 of EN-1. Desk-based studies should take into account any geotechnical or geophysical surveys that have been undertaken to aid the wind farm design.	An archaeological assessment of geophysical survey data was undertaken for Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment of the ES (application ref: 6.4.11.1) and are summarised in Section 11.8 of this report.
Draft NPS EN-3	Paragraph 2.32.5: Assessment should be undertaken as set out in Section 5.8 of EN-1. Desk-based studies should take into account any geotechnical or geophysical surveys that have been undertaken to aid the wind farm design.	
NPS EN-3	Paragraph 2.6.142: Assessment should include the identification of any beneficial effects on the historic marine environment, for example through improved access or the contribution to new knowledge that arises from investigation.	Beneficial effects have been identified in Sections 11.11 to 11.3 and Table 9 of this report.
Draft NPS EN-3	Paragraph 2.32.6: Assessment should include the identification of any beneficial effects on the historic marine environment, for example through	

LEGISLATION/ POLICY	KEY PROVISIONS	SECTION WHERE COMMENT ADDRESSED
	improved access or the contribution to new knowledge that arises from investigation.	
NPS EN-3	Paragraph 2.6.143: Where elements of an application (whether offshore or onshore) interact with features of historic maritime significance that are located onshore, the effects should be assessed in accordance with the policy at Section 5.8 in EN-1.	The effects have been assessed in Section 11.8.3 of this report and in Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1), Section 6.
Draft NPS EN-3	Paragraph 2.32.7: Where elements of an application (whether offshore or onshore) interact with features of historic maritime significance that are located onshore, the effects should be assessed in accordance with the policy at Section 5.8 in EN-1.	
NPS EN-3	Paragraph 2.6.144: IPC or Secretary of State (draft) should be satisfied that OWFs and associated infrastructure have been designed sensitively taking into account known heritage assets and their status (for example designated features).	In order to address potential adverse effects, mitigation measures have been designed to protect any marine archaeological receptors of interest. With the implementation of the mitigation measures all effects should be reduced to minor negative significance or minor to
Draft NPS EN-3	Paragraph 2.53.7: IPC or Secretary of State (draft) should be satisfied that OWFs and associated	

LEGISLATION/ POLICY	KEY PROVISIONS	SECTION WHERE COMMENT ADDRESSED
	infrastructure have been designed sensitively taking into account known heritage assets and their status (for example designated features).	moderate beneficial significance. Section 11.10 and Table 12 of this report.
NPS EN-3	Paragraph 2.6.145: Avoidance of important heritage assets, including archaeological sites and historic wrecks, is the most effective form of protection *in situ* (draft) and can be achieved through the implementation of AEZ around such heritage assets which preclude development activities within their boundaries.	Avoidance will be achieved through the recommendation of AEZs, as outlined in the mitigation measures. The AEZs have been designed to protect any marine archaeological receptors of interest. Section 11.10 and Table 9 of this report.
Draft NPS EN-3	Paragraph 2.32.8: Avoidance of important heritage assets, including archaeological sites and historic wrecks, is the most effective form of protection *in situ* (draft) and can be achieved through the implementation of AEZ around such heritage assets which preclude development activities within their boundaries.	
NPS EN-3	Paragraph 2.6.146: Where requested by applicants, IPC or Secretary of State (draft) should consider granting consents that allow for micro-siting to be undertaken within a specified tolerance. This allows	Micro-siting is recommended in the mitigation measures, that have been designed to protect any marine

LEGISLATION/ POLICY	KEY PROVISIONS	SECTION WHERE COMMENT ADDRESSED
	changing to be made to the precise location of infrastructure during the construction phase so that account can be taken of unforeseen circumstances such as the discovery of marine archaeological remains.	archaeological receptors of interest. Section 11.10 of this report.
Draft NPS EN-3	Paragraph 2.32.9: Where requested by applicants, IPC or Secretary of State (draft) should consider granting consents that allow for micro-siting to be undertaken within a specified tolerance. This allows changing to be made to the precise location of infrastructure during the construction phase so that account can be taken of unforeseen circumstances such as the discovery of marine archaeological remains.	
Welsh National Marine Plan (2019);	Policy SOC_05: Historic assets Proposals should demonstrate how potential impacts on historic assets and their settings have been taken into consideration and should, in order of preference: a. avoid adverse impacts on historic assets and their settings; and/or	Avoidance will be achieved through the recommendation of AEZs, as outlined in the mitigation measures. The AEZs have been designed to protect any marine archaeological receptors of interest. Section 11.10 and Table 9 of this report.

LEGISLATION/ POLICY	KEY PROVISIONS	SECTION WHERE COMMENT ADDRESSED
	b. minimise impacts where they cannot be avoided; and/ or c. mitigate impacts where they cannot be minimised.	The minimisation and mitigation of impacts have been assessed for each phase in Section 11.11 Environmental assessment.
Future Wales: The National Plan 2040 (2021)	Managing the North's outstanding historic and natural resources is a priority for the region. Outstanding places include the coast and the Llŷn peninsula, Snowdonia National Park, and the Clwydian Range and Dee Valley Area of Outstanding Natural Beauty; and the Pontcysyllte Aqueduct and Canal and the Castles and Town Walls of King Edward World Heritage Site. They should be protected for the enjoyment of future generations and help to provide economic benefits for the region's communities. The region's distinctive heritage should be preserved and enhanced by high quality development.	Section 11.10 and Table 9 of this report outlines mitigation measures needed to preserve any archaeological or historical assets.
Planning Policy Wales Edition 11 (2021)	6.123 The planning system recognises the need to conserve archaeological remains. The conservation of archaeological remains and their settings is a	Avoidance will be achieved through the recommendation of AEZs, as outlined in the mitigation measures. The AEZs have

LEGISLATION/ POLICY	KEY PROVISIONS	SECTION WHERE COMMENT ADDRESSED
	material consideration in determining planning applications, whether those remains are a scheduled monument or not. 6.124 Where nationally important archaeological remains and their settings are likely to be affected by proposed development, there should be a presumption in favour of their physical protection in situ.	been designed to protect any marine archaeological receptors of interest. Section 11.10 and Table 9 of this report.
Marine and Coastal Areas Act 2009 - Marine Policy Statement (MPS), 2011	Marine licensing and marine planning made the responsibility of the NRW.	The NRW is responsible for licensing, regulating and planning marine activities. Section 11.2 of this report.
Protection of Wrecks Act 1973: Section One and Two	This Act allows the Secretary of State (SoS) to designate a restricted area around a wreck to prevent uncontrolled interference.	There are no protected wrecks within the study area. Section 11.8 of this report. The mitigation measures have been designed to protect any marine

LEGISLATION/ POLICY	KEY PROVISIONS	SECTION WHERE COMMENT ADDRESSED
		archaeological receptors of interest. Section 11.10 of this report.
Ancient Monuments and Archaeological Areas Act 1979 (as amended)	Under this Act, the SoS for Digital, Culture, Media and Sport (DCMS) can schedule any site which appears to be of national importance because of its historic, architectural traditional, artistic or archaeological interest. Additional controls are placed upon works affecting Scheduled Monuments and Areas of Archaeological Importance under the Act.	There are no Scheduled Monuments or designated Areas of Archaeological Importance within the study area. Section 11.8 of this report.
Protection of Military Remains Act 1986	This Act provides protection for designated military vessels and for and for all aircraft that crashed while in military service. The Act provides two types of protection: Protected Places (wrecks designated by name even if the location is not known) and Controlled Sites (sites designated by location). It is illegal to disturb or remove anything from sites. For Controlled Sites, it is illegal to conduct any operations (including diving or excavation) within	There are no aircraft crash sites within the study area. Section 11.8 of this report. The fuselage of an Avro Anson Bomber aircraft (2004) was recorded in the offshore Export Cable Corridor (offshore ECC) however no aircraft remains were discovered. Paragraph 102 of this report.

LEGISLATION/ POLICY	KEY PROVISIONS	SECTION WHERE COMMENT ADDRESSED
	the Controlled Site unless licensed to do so by the Ministry of Defence.	
Merchant Shipping Act 1995	This Act sets out the procedures for determining ownership of underwater finds that turn out to be 'wreck', including ship, aircraft, hovercraft, parts of these, their cargo or equipment. Any recovered material must be reported to the Receiver of Wreck.	The mitigation measures have been designed to protect any marine archaeological receptors of interest. Archaeological Exclusion Zones (AEZ) are recommended around known features of anthropogenic origin of archaeological interest (A1 anomalies) and historic records of archaeological material (A3 anomalies). Section 11.10.2 and Table 9. Any discoveries of unexpected material will be reported through the Protocol for Archaeological Discoveries (PAD) and reported to the Receiver of Wreck. Section 11.10.6 of this report.

11 The following guidance also applies:

- Marine Character Areas (NRW 2015);
- Caring for Coastal Heritage (Cadw 1999);
- Caring for Military Sites of the Twentieth Century (Cadw 2009);
- Managing the Marine Historic Environment of Wales (Cadw 2020);
- Conservation Principles for the Sustainable Management of the Historic Environment in Wales (Cadw 2011);
- JNAPC Code of Practice for Seabed Development (Joint Nautical Archaeology Policy Committee and The Crown Estate 2006);
- Historic Environment Guidance for Offshore Renewable Energy Sector (Wessex Archaeology 2007);
- Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (Oxford Archaeology 2008);
- Cumulative Impact Assessment Guidelines: Guiding Principles for Cumulative Impacts Assessment in Offshore Wind Farms (RenewableUK 2013);
- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for Renewable Energy Sector (Fugro EMU Ltd 2011);
- Protocol for Archaeological Discoveries: Offshore Renewables Projects ('ORPAD') (The Crown Estate 2014);
- Our Seas – A shared resource: High level marine objectives (DEFRA 2009);
- Archaeological Written Schemes of Investigation for Offshore Windfarm Projects (The Crown Estate and Wessex Archaeology 2021);
- Marine Geophysics Data Acquisition, Processing and Interpretation Guidance Notes (English Heritage and Bates, R., Dix, J. K., Plets, R. 2013);
- Department of Trade and Industry, Guidance on the Assessment of the Impact of Offshore Wind Farms: Seascape and Visual Impact Report (2005); and

- Standard and guidance for historic environment desk-based assessment (CIFA 2020)

11.3 Consultation and scoping

12 Consultation has been undertaken, between the Applicant and NRW, Cadw, Snowdonia National Park, Anglesey County Council, Gwynedd Council, Conwy County Council and Clwyd Powys Archaeological Trust through the Evidence Plan process via the offshore archaeology Expert Topic Group (ETG), discussing the offshore archaeology and cultural heritage, and the general approaches to the offshore assessment.

13 In addition, responses to scoping were received in October 2020 (Table 2).

14 The principal issues arising from the PINS Scoping Opinion were that PINS did not agree to scoping out a number of impacts and identified additional impacts for consideration. In addition, it was noted that the recommended mitigation of Written Scheme of Investigation (WSI) and the Protocol for Archaeological Discoveries (PAD) are not in themselves mitigation measures but rather methods for assessing the effects of the Proposed Development which should inform the mitigation options.

15 The main issues arising from consultation were that the marine archaeological dataset at scoping was incomplete and needed to be informed by archaeological assessment of geophysical and geotechnical data in order to develop effective mitigation measures, such as AEZs. In addition, the WSI and PAD do not constitute mitigation in themselves, but rather through their implementation. Additional issues discussed included the level of resolution of geophysical survey data and the use of Welsh guidance for setting.

16 Responses to the PEIR were mainly focused on the Intertidal area with regards to a more thorough walk-over survey taking place. This was undertaken by the Onshore team and included in Volume 3, Chapter 8: Onshore Archaeology and Cultural Heritage (application ref: 6.3.8). The ETG meeting also reiterated the same concerns while RCAHMW said that he had no especial concerns.

Table 2: Summary of consultation relating to offshore archaeology and cultural heritage.

DATE AND CONSULTATION PHASE/ TYPE	CONSULTATION AND KEY ISSUES RAISED	SECTION WHERE COMMENT ADDRESSED
June 2020 Scoping Opinion paragraph 4.11.1	The Inspectorate does not agree to scope out removal of sediment containing undisturbed archaeological contexts during construction.	11.9 Key parameters for assessment Table 8
June 2020 Scoping Opinion paragraph 4.11.2	The Inspectorate does not agree to scope out piling disturbing archaeological contexts leading to partial or total loss of the receptor during construction.	11.9 Key parameters for assessment Table 8
June 2020 Scoping Opinion paragraph 4.11.3	The Inspectorate does not agree to scope out compression of stratigraphic contexts containing archaeological material during construction.	11.9 Key parameters for assessment Table 8
June 2020 Scoping Opinion paragraph 4.11.4	The Inspectorate does not agree to scope out disturbance of sediment containing potential archaeological receptors during cable installation during construction.	11.9 Key parameters for assessment Table 8
June 2020	The Inspectorate does not agree to scope out total or partial loss of archaeological receptors during construction from jack-up legs and vessel anchors.	11.9 Key parameters for assessment

DATE AND CONSULTATION PHASE/ TYPE	CONSULTATION AND KEY ISSUES RAISED	SECTION WHERE COMMENT ADDRESSED
Scoping Opinion paragraph 4.11.5		Table 8
June 2020 Scoping Opinion paragraph 4.11.6	The Scoping Report identifies potential impacts from scour effects from WTG foundations, cables and cable protection. Given that the location of these structures is not yet known, it appears that there is a potential for scour effects to extend beyond the proposed study area.	11.12 Environmental assessment: operational phase Section 11.12.2
June 2020 Scoping Opinion paragraph 4.11.7	The Inspectorate notes the advice from the archaeological advisers for the Isle of Anglesey County Council and Conwy Borough Council that OWSI & PAD are not mitigation measures but rather methods for assessing the effects of the Proposed Development which should inform the mitigation options. The Applicant should make effort to agree necessary mitigation measures with relevant consultation bodies.	Section 11.10 Mitigation measures See Sections 11.10.1 and 11.10.6 for detailed description of mitigation.
10/06/2020 Scoping Opinion	Cadw indicated that details about the marine archaeological resource were incomplete, and that mitigation measures, such as AEZs could only be confirmed once the marine archaeological resource had been fully defined.	The archaeological baseline within section 5 of Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref:

DATE AND CONSULTATION PHASE/ TYPE	CONSULTATION AND KEY ISSUES RAISED	SECTION WHERE COMMENT ADDRESSED
		6.4.11.1) completes the description of the archaeological resource as far as we're able. The archaeological assessment of geophysical data has been incorporated within the baseline. A geoarchaeological assessment is recommended as further mitigation in the WSI. Section 11.10 Mitigation measures Table 9 See section 11.10.2 for detailed description of mitigation.
2/06/2020 Scoping Opinion	CPAT indicated that the archaeological assessment needs to be informed by data from geophysical and geotechnical survey data in order to develop effective mitigation measures.	The archaeological assessment of geophysical data has been incorporated

DATE AND CONSULTATION PHASE/ TYPE	CONSULTATION AND KEY ISSUES RAISED	SECTION WHERE COMMENT ADDRESSED
	The WSI is not mitigation in itself, but instead drives the assessment process. The Protocol for Archaeological Discoveries should be informed by the prior assessment and would drive the mitigation options but is not mitigation in itself.	within the baseline. A geoarchaeological assessment, informed by the archaeological assessment of sub-bottom profiler data, is recommended mitigation to be included in the WSI. Section 11.10 Mitigation measures See Sections 11.10.1 and 11.10.6 for detailed description of mitigation.
1/06/2020 Scoping Opinion	Gwynedd Archaeological Planning Service indicated that the assessment of geophysical and geotechnical data are required at the assessment stage as well as continuing throughout the project, in order to support mitigation measures such as the development of AEZs. The WSI and Protocol for Archaeological Discoveries do not constitute mitigation ends in themselves, rather they provide the framework for implementing mitigation actions.	Section 11.10 Mitigation measures See Sections 11.10.1, 11.10.2 and 11.10.6 for detailed description of mitigation.

DATE AND CONSULTATION PHASE/ TYPE	CONSULTATION AND KEY ISSUES RAISED	SECTION WHERE COMMENT ADDRESSED
1/06/2020 Scoping Opinion	Gwynedd Archaeological Planning Service also noted that the potential impacts to be scoped out can all be considered reasonable risks to archaeology from the proposed development. Whether information from assessment enables design solutions to be adopted and whether this eliminates impact or reduces it to a less than significant level, the evidence and decision-making process leading to this conclusion needs to be set out in the EIA	Section 251 Summary of effects. Table 12
27/01/2021 Cultural heritage and Archaeology ETG Meeting	Cadw wanted further information about whether the geophysical survey data was of high enough resolution for archaeological assessment, and was assured by Wessex Archaeology that the specifications had been reviewed	Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1) Section 3.4
27/01/2021 Cultural heritage and Archaeology ETG Meeting	Cadw pointed out that the Welsh guidance for setting should be followed	11.4 Scope and methodology Since these meetings, the assessment of offshore setting and the offshore archaeology and cultural heritage methodology statements

DATE AND CONSULTATION PHASE/ TYPE	CONSULTATION AND KEY ISSUES RAISED	SECTION WHERE COMMENT ADDRESSED
		have been submitted for agreement.
11/10/2021 Section 42 consultation Denbighshire County Council	Denbighshire County Council said that the CPAT comments set out referred to the Offshore chapter rather than the Onshore chapter.	Section 11.8.3 Landfall – The assessment and mitigation of the intertidal area is presented in Volume 3, Chapter 8: Onshore Archaeology and Cultural Heritage (application ref: 6.3.8) and WSI (application ref: 8.14).
11/10/2021 Section 42 consultation Cadw	Cadw has serious concerns about the Environmental Impact Assessment (EIA) which we note is incomplete. In particular, we note that 30% of the proposed walkover survey for terrestrial archaeology has not been completed and the survey on the intertidal area is also incomplete. The geophysical survey has also only been undertaken on some 65% of the area required. However, the results of this work are essential if any sub-surface archaeological sites are to be identified and the need for further investigative work, including archaeological evaluation,	Section 11.8.3 Landfall – The assessment and mitigation of the intertidal area is presented in Volume 3, Chapter 8: Onshore Archaeology and Cultural Heritage (application ref: 6.3.8) and WSI (application ref: 8.14).

DATE AND CONSULTATION PHASE/ TYPE	CONSULTATION AND KEY ISSUES RAISED	SECTION WHERE COMMENT ADDRESSED
	carried out. The failure to complete these aspects is contrary to section 5.8.10 of National Policy Statement EN-1 which states that any application should contain sufficient information to allow heritage significance to be understood. The surveys must therefore be completed so that the impact of the proposed development on the historic environment can be understood.	
12/10/2021 RCAHMW	From the point of view of the offshore element I didn't have any comments to make as it all appeared in order, and I conveyed this to Neil. I know that he had some comments on the inter-tidal area and the wider setting. Although our remit for planning is low tide and outwards, my job at the RCAHMW means that I do tend to look at the inter-tidal as well, as our overall remit is nationwide, but I had no especial concerns in that area either.	Section 11.8.3 Landfall – The assessment and mitigation of the intertidal area is presented in Volume 3, Chapter 8: Onshore Archaeology and Cultural Heritage (application ref: 6.3.8) and WSI (application ref: 8.14).
18/10/2021 ETG8 meeting	The assessment and mitigation of the intertidal area will be done by an Onshore WSI as the geotechnical investigations that are being done in the intertidal zone, the contractor and the methodologies are likely to be working in the intertidal and the	Section 11.8.3 Landfall – The assessment and mitigation of the intertidal area will be done by the Onshore team.

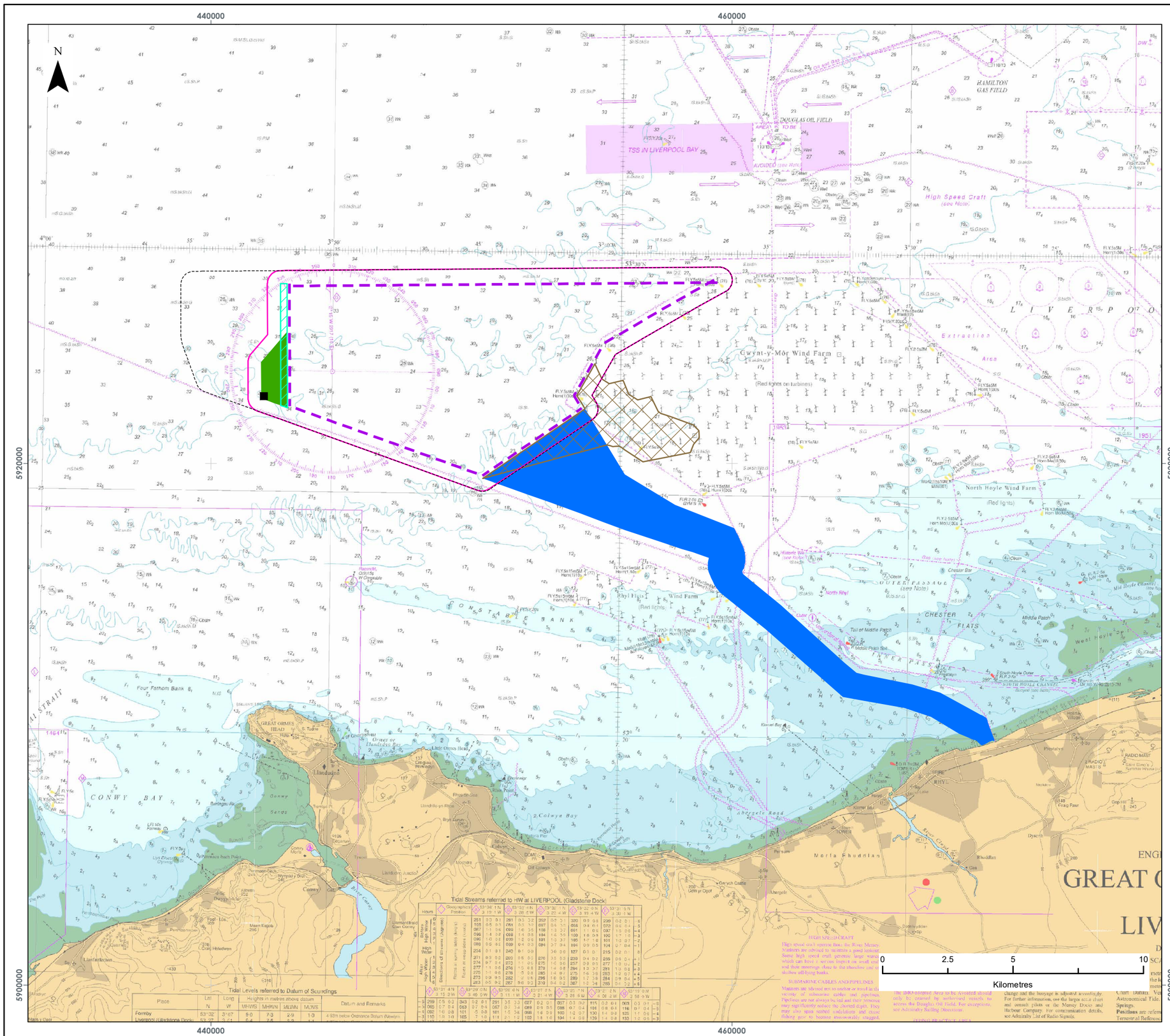
DATE AND CONSULTATION PHASE/ TYPE	CONSULTATION AND KEY ISSUES RAISED	SECTION WHERE COMMENT ADDRESSED
	adjacent onshore areas, so it is felt it best sits with the Onshore team.	

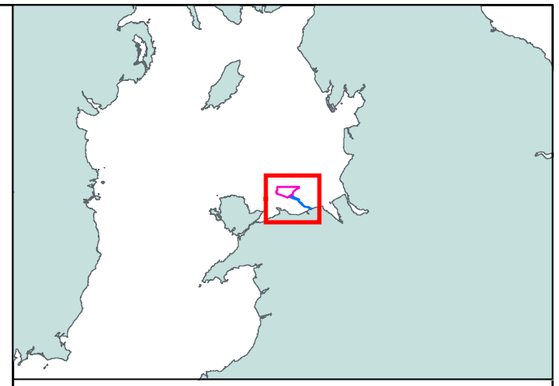
11.4 Scope and methodology

17 The array area of AyM OWF will cover approximately 78 km² with a cable corridor running from the east of the array up to and including the intertidal zone defined as ending at MHWS. The grid connection will be made at Bodelwyddan in Denbighshire and export cables will be buried between the landfall and the grid connection.

18 The methodology employed during this assessment reflects the requirements of EIA as set out in European Council Directive 85/ 337/ EEC as named by Directive 97/ 11/ EC and follows best practice professional guidance outlined by the CIfA's Standard and guidance for Historic Environment Desk-Based Assessment (2014, updated 2020).

19 The study area comprises the array area, the offshore ECC, other wind farm infrastructure zone, subsea infrastructure and temporary works interlink zone, a500 m buffer around the combined array area and infrastructure zones and a wider buffer representing the geophysical reporting extent (Figure 1). With regards to terrestrial features in the intertidal zone, only sites and material within the Site Investigation Boundary to MHWS are discussed.





LEGEND

- Met Mast Location
- Array Area
- Subsea Infrastructure and Temporary Works
- Other Wind Farm Infrastructure Zone
- Array and Infrastructure Zones buffer
- Geophysical reporting extent
- AyM to GyM interlink
- Offshore Export Cable Corridor

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

Study Area

VER	DATE	REMARKS	Drawn	Checked
1	14/02/2022	For Issue	KJF	LR

FIGURE NUMBER:

Figure 1

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:150,000	A3	WGS84	UTM30N

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

20 Baseline data searches for marine archaeology and cultural heritage associated with the development included data from the United Kingdom Hydrographic Office (UKHO), the National Heritage List (Cadw), Coflein, Lle, Receiver of Wreck, NRW, the relevant county Historic Environment Record(s) (HER) particularly from Gwynedd Archaeological Trust and Clwyd-Powys Archaeological Trust, relevant mapping including Admiralty Charts, historic maps and Ordnance Survey, Welsh Research Frameworks and relevant documentary sources and grey literature held by Wessex Archaeology, and those available through the Archaeological Data Service and other websites.

21 The data used to compile the marine archaeological technical report (Appendix 4 of Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1)) consisted of secondary information derived from a variety of sources. The assumption made, as with all archaeological assessments in the offshore area, is that the data, and any additional information, are reasonably accurate. The records held by the UKHO, NMRW, relevant HERs and other sources used for the assessment are not a record of all the surviving cultural heritage assets, but rather a record of those that have been discovered. The information therefore is not complete and does not preclude the subsequent discovery of further elements of the marine historic environment that are, at present, unknown.

22 The review of secondary information was supplemented with the archaeological assessment of geophysical data. This was primarily based on new data acquired from the site by Fugro Marine GB Ltd. in 2020, comprising sidescan sonar, multibeam echosounder, marine magnetometer, and sub-bottom profiler data sets. The extents of the geophysical study areas are illustrated in (Figure 1). A full outline of the assessed data and the geophysical assessment methodology is provided in the marine archaeological technical report (Wessex Archaeology 2021a). Additional geophysical information was obtained from the results of the previous archaeological assessment of geophysical data from the adjacent Gwynt y Môr (hereafter referred to as 'GyM') OWF (Wessex Archaeology 2012).

23 In accordance with guidance (Wessex Archaeology 2008), each wreck is assessed on a case-by-case basis, in order to take into account the full range of criteria for assessing value (such as period, rarity, documentation, group value, survival/ condition, potential, build, use, loss, and investigation), however it is also possible to provide a broad assessment of the sites, based on date categories defined by the Marine Class Description and principles of selection.

24 The approach for the assessment of setting of historic assets as laid out in Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1) follows relevant guidance and is the subject of a document detailing the methodology that was submitted to and agreed with the stakeholders. It is based on the baseline assessment of the palaeogeography, terrestrial, maritime and aviation assets, and is described using the following two factors; Physical surroundings and View, and Non-visual factors.

25 The main themes relevant to the offshore archaeological baseline are: palaeogeography; seabed features, including shipwrecks and aviation sites; and historic seascape character.

26 Where possible, data with positional information were incorporated into a project Geographic Information System (GIS) using ArcGIS 10.6. The data were subsequently compiled into gazetteers of the archaeological resources within the study area. The NMRW and HER records have been discriminated between records for which there is known material on the seabed, and 'recorded losses' (vessels that are known to have been lost, but do not, except by chance, have material on the seabed at their recorded loss location). Records of terrestrial sites in the intertidal zone, from the NMRW and HER datasets, were given 1,000 numbers, and are compiled in a gazetteer (Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1) Appendix 7). The records with known material on the seabed, were given 70,000 numbers, and are included in the 'wrecks and obstructions' gazetteer along with data from the UKHO (Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1) Appendix 4). The recorded losses are in a separate gazetteer (Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1) Appendix 6) and have been used to assess the potential for further discoveries. Information relating to the offshore archaeology and cultural heritage that did not include location or positional information was used to inform the marine archaeological baseline assessment where relevant.

27 A palaeogeographic baseline, including both background geology and prehistoric archaeological potential, has been produced and is presented in Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1).

28 The baseline for palaeogeography was based on a review of geological mapping of seabed sediments and Quaternary geology from published British Geological Society sources, alongside the results from previous regional academic and industry studies from the wider Irish Sea area. This has been enhanced with the geophysical data assessed for the AyM project. This review, alongside the known archaeological record, formed the basis for assessing the potential for submerged prehistory.

29 The baseline for terrestrial, maritime and aviation archaeology was assessed by reviewing records of known features, wrecks, casualties, and seabed features obtained from the UKHO, NMRW and HERs. The baseline assessment of maritime and aviation archaeology was further supplemented by a review of relevant primary and secondary source material in order to provide an indication on the nature of maritime and aviation activity across the region, and the results of the review of geophysical survey data. It provides a background to assess the potential for further discoveries.

30 As noted in the MPS (DEFRA, 2011: 21), there is no legal definition of 'seascape' in the UK, but the European Landscape Convention defines landscape as 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/ or human factors', and therefore, seascape is taken to mean landscapes with views of coasts or seas, and coasts and seas with cultural, historical and archaeological links with each other. A HSC was undertaken by NRW in 2015 and included a series of individual Marine Characterisation Plans (*National Seascape Assessment for Wales* 2015), and this assessment is based on that work.

11.5 Cumulative impact methodology

31 Cumulative environmental assessment has been undertaken in accordance with guidelines issued by RenewableUK, Cumulative Impact Assessment Guidelines – Guiding principles for cumulative impacts assessment in offshore wind farms (2013), the Guidance for Assessment of Cumulative Impacts on the Historic Environment (Oxford Archaeology, 2008), and Advice Note 17: Cumulative Effects Assessment (PINS, 2015). The cumulative environmental assessment has been undertaken in section 13.14.

32 Cumulative impacts are considered to identify potentially significant impacts of the development in-combination or cumulatively with other projects or activities. Cumulative impacts are defined as those that result from additive impacts caused by present and reasonably foreseeable actions.

33 Cumulative impacts may therefore occur to archaeological receptors that have the potential to be incrementally impacted by other existing, consented and/ or proposed developments or activities. These impacts may be seen individually as minor, but collectively as significant. The emphasis in this assessment is on potentially significant impacts, rather than on any impact that could possibly occur.

34 The cumulative impact assessment has been undertaken within a three-tier approach, based on the current stage of each project within the planning and development process (as discussed in more detail in Section 13.14). The assessment of cumulative impact considered whether impacts on a receptor can occur on a cumulative basis between AyM and other projects, within a 50 km radius. The boundary for assessment was developed based on best practice and through discussions with Cadw, as the offshore archaeological curator.

35 The types of impact assessed include: direct impact to offshore archaeological receptors; indirect impacts arising as a result of changes to sedimentary and erosion regimes; and indirect effects.

36 Archaeological receptors are known shipwrecks, aircraft crash sites and findspots, paleogeographic landscapes and buried and unknown archaeology. The receptors related to wrecks, aircraft, findspots and buried and unknown archaeology are those that are impacted by the works while buried and unknown archaeology is most at risk. Paleogeographic landscapes are a much wider scale receptor as they tend to span over a larger area and therefore any damage to these may be localised.

11.6 Assessment criteria and assignment of significance

37 In order for the significance of any given impact to be fully understood, the sensitivity of any receptors that may be impacted need to be considered. The capability of a receptor to accommodate change and its ability to recover if affected is a function of its sensitivity. Receptor sensitivity is typically assessed via the following factors:

- Adaptability – the degree to which a receptor can avoid or adapt to an effect;

- Tolerance – the ability of a receptor to accommodate temporary or permanent change without significant adverse impact;
- Recoverability – the temporal scale over and extent to which a receptor will recover following an effect; and
- Value – a measure of the receptor's importance, rarity and worth.

38 The MPS notes that heritage assets are 'a finite and often irreplaceable resource and can be vulnerable to a wide range of human activities and natural processes' (DEFRA, 2011: 21). It goes on to note that in considering the significance of heritage assets and their setting, the assessment 'should take into account the particular nature of the interest in the assets and the value they hold for this and future generations. This understanding should be applied to avoid or minimise conflict between conservation of that significance and any proposals for development' (*ibid*: 22).

39 As archaeological receptors cannot adapt, tolerate or recover from physical impacts caused by a proposed development, for the purpose of this assessment, the sensitivity of each asset will be quantified only by its value.

40 The UK Marine Policy also notes that it is desirable to sustain and enhance the significance of heritage assets, and any development should adopt a general presumption in favour of the conservation of designated heritage assets within an appropriate setting (*ibid*).

41 The *Overarching National Policy Statement for Energy* (EN-1) (DECC, 2011) notes that 'there should be a presumption in favour of the conservation of designated heritage assets and the more significant the designated heritage asset, the greater the presumption in favour of its conservation should be.' However, there are very few designated archaeological sites offshore, and non-designated sites are not necessarily of lesser value. Therefore, non-designated assets that can be demonstrated to be of equivalent value to designated sites are considered to be of equivalent significance to a designated asset for the purpose of this assessment.

42 There are a number of criteria for assessing a heritage asset's value, and these are considered in detail in Section 3.5 of Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1)

43 The nature of the archaeological resource is such that there is a high level of uncertainty concerning the distribution of potential, unknown archaeological remains on the seabed. It is often the case that data concerning the nature and extent of sites is out of date, extremely limited or entirely lacking. As a precautionary measure, unknown potential cultural heritage receptors are therefore considered to be of high sensitivity and high value.

44 The sensitivity/ importance of the marine archaeology and cultural heritage is defined in Table 3.

Table 3: Sensitivity/ importance of the environment.

SENSITIVITY/ IMPORTANCE	DEFINITION
High	Best known or above average example and/ or high potential to contribute to knowledge and understanding and/ or outreach. Receptors with a demonstrable international or national dimension to their importance are likely to fall within this category. Wrecked ships and aircraft that are protected under the Protection of Wrecks Act 1973, Ancient Monuments and Archaeological Areas Act 1979 or Protection of Military Remains Act 1986 with an international dimension to their importance, plus as-yet undesignated sites that are demonstrably of equivalent archaeological value. Known submerged prehistoric sites and landscapes with the confirmed presence of largely in situ artefactual material. Palaeogeographic features with demonstrable potential to include artefactual and/or palaeoenvironmental material, possibly as part of a prehistoric site or landscape.
Medium	Average example and/ or moderate potential to contribute to knowledge and understanding and/ or outreach.

SENSITIVITY/ IMPORTANCE	DEFINITION
	Receptors with a demonstrable district level dimension to their importance are likely to fall within this category. Includes wrecks of ships and aircraft that do not have statutory protection or equivalent significance, but have moderate potential based on a formal assessment of their importance in terms of build, use, loss, survival and investigation. Prehistoric deposits with moderate potential to contribute to an understanding of the palaeoenvironment.
Low	Below average example and/ or low potential to contribute to knowledge and understanding and/ or outreach. Receptors with a demonstrable local/ district dimension to their importance are likely to fall within this category.
Negligible	Poor example and/ or little or no potential to contribute to knowledge and understanding and/ or outreach. Assets with little or no surviving archaeological interest.

45

46 The magnitude of an effect upon known and potential marine archaeological receptors has been considered between very low and very high, and is defined by the following factors:

- Extent – the area over which an effect occurs;
- Duration – the time for which the effect occurs;
- Frequency – how often the effect occurs; and
- Severity – the degree of change relative to existing environmental conditions.

47 Magnitude of impact is defined in Table 4.

Table 4: Impact magnitude definitions.

MAGNITUDE	DEFINITION
High	Total or considerable loss of or alteration to key elements or features of the pre-development conditions, such that the post-development character of the archaeological heritage asset would be fundamentally or considerably changed. For beneficial – total or considerable protection and understanding gained from key elements or features above and beyond the pre-development conditions, such that the post-development character of the archaeological heritage asset would be fundamentally better understood.
Medium	Loss of or alteration to key elements or features of the pre-development conditions, such that the post-project character of the archaeological heritage asset would be partially changed. For beneficial – protection and understanding gained from key elements or features above the pre-development conditions, such that the post-development character of the archaeological heritage asset would be considerably better understood.
Low	Minor alteration from pre-development conditions.
Negligible	No or unquantifiable change to pre-development conditions.

48 The matrix in Table 5 combines the magnitude of impact (from Table 4) and sensitivity/importance of the offshore archaeological receptors (from Table 3) in order to determine the effect significance. Effects of major or moderate adverse significance are considered 'significant' in terms of the EIA Regulations.

Table 5: Matrix to determine effect significance.

		SENSITIVITY			
		HIGH	MEDIUM	LOW	NEGLIGIBLE
ADVERSE MAGNITUDE	HIGH	Major	Major	Moderate	Minor
	MEDIUM	Major	Moderate	Minor	Negligible
	LOW	Moderate	Minor	Minor	Negligible
	NEGLIGIBLE	Minor	Minor	Negligible	Negligible
BENEFICIAL MAGNITUDE	NEGLIGIBLE	Minor	Minor	Negligible	Negligible
	LOW	Moderate	Minor	Minor	Negligible
	MEDIUM	Major	Moderate	Minor	Negligible
	HIGH	Major	Major	Moderate	Minor

Note: Effects of 'moderate' significance or greater are defined as significant with regard to the EIA Regulations.

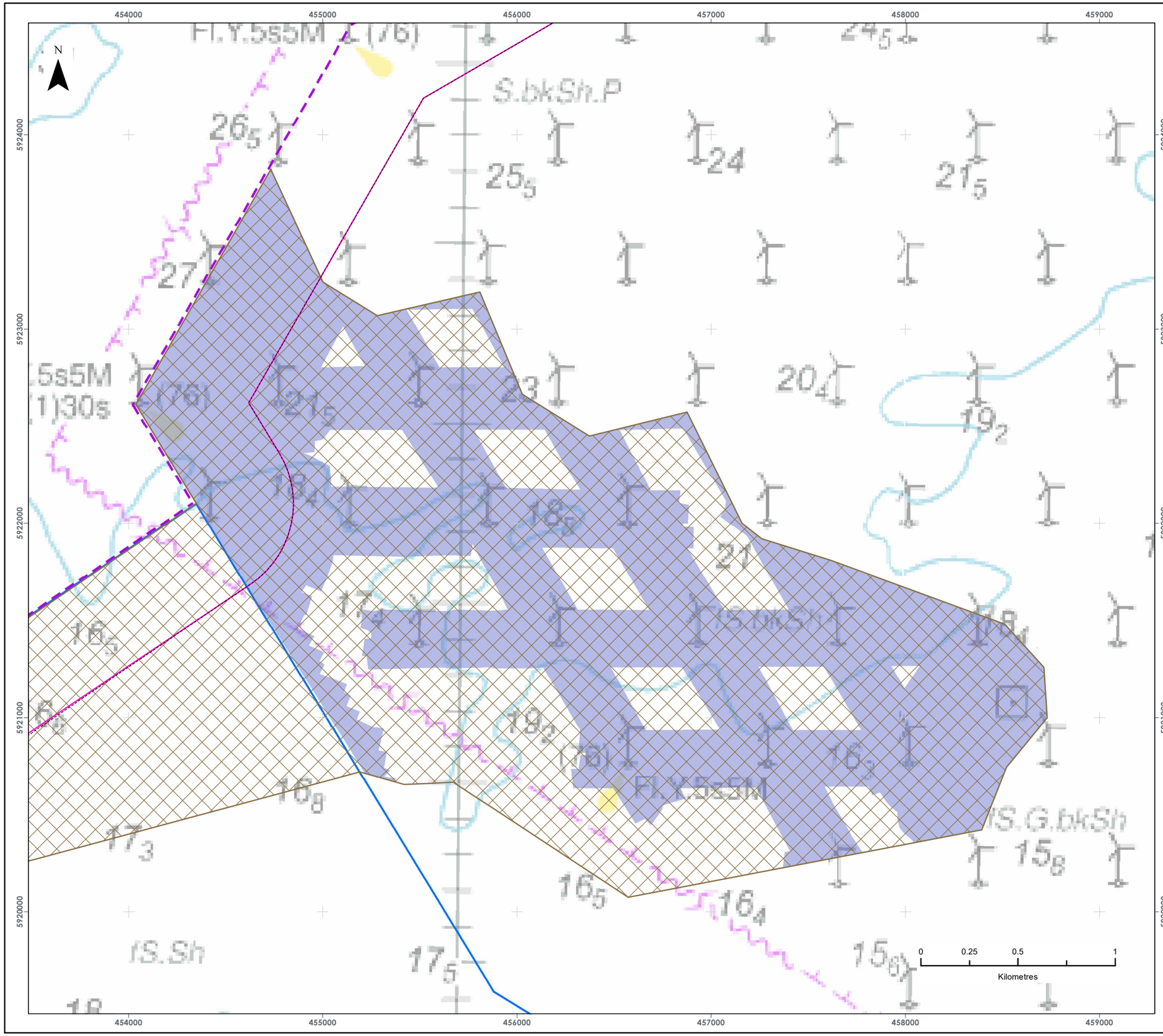
11.7 Uncertainty and technical difficulties encountered

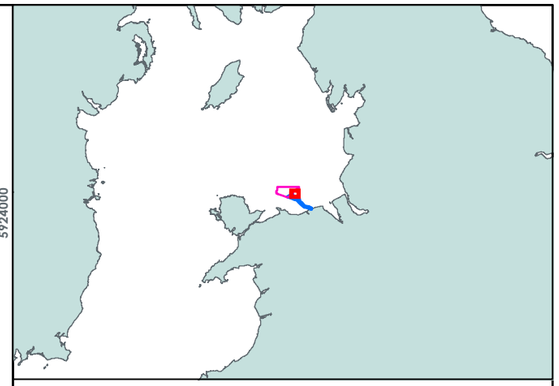
49 The offshore archaeology and cultural heritage assessment has been based on secondary information derived from a number of sources, and the assumption made is that the data, and any additional information, are reasonably accurate. Data from the UKHO is skewed towards 19th and 20th century data. Not much is known about wooden wrecks and they may not be represented, therefore everything may not be included.

50 As a result of the geophysical survey data collection, analysis, and provision timescales, only the result of the interpretation of seabed features is provided in this document. A basic palaeolandscapes baseline and assessment is presented in the marine archaeological technical report (Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1)). The available data are considered adequate for the purposes of EIA and preliminary environmental information.

51 The geophysical assessment of the interlink area between AyM and GyM is reliant solely on a previous assessment undertaken by Wessex Archaeology (Wessex Archaeology 2012). The survey data for this previous assessment did not cover the entire interlink area, as illustrated in (Figure 2); as such, the potential remains for unidentified features of archaeological potential to be present within the interlink area. Additionally, no palaeolandscapes assessment was undertaken during the 2012 GyM assessment. As such, a palaeolandscape assessment of the GyM interlink area outside the array area and ECC is not possible.

52 The worst-case scenario has been adopted to cope with uncertainties and reduce risk of later design modifications falling outside of the assessment envelope.





LEGEND

- Array Area
- Array and Infrastructure Zones buffer
- Geophysical reporting extent
- AyM to GyM interlink
- Offshore Export Cable Corridor
- Combined 2010 and 2020 geophysical data coverage

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

Interlink geophysical data coverage

VER	DATE	REMARKS	Drawn	Checked
1	14/02/2022	For Issue	KF	DH

FIGURE NUMBER:

Figure 2

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:20,000	A3	WGS84	UTM30N

Fferm Wynt Ailtraeth
AWEL Y MÔR
Offshore Wind Farm

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11.8 Existing environment

53 A technical report was produced for the area of the array and the offshore ECC (Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment). A review of the key findings from that study has been incorporated into the description of the existing environment. It is not intended to repeat or to carry out any additional assessment of impacts within the cable corridor.

54 The offshore archaeology and cultural heritage baseline was assessed in relation to three themes: palaeogeography; seabed features, including maritime and aviation sites; and historic seascape character.

55 The study area is located between Anglesey and Liverpool Bay, offshore North Wales, in the Welsh Platform area of the Irish Sea. The basement geology of this area of the Irish Sea comprises sandstones and mudstones dating from the Permian through to the Triassic, with some potential Carboniferous deposits in the nearshore, all which are extensively folded and faulted. (Jackson *et al.* 1995, Mellett *et al.* 2015).

56 The upper surface of the bedrock represents a significant unconformity, and the bedrock units are directly overlain by Quaternary sediments within the study area (Jackson *et al.* 1995, Mellett *et al.* 2015).

57 The presence of Palaeolithic cave sites along the North Wales coast indicate that occupation of the Irish Sea during times of low relative sea level may have been possible. In particular, early Neanderthal remains discovered in Pontnewydd Cave near St Asaph, Denbighshire, dating from c. 225 ka before present (BP), indicate hominin presence in the area during the Early Middle Palaeolithic (Lynch *et al*. 2000, Flemming 2005).

58 Archaeologically, it is known that Wales was occupied at least during the earlier Devensian, with Neanderthal finds dating from 50 ka BP identified from Coygan Cave near Tenby, and modern human remains dating from 26 ka BP discovered in Paviland Cave on the Gower Peninsular, both in South Wales (Lynch *et al.* 2000, Flemming 2005).

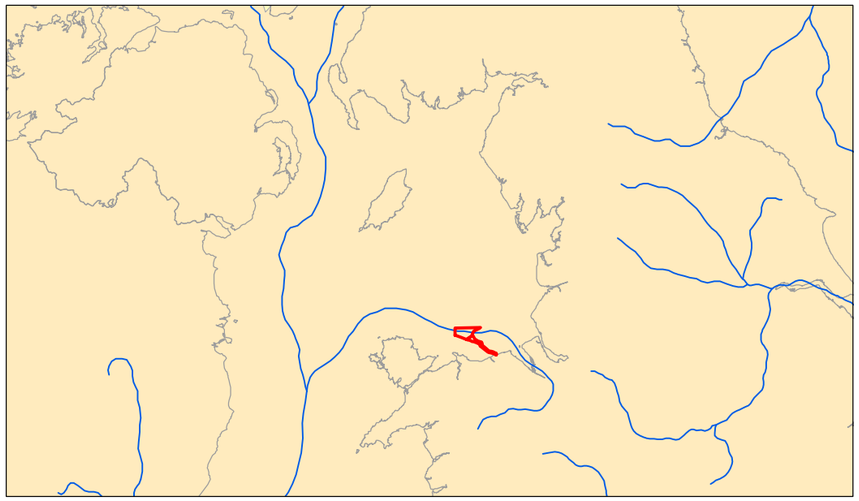
59 Within the Irish Sea, palaeoenvironmental analysis of borehole samples acquired for the Walney OWF recovered pollen sequences relating to the Upper Palaeolithic (ca. 34 ka BP), suggesting isolated pockets of material from the earlier, pre-glacial advance Devensian period may have survived further offshore (Wessex Archaeology 2010).

60 Assuming a terrestrial followed by transgression model, gradual sea level rise would have probably placed much of the Irish Sea either on the coastline or just offshore by the Mesolithic period (c. 10 ka – 6 ka BP) (Shennan and Horton 2002) (Figure 3). Peat deposits, interpreted to date from the Mesolithic, are known to be present in the intertidal area of the AyM ECC, and have been identified during surveys associated with the current proposed development (Fugro 2021).

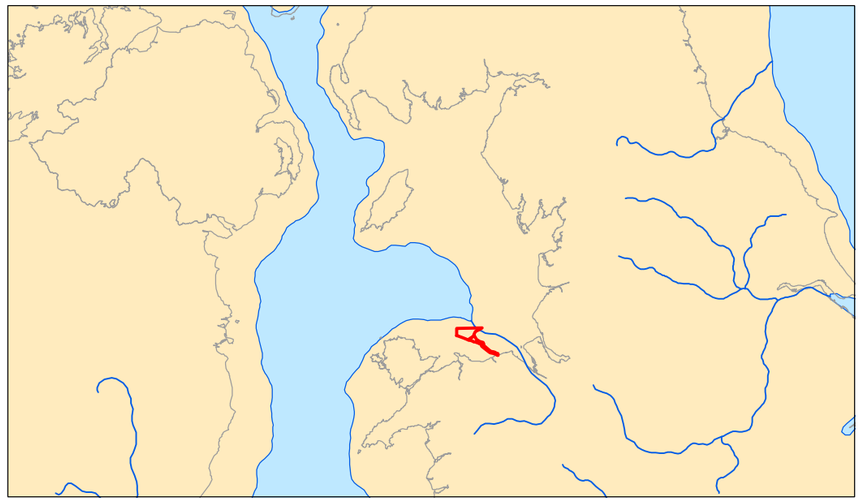
61 The Mesolithic record of the British Isles suggests a strong relationship between human activity and coasts, wetlands, rivers and streams, and evidence of human occupation of the river Mersey, which drains into the eastern Irish Sea, has previously been discovered (Cowell and Innes 1994). Any surviving sedimentary deposits from this period could potentially contain both *in-situ* and derived artefacts from a time when these coastal and littoral landscapes, now submerged by the sea, were utilised intensively by human populations.

62 In addition to these submerged coastal landscapes, the Mesolithic archaeological record potentially contains examples of coastal or sea going craft made from dugout logs or hide covered wooden frames.

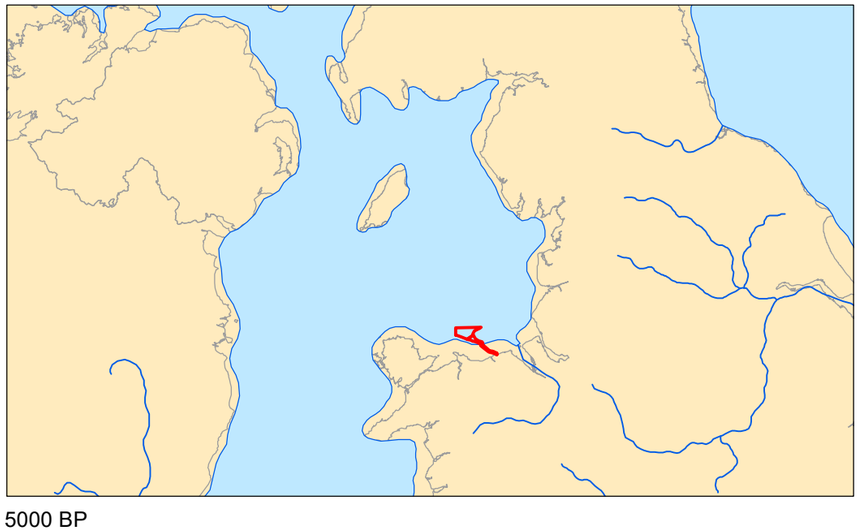
63 By the end of the Mesolithic, the Irish Sea would have been completely submerged, with coastlines approximately close to their present-day positions, and archaeological evidence from the Neolithic onwards will be of an increasingly maritime nature. However, continued use of the intertidal zone surrounding the Irish Sea has been found in the form of preserved human footprints on the foreshore at Formby Point, Merseyside, dating from the Neolithic/Bronze Age (Roberts *et al.* 1996). Further offshore, any artefacts from this period not related to maritime activity are likely to be derived and re-deposited after introduction to the area by fluvial processes or coastal erosion.



16,000 BP - 13,000 BP



10,000 BP



5000 BP

LEGEND

- Proposed Offshore Development Area
- Present high water

Data Source:

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

Generalised palaeogeography of the Irish Sea (after Coles, 1998)

VER	DATE	REMARKS	Drawn	Checked
1	29/11/2021	For Issue	KJF	DH

FIGURE NUMBER:

Figure 3

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:4,000,000	A3	WGS84	UTM30N

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

11.8.1 The Array

64 The array area of AyM and other infrastructure zone will cover approximately 78 km² with a cable corridor running from the east of the array up to and including the intertidal zone.

Palaeogeography

65 There are no designated or known sites within the array. However, there is potential for archaeological material of a prehistoric date to exist within the study area. A description of the geological and prehistoric baselines, and a palaeogeographic assessment, are in Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1)..

66 During assessment of the sub-bottom profiler data, a number of palaeogeographic features of archaeological potential were identified within the Array area and Infrastructure zone. The distribution of these features is illustrated in Figure 4.

67 An extensive area of interpreted Channel Complex Deposits was identified in the north and north-west of the Array area and Infrastructure zone (Figure 5), suggesting the study area was located within a terrestrial environment between the Last Glacial Maximum (LGM) and the Holocene marine transgression.

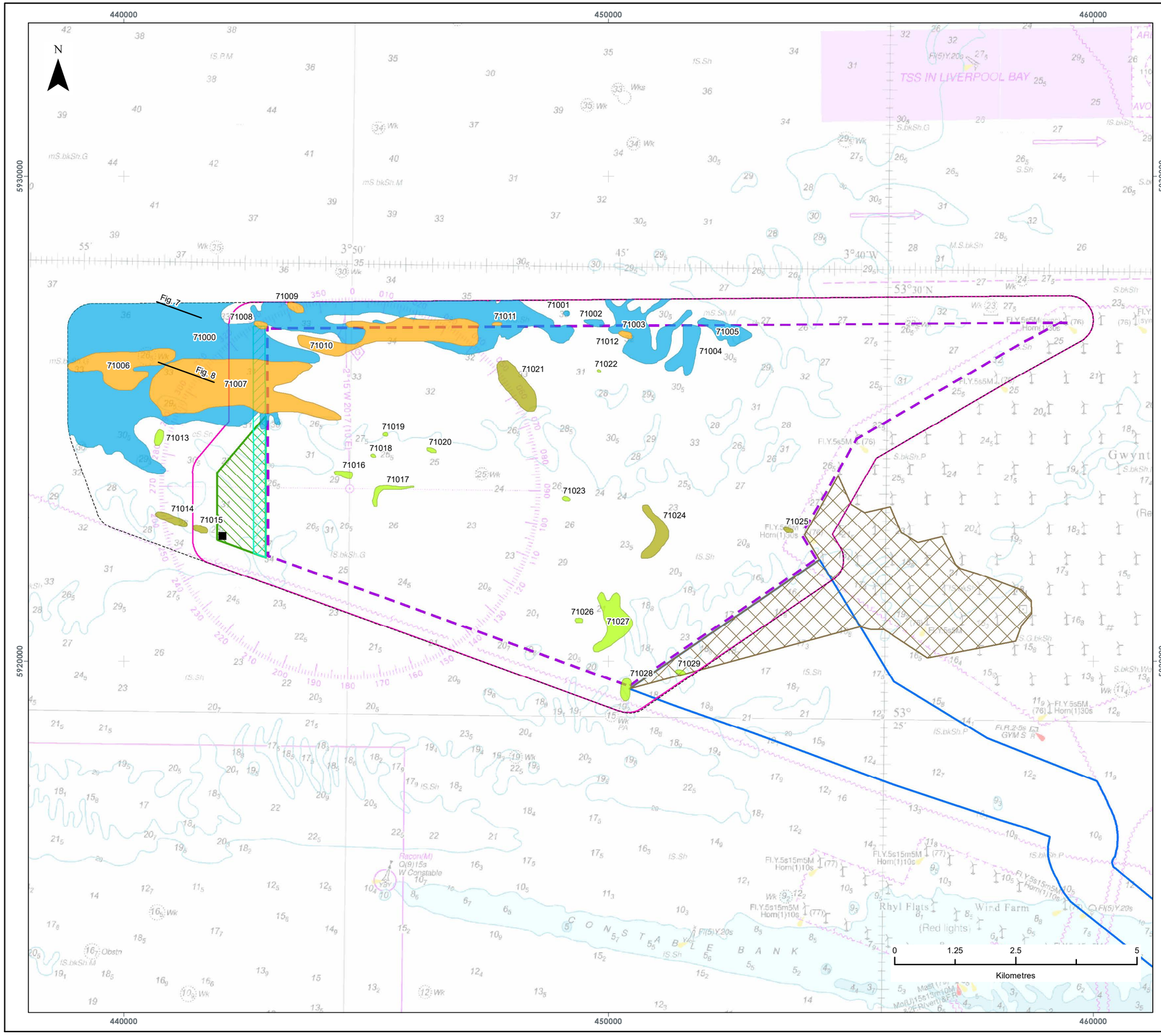
68 These features correlate with a potential palaeo-coastline and associated deltaic features identified during the West Coast Palaeolandscape Survey (WCPS) (Fitch *et al.* 2011). This, combined with the iceberg plough marks identified during previous work in the Irish Sea (Van Landeghem *et al.* 2009), supports the post-LGM landscape theory proposed by Flemming (2005) of an initial glacial lake, followed by sub-aerial expose, and then a marine transgression, rather than a constant maritime environment.

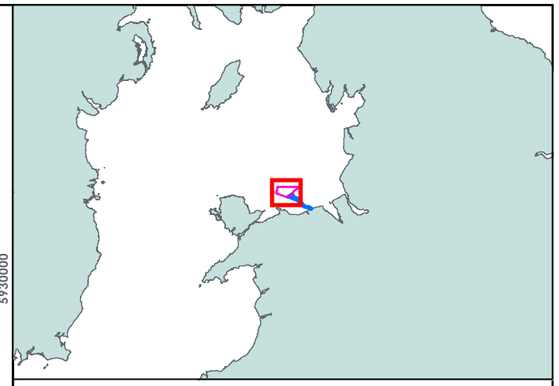
69 The features identified during the WCPS (Fitch *et al.* 2011) were interpreted as representing a Mesolithic shoreline; if this is the case, then the deposits would be considered of high archaeological potential. However, no direct dating evidence is available for these features at present, and they could potentially represent features created earlier in the Holocene prior to human re-occupation of the region. As such, they are currently considered of possible archaeological potential.

70 A number of sporadically distributed features with no clear association or alignments have also been identified within the Array area and Infrastructure zone. These features are all interpreted as cut and fills, potentially representing the remains of partially eroded fluvial channels created during the period of sub-aerial exposure of the study area between the LGM and the Holocene marine transgression.

71 However, the features identified within the Array area and Infrastructure zone are relatively poorly defined compared with those identified along the ECC (described below) and may also represent internal features within older geologically units. As such, they are classified as of possible archaeological potential.

72 A deposit of overlying seabed sediment is present throughout the Array area and Infrastructure zone, ranging from a thin veneer to a relatively thick area of mega-ripples and sand waves. As a post-transgression (modern) sedimentary deposit, the seabed sand is not considered of archaeological potential in itself; however, it has the potential to bury archaeological sites (e.g. shipwrecks) in areas where the sediment is sufficiently thick and mobile and contain reworked material from older underlying geological units.





LEGEND

- Met Mast Location
- Array
- Array and Infrastructure zones buffer
- Geophysical reporting extent
- AyM to GyM interlink
- Offshore Export Cable Corridor
- Subsea Infrastructure and Temporary Works
- Other Wind Farm Infrastructure Zone
- Data example locations

Palaeogeographic Features

- Fine grained deposit
- Channel complex
- Complex cut and fill
- Simple cut and fill

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE: **Palaeogeographic features of archaeological potential – Array area and Infrastructure zone**

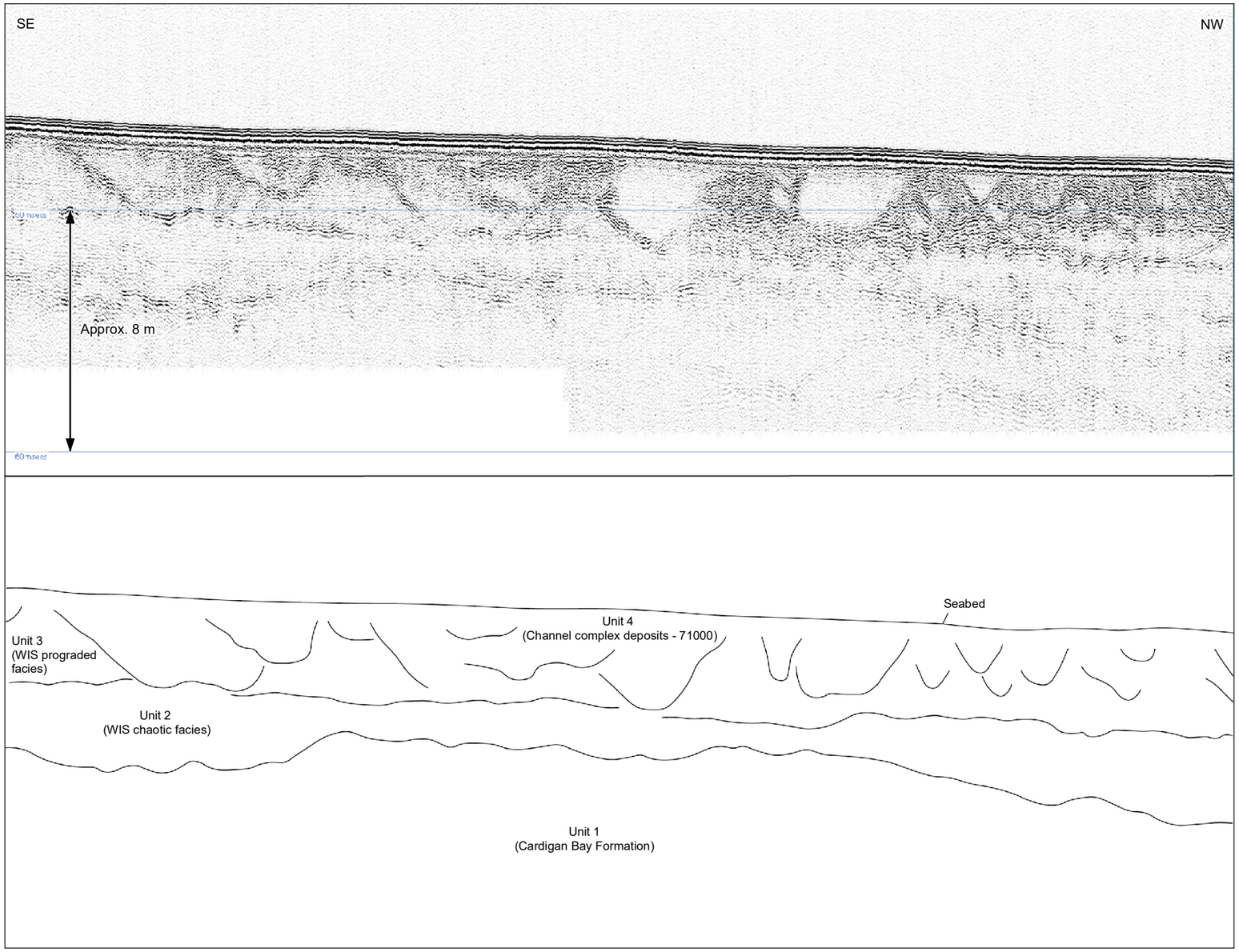
VER	DATE	REMARKS	Drawn	Checked
1	14/02/2022	For Issue	KJF	DH

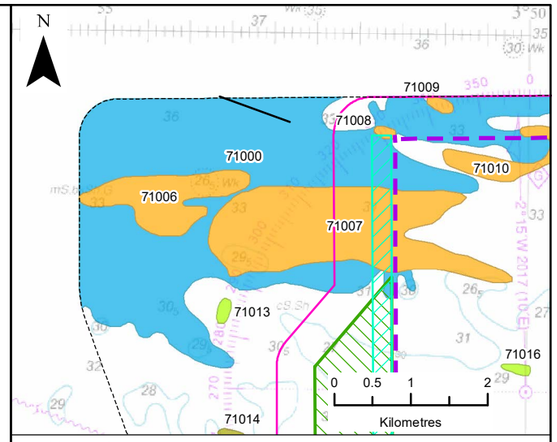
FIGURE NUMBER:

Figure 4

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:80,000	A3	WGS84	UTM30N

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm





LEGEND

- Array Area
- Array and Infrastructure Zones buffer
- Geophysical reporting extent
- Subsea Infrastructure and Temporary Works
- Other Wind Farm Infrastructure Zone
- Data example locations

Palaeogeographic Features

- Fine grained deposit
- Channel complex
- Complex cut and fill
- Simple cut and fill

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

SBP data example – 71000

VER	DATE	REMARKS	Drawn	Checked
1	14/02/2022	For Issue	KJF	DH

FIGURE NUMBER:

Figure 5

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
Location 1:80,000	A3	WGS84	UTM30N

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AWEL Y MÔR
Offshore Wind Farm

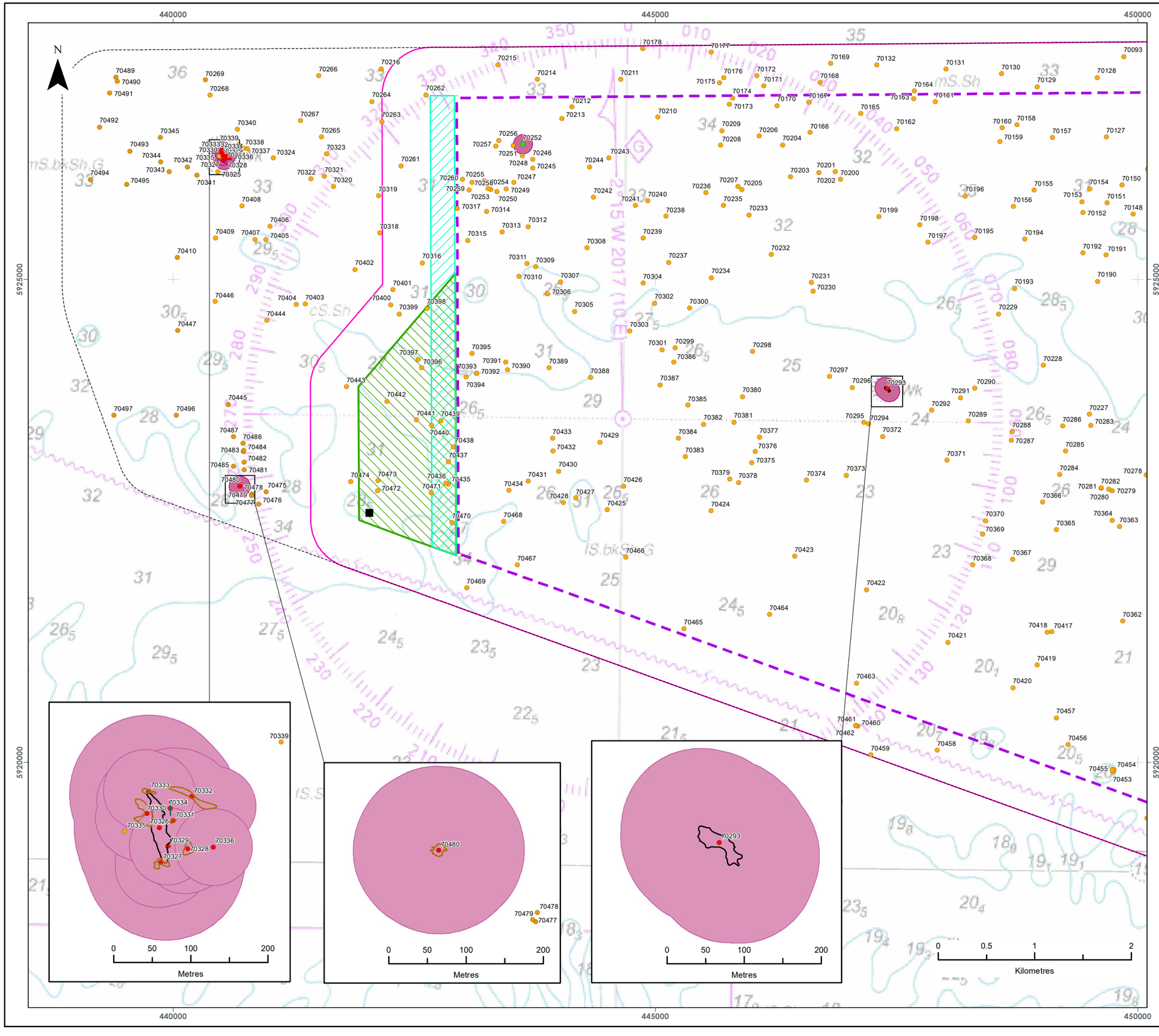
Seabed Features

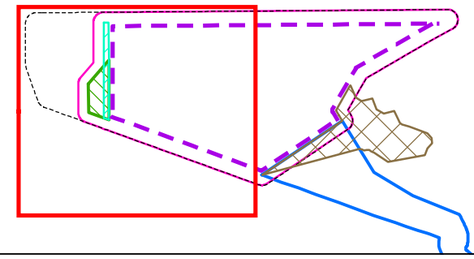
73 During the seabed features assessment, a total of 509 anomalies of archaeological potential were identified within the array area (including the infrastructure zones, interlink area, 500 m array buffer and geophysical reporting extent buffer). These can be summarised as follows, and the distribution of features across the array area is illustrated in Figure 6, Figure 7 and Figure 8:

Table 6: Anomalies of archaeological potential – array area.

ARCHAEOLOGICAL DISCRIMINATION	QUANTITY	INTERPRETATION
A1	21	Anthropogenic origin of archaeological interest
A2	487	Uncertain origin of possible archaeological interest
A3	1	Historic record of possible archaeological interest with no corresponding geophysical anomaly

74 There are six known wrecks in the array area including the 500 m array buffer and geophysical reporting extent buffer (Figure 9). The present assessment of value relies on descriptions of the sites from the UKHO, NMRW and HER and geophysical survey. This assessment is based on the criteria for assessing archaeological value, as set out in Table 3, and based on available guidance (Cadw 2020). AEZs have been applied to the A1 anomalies in the figures in advance of the assessment.





LEGEND

- Met Mast Location
- Array Area
- Array and Infrastructure zones buffer
- Geophysical reporting extent
- Subsea Infrastructure and Temporary Works
- Other Wind Farm Infrastructure Zone
- Recommended archaeological exclusion zones

Anomalies of archaeological potential

- A1: Anthropogenic origin of archaeological interest
- A2: Uncertain origin of possible archaeological interest
- A3: Historic record of possible archaeological interest

Feature boundaries

- Wreck
- Debris field
- Seabed disturbance

Linear features

- Debris
- Rope/chain

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

Seabed features of archaeological potential – Array area and Infrastructure zone

VER	DATE	REMARKS	Drawn	Checked
1	14/02/2022	For Issue	KF	DH

FIGURE NUMBER:

Figure 6

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:40,000	A3	WGS84	UTM30N

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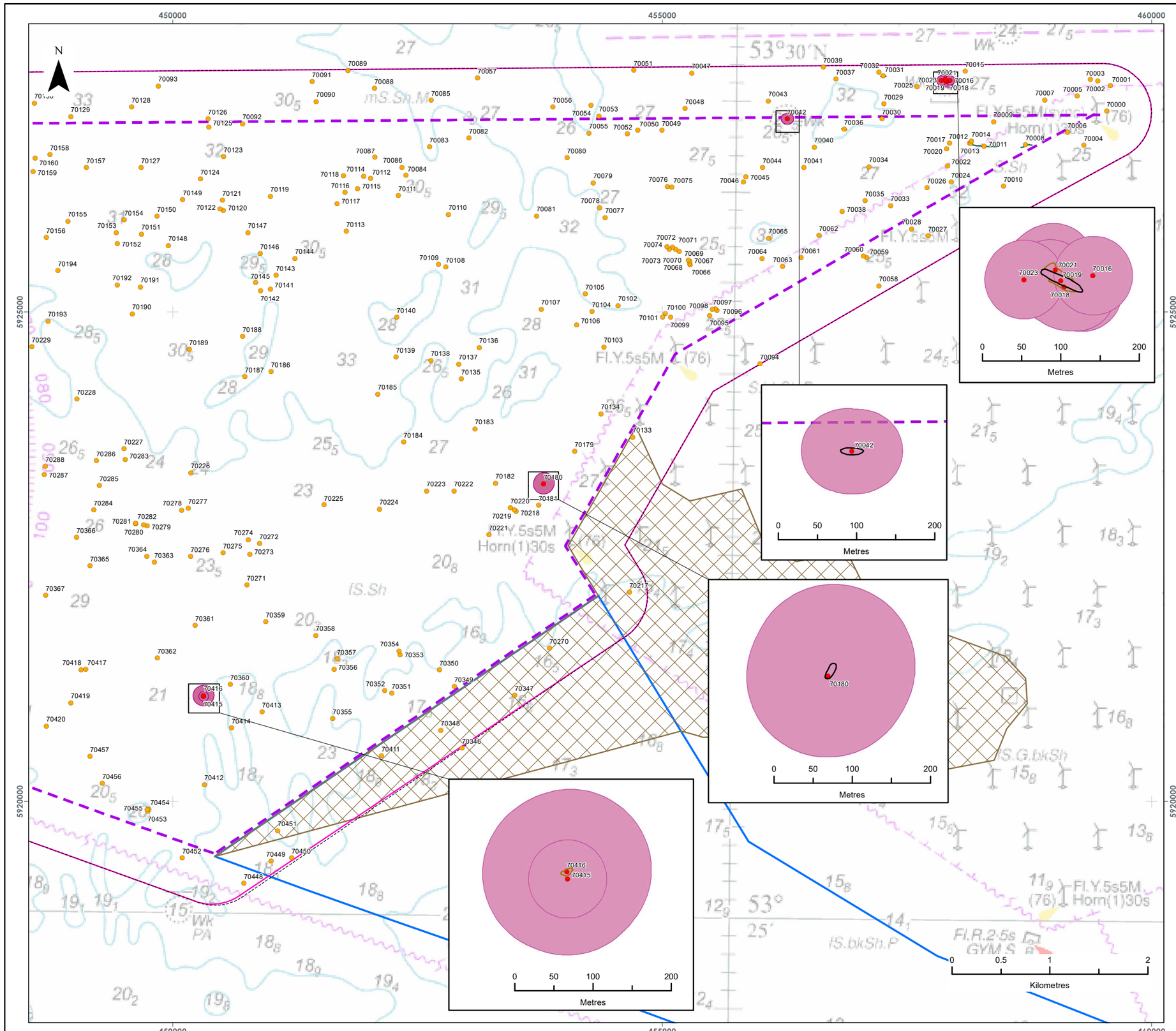
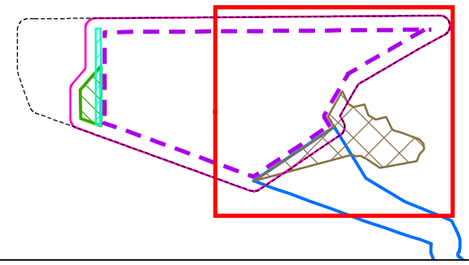
AWEL Y MÔR Offshore Wind Farm





LEGEND

- Array Area
- Array and Infrastructure zones buffer
- Geophysical reporting extent
- AyM to GyM interlink
- Recommended archaeological exclusion zones

Anomalies of archaeological potential

- A1: Anthropogenic origin of archaeological interest
- A2: Uncertain origin of possible archaeological interest
- A3: Historic record of possible archaeological interest

Feature boundaries

- Wreck
- Debris field
- Seabed disturbance

Linear features

- Debris
- Rope/chain

Data Source:

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

Seabed features of archaeological potential – Array area and Infrastructure zone

VER	DATE	REMARKS	Drawn	Checked
1	14/02/2022	For Issue	KF	DH

FIGURE NUMBER:

Figure 7

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:40,000	A3	WGS84	UTM30N

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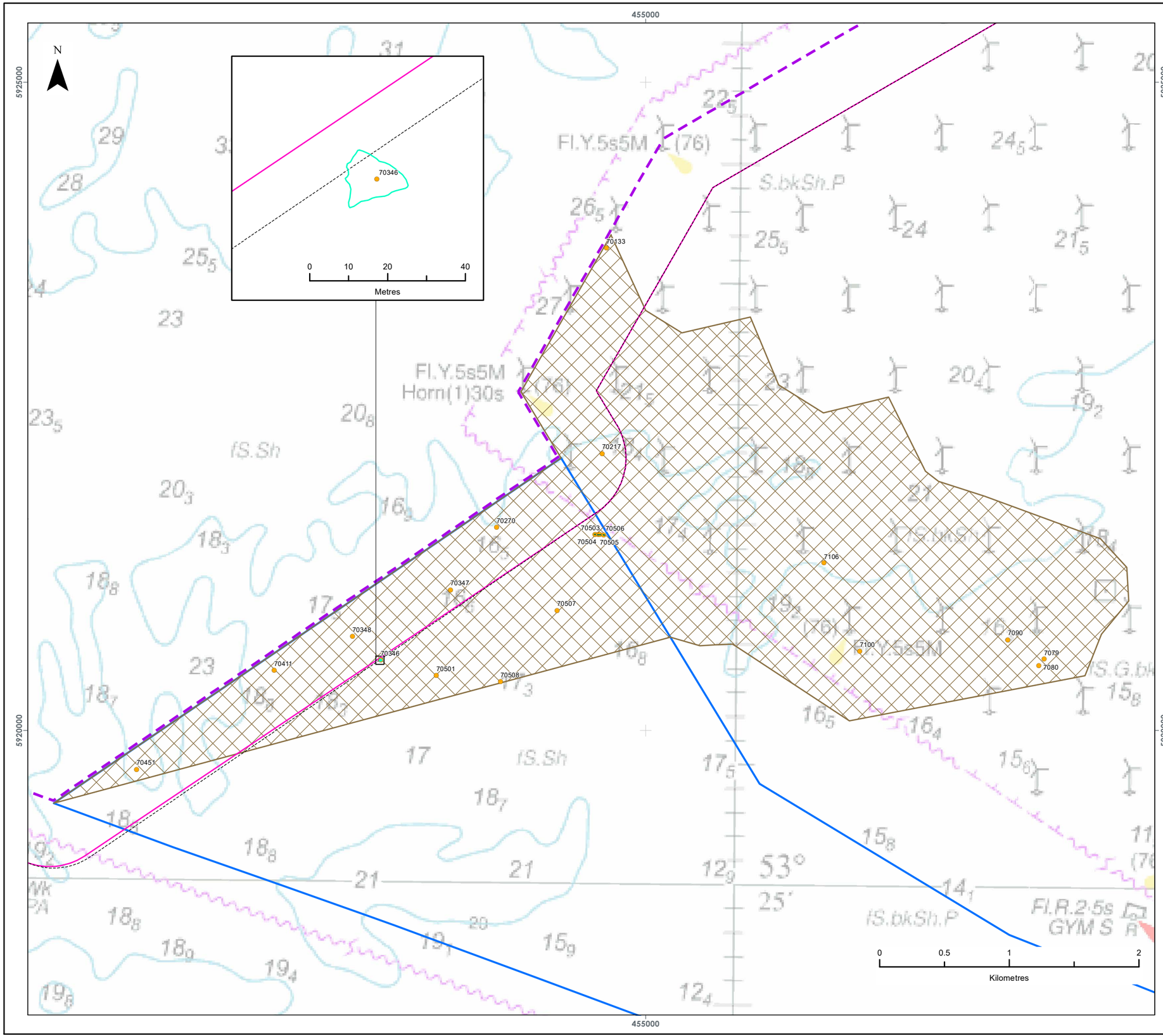
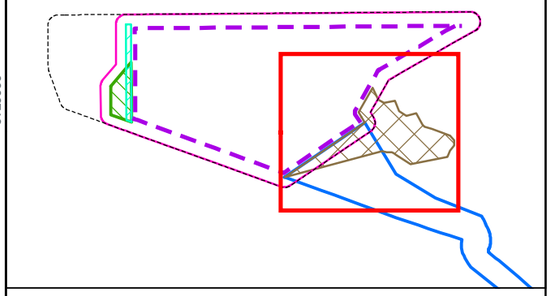




LEGEND

- Array Area
- Array and Infrastructure zones buffer
- Geophysical reporting extent
- AyM to GyM interlink
- Offshore Export Cable Corridor

Anomalies of archaeological potential

- A2: Uncertain origin of possible archaeological interest

Feature boundaries

- Seabed disturbance

Linear features

- Rope/chain

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

Seabed features of archaeological potential – AyM to GyM interlink

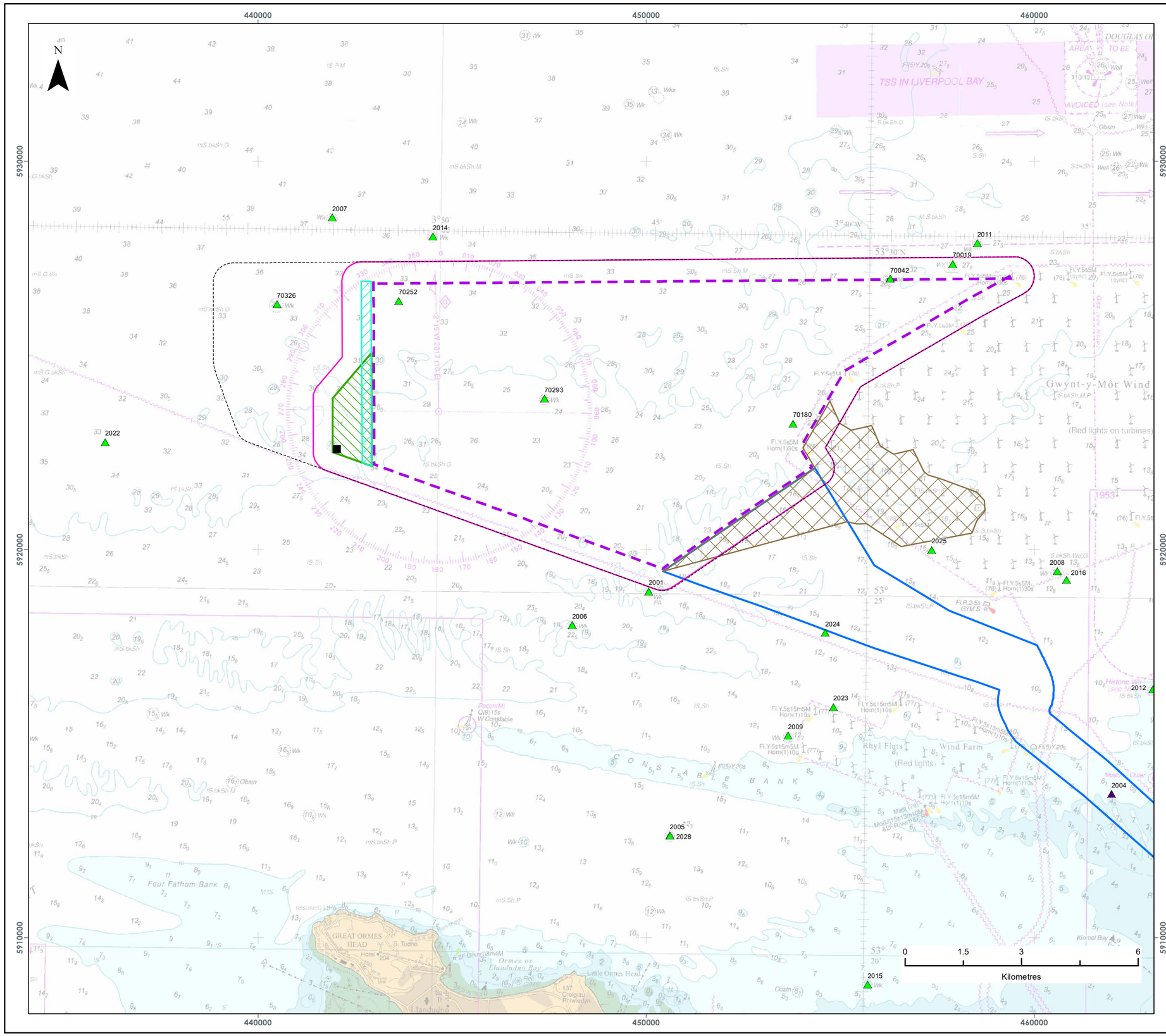
VER	DATE	REMARKS	Drawn	Checked
1	14/02/2022	For Issue	KF	DH

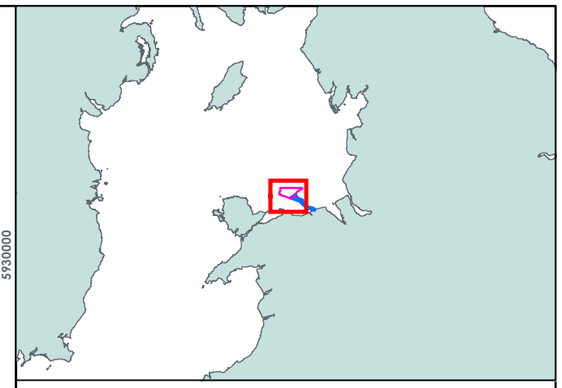
FIGURE NUMBER:

Figure 8

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:30,000	A3	WGS84	UTM30N

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm





LEGEND

- Met Mast Location
- Array Area
- Array and Infrastructure zones buffer
- Geophysical reporting extent
- AyM to GyM interlink
- Subsea Infrastructure and Temporary Works
- Other Wind Farm Infrastructure Zone
- Offshore Export Cable Corridor

Known Maritime and Aviation Sites

- Findspot
- Wreck

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

Offshore Wind Farm Study Area

VER	DATE	REMARKS	Drawn	Checked
1	14/02/2022	For Issue	KJF	LR

FIGURE NUMBER:

Figure 9

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:100,000	A3	WGS84	UTM30N

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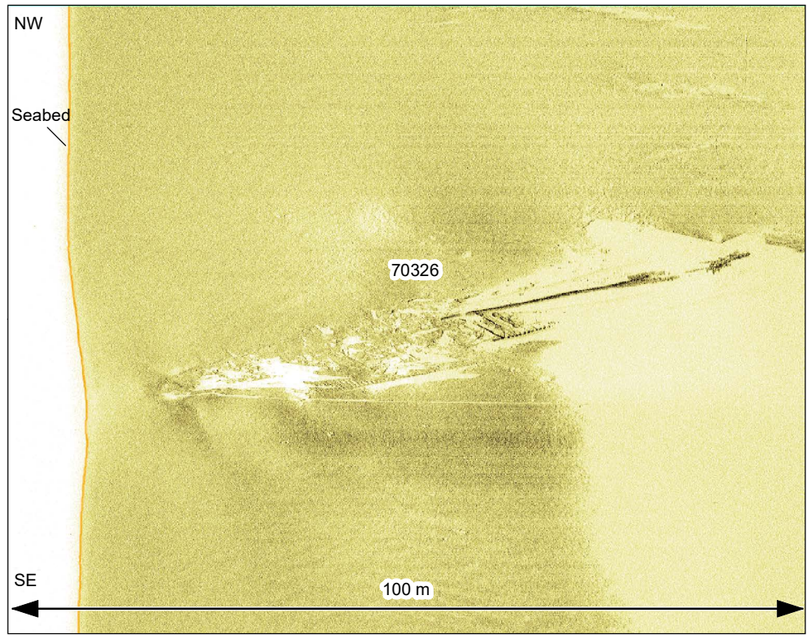
AWEL Y MÔR
Offshore Wind Farm

75 None of the sites in the array study area, the 500 m array buffer and the geophysical reporting extent buffer have been designated.

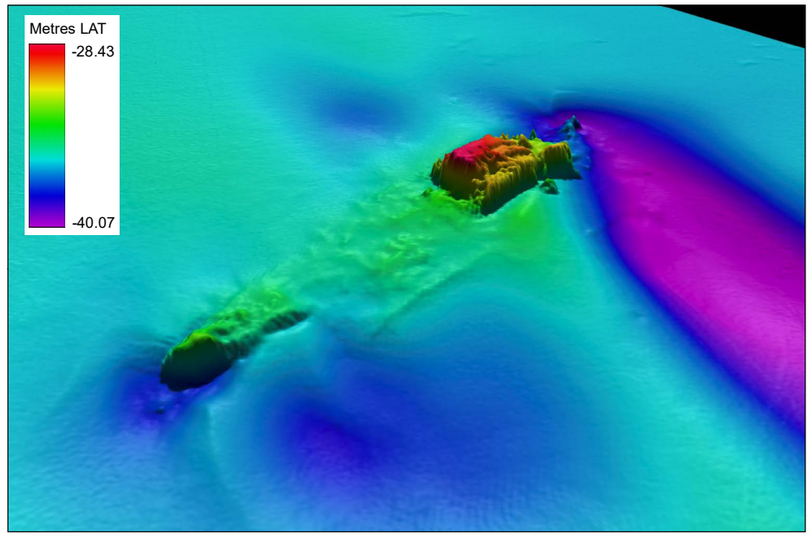
76 SS *Albanian* (70326) Figure 10, Figure 6 and Figure 9 is a British steam ship built in 1870 by T Royden & Sons, Liverpool. The vessel was on a passage from Liverpool for Genoa & Leghorn and sank following a collision with British sailing vessel *Nydia* in clear weather on 18 November 1877. SS *Albanian* maintained course with *Nydia* close to the wind and was struck by *Nydia* port side, aft of the bridge. Third officer Penny was held to be wholly responsible for the collision through holding course. The vessel was confirmed to be SS *Albanian* in 1992 and was reported to be in three pieces following a salvage of the pipework in 1993 by the *Petrel*. In 2014, the forward part of the vessel had collapsed, the midships were upright, the stern was broken, and lies to the starboard. The wreck has a dive trail with a map highlighting the most interesting section of the wreck to visit as well as some background information about the vessel and the sinking and the cargo it carried (https://divernet.com/wp-content/uploads/2018/01/wrecktour_179_albania.pdf accessed December 2020).

77 The wreck is located within the geophysical reporting extent buffer and was identified within the geophysical data at the charted position. Dimensions from the geophysical data were 88.7 x 27.4 x 3.8 m with an associated magnetic anomaly of 4727 nT, and the wreck was seen to be orientated approximately north-south. The wreck appears to be in at least two pieces with a collapsed central section, which correlates with the known condition of the wreck. Nine associated potential debris fields and individual pieces of debris (70327, 70328, 70329, 70330, 70331, 70332, 70333, 70334, and 70336) have been identified close to the wreck, all of which have been assigned an A1 archaeological potential rating.

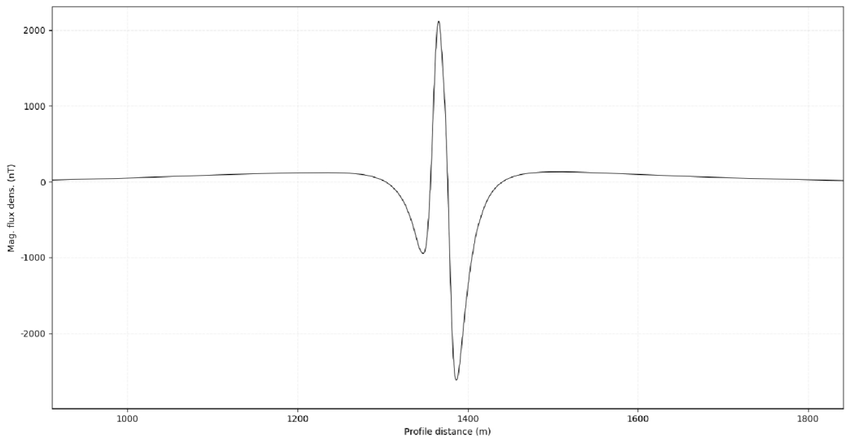
Location		440517 E 5926285 N	**Area**	2020 Array – Block D
Archaeological Importance		High		
Geophysical survey dimensions and notes		Wreck **70326** is situated in the north-western section of the array area, and corresponds with the recorded location of the SS *Albanian* (UKHO 8124). Wreck **70326** is identified in the 2020 SSS dataset as a distinct wreck with clear sections relatively intact and recognisable as vessel structure. The wreck has dimensions of approximately 88.7 x 27.4 x 3.8 m, and is surrounded by a number of small debris fields and individual pieces of debris. However, the MBES data show the wreck to be split into two sections, with a central separating area within which it is difficult to identify individual objects, suggesting it is degraded and/or partially buried. The exposed northern section is an extant, well defined feature, with a series of regular elongate dark reflectors indicating some coherent internal structure. The south section of the vessel appears less distinctive and may indicate higher level of degradation in this area, however some possible internal structure can still be seen. There is some sedimentation at the southern end, however the exposed section is proud of the seabed and is relatively intact. There is scour visible predominantly at intervals along the eastern side, with the largest at the northern end extending approximately 160 m to the east with a depth of up to 6.0 m. In the Mag. data, the wreck is associated with a very large, sharp symmetric dipole with an amplitude of 4727 nT, suggesting significant ferrous content.		
Build	**Type**	*S*team ship		
	Construction	Unknown but assumed steel hull.		
	Dimensions (m)	89.0 x 9.4 x 7.0, 1417 tonnes gross.		
	Shipyard	*T Royden & Sons, Liverpool*		
Loss	**Cause**	Collision with the wooden barque *Nydia.*		
Extent of Survival		The SS *Albanian* was a steamship built in 1870 by T Royden & Sons of Liverpool, with two boilers and a single-shaft compound inverted engine. It was lost in 1877 after being struck by a wooden barque, the *Nydia*. The wreck was first recorded by the UKHO in 1982. It was dived in 1984 and found to be lying upright but with no remaining superstructure. The wreck was partially salvaged in 1992 and confirmed as the SS *Albanian*. Salvaging has caused degradation of the wreck, reported as being in three pieces in 1993. In 2014, the forward part was part collapsed, midships upright, and the stern broken and lying to starboard. The record indicates the wreck was already well broken up during initial surveys, and has degraded further as a result of salvaging efforts. This correlates with the degraded state of the central area of the wreck, and the identified surrounding debris, as visible in the geophysical data.		



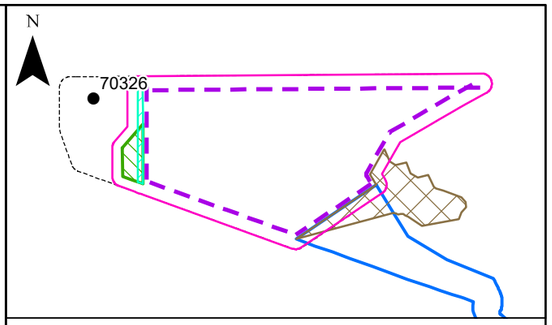
SSS waterfall image, 100 m range per channel



MBES grid image, x1 vertical exaggeration, looking west



Mag. profile image



LEGEND

- Array Area
- Array and Infrastructure zones buffer
- Geophysical reporting extent
- AyM to GyM interlink
- Subsea Infrastructure and Temporary Works
- Other Wind Farm Infrastructure Zone
- Offshore Export Cable Corridor
- Wreck location

Data Source:

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

ID 70326 – UKHO 8124 – SS Albanian

VER	DATE	REMARKS	Drawn	Checked
1	14/02/2022	For Issue	KF	DH

FIGURE NUMBER:

Figure 10

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
NTS	A3	WGS84	UTM30N

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AWEL Y MÔR Offshore Wind Farm

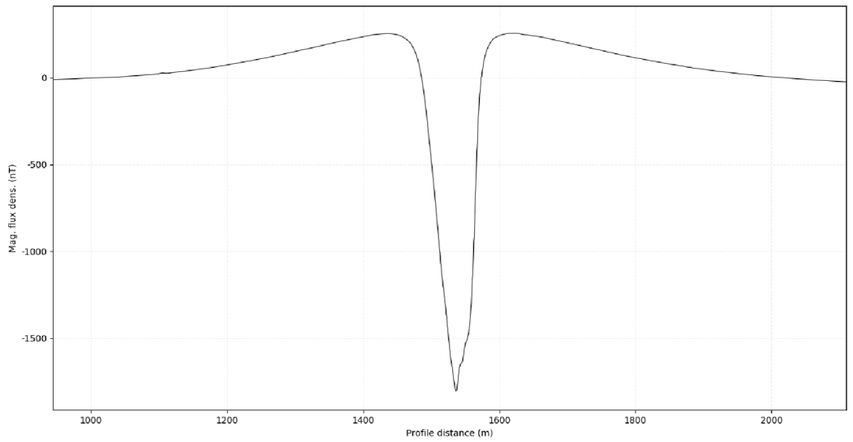
78 *Dublin* (70019) Figure 11, Figure 7 and Figure 9 is a British steam ship built in Dublin by Walpole and Webb in 1866 with a 350 hp engine. The vessel left the river Mersey on 26 October 1888, bound from Garston for Dublin with general cargo and passengers and was struck amidships by the paddle steamer '*Longford*' and sank almost immediately. The crew and passengers made their escape in the boats. In 1989, a bell inscribed 'Dublin' was recovered from the wreck which stands upright, about 7 m high, and with a trawl net over its stern. In 1992, the central hub of the helm was recovered from the wreck inscribed 'Dublin 1866' and a steering pedestal with 'Dublin 1866' stamped on it in 1994. The wreck was examined in 2020 in a general depth of 28 m and was recorded as having a length of 55.9 m, a width of 8.9 m and a height of 10.14 m. The wreck has previously been dived by the Flintshire Sub-Aqua club (https://www.flintsac.co.uk/coastal%20dive%20site.htm accessed December 2020).

79 The wreck is located in the array area buffer and was identified within the geophysical data at the charted position. Dimensions from the geophysical data were 58.3 x 13.2 x 5.5 m with an associated magnetic anomaly of 2015 nT, and the wreck was seen to be orientated approximately NNW-SSE. The wreck appears upright and fairly intact, which correlates with the known condition of the wreck. Two distinct debris fields (70018 and 70021) have been identified immediately adjacent to the wreck, and two possibly associated pieces of debris (70016 and 70023) have been identified approximately 41 m east and 47 m west respectively. These have all also been assigned an A1 archaeological potential rating.

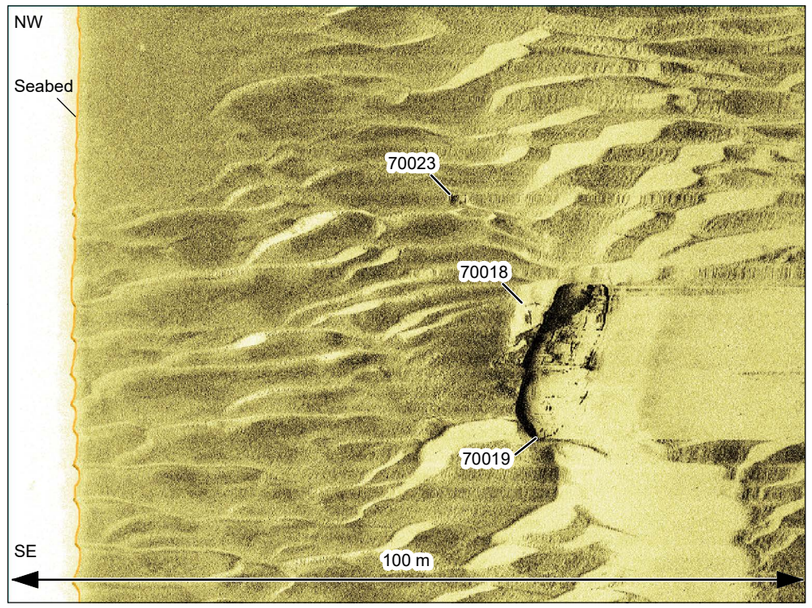
80 *Chacabuco* (Possibly) (70293) Figure 12, Figure 9 and Figure 6 is an iron-hulled full-rigged ship built by Gourlay Brothers & Co, Dundee, in 1869. The vessel had a length of 62 m and 10.3 m in breadth with one bulkhead and two decks. The vessel sank 15 miles from Ormes Head following a collision with SS T*orch* in 1873 (Michael 2008). SS T*orch* is also thought to have sunk 6 miles from this wreck. The vessel was dived in 1989 and was found to be a lot of collapsed steel wreckage including a fair amount of sail rigging, partially buried in a sand wave, in a general depth of 37 m, with the wreck standing upright with bows west. The wreck was examined in 2020 in a general depth of 27 m and was recorded as being broken up and degraded. The wreck is known to have been dived along with SS Torch (Holden 2008).

81 The wreck is located within the array area and was identified within the geophysical data at the charted position. Dimensions from the geophysical data were 70.3 x 37.1 x 2.2 m with an associated magnetic anomaly of 1616 nT, and the wreck was seen to be orientated approximately northwest-southeast. The wreck appears highly degraded and partially buried within the seabed sediment, which correlates with the known condition of the wreck. Due to its position within an area of mobile seabed sediment, it is possible that the wreck is periodically completely buried.

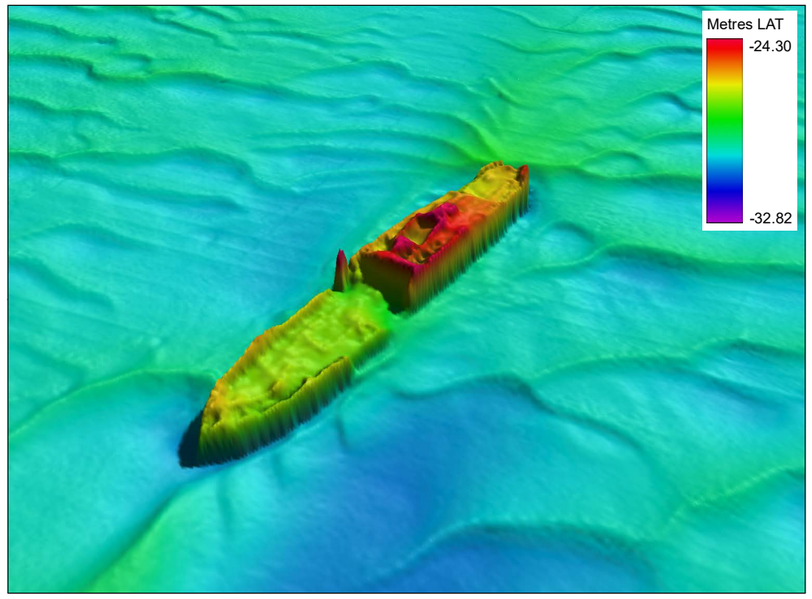
Location		457899 E 5927359 N	**Area**	*Array area buffer*
Archaeological Importance		High		
Geophysical survey dimensions and notes		Wreck **70019** is an upright, intact wreck situated in the north-eastern section of the array area buffer. The wreck is orientated approximately ESE-WSW and has an associated UKHO record (7693) which describes it as the wreck of the *Dublin*, a steamship built in Dublin by Walpole and Webb in 1866. The wreck is visible in the 2020 SSS dataset as a clear outline of upright, intact wreck with dimensions 58.3 x 13.2 x 5.5. A very large, clear shadow is visible, which is roughly in two sections and has a very tall, narrow section which may represent a standing mast. Some complex internal features are also visible. The wreck is visible in the MBES dataset as a large intact wreck with visible internal structure. There is a slight depression on the western edge. The wreck is located in an area of mobile seabed sediment with some sediment build up visible on the southern edge. An associated very large, sharp asymmetric magnetic dipole (2015 nT) identified within the Mag. dataset suggests ferrous construction and/or the presence of ferrous material.		
Build	**Type**	Steam ship		
	Construction	Unknown, but assumed at least partially ferrous, 476 gross tonnage, 350 HP engines		
	Dimensions (m)	53x8.2x4.3		
	Shipyard	Walpole and Webb 1866, Dublin		
Loss	**Cause**	Struck by paddle steamer '*Longford*'		
Extent of Survival		Built in Dublin by Walpole and Webb in 1866, and owned by the United Kingdom Screw Col Co., the *Dublin* Left the River Mersey on Friday 26 October 1866, bound from Garston for Dublin. Was struck in the early hours of the morning by the paddle steamer '*Longford*', and sank almost immediately. There was no loss of life; the passengers and crew escaped into lifeboats. Wreck **70019 was first recorded i**n 1948 (HMS *Seagull*) and recorded as UKHO 7693. Originally believed to be the wreck of the SS *Albanian*, the wreck was confirmed as the *Dublin* following retrieval of various items from the wreck in the 1980's and 1990's. Previous surveys also indicate the wreck is fairly intact, but badly corroded, which correlates with the current geophysical results. The wreck is located within an area of mobile sediment, and so is potentially periodically buried.		



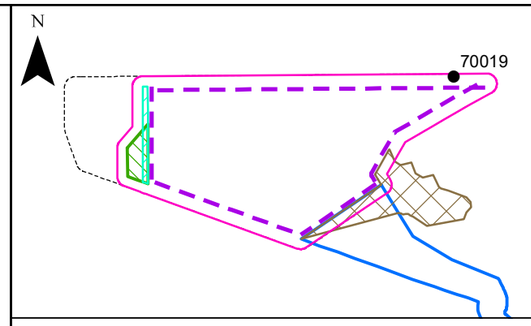
Mag. profile image



SSS waterfall image, 100 m range per channel



MBES grid image, x1 vertical exaggeration, looking west



LEGEND

- Array Area
- Array and Infrastructure zones buffer
- Geophysical reporting extent
- AyM to GyM interlink
- Subsea Infrastructure and Temporary Works
- Other Wind Farm Infrastructure Zone
- Offshore Export Cable Corridor
- Wreck location

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

ID 70019 – UKHO 7693 – *Dublin*

VER	DATE	REMARKS	Drawn	Checked
1	14/02/2022	For Issue	KF	DH

FIGURE NUMBER:

Figure 11

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
NTS	A3	WGS84	UTM30N

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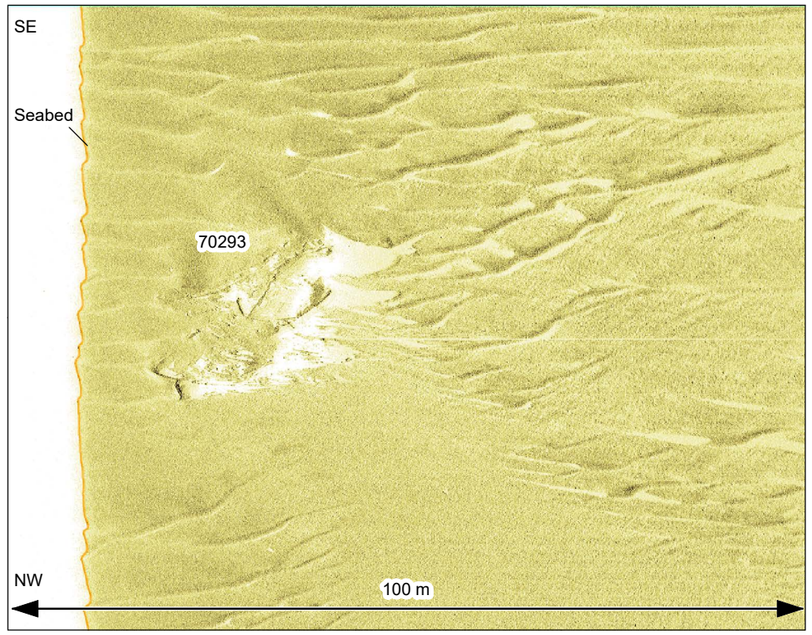
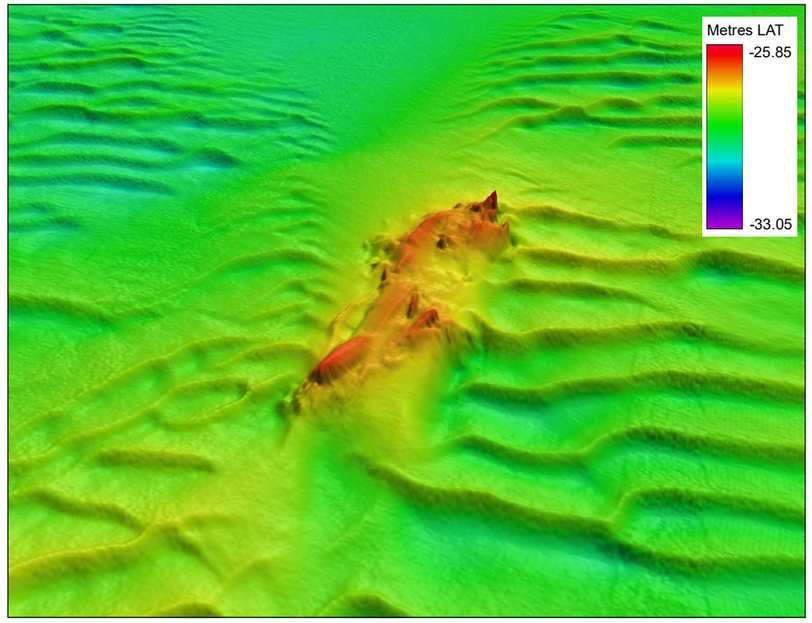
Offshore Wind Farm

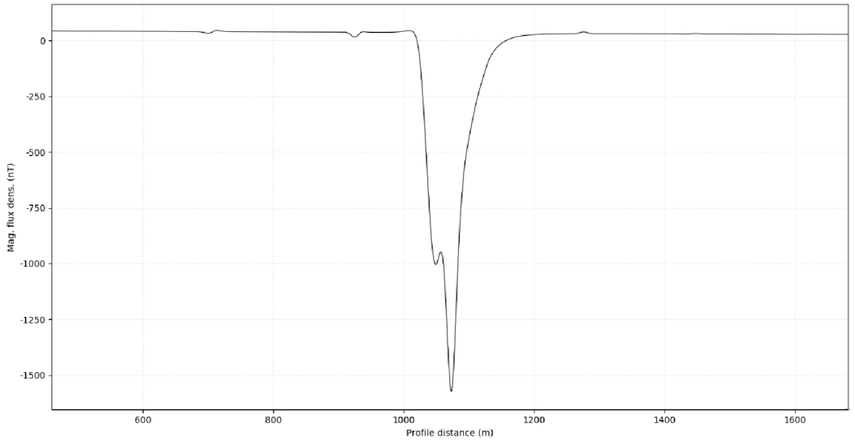
Location		447402 E 593866 N	**Area**	Array area
Archaeological Importance		High		
Geophysical survey dimensions and notes		Wreck **70293** is a highly degraded and potentially partially buried wreck situated around the centre of the array area. The wreck corresponds with UKHO record 7620, and is possibly the wreck of the sailing vessel *Chacabuco*. The wreck comprises an area of irregular, incoherent dark reflectors with significant shadow identified in the 2020 SSS data. The wreck is highly degraded and potentially partially buried in mobile seabed sediment, although a series of parallel dark reflectors with shadows identified at the east end could indicate intact vessel frame. The wreck area measures approximately 70.3 x 37.1 x 2.2 m. The wreck is visible in the MBES data as a large north-west to south-east orientated area of angular elongate objects, ranging from 3.5 m to 28.5 m in length. An anomaly with an amplitude of 1616 nT was identified in the Mag. data indicates the presence of significant amounts of ferrous material.		
Build	**Type**	Sailing vessel		
	Construction	Unknown, but assumed to be at least partially ferrous		
	Dimensions (m)	62.2 x 10.4 x 6.4, 999 tonnes (gross)		
	Shipyard	Unknown		
Loss	**Cause**	Collision with SS *Torch*		
Extent of Survival		Recorded by UKHO as the possible wreck of the sailing vessel *Chacabuco* (7620) which is reported to have sank following a collision with the SS *Torch*. The wreck was first identified during survey in 1939 HMS *Eglet*, and recorded as probably the *Chacabuco* following diver survey in 1989. The survey found collapsed steel wreckage and rigging consistent with a large sailing vessel The wreck is recorded as being highly broken-up and degraded, partially buried in a sandwave, and with a significant amount of collapsed steel wreckage, which correlates with the geophysical anomalies observed during this assessment. It's location within an area of mobile seabed sediment suggests it is likely to be periodically buried.		



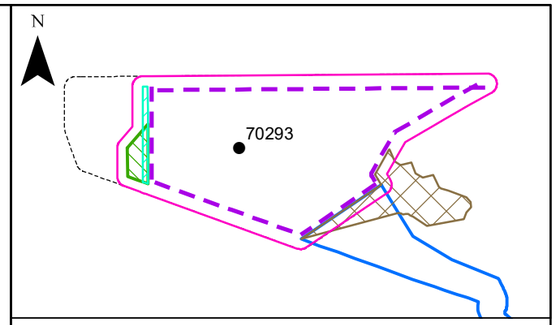
SSS waterfall image, 100 m range per channel



MBES grid image, x3 vertical exaggeration, looking west



Mag. profile image



LEGEND

- Array Area
- Array and Infrastructure zones buffer
- Geophysical reporting extent
- AyM to GyM interlink
- Subsea Infrastructure and Temporary Works
- Other Wind Farm Infrastructure Zone
- Offshore Export Cable Corridor
- Wreck location

Data Source:

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

ID 70293 – UKHO 7620 – Chacabuco

VER	DATE	REMARKS	Drawn	Checked
1	14/02/2022	For Issue	KF	DH

FIGURE NUMBER:

Figure 12

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
NTS	A3	WGS84	UTM30N

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AWEL Y MÔR Offshore Wind Farm

82 An unknown wreck (70042) Figure 13, Figure 9 and Figure 7 located in January 2020 and recorded as a dangerous wreck. The wreck was recorded as being upright and intact in a general depth of 17 m during an examination in August 2020. The wreck was measured as having a length of 12.71 m, a width of 7.5 m and a height of 3.9 m. The date and circumstance of loss is unknown.

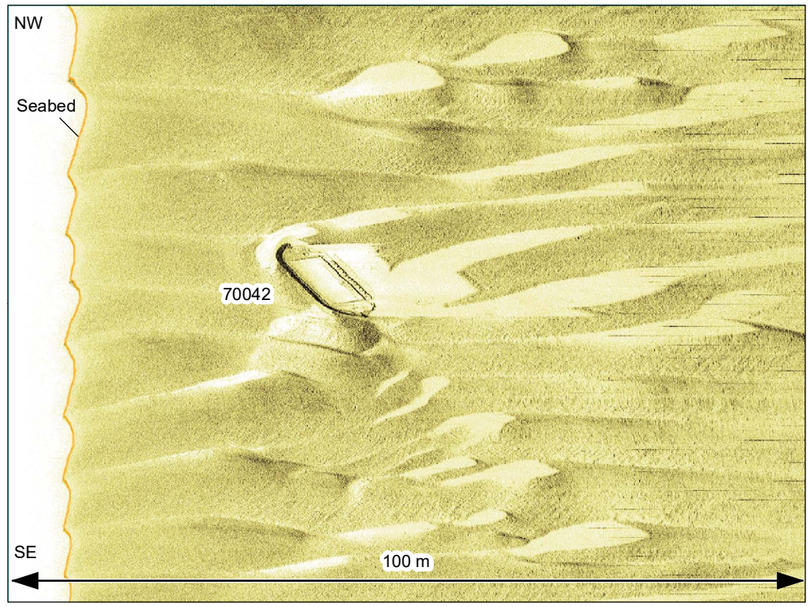
83 The wreck is located within the array area and was identified within the geophysical data at the charted position. Dimensions from the geophysical data were 29.0 x 8.6 x 3.7 m, and the wreck was seen to be orientated approximately east-west. The wreck is located within an area of mobile seabed sediment, and so is potentially buried periodically.

84 An unknown wreck (70180) Figure 14, Figure 9 and Figure 7 located in August 2020 and recorded in a general depth of 29 m while the wreck was measured as having a length of 3 m, a width of 3 m and a height of 1.8 m. The date and circumstance of loss is unknown.

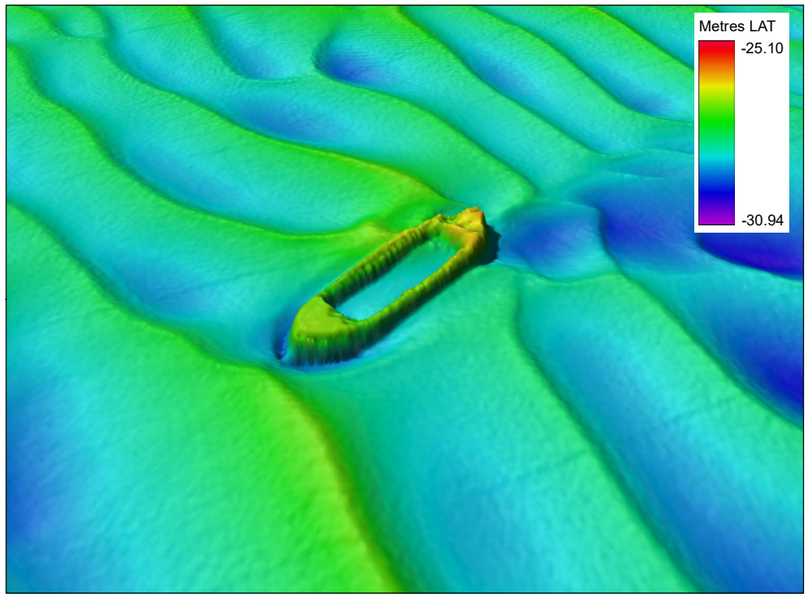
85 The wreck is located within the array area and was identified within the geophysical data at the charted position. Dimensions from the geophysical data were 21.8 x 10.4 x 3.2 m, and the wreck was seen to be orientated approximately northeast-southwest. The wreck is currently charted as an obstruction based on Civil Hydrography Programme bathymetric data acquired in 2020, which shows an isolated mound. The current geophysical data show an elongate area of debris extending northeast of this mound, which is tentatively interpreted as a possible boiler, and the site has been reinterpreted as a wreck.

86 An unknown wreck (70252) Figure 9 and Figure 6 recorded in 1939 as being 8.5 miles off Great Ormes Head and recorded in a general depth of 15 m. The date and circumstance of loss is unknown. The recorded location of this wreck is within the array area, but it was not identified within any of the geophysical data sets. As such, this has been assigned an A3 archaeological potential rating.

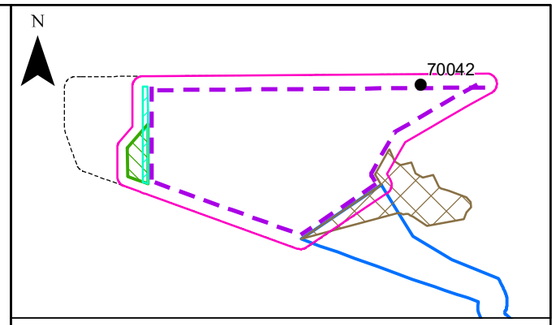
Location	456278 E 596972 N	**Area**	Array area
Archaeological Importance	High		
Geophysical survey dimensions and notes	Wreck 70042 is an upright and intact wreck situated in the north-east section of the array area, recorded as an unknown dangerous wreck by the UKHO (93229). The wreck is visible in the 2020 SSS dataset as a relatively small wreck with an irregular shadow, measuring 29.0 x 8.6 x 3.7 m. The hull outline is clear but no internal features visible, apart from a central rectangular depression. The MBES data show the wreck is orientated east-west, with scour at the eastern end, and is situated within mobile seabed sediment. The wreck is situated midway between two magnetometer survey lines, and so the potential ferrous content of the construction is unknown.		
Build	**Type**	Unknown	
	Construction	Unknown	
	Dimensions (m)	Unknown	
	Shipyard	Unknown	
Loss	**Cause**	Unknown	
Extent of Survival		UKHO record 93229 indicates the wreck was first identified by Clinton Marine during a Civil Hydrography Programme survey in 2020, and as such there is no additional survey history. The wreck appears upright and intact, with no visible debris spread. Its position within mobile sediment indicates it is potentially buried periodically.	



SSS waterfall image, 100 m range per channel



MBES grid image, x1 vertical exaggeration, looking north-east



LEGEND

- Array Area
- Array and Infrastructure zones buffer
- Geophysical reporting extent
- AyM to GyM interlink
- Subsea Infrastructure and Temporary Works
- Other Wind Farm Infrastructure Zone
- Offshore Export Cable Corridor
- Wreck location

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

ID 70042 – UKHO 93229 – Unknown

VER	DATE	REMARKS	Drawn	Checked
1	14/02/2022	For Issue	KF	DH

FIGURE NUMBER:

Figure 13

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
NTS	A3	WGS84	UTM30N

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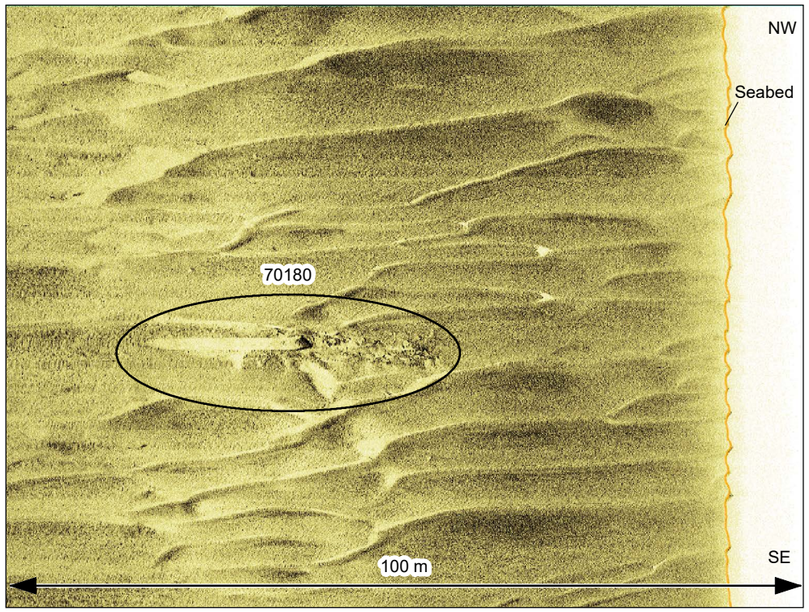
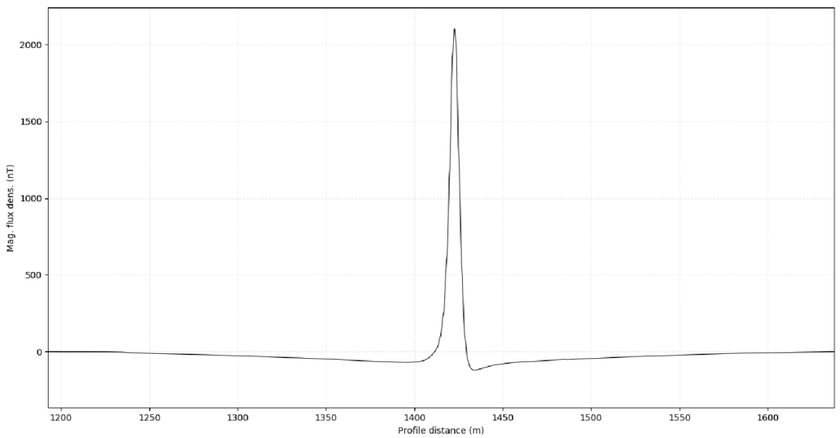
Offshore Wind Farm

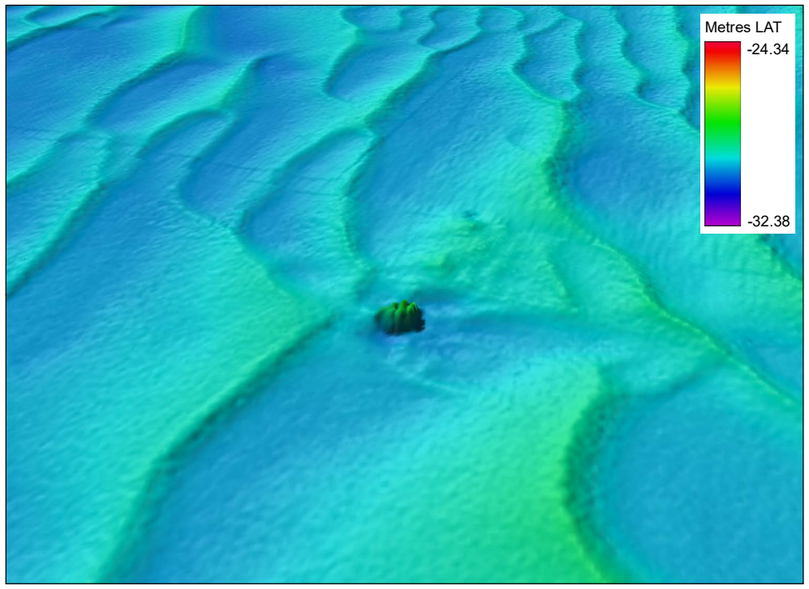
Location		453786 E 5923243 N	**Area**	Array area
Archaeological Importance		High		
Geophysical survey dimensions and notes		Wreck **70180** is a potential unidentified wreck situated in eastern part of the array area. It is recorded by the UKHO as an obstruction (94513). The potential wreck is visible in the 2020 SSS data set as an elongate, irregular seabed disturbance with a large, square dark reflector with associated large, straight shadow at the south-western end, which may be an intact boiler. The total area of disturbance, including possible boiler, measures approximately 21.8 x 10.4 x 3.2 m. In the MBES dataset, the main section of the potential wreck appears as a low, elongate mound, trending north-east to south-west. The potential boiler is visible at the south-western end of the main section as a distinct, taller mound with multiple peaks. In the Mag. data, the potential wreck is associated with a very large, sharp positive monopole of magnitude 2225 nT, indicating a significant amount of ferrous material.		
Build	**Type**	Unknown		
	Construction	Unknown, but assumed at least partially ferrous		
	Dimensions (m)	Unknown		
	Shipyard	Unknown		
Loss	**Cause**	Unknown		
Extent of Survival		The potential boiler is recorded by the UKHO as an obstruction (94513), first identified by Clinton Marine during a Civil Hydrography Programme survey in 2020, and as such there is no additional survey history. However, the record does not mention the rest of the seabed disturbance extending to the north-east, which may indicate further buried and/or low-lying debris. This suggests the wreck is severely degraded and/or mostly buried, with only solid features such as the potential boiler remaining relatively intact. The wreck is situated within mobile seabed sediment, and is therefore likely to be periodically buried.		



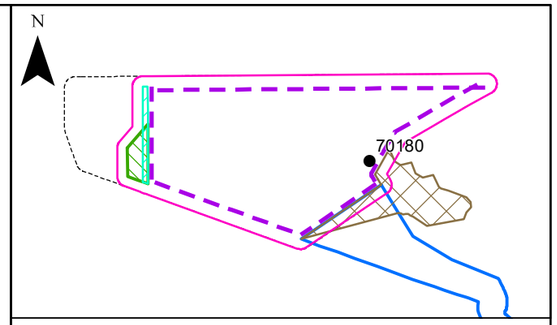
SSS waterfall image, 100 m range per channel



Mag. profile image



MBES grid image, x1 vertical exaggeration, looking north



LEGEND

- Array Area
- Array and Infrastructure zones buffer
- Geophysical reporting extent
- AyM to GyM interlink
- Subsea Infrastructure and Temporary Works
- Other Wind Farm Infrastructure Zone
- Offshore Export Cable Corridor
- Wreck location

Data Source:

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

ID 70180 – UKHO 94513 – Unknown

VER	DATE	REMARKS	Drawn	Checked
1	14/02/2022	For Issue	KF	DH

FIGURE NUMBER:

Figure 14

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
NTS	A3	WGS84	UTM30N

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Offshore Wind Farm

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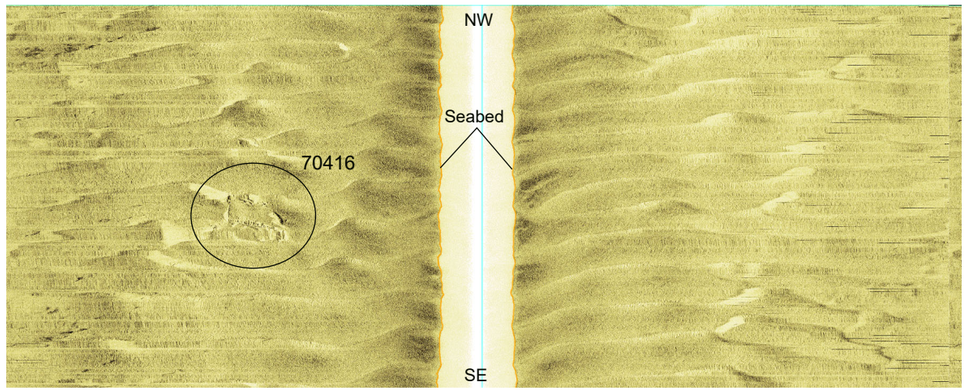
87 A further 16 anomalies identified within the array area have been classified as A1 archaeological potential. Four of these are debris directly associated with the wreck of the *Dublin* (70019) and nine with the wreck of the SS *Albanian* (70326), described earlier.

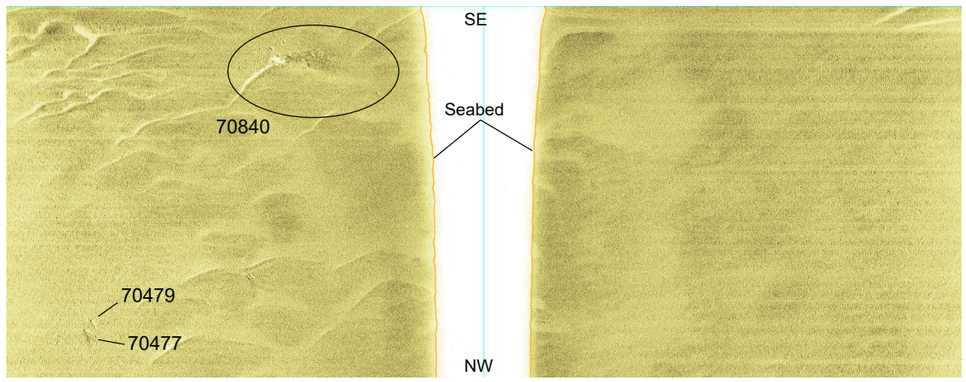
88 Anomaly 70416 is a debris field not directly associated with any known wreck sites and was identified in the sidescan sonar data as an area of irregular dark reflectors measuring 14.0 x 10.0 x 0.6 m Figure 15. This is potentially an area of debris of unknown origin but could be the partially buried remains of a structure such as a wreck. Anomaly 70415 is an isolated feature measuring 2.2 x 1.3 x 0.4 m located 4.0 m from debris field 70416 and may be associated debris. These are both located within the array area and have been assigned an A1 archaeological potential rating.

89 Anomaly 70480 is a second debris field not directly associated with any known wreck sites and was identified in the sidescan sonar data as an area of irregular dark reflectors measuring 37.3 x 15.4 x 0.6 m with an associated magnetic anomaly of 57 nT Figure 15. This is located within the array area buffer and may represent partially ferrous debris of currently unknown origin or could be a dispersed and partially buried wreck site.

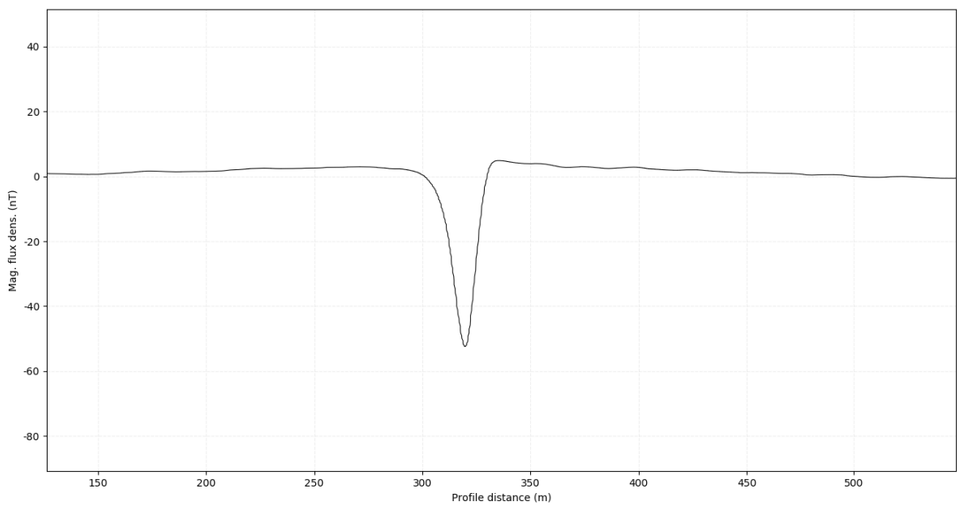
90 The remaining 472 anomalies of archaeological potential identified within the array area have all been assigned an A2 archaeological potential rating. These include individual pieces of debris, lengths of rope or chain, features of uncertain origin, and magnetic anomalies indicating the presence of buried ferrous debris. A full gazetteer detailing all of the identified anomalies is presented in Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1).



Anomaly **70416**, SSS waterfall image, 100 m range per channel



Anomaly **70480**, SSS waterfall image, 100 m range per channel



Anomaly **70840**, Mag. profile image

Data Source:

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

Data examples –
Array area and Infrastructure zone

VER	DATE	REMARKS	Drawn	Checked
1	23/06/2021	For Issue	KJF	DH

FIGURE NUMBER:

Figure 15

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
N/A	A3	N/A	N/A

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Offshore Wind Farm

11.8.2 Export Cable Corridor

Palaeogeography

91 There are no designated or known sites within the ECC. However, there is potential for archaeological material of a prehistoric date to exist within the study area. A description of the geological and prehistoric baselines, and a palaeogeographic assessment can be found in Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1).

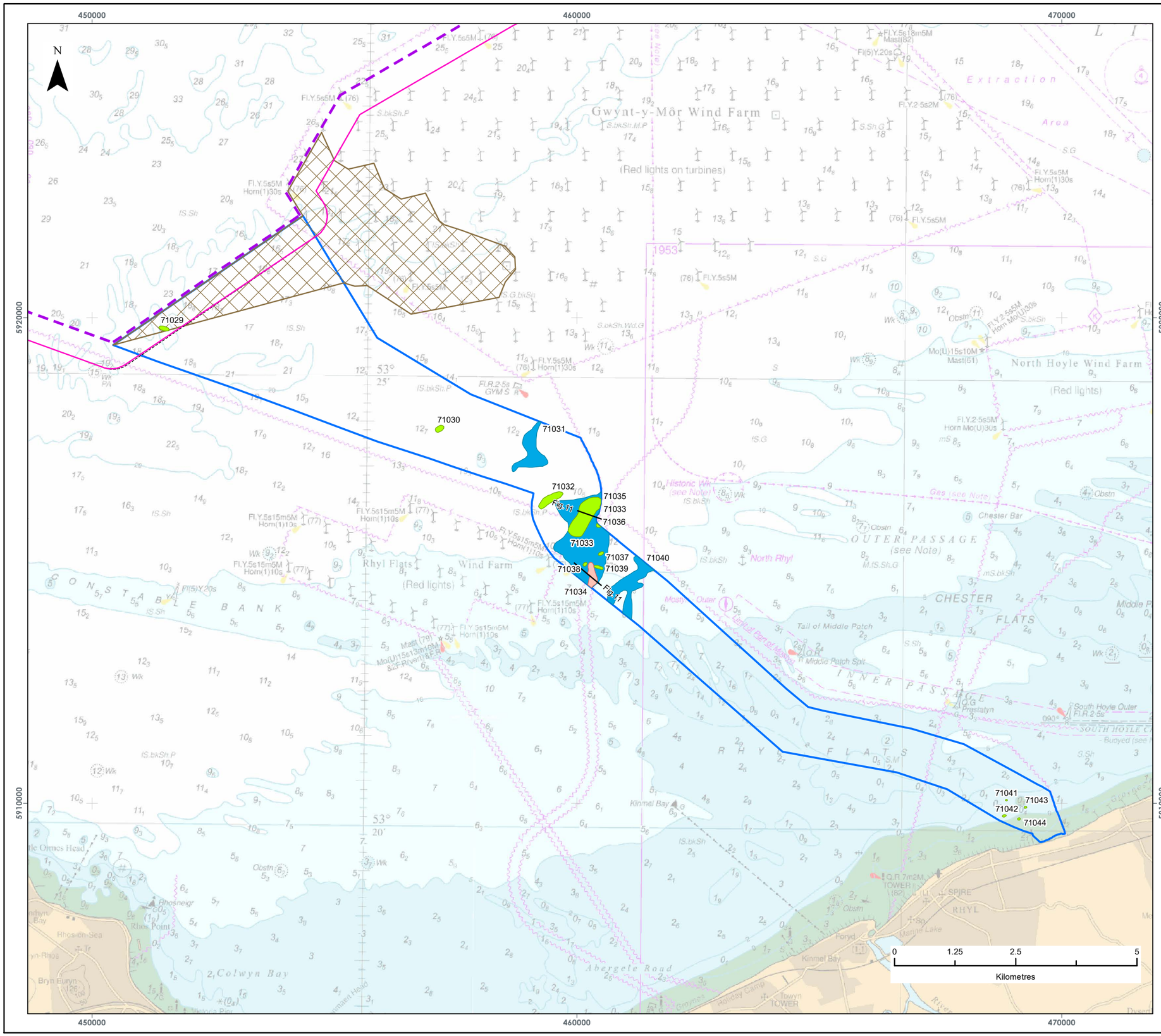
92 During assessment of the sub-bottom profiler data, a number of palaeogeographic features of archaeological potential were identified within the ECC. The distribution of these features is illustrated in Figure 16.

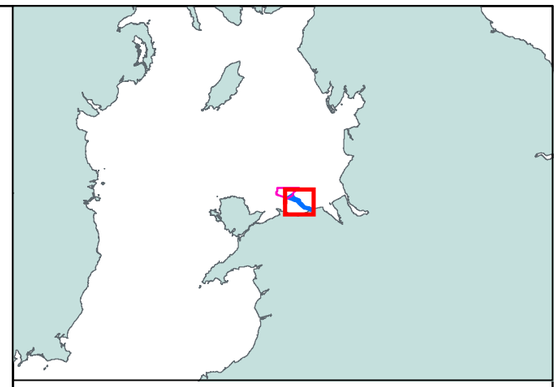
93 Three distinct channel features have been identified cutting across the width of the ECC, approximately in a NNE-SSW orientation, at the section of the ECC just to the west of Rhyl Flats OWF. The largest of these channels is relatively steep sided, suggesting it may have been originally created by glacial processes, and contains multiple phases of fill.

94 This channel also contains two areas of high amplitude reflectors towards the upper layers of the lower fill, interpreted to represent an internal erosion surface or possible deposit with an increased organic content (e.g. an organic clay) (Figure 17). However, it does not appear to be a fully organic deposit, such as a buried peat.

95 The second phase of fill within the channel potentially represents later reactivation of the channel as a fluvial feature following initial complete infilling with sediment.

96 The two other channel features are smaller and shallower, and generally contain a single phase of fill. These channel features are all interpreted as potentially part of the same fluvial system, created in a terrestrial environment between the LGM and Holocene marine transgression. As such, they are considered of high archaeological potential, and could contain both *in situ* and derived archaeological artefacts and preserved palaeoenvironmental material.





LEGEND

- Array Area
- Array and Infrastructure zones buffer
- Geophysical reporting extent
- AyM to GyM interlink
- Offshore Export Cable Corridor
- Data example locations

Palaeogeographic Features

- Channel
- High amplitude reflector
- Simple cut and fill

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE: **Palaeogeographic features of archaeological potential – Offshore export cable corridor**

VER	DATE	REMARKS	Drawn	Checked
1	14/02/2022	For Issue	KJF	DH

FIGURE NUMBER:

Figure 16

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:80,000	A3	WGS84	UTM30N

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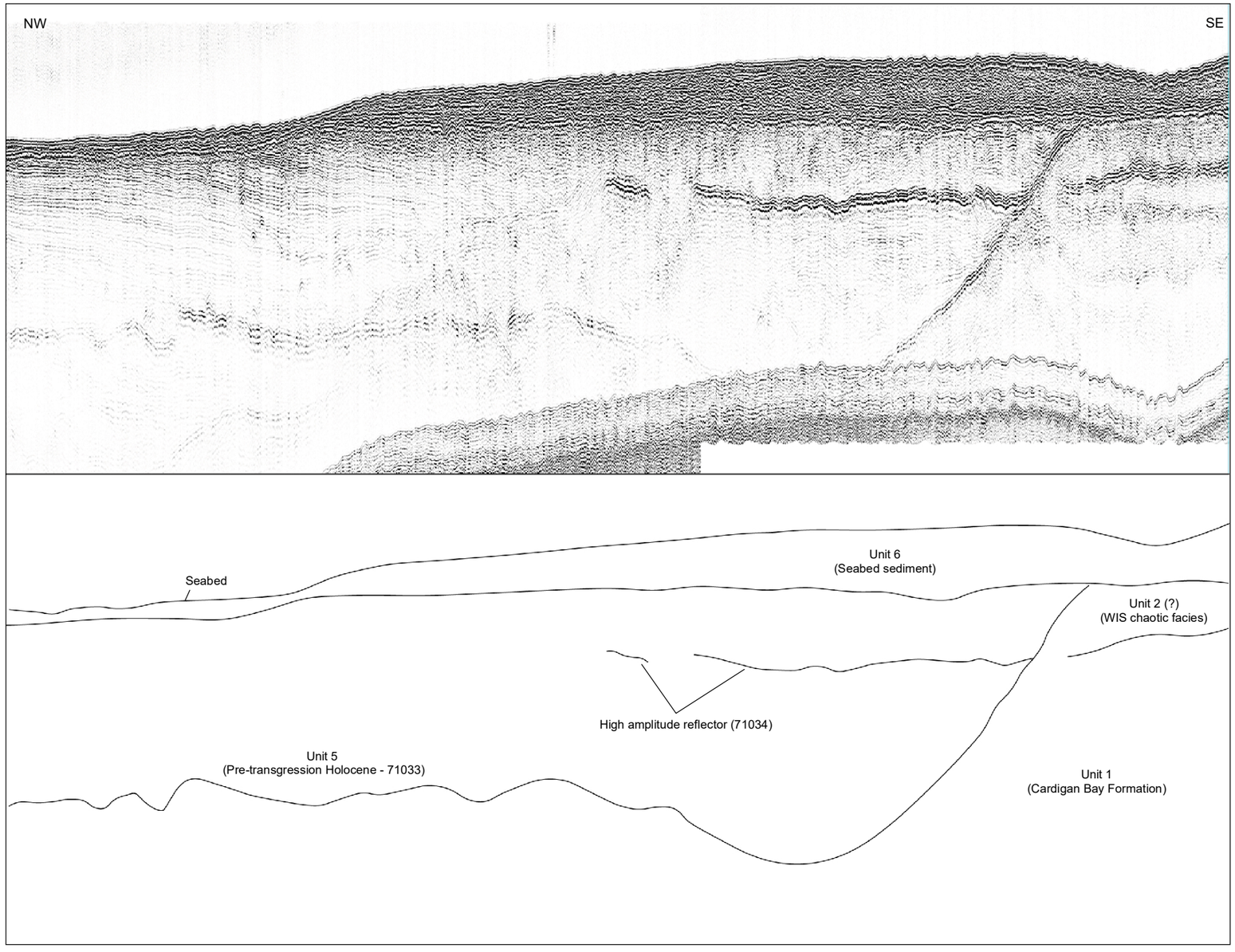
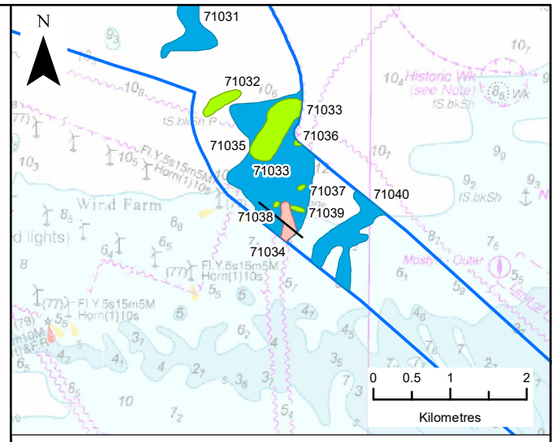
Offshore Wind Farm





LEGEND

- Offshore Export Cable Corridor
- Data example locations

Palaeogeographic

- Channel
- High amplitude reflector
- Simple cut and fill

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

SBP data example – 71033, 71034

VER	DATE	REMARKS	Drawn	Checked
1	14/02/2022	For Issue	KJF	DH

FIGURE NUMBER:

Figure 17

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
Location 1:80,000	A3	WGS84	UTM30N

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AWEL Y MÔR
Offshore Wind Farm

97 A small number of other, smaller cut and fill features are also present within the ECC. As with similar features identified within the Array area and Infrastructure zone, these are smaller, less certain features, and could either represent pre-transgression Holocene deposits or be internal features of the underlying units. As such, these are classified as of possible archaeological potential.

98 It is known that peat deposits have been identified in the intertidal area of the ECC during surveys associated with this proposed development (Fugro 2021). However, the sub-bottom profiler data coverage does not extend as far towards the coast as the intertidal zone, and no definite indications of such deposits extending further offshore have been identified.

99 A deposit of overlying seabed sediment is present throughout the ECC, ranging from a thin veneer close to the coastline to a relatively thick area of mega-ripples and sand waves towards the Array area. As a post-transgression (modern) sedimentary deposit the seabed sand is not considered of archaeological potential in itself; however, it has the potential to bury archaeological sites (e.g. shipwrecks) in areas where the sediment is sufficiently thick and mobile and contain reworked material from older underlying geological units.

Seabed Features

100 During the seabed features assessment, a total of 132 anomalies of archaeological potential were identified within the cable route. These can be summarised as follows, and the distribution of features along the cable route is illustrated in Figure 18 and Figure 19:

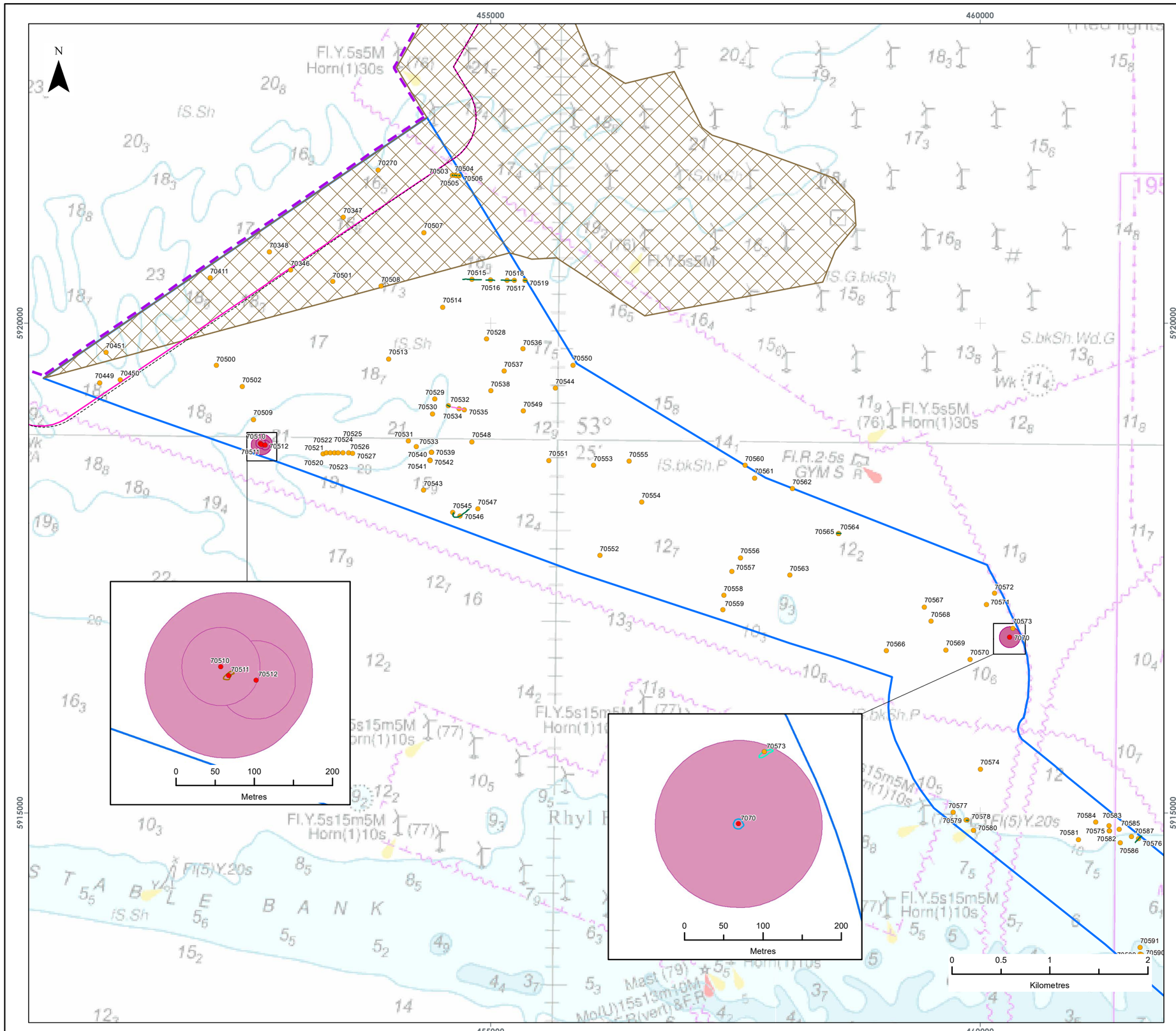
Table 7: Anomalies of archaeological potential – cable route.

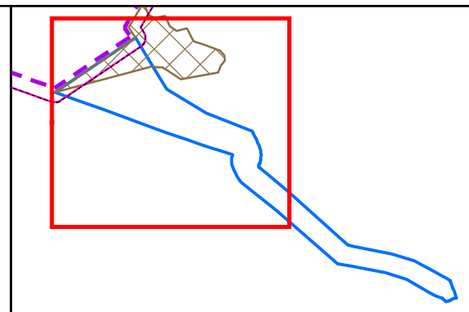
ARCHAEOLOGICAL DISCRIMINATION	QUANTITY	INTERPRETATION
A1	4	Anthropogenic origin of archaeological interest
A2	127	Uncertain origin of possible archaeological interest

ARCHAEOLOGICAL DISCRIMINATION	QUANTITY	INTERPRETATION
A3	1	Historic record of possible archaeological interest with no corresponding geophysical anomaly

101 None of the sites within the cable route area have been designated. One feature was identified in the cable corridor based on data from the UKHO, NMRW and HER (Figure 20) and 131 from the archaeological assessment of the geophysical survey. This assessment is based on the criteria for assessing archaeological value, as set out in Table 3, and based on available guidance (Cadw 2020).

102 The fuselage of an Avro Anson Bomber aircraft (2004) Figure 20 was located in 1993 near Rhyl Buoy. The engines were thought to have already been removed. The date and circumstance of loss is unknown. A survey in 2000 did not locate any more aircraft wreckage and the record was amended to 'dead'. The findspot is located within the cable route and it is recorded by the UKHO as an obstruction. The fuselage corresponds with record 70593, that has been ascribed an archaeological potential rating of A3. This was record as an obstruction by the UKHO for which no anomalies were visible in the geophysical data. This is currently recorded as an area of foul ground, which was previously reported as the wreck of an Avro Anson Bomber. As such, this has been assigned an A3 archaeological potential rating and therefore a precautionary AEZ has been applied to it (Figure 19). It should also be noted that as a military aircraft it would be subject to the Protection of Military Remains Act.





LEGEND

- Array Area
- Array and Infrastructure zones buffer
- Geophysical reporting extent
- AyM to GyM interlink
- Offshore Export Cable Corridor
- Recommended archaeological exclusion zones

Anomalies of archaeological potential

- A1: Anthropogenic origin of archaeological interest
- A2: Uncertain origin of possible archaeological interest

Feature boundaries

- Debris field
- Mound
- Seabed disturbance

Linear features

- Bright reflector
- Debris
- Rope/chain

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

Seabed features of archaeological potential – Offshore Export Cable Corridor

VER	DATE	REMARKS	Drawn	Checked
1	14/02/2022	For Issue	KF	DH

FIGURE NUMBER:

Figure 18

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:40,000	A3	WGS84	UTM30N

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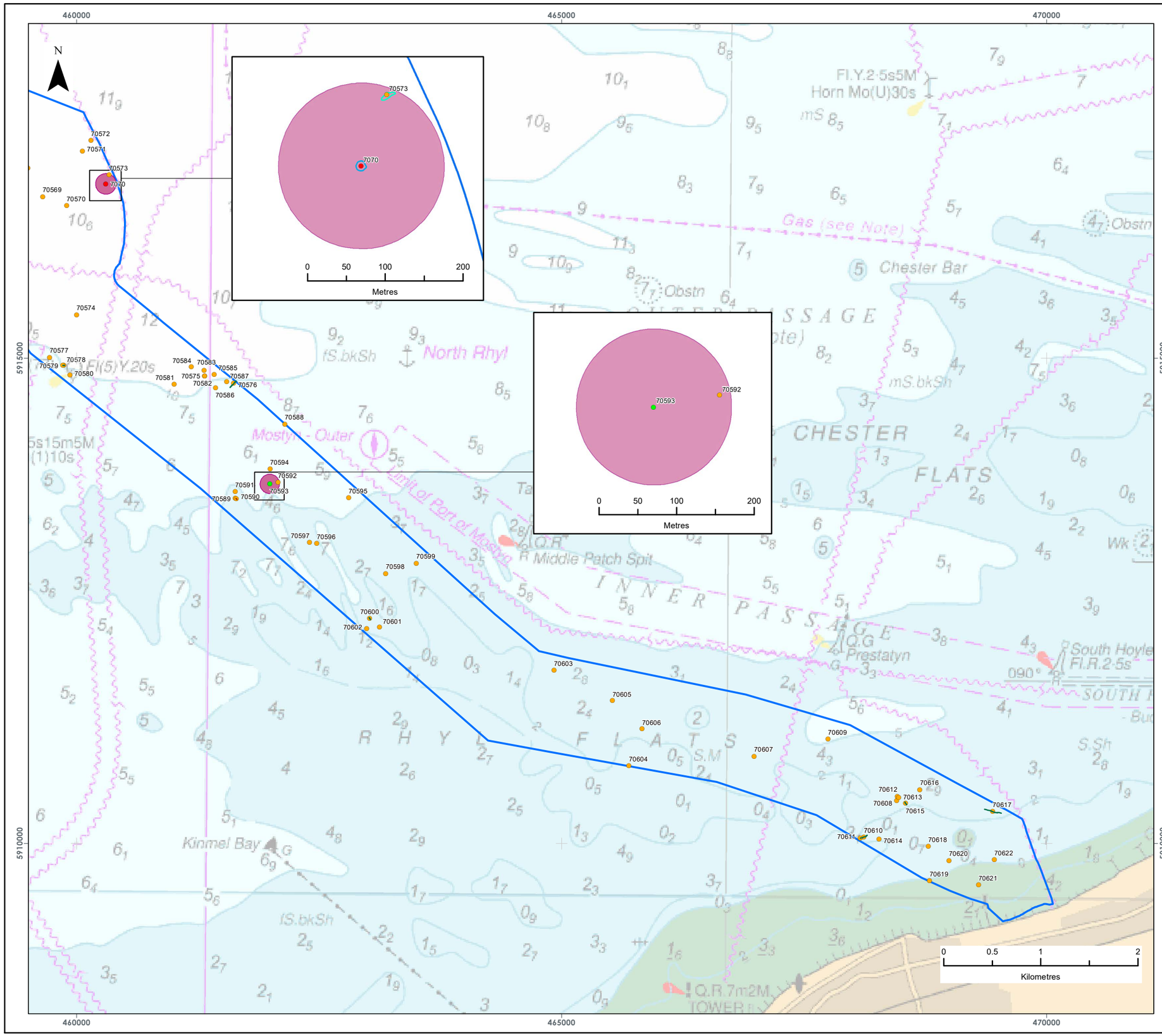
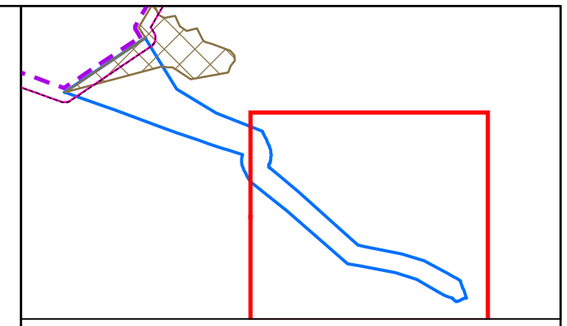
AWEL Y MÔR
Offshore Wind Farm





LEGEND

- Offshore Export Cable Corridor
- Recommended archaeological exclusion zones

Anomalies of archaeological potential

- A1: Anthropogenic origin of archaeological interest
- A2: Uncertain origin of possible archaeological interest
- A3: Historic record of possible archaeological interest

Feature boundaries

- Mound
- Seabed disturbance

Linear features

- Debris
- Rope/chain

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

Seabed features of archaeological potential – Offshore Export Cable Corridor

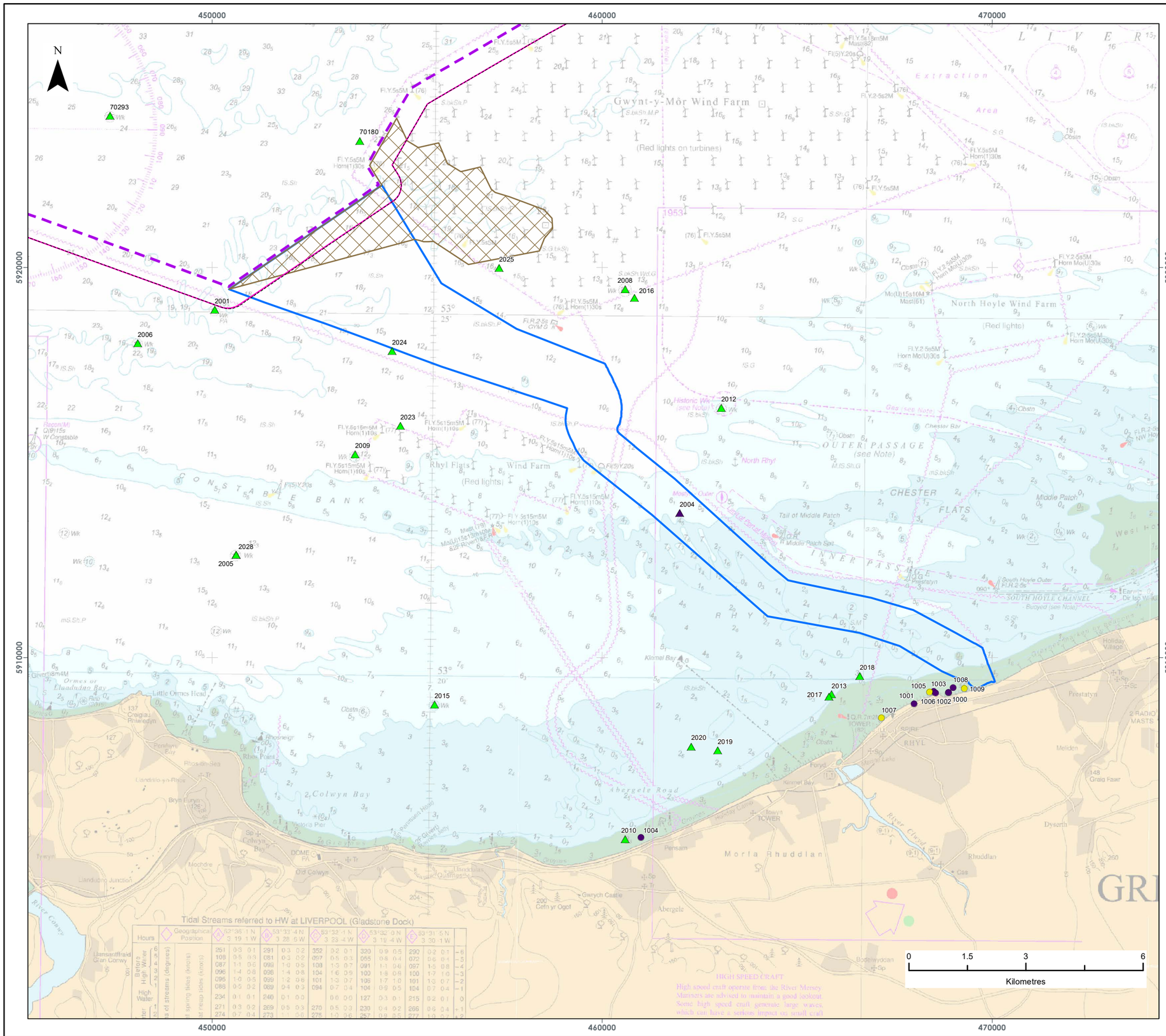
VER	DATE	REMARKS	Drawn	Checked
1	14/02/2022	For Issue	KF	DH

FIGURE NUMBER:

Figure 19

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:40,000	A3	WGS84	UTM30N

Fferm Wynt Alltraeth
AWEL Y MÔR Offshore Wind Farm



LEGEND

- Array Area
- Array and Infrastructure zones buffer
- Geophysical reporting extent
- AyM to GyM interlink
- Offshore Export Cable Corridor

Terrestrial Sites and Findspots in the Intertidal Zone

- Findspot
- Site

Known Maritime and Aviation Sites

- Findspot
- Wreck

Data Source:

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PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

Cable Corridor Study Area

VER	DATE	REMARKS	Drawn	Checked
1	14/02/2022	For Issue	KJF	LR

FIGURE NUMBER:

Figure 20

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:100,000	A3	WGS84	UTM30N

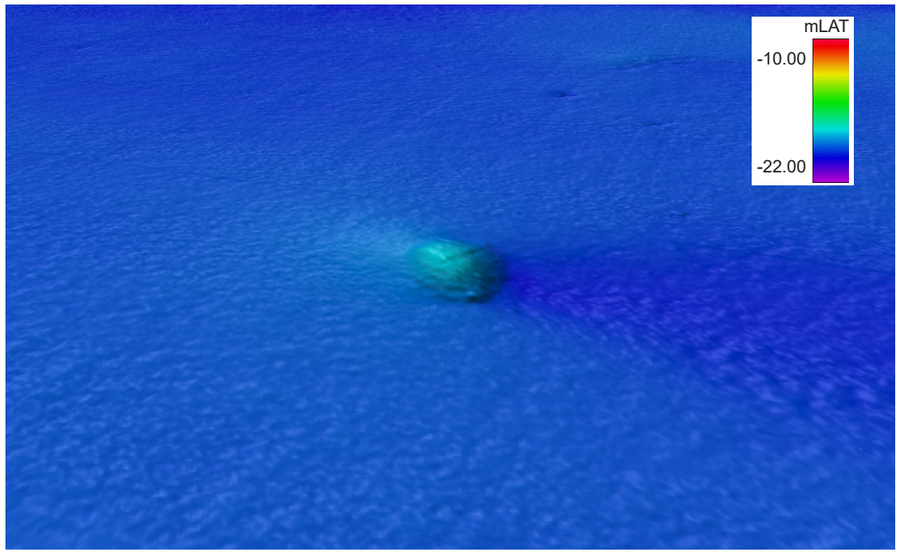
Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

104 Four anomalies not associated with any known wrecks or obstructions have been assigned an A1 archaeological potential rating along the cable route. Anomaly 7070 is a distinct and discrete elongate mound with an irregular surface, which was identified during the GyM assessment (Wessex Archaeology 2012) as well as within the 2020 datasets (Figure 21). The feature measures 14.5 x 11.8 x 1.2 m and has an associated magnetic anomaly of 66 nT, suggesting ferrous material.

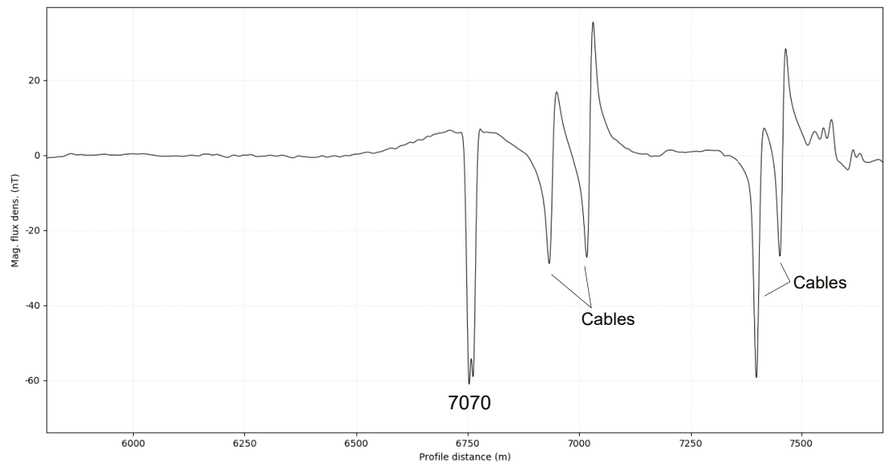
105 The appearance of this anomaly has remained consistent between two surveys a decade apart, suggesting it is a relatively stable, long-lived feature on the seabed. It is a unique feature within the wider study area, and so is unlikely to be natural. This anomaly potentially represents a mound of debris, potentially a ballast mound from a shipwreck, the surrounding remains of which have decayed away. However, this can only be confirmed by visual inspection.

106 Anomaly 70511 is a debris field not directly associated with any known wreck sites and was identified in the sidescan sonar data as an area of irregular dark and bright reflectors measuring 12.4 x 5.0 x 0.5 m with a 24 nT associated magnetic anomaly Figure 21. This is potentially an area of debris of unknown origin but could be the partially buried remains of a structure such as a wreck. Anomalies 70510 and 70512 are individual anomalies located 14 m northwest and 35 m east of 70511 respectively and may be associated debris. All have been assigned an A1 archaeological potential rating.

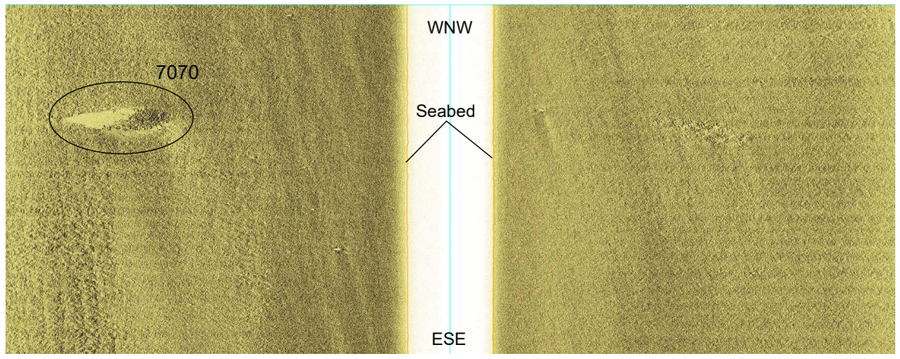
107 The remaining 127 anomalies of archaeological potential identified within the array area have all been assigned an A2 archaeological potential rating. These include individual pieces of debris, lengths of rope or chain, features of uncertain origin, and magnetic anomalies indicating the presence of buried ferrous debris. A full gazetteer detailing all the identified anomalies is presented in the marine archaeological technical report (Wessex Archaeology 2021a).



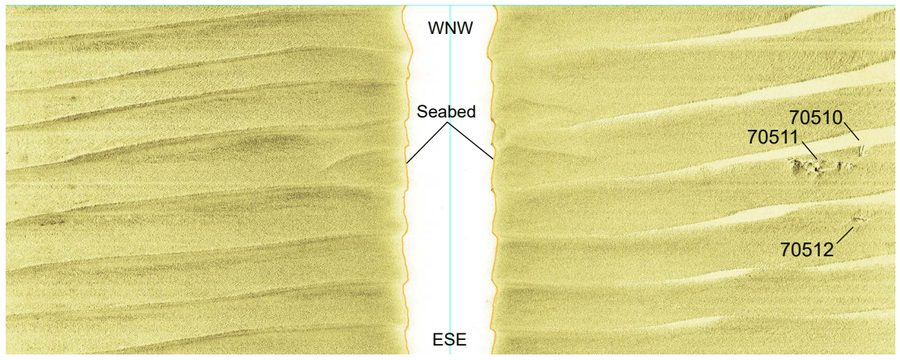
Anomaly **7070,** MBES grid image, x1 vertical exaggeration, looking north



Anomaly **7070**, Mag. profile image



Anomaly **7070**, SSS waterfall image, 100 m range per channel



Anomalies **70510** to **70512**, SSS waterfall image, 100 m range per channel

Data Source:

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

Data examples – ECC

VER	DATE	REMARKS	Drawn	Checked
1	23/06/2021	For Issue	KJF	DH

FIGURE NUMBER:

Figure 21

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
N/A	A3	N/A	N/A

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

11.8.3 Landfall

108 None of the sites identified during the initial searches within the landfall study area have been designated. Of the ten records in the intertidal zone, all were located within the wider buffer, not directly within the landfall area.

109 The assessment and mitigation of the intertidal area have been undertaken within the Onshore Chapter Volume 3, Chapter 8: Onshore Archaeology and Cultural Heritage (application ref: 6.3.8). The proposed mitigation will be presented in further detail in an Onshore WSI as the geotechnical investigations that are being done in the intertidal zone, the contractor and the methodologies are likely to be working in the intertidal and the adjacent onshore areas, so it is felt it best sits with the Onshore team.

11.8.4 Evolution of the baseline

110 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 require that 'a description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge' is included within any ES.

111 If the project were not to go ahead, it is expected that over the next 50-100 years, the offshore archaeology and cultural heritage would remain relatively unaltered. However, there would likely be continued erosion and slow degradation of exposed metal and wooden wrecks on the seabed. Those wrecks that are partially buried are expected to degrade at a slower rate than those that are exposed. Shifting sands in the area means that wrecks should continuously become exposed and re-buried.

11.9 Key parameters for assessment

112 The following section describes the engineering parameters of the project design envelope defined in Volume 2, Chapter 2: Offshore Project Description (application ref: 6.2.1), that constitute the identify the Maximum Design Scenario (MDS) when assessing potential adverse impacts on offshore archaeological and cultural heritage receptors. By assessing the MDS for each individual impact, this assessment presents the maximum possible effect upon the marine archaeological environment in and around the proposed development area. As such, impacts of greater adverse significance would not arise should any other development scenario be taken forward in the final scheme design.

113 Although the proposed development is confined to the Site Investigation Boundary, the exact layout of the proposed turbines, other structures and cable route has not been confirmed. As such, there is no clear MDS for effects upon the offshore archaeological environment. With regards to offshore archaeology, the impact on specific receptors (i.e. a specific very high value wreck site) would be the maximum adverse effect of the development. Variations to the final layout may in theory determine the degree to which different archaeological receptors are affected. However, due to the scale of the project, the wide distribution of known archaeological receptors and the uncertain distribution of potential archaeological receptors, the worst-case scenario approach ensures that any difference in layout has been fully captured as part of the assessment in the ES.

114 For the selection of worst-case scenarios for major adverse effects on offshore archaeological and cultural heritage receptors, a number of potential scenarios have been assessed. For seabed receptors (i.e. wrecks/ aircraft) in shallow seabed sediments, the MDS involves the maximum number of impact locations on the seabed and the design with the greatest maximum footprint including scour protection. For palaeogeographic receptors, the MDS involves the maximum potential disturbance of below seabed sediments across the largest area and in the greatest number of locations.

115 Where potential impacts are considered to arise as a result of changes in hydrodynamic and sedimentary regimes, this assessment relies on the outputs of the assessments in Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes Technical Annex (application ref: 6.2.2).

116 Table 8 describes the project design envelope scenarios identified from Volume 2, Chapter 1: Offshore Project Description (application ref: 6.2.1 presenting the MDS for each potential impact in relation to offshore archaeology and cultural heritage. All scenarios are considered to be realistic and fully justified. Where the term 'seabed receptors' is used, it includes known shipwrecks, aircraft crash sites, geophysical anomalies and palaeogeography, and also terrestrial sites in the intertidal zone, where applicable.

117 For the assessment, the following scenarios were assessed based on information presented in Volume 2, Chapter 1: Offshore Project Description (application ref: 6.2.1) as follows in Table 8.

Table 8: Maximum design scenario.

POTENTIAL EFFECT	MAXIMUM DESIGN SCENARIO ASSESSED	JUSTIFICATION
CONSTRUCTION		
Removal of sediment containing undisturbed archaeological contexts leading to total loss of the receptor during preparation of the seabed for WTGs and offshore substation foundations.	The maximum impact will be from: • Maximum seabed preparation area for turbines; • Maximum number of turbine locations: 50 locations; • Maximum footprint for all gravity-based jacket foundations including seabed preparation (50 turbines): 98,175 m^2; • Max volume of seabed preparation (50 turbines on gravity-based jacket foundations): 196,350 m^3; • Bed preparation depth over full foundation area; • Maximum diameter of seabed preparation area for two Offshore Substation Platforms (OSPs); • Bed preparation depth over full OSPs foundation area; • Maximum seabed preparation per ancillary structure; • Maximum seabed preparation dredge volume for turbine foundations; • Total prepared volume per release;	Seabed preparation footprint: maximum preparation footprint, therefore maximum potential disturbance of seabed across the largest area and in the greatest number of locations (greatest potential for impacts to occur) Disposal of bed levelling material if required.

POTENTIAL EFFECT	MAXIMUM DESIGN SCENARIO ASSESSED	JUSTIFICATION
	▲ Dredged material from bed levelling to impact the seabed; ▲ Seabed preparation material deposition; and ▲ Pre-sweeping for Offshore Export Cable (dredging), if required – indicative length of cable 31.5 km including microrouting allowance. Indicative maximum seabed preparation for export cable vessel laydown areas (to flatten the seafloor) - 57,600 m^3.	
	The maximum construction footprint of the turbines within the study area will be: ▲ Maximum number of locations: 50; and ▲ Configuration with maximum project base footprint (including scour protection): 50 turbines, with gravity-based foundation/WTG gravity-based jacket foundation, including scour protection. Total area: 570,209 m^2.	Maximum project base footprint therefore maximum potential disturbance of seabed across the largest area and in the greatest number of locations (greatest potential for impacts to occur).
	The maximum construction footprint of the associated infrastructure (including seabed preparation and foundation) within the study area will be:	Maximum seabed area disturbed, therefore maximum potential disturbance to seabed features

POTENTIAL EFFECT	MAXIMUM DESIGN SCENARIO ASSESSED	JUSTIFICATION
	▲ Two OSPs. Maximum scour protection, gravity-based jacket OSP Foundations: 21,600 m^2 ▲ One met mast. With maximum footprint of 20 m^2 on the seabed with monopile foundation; and ▲ Deployment of floating lidar buoy(s) are also being considered.	
Compression of stratigraphic contexts containing archaeological material from combined weight of foundation, transition piece, tower, and wind turbine.	The maximum impact for compression will be: ▲ Maximum number of locations: 50; and ▲ Associated infrastructures using gravity-based jacket OSP Foundations.	Maximum compression of stratigraphic contexts.
Disturbance of sediment containing potential archaeological receptors (material and contexts) during	The maximum construction footprint of the cables (including intra-array and export cables) within the study area will be- Inter-array cables:	Largest seabed area disturbed along the greatest distance at the maximum number of locations (greatest potential for direct impacts to occur).

POTENTIAL EFFECT	MAXIMUM DESIGN SCENARIO ASSESSED	JUSTIFICATION
inter-array and export cable laying operations.	▲ Maximum potential length of array cable installed in seabed: 116 km. ▲ Indicative with of seabed affected by installation per cable (ie: pre-lay ploughing, pre-installation dredging, jetting, mechanical trenching): 18 m; ▲ Indicative trench width 6 m (pre-lay ploughing) ▲ Indicative maximum depth of dredging: 5 m ▲ Indicative length of array cable route requiring sandwave clearance 80 km, to an indicative width of 70 m – maximum volume of material cleared from sandwaves 7,600,000 m^3 ▲ Indicative width of rock berm protection (major base) [m]: 15.2 m. ▲ Maximum area of rock berm protection footprint per project 242,853 m^2. Export cables: ▲ Indicative total length per cable: 31.5 km x maximum number of export cables: 2 x Indicative trench width and disturbance from pre-lay ploughing, jetting and mechanical trenching: 18 m. Total area = 1,134 km^2;	

POTENTIAL EFFECT	MAXIMUM DESIGN SCENARIO ASSESSED	JUSTIFICATION
	• Indicative width of disturbance from ploughing: 15 m; • Indicative maximum seabed preparation for export cable vessel laydown areas 57,600 m^2; • Maximum offshore export rock berm protection footprint: 242,853 m^2; • Indicative length of sandwave clearance 63 km, indicative width of sandwave clearance 70 m, maximum volume of material from sandwave cleared: 6,281,000m^3.	
	The maximum construction footprint of the export cable landfall within the study area: • Maximum extent of HDD exit pit; • Maximum extent of temporary piling activities and/or cofferdam if required.	Maximum potential area and depth of disturbance of intertidal deposits along the greatest distance at the maximum number of locations (greatest potential for direct impacts to occur).

POTENTIAL EFFECT	MAXIMUM DESIGN SCENARIO ASSESSED	JUSTIFICATION
Penetration and compression effects of jack-up legs and anchoring of construction vessels during turbine, sub-station or cable installation leading to total or partial loss of archaeological receptors.	The maximum footprint from the legs of jack-up crane vessels and/ or anchors of other vessels during construction within the study area will be: • Jack-up footprint for turbine construction (individual leg footprint area 275 m^2, maximum number of legs 6, combined leg area 1,100 m^2, maximum jacking operations per turbine; • Project Max Total Impacted Area in period 338,800 m^2; • Anchor footprint for installation of turbines: Project Max Total Impacted Area 193,690 m^2; • Anchor footprint for installation of turbines: Project Max Total Impacted Volume 774,758 m^3; • Anchor footprint for installation of export cable: Project Max Total Impacted Area 78,204 m^2; • Anchor footprint for installation of export cable: Project Max Total Impacted Volume 117,306 m^3.	Maximum total physical footprint from vessels associated with construction activities
Intrusion of piling foundations disturbing archaeological contexts leading to a	The scheme design with the maximum depth disturbance within the study area will be: • Indicative max drill penetration depth: 68 m; • Indicative pile penetration depth: 65 m;	Scheme design with the maximum depth therefore maximum potential disturbance of below

POTENTIAL EFFECT	MAXIMUM DESIGN SCENARIO ASSESSED	JUSTIFICATION
partial or total loss of the receptor.	▲ Greatest number of locations: 50 (small turbine capacity); and ▲ Max footprint for all WTG foundations: 50 turbines (13 m pile diameter): 6,637 m^2.	seabed sediments across the largest area and in the greatest number of locations (greatest potential for impacts to occur).
	The associated offshore infrastructure (including seabed preparation and foundations) with the maximum depth disturbance within the study area will be: ▲ Two OSPs foundation: max drill penetration: 60 m; ▲ One met mast. Maximum depth of penetration for monopile; ▲ Mooring buoys. Maximum depth of anchor penetration; and ▲ LIDAR buoys. Maximum depth of anchor penetration.	Maximum depth of disturbance so may impact on submerged prehistoric material and below seabed palaeolandscapes.
	The maximum depth of disturbance from the legs of jack-up crane vessels and/ or anchors of other vessels during construction within the study area will be: ▲ Maximum depth of jack-up footprint: unknown at this stage; and	Maximum depth of disturbance so may impact on submerged prehistoric material and below seabed palaeolandscapes.

POTENTIAL EFFECT	MAXIMUM DESIGN SCENARIO ASSESSED	JUSTIFICATION
	▲ Maximum depth of anchors for installation of turbines and OSPs: 4 m.	
	The maximum depth disturbance of the cables within the study area will be: ▲ Inter-array cables: maximum burial depth 4 m, over the maximum length of cable; and ▲ Export cables: maximum burial depth: 4 m, over the maximum length of cable.	Maximum depth of disturbance so may impact on submerged prehistoric material and below seabed palaeolandscapes (although this is unlikely given that the maximum burial depth is relatively shallow).
Indirect effects upon known and potential marine archaeological receptors as a result of changes to sedimentation and erosion patterns.	Potential introduction of scour as a result of the construction of the array. In order to ensure the full consideration of the metrics in the project description, the potential for scour effects have been assessed as per Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes Technical Annex (Application ref: 6.2.2), and the design that will cause the greatest increase in scour.	Maximum potential for indirect effects.
OPERATION		

POTENTIAL EFFECT	MAXIMUM DESIGN SCENARIO ASSESSED	JUSTIFICATION
Total or partial loss of archaeological receptors during the operation and maintenance phase due to penetration and compression effects	The maximum footprint during the O&M phase within the study area will be: • Maximum jack-up footprint (maximum number of legs: 6, combined leg area 1100 m2) x the number of required activities; and • Maximum area covered by anchors, (8 anchors, Indicative Individual anchor footprint area for deployment & recovery of one anchor 116 m^2) x maximum number of required activities. The maximum depth during the O&M phase within the study area will be: • Maximum depth of jack-up: unknown at this stage, over the maximum number of required activities	Maximum total physical footprint from vessels associated with O&M activities. Maximum depth of effect from vessels associated with O&M activities, potentially impacting and compressing buried receptors such as palaeogeography.
Total or partial loss of archaeological receptors during the operation and maintenance phase due to scour effects	Potential introduction of scour as a result of the presence of the array. In order to ensure the full consideration of the metrics in the project description, the potential for scour effects have been assessed as per Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes Technical	Maximum potential for indirect effects.

POTENTIAL EFFECT	MAXIMUM DESIGN SCENARIO ASSESSED	JUSTIFICATION
	Annex (Application ref: 6.2.2), and the design that will cause the greatest increase in scour.	
DECOMMISSIONING		
Total or partial loss of archaeological receptors during the decommissioning phase due to penetration and compression effects	The maximum footprint during the decommissioning phase within the study area will be: ▲ Maximum jack-up footprint (maximum number of legs: 6, combined leg area 1100 m2) x the maximum number of turbines (50). Total area = 55,000 m^2 The maximum depth during the decommissioning phase within the study area will be: ▲ Maximum depth of jack-up: unknown at this stage, over the maximum number of required activities.	Maximum project base footprint therefore maximum potential disturbance of seabed across the largest area and in the greatest number of locations (greatest potential for impacts to occur). Maximum seabed area disturbed, therefore maximum potential disturbance to seabed features
Total or partial loss of archaeological receptors during the decommissioning	Draw-down of sediment into voids left by removed turbine foundations leading to loss of sediment, destabilising archaeological sites and contexts, and exposing such	Currently only general locations of known wrecks and obstructions are available, with the position

POTENTIAL EFFECT	MAXIMUM DESIGN SCENARIO ASSESSED	JUSTIFICATION
phase due to the draw-down of sediments	material to natural, chemical or biological processes, and causing or accelerating loss of the same.	and extent of the marine archaeological resources not yet established. Mitigation will include a review of the geophysical survey and monitoring data throughout the life of the project to gain a greater understanding of the archaeological resource and the long-term effect of the development. Identified features of value will be avoided through AEZ and any unexpected finds will be reported through a project specific PAD.
CUMULATIVE EFFECTS		
Permanent physical loss/ disturbance of potential marine	Cumulative direct impacts to potential marine archaeological receptors within the wider marine	Potential for cumulative impacts from developments within the wider area.

POTENTIAL EFFECT	MAXIMUM DESIGN SCENARIO ASSESSED	JUSTIFICATION
archaeological receptors in the wider marine archaeological environment from cumulative impacts.	archaeological environment, as a result of the proposed AyM development.	

11.10 Mitigation measures

118 Mitigation measures that were identified and adopted as part of the evolution of the project design (embedded into the project design) and that are relevant to offshore archaeology and cultural heritage are listed in Table 9. These general mitigation measures apply to all parts of the development works, including pre-construction, construction, operation and decommissioning.

119 The mitigation measures are embedded in the sense that they are secured through the WSI and measures will be required to be agreed and in place, but the exact mitigation design will not be finalised until pre-construction surveys are undertaken.

120 The following measures are designed to mitigate any predicted adverse effects upon seabed receptors from direct impacts. The measures are designed to reduce or offset any damage/ disturbance occurring as a result of the proposed development upon known sites, and to establish the presence of unknown sites.

121 Mitigation measures that were identified and adopted as part of the evolution of the project design and that are relevant to offshore archaeology and cultural heritage are listed in Table 9. The mitigation includes embedded measures such as design changes and applied mitigation which is subject to further study or approval of details; these include avoidance measures that will be informed by pre-construction surveys, and necessary additional consents where relevant. The composite of embedded and applied mitigation measures apply to all parts of the AyM development works, including pre-construction, construction, O&M and decommissioning.

Table 9: Mitigation measures relating to offshore archaeology and cultural heritage.

PARAMETER	MITIGATION MEASURES
GENERAL	

PARAMETER	MITIGATION MEASURES
WSI	A WSI will be produced, and agreed by the archaeological curator(s), outlining mitigation measures that will be in place during the construction, operational, and decommissioning phases. The implementation of a WSI is the mitigation, rather than the document itself.
AEZs	AEZs are recommended around known features of anthropogenic origin of archaeological interest (A1 anomalies) and historic records of archaeological material (A3 anomalies). The locations and extents of AEZs will be established within the Marine WSI. No works that impact the seabed will be undertaken within the extent of an AEZ during the construction, operational, or decommissioning phases.

11.10.1 WSI

122 As mitigation, during the pre-construction phase, a draft Written Scheme of Investigation (WSI) has been produced for submission with the EIA that details all aspects of any further archaeological work (application ref: 8.3). Although the WSI in and of itself is not a mitigation measure, it details the agreed mitigation, and its implementation will be the mitigation. The WSI has been developed in line with standard guidance and The Crown Estate document, Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (TCE and Wessex Archaeology, 2021), which sets out agreed archaeological methodologies. The WSI has been based on the mitigation measures set out in this chapter and will be subject to approval by the archaeological curator(s). The mitigation measures set out in the WSI and the production of the Protocol for Archaeological Discoveries (PAD) will be discussed with the relevant consultation bodies to ensure agreement.

123 The draft WSI sets out procedures for implementing AEZs; some of which have already been applied around the geophysical anomalies, provides information about areas of archaeological potential, identify further geotechnical work on existing cores, and sets out procedures for further works, including archaeological input into any further geophysical, geotechnical, ROV, UXO, and/ or diver surveys, as well as any watching briefs, preservation by record, offsetting damage and how to handle the discovery of previously unidentified material. It is important that archaeological expertise is incorporated in any remaining surveys undertaken for non-archaeological purposes, to ensure that the survey data acquired is to a specification to maximise the potential to inform archaeological assessment of the data.

124 Once the final development scheme has been confirmed, the WSI can be finalised, setting out when, how, and why mitigation measures are to be implemented, and methodologies for any further work can be assessed and incorporated, or appended as separate method statements, if required. Scheme-specific mitigation will be established where appropriate. The WSI includes a strategy for monitoring the effects over all phases of the development.

125 The WSI has been drafted for the ES for discussion with the archaeological curators. A final WSI will be agreed post-consent and will be agreed with the archaeological curators. The submission of the final offshore WSI is anticipated to be a condition of the marine licence, as described in application document 5.4 (other consents and licences) and the associated annex (approach to marine licensing). This section provides an indication of provisional content of the WSI (Wessex Archaeology, 2021), so that it can be considered here as mitigation.

11.10.2 AEZs

126 Best practice favours the preservation *in situ* of archaeological remains, and therefore the ideal mitigation is avoidance. For the proposed development, impact will be avoided by assuming the application of AEZs. The TCE document Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (2021) states that AEZs are formed by establishing a buffer around the known extents of sites for which the available evidence suggests that there could be archaeological material present on the seabed. All development and related activities that could impact the seabed are prohibited within the boundaries of an AEZ.

127 The final development layout will take into account the locations of all AEZs. All AEZs will be marked on the scheme masterplans. If impacts cannot be avoided, measures to reduce, remedy or offset disturbance will be agreed.

128 Although AEZs are fixed, provision should be made for them to be refined or be removed (with agreement of the archaeological curators) as the project progresses, subject to additional archaeological assessment of subsequent surveys that may be required. Surveys could include further geophysical, ROV, or diver surveys. In addition, in order to maximise the potential benefits of any further surveys, archaeological advice should be sought during the planning stages.

129 Archaeological Exclusion Zones (AEZs) are recommended around all anomalies classified as A1 or A3 archaeological potential. Archaeological Exclusion Zones of 50 m radius are recommended around features that are well constrained, and 100 m radius around more disperse sites; recorded wreck or obstruction locations.

130 These AEZs all have the potential to be amended or removed at a later date, should further information become available that proves their associated features are not of archaeological potential or represent more widely dispersed sites.

131 Where nationally important archaeological remains and their settings are likely to be affected by proposed development, there should be a presumption in favour of their physical protection *in situ*.

11.10.3 A2 anomalies

132 For features assigned A2 archaeological potential ratings, no AEZs are recommended at this time. However, avoidance of these features by micro-siting is recommended if there is potential for them to be impacted by the development. In order to facilitate the design of the development scheme, buffers are not currently proposed for any of these anomalies. However, if these anomalies will be impacted by the development, they should be assessed on a case-by-case basis, in agreement with the archaeological curators, for example, this could be undertaken in conjunction with a UXO or ROV survey. The methodology for assessing seabed and sub-seabed anomalies will be outlined in the WSI, as the anomalies would require further archaeological investigation to confirm their character and to allow an assessment of their relative value. It is possible that these anomalies could represent material from wreck sites of considerable age and be, from an archaeological standpoint, more important than those already suggested for AEZs, and therefore further AEZs could be instituted if required. However, it is also possible that these anomalies could comprise modern debris of no archaeological significance. Additional assessment could, for example, be undertaken as part of a UXO or ROV survey undertaken for other works.

133 Where it is not possible to preserve *in situ* A2 geophysical anomalies or findspots, disturbance will be offset by appropriate and satisfactory measures, also known as 'preservation by record'. In these circumstances, the effects of the development can be mitigated by carrying out survey, recording and/ or excavation prior to the impact occurring (Wessex Archaeology, 2007). The impact of the development, if and where appropriate, may also be remedied by restabilising sites that have been destabilised but not destroyed, or by offsetting damage to a site by detailed analysis and safeguarding of otherwise comparable sites elsewhere.

134 If sites of significance are discovered, Method Statements will be developed for further investigation/excavation, if required, as discussed with the Archaeological Curators

11.10.4 Data gaps

135 The assessed geophysical data collected for AyM did not include all of GyM interlink area, so should data acquisition be proposed for this area (either geophysical or geotechnical), it is recommended that in line with the draft WSI, archaeologists be involved at the planning stage to ensure its suitability and that data be made available for archaeological assessment to ensure a full assessment of the area is achieved pre-construction. However, data was collected for the existing GyM site and Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1) states that the existing data in the GyM interlink zone is considered to be adequate for characterising the receiving environment for EIA purposes. The final WSI will be developed once final design and routeing are known post-consent. There is enough evidence to draw a robust conclusion on the likely significant effects for EIA purposes but there are areas of the seabed that have not been looked at and would need further assessment for the purposes of archaeological characterisation of material on the seabed.

11.10.5 Palaeogeography

136 The archaeological assessment of sub-bottom profiler data, detailed in the technical report (Volume 4, Annex 11.1: Offshore Archaeology Desk Based Assessment (application ref: 6.4.11.1)), indicated that a number of palaeolandscape features of archaeological potential have been identified within the study area. Within the Array area and Infrastructure zone, an extensive area of Channel Complex Deposits (Unit 4) were identified in the north and north-west, suggesting the study are was located within a terrestrial environment between the LGM and the Holocene marine transgression. These features correlate with a potential palaeo-coastline and associated deltaic features and are considered of possible archaeological potential. It is recommended that, should any sediment sampling (e.g. coring/ boreholing) be undertaken within the study area, any core records and samples acquired from within these Unit 4 features be made available for geoarchaeological assessment by a suitably qualified archaeological contractor. This should aid in determining the nature and age, and therefore archaeological potential of these deposits.

137 Within the ECC, three major channel features were identified, also potentially dating between the LGM and the Holocene marine transgression. Although they may have originally been cut by glacial processes, it is likely that they were later reactivated and filled as fluvial features. As terrestrial features of potential Holocene age, these channels are interpreted as of high archaeological potential, and it is recommended that, should any sediment sampling (e.g. coring/ boreholing) be undertaken within the study area, any core records and samples acquired from within these Unit 4 features be made available for geoarchaeological assessment by a suitably qualified archaeological contractor.

138 Provision should be made at the planning stages of any geotechnical work for archaeological advice to ensure that the coring/ boreholing locations will maximise the results for archaeological investigation. For example, samples acquired from within identified Pleistocene/ Early Holocene features should be retrieved following the methodology set out in a bespoke Method Statement.

139 The geotechnical survey results should provide adequate levels of information for a palaeogeographic assessment. This will enable a detailed understanding of the significance of the recorded deposits, and past landscapes, which will lead to a coherent and comprehensive understanding of the stratigraphy of the area.

140 A terrestrial borehole transect/ geoarchaeological assessment will be undertaken prior to construction (Volume 3, Chapter 8: Onshore Archaeology and Cultural Heritage (application ref: 6.3.8)), and the results of that assessment will be reviewed for the Offshore Archaeology ES to ensure a seamless approach.

11.10.6 Protocol for Archaeological Discoveries

141 If previously unknown sites or material are encountered during development works, measures will be taken to reduce the level of impact. In order to provide for these unexpected discoveries, As per the WSI, a PAD will be adopted. The PAD is a system for reporting and investigating unexpected archaeological discoveries encountered during preparation activities, with a Retained Archaeologist providing guidance and advising industry staff on the implementation of the PAD. The PAD also makes provision for the implementation of temporary exclusion zones around areas of possible archaeological interest, for prompt archaeological advice, and, if necessary, for archaeological inspection of important features prior to further construction in the vicinity. The PAD provides a mechanism to comply with the *Merchant Shipping Act* 1995, including notification of the Receiver of Wreck, and accords with the Code of Practice for Seabed Developers (JNAPC, 1995, 1998).

11.11 Environmental assessment: construction phase

142 Impacts resulting in potential adverse effects upon archaeological receptors as part of construction works are those involving contact with the seabed or the removal of seabed sediments. Offshore archaeological receptors with height above the seabed, such as shipwrecks, may also be impacted by activities that occur within the water column. Impacts from construction activities include:

- Seabed preparation prior to foundation installation;
- Installation of turbine foundations;
- Placing of scour protection around turbine foundations;
- Installation of OSPs;
- Installation of met mast, mooring buoys, and LIDAR buoys;
- Seabed preparation prior to cable laying;
- Installation of inter-array and export cables;
- Installation of cable protection;
- Vessel moorings; and
- Seabed contact by the legs of jack-up vessels, and/ or anchors of other vessels.

11.11.1 Removal of sediment containing undisturbed archaeological contexts leading to total loss of the receptor during preparation of the seabed for WTGs and offshore substation foundations.

143 Activities considered here refer to direct impacts associated with seabed preparation, construction and decommissioning activities undertaken in the proposed development areas. Direct impacts associated with construction works are considered to arise as a result of seabed preparation, turbine installation and associated scour protection, installation of the OSPs, cable installation/ protection.

Magnitude of impact

144 Any impact upon offshore archaeological receptors including A1 anomalies and any unknown archaeology would be permanent and irreversible. As such, the magnitude of direct impacts on known and potential seabed receptors as part of construction activities, if they were to occur, would be **high adverse**.

Sensitivity of receptor

145 The varying level of sensitivity of archaeological receptors ranges from **high** to **negligible** sensitivity. For example, a previously unknown military aircraft crash site would have **high** sensitivity while an A2 anomaly confirmed through ROV or diver assessment to be modern debris would have **negligible** sensitivity.

Significance of residual effect

146 With regards to activities associated with the construction works, any of the sources of direct impact listed above have the potential to destroy entire receptors as well as damaging a receptor or its relationship with the wider environment. Once a receptor is damaged or destroyed, or its context is altered, it is not possible to reinstate lost data. Therefore, without mitigation, the effects on the archaeological receptors would be **major adverse**. Following the application of appropriate mitigation, as outlined in the mitigation section 11.10 (such as the implementation of AEZs, further assessment of A2 anomalies, and a PAD) the magnitude would be reduced to **low** to **negligible adverse** which is not significant in EIA terms.

147 It should be noted that the level of mitigation will be determined based on the significance of the archaeological receptor, for example, a medieval wooden shipwreck may require full excavation whereas an A2 anomaly confirmed through further assessment as modern debris would require no further mitigation.

148 In some cases, the application of appropriate mitigation, such as an archaeological investigation of seabed anomalies prior to impact or the implementation of a PAD could lead to effects of **minor** to **moderate beneficial** significance, which is a significant beneficial effect in EIA terms. For example, discovering a wreck of interest and being able to share it with the wider public would be **moderate beneficial**.

11.11.2 Penetration and compression effects of jack-up legs and anchoring of construction vessels during turbine, sub-station or cable installation leading to total or partial loss of archaeological receptors.

149 Activities considered here refer to direct impacts associated with the vessels used during construction works (e.g. turbine installation, OSPs installation, and cable installation), where activities may penetrate the seabed by construction vessels through jack-ups or anchors

Magnitude of impact

150 Any impact upon offshore archaeological receptors would be permanent and irreversible. As such, the magnitude from the temporary footprint of a jack-up barge is of the same magnitude as a turbine foundation with a longer-term presence, if they were to occur, would be **high adverse**. Compression effects from works undertaken on archaeological receptors such as soft wooden shipwrecks would also be **high adverse.**

Sensitivity of receptor

151 The varying level of sensitivity of archaeological receptors ranges from **high** to **negligible** sensitivity, for example an A1 geophysical anomaly or an unknown medieval wooden shipwreck would have **high** sensitivity while an A2 anomaly confirmed through ROV or diver assessment to be modern debris would have **negligible** sensitivity.

Significance of residual effect

152 Without mitigation, the effects on the archaeological receptors would be **major adverse**. Following the application of appropriate mitigation, as outlined in the mitigation section 11.10, the magnitude would be reduced to **low** to **negligible adverse** which is not significant in EIA terms. It should be noted that the level of mitigation would be determined by the importance of the archaeological receptor, for example, a medieval wooden shipwreck may require full excavation where as an A2 anomaly confirmed through further survey to be modern debris such as rebar would require no further mitigation.

153 In some cases, the application of appropriate mitigation, such as archaeological investigation of seabed anomalies prior to impact could lead to effects of **moderate beneficial** significance which is a significant beneficial effect in EIA terms. For example, discovering a wreck of interest and being able to share it with the wider public would be **moderate beneficial**.

11.11.3 Intrusion of piling foundations disturbing archaeological contexts leading to a partial or total loss of the receptor

154 Activities considered here refer to direct impacts associated with construction works (e.g. turbine installation, OSPs installation, and cable installation), where activities penetrate the seabed.

Magnitude of impact

155 Any impact upon offshore palaeogeographic receptors would be permanent and irreversible. As such, the magnitude from the temporary from piling foundations would be **high adverse**.

Sensitivity of receptor

156 Archaeological sites and material beneath the shallow seabed sediments comprise potential palaeogeographic receptors which can range in size from individual artefacts or artefact scatters through to palaeolandscapes and due to their age and international importance, can have **high** sensitivity**,** although features covering large areas may be of lower sensitivity**.** Features may also include buried shipwrecks or aircraft crash sites, which also have the potential to be of **high** sensitivity.

Significance of residual effect

157 Without mitigation, the effects on the archaeological receptors would be **major adverse** which is significant in EIA terms.

158 Following the application of appropriate mitigation, such as the proposed archaeological assessment of geotechnical data as outlined in more detail in the mitigation section 11.10, the magnitude would be reduced to **low** to **negligible adverse.** Palaeogeographic features are usually spread over a large area and impacts from the development are likely to be limited to a comparatively small part of the seabed.

159 For buried sites, such as shipwreck or aircraft material, the application of appropriate mitigation, such as a PAD, as outlined in more detail in the mitigation section 11.10, the magnitude would be reduced to **low** to **negligible adverse.**

160 In some cases, the application of appropriate mitigation, such as archaeological investigation of bore hole logs and vibrocores prior to impact could lead to effects of **medium** to **major beneficial** significance which is a significant beneficial effect in EIA terms. For example, providing details about the prehistoric landscape and being able to share it with the wider public would be **major beneficial**.

11.11.4 Disturbance of sediment containing potential archaeological receptors (material and contexts) during inter-array and export cable laying operations.

161 Activities considered here refer to direct impacts associated with seabed preparation undertaken during cable installation in the proposed development areas.

Magnitude of impact

162 Any impact upon offshore archaeological receptors including A1 and A2 anomalies and any currently unknown or buried archaeology would be permanent and irreversible. As such, the magnitude of direct impacts on known and potential seabed receptors as part of construction activities, if they were to occur, would be **high adverse**.

Sensitivity of receptor

163 The varying level of sensitivity of archaeological receptors ranges from **high** to **negligible** sensitivity. For example, an unknown aircraft crash site would have **high** sensitivity while an A2 anomaly confirmed through ROV or diver assessment to be modern debris would have **negligible** sensitivity.

Significance of residual effect

164 Without mitigation, the effects on the **high** sensitivity archaeological receptors would be **major adverse**. Following the application of appropriate mitigation, such as implementing AEZs around A1 anomalies, further investigations of A2 anomalies, and, if necessary full excavation of significant features (such as previously unknown aircraft crash sites or medieval wooden shipwrecks), and implementing a PAD during the laying operations as outlined in more detail the mitigation section 11.10, the magnitude would be reduced to **low** to **negligible adverse** which is not significant in EIA terms.

165 In some cases, the application of appropriate mitigation, such as the excavation and publication of a previously unknown wreck site of archaeological importance could lead to effects of **minor** to **moderate** beneficial significance which is a significant beneficial effect in EIA terms.

11.11.5 Indirect effects upon known and potential marine archaeological receptors as a result of changes to sedimentation and erosion patterns.

166 The indirect effects upon the known and potential offshore archaeological receptors considered here are those which occur as a result of changes to hydrodynamic and sediment transport regimes, where these changes have occurred as a consequence of activities and structures associated with the construction activities.

Magnitude of impact

167 Changes to hydrodynamic regimes, such as erosion or scour, could cause permanent and irreversible impact upon offshore archaeological receptors including A1 and A2 anomalies and any unknown archaeology, which would be of **high** magnitude. However, increased sedimentation could lead to temporary to permanent coverage and protection of offshore archaeological receptors if buried, which would be of **low** to **high** magnitude.

168 Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (application ref: 6.2.2) concludes that the scale of change would vary depending upon the foundation type, the local baseline oceanographic and sedimentary environments and the type of scour protection implemented (if needed). In some cases, the modified sediment character within a scour pit may not be so different from the surrounding seabed. However, changes relating to bed slope and elevated flow speed and (near-field) turbulence are still likely to apply. In practice, the thickness of erodible sediments overlying erosion resistant glacial tills is less than 2 m over much of the north and western parts of the array area, which will naturally limit the maximum potential scour depth and volume for foundations located in these areas.

169 Where scour protection is used, primary scour is unlikely to occur, although a small amount of secondary scour may develop at the edges of the scour protection in response to the interaction between the scour protection materials and foundation, and the hydrodynamic and sediment transport regimes. However, the extent and volume of secondary scour will be considerably less than that described for monopile, multileg and gravity base foundations.

Sensitivity of receptor

170 The varying level of sensitivity of archaeological receptors ranges from **high** to **negligible** sensitivity. For example, an unknown medieval shipwreck would have **high** sensitivity while an A2 anomaly confirmed through ROV or diver assessment to be modern debris would have **negligible** sensitivity.

Significance of residual effect

171 Without mitigation, the effects of scour on archaeological receptors could be **major adverse**.

172 However, following the application of appropriate mitigation, including the implementation of scour protection, review of scour monitoring data (either through archaeological assessment of data, or with any exposed archaeological material reported through a PAD), and subsequent investigation of any exposed material, effects would be minimised to **minor** to **negligible adverse**, which are not significant in EIA terms.

173 In some cases, temporarily covering any known or potential archaeological receptors that have been exposed due to scour with additional protective material could lead to effects of **minor** beneficial significance which is not significant in EIA terms.

11.11.6 Compression of stratigraphic contexts containing archaeological material from combined weight of foundation, transition piece, tower, and wind turbine.

Magnitude

174 Any impact on any unknown archaeological features or palaeolandscapes would be permanent and irreversible. As such, the magnitude from the temporary footprint of a jack-up barge is of the same magnitude as a turbine foundation with a longer-term presence, if they were to occur, would be **high** magnitude. Compression effects on archaeological receptors such as soft wooden shipwrecks would also be **high** magnitude.

Sensitivity of receptor

175 The varying level of sensitivity of archaeological receptors ranges from **high** to **negligible** sensitivity. For example, an unknown medieval wooden shipwreck would have **high** sensitivity, whereas a large palaeolandscape feature may have lower sensitivity due to the comparatively smaller area being impacted.

Significance of residual effect

176 Without mitigation, the effects on the archaeological receptors could be **major adverse**. Following the application of appropriate mitigation, such as the proposed archaeological assessment of geotechnical data, as outlined in more detail in the mitigation section 11.10, the magnitude would be reduced to **low** to **negligible adverse** which is not significant in EIA terms. For example, the additional information gained about palaeolandscape features and/or any previously unknown buried archaeological features leading to further investigations would minimise the magnitude of impact.

177 In some cases, the application of appropriate mitigation, such as archaeological investigation of palaeolandscapes prior to impact and publication of results could lead to effects of **moderate beneficial** significance which is a significant beneficial effect in EIA terms.

11.12 Environmental assessment: operational phase

178 Activities undertaken as part of O&M works, and existing structures during the O&M phase, have the potential to directly and indirectly impact marine archaeological receptors on or under the seabed, resulting in their loss or the disruption of relationships between receptors and their wider surroundings.

179 Direct impacts resulting in these potential effects as part of O&M works are those involving seabed contact, and include:

- Anchors of vessels deployed during periodic overhauls and scheduled or unscheduled O&M; and
- Seabed contact by the legs of jack-up vessels.

11.12.1 Total or partial loss of archaeological receptors during the operation and maintenance phase due to penetration and compression effects

180 Activities associated with the decommissioning phase are anticipated to be broadly similar to the construction phase. As such, the magnitude of any potential impacts on known and potential receptors on the seabed and in shallow sediments associated with this phase are unlikely to exceed the MDS assessed for construction.

Magnitude

181 Any impact upon offshore archaeological receptors including A1 anomalies and any unknown archaeology would be permanent and irreversible. As such, the magnitude from the temporary footprint of a jack-up barge is of the same magnitude as a turbine foundation with a longer-term presence, if they were to occur, would be **high adverse**. Compression effects from works undertaken on archaeological receptors such as soft wooden shipwrecks would also be **high adverse.**

Sensitivity of receptor

182 The varying level of sensitivity of archaeological receptors ranges from **high** to **negligible** sensitivity. For example, an unknown medieval wooden shipwreck would have **high** sensitivity while an A2 anomaly confirmed through ROV or diver assessment to be modern debris would have **negligible** sensitivity.

Significance of residual effect

183 In areas where impact has already occurred during the construction phase, there is unlikely to be further impact.

184 However, in areas that have not yet been impacted, without mitigation, the effects on the archaeological receptors could be **major adverse**. Following the application of appropriate mitigation, as outlined in the mitigation section 11.10, including retaining AEZs and implementing a PAD, the magnitude would be reduced to **low** to **negligible adverse** which is not significant in EIA terms.

185 In some cases, the application of appropriate mitigation, such as archaeological investigation of seabed anomalies prior to impact could lead to effects of **moderate beneficial** significance which is a significant beneficial effect in EIA terms. For example, discovering a wreck of interest and being able to share it with the wider public would be **moderate beneficial**.

11.12.2 Total or partial loss of archaeological receptors during the operation and maintenance phase due to scour effects

186 The effects upon the known and potential offshore archaeological receptors considered here are those which occur as a result of changes to hydrodynamic and sediment transport, where these changes have occurred as a result of the presence of foundation structures associated with the proposed development.

Magnitude

187 Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes Technical Annex (application ref: 6.2.2) has assessed the potential for scour of seabed sediments, including that around scour protection structures. The scale of change would vary depending on the foundation type, the local baseline oceanographic and sedimentary environments and the type of scour protection implemented (if needed). The modelled estimates are highly conservative, as they assume an unlimited depth of erodible sediment at all foundations, whereas in practice the thickness of erodible sediments is less than 2 m over much of the north and western parts of the array area.

188 The assessment indicated potential for scour, but also notes that where scour protection is used, primary scour is unlikely to occur, although a small amount of secondary scour may develop at the edges of the scour protection in response to the interaction between the scour protection materials and foundation, and the hydrodynamic and sediment transport regimes. However, the extent and volume of secondary scour will be considerably less than that identified for monopile, multileg and gravity base foundations. The results are consistent with the available monitoring data available for GyM OWF. There may also be highly localised scour where rock placement is used to protect cables.

189 Should scour result in increased exposure of buried offshore archaeological receptors, the magnitude would be **high adverse**. However, should offshore archaeological receptors be subject to increased sedimentation and burial they may in turn benefit from conditions which afford higher levels of preservation, leading to **medium** to **high** beneficial magnitude.

Sensitivity of receptor

190 The varying level of sensitivity of archaeological receptors ranges from **high** to **negligible** sensitivity. For example, an unknown medieval wooden shipwreck would have **high** sensitivity while an A2 anomaly confirmed through ROV or diver assessment to be modern debris would have **negligible** sensitivity.

Significance of residual effect

191 Without mitigation, the effects on the archaeological receptors could be **major adverse**. Following the application of appropriate mitigation, including the implementation of scour protection, review of scour monitoring data (either through archaeological assessment of data, or with any exposed archaeological material reported through a PAD), and archaeological investigation of any material exposed, as outlined in the mitigation section (11.10), the magnitude would be reduced to **low** to **negligible adverse** which is not significant in EIA terms.

192 In some cases, where sedimentation leads to increased burial of archaeological material, this could lead to effects of **minor** beneficial significance which is not significant in EIA terms.

11.13 Environmental assessment: decommissioning phase

193 Activities undertaken as part of decommissioning works have the potential to directly and indirectly impact marine archaeological receptors on or under the seabed, resulting in their loss or the disruption of relationships between receptors and their wider surroundings.

194 Direct impacts resulting in these potential effects as part of decommissioning works are those involving seabed contact, and include:

- Where required, the removal of turbine and OSPs foundations, scour protection, cable protection and cables;
- Anchors of vessels deployed during periodic overhauls and scheduled or unscheduled O&M; and
- Seabed contact by the legs of jack-up vessels.

195 Indirect impacts include changes to hydrodynamic and sedimentary regimes due to the removal of foundation structures.

11.13.1 Total or partial loss of archaeological receptors during the decommissioning phase due to penetration and compression effects

196 Activities associated with the decommissioning phase are anticipated to be broadly similar to the construction phase. As such, the magnitude of any potential impacts on known and potential receptors on the seabed and in shallow sediments associated with this phase are unlikely to exceed the MDS assessed for construction.

Magnitude

197 Any impact upon offshore archaeological receptors including A1 anomalies and any unknown archaeology would be permanent and irreversible. As such, the magnitude due to penetration, if they were to occur, would be **high adverse**. Compression effects from works undertaken on archaeological receptors such as soft wooden shipwrecks and palaeolandscapes would also be **high adverse.**

Sensitivity of receptor

198 The varying level of sensitivity of archaeological receptors ranges from **high** to **negligible** sensitivity. For example, an unknown medieval wooden shipwreck would have **high** sensitivity while an A2 anomaly confirmed through ROV or diver assessment to be modern debris would have **negligible** sensitivity. Palaeolandscapes that cover large areas would be of lower sensitivity than small, discrete features.

Significance of residual effect

199 Without mitigation, the effects on the archaeological receptors could be **major adverse**. Following the application of appropriate mitigation, as outlined in the mitigation section 11.10, the magnitude would be reduced to **low** to **negligible adverse** which is not significant in EIA terms. The level of mitigation would depend on the importance or sensitivity of the receptor, for example, a medieval wooden shipwreck may require full excavation where as an A2 anomaly determined through further assessment to be modern debris would not require further mitigation.

200 In some cases, the application of appropriate mitigation, such as archaeological investigation of seabed anomalies prior to impact and the implementation of AEZs could lead to effects, of **moderate beneficial** significance which is a significant beneficial effect in EIA terms. For example, discovering a wreck of interest and being able to share it with the wider public would be **moderate beneficial**.

11.13.2 Total or partial loss of archaeological receptors during the decommissioning phase due to the draw-down of sediments

201 Activities considered here refer to direct impacts of draw-down of sediment into voids left by removed turbine foundations leading to loss of sediment, destabilising archaeological sites and contexts, and exposing such material to natural, chemical or biological processes, and causing or accelerating loss of the same.

Magnitude

202 Any impact upon offshore archaeological receptors including A1 anomalies and any unknown archaeology would be permanent and irreversible. As such, the magnitude would be **high adverse**.

203 Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes Technical Annex (application ref: 6.2.2) indicates that the removal of wind turbine foundations is expected to result in some localised seabed disturbance accompanied by temporary increases in Suspended Sediment Concentration. Foundations involving piled solutions would be cut off at or just below, potentially causing a localised disturbance of the bed and a temporary increase in Suspended Sediment Concentration. However, for all expected decommissioning activities, the changes to Suspended Sediment Concentration and bed levels are expected to be lesser than that associated with construction.

Sensitivity of receptor

204 The varying level of sensitivity of archaeological receptors ranges from **high** to **negligible** sensitivity. For example, an unknown medieval wooden shipwreck would have **high** sensitivity while an A2 anomaly confirmed through ROV or diver assessment to be modern debris would have **negligible** sensitivity.

Significance of residual effect

205 Without mitigation, the effects on the archaeological receptors could be **major adverse**. Following the application of appropriate mitigation, such as review of any geophysical survey data associated with post-decommissioning monitoring (either through archaeological assessment of survey data or through implementation of a PAD for reporting unexpected discoveries), and archaeological investigation of material exposed, as outlined in the mitigation section 11.10, the magnitude would be reduced to **low** to **negligible adverse**, which is not significant in EIA terms. If there is increased sedimentation and archaeological material is buried, there could be **minor beneficial** effects.

11.14 Environmental assessment: cumulative effects

206 Cumulative effects refer to effects upon receptors arising from AyM development when considered alongside other proposed developments and activities and any other reasonably foreseeable project(s) proposals. In this context, the term 'projects' is considered to refer to any project with comparable effects and is not limited to offshore wind projects. The distance around the study area is within 50 km, as agreed with Cadw during consultation.

207 The approach to cumulative assessment for AyM takes into account the Cumulative Impact Assessment Guidelines issued by Renewable UK in June 2013. The renewable energy developments that have informed this approach have been agreed provision of the CEA methodology and long list to NRW via the evidence plan process.

208 In assessing the potential cumulative impact(s) for AyM, it is important to bear in mind that for some projects, predominantly those 'proposed' or identified in development plans etc. may or may not actually be taken forward. There is thus a need to build in some consideration of certainty (or uncertainty) with respect to the potential impacts which might arise from such proposals. For example, relevant projects/ plans that are already under construction are likely to contribute to cumulative impact with AyM (providing effect or spatial pathways exist), whereas projects/ plans not yet approved or not yet submitted are less certain to contribute to such an impact, as some may not achieve approval or may not ultimately be built due to other factors.

209 For this reason, all relevant projects/ plans considered cumulatively alongside AyM have been allocated into 'Tiers', reflecting their current stage within the planning and development process. This allows the cumulative impact assessment to present several future development scenarios, each with a differing potential for being ultimately built out. Appropriate weight may therefore be given to each scenario (Tier) in the decision-making process when considering the potential cumulative impact associated with AyM (e.g. it may be considered that greater weight can be placed on the Tier 1 assessment relative to Tier 2).

210 The projects and plans selected as relevant to the assessment of impacts to offshore archaeology and cultural heritage are based upon an initial screening exercise undertaken on a long list. Each project, plan or activity has been considered and scoped in or out on the basis of effect–receptor pathway, data confidence and the temporal and spatial scales involved.

211 The proposed tier structure that is intended to ensure that there is a clear understanding of the level of confidence in the cumulative assessments provided in the AyM ES is as follows:

11.14.1 Tier 1

212 AyM considered alongside other projects/ plans currently under construction and/ or those consented but not yet implemented, and/ or those submitted but not yet determined where data confidence for the projects falling within this category is high. Permitted applications, whether under the Planning Act 2008 or other regimes, but not yet implemented and submitted applications, whether under the Planning Act 2008 or other regimes, but not yet determined are also in this tier.

213 Built and operational projects will be included within the cumulative assessment where they have not been included within the environmental characterisation survey, i.e. they were not operational when baseline surveys were undertaken, and/ or any residual impact may not have yet fed through to and been captured in estimates of 'baseline' conditions or there is an ongoing effect.

11.14.2 Tier 2

214 All projects included in Tier 1 plus other projects/ plans consented but not yet implemented and/ or submitted applications not yet determined where data confidence for the projects falling into this category is medium.

215 Projects on the Planning Inspectorate's Programme of Projects where a Scoping Report has been submitted are also in this category.

11.14.3 Tier 3

216 The above plus projects on relevant plans and programmes (the PINS Programme of Projects and the NRW marine licensing portal being the source most relevant for this assessment). Specifically, all projects where the developer has advised PINS in writing that they intend to submit an application in the future were considered. This includes, projects for which scoping reports have been submitted and data availability is limited and/ or data confidence is low.

217 Projects on the Planning Inspectorate's Programme of Projects where a Scoping Report has not been submitted also fall into this category.

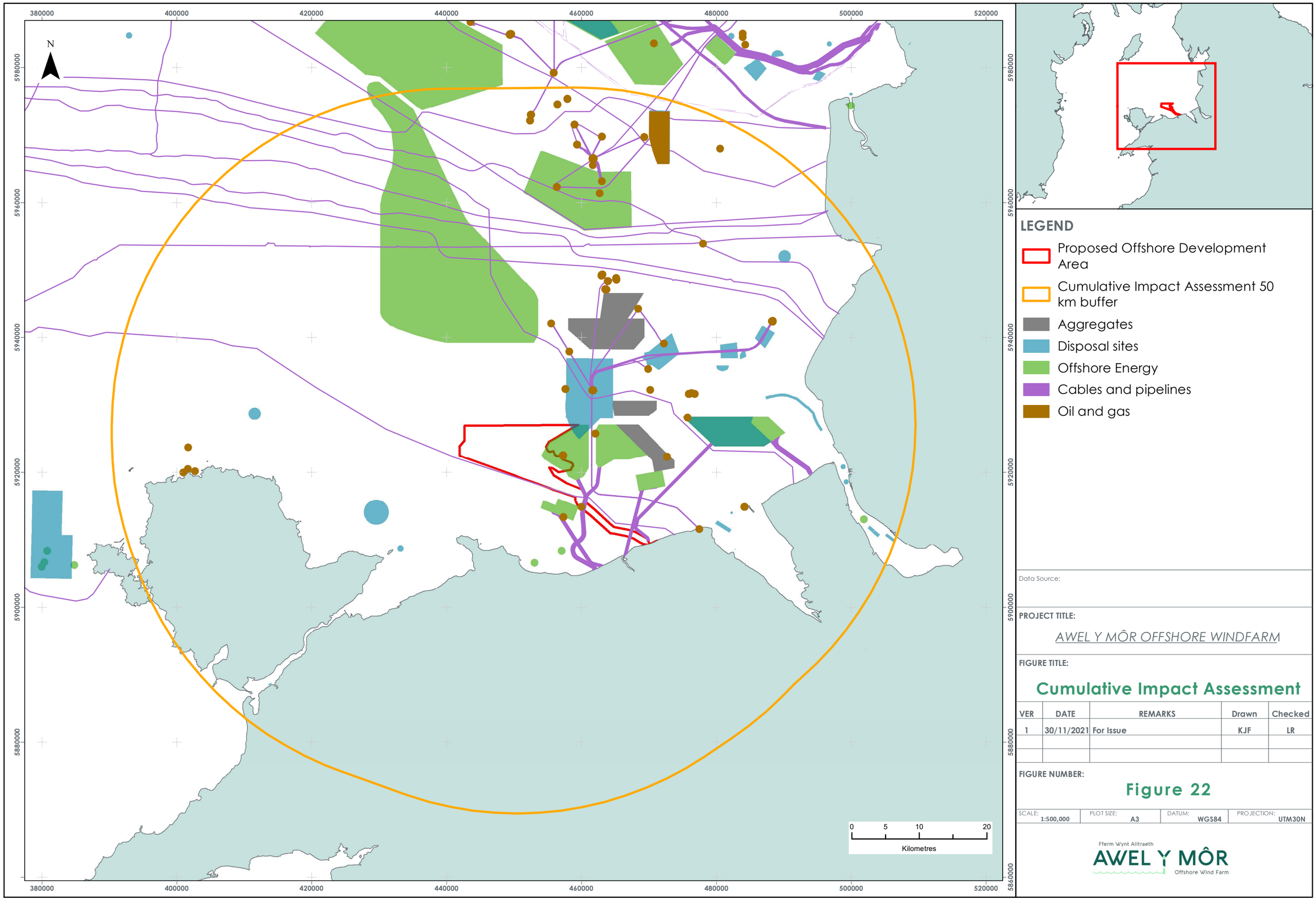
218 Projects identified in the relevant Development Plan (and emerging Development Plans with appropriate weight being given as they move closer to adoption) while recognising that much information on any relevant proposals will be limited will also be placed in Tier 3.

219 Projects identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward will also be in this category.

220 The specific projects scoped into this cumulative impact assessment, and the tiers into which they have been allocated are presented in Figure 22. The operational projects included within the table are included due to their potential impacts due to operation and future decommissioning subsequent to the data collection process for AyM and as such not included within the baseline characterisation.

221 The offshore archaeology and cultural heritage cumulative impact assessment reviewed all projects within 50 km. Any projects that fall into the category of disused, not in use, removed, decommissioned, abandoned, or closed were deemed to form part of the existing baseline, and therefore they are not included in the table below.

222 The complete long list can be found in Volume 1, Annex 1.3.1: Cumulative Effects Assessment.



LEGEND

- Proposed Offshore Development Area
- Cumulative Impact Assessment 50 km buffer
- Aggregates
- Disposal sites
- Offshore Energy
- Cables and pipelines
- Oil and gas

Data Source:

PROJECT TITLE:

AWEL Y MÔR OFFSHORE WINDFARM

FIGURE TITLE:

Cumulative Impact Assessment

VER	DATE	REMARKS	Drawn	Checked
1	30/11/2021	For Issue	KJF	LR

FIGURE NUMBER:

Figure 22

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:500,000	A3	WGS84	UTM30N

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

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Table 10: Projects considered within the offshore archaeology and cultural heritage cumulative effect assessment.

DEVELOPMENT TYPE	PROJECT	STATUS	DATA CONFIDENCE ASSESSMENT/ PHASE	TIER
Aggregates and Disposal	Liverpool Bay (1808) Hilbre Swash (392) Hilbre Swash (393) Liverpool Bay (457)	Active	Medium - Third party project details published in the public domain and confirmed as being 'accurate'	Tier 1
	Site Y Conway Beneficial Use Deganwy Beneficial Use Site Z Mostyn Deep (Maintenance) Mostyn Breakwater Mersey (Mid-River Site) Canning Half Tide Mersey (Garston Site)	Open	Medium - Third party project details published in the public domain and confirmed as being 'accurate'	Tier 1
Offshore Energy	Gwynt y Môr Rhyl Flats North Hoyle	Operational	High - Third party project details published in the public domain and confirmed as being	Tier 1

DEVELOPMENT TYPE	PROJECT	STATUS	DATA CONFIDENCE ASSESSMENT/ PHASE	TIER
	Burbo Bank Extension Burbo Bank		'accurate' by The Crown Estate	
	Port of Mostyn Tidal Lagoon Mersey Tidal Power	Pre-planning	High - Third party project details published in the public domain and confirmed as being 'accurate' by Crown Estate Scotland	Tier 2
Commercial Fisheries	Fishing Rights	Ongoing	High - Third party details published in the public domain and confirmed as being 'accurate' by Cefas.	Tier 1
	Aquaculture: Mussels (Class 2,3,4 and 5) Cockles (Class 2 ,3, 4 and 5) Pacific Oysters (Class 4 and 5) Native Oysters (Class 4) Tapes Species (Class 4)	Ongoing	High - Third party details published in the public domain and confirmed as being 'accurate' by DEFRA.	Tier 1

DEVELOPMENT TYPE	PROJECT	STATUS	DATA CONFIDENCE ASSESSMENT/ PHASE	TIER
	Surf Clam (Class 4) Hard Clam (Class 4)			
Cables and Pipelines	Gwynt y Môr OFTO Rhyl Flats North Hoyle Burbo Bank Extension OFTO Burbo Bank Walney Extension Transmission Asset Walney 2 OFTO West of Duddon Sands OFTO Barrow OFTO Ormonde OFTO Walney 1 OFTO Geo-Rirgrid (East West Interconnector) Western HVDC Link ESAT- 2 GTT Atlantic (Hibernia 'C') Sirius South Lanis -1 GTT Atlantic (Hibernia 'A') E-LLAN	Active	High - Third party project details published in the public domain and confirmed as being 'accurate' by the Crown Estate	Tier 1

DEVELOPMENT TYPE	PROJECT	STATUS	DATA CONFIDENCE ASSESSMENT/ PHASE	TIER
	Rockabill CeltixConnect-1 (CC-1)(BT-TE1) DD-POA Gas Export POA-DD Methanol POA-DD Concensate Conwy to Douglas Oil Export Douglas to Conwy Condensate Injection Douglas to Conwy Umbilical Douglas to CACM Hamilton to Douglas Gas Line Hamilton North to Douglas Gas Line Douglas to Hamilton North Douglas to Lennox Gas Line (PL1036A) Lennox to Douglas Gas Line Douglas to Lennox Chemical Line (PL1037) Douglas to Hamilton Douglas to Lennox Chemical Line (PL1038) Hamilton East Umbilical Hamilton East Pipeline OSI Anchor Cable 4			

DEVELOPMENT TYPE	PROJECT	STATUS	DATA CONFIDENCE ASSESSMENT/ PHASE	TIER
	OSI Anchor Cable 5 OSI Anchor Cable 6 OSI Anchor Cable 3 OSI Anchor Cable 1 OSI Anchor Cable 2 OSI Anchor Cable 8 OSI Anchor Cable 7 OSI Anchor Cable 9 Rivers Onshore Terminal to Calder Calder to Rivers Onshore Terminal Calder to CPP1 Morecambe DP6 to CPP1 Morecambe CPP1 to DP6 Morcambe CPP1 to DP8 Morecambe DP8 to CPP1 Morcambe CPP1 to DP6 Electric SMT Trunkline Morecambe DP1 to Bains Bains to Morecambe DP1 Morecambe DP6 to DP8 Dalton Plem to Dalton Wellhead R2 Wellhead R2 to Dalton Plem			

DEVELOPMENT TYPE	PROJECT	STATUS	DATA CONFIDENCE ASSESSMENT/ PHASE	TIER
	Dalton Wellhead R1 to Dalton Plem Dalton Plem to Dalton Wellhead R1 Morecambe DPPA to Dalton Plem Dalton Plem to DPPA			
	Havhingsten / CeltixConnect-2 (CC-2)	Under Construction	Medium - Third party project details published in the public domain but not confirmed as being 'accurate'	Tier 2
Oil and Gas	Douglas DA Douglas DP Hamilton A Conwy Platform NPAI Hamilton North Calder CA1 Platform Calder Platform South Morecambe AP1 Accommodation Platform AP1 South Morecambe CPP1 Central Production Platform CPP1 South Morecambe DP1	Operational	Medium - Third party project details published in the public domain but not confirmed as being 'accurate'	Tier 1

DEVELOPMENT TYPE	PROJECT	STATUS	DATA CONFIDENCE ASSESSMENT/ PHASE	TIER
	Drilling Platform DP1 South Morecambe FL1 Flare Tripod DP6 Platform South Morecambe DP6 DP4 Platform DP8 Platform South Morecambe DP8			
	Douglas DW Liverpool Bay Buoy: KFB 07/2012 Liverpool Bay Smart Buoy: KFB20/2012 AREA5 OSI (Offshore Storage Inst.) FPSO Point of Ayr Terminal Lennox	Active	Medium - Third party project details published in the public domain but not confirmed as being 'accurate'	Tier 1
	Gateway Gas Storage Project	In Planning	Medium - Third party project details published in the public domain but not confirmed as being 'accurate'	Tier 2

Table 11: Cumulative MDS.

POTENTIAL EFFECT	SCENARIO	JUSTIFICATION
Cumulative permanent physical loss/ disturbance of offshore archaeological and cultural heritage receptors as well as potential marine archaeological receptors in the wider marine archaeological environment in the wider environment.	Significant cumulative impacts to known and potential marine archaeological receptors, from a variety of developments including renewable energy developments, offshore oil and gas developments, pipelines and cable developments, port and harbour activities, marine disposal sites and marine dredging sites. Such impacts may result in direct effects on potential receptors on or under the seabed or disturb relationships between receptors and their wider surroundings as the result of seabed contact, the removal of seabed sediments or other such activity in the water column.	Numerous developments within a 50 km radius potentially directly impacting known and potential offshore archaeology and cultural heritage receptors.
Cumulative indirect effects upon offshore archaeological and cultural heritage receptors as a	There is the potential for indirect effects to occur upon known and potential receptors as a result of changes to hydrodynamic and sediment transport regimes, caused by	Numerous developments within a 50 km radius potentially causing changes to sedimentary and erosion regimes, and therefore indirectly impacting known and

POTENTIAL EFFECT	SCENARIO	JUSTIFICATION
result of changes to hydrodynamic, sedimentary and erosion regimes	renewable energy developments, offshore oil and gas developments, pipelines and cable developments, port and harbour activities, marine disposal sites and marine dredging sites. Such effects are predicted to arise as a result of changes to bed levels at the seabed caused by changes to sedimentation and erosion regimes and leading to increased exposure or coverage of receptors. Increased exposure could cause receptors to be vulnerable to deterioration, whereas increased coverage would promote preservation.	potential offshore archaeology and cultural heritage receptors.

223 Cumulative effects result from the combined impact of a number of different projects on the same receptor. Cumulative effects on the offshore archaeological and cultural heritage receptors can result in incremental changes over time and over a wide area (Oxford Archaeology, 2008).

224 The overall scope for potential cumulative effects of the proposed development was assessed in relation to all projects and plans within 50 km of AyM OFW, based on agreement with the curators.

225 The cumulative assessment has been compiled with Tier 1 and Tier 2 projects, as no Tier 3 projects exist within the 50 km buffer. The majority of the projects in Table 9 above are already operational. Those scoped into the assessment are considered to result in potential incremental changes to the offshore archaeology and cultural heritage resource across a wider area. The small number of Tier 2 projects are unlikely to have considerably different cumulative effects on the offshore archaeology and cultural heritage receptors, and therefore, this section considers Tier 1 and Tier 2 projects together.

226 There should be limited cumulative effects on the offshore archaeology and cultural heritage as all of the other projects will have undergone EIA and the impacts will have been mitigated for. The only cumulative effects should be beneficial in the form of data becoming publicly available and contributing to society. If a wreck was discovered and avoided as a result of the project, and a dive trail was made, this would be a beneficial magnitude.

11.14.4 Marine Aggregates and Disposal

227 There are a number of marine aggregate licenced dredging areas within 50 km of AyM; four of which are currently active.

228 EIAs will have been undertaken for the existing dredging areas and are likely underway for the proposed areas. The EIAs will likely recommend avoidance of any known seabed features, not only for their historic importance but also as operational hazards. In addition, the EIAs will recommend adherence to a reporting protocol for unexpected finds. Many of the aggregate companies involved (Hanson Aggregates Marine Ltd, Tarmac Marine Ltd., CEMEX UK Marine Ltd., Britannia Aggregates Ltd., and DEME Building Materials Ltd.) participate in the Marine Aggregate Industry Archaeological Protocol (BMAPA and English Heritage, 2005) and receive associated training to mitigate for the impact on potential archaeological receptors. Therefore, any cumulative impacts of marine aggregate dredging would be of Negligible magnitude and therefore of Minor to Negligible Adverse significance.

229 The archaeological assessments of geophysical and geotechnical survey data, undertaken as part of the EIA process, will have contributed to wider understanding of seabed prehistory in the area, and therefore are of Moderate beneficial significance.

230 Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes Technical Annex (application ref: 6.2.2) says that there is potential for cumulative temporary increases in Suspended Sediment Concentration and seabed levels as a result of AyM foundation installation and dredge spoil disposal at licensed disposal grounds.

231 Cumulative sediment regime changes have potential to affect the burial or exposure of archaeological receptors.

232 Sediment plume interaction generally has the potential to occur if the activities generating the sediment plumes are located within one spring tidal excursion ellipse from one another and occur at the same time. Identified sites are within 12 km as this distance represents the largest spring tidal excursion ellipse observed in the array and offshore ECC.

11.14.5 Offshore Wind Farms

233 The cumulative assessment has reviewed the 12 OWFs within 50 km of AyM. Projects beyond this have been scoped out due to their distance from the project.

234 Of the 5 OWFs, five are presently operational. These five have undergone EIA, and suitable mitigation measures have been implemented. Mitigation measures have included AEZs around known offshore archaeology and cultural heritage receptors, geophysical and geotechnical surveys, and protocols for unexpected discoveries. Therefore, any cumulative impacts from existing and under construction OWFs would be of Negligible magnitude and therefore of **low to negligible adverse** significance.

235 The archaeological assessments of geophysical and geotechnical survey data, undertaken as part of the EIA process, have contributed to wider understanding of palaeogeography in the area, and therefore are of **moderate beneficial** significance.

236 The remaining OWFs, which are early concept, concept/ early planning or pre-planning, will also undergo EIA, and therefore any significant impacts will likely be mitigated against, and the likeliness of effects to occur is reduced, resulting in **low to negligible** significance of effects. However, should impact occur, it could range from **low to major adverse** significance, depending on the value of the receptor being impacted.

237 There is potential for indirect impacts to occur upon known and potential offshore archaeological and cultural heritage receptors as a result of changes to hydrodynamic and sediment transport regimes, during the construction phase of the proposed development and/ or the decommissioning stages of all of the projects. The potential for impact increases as the distance between sites decreases, and therefore there is highest potential relating to GyM. However, Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes Technical Annex (application ref: 6.2.2) indicated that indirect impacts, such as scour, are very localised, and therefore even GyM is unlikely to cause any indirect impacts cumulatively with AyM.

11.14.6 Commercial Fisheries

238 Commercial fishing in the area includes potting fishery, netting fishery, dredge fishing, beam trawling and otter trawling. Further detail is provided in the Scoping report and in Volume 2, Chapter 8: Commercial Fisheries (application ref: 6.2.8).

239 Trawling and netting may damage or destroy offshore archaeology and cultural heritage receptors on the seabed and in shallow seabed sediments.

240 This impact will lead to localised loss of access to fishing grounds and the fish and shellfish resources within these grounds for a range of fishing opportunities during the operational and maintenance phase, which will directly affect fleets over a long-term duration. The impact is predicted to be continuous with low reversibility for the lifetime of AyM and is of relevance to national fishing fleets.

241 However, the industry is well established and is widespread throughout the region, and therefore, any changes in fishing activity that may manifest from the construction of the proposed OWF are unlikely to result in any significant new cumulative direct impacts. Therefore, any cumulative direct impacts of commercial fisheries would be of Negligible magnitude and therefore of **low to negligible** adverse significance.

242 Commercial fisheries are unlikely to cause noticeable changes to hydrodynamic, sedimentation or erosion regimes. Therefore, any cumulative indirect effects would be of **negligible adverse** significance.

11.14.7 Oil and Gas

243 There are 20 operational oil and gas receptors within 50 km of AyM while others are active or being decommissioned.

244 Although drilling associated with oil and gas would cause permanent, adverse damage, oil and gas receptors are unlikely to cause noticeable changes to hydrodynamic, sedimentation or erosion regimes. Therefore, any cumulative indirect effects would be of Negligible Adverse significance.

245 Any cables and pipeline associated with the oil and gas industry are associated below.

11.14.8 Cables and Pipelines

246 There are 79 cables and pipelines for consideration. Some of these cables related to export cables for wind farms have undergone EIA, and as such, any potential impacts have been mitigated. It is unclear whether the remaining projects have undergone detailed assessment.

247 Any known seabed features should have been avoided during construction, as these would constitute engineering hazards. However, it is believed that the protected wreck of *Resurgam* was buried until the installation of the pipeline from Hamilton North to Douglas in 1995.

248 Impact to buried material in general is likely to be relatively minimal, as the impact to the seabed is relatively minimal, although over a long distance. The cables and pipelines would likely have been shallowly buried, or any covering material would have had a relatively small footprint. Although O&M activities could represent a potential cumulative impact, the mitigation measures which would likely be required for any such activity including further surveys after pipes installed would reduce the pathway for cumulative impacts to occur. Therefore, any cumulative impacts of cables and pipelines would be of Negligible magnitude and therefore of **low to negligible** Adverse significance.

249 As cables and pipelines are likely to be buried or covered by low-lying material, they are unlikely to cause noticeable changes to hydrodynamic, sedimentation or erosion regimes. Therefore, any cumulative impacts of the indirect impacts of cables and pipelines would be of **negligible adverse** significance.

11.15 Inter-relationships

250 Inter-relationships exist between the offshore archaeological environment and the assessments undertaken for:

- Volume 3, Chapter 8: Onshore Archaeology and Cultural Heritage (application ref: 6.3.8).
- Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (application ref: 6.2.2);
- Volume 2, Chapter 8: Commercial Fisheries (application ref: 6.2.8); and
- Volume 2, Chapter 10: SLVIA (application ref: 6.2.10).

- Inter-relationships between offshore archaeology and cultural heritage and onshore archaeology and cultural heritage, physical processes, commercial fisheries, and Seascape, Landscape and Visual have been discussed as part of the environmental assessment above in relation (respectively): the seamless nature of the archaeological resource from onshore to offshore contexts; impacts regarding the indirect impacts due to potential changes in hydrodynamic, sedimentary and erosion regimes; potential cumulative effects from commercial fisheries; and setting and visual impact. Further information is available in Volume 2, Chapter 14: Inter-related Effects (Application ref: 6.2.14).

11.16 Transboundary effects

251 The transboundary screening, has been submitted with the application (Volume 1, Annex 3.2 (application ref: 6.1.3.2)) and PINS has published its Regulation 32 Transboundary Screening which screens out a transboundary assessment for offshore archaeology on the basis that impacts will be limited entirely to within the UK Exclusive Economic Zone (EEZ).

11.17 Summary of effects

252 With the implementation of the mitigation measures discussed above, all effects should be reduced to minor adverse significance or minor to moderate beneficial significance, and therefore there are no residual significant positive or adverse effects that cannot be eliminated (see Table 11 below).

Table 12: Summary of effects.

IMPACT	MAGNITUDE	SENSITIVITY OF RECEPTOR	MITIGATION MEASURES	RESIDUAL EFFECT
CONSTRUCTION				
Removal of sediment containing undisturbed archaeological contexts leading to total loss of the receptor during preparation of the seabed for WTGs and offshore substation foundations.	High adverse	High to negligible sensitivity	Implementation of WSI. Implementation of AEZs. Archaeological investigation of seabed anomalies (A2s) prior to impact. Implementation of a PAD.	Minor to negligible adverse (not significant) or minor to moderate beneficial (not significant to significant)
Penetration and compression effects of jack-up legs and anchoring of construction vessels during turbine, sub-station or cable	High adverse	High to negligible sensitivity	Implementation of WSI. Implementation of AEZs. Archaeological investigation of	Minor to negligible adverse (not significant) or minor to moderate beneficial (not significant to significant)

IMPACT	MAGNITUDE	SENSITIVITY OF RECEPTOR	MITIGATION MEASURES	RESIDUAL EFFECT
installation leading to total or partial loss of archaeological receptors.			seabed anomalies (A2s) prior to impact. Implementation of a PAD. Archaeological assessment of any geotechnical data.	
Intrusion of piling foundations disturbing archaeological contexts leading to a partial or total loss of the receptor	High adverse	High sensitivity	Implementation of WSI. Archaeological assessment of any geotechnical work for any palaeogeographic sites or material. Implementation of a PAD.	Minor to negligible adverse (not significant) or major beneficial (significant)

IMPACT	MAGNITUDE	SENSITIVITY OF RECEPTOR	MITIGATION MEASURES	RESIDUAL EFFECT
Disturbance of sediment containing potential archaeological receptors (material and contexts) during inter-array and export cable laying operations	High adverse	High to negligible sensitivity	Implementation of WSI. Implementation of AEZs, Further assessment of A2 anomalies, and implementation of a PAD.	Minor to negligible adverse (not significant) or minor to moderate beneficial (not significant to significant)
Indirect effects upon known and potential marine archaeological receptors as a result of changes to sedimentation and erosion patterns.	High adverse	High to negligible sensitivity	Scour protection. Review of monitoring data to assess whether AEZs have been impacted or whether buried material has been exposed (archaeological assessment of survey data and/or	Minor to negligible adverse (not significant) or minor to moderate beneficial (not significant to significant)

IMPACT	MAGNITUDE	SENSITIVITY OF RECEPTOR	MITIGATION MEASURES	RESIDUAL EFFECT
			implementation of PAD)	
Compression of stratigraphic contexts containing archaeological material from combined weight of foundation, transition piece, tower, and wind turbine.	High adverse	High to negligible sensitivity	Implementation of WSI. Archaeological assessment of geotechnical data.	Minor to negligible adverse (not significant) or minor to moderate beneficial (not significant to significant)
OPERATION				
Total or partial loss of archaeological receptors during the operation and maintenance phase due to penetration	High adverse	High to negligible sensitivity	Implementation of WSI. Retention of AEZs. Avoidance of A2 anomalies.	Minor to negligible adverse (not significant) or minor to moderate beneficial (not significant to significant)

IMPACT	MAGNITUDE	SENSITIVITY OF RECEPTOR	MITIGATION MEASURES	RESIDUAL EFFECT
and compression effects			Archaeological assessment of geoarchaeological data pre-construction.	
Total or partial loss of archaeological receptors during the operation and maintenance phase due to scour effects	High adverse	High to negligible sensitivity	Assignment and monitoring of potential scour in AEZs. Scour protection. Review of monitoring data to assess whether buried material has been exposed (archaeological assessment of survey data and/or implementation of PAD)	Minor to negligible adverse (not significant) or minor beneficial (not significant)

IMPACT	MAGNITUDE	SENSITIVITY OF RECEPTOR	MITIGATION MEASURES	RESIDUAL EFFECT
DECOMMISSIONING				
Total or partial loss of archaeological receptors during the decommissioning phase due to penetration and compression effects	High adverse	High to negligible sensitivity	Implementation of WSI. Retention of AEZs. Avoidance of A2 anomalies.	Minor to negligible adverse (not significant) or minor to moderate beneficial (not significant to significant)
Total or partial loss of archaeological receptors during the decommissioning phase due to the draw-down of sediments	High adverse	High to negligible sensitivity	Implementation of WSI. Reviewing AEZs to ensure modeled draw-down of sediments will not occur within AEZ. Review of monitoring data to assess whether buried material has been exposed	Minor to negligible adverse (not significant) or minor beneficial (not significant)

IMPACT	MAGNITUDE	SENSITIVITY OF RECEPTOR	MITIGATION MEASURES	RESIDUAL EFFECT
			(archaeological assessment of survey data and/or implementation of PAD)	
CUMULATIVE EFFECTS				
Effects on known and potential archaeological receptors	**High adverse** Combined impact of a number of projects on the same receptor and incremental changes over time and over a wide area	High to negligible sensitivity	Impact from other projects unlikely due to distance, and indirect impacts from AyM are localised Incremental changes over time managed through standard mitigation measures across the EIA process	Minor to negligible adverse (not significant) or minor to moderate beneficial (not significant to significant)

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