

MDM Ltd

SOBR 1 Cable Route Site Investigation Surveys

Habitats Regulations Assessment Report

COMMERCIAL IN CONFIDENCE



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1. Introduction

1.1 Overview

Proposed plans or projects that have the potential to affect designated nature conservation sites are required to be considered through the Habitats Regulations Assessment (HRA) process under The Conservation of Habitats and Species Regulations 2017 and The Conservation of Offshore Habitats and Species Regulations 2017 (as amended¹) (the Habitats Regulations).

This Report to Inform Appropriate Assessment (RIAA) considers the work activities (hereafter referred to as ‘works’ or ‘work activities’) required for a marine survey and site investigation works to investigate the feasibility of constructing a new subsea telecoms cable system, SOBR1, with the landfall located at Holy Island, north Wales. The report provides the information required by Natural Resources Wales (NRW) to fulfil its function as a ‘competent authority’ under the Habitats Regulations and determine if the proposed works are likely to have a significant effect on the conservation objectives of a European Site, either alone, or in combination with other plans or projects.

1.2 Project details

McMahon Design and Management Ltd (MDM) is working to identify a cable route and cable landing locations for the development of a new subsea fibre optic cable system, known as SOBR 1, with landfall located at Holy Island, north Wales. Only works carried out in Welsh waters are being considered in the marine licence application to NRW (works carried out in Irish waters will be covered under the Irish regulatory system).

The site investigation works (hereafter referred to as ‘S.I. works’) will be predominately composed of a geophysical survey and a geotechnical survey (Table 1). A cable route corridor of approximately 500 m width will be surveyed (hereafter referred to as the ‘S.I. Survey Area’) for the geophysical survey and geotechnical works.

1.3 Habitats Regulations Assessments

The Habitats Regulations require that an Appropriate Assessment of the implications of any development consent must be made by the relevant competent authority, in this case NRW,

¹ <https://www.legislation.gov.uk/uksi/2017/1013/contents/made>

if a project (or plan) is likely to have a significant effect on the conservation objectives of a European Site (defined below), either alone, or in-combination with other plans or projects.

HRA is generally understood to be a progressive, four stage process which determines Likely Significant Effect (LSE) and, where required, assesses potential adverse impacts on the integrity of a European Site, examines alternative solutions and provides justification of Imperative Reasons of Overriding Public Interest (IROPI) (Planning Inspectorate 2017). Further detail on the process followed and the definition of particular terms, is provided in the methodology (Section 3).

1.4 Structure and purpose of the report

This report provides information on the work activities and the HRA Screening and Appropriate Assessment process. The report records the process and presents the results and conclusion.

The report provides information to allow NRW (as the competent authority) to determine whether there will be an adverse effect on the integrity of any European Site(s) in view of their Conservation Objectives (COs) as a result of the project.

In the context of a HRA, where the potential for likely significant effects cannot be excluded for a Site, a competent authority must make an Appropriate Assessment of the implications of the plan or project for that site, in view of the Site's conservation objectives. The competent authority may agree to the plan or project only after having ruled out adverse effects on the integrity of the European Site. Where an adverse effect on the site's integrity cannot be ruled out, and where there are no alternative solutions, the plan or project can only proceed if there are IROPI and if the necessary compensatory measures can be secured.

This RIAA has been undertaken to support the marine licence application for the geotechnical S. I. works. Due to the nature of the geophysical survey, this element of the works is considered to be exempt from requiring a marine licence, but assessment of potential effects on European Sites is included in this report for completeness.

2. The proposed works

2.1 Location and context

The proposed S. I. Survey Area boundary extends approximately 48 km off the coast of Holy Island, north Wales, to the UK/Ireland Exclusive Economic Zone (EEZ) boundary, with an overall area of approximately 3,437 ha. The S. I. Survey Area is indicated in Figure 1 and is comprised of the cable corridor and landfall locations. The cable corridor is not uniform in width but is predominately 500 m, with some sections varying between 400 – 700 m in width.

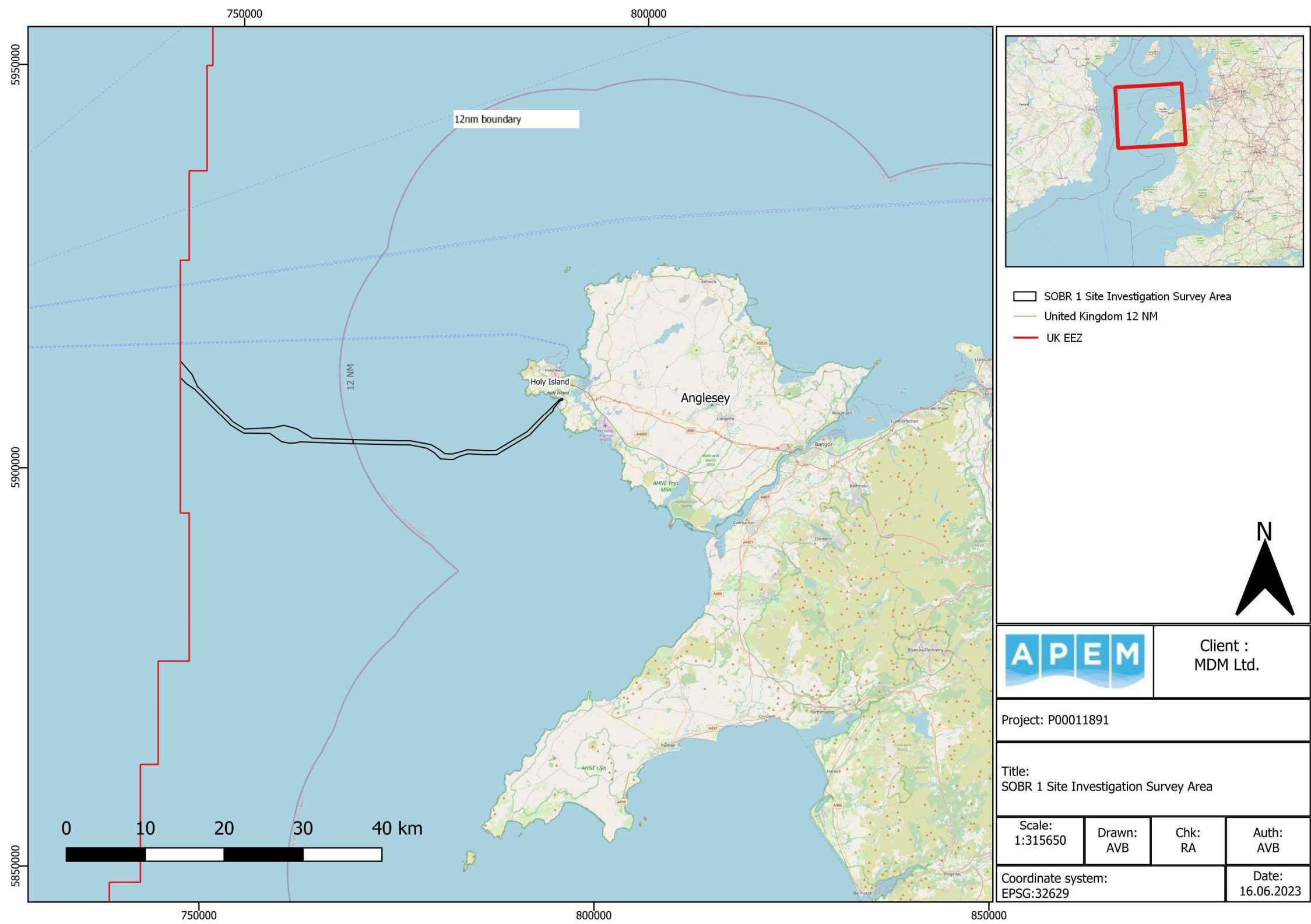


Figure 1. The proposed location for the Site Investigation works.



2.2 Summary of marine works

The objective of the S. I. works is to identify a feasible and safe route for the cable system design, deployment, survivability and subsequent maintenance. The works will also enable further understanding of site conditions including benthic characteristics, bathymetry, underlying geology, possible obstructions, and environmental characteristics. The geophysical survey data will be acquired prior to the geotechnical and sampling survey. The proposed programme of surveys is summarised in Table 1 below. Further information regarding survey methods can be found in the Marine Licence Application Methodology (MDM 2023) that accompanies this RIAA.

Two survey vessels are proposed for this project, namely:

- The Lady Kathleen; and
- The Roman Rebel.

The Lady Kathleen is proposed for acquisition of the geophysical data in shallow water areas within the 12 NM boundary. The Roman Rebel is proposed to survey the deeper areas of the cable routes as well as for the geotechnical survey scope. Further details of the vessels proposed to undertake the works can be found in Appendix 2: Survey vessels and equipment.

Should these vessels not be available at the planned commencement of works then comparable alternative vessels will be sourced.

Table 1. Summary of proposed survey methodology and timings.

Category	Survey	Purpose	Sampling / Area	Duration
Geophysical	Multibeam Echo	Map seabed features and/or other cables and pipelines, obstructions, wrecks, debris etc.	Full coverage of Survey Area.	Expected to commence May 2024 and completed within four weeks.
	Sounder (MBES)			
	Side Scan Sonar (SSS)	Provide interpretation of seabed sediments and identification of any object on seabed larger than 0.5 m.		
	Sub-Bottom	Identify character of	Minimum of five lines.	

Category	Survey	Purpose	Sampling / Area	Duration
	Profiler (SBP)	shallow geology, locating any structural complexities or geohazards.		
	Magnetometer Survey	Map any metallic obstacles or hazards, including UXO		
Geotechnical	Grab samples	Representative samples of surficial seabed sediments for laboratory testing.	Up to 12 samples (two per location). In situ surficial sampling, at 8 km intervals along the cable route corridor.	Expected to commence June 2024 for a duration of approximately 6 weeks
	Bar probes		16 samples on the intertidal and 16 samples from Low Water to 3 m.	
	Vibrocore (VC) / Gravity Cores		Up to 10 samples (120 mm diameter) to 3 m along the cable route corridor.	
	Cone Penetration Testing (CPT)		Up to 10 samples along the cable route corridor.	
	Slit Trenches		Four trenches on the beach, using a mini digger/JCB to excavate 0.8 – 1 m width trenches, up to 2.5 m depth.	
Intertidal and Beach surveys	Walkover surveys		At low spring tide by a project ecologist. A camera, GPS and marine metal detector will be deployed, scanning a series of survey lines in a grid pattern on	Unknown

Category	Survey	Purpose	Sampling / Area	Duration
			the beach and intertidal zones	

3. Assessment Methodology

3.1 Legislative and policy context

3.1.1 *UK (domestic) legislation*

This section describes the legislation as it applies now that the UK has left the European Union (EU). Guidance from the Department for Environment, Food, and Rural Affairs (DEFRA) has been provided on the application of the relevant legislation in the post-Brexit period in their policy paper published on 1st January 2021². The Habitats Regulations provide for the protection of particular habitats, plants and animals through the creation of, and specific decision-making procedures applied to, the 'national site network' (Regulation 3 'Interpretation'). This 'national site network' consists of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) that were designated both in that period when the UK was a member of the EU and since the UK left the EU.

Since those particular parts of the Habitats Regulations relating to the HRA process continue to refer to the designated sites collectively as 'European Sites', rather than as the 'national site network', that approach has been followed in this RIAA.

3.1.2 *Policy requirements additional to domestic legislation*

It is UK Government policy that all competent authorities should treat candidate SACs (cSACs) and potential SPAs (pSPAs) as being within the requirements of the Habitats Regulations. In Wales, this is identified in paragraph 4.6 and 4.7 of the Developments of National Significance Guidance (The Planning Inspectorate 2019).

Accordingly, in this report the term 'European Site' is used to refer collectively to SACs, cSACs, SPAs and pSPAs.

² Available at: <https://www.gov.uk/government/publications/changes-to-the-habitats-regulations-2017/changes-to-the-habitats-regulations-2017>.

3.1.3 *International legal and policy obligations*

The UK is a contracting party to the Convention on wetlands of international importance especially as waterfowl habitat, Ramsar, Iran, 1971 (the 'Ramsar Convention'), which seeks to protect wetlands of international importance, especially those wetlands utilised as waterfowl habitat.

It is UK Government policy that all competent authorities should treat Ramsar Sites in their decision-making processes as if they are SACs or SPAs and hence Ramsar Sites are considered within the requirements for HRA of the Habitats Regulations. In Wales, this is identified in paragraph 4.6 and 4.7 of the Developments of National Significance Application Guidance (The Planning Inspectorate 2019). As a consequence, in this report Ramsar Sites are referred to alongside European Sites collectively as European and Ramsar Sites.

3.1.4 *Areas that are functionally linked to European and Ramsar Sites*

Animals that are interest features of European and Ramsar Sites may be mobile and not confined to the boundary of the designated site. For example, wintering waterbirds may forage or roost on agricultural land outside of the designated site. Although that agricultural land is not part of the European or Ramsar Site, it is 'functionally linked' because it serves a function for waterfowl that are interest features of the designated site. Account has to be taken of such functionally linked land in the HRA process since, for instance, the loss of such land to development could potentially adversely affect the survival of those wintering waterbirds and lead to a reduction in the population of birds within the designated site.

Functionally linked land has been defined as follows (Chapman & Tyldesley 2016):

"The term 'functional linkage' refers to the role or 'function' that land or sea beyond the boundary of a European Site might fulfil in terms of ecologically supporting the populations for which the site was designated or classified. Such land is therefore 'linked' to the European Site in question because it provides an important role in maintaining or restoring the population of qualifying species at favourable conservation status."

3.2 **The HRA process**

3.2.1 *Overview*

The requirements of the Habitats Regulations with regard to the implications of plans or projects are set out within Regulation 63. The step-based approach implicit within this Regulation is referred to as a 'Habitats Regulations Assessment' (HRA), which is the term that has been used throughout this report.

It is a requirement of any public body, referred to as a ‘competent authority’ within the Habitats Regulations, to carry out a HRA when they are proposing to carry out a project, implement a plan or authorise another party to carry out a plan or project. Competent authorities are required to record the process undertaken, ensuring that there will be no adverse effects on the integrity of any European or Ramsar Site as a result of a plan or project whether alone, or in combination with other plans or projects.

3.2.2 Assessment stages

The assessment of a plan or project goes through a number of stages, with guidance having been published to aid competent authorities to fulfil their responsibilities. Those stages are summarised in Table 2.

Table 2. Stages in the HRA process

Stage	Description	Legislative Context
Purpose	Determines if the purpose of the plan or project is directly connected with, or necessary, to the management of a European or Ramsar Site. If it is, then no further assessment is necessary.	Regulation 63(1)(b)
Scoping	The identification of any European or Ramsar Site that might be within scope of a HRA i.e. those sites that should be taken forward to the screening stage based on a wide consideration of spatial and ecological factors. Such a site may be located within the plan or project area but may also include sites located in neighbouring authority areas.	
Screening	Assessment of whether a plan or project, either alone or in combination with other plans or projects, is likely to have a significant effect on any qualifying feature (habitats and species) and the achievement of the conservation objectives of a European or Ramsar Site. This is also known as the ‘test of likely significant effect’ (ToLSE).	Regulation 63(1)(a)
Appropriate Assessment	Consideration of the effects of the proposals to determine whether or not it is possible to conclude with certainty that the development will not result in any adverse effect on the integrity of European or Ramsar Site, either alone or in combination with other plans or projects and with reference to the conservation objectives of the European or Ramsar Site. This is also known as the test of ‘adverse effect on integrity’ (AEoI). At this stage consent may be granted for the plan or project if it is possible to conclude with certainty that the proposal will not result in any adverse effect on the integrity of any European or Ramsar Site, either alone or in combination with other plans or projects.	Regulation 63(5)
If it cannot be concluded with certainty that the proposal will not result in any adverse effect on the integrity of any European or Ramsar Site then proceed to:		

Stage	Description	Legislative Context
Assessment of alternative solutions	Assess whether there is an alternative solution to the plan or project i.e. one that better respect the European or Ramsar Sites. If no such alternative solution exists, the process continues to Assessment of IROPI.	Regulation 64(1)
Assessment of IROPI	Assess whether a plan or project can be justified as being needed for 'imperative reasons of overriding public interest' (IROPI).	Regulation 64(1)
Compensatory measures	Identify and secure any necessary compensatory measures to ensure that the overall coherence of the 'national site network' is protected.	Regulation 68

3.2.3 In-combination assessment

The Habitats Regulations, taken with Government policy, require the consideration of the potential effects of a project on European and Ramsar Sites both alone and in-combination with other plans or projects.

The identification of plans and projects to include in the in-combination assessment will be based on:

- approved plans;
- approved, but as yet unconstructed projects; and
- projects for which an application has been made, are currently under consideration and will be consented before the proposed development is operational.

3.3 Guidance on the HRA process

In preparing this report, consideration has been given to the relevant guidance issued by a number of Governmental, statutory and industry bodies.

Guidance from Government bodies includes:

- Ministry of Housing, Communities and Local Government online Guidance on the use of Habitats Regulations Assessment <https://www.gov.uk/guidance/appropriate-assessment>
- Defra, NE, Welsh Government and NRW guidance on Habitat Regulations Assessments <https://www.gov.uk/guidance/habitats-regulations-assessments-protecting-a-european-site>

Guidance from the Statutory Bodies includes:

- MMO online guidance on Marine Licensing: impact assessments <https://www.gov.uk/guidance/marine-licensing-impact-assessments>

- NRW online guidance on HRA in the marine licensing process
<https://naturalresources.wales/permits-and-permissions/marine-licensing/marine-licence-habitats-regulations-assessment/?lang=en>
- NRW's position on the use of Marine Mammal Management Units for screening and assessment in Habitats Regulations Assessments for Special Areas of Conservation with marine mammal features
<https://cdn.cyfoethnaturiol.cymru/media/695250/ps006-mmmus-in-hra-position-statement-may22.pdf>.

4. Identification of European and Ramsar Sites and features potentially affected by the proposed works

4.1 European and Ramsar Site Identification process

For the screening process, European and Ramsar Sites in the vicinity of the proposed works activities which could potentially be influenced by the proposed works were identified. The different interest features within these sites were then considered individually.

It only requires one site interest feature to be considered to be potentially impacted by the work activities for the European and/or Ramsar Site to be screened into the HRA, along with each of its associated interest features.

This screening used the conceptual 'source-pathway-receptor' model. The model was used to identify potential environmental effects resulting from the works activities. This process provides an easy to follow assessment route between impact sources and potentially sensitive receptors ensuring a transparent impact assessment. The parameters of the model are defined as follows:

- source – the origin of a potential effect (noting that one source may have several pathways and receptors);
- pathway – the means by which the effect of the activity could impact a receptor; and
- receptor – the element of the receiving environment that is impacted.

Where there is no pathway, or the pathway is so long that the effect from the source has dissipated to a negligible level before reaching the receptor, there is justification for the screening out of that particular receptor.

Where the receptor (site interest feature) only occurs in the area on a seasonal basis and/or that receptor is not present in the period in which particular activities of the proposed works

are a source of a potential effect, there is justification for the screening out of that particular receptor.

4.2 Potential European and Ramsar Site (receptors)

The proposed S. I. Survey Area extends from Trearddur Bay in the west of Holy Island, North Wales, out to 48 km off the Welsh coast into the Irish Sea.

The following criteria were used to identify European sites that should be taken through to screening, using a precautionary approach (reasons for the distances considered are indicated below):

- Inclusion of any site within a potential Zone of Influence (Zoi) of 2 km of the investigation area (i.e. including sites with only habitat features, only mobile features, or a combination of the two). This is considered to be highly precautionary for sites with just habitat features;
- Inclusion of any site up to 50 km from the investigation area that contains mobile receptors (not including birds) that have the potential to occur within the investigation area – this applies to marine mammals and fish species;
- For marine mammals, protected sites can be incorporated at greater distances for this receptor, based on NRW guidance (NRW 2022). Where NRW guidance is not applicable or available, the Zoi is set at 50 km, which should be regarded as precautionary.
- Inclusion of sites within a 10 km Zoi from the investigation area for coastal birds and within a 20 km Zoi for sites with geese as a qualifying feature given typical commuting ranges between roosting and foraging grounds (Mitchell 2012; SNH 2016); and
- Zoi based on mean max foraging ranges for seabirds (Woodward *et al.* 2019).

For benthic habitat features, a 2 km Zoi will be applied. The potential impacts of the expected survey activities include abrasion/penetration of substrate, smothering/siltation rate change and pollution, which pose a potential risk to benthic habitat features. Given the nature of the activities, potential effects will be restricted to the immediate survey area with the exception of an accidental spill event, which may extend beyond the immediate survey area. However, the 2 km Zoi is considered highly precautionary for habitat features.

For some species of marine mammal, such as harbour seals, grey seals and bottlenose dolphins, telemetry data (seal species) and photo-identification data (seal species and bottlenose dolphins), can assist in identifying connectivity to protected areas. These data are often used in the process of designating protected areas. For example, harbour seals show high site fidelity, and although some telemetry tagged individuals have travelled beyond 100 km (Thompson *et al.* 1998; Wilson *et al.* 2015), the majority of seal trips are less than 50 km from their preferred haul-out site (Carter *et al.* 2022). Grey seals along the Welsh coast also

show connectivity between haul-out sites up to 230 km apart; however, photo-identification studies show that on average, grey seals typically remain within 50 km of their preferred haul-out site (Langley *et al.* 2020). Taking a precautionary approach, and following NRW guidance on grey seals (NRW 2022), three SACs in Welsh waters are scoped into the assessment:

- Pen Llyn a'r Sarnau/ Llyn Peninsula and the Sarnau SAC;
- Cardigan Bay SAC; and,
- Pembrokeshire Marine SAC.

In addition, following the 50 km Zol approach, Lambay Island SAC in Irish waters is also scoped into the assessment. The latter SAC also includes harbour seals as a qualifying feature; therefore, this species is also scoped in for this site. Harbour seals are not a qualifying feature of any Welsh SAC, therefore NRW do not provide any guidance on this species in relation to screening for HRA.

For bottlenose dolphins, boat-based surveys can provide information on where animals occur, and with the addition of photo-identification, these data can show that individuals using protected areas also use areas further afield (Cheney *et al.* 2013; Robinson *et al.* 2012). The Pen Llyn a'r Sarnau/ Llyn Peninsula and the Sarnau SAC is within the Zol of the S.I. works, and therefore has been scoped into the assessment. Furthermore, following NRW guidance (NRW 2022), Cardigan Bay SAC is also included in the assessment, despite being further than 50 km from the S. I. works, due to known connectivity of individuals from this site and the wider area, including the Pen Llyn a'r Sarnau/ Llyn Peninsula and the Sarnau SAC (Feingold and Evans 2013).

For other more elusive and challenging species to study at the individual-level, such as harbour porpoise, protected areas are often identified as areas with higher densities of the species compared to other regions. For harbour porpoise, which is the most abundant cetacean species in UK and Irish waters, connectivity to the site is likely, but it is important to remember the rationale for designating the protected site; it is an area of higher density and is therefore considered to be more important to the species when compared to neighbouring areas. Consequently, a key Conservation Objective in these cases is to ensure that the potential usage of the site by harbour porpoise is maintained (JNCC 2019a; 2019b). Following NRW guidance (NRW 2022), and incorporating the precautionary 50 km Zol, two SACs in Welsh waters, North Anglesey Marine SAC and West Wales Marine SAC, have been scoped into the assessment. In addition, the Rockabill to Dalkey Island SAC in Irish waters has also been scoped in.

There is no guidance or literature to support a specific distance for the consideration of sites with mobile fish features. Consequently, a distance of 50 km has been used for mobile marine

fish species (including anadromous species) as a precautionary approach. Migratory fish could potentially pass through the ZOI if transiting to sites near the S. I. area, however, there would likely also be many routes for migration available outside the ZOI. For migratory fish features of sites further than 50 km from the S. I. area it is considered that individuals will likely not need to transit through the S. I. area during migration, and if they did, it would only be a small proportion of the population of migratory fish from the SAC. In addition, they would also be able to avoid an area during S. I. works, if required.

For SPAs with birds as qualifying features, an area of interest of 10 km has been adopted for coastal and intertidal bird species, extended to 20 km for geese and swans given typical commuting ranges between roosting and foraging grounds (Mitchell 2012; SNH 2016). For breeding seabird species, published mean-maximum foraging ranges have been used to establish potential connectivity between the S.I Survey Area and designated sites (Woodward *et al.* 2019). For those sites with features where there could be connectivity, they have been considered in the screening stage. There is no guidance or literature to support a specific distance for the consideration of sites with seabird features, however, using professional judgement sites up to 230 km from the S. I. Survey Area have been included in the screening stage to include all sites for seabirds with a lower mean-maximum foraging range (e.g. lesser black-backed gull or kittiwake) which may have connectivity to the S. I. Survey Area. In addition, more distant SPAs which have the potential to be functionally linked (see Section 3.1.4), may be connected to the S. I. Survey area should they host seabirds with extremely large foraging ranges, such as Manx shearwater, Leach's storm petrel, European storm petrel, fulmar and gannet which have mean maximum foraging ranges between 315.2 and 1,346.8 km. However, no sites over 230 km from the S. I. Survey area have been considered in this report as it is not anticipated that birds from these colonies will reach the S. I. Survey Area in sufficient numbers to warrant inclusion within the assessment. These locations, over 230 km from the S. I. Survey Area, also have no straight-line route to the site without crossing over land and as seabirds generally avoid overland flights this means that foraging distances that would need to be travelled to fly to the S. I. Survey Areas are in effect, much greater than they would be if measured in a straight line.

The European and Ramsar Sites that fall within the scoping criteria described above are listed below. A total of 33 sites were identified, including 8 SACs, 18 SPAs and 7 Ramsar sites. These protected sites are designated for a variety of habitats and / or bird, fish and marine mammal species as listed in Table 3 The majority of sites are within UK waters however, two SACs in Irish waters also met the screening criteria for marine mammals: Rocakabill to Dalkey Island SAC and Lambay SAC. These sites have been included in this assessment for completeness, however, they will also be assessed as part of the licensing process for the survey in Irish waters.

SACs

- North Anglesey Marine / Gogledd Mon Forol (UK0030398)
- Llyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau (UK0013117)
- West Wales Marine / Gorllewin Cymru Sarnau (UK0030397)
- Cardigan Bay/ Bae Ceredigion (UK0012712)
- Pembrokeshire marine / Sir Benfro Forol (UK0013116)
- Rockabill to Dalkey Island (IE003000)
- Lambay Island (IE000204)

SPAs

- Anglesey Terns / Morwenoliaid Ynys Mon (UK9020321)
- Liverpool Bay / Bae Lerpwl (UK9020294)
- Puffin Island / Ynys Seiriol (UK9020285)
- Lavan Sands, Conway Bay / Traeth Lafan (UK9013031)
- Northern Cardigan Bay / Gogledd Bae Ceredigion (UK90203227)
- Dee Estuary (UK9013011)
- Carlingford Lough (UK9020161)
- Mersey Narrows and North Wirral Foreshore (UK9020287)
- Ribble and Alt Estuaries (UK9005103)
- Mersey Estuary (UK9005131)
- Outer Ards (UK9020271)
- Morecambe Bay and Duddon Estuary (UK9020326)
- Strangford Lough (UK9020111)
- Belfast Lough Open Water (UK9020290)
- Solway Firth (UK9005012)
- Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro (UK9014051)
- Irish Sea front (UK9020328)
- Larne Lough (UK9020042)

Ramsar

- The Dee estuary Ramsar (Site no. 298)
- Duddon Estuary Ramsar (Site no. 938)
- Mersey Estuary Ramsar (Site no. 785)
- Mersey Narrows and North Wirral Foreshore Ramsar (Site no. 2202)
- Morecambe Bay Ramsar (Site no. 863)
- Ribble and Alt Estuaries Ramsar (Site no. 325)
- Upper Solway Flats and Marshes Ramsar (Site no. 341)

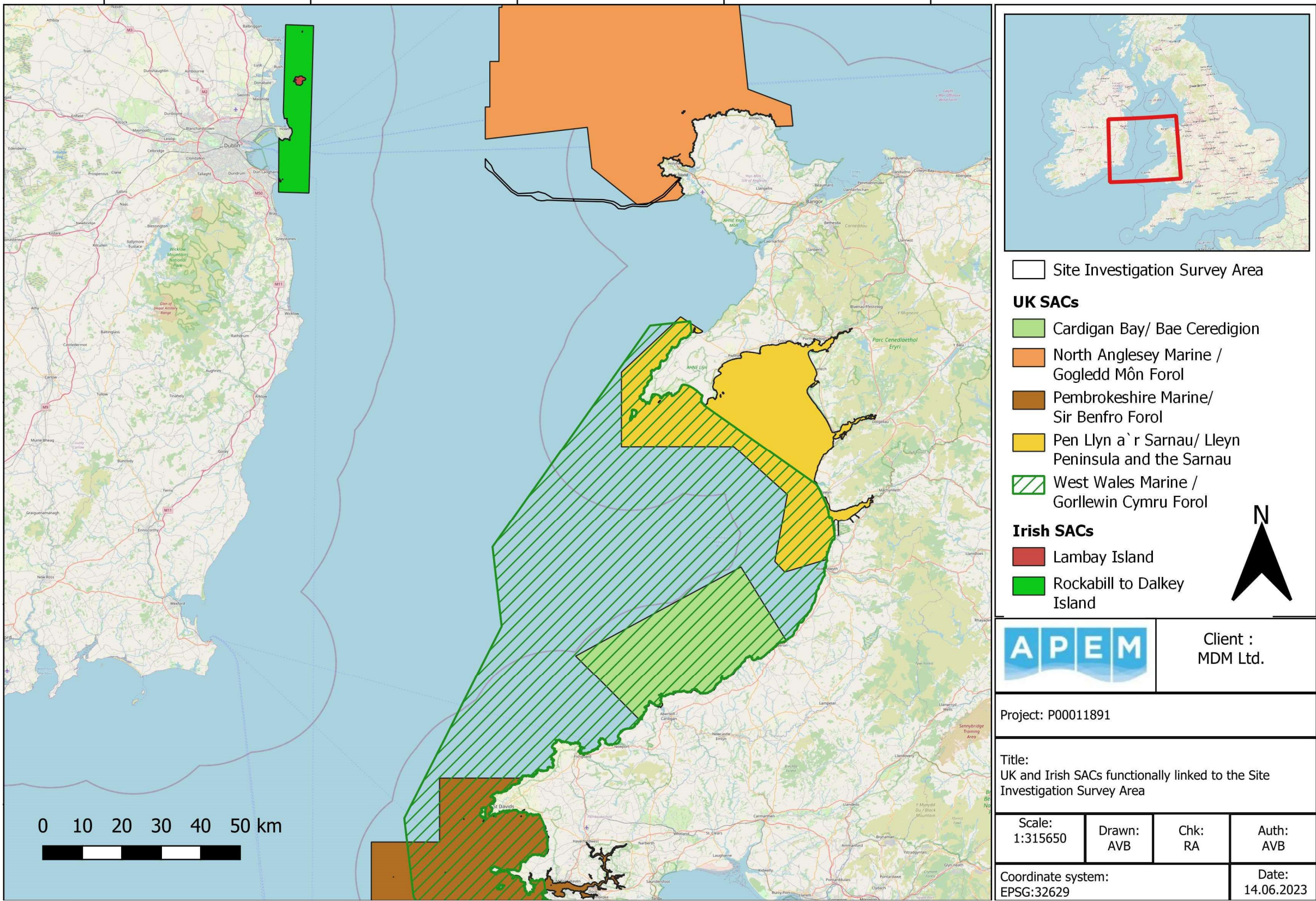


Figure 2. SACs scoped into the assessment based on NRW guidance and/or are within the ZOI (relevant to qualifying features) of the Site Investigation Survey Area.

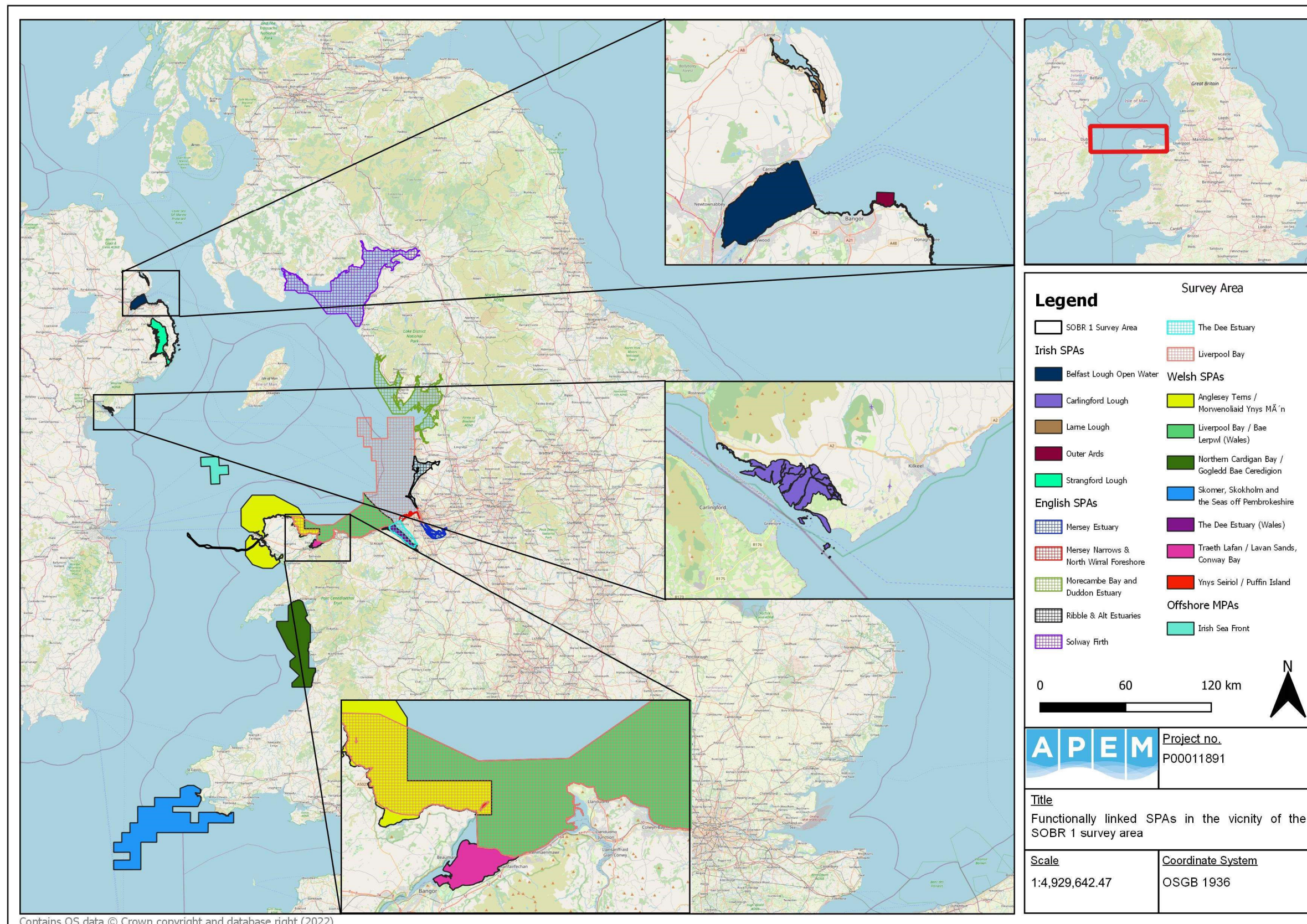


Figure 3. SPAs scoped into the assessment based on NRW guidance and/or are within the ZOI (relevant to qualifying features) of the Site Investigation Survey Area.

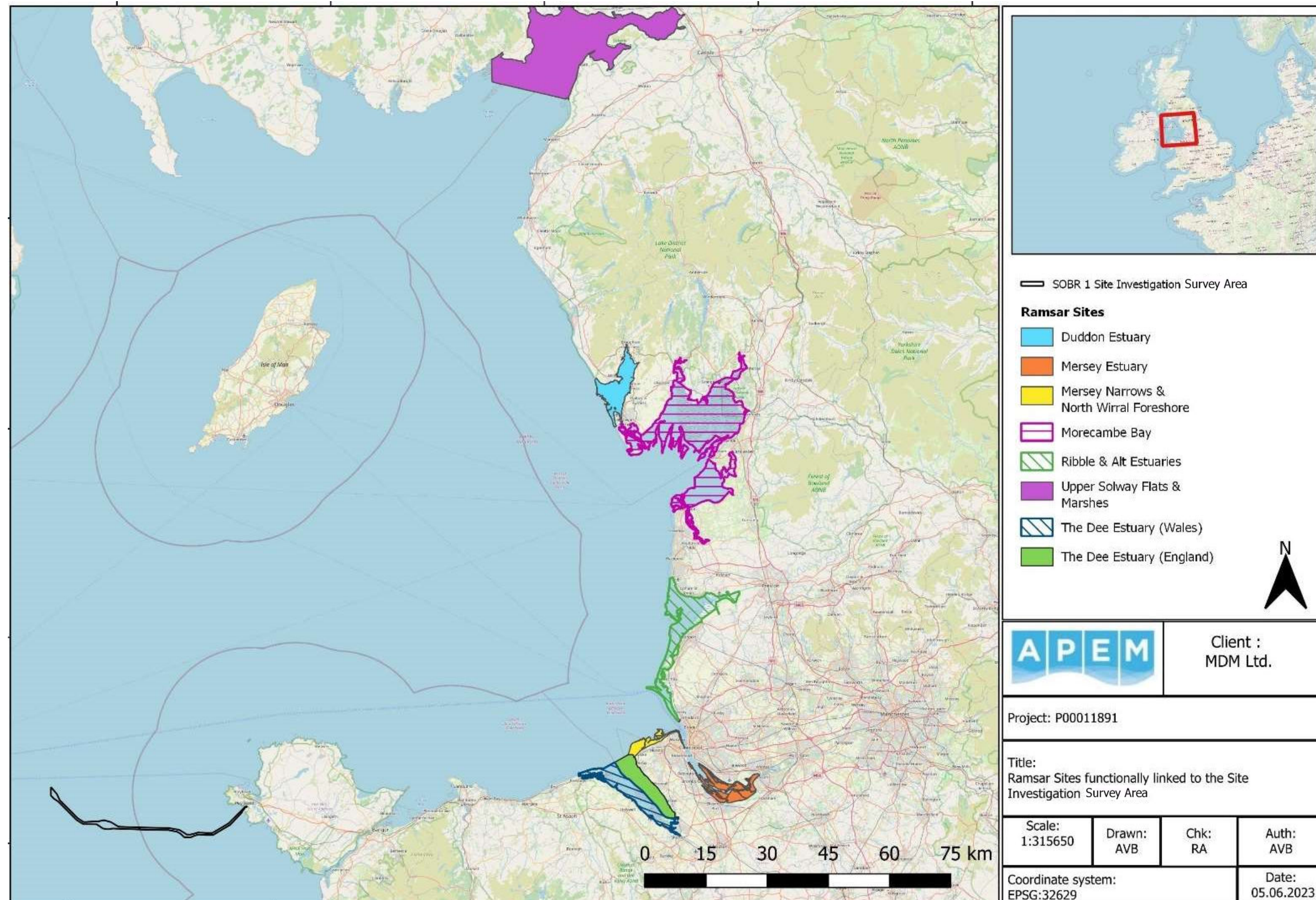


Figure 4. Ramsar Sites scoped into the assessment based on NRW guidance and/or are within the ZOI (relevant to qualifying features) of the Site Investigation Survey Area.

4.3 European and Ramsar Site features of interest

Qualifying features of the European and Ramsar Sites that fall within the scoping criteria and the distance of these sites from the S. I. Survey Area are indicated in Table 3.

Table 3. European and Ramsar Sites scoped into the assessment based on NRW guidance and/or are within the ZoI (relevant to qualifying features) of the S. I. Survey Area. *= Priority, numbers in brackets are site codes

Site	Distance from S. I. Survey Area (km)	Qualifying Features (Features screened in for assessment are in bold)
SACs		
North Anglesey Marine / Gogledd Mon Forol SAC (UK0030398)	0	[1351] Harbour Porpoise (<i>Phocoena phocoena</i>)
Lleyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC (UK0013117)	28.8	[1349] Bottlenose dolphin (<i>Tursiops truncatus</i>) [1355] Otter (<i>Lutra lutra</i>) [1364] Grey seal (<i>Halichoerus grypus</i>) [1110] Sandbanks which are slightly covered by sea water all the time [1130] Estuaries [1150] Coastal lagoons * [1160] Large shallow inlets and bays [1170] Reefs [1140] Mudflats and sandflats not covered by seawater at low tide [1310] Salicornia and other annuals colonizing mud and sand [1330] Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>) [8330] Submerged or partially submerged sea caves
West Wales Marine / Gorllewin Cymru Sarnau SAC (UK0030397)	29.7	[1351] Harbour Porpoise (<i>Phocoena phocoena</i>)
Cardigan Bay / Bae Ceredigion SAC (UK0012712)	91.8	[1349] Bottlenose dolphin (<i>Tursiops truncatus</i>) [1364] Grey seal (<i>Halichoerus grypus</i>) [1110] Sandbanks which are slightly covered by sea water all the time [1170] Reefs [8330] Submerged or partially submerged sea caves [1095] Sea lamprey (<i>Petromyzon marinus</i>) [1099] River lamprey (<i>Lampetra fluviatilis</i>)
Pembrokeshire marine / Sir Benfro Forol SAC (UK0013116)	143.8	[1364] Grey seal (<i>Halichoerus grypus</i>)

		[1441] Shore dock (<i>Rumex rupestris</i>) [1130] Estuaries [1160] Large shallow inlets and bays [1170] Reefs 1110 Sandbanks which are slightly covered by sea water all the time [1140] Mudflats and sandflats not covered by seawater at low tide [1150] Coastal lagoons* [1330] Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>) [8330] Submerged or partially submerged sea caves [1095] Sea lamprey (<i>Petromyzon marinus</i>) [1099] River lamprey (<i>Lampetra fluviatilis</i>) [1102] Allis shad (<i>Alosa alosa</i>) [1103] Twaite shad (<i>Alosa fallax</i>) [1355] Otter (<i>Lutra lutra</i>)
Rockabill to Dalkey Island SAC (IE003000)	43	[1351] Harbour Porpoise (<i>Phocoena phocoena</i>) [1170] Reefs
Lambay Island SAC (IE000204)	48.3	[1364] Grey Seal (<i>Halichoerus grypus</i>) [1365] Common (Harbour) Seal (<i>Phoca vitulina</i>) [1170] Reefs [1230] Vegetated Sea Cliffs
SPAs		
Anglesey Terns / Morwenoliaid Ynys Mon (UK9020321)	0	[A193] Common tern (<i>Sterna hirundo</i>) [A192] Roseate tern (<i>Sterna dougalli</i>) [A191] Sandwich tern (<i>Sterna sandvicensis</i>) [A194] Arctic tern (<i>Sterna paradisaea</i>)
Liverpool Bay / Bae Lerpwl (UK9020294)	31.4	[A001] Red-throated diver (<i>Gavia stellata</i>) [A177] Little gull (<i>Larus minutus</i>) [A065] Common scoter (<i>Melanitta nigra</i>) [A195] Little tern (<i>Sterna albifrons</i>)

		[A193] Common tern (<i>Sterna hirundo</i>) [A999] Waterbird assemblage
Lavan Sands, Conway Bay / Traeth Lafan (UK9013031)	34.9	[A130] Eurasian oystercatcher (<i>Haematopus ostralegus</i>) [A069] Red-breasted Merganser (<i>Mergus serrator</i>) [A160] Eurasian curlew (<i>Numenius arquata</i>) [A005] Great-crested grebe (<i>Podiceps cristanus</i>) [A162] Common redshank (<i>Tringa totanus</i>)
Irish Sea Front (UK9029328)	35.5	[A013] Manx shearwater (<i>Puffinus puffinus</i>)
Northern Cardigan Bay / Gogledd Bae Ceredigion (UK90203227)	45.6	[A001] Red-throated diver (<i>Gavia stellata</i>)
Dee Estuary (UK9013011)	13.3	[A054] Northern pintail (<i>Anas acuta</i>) [A052] Eurasian teal (<i>Anas crecca</i>) [A672] Dunlin (<i>Calidris alpina alpina</i>) [A143] Red knot (<i>Calidris canutus</i>) [A130] Eurasian oystercatcher (<i>Haematopus ostralegus</i>) [A157] Bar-tailed godwit (<i>Limosa lapponica</i>) [A616] Black-tailed godwit (<i>Limosa limosa islandica</i>) [A160] Eurasian curlew (<i>Numenius arquata</i>) [A141] Grey plover (<i>Pluvialis squatarola</i>) [A195] Little tern (<i>Sterna albifrons</i>) [A193] Common tern (<i>Sterna hirundo</i>) [A191] Sandwich tern (<i>Sterna sandvicensis</i>) [A048] Common shelduck (<i>Tadorna tadorna</i>) [A162] Common redshank (<i>Tringa tetanus</i>) [A999] Waterbird assemblages
Carlingford Lough (UK9020161)	93.2	[A193] Common Tern (<i>Sterna hirundo</i>) [A046] Light-bellied Brent Goose (<i>Branta bernicla</i>) [A191] Sandwich tern (<i>Thalasseus sandvicensis</i>)
Mersey Narrows and North Wirral Foreshore (UK9020287)	94.3	[A144] Sanderling (<i>Calidris alba</i>) [A672] Sanderling (<i>Calidris alpina alpina</i>) subspecies

		[A671] Sanderling (<i>Calidris canutus islandica</i>) subspecies [A130] Oystercatcher (<i>Haematopus ostralegus</i>) [A177] Little Gull (<i>Larus minutus</i>) [A157] Bar-tailed Godwit (<i>Limosa lapponica</i>) [A017] Cormorant (<i>Phalacrocorax carbo</i>) [A141] Grey Plover (<i>Pluvialis squatarola</i>) [A193] Common Tern (<i>Sterna hirundo</i>) [A162] Redshank (<i>Tringa totanus</i>)
Ribble and Alt Estuaries (UK9005103)	104.9	[A054] Northern pintail (<i>Anas acuta</i>) [A052] Eurasian teal (<i>Anas crecca</i>) [A050] Eurasian wigeon (<i>Anas penelope</i>) [A040] Pink-footed goose (<i>Anser brachyrhynchus</i>) [A062] Greater scaup (<i>Aythya marila</i>) [A144] Sanderling (<i>Calidris alba</i>) [A672] Dunlin (<i>Calidris alpina alpina</i>) [A143] Red knot (<i>Calidris canutus</i>) [A137] Ringed plover (<i>Charadrius hiaticula</i>) [A037] Tundra swan (<i>Cygnus columbianus bewickii</i>) [A038] Whooper swan (<i>Cygnus cygnus</i>) [A130] Eurasian oystercatcher (<i>Haematopus ostralegus</i>) [A183] Lesser black-backed gull (<i>Larus fuscus</i>) [A179] Black-headed gull (<i>Larus ridibundus</i>) [A157] Bar-tailed godwit (<i>Limosa lapponica</i>) [A616] Black-tailed godwit (<i>Limosa limosa islandica</i>) [A065] Common scoter (<i>Melanitta nigra</i>) [A160] Eurasian curlew (<i>Numenius arquata</i>) [A158] Whimbrel (<i>Numenius phaeopus</i>) [A017] Great cormorant (<i>Phalacrocorax carbo</i>)

		[A151] Ruff (<i>Philomachus pugnax</i>) [A140] European golden plover (<i>Pluvialis apricaria</i>) [A141] Grey plover (<i>Pluvialis squatarola</i>) [A193] Common tern (<i>Sterna hirundo</i>) [A048] Common shelduck (<i>Tadorna tadorna</i>) [A162] Common redshank (<i>Tringa totanus</i>) [A142] Northern lapwing (<i>Vanellus vanellus</i>)
Mersey Estuary (UK9005131)	111.5	[A149] Dunlin (<i>Calidris alpina</i>) [A157] Bar-tailed Godwit (<i>Limosa lapponica</i>) [A162] Common redshank (<i>Tringa totanus</i>) [A140] European golden Plover (<i>Pluvialis apricaria</i>) [A054] Northern pintail (<i>Anas acuta</i>) [A048] Common shelduck (<i>Tadorna tadorna</i>) [A052] Eurasian teal (<i>Anas crecca</i>) [A999] Wetland and waterbirds
Outer Ards (UK9020271)	114	[A194] Arctic Tern (<i>Sterna paradisaea</i>) [A140] European golden plover (<i>Pluvialis apricaria</i>) [A169] Ruddy turnstone (<i>Arenaria interpres</i>) [A046] Light-bellied Brent Goose (<i>Branta bernicla</i>) [A137] Common ringed Plover (<i>Charadrius hiaticula</i>)
Morecambe Bay and Duddon Estuary (UK9020326)	127.8	[A054] Northern pintail (<i>Anas acuta</i>) [A040] Pink-footed goose (<i>Anser brachyrhynchus</i>) [A169] Turnstone (<i>Arenaria interpres</i>) [A144] Sanderling (<i>Calidris alba</i>) [A672] Dunlin (<i>Calidris alpina alpina</i>) [A143] Red knot (<i>Calidris canutus</i>) [A130] Eurasian oystercatcher (<i>Haematopus ostralegus</i>) [A137] Ringed plover (<i>Charadrius hiaticula</i>) [A038] Whooper swan (<i>Cygnus cygnus</i>)

		[A026] Little egret (<i>Egretta garzetta</i>) [A183] Lesser black-backed gull (<i>Larus fuscus</i>) [A184] Herring gull (<i>Larus argentatus</i>) [A176] Mediterranean gull (<i>Larus melanocephalus</i>) [A157] Bar-tailed godwit (<i>Limosa lapponica</i>) [A616] Black-tailed godwit (<i>Limosa limosa islandica</i>) [A160] Eurasian curlew (<i>Numenius arquata</i>) [A151] Ruff (<i>Philomachus pugnax</i>) [A140] European golden plover (<i>Pluvialis apricaria</i>) [A141] Grey plover (<i>Pluvialis squatarola</i>) [A195] Little tern (<i>Sterna albifrons</i>) [A193] Common tern (<i>Sterna hirundo</i>) [A191] Sandwich tern (<i>Sterna sandvicensis</i>) [A048] Common shelduck (<i>Tadorna tadorna</i>) [A162] Common redshank (<i>Tringa tetanus</i>)
Strangford Lough (UK9020111)	130.5	[A193] Common tern (<i>Sterna hirundo</i>) [A191] Sandwich tern (<i>Sterna sandvicensis</i>) [A194] Arctic tern (<i>Sterna paradisaea</i>) [A140] European golden plover (<i>Pluvialis apricaria</i>) [A157] Bar-tailed godwit (<i>Limosa lapponica</i>) [A046] Light-bellied Brent Goose (<i>Branta bernicla</i>) [A143] Red knot (<i>Calidris canutus</i>) [A162] Common redshank (<i>Tringa tetanus</i>) [A005] Great Crested Grebe (<i>Podiceps cristatus</i>) [A017] Great cormorant (<i>Phalacrocorax carbo</i>) [A043] Greylag goose (<i>Anser anser</i>) [A052] Eurasian teal (<i>Anas crecca</i>) [A050] Eurasian wigeon (<i>Anas penelope</i>) [A051] Gadwall (<i>Anas strepera</i>)

		[A053] Mallard (<i>Anas platyrhynchos</i>) [A054] Northern pintail (<i>Anas acuta</i>) [A056] Northern shoveler (<i>Anas clypeata</i>) [A067] Common goldeneye (<i>Bucephala clangula</i>) [A130] Eurasian oystercatcher (<i>Haematopus ostralegus</i>) [A069] Red-breasted Merganser (<i>Mergus serrator</i>) [A125] Eurasian coot (<i>Fulica atra</i>) [A141] Grey plover (<i>Pluvialis squatarola</i>) [A142] Northern lapwing (<i>Vanellus vanellus</i>) [A137] Common ringed Plover (<i>Charadrius hiaticula</i>) [A149] Dunlin (<i>Calidris alpina</i>) [A160] Eurasian curlew (<i>Numenius arquata</i>) [A169] Ruddy turnstone (<i>Arenaria interpres</i>) [A999] Wetland and waterbirds
Belfast Lough Open Water (UK9020290)	151.8	[A005] Great Crested Grebe (<i>Podiceps cristatus</i>)
Solway Firth (UK9005012)	156.2	[A054] Northern pintail (<i>Anas acuta</i>) [A056] Ana clypeata (<i>Anas clypeata</i>) [A040] Pink-footed goose (<i>Anser brachyrhynchus</i>) [A169] Turnstone (<i>Arenaria interpres</i>) [A144] Sanderling (<i>Calidris alba</i>) [A672] Dunlin (<i>Calidris alpina alpina</i>) [A143] Red knot (<i>Calidris canutus</i>) [A130] Eurasian oystercatcher (<i>Haematopus ostralegus</i>) [A137] Ringed plover (<i>Charadrius hiaticula</i>) [A038] Whooper swan (<i>Cygnus cygnus</i>) [A026] Little egret (<i>Egretta garzetta</i>) [A183] Lesser black-backed gull (<i>Larus fuscus</i>) [A184] Herring gull (<i>Larus argentatus</i>) [A176] Mediterranean gull (<i>Larus melanocephalus</i>)

		[A157] Bar-tailed godwit (<i>Limosa lapponica</i>) [A616] Black-tailed godwit (<i>Limosa limosa islandica</i>) [A160] Eurasian curlew (<i>Numenius arquata</i>) [A151] Ruff (<i>Philomachus pugnax</i>) [A140] European golden plover (<i>Pluvialis apricaria</i>) [A141] Grey plover (<i>Pluvialis squatarola</i>) [A195] Little tern (<i>Sterna albifrons</i>) [A193] Common tern (<i>Sterna hirundo</i>) [A191] Sandwich tern (<i>Sterna sandvicensis</i>) [A048] Common shelduck (<i>Tadorna tadorna</i>) [A162] Common redshank (<i>Tringa tetanus</i>)
Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro (UK9014051)	161.1	[A222] Short-eared owl (<i>Asio flammeus</i>) [A204] Atlantic puffin (<i>Fregata arctica</i>) [A014] European storm petrel (<i>Hydrobates pelagicus</i>) [A183] Lesser black-backed gull (<i>Larus fuscus</i>) [A013] Manx shearwater (<i>Puffinus puffinus</i>) [A346] Red-billed chough (<i>Pyrrhocorax pyrrhocorax</i>)
Larne Lough (UK9020042)	163.3	[A192] Roseate Tern (<i>Sterna dougallii</i>) [A193] Common Tern (<i>Sterna hirundo</i>) [A046] Light-bellied Brent Goose (<i>Branta bernicla</i>) [A191] Sandwich tern (<i>Thalasseus sandvicensis</i>) [A176] Mediterranean gull (<i>Larus melanocephalus</i>)
Ramsar		
The Dee estuary Ramsar (Site no. 298)	81.8	[A054] Northern pintail (<i>Anas acuta</i>) [A052] Eurasian teal (<i>Anas crecca</i>) [A672] Dunlin (<i>Calidris alpina alpina</i>) [A143] Red knot (<i>Calidris canutus</i>) [A130] Eurasian oystercatcher (<i>Haematopus ostralegus</i>) [A157] Bar-tailed godwit (<i>Limosa lapponica</i>)

		[A616] Black-tailed godwit (<i>Limosa limosa islandica</i>) [A160] Eurasian curlew (<i>Numenius arquata</i>) [A141] Grey plover (<i>Pluvialis squatarola</i>) [A195] Little tern (<i>Sterna albifrons</i>) [A193] Common tern (<i>Sterna hirundo</i>) [A191] Sandwich tern (<i>Sterna sandvicensis</i>) [A048] Common shelduck (<i>Tadorna tadorna</i>) [A162] Common redshank (<i>Tringa tetanus</i>) [1140] Mudflats and sandflats not covered by sweater at low tide [1310] Salicornia and other annuals colonizing mud and sand [1330] Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>)
Duddon Estuary Ramsar (Site no. 938)	127.8	[A054] Northern pintail (<i>Anas acuta</i>) [A162] Common redshank (<i>Tringa tetanus</i>) [A143] Red knot (<i>Calidris canutus</i>)
Mersey Estuary Ramsar (Site no. 785)	111.5	[A144] Sanderling (<i>Calidris alba</i>) [A672] Sanderling (<i>Calidris alpina alpina</i>) subspecies [A671] Sanderling (<i>Calidris canutus islandica</i>) subspecies [A130] Oystercatcher (<i>Haematopus ostralegus</i>) [A177] Little Gull (<i>Larus minutus</i>) [A157] Bar-tailed Godwit (<i>Limosa lapponica</i>) [A017] Cormorant (<i>Phalacrocorax carbo</i>) [A141] Grey Plover (<i>Pluvialis squatarola</i>) [A193] Common Tern (<i>Sterna hirundo</i>) [A162] Redshank (<i>Tringa totanus</i>)
Mersey Narrows and North Wirral Foreshore Ramsar (Site no. 2202)	94.3	[A157] Bar-tailed godwit (<i>Limosa lapponica</i>) [A193] Common tern (<i>Sterna hirundo</i>) [A143] Red knot (<i>Calidris canutus</i>) [A177] Little gull (<i>Hydrocoloeus minutus</i>) [A017] Great cormorant (<i>Phalacrocorax carbo</i>)

		[A130] Eurasian oystercatcher (<i>Haematopus ostralegus</i>) [A141] Grey Plover (<i>Pluvialis squatarola</i>) [A144] Sanderling (<i>Calidris alba</i>) [A149] Dunlin (<i>Calidris alpina</i>) [A162] Common redshank (<i>Tringa totanus</i>)
Morecambe Bay Ramsar (Site no. 863)	127.8	[A184] European herring gull (<i>Larus argentatus</i>) [A183] Lesser black-backed gull (<i>Larus fuscus</i>) [A191] Sandwich tern (<i>Thalasseus sandvicensis</i>) [A017] Great cormorant (<i>Phalacrocorax carbo</i>) [A054] Northern pintail (<i>Anas acuta</i>) [A048] Common shelduck (<i>Tadorna tadorna</i>) [A130] Eurasian oystercatcher (<i>Haematopus ostralegus</i>) [A141] Grey Plover (<i>Pluvialis squatarola</i>) [A137] Common ringed Plover (<i>Charadrius hiaticula</i>) [A144] Sanderling (<i>Calidris alba</i>) [A162] Common redshank (<i>Tringa totanus</i>) [A160] Eurasian curlew (<i>Numenius arquata</i>) [A005] Great Crested Grebe (<i>Podiceps cristatus</i>) [A040] Pink-footed goose (<i>Anser brachyrhynchus</i>) [A050] Eurasian wigeon (<i>Anas Penelope</i>) [A067] Common goldeneye (<i>Bucephala clangula</i>) [A069] Red-breasted merganser (<i>Mergus serrator</i>) [A140] European golden plover (<i>Pluvialis apricaria</i>) [A142] Northern lapwing (<i>Vanellus vanellus</i>) [A143] Red knot (<i>Calidris canutus</i>) [A149] Dunlin (<i>Calidris alpina</i>) [A157] Bar-tailed godwit (<i>Limosa lapponica</i>)
Ribble and Alt Estuaries Ramsar (Site no. 325)	104.9	[A054] Northern pintail (<i>Anas acuta</i>) [A052] Eurasian teal (<i>Anas crecca</i>)

		[A050] Eurasian wigeon (<i>Anas penelope</i>) [A040] Pink-footed goose (<i>Anser brachyrhynchus</i>) [A062] Greater scaup (<i>Aythya marila</i>) [A144] Sanderling (<i>Calidris alba</i>) [A672] Dunlin (<i>Calidris alpina alpina</i>) [A143] Red knot (<i>Calidris canutus</i>) [A137] Ringed plover (<i>Charadrius hiaticula</i>) [A037] Tundra swan (<i>Cygnus columbianus bewickii</i>) [A038] Whooper swan (<i>Cygnus cygnus</i>) [A130] Eurasian oystercatcher (<i>Haematopus ostralegus</i>) [A183] Lesser black-backed gull (<i>Larus fuscus</i>) [A179] Black-headed gull (<i>Larus ridibundus</i>) [A157] Bar-tailed godwit (<i>Limosa lapponica</i>) [A616] Black-tailed godwit (<i>Limosa limosa islandica</i>) [A065] Common scoter (<i>Melanitta nigra</i>) [A160] Eurasian curlew (<i>Numenius arquata</i>) [A158] Whimbrel (<i>Numenius phaeopus</i>) [A017] Great cormorant (<i>Phalacrocorax carbo</i>) [A151] Ruff (<i>Philomachus pugnax</i>) [A140] European golden plover (<i>Pluvialis apricaria</i>) [A141] Grey plover (<i>Pluvialis squatarola</i>) [A193] Common tern (<i>Sterna hirundo</i>) [A048] Common shelduck (<i>Tadorna tadorna</i>) [A162] Common redshank (<i>Tringa totanus</i>) [A142] Northern lapwing (<i>Vanellus vanellus</i>)
Upper Solway Flats and Marshes Ramsar (Site no. 341)	184.5	[A130] Eurasian oystercatcher (<i>Haematopus ostralegus</i>) [A038] Whooper swan (<i>Cygnus cygnus</i>) [A040] Pink-footed goose (<i>Anser brachyrhynchus</i>) [A045] Barnacle goose (<i>Branta leucopsis</i>)

		[A054] Northern pintail (<i>Anas acuta</i>) [A062] Greater scaup (<i>Aythya marila</i>) [A157] Bar-tailed godwit (<i>Limosa lapponica</i>) [A162] Common redshank (<i>Tringa totanus</i>) [A143] Red knot (<i>Calidris canutus</i>) [A160] Eurasian curlew (<i>Numenius arquata</i>) [A149] Dunlin (<i>Calidris alpina</i>) [A137] Common ringed Plover (<i>Charadrius hiaticula</i>) [A184] European herring gull (<i>Larus argentatus</i>) [A183] Lesser black-backed gull (<i>Larus fuscus</i>)
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5. Potential effects of the proposed works

5.1 The Assessment Process

The process of testing for significant effects considers the adverse effects that might arise from the work activities and identifies whether or not there is a probability that each adverse effect can affect each European Site and their qualifying features.

The process that is followed is to identify if the works will generate effects that could affect any of the interest features of the relevant European Sites. At this point, the pathway will be identified and what may reduce or prevent the effects reaching the relevant European Sites. Only when there is a source, a pathway and an effect that reaches the interest feature is it judged that there is an LSE that requires the more detailed assessment that is carried out at the Appropriate Assessment stage.

Potential adverse effects of the work activities on European Sites have been identified using a combination of:

- Conservation Advice provided by Natural Resources Wales in fulfilment of Regulation 37 of the Conservation of Habitats and Species Regulation 2017 (2018)³;
- Natural England's Advice on Operations (AoO); and
- Professional judgement based on experience of conducting numerous assessments of similar work activities in the vicinity of European and Ramsar Sites.

In Section 6, a table is provided for the Screening Stage of the HRA which details the test for LSE and the following information:

- The pressures being considered (derived from the above sources of conservation advice and professional judgement);
- The features being assessed;
- Whether alone, or in-combination, there is an LSE for each pressure / feature combination; and

³ Accessed via <https://naturalresources.wales/guidance-and-advice/environmental-topics/wildlife-and-biodiversity/protected-areas-of-land-and-seas/conservation-advice-for-european-marine-sites/?lang=en>

- Justification for the assessment.

Pressures indicated as being of medium-high risk which could be associated with the work activities and that could affect European Site features were considered in this screening, in line with the AoO guidance. These pressures were as follows:

- Above water noise;
- Visual disturbance;
- Underwater noise changes and vibration;
- Collision below water and static or moving objects not naturally found in the marine environment;
- Pollution from vessels and equipment (Hydrocarbon & Polycyclic Aromatic Hydrocarbon (PAH) contamination); and
- Reduction in prey availability (all aspects of survey generating underwater noise and vibration).

The following medium-high risk pressures that were not anticipated to be associated with the proposed works and / or did not have the potential to affect designated site features were not included in the screening, in line with the AoO guidance:

- Abrasion / disturbance of the substrate on the surface of the seabed;
- Penetration and /or disturbance of the substratum below the surface of the seabed, including abrasion;
- Smothering and siltation rate changes (light);
- Introduction or spread of invasive non-native species (INNS).
- Barrier to species movement;
- Habitat structure changes – removal of substratum (extraction);
- Physical change (to another seabed type);
- Physical change (to another sediment type);
- Physical loss (to land or freshwater habitat);
- Smothering and siltation rate changes (heavy);

The following low risk pressures were also not included in the screening, in line with the AoO guidance:

- Deoxygenation;
- Genetic modification & translocation of indigenous species;
- Introduction of light;
- Introduction of microbial pathogens;

- Introduction of other substances (solid, liquid or gas);
- Litter;
- Nutrient enrichment;
- Organic enrichment;
- Radionuclide contamination;
- Salinity decrease;
- Salinity increase;
- Synthetic compound contamination (inc. pesticides, antifoulants, pharmaceuticals);
- Temperature decrease;
- Temperature increase;
- Transition elements & organo-metal contamination;
- Water flow (tidal current) changes, including sediment transport considerations; and
- Wave exposure changes.

6. Screening: Testing for LSE

The table below details the test for LSE for the qualifying features within the European Sites taken forward for assessment (Table 4).

Table 4. HRA screening for European and Ramsar Sites within the vicinity of the Project.

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
SACs					
North Anglesey Marine / Gogledd Mon Forol SAC (UK0030398)	[1351] Harbour Porpoise (<i>Phocoena phocoena</i>)	Underwater noise and vibration	Yes	Survey activities could disturb harbour porpoise due to underwater noise and vibration, therefore there is potential for LSE.	Screened In Harbour Porpoise
		Collision risk	No	The risk of and outcome (e.g. injury or mortality) of collision between marine mammals and vessels is directly influenced by the type of vessel and the speed at which it is travelling (Laist <i>et al.</i> 2001). Studies from the UK suggest that incidents of mortality or injury of harbour porpoise caused by vessels remain a very rare occurrence, although numerous instances are expected to remain unreported (Thompson <i>et al.</i> 2013; Deaville <i>et al.</i> 2018). Of 537 post-mortem examinations on stranded harbour porpoises in the UK between 2011 and 2017, 10 deaths (1.9%) were attributed to probable effect of a vessel collision (Deaville <i>et al.</i> 2018). A further 33 harbour porpoises died from physical trauma of unknown origin, which may be the result of vessel strike but could also be undiagnosed bycatch or caused by bottlenose dolphin attacks (Deaville <i>et al.</i> 2018). Given the slow speeds and predictable movement of the vessels on survey, the risk of collision is considered negligible and as such, there is no LSE from this impact pathway.	

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
		Pollution	No	Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	
		Reduction in prey availability (all aspects of survey generating underwater noise and vibration)	No	Prey species of harbour porpoise may be affected by the survey activities due to disturbance; however, the number of individuals will be small in relation to the availability of prey in the wider area. The activity is relatively short in nature, meaning any displacement of prey is likely to be short term. Harbour porpoise are a highly mobile species and could move to other nearby prey patches, therefore, any potential impact on prey species is likely to have negligible to no effect and there would be no LSE.	
Pen Llyn a'r Sarnau/ Llyn Peninsula and	[1349] Bottlenose dolphin (<i>Tursiops truncatus</i>)	Underwater noise and vibration	Yes	Survey activities could disturb bottlenose dolphins and grey seals due to underwater noise and vibration, therefore there is potential for LSE.	Screened In

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
the Sarnau SAC (UK0013117)	[1355] Otter (<i>Lutra lutra</i>) [1364] Grey seal (<i>Halichoerus grypus</i>)	Collision risk	No	The risk of and outcome (e.g. injury or mortality) of collision between marine mammals and vessels is directly influenced by the type of vessel and the speed at which it is travelling (Laist <i>et al.</i> 2001). A review of collisions between vessels and large marine megafauna did find reports of vessel collisions with grey seals (Schoeman <i>et al.</i> 2020). However, vessel collisions appear to be rare, although a lack of reporting and/or witnessing of such events should not be ruled out. Of 23 post-mortem examinations on stranded bottlenose dolphins in the UK between 2011 and 2017, no deaths were attributed to probable effect of a vessel collision, and one animal died from physical trauma of unknown origin (Deaville <i>et al.</i> 2018). Given the slow speeds and predictable movement of the vessels on survey, the risk of collision is considered negligible and as such, there is no LSE from this impact pathway. Otters can be found near the coastline where there is a freshwater source. They can use the marine environment to forage; however, foraging is usually close to shore, often within 100 m (Watson 1986). This means they are unlikely to be in the survey area. Otters can travel a number of kilometres, ca.5 km in coastal waters, however, this site is 28 km from the survey area. As such, they are unlikely to be in the survey area and it is considered that there will be no LSE to otters.	Bottlenose dolphin Grey seal

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
		Pollution	No	Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	
		Reduction in prey availability (all aspects of survey generating underwater noise and vibration)	No	Prey species of bottlenose dolphins and grey seals may be affected by the survey activities due to disturbance; however, the number of individuals will be small in relation to the availability of prey in the wider area. The activity is relatively short in nature, meaning any displacement of prey is likely to be short term. Bottlenose dolphins and grey seals are highly mobile and could move to other nearby prey patches, therefore, any potential impact on prey species is likely to have negligible to no effect and there will be no LSE.	
West Wales Marine / Gorllewin	[1351] Harbour Porpoise (<i>Phocoena phocoena</i>)	Underwater noise and vibration	Yes	Survey activities could disturb harbour porpoise due to underwater noise and vibration, therefore there is potential for LSE.	Screened In Harbour porpoise

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
Cymru Sarnau SAC (UK0030397)		Collision risk	No	The risk of and outcome (e.g. injury or mortality) of collision between marine mammals and vessels is directly influenced by the type of vessel and the speed at which it is travelling (Laist <i>et al.</i> 2001). Studies from the UK suggest that incidents of mortality or injury of harbour porpoise caused by vessels remain a very rare occurrence, although numerous instances are expected to remain unreported (Thompson <i>et al.</i> 2013; Deaville <i>et al.</i> 2018). Of 537 post-mortem examinations on stranded harbour porpoises in the UK between 2011 and 2017, 10 deaths (1.9%) were attributed to probable effect of a vessel collision (Deaville <i>et al.</i> 2018). A further 33 harbour porpoises died from physical trauma of unknown origin, which may be the result of vessel strike but could also be undiagnosed bycatch or caused by bottlenose dolphin attacks (Deaville <i>et al.</i> 2018). Given the slow speeds and predictable movement of the vessels on survey, the risk of collision is considered negligible and as such, there is no LSE from this impact pathway.	
		Pollution	No	Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered	

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	
		Reduction in prey availability (all aspects of survey generating underwater noise and vibration)	No	Prey species of bottlenose dolphins and grey seals may be affected by the survey activities due to disturbance; however, the number of individuals will be small in relation to the availability of prey in the wider area. The activity is relatively short in nature, meaning any displacement of prey is likely to be short term. Bottlenose dolphins and grey seals are highly mobile and could move to other nearby prey patches, therefore, any potential impact on prey species is likely to have negligible to no effect and there will be no LSE.	
Cardigan Bay/ Bae Ceridigion SAC (UK0012712)	[1349] Bottlenose dolphin (<i>Tursiops truncatus</i>) [1364] Grey seal (<i>Halichoerus grypus</i>)	Underwater noise and vibration	Yes	Survey activities could disturb bottlenose dolphins and grey seals due to underwater noise and vibration, therefore there is potential for LSE.	Screened In Bottlenose dolphin Grey seal

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
		Collision risk	No	The risk of and outcome (e.g. injury or mortality) of collision between marine mammals and vessels is directly influenced by the type of vessel and the speed at which it is travelling (Laist <i>et al.</i> 2001). A review of collisions between vessels and large marine megafauna did find reports of vessel collisions with grey seals (Schoeman <i>et al.</i> 2020). However, vessel collisions appear to be rare, although a lack of reporting and/or witnessing of such events should not be ruled out. Of 23 post-mortem examinations on stranded bottlenose dolphins in the UK between 2011 and 2017, no deaths were attributed to probable effect of a vessel collision, and one animal died from physical trauma of unknown origin (Deaville <i>et al.</i> 2018). Given the slow speeds and predictable movement of the vessels on survey, the risk of collision is considered negligible and as such, there is no LSE from this impact pathway.	
		Pollution	No	Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely	

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	
		Reduction in prey availability	No	Prey species of bottlenose dolphins and grey seals may be affected by the survey activities due to disturbance; however, the number of individuals will be small in relation to the availability of prey in the wider area. The activity is relatively short in nature, meaning any displacement of prey is likely to be short term. Bottlenose dolphins and grey seals are highly mobile and could move to other nearby prey patches, therefore, any potential impact on prey species is likely to have negligible to no effect and there will be no LSE.	
Pembrokeshire Marine/ Sir Benfro Forol SAC (UK0013116)	[1364] Grey seal (<i>Halichoerus grypus</i>)	Underwater noise and vibration	Yes	Survey activities could disturb grey seals due to underwater noise and vibration, therefore there is potential for LSE.	Screened In Grey seal
		Collision risk	No	The risk of and outcome (e.g. injury or mortality) of collision between marine mammals and vessels is directly influenced by the type of vessel and the speed at which it is travelling (Laist et al.	

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				2001). A review of collisions between vessels and large marine megafauna did find reports of vessel collisions with grey seals (Schoeman et al. 2020). However, vessel collisions appear to be rare, although a lack of reporting and/or witnessing of such events should not be ruled out. Given the slow speeds and predictable movement of the vessels on survey, the risk of collision is considered negligible and as such, there is no LSE from this impact pathway.	
		Pollution	No	Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	
		Reduction in prey availability (all aspects of survey generating	No	Prey species of grey seals may be affected by the survey activities due to disturbance; however, the number of individuals will be small in relation to the availability of prey in the wider area. The activity is relatively short in nature, meaning any displacement of prey is likely to be short term. Bottlenose dolphins and grey seals	

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
		underwater noise and vibration)		are highly mobile and could move to other nearby prey patches, therefore, any potential impact on prey species is likely to have negligible to no effect and there will be no LSE.	
Rockabill to Dalkey Island SAC (IE003000)	[1351] Harbour Porpoise (<i>Phocoena phocoena</i>)	Underwater noise and vibration	Yes	Survey activities could disturb harbour porpoise due to underwater noise and vibration, therefore there is potential for LSE.	Screened In Harbour Porpoise
		Collision risk	No	The risk of and outcome (e.g. injury or mortality) of collision between marine mammals and vessels is directly influenced by the type of vessel and the speed at which it is travelling (Laist <i>et al.</i> 2001). Studies from the UK suggest that incidents of mortality or injury of harbour porpoise caused by vessels remain a very rare occurrence, although numerous instances are expected to remain unreported (Thompson <i>et al.</i> 2013; Deaville <i>et al.</i> 2018). Of 537 post-mortem examinations on stranded harbour porpoises in the UK between 2011 and 2017, 10 deaths (1.9%) were attributed to probable effect of a vessel collision (Deaville <i>et al.</i> 2018). A further 33 harbour porpoises died from physical trauma of unknown origin, which may be the result of vessel strike but could also be undiagnosed bycatch or caused by bottlenose dolphin attacks (Deaville <i>et al.</i> 2018). Given the slow speeds and predictable movement of the vessels on survey, the risk of collision is considered negligible and as such, there is no LSE from this impact pathway.	

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
		Pollution	No	Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	
		Reduction in prey availability	No	Prey species of harbour porpoise may be affected by the survey activities due to disturbance; however, the number of individuals will be small in relation to the availability of prey in the wider area. The activity is relatively short in nature, meaning any displacement of prey is likely to be short term. Harbour porpoise are a highly mobile species and could move to other nearby prey patches, therefore, any potential impact on prey species is likely to have negligible to no effect and there would be no LSE.	
Lambay Island SAC (IE000204)	[1364] Grey seal (<i>Halichoerus grypus</i>) [1365] Harbour seal (<i>Phoca vitulina</i>)	Underwater noise and vibration	Yes	Survey activities could disturb grey and harbour seals due to underwater noise and vibration, therefore there is potential for LSE.	Screened In Grey seal Harbour seal
		Collision risk	No	The risk of and outcome (e.g. injury or mortality) of collision between marine mammals and vessels is directly influenced by the	

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				type of vessel and the speed at which it is travelling (Laist <i>et al.</i> 2001). A review of collisions between vessels and large marine megafauna did find reports of vessel collisions with grey seals (Schoeman <i>et al.</i> 2020). However, vessel collisions appear to be rare, although a lack of reporting and/or witnessing of such events should not be ruled out. Given the slow speeds and predictable movement of the vessels on survey, the risk of collision is considered negligible and as such, there is no LSE from this impact pathway.	
		Pollution	No	Pollution will be controlled by adhering to relevant MARPOL guidance for pollution prevention and marine pollution legislation for which compliance is required by law. All vessels will be MARPOL compliant. Published guidelines and best working practices will be followed to ensure that the likelihood of accidental spills is extremely low. This compliance is a basic requirement under UK law and should be adhered to even when no European Sites are involved and is therefore not considered mitigation for the purposes of HRA. Furthermore, in the event of a spill, the volumes of potential contaminants released would likely be small and would rapidly disperse, thus any effects would be anticipated to be negligible, and therefore will have no LSE.	
		Reduction in prey availability	No	Prey species of grey and harbour seals may be affected by the survey activities due to disturbance; however, the number of individuals will be small in relation to the availability of prey in the wider area. The activity is relatively short in nature, meaning any	

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				displacement of prey is likely to be short term. Grey and harbour seals are highly mobile and could move to other nearby prey patches, therefore, any potential impact on prey species is likely to have negligible to no effect and there will be no LSE.	
SPAs					
Liverpool Bay/Bae Lerpwl SPA (UK9020294)	[A001] Red-throated diver (<i>Gavia stellata</i>) [A177] Little gull (<i>Larus minutus</i>) [A195] Little tern (<i>Sterna albifrons</i>) [A193] Common tern (<i>Sterna hirundo</i>) [A999] Waterbird assemblages	Short term reduction in prey availability Visual and noise disturbance	No	Survey work carried out for the proposed Mona Offshore wind farm which is close to the S.I works area recorded few counts of these species, with red throated diver only observed in the northern section of the Liverpool Bay SPA from August onwards in low numbers. Tern species were observed through the breeding and post-breeding months in low numbers. Little gull was recorded predominantly to the north of the S.I works location with no recordings of Common scoter within the Mona OWF Survey area. Its therefore concluded that while the proposed S.I. works location is within the mean max foraging range +1 S.D for some of the species under protection at this site these species occur at relatively low densities. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) species which do avoid boats are unlikely to be excluded from	Screened Out

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				significant proportions of the habitat, minimising effects on behaviours and foraging opportunities. Terns show minimal responses to boat presence and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. It is therefore concluded that while the proposed S.I. works location is partially or fully within the mean max foraging range +1 S.D for tern species the proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects.	

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
Anglesey Terns / Morwenoliaid Ynys Môn SPA (UK9013061)	[A192] Roseate tern (<i>Sterna dougallii</i>) [A193] Common tern (<i>Sterna hirundo</i>) [A194] Arctic tern (<i>Sterna paradisaea</i>) [A191] Sandwich tern (<i>Sterna sandvicensis</i>)	Short term reduction in prey availability Visual and noise disturbance	No	Terns show minimal responses to boat presence and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. Its therefore concluded that while the proposed S.I. works location is partially or fully within the within the mean max foraging range +1 S.D for tern species the proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects.	Screened Out
Dee Estuary / Aber Dyfrdwy (UK9013011)	[A195] Little tern (<i>Sterna albifrons</i>) [A193] Common tern (<i>Sterna hirundo</i>) [A191] Sandwich tern (<i>Sterna sandvicensis</i>) [[A999] Waterbird assemblages	Short term reduction in prey availability Visual and noise disturbance	No	The majority of protected features are near shore/intertidal foraging species and therefore survey impacts are expected to be negligible. These species would only be potentially affected during the migratory period, please see section 6.1 below. Terns show minimal responses to boat presence and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. Its therefore concluded that while the proposed S.I. works location is partially or fully within the within the mean max foraging range	Screened Out

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				+1 S.D for tern species the proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects.	
Puffin Island / Ynys Seiriol SPA (UK9020285)	[A017] Cormorant (<i>Phalacrocorax carbo</i>)	Short term reduction in prey availability Visual and noise disturbance	No	The proposed S.I. works location is predominantly outside the mean max foraging range +1 S.D for cormorant. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I works area and d) the proposed work are unlikely to exclude the protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities.	Screened Out

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
Lavan Sands, Conway Bay / Traeth Lafan SPA (UK9013031)	[A130] Eurasian oystercatcher (<i>Haemotopus ostralegus</i>)	Short term reduction in prey availability Visual and noise disturbance	No	The proposed S.I. works location is mainly out with the mean max foraging range +1 S.D of the species under protection at this site. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I works area and d) the proposed work are unlikely to exclude the protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities. The majority of protected features are near shore/intertidal foraging species and therefore marine survey impacts are expected to be negligible, and walkover and slit trench surveys are not within this site. These species would only be potentially affected during the migratory period, please see section 6.1 below .	Screened Out
Mersey Narrows and North Wirral Foreshore SPA (UK9020287)	[A130] Oystercatcher (<i>Haematopus Ostralegus</i>) [A177] Little Gull (<i>Larus minutus</i>) (<i>Pluvialis squatarola</i>) [A193] Common Tern (<i>Sterna hirundo</i>)	Short term reduction in prey availability Visual and noise disturbance	No	The majority of protected features are near shore/intertidal foraging species and therefore survey impacts are expected to be negligible. These species would only be potentially affected during the migratory period, please see section 6.1 below Terns show minimal responses to boat presence and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any	Screened Out

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				significant effect. Its therefore concluded that while the proposed S.I. works location is partially or fully within the within the mean max foraging range +1 S.D for tern species the proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects.	
Ribble and Alt Estuaries SPA (UK9005103)	[A183] Lesser black-backed gull (<i>Larus fuscus</i>) [A179] Black-headed gull (<i>Larus fuscus</i>) [A193] Common tern (<i>Sterna hirundo</i>)	Short term reduction in prey availability Visual and noise disturbance	No	The majority of protected features are near shore/intertidal foraging and waterbird species and therefore survey impacts are expected to be negligible. These species would only be potentially affected during the migratory period, please see section 6.1 below. Terns show minimal responses to boat presence and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. Gull species are wide ranging and rarely dive. They show minimal disturbance response to boat presence and are often attracted to them due to local fishing activities and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. Its therefore concluded that while the proposed S.I. works location is partially or fully within the within the mean max foraging range	Screened Out

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				+1 S.D for species at this site as the proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects.	
Morecambe Bay and Duddon Estuary SPA (UK9020326)	[A183] Lesser black-backed gull (<i>Larus fuscus</i>) [A184] Herring gull (<i>Larus argentatus</i>) [A176] Mediterranean gull (<i>Larus melanocephalus</i>) [A195] Little tern (<i>Sterna albifrons</i>) [A193] Common tern (<i>Sterna hirundo</i>) [A191] Sandwich tern (<i>Sterna sandvicensis</i>)	Short term reduction in prey availability Visual and noise disturbance	No	The majority of protected features are near shore/intertidal foraging species and therefore survey impacts are expected to be negligible. These species would only be potentially affected during the migratory period, please see section 6.1 below. Terns show minimal responses to boat presence and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. Gull species are wide ranging and rarely dive. They show minimal disturbance response to boat presence and are often attracted to them due to local fishing activities and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. Its therefore concluded that while the proposed S.I. works location is partially or fully within the within the mean max foraging range	Screened Out

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				+1 S.D for species present on site as the proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects.	
Solway Firth SPA (UK9005012)	[A183] Lesser black-backed gull (<i>Larus fuscus</i>) [A184] Herring gull (<i>Larus argentatus</i>) [A176] Mediterranean gull [A195] Little tern (<i>Sterna albifrons</i>) [A193] Common tern (<i>Sterna hirundo</i>) [A191] Sandwich tern (<i>Sterna sandvicensis</i>)	Short term reduction in prey availability Visual and noise disturbance	No	The majority of protected features are near shore/intertidal foraging species and therefore survey impacts are expected to be negligible. These species would only be potentially affected during the migratory period, please see section 6.1 below. Terns show minimal responses to boat presence and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. Gull species are wide ranging and rarely dive. They show minimal disturbance response to boat presence and are often attracted to them due to local fishing activities and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. Its therefore concluded that while the proposed S.I. works location is partially or fully within the within the mean max foraging range +1 S.D for species present on site the proposed work is not expected to significantly impact the foraging or breeding	Screened Out

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects.	
Strangford Lough SPA (UK9020111)	[A193] Common tern (<i>Sterna hirundo</i>) [A191] Sandwich tern (<i>Sterna sandvicensis</i>) [A999] Wetland and waterbirds	Short term reduction in prey availability Visual and noise disturbance	No	The majority of protected features are near shore/intertidal foraging species and therefore survey impacts are expected to be negligible. These species would only be potentially affected during the migratory period, please see section 6.1 below. Terns show minimal responses to boat presence and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. The walkover surveys and silt trench sampling is not being undertaken at this site therefore is work is not relevant. Its therefore concluded that while the proposed S.I. works location is partially or fully within the within the mean max foraging range +1 S.D for the species present on site as the proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects.	Screened Out

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
Belfast Lough Open Water SPA (UK9020290)	[A005] Great Crested Grebe (<i>Podiceps cristatus</i>)	Short term reduction in prey availability Visual and noise disturbance	No	The proposed S.I. works location is out with the mean max foraging range +1 S.D for great crested grebe at this site. Great crested grebe are near shore/intertidal foraging species and therefore survey impacts are expected to be negligible. These species would only be potentially affected during the migratory period, please see section 6.1 below.	Screened Out
Outer Ards SPA (UK9020271)	[A194] Arctic Tern (<i>Sterna paradisaea</i>)	Short term reduction in prey availability Visual and noise disturbance	No	The proposed S.I. works location is within the mean max foraging range +1 S.D for some of the species under protection at this site. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I works area and d) the proposed work are unlikely to exclude the protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities. The majority of protected features are near shore/intertidal foraging species and therefore survey impacts are expected to be negligible. These species would only be potentially affected during the migratory period, please see section 6.1 below.	Screened Out

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				Terns show minimal responses to boat presence and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. Its therefore concluded that while the proposed S.I. works location is partially or fully within the within the mean max foraging range +1 S.D for tern species the proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects.	
Larne Lough SPA (UK9020042)	[A192] Roseate Tern (<i>Sterna dougallii</i>) [A193] Common Tern (<i>Sterna hirundo</i>) [A191] Sandwich tern (<i>Thalasseus sandvicensis</i>) [A176] Mediterranean gull (<i>Larus melanocephalus</i>)	Short term reduction in prey availability Visual and noise disturbance	No	The proposed S.I. works location is within the mean max foraging range +1 S.D for some of the species under protection at this site. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I. works area and d) the proposed work are unlikely to exclude the protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities. Light-bellied brent goose is only potentially impacted during its migratory period. Please see section 6.1 below.	Screened Out

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				Gull species are wide ranging and rarely dive. They show minimal disturbance response to boat presence and are often attracted to them due to local fishing activities and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. Terns show minimal responses to boat presence and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. Its therefore concluded that while the proposed S.I. works location is partially or fully within the within the mean max foraging range +1 S.D for tern species the proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects.	
Carlingford Lough SPA (UK9020161)	[A193] Common Tern (<i>Sterna hirundo</i>) [A046] Light-bellied Brent Goose (<i>Branta bernicla</i>) [A191] Sandwich tern (<i>Thalasseus sandvicensis</i>)	Short term reduction in prey availability Visual and noise disturbance	No	The proposed S.I. works location is within the mean max foraging range +1 S.D for some of the species under protection at this site. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I. works area and d) the proposed work are unlikely to exclude the	Screened Out

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities. Light-bellied brent goose is only potentially impacted during its migratory period. Please see section 6.1 below. Terns show minimal responses to boat presence and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. It is therefore concluded that while the proposed S.I. works location is partially or fully within the mean max foraging range +1 S.D for tern species the proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects.	
Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA (UK9014051)	[A183] Lesser black-backed gull (<i>Larus fuscus</i>) [A013] Manx shearwater (<i>Puffinus puffinus</i>)	Short term reduction in prey availability Visual and noise disturbance	No	The proposed S.I. works location is within the mean max foraging range +1 S.D for some of the species under protection at this site. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I. works area and d) the proposed work are unlikely to exclude the	Screened Out

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities.	
Irish Sea Front SPA (UK9029328)	[A013] Manx shearwater (<i>Puffinus puffinus</i>)	Short term reduction in prey availability Visual and noise disturbance	No	The proposed S.I. works location is within the mean max foraging range +1 S.D for some of the species under protection at this site. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I works area and d) the proposed work are unlikely to exclude the protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities.	Screened Out
Mersey Estuary SPA (UK9005131)	[A999] Wetland and waterbirds	Short term reduction in prey availability Visual and noise disturbance	No	The protected features are near shore/intertidal foraging species and therefore marine survey impacts are expected to be negligible as beyond the mean max foraging range. These species would only be potentially affected during the migratory period, please see section 6.1 below. The proposed silt trench geotechnical samples will likely cause short term disturbance within a small area of the SPA along foreshore and shoreline. This effect is expected to be negligible on the species listed as only a small area of habitat will be disturbed for a short period, with access to large areas of similar habitat	Screened Out

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				unrestricted indicating there will be limited restrictions on resource access.	
Northern Cardigan Bay / Gogledd Bae Ceredigion SPA (UK9020327)	[A001] Red-throated diver (<i>Gavia stellata</i>)	Short term reduction in prey availability Visual and noise disturbance	No	The proposed S.I. works location is partially within the mean max foraging range +1 S.D for red throated diver. The approach and landfall location are within the 9km foraging range of the species. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects and red throated diver is known to avoid boats and there collision is very unlikely, c) there are low densities of these species over the majority of the S.I works area and d) the proposed work are unlikely to exclude the protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities.	Screened Out
Ramsar Sites					
The Dee Estuary (Wales) Ramsar (Site no. 298)	[A195] Little tern (<i>Sterna albifrons</i>) [A193] Common tern (<i>Sterna hirundo</i>) [A191] Sandwich tern (<i>Sterna sandvicensis</i>) maritima)	Short term reduction in prey availability Visual and noise disturbance	No	The majority of protected features are near shore/intertidal foraging species and therefore survey impacts are expected to be negligible. These species would only be potentially affected during the migratory period, please see 6.1 below. The proposed S.I. works location is within the mean max foraging range +1 S.D for some of the species under protection at this site.	Screened Out

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I works area and d) the proposed work are unlikely to exclude the protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities. See section of Migratory birds for migratory assessment. Terns show minimal disturbance responses to boat presence and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. Its therefore concluded that while the proposed S.I. works location is partially or fully within the within the mean max foraging range +1 S.D for species present on site as the proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects.	

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
Duddon Estuary Ramsar (Site no. 938)	[A162] Common redshank (<i>Tringa tetanus</i>) [A143] Red knot (<i>Calidris canutus</i>)	Short term reduction in prey availability Visual and noise disturbance	No	The proposed S.I. works location is out with the mean max foraging range +1 S.D for the species under protection at this site. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I works area and d) the proposed work are unlikely to exclude the protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities.	Screened Out
Mersey Estuary Ramsar (Site no. 785)	[A177] Little Gull (<i>Larus minutus</i>) [A193] Common Tern (<i>Sterna hirundo</i>)	Short term reduction in prey availability Visual and noise disturbance	No	The proposed S.I. works location is within the mean max foraging range +1 S.D for some of the species under protection at this site. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I works area and d) the proposed work are unlikely to exclude the protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities. Terns show minimal disturbance responses to boat presence and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. Its therefore concluded that while the	Screened Out

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				proposed S.I. works location is partially or fully within the within the mean max foraging range +1 S.D for tern species the proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects.	
Mersey Narrows and North Wirral Foreshore Ramsar (Site no. 2202)	[A193] Common tern (<i>Sterna hirundo</i>) [A177] Little gull (<i>Hydrocoloeus minutus</i>)	Short term reduction in prey availability Visual and noise disturbance	No	The proposed S.I. works location is within the mean max foraging range +1 S.D for some of the species under protection at this site. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I works area and d) the proposed work are unlikely to exclude the protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities. Terns show minimal disturbance responses to boat presence and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. Its therefore concluded that while the proposed S.I. works location is partially or fully within the within the mean max foraging range +1 S.D for tern species the proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales	Screened Out

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
				intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects.	
Morecambe Bay Ramsar (Site no. 863)	[A183] Lesser black- backed gull (<i>Larus fuscus</i>) [A191] Sandwich tern (<i>Thalasseus sandvicensis</i>)	Short term reduction in prey availability Visual and noise disturbance	No	The proposed S.I. works location is within the mean max foraging range +1 S.D for some of the species under protection at this site. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I works area and d) the proposed work are unlikely to exclude the protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities. Gull species are wide ranging and rarely dive. They show minimal disturbance response to boat presence and are often attracted to them due to local fishing activities and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. The majority of protected features are near shore/intertidal foraging species and therefore survey impacts are expected to be negligible. These species would only be potentially affected during the migratory period, please see section 6.1 below.	Screened Out

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
Ribble and Alt Estuaries Ramsar (Site no. 325)	[A183] Lesser black- backed gull (<i>Larus fuscus</i>) [A179] Black-headed gull (<i>Larus ridibundus</i>) [A193] Common tern (<i>Sterna hirundo</i>)	Short term reduction in prey availability Visual and noise disturbance	No	Gull species are wide ranging and rarely dive. They show minimal disturbance response to boat presence and are often attracted to them due to local fishing activities and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. The majority of protected features are near shore/intertidal foraging species or waterbirds and therefore survey impacts are expected to be negligible. These species would only be potentially affected during the migratory period, please see section 6.1 below. The proposed S.I. works location is within the mean max foraging range +1 S.D for some of the species under protection at this site. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I works area and d) the proposed work are unlikely to exclude the protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities.	Screened out

Site name	Qualifying features scoped into screening (include sub-features and supporting habitats)	Pressure	LSE?	Justification	Screened in / Screened out?
Upper Solway Flats and Marshes Ramsar (Site no. 341)	[A184] European herring gull (<i>Larus argentatus</i>) [A183] Lesser black- backed gull (<i>Larus fuscus</i>)	Short term reduction in prey availability Visual and noise disturbance	No	Gull species are wide ranging and rarely dive. They show minimal disturbance response to boat presence and are often attracted to them due to local fishing activities and with the small increase in vessel numbers compared to the vessel traffic already present in the area it is unlikely the S.I. works will have any significant effect. The majority of protected features are near shore/intertidal foraging species and waterbirds and therefore survey impacts are expected to be negligible. These species would only be potentially affected during the migratory period, please see section 6.1 below. The proposed S.I. works location is within the mean max foraging range +1 S.D for some of the species under protection at this site. The proposed work is not expected to significantly impact the foraging or breeding behaviour as a) the work is carried over short time scales intermittently over the breeding and post-breeding seasons, b) activities carry a low degree of disturbance effects, c) there are low densities of these species over the majority of the S.I. works area and d) the proposed work are unlikely to exclude the protected species from significant proportions of the habitat, minimising effects on behaviours and foraging opportunities.	Screened Out

6.1 Migratory birds

It is possible that most of the ornithological species of interest will pass through the survey area at the time of the proposed activity. However, site specific migratory pathways for many species are largely unknown and challenging to identify. Those that are most likely to pass throughout the Zol are listed in Table 5. This is based upon the migratory timing of these species, the locations in which they breed within UK and Ireland, and whether the wider area that includes the Zol is included in the descriptions of migratory pathways in Wright et al (2012).

It is also possible that 34 bird species will be present within the Zol during the proposed activity time but the estimated migratory pathways for these species cover a much larger area and therefore confidence in the likelihood of presence of these species within the Zol during their migratory period is low. These species are listed in Table 5.

Some species are not expected to be migrating through the Zol during the proposed activity timeframe due to their likely migratory pathway not including the Zol or due to the timing of their migratory season. Finally, waders and little gull may be present but there is limited data to confirm their migratory distributions in the UK. Further quantification of the migratory destination of migratory individuals passing through the Zol to local sites is largely unknown, however the timing of the passage period and the low level of additional sources of impact (i.e. number of likely vessels) is not considered to significantly contribute to light levels to cause migratory disturbance.

Table 5. Summary of migratory pathways for ornithological features of interest within the Zol.

Species	Mean max foraging range (S.D. in brackets) (km) (if applic.)	Migratory pathway
Red-throated diver	9 ± NA	Possible presence but migratory range large
Manx shearwater	1346.8 ± 1019.3	Possible presence but migratory range large
Fulmar	542.3 ± 657.9	Possible presence but migratory range large
Gannet	315.2 ± 194.2	Possible presence but migratory range large
Cormorant	25.6 ± 8.3	Likely to be within the Zol. Migration routes noted to be concentrated in the Irish sea
Kittiwake	156.1 ± 144.5	Possible presence but migratory range large
Common gull	50 ± NA	Possible presence but migratory range large
Herring gull	58.8 ± 26.8	Possible presence but migratory range large
Lesser black-backed gull	127 ± 109	Possible presence but migratory range large

Great black-backed gull	73 ± NA	Possible presence but migratory range large
Little gull	NA ± NA	No data
Sandwich tern	34.3 ± 23.2	Possible presence but migratory range large
Little tern	5 ± NA	Likely within the Zol given the Irish Sea is noted as a possible migratory route
Common tern	18 ± 26.9	Possible presence but migratory range large
Arctic tern	25.7 ± 14.8	Possible presence but migratory range large
Guillemot	73.2 ± 80.5	Likely within the Zol due to dispersive nature of species
Razorbill	88.7 ± 164.6	Possible presence but migratory range large
Black-headed gull	18.5 ± NA	Possible presence but migratory range large
Waders	NA	No data
Great skua	443.3 ± 931.2	Likely within the Zol given the west coast of UK is noted as a possible migratory route
Arctic skua	2 ± 2.7	Possible presence but migratory range large
Puffin	137.1 ± 128.3	Possible presence but migratory range large
Storm petrel	336 ± NA	Possible presence but migratory range large
Roseate tern	12.6 ± 23.2	Likely as individuals are known to congregate within the Irish Sea prior to migration in Sept/Oct
Oystercatcher	NA	Likely within the Zol given the west coast of UK is noted as a possible migratory route
Redshank	NA	Possible presence but migratory range large
Curlew	NA	Migration routes not considered to be within the Zol
Common shelduck	NA	Possible presence but migratory range large
Grey plover	NA	Likely within the Zol given the west coast of UK is noted as a possible migratory route
Knot	NA	Possible presence but migratory range large
Dunlin	NA	Possible presence but migratory range large
Black-tailed godwit	NA	Migration routes not considered to be within the Zol
Common scoter	NA	Possible presence but migratory range large
Red-breasted merganser	NA	Likely within the Zol given the west coast of UK is noted as a possible migratory route

The presence of a small number of additional ships in what is considered a high traffic area is unlikely to have a significant adverse impact on the migratory bird species that may be present in the Zol during the proposed activity.

6.2 LSE Conclusion

European and Ramsar Sites determined to have no LSE and therefore not taken through to Stage two AA were:

- Liverpool Bay/Bae Lerpwl SPA
- Anglesey Terns/Morwenoliaid Ynys Môn SPA
- Dee Estuary SPA
- Ynys Seiriol / Puffin Island SPA
- Traeth Lafan/Lavan Sands, Conway Bay SPA
- Ribble and Alt Estuaries SPA
- Morecambe Bay and Duddon Estuary SPA
- Solway Firth SPA
- Strangford Lough SPA
- Belfast Lough Open Water SPA
- Outer Ards SPA
- Larne Lough SPA
- Carlingford Lough SPA
- Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA
- Irish Sea Front SPA
- Northern Cardigan Bay / Gogledd Bae Ceredigion SPA
- Mersey Estuary SPA
- Mersey Estuary Ramsar
- The Dee Estuary (Wales) Ramsar
- Duddon Estuary Ramsar
- Mersey Narrows and North Wirral Foreshore Ramsar
- Ribble and Alt Estuaries Ramsar
- Upper Solway Flats and Marshes Ramsar

European Sites determined to have potential for LSE and therefore taken through to Stage two AA are presented in Table 6.

Table 6. European Sites screened through to Stage 2 AA

Site name	Qualifying features screened into AA	Impact Pathway
North Anglesey Marine / Gogledd Mon Forol SAC (UK0030398)	Harbour porpoise	Underwater noise and vibration
Pen Llyn a'r Sarnau/ Llyn Peninsula and the Sarnau SAC (UK0013117)	Bottlenose dolphin	
	Grey Seal	
West Wales Marine / Gorllewin Cymru Sarnau SAC (UK0030397)	Harbour porpoise	
Cardigan Bay/ Bae Ceridigion SAC (UK0012712)	Bottlenose dolphin	
	Grey seal	
Pembrokeshire Marine/ Sir Benfro Forol SAC (UK0013116)	Grey seal	
Rockabill to Dalkey Island SAC (IE003000)	Harbour porpoise	
Lambay Island SAC (IE000204)	Grey seal	
	Harbour seal	

7. Appropriate Assessment

As described in Section 3, European Sites and their qualifying features are progressed to AA (Stage 2) where it is not possible to exclude potential for LSE. Information to inform the AA is provided below and includes a description of the European Sites and the qualifying features under consideration. An assessment of potential effects on site integrity in light of the Conservation Objectives has been conducted.

AA (Stage 2) requires the consideration of impacts on the integrity of a European Site, in relation to the site's structure and function and its Conservation Objectives, which aim to define favourable conservation condition for habitats and species. As such, the assessment below considers the Conservation Objectives of the European Sites included for Stage 2 assessment.

7.1 Assessment

7.1.1 Underwater noise and vibration

It is widely documented that marine mammals are sensitive to underwater sound (Richardson *et al.*, 1995; Nowacek *et al.*, 2007; OSPAR, 2009; Southall *et al.*, 2019; Southall *et al.*, 2021). A wealth of evidence indicates that many anthropogenic sound sources, such as vessel sound (Pirodda *et al.*, 2012; Culloch *et al.*, 2016; Dunlop, 2016; Wisniewska *et al.*, 2018) and geophysical surveys (Pirodda *et al.*, 2014; Stone *et al.*, 2017) can have impacts on marine mammals. In addition, indirect impacts may occur due to direct impacts, such as disturbance, on prey species (Sivle *et al.*, 2021).

These impacts have varying degrees of severity, ranging from masking (i.e. affecting communication and listening space, and/or locating prey; Pirodda *et al.*, 2012; Dunlop, 2016; Erbe *et al.*, 2016; Heiler *et al.*, 2016; Wisniewska *et al.*, 2018; Pine *et al.*, 2019; Basran *et al.*, 2020), to behavioural displacement and disturbance responses (Brandt *et al.*, 2011; Pirodda *et al.*, 2014; Culloch *et al.*, 2016; Stone *et al.*, 2017; Graham *et al.*, 2019) to injury and even mortality for high intensity sound sources (Schaffeld *et al.*, 2019).

In total seven sites were screened into Stage 2 Appropriate Assessment due to potential LSE from underwater noise and vibration on marine mammals (

Table 7).

Table 7. Sites screened into Appropriate Assessment for underwater noise and vibration.

Site name	Qualifying Features Screened into AA
North Anglesey Marine / Gogledd Mon Forol SAC	Harbour porpoise (<i>Phocoena phocoena</i>)
Pen Llyn a'r Sarnau/ Llyn Peninsula and the Sarnau SAC	Bottlenose dolphin (<i>Tursiops truncatus</i>) Grey seal (<i>Halichoerus grypus</i>)
West Wales Marine / Gorllewin Cymru Sarnau SAC	Harbour porpoise (<i>Phocoena phocoena</i>)
Cardigan Bay/ Bae Ceridigion SAC	Bottlenose dolphin (<i>Tursiops truncatus</i>) Grey seal (<i>Halichoerus grypus</i>)
Pembrokeshire Marine/ Sir Benfro Forol SAC	Grey seal (<i>Halichoerus grypus</i>)
Rockabill to Dalkey Island SAC	Harbour porpoise (<i>Phocoena phocoena</i>)
Lambay Island SAC	Grey seal (<i>Halichoerus grypus</i>) Harbour seal (<i>Phoca vitulina</i>)

Species ecology

Harbour porpoises are the only porpoise species in the North Atlantic. This species is the smallest, most numerous and widespread cetacean in Welsh waters and is present year-round (Baines and Evans 2012). Hot spots of higher density in proximity to the S. I. Survey Area exist off north and west Anglesey, particularly around Holyhead, and Point Lynas and South Stacks (Baines and Evans 2012).

Harbour porpoises have a broad distribution, found around areas of open coast, shallow bays, estuaries, sea lochs, tidal channels and occasionally up rivers. Being a small species in a cold-water environment, harbour porpoises have high feeding rates and a varied diet, which primarily includes small shoaling fish from pelagic and demersal habitats (Santos and Pierce 2003). In any one area, diet composition may be primarily two to four species of fish which includes, but is not limited to, herring (*Clupea harengus*) and sprat (*Sprattus sprattus*), sandeel (*Ammodytidae*) and members of the cod family (*Gadidae*) (Santos and Pierce 2003). The current conservation status and overall trend for harbour porpoise within UK waters are unknown, due to insufficient data for the species (JNCC 2019c).

Harbour porpoises are dependent on sound to detect their prey and are sensitive to anthropogenic induced underwater noise. Noise exposure criteria outlined in Southall *et al.* (2019) grouped all marine mammals into functional hearing groups (FHGs) based on their hearing ability (Table 8). With respect to their classification within the FHGs, harbour porpoises are defined as very high frequency (VHF) cetaceans, with a vocal repertoire (and hearing range) ranging between 275 Hz to 160 kHz (NMFS 2018; Southall *et al.* 2019; Table 8) including their very high frequency (VHF), short-range and narrow-band (NBHF) echolocation clicks. The hearing sensitivity of harbour porpoise is greatest in the higher part of this range. The peak sound pressure level (SPL) for temporary threshold shift (TTS) in hearing is 196 dB 1µPa @ 1m and permanent threshold shift (PTS) in hearing is 202 dB 1µPa @ 1m (Table 8). Their high sensitivity to sound, coupled with this species being the most abundant cetacean in UK and Irish waters, means they are often a key species of concern when assessing risks of impacts from impulsive sound sources, such as geophysical surveys.

Harbour porpoises are a qualifying feature of the North Anglesey Marine SAC, which is estimated to support 2.4 % of the Celtic and Irish Seas management unit (MU) population. This site provides a good foraging ground and may also be used for breeding and calving (JNCC 2019a); this SAC is considered especially important to porpoise during summer months (Heinänen & Skov 2015; JNCC 2019a). The West Wales Marine SAC features one of the top 10% of persistent high-density areas for harbour porpoise in UK waters during both winter and summer seasons (NRW & JNCC 2017). The site is estimated to support 5.4 % of the Celtic and Irish Seas MU population. The Rockabill to Dalkey Island SAC in Irish waters is also highlighted as an area of importance to harbour porpoise for foraging, breeding and calving, with surveys recording harbour porpoise year-round at this site (NPWS 2014a). Given that it is well documented that porpoise avoid vessels (e.g. Benhemma-Le Gall *et al.* 2021; Culloch *et al.* 2016), and considering the wider area available to these animals, the risk of injury is negligible if the JNCC mitigation guidelines for geophysical surveys are followed (JNCC 2017).

As noted in Section 4.2, for elusive species such as harbour porpoise, where studying the species at the individual-level is challenging, protected sites are often identified as areas with higher densities of the species as compared to other regions. In these cases, the protected site is considered to be more important to the species compared to neighbouring areas. Consequently, targets relating to the overarching Conservation Objective relate to ensuring that spatial and temporal use of the protected site by harbour porpoises is maintained (JNCC 2019a; 2019b; 2020).

Bottlenose dolphins are the second most frequently recorded cetacean in Welsh waters, with a predominantly coastal distribution. Bottlenose dolphins are defined as high frequency (HF) cetaceans, with respect to their classification within the FHGs, with a hearing range of 150 Hz – 160 kHz (NMFS 2018; Southall *et al.* 2019; Table 8). The peak SPL for TTS in hearing is 224

dB 1 μ Pa @ 1m and PTS in hearing is 230 dB 1 μ Pa @ 1m (Table 8). Bottlenose dolphins are dependent on sound to detect their prey and are sensitive to underwater noise. They are generalist and opportunistic feeders, eating a wide range of pelagic and benthic (demersal) fish, crustaceans, and molluscs, making them highly adaptable with respect to diet and feeding strategy (NRW 2018a). The Lley Peninsula and the Sarnau SAC contains important potential feeding areas for bottlenose dolphins, with individuals often observed feeding whilst within the waters of the SAC (NRW 2018a). They are considered of significant importance within Lley Peninsula and the Sarnau SAC and are part of a wider population that ranges across the Irish Sea, and the Cardigan Bay SAC, which supports a semi-resident population of bottlenose dolphins (NRW 2018b). This has been confirmed through photographic-identification studies, which show dolphins associated with the Cardigan Bay SAC population move into and through the Lley Peninsula and the Sarnau SAC (Feingold & Evans 2013) and up to the Shannon Estuary SAC to the west of Ireland and the Moray Firth SAC on the east coast of Scotland (Cheney *et al.* 2013; Robinson *et al.* 2012). Bottlenose dolphins in this region are commonly sighted within 10 miles (*ca.* 16 km) of the coast in summer, but range more widely in winter (Baines & Evans 2012; NRW 2018a). The current conservation status and overall trend for bottlenose dolphin within UK waters are unknown, due to insufficient data for the species (JNCC 2019d).

For true seals (phocids, which includes grey seal and harbour seal) the generalised underwater hearing range is between 50 Hz – 86 kHz (Table 8). The peak SPL for TTS in hearing is 212 dB 1 μ Pa @ 1m and PTS in hearing is 218 dB 1 μ Pa @ 1m (Table 8). Neurophysiological studies have reported that grey seals have an underwater hearing range of <1.4 kHz – 100 kHz (Southall *et al.* 2019). Grey seals are most sensitive during the breeding season (August to November) and when moulting (December-April), when they spend most or all their time hauled out (SCOS 2021; NRW 2018a). During these times, activities close to the SAC (within 500 m) that may startle grey seals and cause them to return to the sea, for example, are often regarded as the greatest risk. Telemetry tagging studies have shown, when at sea, grey seals can travel over 100 km from haul out sites to forage, can cover large areas when foraging, and are able to move between prey patches (SCOS 2020; Carter *et al.* 2020; 2022). Local tracking data has shown that seals moved from haul out sites on Bardsey Island, situated within Lley Peninsula and the Sarnau SAC, to the east coast of Ireland, Inner Hebrides, and Pembrokeshire (NRW 2018a). Therefore, it is likely that the individuals breeding within the Lley Peninsula and the Sarnau SAC are part of a wider population that extends to southwest Wales and to the southeast and eastern Irish coasts (NRW 2018a). Grey seals within Cardigan Bay SAC are also part of a wider population, with a small number making long foraging trips up the Irish Sea to deeper waters (NRW 2018b). Pembrokeshire Marine SAC is an important breeding site for grey seals, representing over 2% of annual UK pup production (SCOS 2021; NRW 2018c; 2022). Outside of the pupping season, individuals are less site faithful. Due to this, there is a

seasonal difference in grey seal population distribution and individuals will be more susceptible to disturbance during pupping and moulting periods. Grey seals have a 'favourable' conservation status in the UK due to their improving population trend (JNCC 2019e).

In Irish waters, Lambay Island SAC supports the main breeding colony of grey seals on the east coast (NPWS 2014b). Grey seals are present year-round within the SAC, using the site for breeding, moulting, resting, and foraging (NPWS 2013).

Behavioural studies have reported that harbour seals have an underwater hearing range of <0.1 kHz – 79 kHz (Southall *et al.* 2019). Harbour seals are most sensitive during the breeding season (June-July) and when moulting (August-September), when they spend most or all their time hauled out. During these times, activities within 500 m to the SAC that may startle harbour seals and cause them to return to the sea, for example, are often regarded as the greatest risk. Although telemetry tagged harbour seals have been recorded to travel >100 km to forage, foraging trips typically remain within 50 km from their preferred haul-out sites (Carter *et al.* 2022). There are no SACs in Welsh waters for which harbour seals are a qualifying feature. However, they are a qualifying feature of Lambay Island SAC, in Irish waters, where they are present throughout the year, using the site for breeding, moulting, resting, and foraging (NPWS 2013).

Table 8. Generalised hearing ranges and noise exposure criteria from Southall *et al.* (2019) for Temporary Threshold Shift (TTS) and Permanent Threshold Shift (PTS) in hearing for the functional hearing groups Phocid in Water (PW), High Frequency cetaceans (HF), and Very High Frequency cetaceans (VHF), (NMFS 2018; Southall *et al.* 2019).

Functional hearing group	Relevant species	Generalised hearing range	Estimated peak region of sensitivity	Noise exposure criteria					
				Impulsive				Non-impulsive	
				TTS		PTS		TTS	PTS
				SEL	Peak SPL	SEL	Peak SPL	SEL	SEL
Phocids in water	Grey and harbour seal	50 Hz – 86 kHz	1.9 – 30 kHz	170	212	185	218	181	201
High Frequency Cetaceans	Bottlenose dolphin	150 Hz – 160 kHz	8.8 – 110 kHz	170	224	185	230	178	198
Very High Frequency Cetaceans	Harbour porpoise	275 Hz – 160 kHz	12 – 140 kHz	140	196	155	202	153	173

Underwater noise assessment

It is widely documented that marine mammals are sensitive to underwater noise (Richardson *et al.* 1995; Nowacek *et al.* 2007; OSPAR 2009; Southall *et al.* 2019; Southall *et al.* 2021). A large body of evidence indicates that many anthropogenic sound sources, such as vessel noise (Pirrotta *et al.* 2012; Dunlop 2016; Wisniewska *et al.* 2018) and seismic surveys (Pirrotta *et al.* 2014; Stone *et al.* 2017) can have negative impacts on marine mammals. In addition, indirect impacts may occur due to direct impacts on prey species (Sivle *et al.* 2021).

These impacts have varying degrees of observed and/or predicted severity, ranging from changes in behaviour and masking such as, affecting communication and listening space, and/or locating prey (Pirrotta *et al.* 2012; Dunlop 2016; Erbe *et al.* 2016; Heiler *et al.* 2016; Wisniewska *et al.* 2018; Pine *et al.* 2019; Basran *et al.* 2020), to displacement and disturbance (Brandt *et al.* 2011; Pirrotta *et al.* 2014; Culloch *et al.* 2016; Stone *et al.* 2017; Graham *et al.* 2019) to injury and even mortality (Schaffeld *et al.* 2019).

With respect to noise assessments, using the criteria outlined in Southall *et al.* (2019), there are often two types of impacts which are considered: TTS and PTS, the latter of which is typically regarded as injury. To assess this, sound sources are typically divided into two categories, 'impulsive' and 'non-impulsive', based on attributes of the sound source:

- **Impulsive sound sources**, such as impact pile driving and seismic airguns, are transient and brief (less than a second), broadband and typically consist of high peak pressure with rapid rise time and decay.
- **Non-impulsive sound sources**, such as shipping, cone penetration testing (CPT), rotary core borehole (BH), and vibrocores, can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent and typically do not have a high peak pressure with rapid rise time.

Behavioural responses are challenging to assess, therefore deriving disturbance thresholds is often not possible, and recent research has shown that attempting to derive simple all-or-nothing thresholds for behavioural responses to noise exposure across broad taxonomic groups and sound sources can lead to significant errors in predicting effects (Southall *et al.* 2021). Therefore, assessment of disturbance is often qualitative, taking into consideration what we know about the ecology and behaviour of the species, and the activity being assessed.

The noise level thresholds outlined in Table 9 are peak Sound Pressure Level (SPL), which is the maximum absolute value, which is used to assess the potential risk of instantaneous TTS or PTS. These are based on the animal being close to the sound source (within 1 m), which is

unlikely and, therefore, extremely precautionary. The cumulative Sound Exposure Level (SEL_{cum}) is used to assess the potential risk of TTS or PTS through exposure to noise accumulated over time.

The VHF FHG is the most sensitive to impulsive (e.g. geophysical surveys) and non-impulsive (e.g. vessel/engine noise) sound sources. Consequently, all the exposure criteria for this FHG are lower than those of the other FHGs for the respective sound source and exposure criteria. In the context of the proposed S. I. surveys, the only VHF cetacean species in this site is the harbour porpoise, which is the most abundant cetacean species in UK and Irish waters (Baines & Evans 2012; Wall *et al.* 2013; Rogan *et al.* 2018; Hague *et al.* 2020).

Indicative SPLs associated with different types of marine S. I. surveys are presented in Table 9. Geophysical survey equipment types incorporated in the S. I. surveys are multibeam echosounder (MBES), side scan sonar (SSS), sub-bottom profiler (SBP), magnetometer survey, and the ultra-short baseline (USBL) subsea positioning. Geophysical survey equipment is typically an impulsive sound source, which is broadly regarded as a higher risk to marine mammals compared to non-impulsive sound sources. One exception in the S. I. surveys, whilst often included in geophysical survey equipment lists, is magnetometers, which are a completely passive device, meaning they do not produce any sound while in operation. The MBES and SSS operate outside of the hearing range of the marine mammal species included in this assessment. As there is no impact pathway associated with MBES, SSS, and magnetometer surveys, they have been scoped out of this assessment.

The operating frequency of the SBP is within the generalised hearing range of seals in water, bottlenose dolphin, and harbour porpoise, and within the estimated peak region of sensitivity of bottlenose dolphin and harbour porpoise (Table 8; Table 9). Although the operating frequency of the SBP is outside the estimated peak region of sensitivity of seals in water, it is concluded that the SBP may cause instantaneous PTS and TTS in grey and harbour seals following a precautionary approach to assessment. The operating frequency of the USBL system is within the generalised hearing range and estimated region of peak sensitivity of seals in water, bottlenose dolphin, and harbour porpoise, but the SPL is not likely to cause instantaneous PTS or TTS in grey and harbour seals, bottlenose dolphins, and harbour porpoise (Table 9). Therefore, the only activity involved in the geophysical S. I. works that may cause an instantaneous PTS in grey and harbour seals, bottlenose dolphins, and harbour porpoise is the SBP (Table 9).

Although these sound sources (e.g. SBP) can be relatively loud with high duty cycles, they are typically highly directional with expected low levels of propagation both vertically and horizontally, with many of these devices operating at high frequencies and therefore subject to high transmission loss (Crocker & Frantantonio 2016; Crocker *et al.* 2019). Directionality

must also be considered, as well as propagation. For example, sound propagation through the water column on the horizontal for side-scanning sonar is minimal; therefore, the noise level decreases rapidly with distance from the source (Trabant 2013). Once the sound pulse has been emitted, the intensity is greatly reduced within a few metres due to scattering and absorption (Medwin 1970; Deane & Stokes 2010; Farcas *et al.* 2016).

Table 9. Marine survey noise sources and the risk of an instantaneous TTS and PTS in hearing from impulsive noise sources for each of the functional hearing groups where Y (red) indicates onset is possible and N (green) indicates that it is not.

Noise Source	Frequency (kHz)	Sound Pressure Level (dB re 1µPa @ 1m)	PCW		HF		VHF	
			TTS	PTS	TTS	PTS	TTS	PTS
Innomar Medium-100 SBP	85 to 100 (primary)	247	Y	Y	Y	Y	Y	Y
	2 to 22 (secondary)	247	Y	Y	Y	Y	Y	Y
Kongsberg µPAP 201-H USBL system	20 to 30*	190*	N	N	N	N	N	N

*Information taken from online specification (Kongsberg Maritime 2023).

The geotechnical equipment and activities associated with the proposed S. I. surveys are vibrocorer and CPT. There are few estimates of operating frequencies and SPLs of these equipment and activities published in the public domain. For all activities the SPL range is between 118 and 187.4 dB re 1µPa @1m (Table 10), and in the case of the operating frequencies, both the vibrocorer and CPT are outside the generalised hearing ranges of harbour porpoise, bottlenose dolphin and seals in water (Table 10). As such, it is concluded that there is no risk of instantaneous or cumulative TTS or PTS to harbour porpoises, bottlenose dolphins or seals during the geotechnical surveys.

With respect to disturbance, as the activities are transient and short in duration, any disturbance effects would be negligible, particularly given the extensive suitable foraging habitat elsewhere in the Irish Sea and beyond.

Table 10. Marine survey noise sources and marine mammal hearing ranges (Table 8) where red indicates the equipment can operate within the peak sensitivity range of the

relevant functional hearing group, orange indicates it is in the hearing range but not in the peak sensitivity range and green indicates that it is not in the hearing range.

Noise Source	Frequency (Hz)	Sound Pressure Level (dB re 1µPa @ 1m)	PCW	HF	VHF
FT0551 Vibrocorer ¹	30	187.4			
Geomil Manta 100DW CPT ²	28	118-145			

¹ Values taken from (LGL 2010)

² Values taken from (Campanella *et al.* 1986; BOEM 2012; EIRGRID 2014)

In summary, magnetometers are passive devices which do not emit sound waves and the MBES, SSS, vibrocorer and CPT operate outwith the hearing frequencies of marine mammals and therefore pose no risk of injury or disturbance to marine mammals. The USBL emits sound frequencies within hearing ranges of marine mammals but the SPL and SEL are not likely to cause instantaneous PTS or TTS to species of concern. The SBP is the only equipment used in the survey with the potential for instantaneous PTS and is therefore the only sound source taken through to further assessment.

North Anglesey Marine SAC (UK0030398)

This site was screened into AA due to the potential for LSE on harbour porpoise from underwater noise and vibration.

The Conservation Objectives for harbour porpoise for North Anglesey Marine SAC, and individual attributes with targets are provided in Table 11.

Table 11. Conservation Objective information for harbour porpoise in North Anglesey Marine SAC (UK0030398) (JNCC 2019a).

Conservation Objective information for: North Anglesey Marine SAC (UK0030398)		
[1351] Harbour porpoise		
To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for harbour porpoise in UK waters, which is defined by the following list of attributes and targets:		
Attribute	Target	Notes
Species is a viable component of the site	Maintained or restored in the long term – subject to natural change	Not applicable
Disturbance	No significant disturbance of the species	Not applicable

Conservation Objective information for: North Anglesey Marine SAC (UK0030398)		
Habitats and processes	Habitats and processes relevant to harbour porpoise and its prey are maintained or restored in the long term – subject to natural change	Not applicable

A portion of the SAC and the S. I. Survey Area overlap (Figure 2), therefore, porpoise located within the SAC could be affected by S. I. surveys. If an individual were to be that close to the source, any event of injury would be to that sole individual and would not incur a population level effect as it is an extremely unlikely event. Harbour porpoise also show evasion behaviour to vessel presence so the likelihood that individuals spend a prolonged period near the S.I. survey vessel is considered highly unlikely. There is extensive suitable foraging habitat elsewhere in the Irish Sea and beyond enabling harbour porpoise to avoid the survey area if required. The S. I. surveys are also anticipated to be relatively short term (over a four-month period across the whole survey area in Irish and UK waters), and the duration of the survey within, and in close proximity to, the SAC would be considerably shorter than this. Therefore, short-term localised disturbances, such as the S. I. surveys proposed here would have negligible to no impact on porpoise in the SAC.

Conclusion

Consequently, it is considered that targets, with respect to the Conservation Objectives indicated in Table 11, would not be significantly affected and that there would be **no adverse effects on integrity (AEol)** for harbour porpoise in North Anglesey Marine SAC due to the S. I. surveys.

Mitigation

Although it has been assessed there would be no AEol on North Anglesey Marine SAC, to further reduce any risk of potential injury to individuals, mitigation measures will be applied to reduce the impact of underwater noise and vibration on harbour porpoise. Geophysical acoustic survey guidance, as specified in 'JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys' (2017) will be followed during all impulsive surveys (including: SBP). These guidelines specify procedures including, but not limited to a 'soft start' procedure, which shall be used to ensure that any animals in the vicinity will have chance to leave. With the implementation of these guidelines there will be a negligible risk of disturbance to marine mammals (see Appendix 1 for Marine Mammal Observer protocol) as recommended in the JNCC guidance).

Lleyn Peninsula and the Sarnau SAC (UK0013117)

This site was screened into AA due to a possible LSE on bottlenose dolphin and grey seal from underwater noise and vibration.

The Conservation Objectives for bottlenose dolphin and grey seal for Llyn Peninsula and the Sarnau SAC, and individual attributes with targets are provided in Table 12.

Table 12. Conservation Objective information for bottlenose dolphin and grey seal in Llyn Peninsula and the Sarnau SAC (UK0013117) (NRW 2018a).

Conservation Objective information for Llyn Peninsula and the Sarnau SAC (UK0013117)			
[1349] Bottlenose dolphin			
To maintain (or restore) the habitat and species features, as a whole, at (or to) favourable conservation status (FCS) within the site. To achieve favourable conservation status all the following attributes and targets, subject to natural processes, need to be fulfilled and maintained in the long-term			
Attribute	Measure	Target	Notes
Population	Size, structure, production and physiological health.	The population is maintaining itself on a long-term basis as a viable component of its natural habitat.	As part of this objective, it should be noted that for bottlenose dolphin, contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression
Range	Areas of the site which the population/individuals use.	The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.	As part of this objective, it should be noted that for bottlenose dolphin their range within the SAC and adjacent inter-connected areas is not constrained or hindered, there are appropriate and sufficient food resources within the SAC and beyond.
Supporting habitats and species	Distribution and extent, structure, function and quality and prey availability and quality.	The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.	Not applicable.
[1364] Grey seal			
To maintain (or restore) the habitat and species features, as a whole, at (or to) favourable conservation status (FCS) within the site. To achieve favourable conservation status all the following attributes and targets, subject to natural processes, need to be fulfilled and maintained in the long-term			
Attribute	Measure	Target	Notes

Population	Size, structure, production and physiological health.	The population is maintaining itself on a long-term basis as a viable component of its natural habitat.	As part of this objective, it should be noted that for grey seal, contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression. Grey seal populations should not be reduced as a consequence of human activity.
Range	Areas of the site which the population/individuals use.	The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.	As part of this objective, it should be noted that for grey seal, their range within the SAC and adjacent inter-connected areas is not constrained or hindered, there are appropriate and sufficient food resources within the SAC and beyond
Supporting habitats and species	Distribution and extent, structure, function and quality and prey availability and quality.	The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.	Not applicable.

Overall, it is considered highly unlikely there will be an AEoI of the populations of bottlenose dolphin and grey seal within Llyn Peninsula and the Sarnau SAC which is 28.8 km from the S. I. Survey Area. As mentioned previously, sound attenuates increasingly from the source and, the individual would have to be extremely close to the source at the time of maximum output. If an individual were to be that close to the source, any event of injury would be to that sole individual and would not incur a population level effect as it is an extremely unlikely event. There is extensive suitable foraging and haul-out (seal specific) habitat elsewhere enabling both bottlenose dolphin and grey seal to avoid the survey area if required. The S. I. survey is also anticipated to be relatively short term (over a four-month period across the whole survey area in Irish and UK waters) and is transient, meaning exposure to underwater noise will be short-term, both spatially and temporally. Therefore, short-term localised disturbances, such as the S. I. surveys proposed here would have negligible to no impact on bottlenose dolphins or grey seals in the SAC.

Conclusion

Consequently, it is considered that targets, with respect to Conservation Objectives, indicated in Table 12 would not be significantly affected and that there would be **no AEol** on bottlenose dolphin and grey seal in the Llyn Peninsula and the Sarnau SAC due to the S. I. surveys.

Mitigation

Although it has been assessed there would be no AEol on Llyn Peninsula and the Sarnau SAC, to further reduce any risk of potential injury to individuals, mitigation measures will be applied to reduce the impact of underwater noise and vibration on porpoise. Geophysical acoustic survey guidance, as specified in 'JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys' (2017) and will be followed during all impulsive surveys (including: SBP). These guidelines specify procedures including, but not limited to a 'soft start' procedure, which shall be used to ensure that any animals in the vicinity will have chance to leave. With the implementation of these guidelines there will be a negligible risk of disturbance to marine mammals (see Appendix 1 for Marine Mammal Observer protocols as recommended in the JNCC guidance).

West Wales Marine SAC (UK0030397)

This site was screened into AA due to a possible LSE on harbour porpoise from underwater noise and vibration.

The Conservation Objectives for harbour porpoise for West Wales Marine SAC, and individual attributes with targets are provided in Table 13.

Table 13. Conservation Objective information for harbour porpoise in West Wales Marine SAC (UK0030397) (JNCC 2019b).

Conservation Objective information for West Wales Marine SAC (UK0030397)		
[1351] Harbour porpoise		
To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for harbour porpoise in UK waters, which is defined by the following list of attributes and targets:		
Attribute	Target	Notes
Species is a viable component of the site	Maintained or restored in the long term – subject to natural change	Not applicable
Disturbance	No significant disturbance of the species	Not applicable
Habitats and processes	Habitats and processes relevant to harbour porpoise and its prey are maintained or restore in the long term – subject to natural change	Not applicable

Overall, it is considered highly unlikely there will be an AEol on the population of harbour porpoise within West Wales Marine SAC which is 29.7 km from the S. I. Survey Area. Harbour porpoise show evasion behaviour to vessel presence so the likelihood that individuals spend a prolonged period near the S.I. survey vessel is unlikely. There is extensive suitable foraging habitat elsewhere in the Irish Sea and beyond enabling harbour porpoise to avoid the survey area if required. If an individual was to be that close to the source, any event of injury would be to that sole individual and would not incur a population level effect as it is an extremely unlikely event. The S. I. surveys are also anticipated to be relatively short term (over a four-month period across the whole survey area in Irish and UK waters) and is transient, meaning exposure to underwater noise will be short-term, both spatially and temporally. Therefore, short-term localised disturbances, such as the S. I. surveys proposed here would have negligible to no impact on porpoise in the SAC.

Conclusion

Consequently, it is considered that targets, with respect to Conservation Objectives, indicated in Table 13 would not be significantly affected and that there would be **no AEol** on harbour porpoise in West Wales Marine SAC due to the S. I. surveys.

Mitigation

Although it has been assessed there would be no AEol on West Wales Marine SAC, to further reduce any risk of potential injury to individuals, mitigation measures will be applied to reduce the impact of underwater noise and vibration on harbour porpoise. Geophysical acoustic survey guidance, as specified in 'JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys' (2017) and will be followed during all impulsive surveys (including: SBP). These guidelines specify procedures including, but not limited to a 'soft start' procedure, which shall be used to ensure that any animals in the vicinity will have chance to leave. With the implementation of these guidelines there will be a negligible risk of disturbance to marine mammals (see Appendix 1 for Marine Mammal Observer protocols as recommended in the JNCC guidance).

Cardigan Bay SAC (UK0012712)

This site was screened into AA due to a possible LSE on bottlenose dolphin and grey seal from underwater noise and vibration.

The Conservation Objectives for bottlenose dolphin and grey seal for Cardigan Bay SAC, and individual attributes with targets are provided in Table 14.

Table 14. Conservation Objective information for bottlenose dolphin and grey seal in Cardigan Bay SAC (UK0012712) (NRW 2018b).

Conservation Objective information for Cardigan Bay SAC (UK0012712)			
[1349] Bottlenose dolphin			
To maintain (or restore) the habitat and species features, as a whole, at (or to) favourable conservation status (FCS) within the site. To achieve favourable conservation status all the following attributes and targets, subject to natural processes, need to be fulfilled and maintained in the long-term			
Attribute	Measure	Target	Notes
Population	Size, structure, production, condition, of the species within the site.	The population is maintaining itself on a long-term basis as a viable component of its natural habitat.	As part of this objective, it should be noted that for bottlenose dolphin, contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression.
Range	Areas of the site which the population/individuals use.	The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.	As part of this objective, it should be noted that, for bottlenose dolphin, their range within the SAC and adjacent inter-connected areas is not constrained or hindered, there are appropriate and sufficient food resources within the SAC and beyond, and the sites and amount of supporting habitat used by these species are accessible and their extent and quality is stable or increasing.
Supporting habitats and species	Distribution, extent, structure, function and quality of habitat, and prey availability and quality.	The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.	As part of this objective, it should be noted that the abundance of prey species subject to existing commercial fisheries needs to be equal to or greater than that required to achieve maximum sustainable yield and secure in the long term; the management and control of activities or operations likely to adversely affect the species feature is appropriate for maintaining it in favourable condition and is secure in the long term; contamination of potential prey species should be below concentrations potentially

			harmful to their physiological health; and disturbance by human activity is below levels that suppress reproductive success, physiological health or long-term behaviour. As part of this objective it should be noted that for the bottlenose dolphin populations should be increasing.
[1364] Grey seal			
To maintain (or restore) the habitat and species features, as a whole, at (or to) favourable conservation status (FCS) within the site. To achieve favourable conservation status all the following attributes and targets, subject to natural processes, need to be fulfilled and maintained in the long-term			
Attribute	Measure	Target	Notes
Population	Size, structure, production, condition, of the species within the site.	The population is maintaining itself on a long-term basis as a viable component of its natural habitat.	As part of this objective, it should be noted that for grey seal, contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression. For grey seal populations should not be reduced as a consequence of human activity.
Range	Areas of the site which the population/individuals use.	The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.	As part of this objective, it should be noted that, for grey seal, their range within the SAC and adjacent inter-connected areas is not constrained or hindered, there are appropriate and sufficient food resources within the SAC and beyond, and the sites and amount of supporting habitat used by these species are accessible and their extent and quality is stable or increasing.
Supporting habitats and species	Distribution, extent, structure, function and quality of habitat, and prey availability and quality.	The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.	As part of this objective, it should be noted that the abundance of prey species subject to existing commercial fisheries needs to be equal to or greater than that required to achieve maximum sustainable yield and secure in the long term; the management and control of activities or operations

			likely to adversely affect the species feature is appropriate for maintaining it in favourable condition and is secure in the long term; contamination of potential prey species should be below concentrations potentially harmful to their physiological health; and disturbance by human activity is below levels that suppress reproductive success, physiological health or long-term behaviour.
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Overall, it is considered highly unlikely there will be an AEoI of the populations of bottlenose dolphin and grey seal within Cardigan Bay SAC which is 91.8 km from the S. I. Survey Area. As mentioned previously sound attenuates increasingly from the source and the individual would have to be extremely close to the source at the time of maximum output. If an individual were to be that close to the source, any event of injury would be to that sole individual and would not incur a population level effect as it is an extremely unlikely event. There is extensive suitable foraging and haul-out (seal specific) habitat elsewhere enabling both bottlenose dolphin and grey seal to avoid the survey area if required. The S. I. survey is also anticipated to be relatively short term (over a four-month period across the whole survey area in Irish and UK waters) and is transient, meaning exposure to underwater noise will be short-term, both spatially and temporally. Therefore, short-term localised disturbances, such as the S. I. surveys proposed here would have negligible to no impact on bottlenose dolphins or grey seals in the SAC.

Conclusion

Consequently, it is considered that targets, with respect to Conservation Objectives, indicated in Table 14 would not be significantly affected and that there would be **no AEoI** on bottlenose dolphin and grey seal in Cardigan Bay SAC due to the S. I. surveys.

Mitigation

Although it has been assessed there would be no AEoI on Cardigan Bay SAC, to further reduce any risk of potential injury to individuals, mitigation measures will be applied to reduce the impact of underwater noise and vibration on porpoise. Geophysical acoustic survey guidance, as specified in 'JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys' (2017) and will be followed during all impulsive surveys (including: SBP). These guidelines specify procedures including, but not limited to a 'soft start' procedure which shall be used to ensure that any animals in the vicinity will have chance to leave. With

the implementation of these guidelines there will be a negligible risk of disturbance to marine mammals (see Appendix 1 for Marine Mammal Observer protocol as recommended in the JNCC guidance).

Pembrokeshire Marine SAC (UK0013116)

This site was screened into AA due to a possible LSE on grey seal from underwater noise and vibration.

The Conservation Objectives for grey seal in Pembrokeshire Marine SAC, and individual attributes with targets are provided in Table 15.

Table 15. Conservation Objective information for grey seal in Pembrokeshire Marine SAC (UK0013116; NRW, 2018c).

Conservation Objective information for: Pembrokeshire Marine SAC (UK0013116)			
[1364] Grey seal			
To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for grey seal in UK waters, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Population	Size, structure, production and physiological health.	The population is maintaining itself on a long-term basis as a viable component of its natural habitat.	As part of this objective, it should be noted that for grey seal, contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression. Grey seal populations should not be reduced as a consequence of human activity.
Range	Areas of the site which the population/individuals use.	The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.	As part of this objective, it should be noted that for grey seal, their range within the SAC and adjacent inter-connected areas is not constrained or hindered, there are appropriate and sufficient food

			resources within the SAC and beyond
Supporting habitats and species	Distribution and extent, structure, function and quality and prey availability and quality.	The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.	Not applicable.

Overall, it is considered highly unlikely there will be an AEoI of the population of grey seal within Pembrokeshire Marine SAC which is 143.8 km from the S. I. Survey Area. As mentioned previously sound attenuates increasingly from the source and, the individual would have to be extremely close to the source at the time of maximum output. If an individual were to be that close to the source, any event of injury would be to that sole individual and would not incur a population level effect as it is an extremely unlikely event. There is extensive suitable foraging and haul-out habitat elsewhere enabling grey seals to avoid the survey area if required. The S. I. survey is also anticipated to be relatively short (over a four-month period across the whole survey area in Irish and UK waters) and is transient, meaning exposure to underwater noise will be short-term, both spatially and temporally. Therefore, short-term localised disturbances, such as the S. I. surveys proposed here would have negligible to no impact on grey seals in the SAC.

Conclusion

Consequently, it is considered that targets, with respect to Conservation Objectives, indicated in Table 15 would not be significantly affected and that there would be **no AEoI** on grey seal in the Pembrokeshire Marine SAC due to the S. I. surveys.

Mitigation

Although it has been assessed there would be no AEoI on Pembrokeshire Marine SAC, to further reduce any risk of potential injury to individuals, mitigation measures will be applied to reduce the impact of underwater noise and vibration on grey seals. Geophysical acoustic survey guidance, as specified in 'JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys' (2017) and will be followed during all impulsive surveys

(including: SBP). These guidelines specify procedures including, but not limited to a 'soft start' procedure, which shall be used to ensure that any animals in the vicinity will have chance to leave. With the implementation of these guidelines there will be a negligible risk of disturbance to marine mammals (see Appendix 1 for Marine Mammal Observer protocols as recommended in the JNCC guidance).

Rockabill to Dalkey Island SAC (IE003000)

This site was screened into AA due to a possible LSE on harbour porpoise from underwater noise and vibration.

The Conservation Objectives for harbour porpoise for Rockabill to Dalkey Island SAC, and individual attributes with targets are provided in Table 16.

Table 16. Conservation Objective information for harbour porpoise in Rockabill to Dalkey Island SAC (IE003000) (NPWS 2014a).

Conservation Objective information for Rockabill to Dalkey Island SAC (IE003000)			
[1351] Harbour Porpoise			
To maintain the favourable conservation condition of harbour porpoise in Rockabill to Dalkey Island SAC, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Access to suitable habitat	Number of artificial barriers	Species range within the site should not be restricted by artificial barriers to site use.	Not applicable.
Disturbance	Level of impact	Human activities should not occur at levels that do not adversely affect the harbour porpoise community at the site.	Not applicable.

Overall, it is considered highly unlikely there will be an AEoI on the population of harbour porpoise within Rockabill to Dalkey Island SAC which is 43 km from the S. I. Survey Area. Harbour porpoise show evasion behaviour to vessel presence so the likelihood that individuals spend a prolonged period near the S.I. survey vessel is considered highly unlikely. If an individual were to be that close to the source, any event of injury would be to that sole individual and would not incur a population level effect as it is an extremely unlikely event. There is extensive suitable foraging habitat elsewhere in the Irish Sea and beyond enabling harbour porpoise to avoid the survey area if required. The S. I. surveys are also anticipated to be relatively short term (over a four-month period across the whole survey area in Irish and UK waters) and is transient, meaning exposure to underwater noise will be short-term, both spatially and temporally. Therefore, short-term localised disturbances, such as the S. I. surveys proposed here would have negligible to no impact on porpoise in the SAC.

Conclusion

Consequently, it is considered that targets, with respect to Conservation Objectives, indicated in Table 16 would not be significantly affected and that there would be **no AEol** on harbour porpoise in Rockabill to Dalkey Island SAC due to the S. I. surveys.

Mitigation

Although it has been assessed there would be no AEol on Rockabill to Dalkey Island SAC, to further reduce any risk of potential injury to individuals, mitigation measures will be applied to reduce the impact of underwater noise and vibration on porpoise. Geophysical acoustic survey guidance, as specified in 'JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys' (2017) and will be followed during all impulsive surveys (including: SBP). These guidelines specify procedures including, but not limited to a 'soft start' procedure which shall be used to ensure that any animals in the vicinity will have chance to leave. With the implementation of these guidelines there will be a negligible risk of disturbance to marine mammals (see Appendix 1 for Marine Mammal Observer protocols as recommended in the JNCC guidance).

Lambay Island SAC (IE000204)

This site was screened into AA due to a possible LSE on harbour seals and grey seals from underwater noise and vibration.

The Conservation Objectives for harbour seal and grey seal for Lambay Island SAC, and individual attributes with targets are provided in Table 17.

Table 17. Conservation Objective information for harbour seal and grey seal in Lambay Island SAC (IE000204) (NPWS 2014b).

Conservation Objective information for: Lambay Island SAC (IE000204)			
[1365] Harbour seal			
To maintain the favourable conservation condition of harbour seal in Lambay Island SAC, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Access to suitable habitat	Number of artificial barriers	Species range within the site should not be restricted by artificial barriers to site use.	Not applicable
Breeding behaviour	Breeding sites	Conserve the breeding sites in a natural condition.	Attribute and target based on background knowledge of Irish breeding populations,

Conservation Objective information for: Lambay Island SAC (IE000204)			
			review of data summarised by Summers <i>et al.</i> (1980), Harrington (1990), Lyons (2004) and unpublished NPWS records.
Moulting behaviour	Moult haul-out sites	Conserve the moult haul-out sites in a natural condition.	Attribute and target based on background knowledge of Irish populations, review of data from Lyons (2004), Cronin <i>et al.</i> (2004), and unpublished NPWS records.
Resting behaviour	Resting haul-out sites	Conserve the resting haul-out sites in a natural condition.	Attribute and target based on background knowledge of Irish populations, review of data from Lyons (2004) and unpublished NPWS records.
Disturbance	Level of impact	Human activities should occur at levels that do not adversely affect the harbour seal population at the site	Not applicable
[1364] Grey seal			
To maintain the favourable conservation condition of grey seal in Lambay Island SAC, which is defined by the following list of attributes and targets:			
Attribute	Measure	Target	Notes
Access to suitable habitat	Number of artificial barriers	Species range within the site should not be restricted by artificial barriers to site use.	Not applicable
Breeding behaviour	Breeding sites	Conserve the breeding sites in a natural condition.	Not applicable

Conservation Objective information for: Lambay Island SAC (IE000204)			
Moulting behaviour	Moult haul-out sites	Conserve the moult haul-out sites in a natural condition.	Attribute and target based on background knowledge of Irish populations, review of data from Lyons (2004), Cronin <i>et al.</i> (2004), and unpublished NPWS records.
Resting behaviour	Resting haul-out sites	Conserve the resting haul-out sites in a natural condition.	Attribute and target based on background knowledge of Irish populations, review of data from Lyons (2004) and unpublished NPWS records.
Disturbance	Level of impact	Human activities should occur at levels that do not adversely affect the harbour seal population at the site	Not applicable

Overall, it is considered highly unlikely there will be an AEoI of the populations of harbour seal and grey seal within Lambay Island SAC which is 48.3 km from the S. I. Survey Area. As mentioned previously sound attenuates increasingly from the source and, the individual would have to be extremely close to the source at the time of maximum output. If an individual were to be that close to the source, any event of injury would be to that sole individual and would not incur a population level effect as it is an extremely unlikely event. There is extensive suitable foraging and haul-out habitat elsewhere enabling harbour seals and grey seals to avoid the survey area if required. The S. I. survey is also anticipated to be relatively short term (over a four-month period across the whole survey area in Irish and UK waters) and is transient, meaning exposure to underwater noise will be short-term, both spatially and temporally. Therefore, short-term localised disturbances, such as the S. I. surveys proposed here would have negligible to no impact on harbour seals or grey seals in the SAC.

Conclusion

Consequently, it is considered that targets, with respect to Conservation Objectives, indicated in Table 17 would not be significantly affected and that there would be **no AEoI** on harbour seal and grey seal in Lambay Island SAC due to the S. I. surveys.

Mitigation

Although it has been assessed there would be no AEol on Llyn Peninsula and the Sarnau SAC, to further reduce any risk of potential injury to individuals, mitigation measures will be applied to reduce the impact of underwater noise and vibration on porpoise. Geophysical acoustic survey guidance, as specified in 'JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys' (2017) will be followed during all impulsive surveys (including: SBP). These guidelines specify procedures including, but not limited to a 'soft start' procedure which shall be used to ensure that any animals in the vicinity will have chance to leave. With the implementation of these guidelines there will be a negligible risk of disturbance to marine mammals (see Appendix 1 for Marine Mammal Observer protocols as recommended in the JNCC guidance).

7.2 AA Conclusion

The appropriate assessment has concluded, based on consideration of the proposed works, no Adverse Effect on Integrity (AEol) for those European Sites screened into Stage 2 of the assessment.

8. In-combination Assessment

8.1 Projects considered

The identification of plans and projects to include in the in-combination assessment is based on:

- Approved plans or projects with relevant ongoing activities;
- Approved but as yet unconstructed projects; and
- Projects for which an application has been made, are currently under consideration and will be consented before the proposed works begin.

To identify relevant projects or plans, a combination of the NRW Public Register and Data Map Wales were used. Three projects were identified that are within the vicinity (10 km) of the works and have the potential to have an in-combination effect with the work activities. Distances to the proposed works are provided within brackets:

- DML2278 – Maintenance Dredging at Holyhead Harbour (3.47 km)
- Morlais West Anglesey Demonstration Zone (4.27 km)
- DML2163 – Holyhead Waterfront Regeneration Scheme (4.84 km)

DML2278 – Maintenance Dredging and disposal at Holyhead Harbour (3.47 km)

Maintenance dredging and subsequent disposal at Holyhead Harbour is planned to take place periodically from 2023 to 2028 with an estimated maximum dredge area of 99,000 m² per year. Accumulated silt will be removed from the Inner Harbour, Terminal 3 and 5, and deep-water berth areas and will be disposed of approximately 16 km northwest of the harbour (NRW 2023a).

The schedule for dredge disposals is unknown, however, given the nature of the proposed S. I. works and the temporary and short-term duration, it is concluded that there is no potential for the works and activities at the dredge disposal site and proposed S. I. works to have in-combination effects on the European Sites and therefore there would be no LSE.

Morlais West Anglesey Demonstration Zone (4.27 km)

The Morlais project is a tidal stream renewable energy development located on the west coast of Holy Island, Anglesey. The project covers 35 km² of the seabed and has the potential to generate 240 MW of electricity. The tidal energy devices will be connected to the mainland via a maximum of nine sub-sea cables and energy will be transported from the Morlais site

landfall locations at Penrhos fell to the National Grid at Holyhead (Morlais 2023). The marine licence for the Morlais project was issued in December 2021 and is currently in the construction phase, with all cables now installed (Morlais 2023).

The schedule for construction and operation is unknown, however, given the nature of the proposed S. I. works and the temporary and short-term duration, it is concluded that there is no potential for the works and activities at the Morlais project and proposed S. I. works to have in-combination effects on the European Sites and therefore there would be no LSE.

DML2163 – Holyhead Waterfront Regeneration Scheme (4.84 km)

Conygar Holyhead Ltd. has proposed the Holyhead Waterfront Regeneration Scheme within the new Holyhead Harbour near Porth-y-felin. The scheme involves a new breakwater and revetment, land reclamation, dredge and disposal activities, and the construction of new marine infrastructure including 250 finger berths, walkways and floating pontoon (Royal Haskoning DHV 2021). The Environmental Statement for this development was submitted in 2010 and the Marine Licence was approved in February 2023 (NRW 2023b).

The schedule for the proposed waterfront regeneration scheme is unknown, however, given the nature of the proposed S. I. works and the temporary and short-term duration of the works, it is concluded that there is no potential for the works and activities at the Regeneration scheme and S. I. works to have in-combination effects on the European Sites and therefore there would be no LSE.

8.2 In-combination assessment conclusion

The in-combination assessment of potential effects arising from identified projects, in-combination with the proposed works, concluded that the S. I. work activities would not act in-combination to give rise to an LSE on any European Sites.

9. Conclusions

The work activities required for site investigation works, including geotechnical and geophysical surveys, to investigate the feasibility of constructing a new subsea telecoms cable system, SOBR1, have the potential to interact with European and Ramsar Sites. This assessment identified protected sites in the vicinity of the proposed works that could potentially be influenced by effects arising from the works.

Consideration was given to the relevant guidance issued by a number of governmental, statutory and industry bodies including, but not limited to, Welsh Government and NRW guidance on Habitat Regulations Assessments, NRW online guidance on HRA in the marine licensing process, Natural England's Advice on Operations, and NRW's position on the use of Marine Mammal Management Units for screening and assessment in Habitats Regulations Assessments for Special Areas of Conservation with marine mammal features. Following reference to this guidance, the following impact pathways were assessed:

- Underwater noise and vibration
- Collision risk
- Pollution
- Visual and noise disturbance
- Reduction in prey availability

The test for LSE carried out on SACs concluded that there is potential for LSE from underwater noise and vibration impacts on the marine mammal features of the following sites:

- North Anglesey Marine / Gogledd Mon Forol SAC (UK0030398)
- Pen Llyn a'r Sarnau/ Llyn Peninsula and the Sarnau SAC (UK0013117)
- West Wales Marine / Gorllewin Cymru Sarnau SAC (UK0030397)
- Cardigan Bay/ Bae Ceridigion SAC (UK0012712)
- Pembrokeshire Marine/ Sir Benfro Forol SAC (UK0013116)
- Rockabill to Dalkey Island SAC (IE003000)
- Lambay Island SAC (IE000204)

The test for LSE carried out on SPAs and Ramsar sites concluded that there is no potential for LSE from the proposed works.

As such, the SAC sites listed above were taken through to Stage 2 Appropriate Assessment for consideration of adverse effects on site integrity (AEoI).

The Appropriate Assessment considered the potential effects on site integrity and concluded no AEoI without the requirement for mitigation measures. However, JNCC guidelines for geophysical surveys shall be followed to reduce the risk of adverse effects on individual marine mammals.

The in-combination assessment concluded no LSE or AEoI on any of the sites resulting from a combination of the projects considered.

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Appendix 1 Geophysical surveys operational guidance (JNCC, 2017)

1. Qualified and experienced marine mammal observers (MMO) and passive acoustic monitoring (PAM) operators shall be appointed to monitor for marine mammals and to log all relevant events using standardised data forms. Sufficient personnel should be employed considering the size and location of the survey, the number of line changes and soft starts required, the duration of daylight hours and the requirement for night-time operations to prevent observer fatigue and to meet health and safety requirements.
2. 'The MMO/PAM operative will monitor the agreed mitigation zone and advise if any marine mammals are within it. The standard radius of the mitigation zone is 500m, estimated from the centre of the airgun array or noise source location (noting comments in 0). If the size of the mitigation zone is adjusted for any reason, this will be stipulated within the survey consent or licence conditions.'
3. 'If marine mammals are detected within the mitigation zone during the pre-shooting search (visually or acoustically), the soft-start must be delayed until their passage, or the transit of the vessel, results in them being outside of the mitigation zone. There must be a minimum of a 20-minute delay from the time of the last detection within the mitigation zone and the commencement of the soft-start, to allow animals unavailable for detection (i.e. not re-surfacing in that time) to have moved outside of the mitigation zone. A full soft-start must be undertaken after any delay due to the presence of marine mammals within the mitigation zone. If marine mammals are detected within the mitigation zone whilst the airguns are firing, either during the soft-start procedure or when at full power, there is no requirement to stop firing.'

Section 2: Mitigation

2.1 Standard Airgun Mitigation Procedures

The following guidelines apply to all geophysical surveys that use airguns.

2.1.1 Pre-shooting search

Clear communication channels between the MMO/PAM operator and relevant crew must be established prior to the commencement of any operations. The MMO/PAM operator must be aware of the timings of the proposed operations. The crew must inform the MMO/PAM operators (or nominated lead) sufficiently in advance of airgun firing so that a full pre-shooting search can be completed prior to the soft start commencing.

Location of MMO/PAM

All monitoring (visual and PAM) should be undertaken from the source vessel (where the noise source is deployed from), unless alternative arrangements have been agreed with the Regulator. The MMO should be positioned on a high platform with a clear view of the horizon,

mitigation zone and ahead of the vessel. The PAM operator should be positioned in the most appropriate location to allow them to monitor the PAM equipment for acoustic detections and maintain contact with both the MMO and relevant crew, for both mitigation purposes and ensuring the PAM equipment is deployed correctly.

Mitigation zone

The MMO/PAM operative will monitor the agreed mitigation zone and advise if any marine mammals are within it. The standard radius of the mitigation zone is 500m, estimated from the centre of the airgun array or noise source location (noting comments in 0). If the size of the mitigation zone is adjusted for any reason, this will be stipulated within the survey consent or licence conditions.

Duration of search

The MMO must monitor the mitigation zone for the full duration of the pre-shooting search and soft-start procedure. Where PAM is being used in conjunction with or in place of visual surveys, acoustic monitoring must also occur for the full duration of the pre-shooting search and soft-start procedure. Once the soft start has ended and data acquisition begins, monitoring can cease.

The duration of the pre-shooting search is determined as follows:

- Waters less than 200m deep: 30 minutes prior to the use of any airguns.
- Waters greater than 200m deep: 60 minutes prior to the use of any airguns.

The longer search period is to allow for deep diving species (e.g. sperm whale and beaked whale) which are known to dive for longer than 30 minutes. PAM may also be required on all pre-shooting searches in deeper waters (i.e. to complement visual surveys) to increase the potential to detect species with long dive times.

Due to the longer pre-shooting search time required in deeper waters, pre-shooting searches can commence before the end of a preceding survey line (whilst the airguns are still firing) IF line changes will take less time than the pre-shooting search and soft-start combined (i.e. 80 mins).

2.1.2 If marine mammals are detected within the mitigation zone

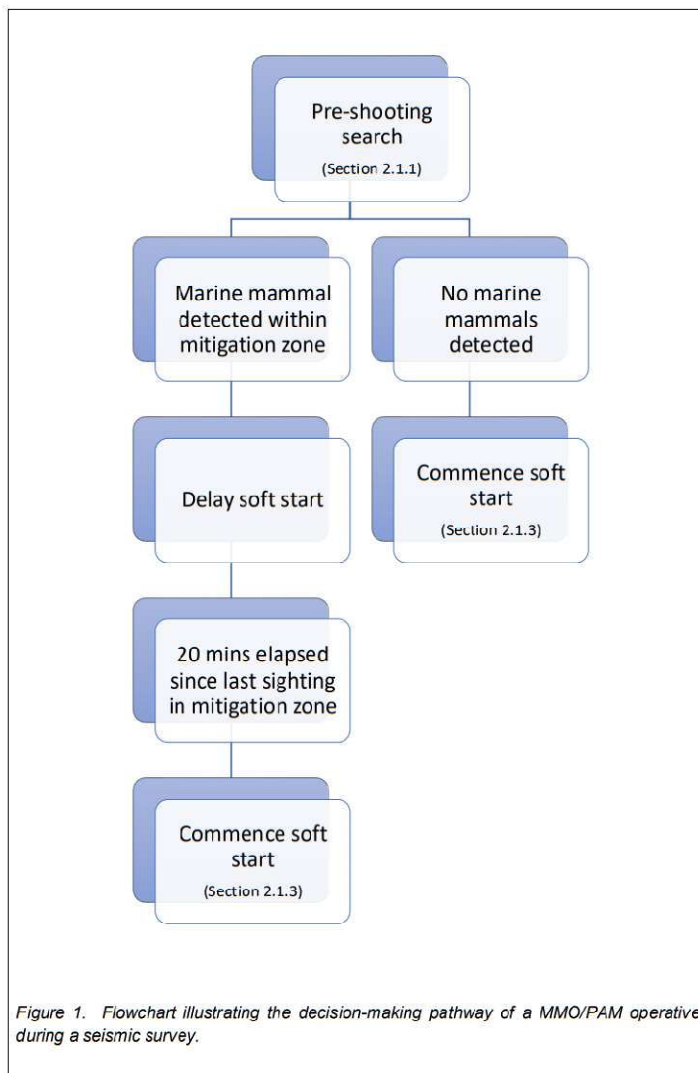
If marine mammals are detected within the mitigation zone during the pre-shooting search (visually or acoustically), the soft-start must be delayed until their passage, or the transit of the vessel, results in them being outside of the mitigation zone. There must be a minimum of a 20-minute delay from the time of the last detection within the mitigation zone and the commencement of the soft-start, to allow animals unavailable for detection (i.e. not re-surfacing in that time) to have moved outside of the mitigation zone.

A full soft-start must be undertaken after any delay due to the presence of marine mammals within the mitigation zone.

In situations where seal(s) are congregating around a fixed platform within a survey area, the soft-start should commence at a location at least 500m from the platform.

If marine mammals are detected within the mitigation zone whilst the airguns are firing, either during the soft-start procedure or when at full power, there is no requirement to stop firing.

Figure 1 below illustrates a typical seismic survey with decision making pathways in the event a marine mammal is detected.



2.1.3 Soft-start

Two criteria define the standard duration of a soft start:

- From the start of the soft-start until full operational power: minimum of 20 minutes;
- From the start of the soft-start until the start of the survey line: maximum of 40 minutes.

One exception to these criteria is for surveys where the maximum airgun volume is <180 cubic inches, in which case:

- From the start of the soft-start until full operational power: minimum of 15 minutes;
- From the start of the soft-start until the start of the survey line: maximum of 25 minutes.

Regardless of duration, power should be built up gradually, in uniform stages from a low energy start-up (e.g. increasing the number of airguns starting with the smallest airgun in the array or increasing the airgun pressure).

There should be a soft-start every time the airguns are scheduled to be used, the only exceptions being for certain types of airgun testing, and the use of a 'mini-airgun' (single gun volume equal to or less than 10 cubic inches). Mini airguns do not require a soft start.

Surveys operations should be planned to avoid unnecessary firing at operational power before commencement of a survey line and to time operations to commence data collection as soon as possible once full operational power is achieved.

2.1.4. Line changes

Seismic data is usually collected along predetermined survey lines. Line change or line turn is the term used to describe the activity of turning the vessel at the end of one survey line prior to commencement of the next.

The following procedures depend on the duration of the line change. If an operator determines that an effective line change cannot be achieved using these procedures, then they should contact the Regulator and appropriate SNCB(s) at the earliest possible opportunity to discuss a proposed alternative. Details of any agreed alternative procedures should be described during the application process and reiterated, if appropriate, in the survey consent or licence conditions.

One example of airgun use that does not require a line change is Vertical Seismic Profiling (VSP), a technique where measurements are made at a series of depths in the wellbore using geophones inside the wellbore and an airgun source at the surface near the well. In this instance, the breaks in operations required to reposition geophones are treated in the same manner as line changes.

If monitoring operations are being undertaken using PAM and difficulties are encountered when deploying the PAM equipment, the line changes should be extended to allow the full pre-shooting search and soft start to be completed using PAM.

a) If line changes are expected to take longer than 40 minutes:

If line changes (or geophone repositioning) are expected to take longer than 40 minutes, regardless of airgun volume:

- Firing is to be terminated at the end of the survey line (or during geophone repositioning);
- A pre-shooting search is to be undertaken during the scheduled line change (or geophone repositioning);
- The soft-start is to be delayed if marine mammals are seen within the mitigation zone during the pre-shooting search; and
- A full 20-minute soft-start is to be undertaken before the start of the next line or VSP data collection.

Most seismic surveys with airgun array volumes of 500 cubic inches or more and extensive hydrophone arrays are not able to complete their line changes within 40 minutes (Stone, 2015b) and should therefore follow the procedures outlined above.

b) If line changes are expected to take less than 40 minutes:

If line changes (or geophone repositioning) are expected to be completed within 40 minutes, regardless of airgun volume:

- Airgun firing can continue during the line change only if power is reduced to 180 cubic inches (or as close as is practically feasible) at standard pressure. Airgun volumes of less than 180 cubic inches can continue to fire at their operational volume and pressure; AND
- The Shot Point Interval (SPI) is increased to provide a longer duration between shots, with the SPI not to exceed 5 minutes; AND
- The power is increased and the SPI is decreased in uniform stages during the final 10 minutes of the line change (or geophone repositioning), prior to data collection recommencing (i.e. a form of mini soft start).

If the above is not practical, and an alternative procedure has not been agreed with the Regulator, then airgun firing should be terminated and a pre-shooting search and soft-start implemented prior to the start of the next line.

2.1.5 Airgun testing

Airgun tests may be required to trial new equipment or to test damaged or misfiring airguns following repair. Individual airguns or several airguns may need testing and the airguns may

also be tested at varying power levels. The following guidance is provided to clarify when a soft-start is required for airgun testing:

- If the intention is to test a single airgun, a soft-start is not required.
- If the intention is to test multiple airguns, a soft-start is required. This should be carried out over a time period proportional to the number and/or volume of guns being tested and should not exceed 20 minutes in duration. Airguns should be tested in order of volume, smallest first.
- A pre-shooting search must be undertaken before any instances of airgun testing.

Where feasible, it is recommended that airgun testing is incorporated into the soft start procedure and conducted before the start of a survey line to reduce the total amount of noise being introduced into the marine environment.

2.1.6 Undershoot operations

The MMO/PAM operatives should be located on the source vessel to ensure they are close enough to the airguns to effectively monitor the mitigation zone. If this is not possible, e.g. for logistical or health and safety reasons, the operator should explain this during the application process and suggest and agree any alternative mitigation arrangements with the Regulator.

A pre-shooting search and soft-start procedure must be followed prior to undertaking all undershoot operations.

2.1.7 Breaks in operations

Unplanned breaks: This refers to instances where the airguns cease firing unexpectedly during data acquisition, e.g. a technical problem or breakdown. In such circumstances, it is imperative the MMO/PAM operatives begin to monitor the mitigation zone as quickly as possible after an unplanned break has occurred.

- **Unplanned breaks of less than 10 minutes:** If the airguns can be restarted and data acquisition resumed in less than 10 minutes, there is no requirement for a soft-start and firing can recommence at the same power level as at prior to the break (or lower), provided no marine mammal(s) have been detected in the mitigation zone during the breakdown period.

If a marine mammal is detected in the mitigation zone during the breakdown period, the MMO/PAM operative will advise to delay recommencement of the airgun firing until their passage, or the transit of the vessel, results in the marine mammals being outside of the mitigation zone. There must be a minimum of a 20-minute delay from the time of the last detection within the mitigation zone and a soft-start must then be undertaken, as described in Section 2.1.3.

- **Unplanned breaks of longer than 10 minutes:** If it takes longer than 10 minutes to restart the airguns, a full pre-shooting search and soft-start should be carried out before the survey re-commences. If an MMO/PAM operative has been monitoring during the breakdown period, this time can contribute to the pre-shooting search time (30 or 60 minutes as appropriate).

If the breakdown occurs at night or during daylight conditions not conducive for a visual search, the mitigation zone should be monitored as described above using PAM. If PAM is not available, the survey must be delayed until conditions are suitable for visual observations.

Planned breaks: If breaks in data acquisition other than during a line change are required (e.g. to avoid a structure), these should be considered within the application to allow the Regulator and SNCB to fully understand the survey procedure.

The same procedures as above (for unplanned breaks) can be applied. However, if the planned break will be for less than 10 minutes, the MMO/PAM operatives **must** begin monitoring 20 minutes prior to the planned break and continue for the duration of the break.

Appendix 2 – Survey Vessels and Equipment

The Roman Rebel

The Roman Rebel is a purpose-built survey platform and is considered a top-of-the line vessel for its class. This vessel's unique design enables this boat to provide the performance of a much larger survey vessel in a smaller, more agile hull. She is a purpose-built survey platform with a semi-SWATH (Small Waterplane Area Twin Hull) hull design that optimises stability. The survey equipment plan essentially enables this vessel to be operated as two identical, harmonised platforms during survey work, ensuring the most productive hydrographic data collection while maintaining precision and efficiency.



Roman Rebel

Vessel Data (v2)



General

Builder:	Socarenam Boulogne, France
Designer:	Bureau Mauric, Marseilles
Launched:	2014
Length:	27.5 m
Beam:	10.0 m
Draught:	3.5 m
Tonnage:	134 GT
Ops Code:	UK MCA SCV Category 1 (150 miles)
Class:	Lloyd's Register 100A1SSC Catamaran, G6, DP1
Flag:	UK
Previous name:	Bibby Athena

Propulsion

Main:	2 x Cummins KTA19 M3 447 kW each (600 hp) marine diesels
Main Propellers:	5 blade fixed pitch
Main Gearbox:	MG516C twin disk hydraulic gearboxes
Survey:	2 x Schottel SPJ57 azimuth pump jets 175 kW (235 hp)
Bow Thrusters:	2 x Schottel SPJ15 azimuth pump jets 60 kW (80 hp)
Max speed:	12 knots
Cruising speed:	10 knots
Survey speed:	3.5 – 6.0 knots

Generators

Main:	2 x Scania DI13-074M (340 kVA each)
Harbour:	1 x Cummins Onan 35 kVA
Deck Connection:	1 x 175 kVA and 1 x 50 kVA

Manning and Endurance

Berths:	16
Safe manning:	5
Endurance:	10 days (with 16 crew)

Capacities

Gas oil:	24 m ³
Fresh water:	8 m ³
Water maker:	2 m ³

Fuel Consumption

Transit:	2.5 m ³ · day ⁻¹
Survey:	1.2 m ³ · day ⁻¹
DP:	1.8 m ³ · day ⁻¹

Nav aids

Radar:	2 x 94m Furuno FAR 2117 Black Box
Autopilot:	Navico AP50 with remote control
ECDIS:	Navmaster
AIS:	Furuno FA150
dGPS:	C&C Tech C-Nav 3050 and Furuno GP150
Echosounder:	Furuno FE700
Heading INS Gyro:	iXBlue Quadrans
Secondary Heading:	2x iXBlue Hydrans
Speed log:	Skipper Electromagnetic
Navtex:	Furuno700B
Weather:	2 x Furuno WS200
VHF:	2x Icom 603 DSC
MF:	Furuno FS1570
Sat Comms:	Furuno 250 Fleet Broadband; Furuno Felcom 15 Sat C
GNSS:	C-NAV and Hemisphere

Dynamic Positioning (DP1)

System:	Sirehna EasyDP BV - AM/AT
Modes:	Station keeping, ROV follow, slow speed line keeping, high speed line keeping, Auto heading
Ref Sensors:	2 x dGPS, 2 x MRU (Hydrans and Quadrans), dual axis log, 2 x wind sensors, Sonardyne Mini-Ranger 2 USBL acoustic navigation system

Roman Rebel

Vessel Data (v3)



Deck Equipment

Crane:	Palfinger PK23500-M, 5,450 kg at 4.2 m, 8 m reach
Crane remote:	Full function radio control
A-Frame:	Hydraulic 8,000 kg SWL with 6.5m deck clearance
A-Frame outriggers:	Full beam width for towing geophysical sensors
Lifting winch:	Hydraulic 8,000 kg line pull
Moonpool:	2.05 m x 2.30 m central moonpool
Main Survey Winch:	MacArtney "Cormac" 4 1,500 m of 8.2 mm coax cable
Secondary survey winch:	2x STR ESW-1500 600 m of 11.4 mm coax cable
Sonar well:	2x 600 mm x 540 mm
USBL well:	310 mm diameter
Capstan:	2 x deck mounted 2000 kg line pull

Survey Positioning

GNSS 1:	C&C Tech C-Nav 3050
GNSS 2:	Hemisphere R330
INS:	2x iXBlue Hydrans

Underwater Positioning

USBL transceiver:	Sonardyne HPT 3000 ("Mini Ranger 2")
Surface unit:	Sonardyne Hub
Transponder:	Sonardyne WSM 6+

Safety

Liferaft capacity:	2x 16 man
Lifejackets:	16x emergency; 8x deck work
Survival suits:	16x neoprene immersion suits
Emergency positioning:	EPIRB 406 kHz
Other:	2x SAR transponders

Multibeam Echosounder

Sonar heads:	2x Teledyne SeaBat T50-R (total 2,048 beams per ping)
Processor:	2x Teledyne Reson T50 IDH processor
SV sensor:	2x Reson SVP-70

Sub-Bottom Profilers

Pinger Transducer:	4x Neptune T335
Parametric Transducer:	Innomar Medium-100; 2-22 kHz secondary frequencies; vertical resolution better than 5 cm
Surface unit 1:	Kongsberg Geoacoustics Geopulse 5430A
Surface unit 2:	2x Coda DA4G Acquisition Unit - Simultaneous A/D System
Surface unit 3:	Innomar Medium topside

Side-Scan Sonar

Towfish:	EdgeTech 4205
Processor:	EdgeTech 701-DL

Magnetometers

Magnetometer:	Geomatrix G-882
TVG frames:	Geomatrix carbon fibre with telemetry
Gradiometer setups:	up to 3x 2-sensor TVG frames (6 sensors); up to 3x EIVA 4-sensor scanfish (12 sensors)

Deck space

Available:	7 m x 5 m (35 m ²)
Surface:	wooden planks
Typical uses:	ROV LARS systems; shallow coring and grabs; 20' storage container

Roman Rebel
Vessel Data (v3)

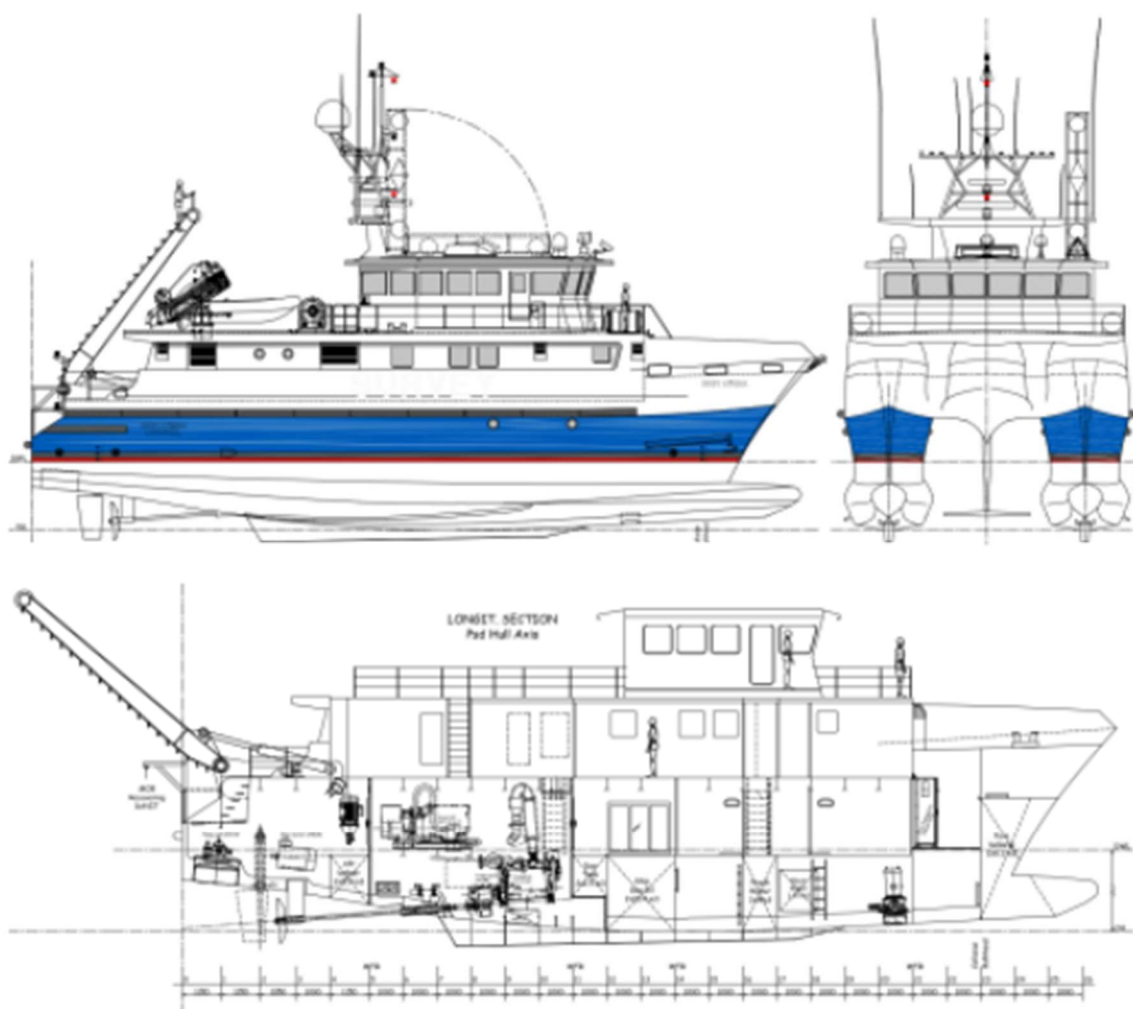


Specifications

Name:	Roman Rebel
Call Sign:	2ICAS
Lloyd's Register	Oceanographic Survey
Class:	Vessel, DP(AM)
IMO Number:	9714824

Inquiries

Contact:	Jared Peters
Email:	info@greenrebel.ie



The Lady Kathleen

The Lady Kathleen is a state-of-the-art 14 m survey vessel that provides a stable platform for reliable, cutting-edge sensor deployment. The vessel is purpose-built for hydrographic and geophysical data acquisition. She is a cutting-edge survey platform with exceptional manoeuvrability both at low and high speed and can conduct nearshore work in a wide range of water depths from 100 m. With top speeds of 25 knots, Lady Kathleen can get to site fast and brings a fuel consumption of 10 L per hour on survey operations.



LADY KATHLEEN

Technical Specifications

General Vessel Information		Propulsion & Generator	
Builder:	Blyth Workboats	Main Engines:	Twin Cummins QSC8.3
Designer:	Blyth Workboats	Gearbox:	ZF with PTO
Launched:	2021	Generator:	Fisher Panda 8KW
Length:	14 m	Max Speed:	25 knots
Beam:	5 m	Cruise:	15 knots
Draught:	1.4 m	Survey:	3.5 – 6 knots
Flag / License:	Irish – MSO P5 30nm	Prop(s):	Twin 5 blade

General Safety Information		Survey Equipment	
Duration:	12 hour Day or Night	MBES:	Teledyne SeaBat T50-R
Safe Manning:	Master & Deckhand	Processor:	Teledyne Reason T50 IDH
Limitations:	30nm to sea	SV Sensor:	Reason SVP-70
Liferaft:	1x 8man Port & Stb	SSS:	Edge Tech 4205
Lif jackets:	8x Solas	Magnetometer:	Geomatix G-882
EPIRB:	Yes	Gradiometers:	2-sensor TVG Frame
SART:	Yes	Parametric SBP:	Innomar SES-2000

Deck Equipment		Navigation Equipment	
Winch 1:	1T Hydraulic Tugger Winch	Plotter:	2x Axiom Pro RVX 16"
Winch 2:	STR ESW 500 – 500m Coax	Auto Pilot:	Simrad AP70
Winch 3:	STR ESW 500 – 500m Coax	AIS:	Class A
A Frame:	Hydraulic 1T SWL	DSC VHF:	2x Icom GM600 GMDSS
Moonpool:	700mm x 700mm	DSC MF/HF:	1x Icom GM800 GMDSS
Side Pole:	SS Duel Mount	Navtex:	Yes
Side Winch:	1x 1T Capstan	Internet:	4G Broadband

USBL:	GAPS M5	Navigation:	QPS QINSy 9.5.0
SV Profiler:	Valeport Swift (x2)	SV Profiler:	Valeport Swift (x2)
Attitude/Heading:	Applanix Integrated INS	Attitude/Heading:	Applanix Integrated INS
GNSS:	Applanix Integrated INS	GNSS:	Applanix Integrated INS
	Trimble AT1675-540TS (x2)		Trimble AT1675-540TS (x2)

Hydrographic Equipment

The Roman Rebel runs a dual-head MBES system driven by dual SeaBat RSP+ processors. A multi-unit Inertial Navigation System (INS) feeds positional data to the MBES (and other geophysical systems). An extremely dense array of 2,048 sound beams per ping is produced by two Teledyne SeaBat T50-R (TC2181 transmitter and EM2781 receiver) MBES sonar heads

that each use their own SeaBat RSP+ processing computer (Table 18). This setup maximises survey efficiency and precision.

Table 18. Teledyne Seabat T50-R MBES specifications.

Characteristic	Teledyne T50 (EM7218)
Low frequency (kHz)	190
High frequency (kHz)	420
Frequency adjustability	10 kHz steps
Swath coverage (°)	170
Beam width (° at 400 kHz)	0.5
Shortest pulse (µs)	15
Max depth at low frequency (m)	575
Max ping rate (pings/s, i.e. Hz)	66
Beams/swath	1,024 (per head, 2,048 per swath)

Local sound velocity will be recorded continuously at the surface (at the MBES heads using Teledyne SVP70s) and periodically through the water column. Water column measurements will be collected using a Valeport Swift prior to the initiation of data acquisition operations and whenever significant changes are observed in the surface sound velocity. Equipment specifications are provided in Table 19.

Table 19. SVP Specifications

Device	Deployment	Depth rating (m)	Resolution (m/s)	Accuracy (m/s)
Teledyne SVP70	Fixed at heads	6,000	0.01	± 0.05
Valeport Swift	Dips	500	0.001	± 0.02

Sub-bottom profiler (SBP)

A hull-mounted Innomar Medium-100 parametric SBP system is used from the Roman Rebel (Figure 4). This parametric system generates two simultaneous sound signals that create a controlled, subsequent signal (secondary frequency) that yields better penetration than comparable SBPs (Table 20). Data products can reach 70 m of penetration with vertical resolutions better than 5 cm.

Table 20. Innomar Medium-100 SBP specifications.

Characteristic	Innomar Medium - 100
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Primary frequencies	Low frequency (kHz)	85
	High frequency (kHz)	100
Secondary frequencies	Low frequency (kHz)	2
	High frequency (kHz)	22
Source level (dB// μ Pa re 1 m)		247
Maximum depth (m)		2,000
Penetration in mud (m)		70
Vertical resolution (cm)		Better than 5

Side-Scan Sonar (SSS)

Green Rebel proposes the use of a motion tolerant, multipulse EdgeTech 4205 SSS system capable of simultaneous dual-frequency operation. Variable signal frequencies allow range to be balanced with resolution to fit local conditions and survey needs while motion tolerance and multi-pulse capabilities ensure quality in demanding conditions. This unit is depth rated for use in up to 2,000 meters of water. Details are provided in Table 21.

Table 21. EdgeTech 4205 SSS Specifications.

Characteristic	Edgetech 4205
Low frequency (kHz)	230
High frequency (kHz)	850
Frequency adjustability	Dual
Horizontal beam width	0.70° @ 120 kHz; 0.44° @ 230 kHz; 0.28° @ 410 kHz; 0.26° @ 540 kHz; 0.23° @ 850 kHz
Best resolution across track (cm)	1
Worst resolution across track (cm)	8
Vertical beam width (°)	50
Towfish weight (kg in air)	52
Max depth (m)	2,000
Piggyback capabilities	Magnetometer or Gradiometer

Magnetometer

The Roman Rebel and Lady Kathleen will tow a single Geomatrix G-882 magnetometer piggybacked from the SSS towfish (Table 22). Height above seabed during survey operations is determined by the height-to-range ratio required by the SSS.

Table 22. Geomatrix G-882 Magnetometer Specifications.

Characteristic	Geomatrix G-88s
Operating principle	Self-Oscillating split beam Optically pumped Caesium Vapour cell
Typical sensitivity (nT)	0.02 (at 0.1 samples/second)
Heading error (nT)	< 1
Absolute accuracy (nT)	< 3
Power supply (VDC)	24 - 32
Max depth (m)	2,600
Operating zones	The earth's field vector should be at an angle of greater than 6° away from the sensor's equator and greater than 6° away from the sensor's long axis.

Surface positioning

The Roman Rebel uses two GNSS systems to ensure redundancy and enable cross-checking and validation of positioning data (Table 23). The primary system is provided by Oceaneering International Services Limited and consists of a C-Nav 3050 receiver using C-NavC2 corrections. The C-Nav 3050 receiver offers global decimetre-level accuracy. The secondary system consists of a Hemisphere R330 receiver using Atlas corrections.

Table 23. GNSS Specifications

Receiver	Corrections	XY accuracy (m)	Z accuracy (m)
C-Nav 3050	SBAS, PPP, RTK	0.08	0.15
Hemisphere R330	L1/L2, RTK, SBAS	0.30	0.30

Underwater Positioning

Towed sensors will be tracked with a Kongsberg μ PAP 201-H USBL system. This system can track multiple targets at ranges of up to 4,000 m. The expected accuracy is 0.45%, range: $\pm$ 0.02 m (Table 24).

Table 24. USBL Specifications.

Characteristic	Specification
Model	μ PAP 201-H
Operational models	SSBL, LBL, and data telemetry

Inbuilt motion sensor	Seatex MRU-
Motion sensor accuracy	0.05°
Operating range	1 – 4,000 m
Angular accuracy	0.25°
Position accuracy	0.45% (1 Sigma, SNR > 20dB rel. 1μPa in bandwidth)
Transducer beam width	± 80°
Data telemetry	up to 2.5 kBit/s

Roman Rebel Geotechnical Survey Equipment

The geotechnical investigation aims to collect high-quality data using various methods including vibrocores, CPTs and grab samples. These data will be collected after the geophysical dataset, which will help inform sampling locations, and will be used to determine the geotechnical properties of the seabed along the three proposed cable routes. The information gathered will enable assessments of cable burial and help ensure a successful cable installation. Details of the proposed equipment are provided in the sections below.

Vibrocorer

The proposed FT0551 Vibrocorer has a high-power electric motor providing 75 kN total force and an increased vibratory amplitude due to improved power to weight ratio. A modular frame structure reduces the mobilisation time for cores of 1-9 m long. For the collection of samples across the cable routes, the vibrocorer will be configured for 3 m cores. Cores will be recovered in 1 m sections.

Cone-Penetration test (CPT)

The Geomil Manta 100DW allows in situ sediment property measurements to be conducted in a wide range of water depths, up to 1,500 m. The Manta-100 is also by far the most compact system in its class when transported. Umbilical and umbilical winch are also included to ensure power and communication with the vessel. Penetration speed is variable from 0 -80 mm/s and the Thrust capacity of 0 -100 kN help ensure appropriate penetration.

Seabed Sampling

A 1 x 0.1 m² Van Veen grab is proposed as the primary grab sampler for seabed sample collection. The Van Veen is ideal for taking samples in shallow to medium water depths, for biological, hydrological and environmental studies. The lead-weighted jaws close positively,

capturing the sample for secure recovery to the surface. The weights also ensure reliable operation in strong currents.

All sampling is logged during operations both on deck and independently in the laboratory. This allows quality control and cross-checking of operations on completion of the project. All sample containers are labelled with a clear pre-printed label describing the Client, location, replicate, sample type, operator, sample number code (the latter can be cross-referenced with log sheets to provide additional information on description, time, easting, northing, water depth etc.).

Lady Kathleen Equipment Overview

Hydrographic Equipment

The Lady Kathleen uses a single-head Teledyne T50-R MBES system (Table 25). An integrated Applanix OceanMaster Inertial Navigation System (INS) pairs positional data to the MBES data (and other geophysical data).

Table 25. Seabat T50-R MBES specifications

Characteristic	Teledyne T50 (EM7218)
Low frequency (kHz)	190
High frequency (kHz)	420
Frequency adjustability	10 kHz steps
Swath coverage (°)	170
Beam width (° at 400 kHz)	0.5
Shortest pulse (µs)	15
Max depth at low frequency (m)	575
Max ping rate (pings/s, i.e. Hz)	66
Beams/swath	1,024 (per head, 2,048 per swath)

Sub-Bottom Profiler (SBP)

A pole-mounted Innomar Standard parametric SBP system is used from the Lady Kathleen (Table 26). This parametric system generates two simultaneous sound signals that create a controlled, subsequent signal (secondary frequency) that yields better penetration than comparable SBPs. Data products can reach 40 m of penetration with vertical resolutions better than 5 cm.

Table 26. Innomar Medium-100 SBP specifications

Characteristic		Innomar Medium - 100
Primary frequencies	Low frequency (kHz)	85
	High frequency (kHz)	100
Secondary frequencies	Low frequency (kHz)	2
	High frequency (kHz)	22
Source level (dB// μ Pa re 1 m)		247
Maximum depth (m)		2,000
Penetration in mud (m)		70
Vertical resolution (cm)		Better than 5

Side-Scan Sonar (SSS)

Green Rebel proposes the use of a motion tolerant, multipulse EdgeTech 4205 SSS system capable of simultaneous dual-frequency operation (Table 27). Variable signal frequencies allow range to be balanced with resolution to fit local conditions and survey needs while motion tolerance and multi-pulse capabilities ensure quality in demanding conditions. This unit is depth rated for use in up to 2,000 meters of water.

Table 27. EdgeTech 4205 SSS specifications.

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Best resolution across track (cm)	1
Worst resolution across track (cm)	8
Vertical beam width (°)	50
Towfish weight (kg in air)	52
Max depth (m)	2,000
Piggyback capabilities	Magnetometer or Gradiometer

Magnetometer

The Roman Rebel and Lady Kathleen will tow a single Geomatrix G-882 magnetometer piggybacked from the SSS towfish (Table 28). Height above seabed during survey operations is determined by the height-to-range ratio required by the SSS.

Table 28. Geomatrix G-882 magnetometer specifications.

Characteristic	Geomatrix G-88s
Operating principle	Self-Oscillating split beam Optically pumped Caesium Vapour cell
Typical sensitivity (nT)	0.02 (at 0.1 samples/second)
Heading error (nT)	< 1
Absolute accuracy (nT)	< 3
Power supply (VDC)	24 - 32
Max depth (m)	2,600
Operating zones	The earth's field vector should be at an angle of greater than 6° away from the sensor's equator and greater than 6° away from the sensor's long axis.

Surface Positioning

GNSS corrections for the Lady Kathleen are provided by an Applanix OceanMaster system, which also incorporates an Inertial Measurement Unit (IMU). Corrections are made at 1 Hz intervals and achieve positional accuracies of <0.1 m (XY) and <0.2 m (Z). Real-time correction services are acquired through Marinestar satellite service or Trimble VRS Now RTK corrections.

Underwater Positioning

Towed sensors will be tracked with a Kongsberg µPAP 201-H USBL system. This system can track multiple targets at ranges of up to 4,000 m. The expected accuracy is 0.45%, range: ± 0.02 m. Specifications are provided in Table 24.