Appropriate Assessment Screening for the proposed Atlantic Marine Energy Test Site, Annagh, Co. Mayo

In accordance with the requirements of Article 6(3) of the EU Habitats Directive

Prepared by Simon Berrow (Irish Whale and Dolphin group), Louise Scally (MERC Consultants Ltd) and Jackie Hunt (ANIAR Ecology)
# TABLE OF CONTENTS

1. INTRODUCTION .................................................................................................................. 4
2. BACKGROUND ..................................................................................................................... 6
3. DESCRIPTION OF PROJECT ............................................................................................... 6
4. DEPLOYMENT METHODS ..................................................................................................... 7
   4.1 Wave Energy Converters ................................................................................................. 7
   4.2 Cable Connection .......................................................................................................... 7
5. ALTERNATIVE SITES .......................................................................................................... 8
6. THE EXISTING ENVIRONMENT .......................................................................................... 10
   6.1 Mullet/Blacksoo Bay Complex SAC ............................................................................... 10
       6.1.1 Site description ........................................................................................................ 10
       6.1.2 Assessment of likely effects .................................................................................. 11
   6.2 West Connacht Coast SAC ............................................................................................. 14
       6.2.1 Site description ........................................................................................................ 14
       6.2.2 Assessment of likely effects .................................................................................. 21
   6.3 Other NATURA 2000 Sites within 20 km of the AMETS ............................................. 27
       6.3.1 Site descriptions .................................................................................................... 27
       6.3.2 Use of AMETS by species of Special Conservation Interest connected to SPA’s .... 27
       6.3.3 Assessment of likely effects .................................................................................. 28
7. CUMULATIVE IMPACTS ....................................................................................................... 31
8. SCREENING MATRIX ........................................................................................................... 32
9. SCREENING STATEMENT AND CONCLUSIONS ................................................................. 35
10. STATEMENT OF NO SIGNIFICANT IMPACT .................................................................. 36
11. BIBLIOGRAPHY ............................................................................................................... 37

APPENDIX 1. RISK ASSESSMENT FOR QUALIFYING SPECIES ................................................. 39

   SPECIES INCLUDED: ........................................................................................................... 39
   ECOLOGICAL NEEDS .......................................................................................................... 39
   CURRENT RISKS ................................................................................................................... 39
   Use of AMETS by Geese and Swans .................................................................................. 39

   POTENTIAL INTERACTIONS WITH AND AMETS ............................................................ 40
   SUMMARY RISK OF IMPACT FROM AMETS AND RECOMMENDATIONS .................... 40

   SPECIES INCLUDED: ........................................................................................................... 40
   ECOLOGICAL NEEDS .......................................................................................................... 40
   CURRENT RISKS ................................................................................................................... 40
   Use of AMETS by Divers .................................................................................................... 40

   POTENTIAL INTERACTIONS WITH AND AMETS ............................................................ 40
   SUMMARY RISK OF IMPACT FROM AMETS AND RECOMMENDATIONS .................... 40

   SPECIES INCLUDED: ........................................................................................................... 40
   ECOLOGICAL NEEDS .......................................................................................................... 40
   CURRENT RISKS ................................................................................................................... 40
   Use of AMETS by Shore Birds ............................................................................................ 41

   POTENTIAL INTERACTIONS WITH WECs AND AMETS ................................................ 41
   SUMMARY RISK OF IMPACT FROM AMETS AND RECOMMENDATIONS .................... 41

   SPECIES INCLUDED: ........................................................................................................... 42
1. Introduction

This report provides a screening assessment in accordance with the provisions of Article 6(3) and (4) of the EU Habitats Directive 92/43/EEC for the proposed development of the Atlantic Marine Energy Test Site (AMETS), Belmullet, Co. Mayo. It outlines existing ecological information available for the site, proposed methods of construction and possible impacts should the project proceed.

The area under consideration is partially within the Mullet/Blacksod Bay Complex Special Area of Conservation (SAC) and proposed Natural Heritage Area (NHA), site code 000470 and partially within the proposed West Connacht Coast SAC, Site Code 002998.

A Screening Matrix, following the guidelines for Assessment of plans and projects significantly affecting Natura 2000 sites - Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC is provided in section 8 of this report, a Findings of No Significant Effects Report Matrix is provided in section 9 and a Screening Statement is presented in section 10 of this report.

The proposed project involves the development of the AMETS off Annagh Head, Belmullet, Co. Mayo. It includes the temporary placement of Wave Energy Convertors (WEC’s), subtidal and intertidal electrical cables and the construction of an associated onshore cable bay. Only the section of the intertidal electrical cable and underground cable bay fall within the Mullet/Blacksod Bay Complex SAC. However, a large section of the proposed site falls within the proposed West Connacht Coast SAC (see figure 1.1).

West Connacht Coast SAC consists of a substantial area of marine waters lying off the coasts of counties Mayo and Galway on the west of Ireland. Comprising two parts, in its northern component the site extends from the coastal waters off Erris Head westwards beyond Eagle Island and the Mullet Peninsula in County Mayo. From there it extends southwards immediately off the coast as far as the entrance to Blacksod Bay. In its southern component, the site stretches from Clare Island and the outer reaches of Clew Bay at Old Head and continues southwards off the Mayo coast to the Connemara coast near Clifden and Ballyconneely, County Galway. The waters of the West Connacht Coast represent an exceptional area of key conservation importance for bottlenose dolphin in Ireland.

Preliminary ecological assessments in the Annagh Bay area and surrounding hinterland were undertaken to assist in identifying the most appropriate routes, landfall locations and terrestrial facilities for the test site in order to minimise any environmental impact both alone and in a combination with other projects or plans. Full details of this selection process are documented in the Environmental Scoping Report (SEAI, 2010). Further ecological data for the site was subsequently gathered throughout 2009 and 2010 during a series of detailed baseline ecological studies of the open marine environment within the area currently defined for the West Connacht Coast SAC and within the section of the site within the Mullet/Blacksod Bay Complex SAC at Belerra strand and the surrounding hinterland. These surveys and studies were undertaken as part of an Environmental Impact Assessment (EIA) to inform an Environmental Impact Statement (EIS) for the wider site. Subsequent to the preparation of the EIA, and based on recommendations contained within it, further baseline surveys of the area were conducted in relation to marine mammals, birds and subtidal habitats throughout 2011 and 2012/13. The results of these surveys are detailed in Scally et al 2013.

This screening assessment draws on the information gathered for the Environmental Scoping Report, the EIS and the results of an additional two years of baseline data gathering and analysis for the site and refers to these documents throughout.

This screening assessment has been prepared by Simon Berrow (Irish Whale and Dolphin Group) Louise Scally (MERC Consultants Ltd) and Jackie Hunt (ANIIAR Ecology).
Figure 1.1. Ortho image of the AMETS showing the location of the proposed test areas, cable route and land fall in relation to surrounding SAC and SPA boundaries. © Bing Maps aerial, 2010 Microsoft Corporation and its data suppliers.

Adjacent SPA’s
Adjacent SAC’s

Figure 1.2. Schematic image of the AMETS test site.
2. Background

Ocean Energy, as a source of renewable energy, forms part of the Ocean Energy Strategy for Ireland and Ireland is ideally placed geographically to maximise potential wave energy utilisation. In recent years prototype devices, termed Wave Energy Convertors (WEC’s), to convert wave energy to electricity have been proposed and developed by a number of ocean energy companies, both internationally and also in Ireland. The Irish Government renewable energy programmes make projections for inclusion of various levels of electricity generation from wave power in future years. The potential exists to develop a significant ocean energy industry with sustainable long-term employment and expertise.

As part of the Ocean Energy Strategy an offshore Wave Energy Test Site, known as the AMETS, is proposed for the Belmullet area of County Mayo. The test site will provide a grid-connected national test facility, to which full-scale pre-commercial wave energy converters could be coupled during their final stages of pre-commercial development. The test site is an integral component of Ireland’s Ocean Energy Strategy and will facilitate testing and validation of various wave energy converters in an open ocean environment. It will be operational for a period of fifteen years and will be decommissioned thereafter.

The west coast of Ireland offers the best European resource in terms of wave energy potential. The site at Belmullet in Co. Mayo was selected following a rigorous assessment process of potential wave energy test facilities along Ireland’s western seaboard to identify the most suitable location. The assessment considered issues such as wave resource, technical feasibility, water depth, grid connectivity, seabed condition, accessibility through ports and road networks and the need to minimise potential for environmental impact.

3. Description of project

The purpose of the AMETS is to provide a location for the temporary mooring and deployment of wave energy devices so that their performance in generating electricity and their survivability can be tested and demonstrated in open ocean conditions. It is proposed for the site to operate for up to 15 years with devices on site intermittently throughout the year, or for more prolonged periods e.g. for up to two years. It will provide a grid-connected national test facility, at which full scale pre-commercial wave energy converters could be deployed during their final stages of pre-commercial development. It is an integral component of Ireland’s Ocean Energy Strategy and will facilitate testing and validation of various wave energy converters in an open ocean environment (Kavanagh et al. 2011).

The test site will provide a facility, not only for testing Wave Energy Convertors (WEC’s), but also for gaining experience on how to develop wave farms for electricity generation, understanding what environmental impacts associated with such developments might be and how electricity generated from them can be integrated and connected to the existing electricity network.

Wave energy convertors that could be deployed in the test areas will generate power in situ. They will be anchored to the seabed in water depths of approximately 50m and 100m and could potentially be in arrays of up to five devices. These will transmit power through submarine electricity cables to an onshore substation where connection to the distribution electricity grid will occur. The electricity cables will be buried in the seabed and brought to the substation on shore underground. For a more detailed description of the project please refer to chapter 4 of the EIS which is available to view at: [http://www.seai.ie/Renewables/Ocean_Energy/foreshore_lease_consultation/AMETS_Foreshore_Lease_Application_-_Documents.html](http://www.seai.ie/Renewables/Ocean_Energy/foreshore_lease_consultation/AMETS_Foreshore_Lease_Application_-_Documents.html)

Landing of the submarine electricity cables will require construction works at sea, on land and in the intertidal environment. Electricity cables will be trenched through the soft sediment of the seabed to the shore areas and thereafter buried above the low water mark to the land-based substation. Careful consideration has been given to the selection of the locations for the wave energy convertors themselves,
submarine electricity cables route and shore based facilities that will meet the technical requirements of the project whilst minimising potential for environmental impact.

4. Deployment methods

4.1 Wave Energy Convertors
The exact method for the deployment depends on the type of device being deployed. Currently there are a number of potential technologies at the pre-commercial stage of development that may be suitable for deployment at the AMETS. Depending on the particular technology deployed, WEC’s could be deployed at the 50 or 100 meter water depth locations which correspond to the two test areas (A at 100m water depth and B at 50 meter water depth).

It is not possible to specify the exact method of deployment at this stage as this will be depended on the particular devices deployed. However, a description of the project including cable-laying and anchoring solutions likely to be used for floating WECs is contained in the AMETS EIS.

4.2 Cable connection
The landing location at Belderra Strand was chosen as it provides a suitable environment to facilitate the cable being floated ashore using buoyancy equipment. It was also identified as the best alternative solution (see Chapter on alternatives in the AMETS EIS). Each cable can be pulled ashore at low tide through duct conduits installed under the beach. The cable conduits will be installed in the beach by open trenching. Four separate cable trenches 1-2m in depth and of 200m in length will be constructed into which cable conduit will be laid. The cable corridor will be approximately 40m wide at the low tide area and will converge to approximately 10m in width on approach to the cable transition joint bay, which is located beneath the car park at Belderra Strand.

A conventional excavator will be used and the trench will be dug on a receding tide. The material that is initially excavated to construct the trench will be reused during backfilling. Open trenching offers the least cost and least risk solution. Once backfilled, any trench would be expected to be quickly indistinguishable after a few tide cycles. The exact location of each conduit will be recorded using high accuracy GPS equipment.

It is proposed that the previously heavily modified section of the SAC which is used as a car park will accommodate a cable joint bay of approximate size 4m x 3m x 1.5m. Submarine electricity cables will be deployed from a cable laying vessel and floated to shore. They will be pulled through the cable conduit under the beach to the cable joint interface bay. There, they will be joined to landside cables which will be ducted through the existing road network to the substation location. The jointing bay is to be constructed with concrete floors and sidewalks. Once the cables are connected to the relevant joints within the jointing bay, thermal sand is put into the bay to surround the cables and joints. Additional sand and excavated material is then backfilled into the bay, following which the ground over the jointing bay is reinstated to match existing ground condition and levels. Significant quantities of excess spoil will not arise because the majority of the spoil that is generated can be reused in the scheme. During construction works of the joint bay the roadway adjacent to the car park may temporarily have to be closed. A traffic management plan will be required to temporarily divert traffic away from the works site. It is intended that the beach will be accessed from the eastern side of the car park wall during the works.
5. Alternative sites.

The test area off Belmullet was selected as it was identified as having the most suitable wave energy climate in Ireland for the testing of full scale WEC’s. The assessment process considered issues such as wave resource (figure 5.1), technical feasibility, water depth, grid connectivity, seabed condition, accessibility through ports and road networks and the need to minimise potential for environmental impact.

Figure 5.1. Mean Annual Wave Resource off the west coast of Ireland (from Kavanagh et al. 2011).

At the time of site selection, the marine area of the AMETS site was not within any area designated under the NATURA 2000 network of sites. The West Connacht Coast SAC was proposed subsequent to the
original selection of the AMETS, the preparation of the EIS and the subsequent gathering of an additional two years of baseline ecological data.

Relative to the geographical scale of the area of the proposed West Connacht Coast SAC along the Atlantic seaboard of Ireland, it is considered that alternative sites (with the required wave energy resource and additional criteria necessary for the development of the AMETS) in this area would have no less an ecological impact in relation to the qualifying interests of the West Connacht Coast SAC.

Prior to the selection of Belderra Strand as the most appropriate location to land the onshore cables and construct the cable bay a number of alternative locations within the area were considered and examined in relation to their ecology and conservation interests. All of these alternative locations and an outline of their ecology are documented in detail in the environmental scoping report and EIS for the project (SEAI, 2010). Following this screening assessment it was considered that Belderra Strand was the most appropriate location to land the onshore submarine electricity cables and construct the cable bay from an ecological perspective. It is noted that no Annex 1 habitats or Annex II species would be impacted during the course of the project and the qualifying interests of the site would therefore not be impacted.
6. The existing environment

This section examines the proposed AMETS in relation to the two SAC’s that it falls partially within and to SAC’s and SPA’s that fall within a 15 km radius of the AMETS.

6.1 Mullet/Blacksod Bay Complex SAC

6.1.1 Site description

The land area, surrounding the proposed wave energy test site, forms part of the Mullet/Blacksod Bay Complex Special Area of Conservation (SAC) and proposed Natural Heritage Area (NHA), site code 000470. This is a large coastal site, located in north-west Mayo, comprising much of the Mullet Peninsula, the sheltered waters of Blacksod Bay and the low-lying sandy coastline from Belmullet to Kinvar.

Site location including boundaries

| Latitude: | N 54° 9’ 34” |
| Longitude: | W 10 ° 0’ 53 |
| Area: | 14066.38 ha |
| Altitude Range: | -20 to 92m |

The site is a SAC selected for the following habitats listed in Annex I of the EU Habitats Directive:

- [1140] Mudflats and sandflats not covered by seawater at low tide
- [1160] Large shallow inlets and bays
- [1170] Reefs
- [1310] Salicornia and other annuals colonizing mud and sand
- [2120] Shifting dunes along the shoreline with Ammophila arenaria (“white dunes”)
- [2130] * Fixed coastal dunes with herbaceous vegetation (“grey dunes”)
- [2150] * Atlantic decalcified fixed dunes (Calluno-Ulicetea)
- [21A0] Machairs (* in Ireland)
- [3150] Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation
- [7230] Alkaline fens

The site is a SAC selected for the following species listed in Annex II of the EU Habitats Directive:

- [1355] Lutra lutra
- [1395] Petalophyllum ralfsii

A number of bird species listed in Annex I of Council directive 79/409/EEC are recorded for the site and include:

A001 Gavia stellata
A003 Gavia immer
A038 Cygnus cygnus
A045 Branta leucopsis
A140 Pluvialis apricaria
A157 Limosa lapponica
A170 Phalaropus plobatus
A195 Sterna albifrons
A395 Anser albifrons flavirostris

Other species of importance listed for the site include:

Dactylorhiza traunsteineri
Carduelis flavirostris
Selatosomus melanocholicus
Otiorhynchus arcticus
Lepus timidus hibernicus
Rana temporaria

Paracentrotus lividus
Ostrea edulis
Phellia gausapata
Zostera marina

10
Table 6.1. Habitat classes and their percentage cover found within Mullet/Blacksod Complex SAC

<table>
<thead>
<tr>
<th>Habitat classes</th>
<th>% cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine areas, Sea inlets</td>
<td>60</td>
</tr>
<tr>
<td>Tidal rivers, Estuaries, Mud flats, Sand flats, Lagoons (including saltwork basins)</td>
<td>13</td>
</tr>
<tr>
<td>Salt marshes, Salt pastures, Salt steppes</td>
<td>1</td>
</tr>
<tr>
<td>Coastal sand dunes, Sand beaches, Machair</td>
<td>16</td>
</tr>
<tr>
<td>Shingle, Sea cliffs, Islets</td>
<td>3</td>
</tr>
<tr>
<td>Inland water bodies (Standing water, Running water)</td>
<td>1</td>
</tr>
<tr>
<td>Bogs, Marshes, Water fringed vegetation, Fens</td>
<td>1</td>
</tr>
<tr>
<td>Heath, Scrub, Maquis and Garrigue, Phygrana 1</td>
<td>1</td>
</tr>
<tr>
<td>Improved grassland 1</td>
<td>1</td>
</tr>
<tr>
<td>Inland rocks, Screes, Sands, Permanent Snow and ice 1</td>
<td>1</td>
</tr>
<tr>
<td>Other arable land 1</td>
<td>1</td>
</tr>
<tr>
<td>Other land (including Towns, Villages, Roads, Waste places, Mines, Industrial sites)</td>
<td>1</td>
</tr>
<tr>
<td>Total Habitat Cover</td>
<td>100</td>
</tr>
</tbody>
</table>

6.1.2 Assessment of likely effects

The NPWS Standard Natura 2000 data form for the site lists the following activities that are impacting on the site:

1. The use of bottom-fishing gear such as that used for fishing oysters is thought to be the most damaging activity in the marine area.
2. Bait digging is potentially damaging to littoral sediment communities if the areas are over-fished.
3. High levels of grazing and associated agricultural practices, e.g. feeding of stock and fertilization has already resulted in locally severe damage to areas of dune and machair commonage. The damage has been intensified by the recent division of dune and machair commonage, which is particularly evident on the Mullet.
4. The other main significant threat to the quality of the site is amenity use, such as golf courses and camping/caravaning.
5. The survival of Petalophyllum ralfsii may be threatened by the absence of regular grazing.

None of the bird species are particularly threatened though active management of Annagh Marsh is probably required to encourage Phalaropus lobatus to breed.

Figure 6.1 shows the location of Belderra Strand within the SAC boundaries. Figure 6.2 shows the proposed location of the cable route and cable bay at Belderra Strand.

Belderra strand is an extremely exposed small embayment with a high proportion of fine and medium sands backed by a shingle and gravel bank caused by repeated wave exposure at this site. The beach is approximately 425m long with rocky outcrops at either end and accessed by a public road. A small car parking area is situated at the southern end of the beach and surfers and walkers frequent the area throughout the year.

A survey of the intertidal area of Belderra Strand and the surrounding hinterland, in the vicinity of the proposed cable landfall and cable bay area was conducted in July 2010. The purpose of the survey was to record and characterise the habitats present and assess any impacts the development of the AMETS might have on them. Full details of this survey are documented in the AMETS EIS.

The survey showed Belderra Strand to be characteristic of a high-energy beach characterised by very low diversity and numbers of both sedentary and mobile infauna. The results of the grain size and organic
content analysis indicated the beach was composed of mixed sandy sediments, dominated by fine sand with a variable proportion of medium sand mixed in. The sediments contained very little organic matter.

Only one biotpe complex was present between the lower and upper shores and this was most consistent with “Amphipods and Scolelepis spp. in littoral medium-fine sand” (LS.LSa.MoSa.AmSco). The grain size analysis indicated that the sands in this area are dominated by fine sand with variable amounts of medium sand. The presence of a large percentage of fine sand may be attributed to a period of relatively calm summer weather preceding the sampling and winter events could change the sand composition to some degree.

The common biotope “Talitrids on the upper shore and strand-line” was recorded at the strandline, which was characterised by a typical strandline of decaying seaweed and sandhoppers.

No rare or unusual species were encountered during the analysis.

Walkovers of the beach showed it to appear to be a relatively homogenous site. Other than a small stream, entering the beach via a culvert from the backing area of dune slack, no other conspicuous features were noted. A number of digs across the width and length of the beach showed that no anoxic layer was present at the time of survey.

The small triangular area behind the car park at Belderra Strand is characterised by grasses and broadleaved herbs and typical of a grassy verge on a sandy soil. No species of any conservation importance were recorded in this area.

![Figure 6.1. Location of Belderra strand within the boundaries of the Mullet/Blackod SAC. Courtesy: NPWS maps and documents viewer].
Figure 6.2 Position of proposed cable landfall and cable bay.
6.2 West Connacht Coast SAC

6.2.1 Site description
Test Area B at 50m water depth and the cable corridor ashore are included within the proposed candidate West Connacht Coast SAC (Site Code 002998). This site consists of a substantial area of marine water lying off the coasts of counties Mayo and Galway in the west of Ireland (figure 6.3). Comprising two parts, in its northern component the site extends from the coastal waters off Erris Head westwards beyond Eagle Island and the Mullet Peninsula in County Mayo. From there it extends southwards immediately off the coast as far as the entrance to Blacksod Bay. In its southern component, the site stretches from Clare Island and the outer reaches of Clew Bay at Old Head and continues southwards off the Mayo coast to the Connemara coast near Clifden and Ballyconneely, County Galway. The waters of the West Connacht Coast represent an exceptional area of key conservation importance for bottlenose dolphin in Ireland.

The site is a cSAC selected for the following species listed in Annex II of the EU Habitats Directive: Bottlenose dolphins *Tursiops truncatus* (Montagu).

**Bottlenose dolphin**
Bottlenose dolphins are widespread and relatively abundant off the Irish coast with most sightings along the western seaboard (Berrow *et al.* 2010). Bottlenose dolphins are regularly reported off the northwest and have long been associated with the Connemara region (Fairley 1981).

Recent genetic evidence (Mirimin *et al.* 2011) suggests the existence of three discrete populations of bottlenose dolphins in Ireland: the Shannon Estuary, a Connemara-Mayo (or Inshore) population and a putative offshore population. O’Brien *et al.* (2009) showed that the “Inshore population” is highly mobile with re-sightings of individual bottlenose dolphins from around the entire Irish coast including records from waters adjacent to the AMETS site. Usseldijk *et al.* (2012) carried out a more recent analysis which included 50 individual dolphins photographed off Co Mayo and showed a very high overall re-sighting rate of c.28%. This suggests this highly mobile population is relatively small and exhibits high local site fidelity. Recently individuals from this “Inshore population” in Ireland have been matched to the northeast and west coast of Scotland (Robinson *et al.* 2012) and to southwest England (Ryan *et al.* 2010). Bottlenose dolphins are also recorded offshore and northwest Mayo is the closest land to the shelf edge where bottlenose dolphins have been reported in large numbers (Wall *et al.* 2013). These dolphins are thought to belong to the “Offshore population” making this area the only site where the ranges of both putative populations overlap.

Detailed studies of the bottlenose dolphins off Connemara have been underway since 2001 (Ingram *et al.* 2001). Dedicated transects around the north Galway coastline recorded six dolphin groups with images suitable for photo-identification collected for 13 individuals. A second study carried out in 2009 (Ingram *et al.* 2009) collected images of 86 individually recognisable dolphins, five of which had been recorded in 2001. An abundance estimate was calculated using mark-recapture modelling which generated an estimate of 171±45 dolphins. This estimate was not considered precise as it had a large Co-efficient of Variation (CV) of 0.28 and 95% Confidence Intervals of 100-294 (Ingram *et al.* 2009).
A study of the bottlenose dolphins off the Mullet peninsular was carried out from 2009 by Oudejans et al. (2008) from a platform of opportunity combining both opportunistic and dedicated boat-based surveys and land-based watches. During 102 land-based surveys from vantage points around the Mullet peninsular, three sightings of bottlenose dolphins were reported, with a further 16 casual sighting records. Ten sightings were made during boat-surveys, one offshore, three around the islands of Iniskea South and North and Inishglora, two in Broadhaven Bay and three in Blacksod Bay. Group size ranged from 1-50 with a mean of six individuals. Mother-calf pairs recorded on 11 occasions and neonates on three occasions with six recorded in total. Bottlenose dolphins were recorded in all months between May and September (Oudejans et al. 2008). Further survey effort was conducted in 2009 allowing Oudejens et al. (2010) to report a minimum number of 171 individual dolphins recorded off the Mullet peninsular. Of these 19 dolphins had been re-sighted between years and 70 individuals reported from both the Mullet and north Galway areas showing significant movement between the two sites. Most sightings (29 out of 31) were within 1-2km of the coast with the offshore sightings thought to be of the putative offshore population.

These studies were used to support the proposed designation of the West Connacht Coast candidate SAC, which includes the AMETS site.

Monitoring of the AMETS site was carried out between October 2009 and April 2013 as part of the Environmental Impact Statement (EIS) of the AMETS (and formerly WETS) initiatives. During this EIS a total of 32 land-based watches, 12 dedicated boat transects, see figure 6.4a (three with passive acoustic monitoring) and 31 months of static acoustic monitoring were carried out at the AMETS.

A review of bottlenose dolphin records submitted to the IWDG from the area of interest was carried out by Berrow and O’Brien (2010) as part of the EIS for AMETS. This showed that bottlenose dolphins have
been reported in the area over the last 15 years with the first record reported on 8 April 1995. Bottlenose dolphins had been reported throughout the year though most were in September with records received from throughout the area including offshore. Group size was small with half the records of eight or less individuals and half between 12-20 individuals.

Of the 31 marine mammal sightings made from Annagh Head during 32 months of land-based monitoring, only two were of bottlenose dolphin and both within a few km of Annagh Head. During 12 dedicated boat transects of the AMETS site, bottlenose dolphins were recorded on only two occasions, with two additional sightings made during other fieldwork at the site (figure 6.4b).

![Figure 6.4a. Track-lines survey during EIS of AMETS a](image1)

![Figure 6.4b. Location of bottlenose dolphin sightings](image2)

<table>
<thead>
<tr>
<th>BNDIRL45 – 16 June 2010</th>
<th>3 June 2011</th>
<th>2 July 2011</th>
</tr>
</thead>
</table>

Images of bottlenose dolphins suitable for photo-identification were collected on four different days. From these encounters a total of 34 individual dolphins were recognised and of these 10 individuals were matched to images in the IWDG bottlenose dolphin photo-id catalogue, which contains images of 208 individual dolphins. Of these 10 individually recognisable dolphins two (BNDIRL 45 and 98) photographed on 16 June 2010 were re-sighted at AMETS a year later on 3 June 2011. Both these individuals had also
been recorded in other parts of Ireland including Counties Galway, Sligo, Donegal and other sites in Mayo. Other sites where dolphins recorded at AMETS have been re-sighted include Counties Cork, Kerry, Clare and Antrim. This shows that the bottlenose dolphins at AMETS are part of the highly mobile, coastal population which has been recorded all around the Irish coast (O’Brien et al. 2009) but the waters around Galway and Mayo are recognised as very important for this species.

On 15 October 2009 a group of around 50 bottlenose dolphins was encountered offshore at the western limit of the track-lines. We obtained images of 21 individual dolphins but none of these were matched to the IWDG bottlenose dolphin photo-id catalogue. It is highly unlikely there would be no matches if they were part of this population given the high re-sighting rate which leads us to believe that these were from the putative offshore population (see Mirimin et al. 2011). This is one of the places in Ireland that an offshore population may occur relatively close to the coast due to the close proximity of the edge of the continental shelf.

Table 6.2. Photo-id matches of bottlenose dolphins from the AMETS.

<table>
<thead>
<tr>
<th>Catalogue number</th>
<th>AMETS</th>
<th>AMETS Re-sighting</th>
<th>Other sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>BNDIRL12</td>
<td>3 June 2011</td>
<td>15 May 2007 Cork Harbour</td>
<td></td>
</tr>
<tr>
<td>BNDIRL32</td>
<td>16 June 2010</td>
<td>22 Apr 2010 Castletownshend, Cork</td>
<td>15 Aug 2008 Donegal Bay</td>
</tr>
<tr>
<td>BNDIRL50</td>
<td>3 June 2011</td>
<td>21 Jul 2011 Ballyconneely, Galway</td>
<td>8 Aug 2008 Donegal Bay</td>
</tr>
<tr>
<td>BNDIRL82</td>
<td>3 June 2011</td>
<td>26 Mar 2007 Fanore, Clare</td>
<td></td>
</tr>
<tr>
<td>BNDIRL110</td>
<td>16 June 2010</td>
<td>24 May 2010 Mace Hd, Galway</td>
<td>7 Mar 2010 Ballygalley, Antrim</td>
</tr>
<tr>
<td>BNDIRL126</td>
<td>3 June 2011</td>
<td>21 Jul 2011 Ballyconneely, Galway</td>
<td></td>
</tr>
<tr>
<td>BNDIRL147</td>
<td>16 June 2010</td>
<td>28 Dec 2009 Ventry, Kerry</td>
<td></td>
</tr>
<tr>
<td>BNDIRL150</td>
<td>16 June 2010</td>
<td>30 May 2009 Ventry, Kerry</td>
<td></td>
</tr>
</tbody>
</table>

As part of the AMETS EIS static acoustic monitoring using CPODs was also carried out. CPODs are self-contained units that log the echolocation clicks of odontocetes. CPODs were deployed at the two proposed test areas, the inshore area at Annagh Head and at four control sites (figure 6.5). The site was separated into regions; offshore and inshore in which a total of 2,233 days were monitored.
Figure 6.5. Distribution of CPOD deployments including test areas A and B and four control sites

Table 6.3. Summary of C-POD deployments at all sites including a Monitoring index of %DPM and %PPM, which includes the percentage of total minutes which were positive

<table>
<thead>
<tr>
<th>Location</th>
<th>Depth</th>
<th>Total days</th>
<th>total min</th>
<th>NBHF</th>
<th>Dolphin</th>
<th>%DPM</th>
<th>%PPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test area A</td>
<td>100</td>
<td>608</td>
<td>875520</td>
<td>2319</td>
<td>17809</td>
<td>2.03</td>
<td>0.26</td>
</tr>
<tr>
<td>Test area B</td>
<td>45</td>
<td>381</td>
<td>548640</td>
<td>5642</td>
<td>1244</td>
<td>0.23</td>
<td>1.03</td>
</tr>
<tr>
<td>Inner bay area</td>
<td>27</td>
<td>241</td>
<td>347040</td>
<td>92</td>
<td>59</td>
<td>0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>Control 1</td>
<td>100</td>
<td>404</td>
<td>581760</td>
<td>2375</td>
<td>1921</td>
<td>0.33</td>
<td>0.41</td>
</tr>
<tr>
<td>Control 2</td>
<td>52</td>
<td>389</td>
<td>560160</td>
<td>492</td>
<td>1169</td>
<td>0.21</td>
<td>0.09</td>
</tr>
<tr>
<td>Control 3</td>
<td>100</td>
<td>190</td>
<td>273600</td>
<td>452</td>
<td>200</td>
<td>0.07</td>
<td>0.07</td>
</tr>
<tr>
<td>Control 4</td>
<td>54</td>
<td>175</td>
<td>252000</td>
<td>474</td>
<td>78</td>
<td>0.03</td>
<td>0.19</td>
</tr>
</tbody>
</table>

The percent days with detections ranged from 0 to 98%. The datasets show that dolphin detections were greatest at test area A, while porpoise detections were greatest at test area B. Data from the inner bay area wasn’t comparable with the other sites due to the short duration of the monitoring but it had the least detections across all sites. Sightings data suggest that most dolphin detections at test area B and the inner bay area and at the control sites were of common dolphins *Delphinus delphis* while those at test area A were more likely to be of bottlenose dolphins.

A total of 241 days were monitored acoustically at the inner bay area between October 2009 and December 2010 with 59 DPMs attributed to dolphin (bottlenose dolphin) detections and occurring on 24% of days monitored.
Table 6.4. Summary of C-POD deployments at the inshore test area including dolphin detection positive minutes (from Berrow and O’Brien 2013).

<table>
<thead>
<tr>
<th>Deployment</th>
<th>CPOD</th>
<th>Start date</th>
<th>End date</th>
<th>Total days</th>
<th>% Days with Dolphin Detections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>549</td>
<td>15/10/2009</td>
<td>15/12/2009</td>
<td>42</td>
<td>22</td>
</tr>
<tr>
<td>2</td>
<td>795</td>
<td>15/12/2009</td>
<td>29/01/2010</td>
<td>47</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>173</td>
<td>29/07/2010</td>
<td>27/12/2010</td>
<td>152</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>241</strong></td>
<td><strong>59</strong></td>
</tr>
</tbody>
</table>

Seals
Although the proposed West Connacht Coast SAC is not selected for seals, they are considered here as Northwest Mayo is also an important area for seals and both grey (*Halichoerus grypus*) and common (*Phoca vitulina*) seals, which are present within the area of the West Connacht Coast SAC, are both listed under Annex I of the EU Habitats Directive.

Grey seal
The Inishkea Islands are an important breeding site for grey seals in Ireland (Kiely and Myers 1998). The National Parks and Wildlife Service have been carrying out grey seal surveys of the Inishkea Islands since at least 1978 and is, with the Blasket Islands Co Kerry, the best monitored site in Ireland (Lyons 2004). O’Cadhla and Strong (2002) estimated a population of 1,351-1,737 grey seals in the Inishkea Islands in 2002 from a total Irish population of 5,509-7,083 grey seals of all ages, making it the most important site for this species in Ireland.

There are at least 22-30 sites among the 10 islands making up the Inishkea group used for seal pupping (Kiely and Myers 1998; Lyons, 2004). The first pups are born on the Inishkea Islands in the second week of September and finish in early December with a pupping peak in mid-October (Kiely and Myers 1998). The best available data suggests a three-fold increase in pup production between 1995 and 2003 (O’Cadhla et al. 2007) prompting Cronin et al. (2007a) to test the feasibility of carrying out aerial surveys of these islands in the future.

As part of a study of dispersal of grey seals from pupping sites on the Inishkea Islands a total of 95 pups were tagged during the 1998 and 1999 breeding seasons (BIM 2002). Of these 14 seals were re-sighted. Two animals were observed within the Inishkea Island group 4 and 11 days after tagging. One of these animals had traveled 6kms. A third animal was re-sighted at the Inishkea Islands three months after tagging had ceased. One individual was spotted at Slyne Head, Co Galway 28 days after being tagged 90km from the Inishkea Islands. There were two international re-sightings: one 68 days after tagging at Seine Island, Brittany in North West France, a distance of 840km and one sighted on the Isle of Tiree, Scotland, 60 days after tagging and 360km from the Inishkea Islands. One bycaught seal was landed near Dursey Island, Co. Cork 131 days after it had been tagged, at a distance of 285km from the Inishkea Islands. This shows that seals from the Inishkea Islands disperse widely though site-fidelity to their breeding areas is strong.

The diet of grey seals in the Inishkeas has also been studied (BIM 2002). Two hundred and ninety seven faecal samples were collected between 1997 and 1999 from known grey seal haul out sites within the Inishkea Island group and 138 grey seal stomachs and intestines were collected around the Mullet and north Mayo between 1997 and 1999. Of the eight species positively identified, whiting was the most abundant prey species found in the stomachs in 1997 and 1998 coming a close second to *Trisopterus* sp. in 1999. From scat samples *Trisopterus* sp. otoliths were the most abundant in 1997, and was the third most
abundant in 1998 and the second most abundant in 1999. Scad was the most abundant in 1998 with whiting a close second and sand eels were the most abundant in 1999.

Seals were recorded routinely during land-based observations and boat-based surveys.

Seals were recorded during four of the 32 land-based watches from Annagh Head. Grey seals were reported on four occasions and common seals on two occasions. Sighting rate for seals ranged from 0.20 to 0.60 sightings per hour with most sightings in September and October which is the peak pupping period for grey seal. Seals were recorded on each of the 12 dedicated boat-based surveys with a total of 111 seal sightings with grey seals accounting for >90% of sightings.

Grey seals were recorded throughout the study site in both inshore and offshore waters while common seals were mainly recorded in much smaller numbers towards the middle of the site where the proposed test areas are to be situated. This might be a consequence of increased survey effort in this area.

Grey seal density estimates were estimated from three surveys: October 2009 and July and November 2010. Estimates ranged from 0.56 to 0.85 and thus abundance estimates for grey seal increased from 0.51 seals km\(^{-2}\) in July to 0.56 seals per km\(^{-2}\) (171 seals) in October, to a maximum of 0.88 seals per km\(^{-2}\) (257 seals). The CVs ranged from 0.16 to 0.21 and thus the estimates were quite robust. This increase in abundance at the AMETS is to be expected as November is during the pup rearing season on Inishkea Islands.

**Common or harbour seal**

No common or harbour seals are known to pup in the area but they do occur in Blacksod Bay on the east side of the Mullet peninsular and may visit the area of the AMETS. An aerial survey carried out in 2003 estimated around 116 seals occurred with another 84 recorded on Achill Island to the south of the site (Cronin et al. 2007b). Cronin et al. (2007b) suggested a minimum population of around 2,905 harbour seals occurred in the Republic of Ireland. The harbour seal population in Ireland is thought to be stable.
6.2.2 Assessment of likely effects

The impact of marine renewable energy devices on marine mammals is not known. There have been a number of useful and extensive reviews (e.g. Inger et al. 2009; Boehlert and Gill 2010) speculating about the possible effects, however with a lack of working devices deployed in the marine environment with which to test these hypothesis, there is very little empirical data to inform management. Most studies of environmental impact to date have involved the construction and operation of offshore wind farms. Wilson et al. (2010) reviewed recent environmental impact studies of offshore windfarm construction and concluded that although not benign the impacts were minor and can be mitigated through good siting practices. This conclusion is also relevant to the production of wave energy.

Inger et al. (2009) provided a review of the impacts, both positive and negative, on biodiversity and suggested the main negative effects included:

i) some loss of habitat from physical displacement,
ii) collisions, where marine renewable energy devices have moving or rotating parts,
iii) disturbance of feeding and perhaps migratory behaviour through interference by electromagnetic fields generated along active power cables,
iv) the impact of noise generated by working devices and during construction.

A lot has also been written about the potential benefits that marine renewable energy devices may bring to marine biodiversity (Inger et al. 2009; Wilson et al. 2010). The hard substrates created, especially with respect to offshore wind farms, may act as artificial reefs but all devices may potentially act as fish aggregating devices (FADS). The latter may positively impact on marine mammals especially if fish biomass is increased rather than concentrated around FADS, without depleting surrounding areas. In addition the exclusion zone created around devices, or more realistically an aggregation of devices or farms, may act as no-take zones or marine protected areas. However as with the potentially negative effects these are speculative as there is no empirical data available to explore these issues.

Field studies of the impact of working marine renewable energy devices are limited. An impact assessment of SeaGen in Northern Ireland, the world’s first commercial-scale tidal turbine, suggested noise production during construction could result in temporary displacement of harbour porpoise, but other areas around the project site maintained baseline abundance, and porpoise activity returned to normal baseline in the Narrows once construction was complete however seals did transit further from the site after SeaGen installation (SeaGen 2010). SeaGen involves tidal power involving rotating blades which are not suitable for deployment at AMETS but are one of the few full impact assessments of a marine renewable device available.

The EIS for the Aquamarine Power Ltd development, which will ultimately see the deployment of between 40 and 50 Oyster devices along the coast at Lag na Greine, Isle of Lewis, suggests there will be no impact to marine mammals or basking sharks. This EIS addresses all of the known key issues, including noise disturbance and displacement during construction, operation and decommissioning and also examines the FAD effect.

It does, however, suggest that the area is “not of particular importance for marine mammals or basking sharks” based on 188 hours of land-based observations from two vantage points. However, no boat-based fieldwork or SAM was undertaken.

In relation to noise disturbance during construction and operation, where the greatest impact may be seen, the EIS states that no piling will be necessary and only drilling will occur. The EIS estimates drilling could cause mild avoidance at 21-112m. During operation of Oyster this EIS suggests 3 operational oyster WEC’s could cause avoidance at 120-150m for mysticetes and odontocetes (no data for pinnipeds is
provided), and thus unlikely to cause a barrier effect or any TTS. During operation and maintenance the range for avoidance of three WEC’s is given as 60-110m for mysticetes and odontocetes.

These figures are low and if correct would have no significant impact. However, the EIS states the assessment of impacts of operational noise is based on “synthetic data” and further “speculate that the Oyster device is likely to have low operational noise”. The EIS also states that “in order to complete the acoustic assessment the noise level was estimated using a synthetic spectrum based loosely on drilling noise with its overall noise level reduced by an arbitrary 3dB”. Based on this EIS there appears to be no noise measurements available from an Oyster in operation, and only records during drilling of the socket for Oyster.

_Bottlenose Dolphin_

**Noise disturbance**

_Construction_

The deployment of marine renewable energy convertors will introduce new sources of noise into the underwater environment. Impacts from noise from wave energy developments can occur during either the construction/ decommissioning phase or during the operational phase of the development. The impacts during each of these phases will be device dependent. A list of the impacts likely to be caused by generic device types was provided in Austin _et al._ (2009) and developed into a working document for managers by Magagna _et al._ (2013).

The impacts associated with the construction and installation of floating devices will vary with device type. For the installation of floating devices, impacts will be largely dependent on the mooring system required for the device. Some devices will use large anchors to moor floating components. The noise emissions from the installation of these anchors are associated with the vessel(s) used for deployments. Underwater noise emissions will also be associated with the vessels required for the installation of the floating device itself. Some floating devices have a fixed seabed component associated with them while other devices are designed to be completely fixed to the seabed. Piling or drilling may be required to install these fixed components to the seafloor. Subsea cables or high pressure pipelines may also be required to be fixed to the seabed. Lessons learned from the impacts associated with some of these activities can be taken from other offshore industries (e.g. offshore wind) and are discussed further in the sub-sections below. The installation of fixed devices will probably create general construction type noise at the shoreline or relatively close to the shoreline. Construction vessels are likely to be involved in this activity and their impact will depend on the type of vessel, how they are operated and for what duration (Magagna _et al._ 2013).

_operation_

Noise associated with the operational phase of a device will be largely dependent on the energy conversion mechanism used. Many different types of energy conversion mechanisms are being developed for wave energy devices including electrical generators, air and water turbines, pumps, hydraulic and electromechanical components (Magagna _et al._ 2013). External mechanical noise associated with the devices could arise from vibration of mooring lines and the sound of waves coming into contact with the device. Service visits, both scheduled and unscheduled, will also be required for devices during which vessel noise will also occur. Additional noise that may result from wave energy developments include the noise associated with the construction and operation of collecting hubs that link arrays of devices.

As well as varying with device type, the noise impacts will vary with the physical characteristics of the development site (i.e. depth, topography, sediment structure, hydrography, currents, wave conditions etc.) and with the species present at the site.
There is little available information on the impacts associated with noise from operational WEC’s. There is also little information regarding the acoustic signatures of WEC’s. Noise measurements were made during a Pelamis deployment at EMEC, in Scotland (Lepper et al. 2012). The measured noise spectrum ranged from a few tens of Hz to tens of kHz, within the hearing response of many marine mammals. Source level estimates at around 120 dB re 1 μPa2Hz m for components between 10 Hz-2 kHz for less energetic sea-states rising to 181 dB re 1μPa Hz m in the 1 kHz band. It was found that both frequency of occurrence and the level of some of the potential noise sources from the Pelamis system were likely to be higher at increased sea states as the system becomes more energetic.

We used these reports to identify possible impacts of AMETS on bottlenose dolphins (Table 6.5). Consistent with these reports and in the absence of device specific information we identified most potential impacts as low and noise disturbance from operating WEC’s as low-medium. It should be remembered that positive impacts of WEC’s, such as acting as FADs or by creating in effect a non-take fishing zone, have not been included in these risk assessments.

**Table 6.5.** Possible negative impacts of AMETS on bottlenose dolphins in the proposed West Connacht Coast cSAC.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Duration and Intensity</th>
<th>Risk Assessment</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Construction</td>
<td>Short High</td>
<td>Low</td>
<td>Completed</td>
</tr>
<tr>
<td>Deployment of cables and WEC’s</td>
<td>Short Low</td>
<td>Low</td>
<td>Burying required in sand, overlaid on hard rock substrate</td>
</tr>
<tr>
<td>Deployment of</td>
<td>Short Medium</td>
<td>Low</td>
<td>Design specific</td>
</tr>
<tr>
<td>Vessel movement and noise</td>
<td>Short Low</td>
<td>Low</td>
<td>Associated marine traffic limited in duration and intensity.</td>
</tr>
<tr>
<td>2. Operation</td>
<td>Long Low</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Disturbance due to WEC, incl. collision risk</td>
<td>Long Medium</td>
<td>Low-Medium</td>
<td>Depends on noise generated by WEC. In situ noise measurements required. Likely to be very limited spatially with high attenuation</td>
</tr>
<tr>
<td>Disturbance due to noise generated by</td>
<td>Long Medium</td>
<td>Low-Medium</td>
<td></td>
</tr>
<tr>
<td>Risk of entanglement with moorings and cables</td>
<td>Long Low</td>
<td>Low</td>
<td>Mooring depend on WEC but likely to be limited in number and extent</td>
</tr>
<tr>
<td>3. Decommission</td>
<td>Short Low</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Recovery of moorings</td>
<td>Short Low</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Recovery of</td>
<td>Short Low</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Vessel movement and noise</td>
<td>Short Low</td>
<td>Low</td>
<td></td>
</tr>
</tbody>
</table>

A guidance document for the impacts of marine renewables (Trendell et al. 2011) distinguished between impacts which are significant under the *Habitats Directive*, which links the potential effects to the conservation objectives of a particular site and those with *Statistical significance*; in which changes measured are not deemed to pose a wider risk to the conservation objectives although they may have statistical relevance. For example, small changes to migratory routes may have statistical significance but not pose a risk to the abundance of the species.
Conservation Objectives
No site specific conservation objectives for the proposed West Connacht Coast cSAC have been published as yet but if we use those published for the Lower River Shannon cSAC which is the only other site in Ireland with bottlenose dolphin as a qualifying interest (NPWS 2012a), then we can consider these as:

Objective: To maintain the favourable conservation condition of bottlenose dolphin in West Connacht Coast cSAC, which is defined by the following list of attributes and targets

Target 1: Species range within the site should not be restricted by artificial barriers to site use.

This target may be considered relevant to proposed activities or operations that will result in the permanent exclusion of bottlenose dolphin from part of its range within the site, or will permanently prevent access for the species to suitable habitat therein.

It does not refer to short-term or temporary restriction of access or range.

Early consultation or scoping with the Department in advance of formal application is advisable for proposals that are likely to result in permanent exclusion.

Target 2: Critical areas, representing habitat used preferentially by bottlenose dolphin, should be conserved in a natural condition.

This target 3 is relevant to proposed activities or operations that will result in significant interference with or disturbance of (a) aquatic habitat used preferentially by bottlenose dolphin during the annual cycle and (b) the natural behaviour of bottlenose dolphin within such critical areas (i.e., preferred habitat).

Operations or activities that cause displacement of individuals from a critical area (i.e. preferred habitat) or alteration of natural behaviour to an extent that may ultimately interfere with key ecological functions would be regarded as significant and should therefore be avoided.

Target 3: Human activities should occur at levels that do not adversely affect the bottlenose dolphin population at the site.

Proposed activities or operations should not introduce man-made energy (e.g. aerial or underwater noise, light or thermal energy) at levels that could result in a significant negative impact on individuals and/or the population of bottlenose dolphin within the site. This refers to the aquatic habitats used by the species in addition to important natural behaviours during the species’ annual cycle.

This target also relates to proposed activities or operations that may result in the deterioration of key resources (e.g. water quality, feeding, etc.) upon which bottlenose dolphins depend. In the absence of complete knowledge on the species’ ecological requirements in this site, such considerations should be assessed where appropriate on a case-by-case basis.

Proposed activities or operations should not cause death or injury to individuals to an extent that may ultimately affect the bottlenose dolphin population at the site.

Risk Assessment
The potential risks and the effect of conservation objectives have been addressed (Table 6.6). We have considered these risks in the light of standard mitigation which would be required as part of best practice and in compliance with existing guidelines. A separate risk assessment would be required for each specific WEC to be deployed at AMETS prior to approval.
Table 6.6. Risk assessment of proposed AMETS on the likely Conservation Objectives of the West Connacht cSAC.

<table>
<thead>
<tr>
<th>Target</th>
<th>Objective</th>
<th>Description</th>
<th>Risk Assessment</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target 1</td>
<td>Not restricted by artificial barriers</td>
<td>permanent exclusion from part of its range within the site,</td>
<td>Low</td>
<td>No evidence but spatially restricted</td>
</tr>
<tr>
<td>Target 2</td>
<td>Critical areas, should be conserved in a natural condition</td>
<td>proposed activities or operations that will result in significant interference with or disturbance</td>
<td>Low</td>
<td>No evidence but spatially restricted</td>
</tr>
<tr>
<td>Target 3</td>
<td>Human activities should occur at levels that do not adversely affect the bottlenose dolphin population at the site</td>
<td>not introduce man-made energy levels that could result in a significant negative impact</td>
<td>Low</td>
<td>No evidence but spatially restricted</td>
</tr>
</tbody>
</table>

Table 6.7. Measures to minimise any potential impacts of AMETS on bottlenose dolphins in the West Connacht Coast cSAC, in line with best practice.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Construction</td>
<td>Site surveys; e.g. acoustic surveys Mitigation includes implementation of NPWS (2007) and (2012b) Guidelines</td>
</tr>
<tr>
<td>Deployment of cables and WEC’s</td>
<td>No mitigation required</td>
</tr>
<tr>
<td>Deployment of</td>
<td>Appropriate mitigation specific to WEC</td>
</tr>
<tr>
<td>Vessel movement and noise</td>
<td>Minimise construction period</td>
</tr>
<tr>
<td>2. Operation</td>
<td>Disturbance due to WEC, incl. collision risk SAM before, during and after construction to determine if detections change.</td>
</tr>
<tr>
<td></td>
<td>Disturbance due to noise generated by Land-based monitoring using theodolite tracking to plot track of individual animals near WEC’s to determine if avoidance behaviour</td>
</tr>
<tr>
<td></td>
<td>Noise measurements taken after deployment of WEC in different sea-states to quantify noise generated by WEC above ambient</td>
</tr>
<tr>
<td></td>
<td>Risk of entanglement with moorings and cables Land-based monitoring using theodolite tracking to plot track of individual animals near WEC’s to determine if avoidance behaviour</td>
</tr>
<tr>
<td>3. Decommissioning</td>
<td>Continue SAM after recovery of WEC’s and AMETS to determine if detections change.</td>
</tr>
</tbody>
</table>

On-going monitoring using SAM using a B-A-C-I design and land-based tracking is recommended to ensure the deployment and operation of WEC’s at AMETS has no effect on bottlenose dolphins or other marine megafauna and to inform wave energy development elsewhere.
Seals

Grey seals are widespread and abundant at, and adjacent to, the site. Inishkea Islands (Site Code 000507) is a candidate Special Areas of Conservation for this species as it is a very important breeding area and grey seal is also a qualifying interest of Duvillaun Islands SAC (Site Code 000495) which lies to the south of Inishkea.

Seals are likely to interact with WEC’s and associated infrastructure (cables, moorings) but the impact on them is likely to be limited and spatially constrained. There are no data from wave energy convertors but studies on the impacts of windfarms during construction and operation suggest local disturbance may occur. During pile driving associated with the construction of a windfarm off Denmark Edrén et al. (2004) reported a 10 – 60% decrease in the number of hauled out harbour seals on a sandbank 10km away from the construction during days of ramming activity compared to days when no pile driving took place but this effect was of short duration. Underwater noise was recorded from three different types of wind turbines in Denmark and Sweden. Noise levels were compared with audiograms of harbour seals with audibility ranging from less than 100 m to several kilometres. Behavioural reactions from seals could not be excluded up to distances of a few hundred meters but it was unlikely that the noise reached dangerous levels at any distance from the turbines and the noise was considered incapable of masking acoustic communication by seals (Tougaard et al. (2010)).
6.3 Other Natura 2000 sites within 20 km of the AMETS

6.3.1 Site descriptions
Other Natura 2000 sites within 20 kilometres of the test site are listed in table 6.8 below.

Table 6.8. SAC’s within 15km and SPA’s within 20km of the AMETS.

<table>
<thead>
<tr>
<th>Designated Area</th>
<th>Site Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mullet Peninsula SPA</td>
<td>004227</td>
</tr>
<tr>
<td>Blacksod Bay/Broadhaven SPA</td>
<td>004037</td>
</tr>
<tr>
<td>Termoncarragh Lake and Annagh Machair SPA</td>
<td>004093</td>
</tr>
<tr>
<td>Erris Head SAC</td>
<td>001501</td>
</tr>
<tr>
<td>Broadhaven Bay SAC</td>
<td>004072</td>
</tr>
<tr>
<td>Dunvillaun Islands SPA</td>
<td>004111</td>
</tr>
<tr>
<td>Dunvillaun Islands SAC</td>
<td>000495</td>
</tr>
<tr>
<td>Iniskea Islands SAC</td>
<td>000507</td>
</tr>
<tr>
<td>Iniskea Islands SPA</td>
<td>004004</td>
</tr>
<tr>
<td>Inishglora &amp; Inishkeeragh SPA</td>
<td>004084</td>
</tr>
<tr>
<td>Illanmaster SPA</td>
<td>004074</td>
</tr>
<tr>
<td>Duvillaun Islands SPA</td>
<td>004111</td>
</tr>
<tr>
<td>Stags of Broad Haven SPA</td>
<td>004072</td>
</tr>
</tbody>
</table>

No effects on Erris Head SAC, Dunvillaun Islands SAC or Iniskea Islands SAC are considered possible during the construction, operation or decommission of the AMETS due to the scale of the development and the qualifying interests of these three SAC’s. However, possible impacts on the adjacent SPA’s have been considered and are detailed here.

6.3.2 Use of AMETS by species of Special Conservation Interest connected to SPA’s

EIS and monitoring surveys were completed at AMETS between 2009 and 2013 (Scally et al., 2013). Results from these surveys show that a number of species which use AMETS may be connected to SPA’s associated with the mullet peninsula and, given the foraging ranges of seabirds, the north Mayo coast (Table 6.9). Some seabirds which use AMETS have very large foraging ranges (Table 6.10) and connectivity between these species and SPA’s cannot be established without further investigation (e.g. tagging studies).

Table 6.9. Species which have been recorded from AMETS and are of Special Conservation Interest for coastal SPA’s (within 20 km of the study site). Annex I species are listed in italics. Whether the species is listed as a breeding or wintering bird is shown.

<table>
<thead>
<tr>
<th>Special Protection Area</th>
<th>Species of Special Conservation Interest</th>
<th>Breeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blacksod Bay/Broadhaven SPA</td>
<td>barnacle geese, light-bellied brent geese, great northern diver, ringed plover, dunlin, curlew</td>
<td>sandwich tern</td>
</tr>
<tr>
<td>Termoncarragh Lake and Annagh Machair SPA</td>
<td>barnacle geese</td>
<td></td>
</tr>
<tr>
<td>Dunvillaun Islands SPA</td>
<td>barnacle geese</td>
<td></td>
</tr>
<tr>
<td>Iniskea Islands SPA</td>
<td>barnacle geese, ringed plover, sanderling, purple sandpiper, turnstone</td>
<td>arctic tern, little tern, shag, lesser black-backed gull, herring gull, common gull</td>
</tr>
<tr>
<td>Inishglora &amp; Inishkeeragh SPA</td>
<td>barnacle geese</td>
<td>storm petrel, arctic tern, cormorant shag, lesser black-backed gull, herring gull</td>
</tr>
</tbody>
</table>
Table 6.11. Migratory species and species which may be linked to distant Irish or UK SPA’s and which use the study site.

<table>
<thead>
<tr>
<th>Species</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>gannet</td>
<td>Distant SPA, foraging activity in study site</td>
</tr>
<tr>
<td>skuas</td>
<td>Migratory – occurrence on passage</td>
</tr>
<tr>
<td>manx shearwater</td>
<td>Distant Irish SPA (closest is Cruagh Island SPA in Co. Galway) or UK SPA. Migratory, large numbers in Spring, foraging.</td>
</tr>
<tr>
<td>great &amp; sooty shearwater</td>
<td>Migratory – occurrence on passage</td>
</tr>
</tbody>
</table>

6.3.3 Assessment of likely effects

The assessment of likely significant effects is based on the following mitigation measures being in place:

- No boat activity within 500m of Inishglora and Inishkeeragh Islands (year round) or Annagh Islet and Annagh Head (summer only), to prevent disturbance to breeding and wintering birds.
- Cable laying to the shore to take place during August and September, as these are the least sensitive months in terms of bird use within the Bay.
- No boat activity (excepting short term temporary activity associated with cable laying) within the shallow waters of the Bay (<20m) to minimise disturbance to foraging birds.
- Use of the minimum number of navigation buoys to mark the location of the WEDs to reduce impacts from lights acting as attractants to birds. Ensure no regular activity within the Bay by lighted vessels at dawn, dusk and night, during the breeding season.
- Ensure pollutants are not released into the marine environment and have a comprehensive spill response plan in place, should a spill occur. This will minimise the risk of contamination to birds.

Based on the tables 6.10 and 6.11 an assessment of likely effects should focus on those “qualifying” species summarised in table 6.12. In making this assessment, it is important to note the lack of empirical data on the impacts of wave energy convertors on birds.

In the absence of this empirical data on the impacts of wave energy convertors on birds, the assessment of likely significant effects is based on a risk assessment process. This process has concluded that for most species which use the AMETS and which are part of the Special Conservation Interest of a connected SPA, significant effects are not likely.

Monitoring is recommended at the wave energy test site to examine the interactions between birds and the wave energy convertors. Without such data the impacts of wave energy devices on birds cannot be fully assessed.
Table 6.12. Species for which an assessment of likely significant effects applies (Annex I species in italics).

<table>
<thead>
<tr>
<th>Wintering</th>
<th>Breeding</th>
<th>Migratory SPA, potentially linked to distant SPA's</th>
</tr>
</thead>
<tbody>
<tr>
<td>barnacle geese</td>
<td>storm petrel</td>
<td>gannet</td>
</tr>
<tr>
<td>light bellied brent geese</td>
<td>leach's petrel</td>
<td>skua’s</td>
</tr>
<tr>
<td>great northern diver</td>
<td>arctic tern</td>
<td>manx Shearwater</td>
</tr>
<tr>
<td>ringed Plover</td>
<td>little tern</td>
<td>great Shearwater</td>
</tr>
<tr>
<td>dunlin</td>
<td>sandwich tern</td>
<td>sooty shearwater</td>
</tr>
<tr>
<td>curlew</td>
<td>shag</td>
<td></td>
</tr>
<tr>
<td>sanderling</td>
<td>cormorant</td>
<td></td>
</tr>
<tr>
<td>purple sandpiper</td>
<td>lesser black-backed gull</td>
<td></td>
</tr>
<tr>
<td>turnstone</td>
<td>herring gull</td>
<td></td>
</tr>
<tr>
<td></td>
<td>common gull</td>
<td></td>
</tr>
<tr>
<td></td>
<td>fulmar</td>
<td></td>
</tr>
<tr>
<td></td>
<td>puffin</td>
<td></td>
</tr>
</tbody>
</table>

A risk assessment (Appendix 1) was completed in relation to the proposal to develop test areas A and B. In completing this assessment the following potential impacts arising from the proposed development were considered:

- Loss of foraging habitat due to displacement.
- Mortality or injury due to collision above water and due to collision or entrapment below water.
- Disturbance (noise, presence of structures, boats, increased human activity) during WEC deployment, operation and maintenance.
- Attraction to lighting causing mortality or injury.
- Habitat enhancement where act as fish attraction devices (FADs) or effective Marine Protection Areas (MPAs) or exclusion zones for fishing.

The conclusions from the risk assessment are as follows:

- The risk of negative interactions between cable laying activities within the Bay (semi-enclosed waters between and east of Annagh Head and Inishglora Island) and the species listed in table 6.12 is considered to be low, given the short duration and temporary nature of activities. Likely significant effects on the qualifying wintering and breeding birds which use the Bay are therefore considered unlikely. Monitoring of the Bay is recommended.

- Displacement of foraging birds from the near and off shore test areas A and B is considered to be of low impact for all species groups. The footprint of the test areas is relatively small and alternative foraging habitat is available. There is also, so far, no indication that the test areas provide favoured feeding habitat and are thus attractive to, any species group. Displacement is therefore unlikely to have significant effects on the qualifying species which use the AMETS. Monitoring is recommended.

- The risk of collision, within test areas A and B for all species groups is considered to be low due to the small footprint of the development. Notwithstanding this assessment the risk of collision is higher for a number of species due to aspects of their behaviour (Table 6.13).
### Table 6.13. Species groups at higher risk of collision with

<table>
<thead>
<tr>
<th>Species Group</th>
<th>Reason for higher collision risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terns</td>
<td>Plunge divers</td>
</tr>
<tr>
<td>Petrels</td>
<td>Nocturnal habits</td>
</tr>
<tr>
<td>Shearwaters</td>
<td>Low flying, nocturnal habits.</td>
</tr>
<tr>
<td>Auks</td>
<td>Pursuit divers, low fast flight.</td>
</tr>
</tbody>
</table>
7. Cumulative impacts

The Department of Communications, Energy and Natural Resources have prepared an Offshore Renewable Energy Development Plan (OREDP) for Ireland which describes the policy context for development of offshore wind, wave and tidal stream energy in Irish waters for the period to 2030.

In accordance with the EU Directive 2001/42/EC of the European Parliament and of the Council on the Assessment of the Effects of Certain Plans and Programmes on the Environment (“the SEA Directive”), a Strategic Environmental Assessment (SEA) has been undertaken to evaluate the likely significant environmental effects of implementing the plans to develop offshore renewable (offshore wind, wave and tidal) energy in Irish waters.

In its assessment of potential cumulative impacts with mitigation, this SEA states that for the “centre area of the west coast” (i.e. the location of the AMETS) potential cumulative effects across receptors for the development of commercial wave developments of between 1000MW to 3000 MW are generally negligible - negative. Potential effects up to 6000MW are generally negative although effects are likely to be more significant in the inshore areas. It further states that potential effects are primarily associated with protected sites and mammals located on the adjacent coastline, navigation and commercial fisheries. Potential effects in terms of collision risk and habitat exclusion on birds, marine mammals, reptiles and fish, and possible barrier effects to marine mammals moving along the coast could also be of adverse significance. However the SEA recognises the fact that further information is needed to fully understand and quantify the likely significance of any potential effects on marine mammals, fish, birds, turtles and benthic ecology.

There are currently no additional foreshore applications for the location of the AMETS. However, Emerald Networks are planning to construct a trans-Atlantic fibre optic cable extending from Long Island (N.Y.) to a landfall location at Belderra Strand, Co. Mayo. Although no foreshore application for the construction of the cable has been received to date, an application for a licence to carry out site investigations has been submitted. The proposed Emerald Networks cable follows a path adjacent to the route for the AMETS subsea cable and also reaches landfall at Beldarra Strand within several meters of the AMETS cable.

While the construction methods for the Emerald Networks subsea cable are unknown at this stage, it would be reasonable to assume that, should it proceed, it will involve trenching and backfilling in similar manner to that proposed for the AMETS cable. It is unlikely that the cumulative impact of both cables would have any greater impact on the intertidal area of Belderra strand than that indicated for the AMETS cable alone given the highly exposed and mobile nature of this habitat.
### 8. Screening matrix

<table>
<thead>
<tr>
<th>Brief description of the project or plan</th>
<th>The proposed development of a wave energy test site off Belmullet Co. Mayo which includes the positioning of WEC’s at two test areas; locations 50 and 100 meter water depths, the landing of electrical cables in the intertidal area of Belderra Strand and the construction of a cable Bay behind the car park at Belderra Strand which form part of the development of the AMETS off Annagh Head, Belmullet, Co. Mayo.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brief description of the Natura 2000 site</td>
<td>The AMETS is located partially within the Mullet/Blacksod Complex SAC and proposed NHA. Site code 000470 and within the proposed West Connacht Coast SAC. Site code 002998.</td>
</tr>
</tbody>
</table>

**Assessment criteria**

1. The plan proposes to allow the positioning of wave energy test devices and their associated moorings in two open water marine areas off Annagh Head. One of these locations (test area B) and a section of the submarine cable is within the proposed West Connacht Coast SAC The proposal also includes the laying of sub seabed cables from these devices through an intertidal area at Belderra Strand linking through a cable bay behind Belderra Strand to a substation on semi improved agricultural grassland behind Belderra Strand.

2. The proposed landfall at Belderra Strand would land the cables at the south-western end of the beach where they could be trenched through the beach and through or adjacent to the car park area to a proposed cable bay. This area of the project falls within the Mullet/Blacksod Complex SAC and proposed NHA. Site code 000470. From this point the cables would run to a substation on the landside of the coast road, which is outside the SAC. The distance through the SAC for the cable laying operation is approximately 0.20 km.

3. It is proposed that a small triangular area behind the car park at Belderra Strand is used for the temporary parking of machinery associated with the cable landing operations and the subsequent positioning of a cable bay.

*We consider that it is appropriate to look at the ‘in combination effects’ of two elements of the plan (the positioning of the wave energy devices at test areas A and B and the landing of cables at Belderra strand and the construction of the on-land cable Bay) as outlined above for this screening assessment. We have also considered the possibility of the proposed Emerald Networks subsea cable, although no foreshore application has been submitted for this potential project, and the findings of the SEA as it relates to the implementation of the OREDP.

Accordingly, we consider that there are no significant adverse ‘in combination’ effects arising from the proposed project.*

<table>
<thead>
<tr>
<th>Description of any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 site by virtue of:</th>
<th>1. The size and scale of the project is considerably less than 1% of the total site area.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Size and scale.</td>
<td>2. There will be temporary land take in the intertidal area of Belderra Strand for the trenching of cables. There will be temporary land take for the construction of the cable joint bay [0.2 hectares] in the small car park at Belderra Strand</td>
</tr>
<tr>
<td>2. Land take</td>
<td></td>
</tr>
</tbody>
</table>
3. Distance from the Natura site or key features of the site.
4. Resource requirement (water abstraction etc)
5. Emissions (disposal to land, water or air);
6. Excavation requirements;
7. Transportation requirements;
8. Duration of construction, operation, decommissioning, etc.

but this area will be reinstated following construction.
3. The cable landfall and cable bay are within an existing SAC, which contains ten Annex 1 habitats. However, the landing of the cables at Belderra Strand and the construction of the cable bay will not impact any Annex 1 habitats.
4. There are no resource requirements.
5. There is no emission or disposal of material issues. The material excavated to allow the trenching of the intertidal area will be immediately reused to backfill the trench.
6. Minor excavations will be required construct the cable Bay, but this area will be reinstated.
7. Transportation requirements are limited to the use of already existing roads.
8. The project duration for all stages within the SAC will be no more than 2 months. The construction period will be weather dependent.

Accordingly, we consider that the project is unlikely to give rise to impacts on the Mullet/Blacksod Complex SAC (Site code 000470) or the proposed West Connacht Coast SAC (Site code 002998).

<table>
<thead>
<tr>
<th>Description of any likely changes to the site arising as a result of:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Reduction of habitat area</td>
</tr>
<tr>
<td>• Disturbance to key species</td>
</tr>
<tr>
<td>• Habitat or species fragmentation</td>
</tr>
<tr>
<td>• Reduction in species density</td>
</tr>
<tr>
<td>• Changes in key indicators of conservation value</td>
</tr>
</tbody>
</table>

1. There will be a minor reduction of habitat within the West Connacht Coast SAC due to the positioning of WEC’s within test area B).
2. There will be no disturbance to key species of birds as construction will take place outside of the breeding season for the bird interest at the site. The process of risk assessment for birds has concluded that for most species which use the AMETs and which are part of the Special Conservation Interest of a connected SPA, significant effects are not likely. However, for great northern diver and shag, the significance of disturbance effects could not be determined. Potential collision and habitat loss effects cannot be fully assessed for storm petrel until nocturnal use of the site has been established.

There may potentially be very localised impacts on bottlenose dolphin, including disturbance. However, there could equally be positive impacts in terms of food availability. In either case these effects are not likely to have significant effect on the natural behaviour or processes of this population.
3. There will be temporary habitat loss during the construction of the cable bay and the trenching of cables in the intertidal area. There will be no long term fragmentation of the habitat.
3. Reduction in species density in the intertidal area will be minimal and temporary.
5. There will be no negative changes to key indicators of conservation value.

Accordingly, we consider that the changes to the Mullet/Blacksod Complex SAC (Site code 000470) Natura 2000 site will be temporary in nature within the intertidal area and insignificant given the exposed dynamic nature of the area. We further consider that impacts to species (bottlenose dolphin and seals) within the proposed West Connacht Coast SAC (Site code 002998) to be negligible given the very small area affected and the wide ranging nature of this population.

<table>
<thead>
<tr>
<th>Describe any likely impacts on the Natura 2000 site as a whole in terms of:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Interference with the key relationships</td>
</tr>
</tbody>
</table>

| Interference with the key relationships of the site in terms of the structure of the Natura 2000 site are likely to be of a temporary nature at Belderra strand. |

33
<table>
<thead>
<tr>
<th>that define the structure of the site</th>
<th>Disturbance to breeding birds, especially Ringed Plover which nest on shingle shores will not occur as construction will take place outside of the breeding season. Increased traffic associated with cable laying and the construction of the cable bay will not disturb resident or migratory bird species as construction will take place outside of the breeding season for resident birds to prevent disturbance. Disturbance to bottlenose dolphin and seals, if it occurs at all, would be very limited spatially. The bottlenose dolphin population using this site is highly mobile and recorded all around the coast of Ireland. Seals are likely to interact with WEC’s and associated infrastructure (moorings) but the impact on them is likely to be limited and spatially constrained.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interference with key relationships that define the function of the site.</td>
<td>We do not think that there are any likely impacts on the Mullet/Blacksod Complex SAC (Site code 000470) Natura 2000 or West Connacht Coast SAC (Site code 002998) site in terms of interference with the key relationships that define the structure or function of the site.</td>
</tr>
<tr>
<td>Provide indicators of significance as a result of the identification of effects set out above in terms of:</td>
<td>1. Minor habitat loss will occur by the placement of WEC’s. 2. We do not consider that the placement of WEC’s at the scale proposed will cause habitat fragmentation. 3. Disruption to the bird interest of the site will be insignificant, as operations will take place outside of the breeding season. 4. The site and area adjacent to the site is used regularly by bottlenosed dolphins but there is no evidence that WEC’s will have a negative impact on dolphins nor compromise the conservation objectives of the West Connacht Coast cSAC. Equally there is no evidence that seals will be negatively impacts by the placement of WEC’s at the site. 5. There will be no change to the key elements of the site including water quality and hydrology.</td>
</tr>
<tr>
<td>• Loss</td>
<td>Indicators of significance are provided in points 1 to 5 above. On that basis we do not consider that there will be any significant change to these five key indicators.</td>
</tr>
<tr>
<td>• Fragmentation</td>
<td>Describe from the above, those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale or magnitude of impacts is not known.</td>
</tr>
<tr>
<td>• Disruption</td>
<td>On the basis of a review of the relevant ecological information available for the site, the proposed scope of works and extensive site surveys, including those of the surrounding habitat and access points, it has been concluded that no significant effects are likely to arise as a result of disturbance for all elements of the plan described in the main body of this report.</td>
</tr>
<tr>
<td>• Disturbance</td>
<td></td>
</tr>
<tr>
<td>• Change to key elements of the site (e.g. water quality etc.)</td>
<td></td>
</tr>
</tbody>
</table>
9. Screening Statement and Conclusions

The main threats to the conservation interests of this site (in the immediate vicinity of Belderra Strand) are recreational activities associated with vehicles accessing the sand dune and dune slack area and the construction of drainage ditches in the dune slack area behind Belderra strand. Some disturbance to breeding birds is also likely due to walkers and suffers using the beach area during the breeding season.

Belderra Strand is an extremely exposed dynamic beach and the results of infaunal analysis from intertidal cores taken at the beach have confirmed that the area is extremely species poor with low species diversity.

The triangular area behind the car park at Belderra Strand is an area of dry calcareous grassland influenced by wind-blown sands. No species of conservation interest were recorded in this area. The parking of plant and vehicles will impact this area during the trenching operation to lay cable in the intertidal area. However, it will be fully reinstated following the completion of the project.

The positioning of an intertidal cable at Belderra Strand and the construction of a cable bay at the car park is not considered a threat to the conservation interests of the site. This conclusion has been arrived at following detailed surveys of the wider site, the qualifying interests of the site and the conservation objectives for the site.

The proposed development of the AMETS site was assessed for its potential impact on bottlenose dolphins within the proposed West Connacht Coast candidate Special Area of Conservation. AMETS is wholly within the boundaries of the SAC but accounts for <0.1% of the total area of the proposed SAC. (0.09% of Mayo section of the West Connacht Coast SAC and 0.04% of the total Galway and Mayo combined West Connacht Coast SAC).

Bottlenose dolphins that use the site have been shown to be part of the highly mobile, inshore population which although use the site on a regular and consistent basis, it is only a very small part of their range. Although there may potentially be very localised impacts including disturbance, there could equally be positive impacts in terms of food availability but in either case these effects are not likely to have significant effect on the natural behaviour or processes of this population. On-going monitoring is recommended using a B-A-C-I design to ensure the deployment and operation of WEC’s at AMETS has no effect and to inform wave energy development elsewhere.

In the absence of empirical data on the impacts of WEC’s on birds, the assessment of likely significant effects is based on a risk assessment process. This process has concluded that for most species which use the AMETs and which are part of the Special Conservation Interest of a connected SPA, significant effects are not likely.

The AMETS is not likely to have a significant effect on the bird species of conservation interest within the SPAs identified. This conclusion is based on the information contained in the Ecological Assessment for the EIS, and the Risk Assessment completed as part of this screening assessment. Given that the significance of some impacts are unknown and given the limited data with which to assess other impacts, monitoring is recommended.

The Risk Assessment and Ecological Assessment for the EIS do not indicate that significant negative effects on birds are likely due to the wave energy test site. However precaution is necessary given the novelty of the development and the paucity of data from active wave energy installations. As such robust and focussed monitoring is essential, both to determine the actual effects of wave energy devices at the test site and to inform other wave energy developments in Ireland and elsewhere.
The pre-development monitoring of the test areas combines transect surveys with a BACI survey design to detect before and after impacts at regional and local scales. Should the WEC’s be installed it will be recommended these surveys continue.

Given the risk, albeit low, of collision and displacement interactions, between birds and WEC’s, further monitoring elements will be recommended to address this risk, should the development proceed. The bird survey team have considered a number of survey elements which could be undertaken, pre-development. These have included radio or satellite tracking of targeted species and point count surveys at the test areas. However, while a broader survey approach could be adopted; budgetary constraints demand that surveys are targeted. Within these constraints discussions as to the best survey approach have concluded that the current monitoring programme should continue but that post WEC installation monitoring of displacement, attraction and collision interactions within the test areas will be essential. Use of a recording device/camera within the test areas and point count surveys to observe interactions will be recommended. An on-going issue with the monitoring will be how to address the interactions between the and nocturnal species, especially the Storm Petrels at Inishglora and Manx Shearwater.

Nothwithstanding the above, the AMETS provides an ideal opportunity for research into the interactions of wave energy convertors and birds. Such research is outside scope of an EIA, however it would allow greater scope for survey work and inform our understanding of impacts, useful at both AMETS and other wave energy sites. The Wave Hub development in England incorporates a strong research element (Witt et al., 2010) and this approach can only be recommended.

10. Statement of no significant impact

There will be no significant effect of the AMETS on the intertidal area or area of the proposed cable bay at Belderra Strand.

There will be no significant effect of AMETS on bottlenose dolphins within the proposed West Connacht Coast cSAC.

The process of risk assessment for birds has concluded that for most species which use the AMETs and which are part of the Special Conservation Interest of a connected SPA, significant effects are not likely. However, for great northern diver and shag, the significance of disturbance effects could not be determined. Potential collision and habitat loss effects cannot be fully assessed for storm petrel until nocturnal use of the site has been established.
11. Bibliography

Atlantic Marine Energy Test Site Environmental Impact Statement (SEAI, 2010)


Assessment of plans and projects significantly affecting Natura 2000 sites – Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC.


Appendix 1. Risk assessment for qualifying species

List of functional groups and associated species included in the risk assessment:

1. Geese and Swans: Barnacle, Light-bellied Brent Goose (Whooper Swan)
2. Diving waterfowl: Great northern diver
3. Shorebirds: Ringed plover, ringed plover, sanderling, dunlin, curlew, purple sandpiper, turnstone
4. Terns: Arctic tern, sandwich, little, (common)
5. Gulls: Lesser black-backed gull, herring gull, common gull, (greater black-backed gull, kittiwake)
6. Petrels: Storm petrel, Leach’s petrel
7. Shearwaters: Manx, Great, Sooty, (Balearic)
8. Cormorants and Shags
9. Fulmar
10. Auks: Puffin, (Razorbill, Guillemot)
11. Skuas: great, (pomarine, arctic)
12. Gannets

1. Geese and Swans

Species included:
Barnacle Goose (Branta leucopsis) Ireland: Amber; Europe: Secure
Light Bellied Brent Goose (Branta bernicla hrota) Ireland: Amber; Europe: Vulnerable
Whooper Swan (Cygnus cygnus) Ireland: Amber; Europe: Secure

Ecological needs
Geese and swans over winter in Ireland, taking advantage of the milder climate to feed on coastal grasslands, pastures, aquatic and marine vegetation. They require suitable habitat for both feeding and roosting and have established feeding and roosting sites and flight lines between these sites. Barnacle Geese, Light Bellied Brent Goose and Whooper Swan are largely site faithful returning to same wintering areas each year.

Current risks
While numbers of the Barnacle Goose, Light Bellied Brent goose and Whooper Swan continue to increase (BWI, 2011) BirdWatch Ireland have identified a number of factors affecting shore [and lagoon] bird conservation in Ireland (see below). Specific factors of most relevance to Geese and Swans are likely to be habitat loss and degradation, coastal development and recreation and disturbance.

<table>
<thead>
<tr>
<th>Lack of awareness</th>
<th>Recreation and disturbance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitat loss, degradation and fragmentation</td>
<td>Coastal developments</td>
</tr>
<tr>
<td>Pollution and oil spills</td>
<td>Climate Change</td>
</tr>
<tr>
<td>Alien and invasive species and predation</td>
<td>Mineral and resource use</td>
</tr>
</tbody>
</table>

Use of AMETS by Geese and Swans
Barnacle Geese feed on Inishglora Island during the winter months. The AMETS study site is flown over by Barnacle Geese as they commute between roosting and feeding sites. Whooper Swans have been observed flying inland to Cross Lough, while established flight paths from the islands (Inishkea’s, Inishglora and Inishkeeragh) to the mainland (Termoncarragh Lake) are used by Barnacle Geese at dawn and dusk. Light Bellied Brent goose have been recorded at Annagh Beach and on the water within the inner Bay.
Potential interactions with and AMETS
It is possible that flying Geese and Swans during spring and/or Autumn migration will fly over the inshore test area. Any within winter observations of flighting geese and swans have found that they do not fly over the proposed test areas. Disturbance to Geese on Inishglora Island during construction and deployment at the inshore area is a potential negative interaction. Construction activities are will be limited to the Spring and Summer months and should avoid Inishglora Island reducing any disturbance risk.

Summary risk of impact from AMETS and recommendations
It is possible that swans and geese may pass over during migration, however they tend to fly higher during migration flights and collision is considered unlikely. There is a low risk of disturbance to wintering geese on Inishglora Island due to the proximity of the inshore test area to this island and due to the Spring/Summer construction window.

It considered unlikely that AMETS will have a significant effect on this species group. Given that this is a novel development, monitoring of site use is recommended. Monitoring of wintering geese and swan populations in this region is on-going through the I-WeBs scheme and this data can be considered together with the study site data.

2. Diving Waterfowl

Species included:
Great Northern Diver (Gavia immer) Ireland: Green; Europe: Secure

Ecological needs
Great Northern Diver is a migratory species wintering in Irish coastal waters. They occur in highest numbers during the winter months, with small numbers of non-breeding birds staying on through the summer months. Divers feed in waters of < 30 m depth, where they forage primarily for small fish but also crustaceans, cephalopods and molluscs. Divers dive through the water column to feed, propelling their bodies with their feet, to obtain food primarily by sight although tactile methods may also be used (Wilson et al., 2007).

Current risks
Disturbance, oil spill, and broader threats such as outlined by BirdWatch Ireland and summarised below:

<table>
<thead>
<tr>
<th>Lack of awareness</th>
<th>Recreation and disturbance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine resource use</td>
<td>Disease</td>
</tr>
<tr>
<td>Alien invasive species and predation</td>
<td>Climate change</td>
</tr>
<tr>
<td>Pollution and oil spills</td>
<td></td>
</tr>
</tbody>
</table>

Use of AMETS by divers
Great Northern Diver and small numbers of Red-throated Diver are recorded in the inshore waters of the Bay. Great Northern Diver occur regularly within the Bay during winter and spring, with smaller numbers staying on into the summer months. Great Northern Diver forage within the shallow waters of the Bay.

Potential interactions with and AMETS
An increase in boat activity within the Bay may cause disturbance to Great Northern Divers. Garthe and Huppop (2004) found that the related species, Black-throated and Red-throated Divers were sensitive to ship and helicopter traffic at marine wind farms sites. Wilson et al (2007) considered that collision risk with is likely to be higher than average for this group of birds. will not be located in the area used by Great Northern Diver, so interactions between foraging Divers and WEC are not a concern. Disturbance by boat activity will be a temporary impact and will take place during the summer months. Any oil spill from associated activities and leakage from WECs will have a negative impact on divers especially during moult.
Summary risk of impact from AMETS and recommendations
Construction activities within the Bay may have a negative impact on Great Northern Diver, however as described in the Ecological Assessment, this disturbance should be of short duration and in the summer months when small numbers of divers are present. Biodegradable materials should be used and any leakage of oils or other substances should be prevented. There is a low risk of a negative interaction with the WECs within the test areas as the divers do not use the test areas for feeding.

It considered unlikely that AMETS will have a significant effect on this species group. Given that this is a novel development, monitoring of site use is recommended. Monitoring of wintering Great Northern Diver populations in this region is on-going through the I-WeBs scheme and this data can be considered together with the study site data.

3. Shorebirds (wintering)

Species included:
- Ringed Plover (Charadrius hiaticula) Ireland: Amber; Europe: Secure
- Sanderling (Calidris Alba) Ireland: Green; Europe: Secure
- Dunlin (Calidris alpina) Ireland: Amber; Europe: Declining
- Curlew (Numenias arquata) Ireland: Red; Europe: Declining
- Purple Sandpiper (Calidris maritima) Ireland: Green; Europe: Secure
- Turnstone (Arenaria interpres) Ireland: Green; Europe: Declining

Ecological needs
Wintering shore birds arrive in Ireland during September/October and depart for their breeding grounds in March/April. During the winter months shore birds spend much of their time feeding, restoring their energy resources after migration and return migration and for breeding. Shore birds come to Ireland for the rich feeding resource held in the largely frost free coasts and wetlands. Feeding is a key part of the survival of wintering shore birds, both at their wintering grounds and as factor in breeding success at their breeding grounds. For some wintering species, which cannot habituate to disturbance, undisturbed feeding habitat is essential to their successful return migration and breeding success.

Current risks
Crowe (2008) describes a decrease in the wintering population of Dunlin, Curlew, Purple Sandpiper and Turnstone, while there is a percentage increase for Ringed Plover. A number of factors affecting the shore [and lagoon] bird conservation in Ireland have been identified by BirdWatch Ireland (see Swans and Geese). Factors of particular importance to this species group are: Recreation and disturbance; Coastal developments; Habitat loss, degradation and fragmentation.

Use of AMETS by shore birds
The shore habitats are used by feeding and roosting shorebirds as listed above. Belderra Strand the site of the proposed landfall is used by low numbers of shorebirds.

Potential interactions with WECs and AMETS
Wintering shorebirds will have no interactions with WECs. There will be temporary disturbance at Belderra Strand during cable laying in the summer months.

Summary risk of impact from AMETS and recommendations
It considered unlikely that AMETS will have a significant effect on this species group. Given that this is a novel development, monitoring of site use is recommended. Monitoring of wintering shorebird populations in this region is on-going through the I-WeBs scheme and this data can be considered together with the study site data.

4. Terns
Species included:
Arctic (Sterna paradisaea) Ireland: Amber; Europe: Secure
Sandwich (Sterna sandvicensis) Ireland: Amber; Europe: Declining
Little (Sterna albifrons) Ireland: Amber; Europe: Declining
Common (Sterna hirundo) Ireland: Amber; Europe: Secure

Ecological needs
Terns are migratory moving south for the winter and returning to breed at coastal and mainland island sites during the summer. Terns are colonial nesters and feed mainly on small fish. During the breeding season terns forage extensively in inshore regions. Terns feed by plunge diving though they do not penetrate deeply into the water (Jackson & Whitfield, 2011).

Current risks
Aside from Little Tern, the populations of Common, Arctic and Sandwich terns increased between 1969 and 1995 (BWI, 2011). The Little Tern population declined during this period. Pressures on breeding tern populations include: predation at nest sites, availability of food, quality of nesting habitat and survival in their wintering grounds (Mitchell et al., 2004).

Use of AMETS by Terns
All tern species forage within the Bay. Arctic Tern is the only tern species recorded foraging outside of the Bay and within the study site. Terns forage within the study site between April and August, and are presumed to be part of the local breeding population. Foraging is likely to include gathering food for chick provisioning. Terns on migration have also been recorded within the study site.

Potential interactions with WECs and AMETS
As a plunge diving species terns are likely to be at higher collision risk than other seabirds (Wilson et al., 2007). However as they do not penetrate deep into the water this risk is considered to be low (Jackson & Whitfield, 2011). Availability of prey could be affected by changes to currents and wave action resulting from wave energy converters (Jackson & Whitfield, 2011). Terns foraging in the Bay may be temporarily disturbed from parts of the bay during cable laying activities. However, Garthe and Huppop (2004) found that Common Terns did not react strongly to disturbance by ships and helicopters. Other species of tern may be more sensitive, such as Little Tern. Some disturbance to terns nesting on Inishglora Island caused by deployment and operational activities at test area B is possible although considered unlikely given that test area B is 800 m from the western tip of the island.

Summary risk of impact from AMETS and recommendations
Significant effects on the locally breeding terns species are not considered likely, owing to the relatively small area occupied by the test areas and the lack of any obvious attraction to the test areas. While the risk of collision is considered to be low any mortality due to collision could have a significant effect on the local breeding population. Monitoring interactions between foraging terns and WECs is essential to examine collision risk.

5. Gulls

Species included:
Common Gull (Larus Canus) Ireland: Amber; Europe: Depleted
Herring Gull (Larus argentatus) Ireland: Red; Europe: Secure
Great Black-backed Gull (Larus marinus) Ireland: Amber; Europe: Secure
Lesser Black-backed Gull (Larus fuscus) Ireland: Amber; Europe: Secure
Kittiwake (Rissa tridactyla) Ireland: Amber; Europe: Secure

Ecological needs
The Kittiwake is the smallest and most oceanic of the above gull species nesting Ireland. Breeding in coastal colonies, Kittiwake feed mainly on small pelagic fish, invertebrates and discards from fishing boats. Outside of the breeding season Kittiwake are largely oceanic and range further offshore. Common, Herring, Great and Lesser Black-backed gulls can breed at both inland and coastal sites, though winter foraging is mainly at coastal sites or further offshore. Like Kittiwake, Common, Herring, Great and Lesser
Black-backed gulls Gulls will feed on invertebrates, fish and fishing boat discards. Herring Gull and Great Black-backed Gulls will also scavenge for food, predate off other birds and practice food piracy. Gulls feed mainly from the sea surface and are relatively tolerant of human disturbance. (BWI, 2011, Jackson & Whitfield, 2011, Mitchell et al., 2004)

Current risks
BirdWatch Species Action for marine and sea cliff nesting species show an increase in the breeding population of Kittiwake, Common Gull and Lesser Black-backed Gulls, though contractions in breeding range are also reported (BWI, 2011). The breeding populations of Great Black-backed and Herring Gull have declined. BirdWatch Ireland list a number of factors affecting marine and sea cliff nesting species these are listed below:

<table>
<thead>
<tr>
<th>Lack of awareness</th>
<th>Recreation and disturbance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine resource use</td>
<td>Disease</td>
</tr>
<tr>
<td>Alien invasive species and predation</td>
<td>Climate change</td>
</tr>
<tr>
<td>Pollution and oil spills</td>
<td></td>
</tr>
</tbody>
</table>

Factors of particular note in terms of breeding gulls are predation at nest sites, reduced food availability linked to changes in waste disposal and fisheries practice, habitat changes and botulism (Mitchell et al., 2004).

Use of AMETS by Gulls
Gulls are present year round throughout the study site. Kittiwake, Great Black-backed gull, Lesser black backed Gull and Herring Gull are recorded both inshore and offshore, while Common Gull and mainly recorded inshore. See EIA: Appendix 3.

Potential interactions with WECs and AMETS
Given that gulls are mainly surface feeders, SNH (2011) consider that they are unlikely to be exposed to collision risk from marine turbines. Wilson et al (2004) also consider this species group to be at lower risk of collision than other groups. Gulls make ready use of man-made structures and SNH consider that protruding above the surface are likely to be used by perching gulls.

Summary risk of impact from AMETS and recommendations
Gulls are considered to be at low risk of negative interaction from operational. Possible negative interactions such as collision, displacement and disturbance are unlikely to have an impact on this species group.

6. Storm Petrels

Species included:
European Storm Petrel (Hydrobates pelagicus) Ireland: Amber; Europe: Secure
Leach’s Storm Petrel (Oceanodroma leucorhoa) Ireland: Amber; Europe: Localised

Ecological needs
Storm Petrels are a small pelagic seabird which only returns to land to breed on remote coastal island. Storm Petrels nest in burrows which they leave and enter only under cover of darkness. Storm Petrels are visual feeders and mainly peck food from the water surface feeding on small fish and zooplankton (Mitchell et al., 2004). While known to feed during the day, as for most seabird species, the extent of night time foraging is not known (Wilson et al., 2007). During the breeding season Storm Petrels are known to feed in deep water areas however recent evidence suggests they move inshore to feed at night (Mitchell et al., 2004).
Current risks
Mammalian predators and availability of suitable habitat have been identified as factors affecting Storm Petrel breeding success (Mitchell, 2004). Other general factors identified by BirdWatch Ireland will also be relevant.

Use of AMETS by Storm Petrels
European Storm Petrels nest on Inishglora Island and forage within the deeper waters of the study site. They are present between June and August and are recorded throughout the study site except within the Bay. Their distribution appears to be linked to waters beyond the 50 m isobaths.

Potential interactions with WECs and AMETS
WECs are unlikely to present a collision risk to Storm Petrels due to their feeding behaviour. However, any risk of collision risk is likely to be higher where there are young birds are involved and at night time or in conditions of poor light. Given that Storm Petrels due not plunge dive or dive underwater this risk remains low. Storm Petrels may be displaced from foraging within the test areas however alternative foraging habitat is available. Night time illumination of the vessels and test areas may affect the nocturnal behaviour of Storm Petrels (Jackson & Whitfield, 2011). However the night time lighting will be the same as for navigational bouys. Inishglora Island lies 800 m from the test area B. There is a risk of collision due to birds moving between foraging areas and nesting sites on the island, especially under darkness or poor light.

Summary risk of impact from AMETS and recommendations
There is a low risk of collision involving commuting birds, with a higher risk during poor light and/or when young birds are involved. Overall significant effects on the breeding population are considered unlikely, however adequate monitoring is essential. Should WECs be deployed a method of recording day and night time interactions between Storm Petrels and wave energy convertors should be required.

7. Shearwaters

Species included:
Manx shearwater (*Puffinus puffinus*)
Great shearwater (*Puffinus gravis*)
Sooty shearwater (*Puffinus griseus*)
Cory’s shearwater (*Calonectris diomedea*)
Balearic shearwater (*Puffinus mauretanicus*)

Ireland: Amber; Europe: Secure
Ireland: Amber; Europe: Secure
Ireland: Amber; Europe: Secure
Ireland: Amber; Europe: Secure
Ireland: Red; Europe: Red

Ecological needs
Shearwaters are part of the tubenose group of seabirds and use both scent and sight to help locate prey items. Shearwaters forage primarily on schooling fish and small pelagic crustaceans and molluscs, usually plucking prey from the water’s surface, though will also occasionally pursue prey underwater by swimming or via shallow plunge dives from 1-2m altitude. Shearwaters generally fly within close proximity of the water as they make use of surface air currents for momentum. Foraging and flight frequently occur at night, which may make shearwaters more susceptible for collision events, particularly if there are bright white lights in operation (Jackson & Whitfield, 2011).

Shearwaters are highly pelagic birds and are mostly found in offshore environments. Of the shearwaters found in Irish waters, Manx shearwaters are the only confirmed shearwater species breeding in Ireland. Manx shearwaters nest in burrows, as part of large colonies and usually on islands less accessible to mammalian predators. Manx shearwaters visit colonies only on dark, moonless nights as their inability to walk on land makes them particularly susceptible to predation.
Shearwaters feed chicks on concentrated stomach oil derived from semi-digested prey and forage over wide ranges from the colony (~400km). Specific foraging ranges from Irish colonies are not currently known.

As with other seabirds, shearwaters are long-lived (30+ years) and their populations are particularly sensitive to adult mortality, though will also decline if recruitment is consistently poor.

**Current risks**

Shearwaters generally have medium-low susceptibility to oiling events, possibly being able to avoid oil through olfactory detection (Casement, 1966) but still occurring in oiled bird censuses (Camphuysen, 1989). They are incidentally taken in fishing gear and although rates are not well-characterised there is evidence of mass-mortality in purse-seining as well as mortality from long-line fisheries (e.g. Balearic shearwaters - Louzao et al. 2011). Balearic shearwaters are currently listed as critically-endangered by the IUCN due to both fisheries-related mortality (Louzao et al., 2011) and high predation due to mammalian predators at colonies. The more commonly-occurring species of shearwater using the AMETS area are also subject to similar risks but their larger populations are currently stable.

**Use of AMETS by shearwaters**

Manx Shearwater are the most commonly recorded shearwater in the study site. Manx Shearwater mainly occur between April and August. Large foraging rafts of Manx Shearwater have been recorded in Spring and these may be late arriving non breeding birds. Large numbers of foraging Great Shearwater have been recorded in the study site during Autumn passage, only small numbers of the other species have been recorded.

**Potential interactions with WECs and AMETS**

The nocturnal habits and low flight altitude of shearwaters result in a higher than average potential to collide with WECs or service vessels, particularly if bright lights are employed during night time servicing or construction work. The potential for underwater entanglement is minimal given the shallow depths of shearwater dives. Shearwaters will also be low to moderately vulnerable to accidental fuel spills associated with AMETS activities.

**Summary risk of impact from AMETS and recommendations**

Given the small footprint of the test areas, the overall risk of harm to shearwaters is likely to be low. However, it is recommended that a comprehensive spill prevention and response plan be implemented and the use of bright lights and night time servicing be avoided. Although the footprint of AMETS creates a very small likelihood of collision risk, collisions are still possible, particularly for low-flying nocturnal species like petrels. Monitoring is recommended to estimate collision events post-installation.

### 8. Cormorant and Shag

**Species included:**

Cormorant (*Phalacrocorax carbo*)

Shag (*Phalacrocorax aristotelis*)

Ireland: Amber; Europe: Secure

**Ecological needs**

The Cormorant is found in coastal waters, estuaries or freshwater lakes and reservoirs (Lloyd et al., 1991). The Shag is mainly found in coastal waters. Both species mainly forage inshore within a few km’s of the coast, where they surface dive, using foot propulsion and forage underwater for small fish. They are daytime feeders, using vision and tactile methods to search for prey. Shag and Cormorant dive from the surface to moderate depths of typically <30m (Jackson & Whitfield, 2011) to feed mostly on or close to the sea bottom. Colonial breeders, Shags nest on cliffs or offshore Islands, while Cormorant nest at both coastal and inland breeding sites. Man-made objects are often used as perches by Shag and Cormorant.
Current risks
The breeding populations of Cormorant and Shag have increased (BWI, 2011). However local declines have taken place. Factors leading to these declines include persecution, food availability and mortality due to oiling is a threat (Mitchell et al,2004).

Use of AMETS by Cormorant and Shag
Cormorant and Shag forage and pass through the study site, though as expected their distribution is linked to the mainland and islands and they are found mainly within the Bay. Shag were not recorded during at sea surveys for the EIA, but were recorded in at sea surveys during the first year of monitoring. Further years of data will shed further light on their use of the study site.

Potential interactions with WECs and AMETS
Collision risk is considered to be higher than average for this group (Wilson et al.,2007). This risk is likely to be highest where WECs are located within depths used by foraging Shag and Cormorant. The test areas at the AMETS are both at depths of greater than 30m and collision during foraging is therefore unlikely. There is a risk of collision between WECs and flying Cormorant and Shag, especially given that they fly close to the water, this risk is likely to be greater during poor visibility. Any disturbance effects due to cable laying within the Bay will be of short duration and temporary.

Summary risk of impact from AMETS and recommendations
It is unlikely that the WECs and associated activities will have a significant effect of Shag and Cormorant.

9. Fulmar

Species included:
Fulmar (Fulmarus glacialis)  Ireland: Green; Europe: Secure

Ecological needs
Fulmar are part of the tubenose family of seabirds and use both scent and sight to help locate prey items. Scent is particularly important for night-time foraging. Fulmars forage primarily on pelagic prey including zooplankton, squid and schooling fish, though will also readily take fisheries discards and carrion. Prey are obtained primarily through surface feeding and occasionally through shallow plunge-dives (<3m depth). As fulmars nest on the ground, they are vulnerable to land-based predators and usually nest on offshore islands and inaccessible cliff faces. Fulmars feed chicks on concentrated stomach oil derived from semi-digested prey. This allows fulmar to range more widely from their colonies while provisioning, covering ranges up to 664km, though this varies both with colony and seasonal oceanic conditions. Neither average nor maximum foraging ranges are known for breeding colonies local to AMETS. As with other seabirds, fulmars are long-lived (30+ years) and their populations are particularly sensitive to adult mortality, though will also decline if recruitment is consistently poor. Fulmars generally fly within 4-5 m of the water’s surface.

Current risks
Fulmars do not appear to be as vulnerable to oiling as other species, possibly being able to use olfactory cues to avoid settling in oiled areas (Lorenstsen and Anker-Nilssen, 1993). Likewise, fulmars do not seem to be as vulnerable to fishing mortality or anthropogenic disturbance at breeding colonies as other seabirds (Hatch et al., 1998). Their relative resiliency has resulted in populations that are stable or increasing in most areas.

Use of AMETS by fulmars
Fulmars occur throughout the study site, with highest numbers recorded between January and August.

Potential interactions with WECs and AMETS
Being primarily diurnal in habit, fulmars are considered to have a low risk of collision with WECs, though collision risk will increase in the event of reduced visibility (e.g. fog). The feeding habits of fulmars put them at minimal risk of underwater collision or entanglement with WEC equipment.
Summary risk of impact from AMETS and recommendations
Overall the risk of AMETS having a negative impact on fulmars is low due to the low risk of collision and low impact potential of oiling. Collision risk will likely increase in instances of reduced visibility. It is recommended a spill prevention and response plan be implemented to reduce risk of oiling events.

10. Auks

Species included:
- Razorbill (*Alca torda*)
  - Ireland: Amber; Europe: Secure
- Common guillemot (*Uria aalge*)
  - Ireland: Amber; Europe: Secure
- Puffin (*Fratercula arctica*)
  - Ireland: Amber; Europe: Depleted

Ecological needs
Auks are pursuit-diving seabirds that feed primarily on small fish and crustaceans captured in the offshore environment. Birds will swim underwater in pursuit of prey, commonly descending to <60m deep and traveling through the water at speeds up to 1-2m/s. While all species of auk tend to remain offshore during the wintertime, they must return to land to breed. As auks nest on the ground and in burrows, they are vulnerable to land-based predators and usually nest on offshore islands or rugged cliff faces. Birds will flush from colonies if overly disturbed by humans, which can result in loss of eggs and chicks. Auks feed chicks on whole fish delivered to the chicks at the colony. They thus require isolated breeding locations within commuting distance of adequate populations of small schooling fish. As auks are long lived, populations are very sensitive to adult mortality, but can also become depleted if recruitment is consistently poor. The adaptation of auk wings for underwater travel has resulted in high wing-loaded and relatively poor manoeuvrability in the air. Auks frequently travel at high speeds within 10 m of the water’s surface, particularly when commuting from colonies to foraging areas.

Current risks
The main current risks to auks in Ireland include depleted productivity due to introduced predators (e.g. rats), entanglement in fishing nets, and vulnerability to oiling. Auks spend a large amount of time in and on the water, which increases their likelihood of coming into contact with errant oil and other fluids spilled on the water’s surface. Oil-related mortality results from the ingestion of oil while cleaning oiled feathers as well as from hypothermia due to compromised feather waterproofing. Entanglement and oiling frequently involve adult birds and can thus have significant impacts on breeding populations.

Use of AMETS by auks
Auks were present in highest numbers during the Spring and summer months, and were present throughout the study site, both offshore and within the Bay.

Potential interactions with WECs and AMETS
Auks likely have a low-moderate risk of aerial collision with WECS. Although they amount of time auks spend underwater makes them more vulnerable to entanglement in WEC cables or moving parts, the agility of auks underwater makes this unlikely. Auks are however more vulnerable to striking WECS while in flight due to their relatively limited aerial agility and tendency to fly at high speeds and low altitudes. The fact that auks are used to avoiding waves during flight may make them effective at avoiding WECS as well but overall the risk of collision is not well characterised. Auks are not commonly recorded as daytime bird strikes but there are documented cases of guillemots occasionally striking highly lit ships at night. These latter strikes are most likely caused by excess lighting but do indicate that strikes are possible.

Auks have a greater vulnerability to oiling (Campbell, 1989) than other species and although the likelihood of accidental exposure to oil or hydraulic fluid from AMETS activities is low, their vulnerability makes it particularly important that activities at AMETS follow rigorous fluid management protocols and that an effective spill response plan is in place.

The exclusion of fishing from the AMETS area may result in reduced adult mortality due to reduced incidence of entanglement in fishing nets.
Summary risk of impact from AMETS and recommendations
The risk of a negative impact from AMETS activities is higher for auk species than for most other species, primarily due to the low altitude of auk flight and their vulnerability to accidental spills. However, the risk is still estimated as low given the small footprint of the AMETS area. To ensure minimal impact, it is recommended that focal monitoring of WECs be conducted following their installation to estimate the frequency of auk impacts.

11. Skuas

Species included:
- Great skua (Stercorarius skua) (Ireland: Amber; Europe: Secure)
- Arctic skua (Stercorarius parasiticus) (Ireland: n/a; Europe: n/a)
- Pomarine skua (Stercorarius pomarinus) (Ireland: n/a; Europe: n/a)
- Long-tailed skua (Stercorarius longicaudus) (Ireland: n/a; Europe: Secure)

Ecological needs
Skuas are primarily passage migrants in Ireland, visible between April and October en route to and from their main breeding colonies (Great skua – Scotland, Arctic skua – Iceland/Scandinavia, Pomarine skua – Russia). Only Great skuas nest in Ireland and of these there are only few nesting pairs, all on the West coast. Skuas nest in loose colonies or as lone pairs, frequently associated with nesting colonies of other birds from which they may take chicks and eggs. Great skuas are currently Amber listed in Ireland due to their limited breeding numbers. Pomarine and Arctic skuas are considered as rare and common visitors, respectively. The majority of skuas likely use Irish waters only for temporary feeding during migration. Skuas will plunge feed but generally remain within 1m of the water’s surface. They will also take prey from the surface while swimming. Skuas of all types associate readily with fishing vessels to feed on discards. As they are opportunistic feeders, they generally travel at medium altitudes over marine waters and are agile flyers.

Current risks
There is only one known nesting site for Great Skua in Ireland. Factors affecting the Scottish Great Skua population are persecution and changes in food availability (Mitchell et al., 2004)

Use of AMETS by skuas
Low numbers of Skua’s are found within the study site. Great Skua are the most commonly recorded species and these have been recorded during the Autumn.

Potential interactions with WECs and AMETS
The SNH identifies skuas as low risk for potential negative interactions with WECs. Neither their foraging nor flying habits put them at risk for collision or entanglement and their general attraction to boats suggests that they will not be disturbed by installation and maintenance activities in the AMETS area. Given the brief presence of skuas in the AMETS area the exposure window for disturbance is also very short.

In this instance, the most probable negative impact of WECs on skuas would be through altered prey availability. The low numbers of skua observed during surveys of the AMETS area suggest that the area is not a foraging hotspot for skuas but the limited duration of the surveys does not allow for definite conclusions in this regard. On going monitoring of skua activity in the AMETS area is suggested.

Summary risk of impact from AMETS and recommendations
Based on the ecology of skuas and their temporary, low density presence in the AMETS area, it is unlikely that activities associated with AMETS pose a negative risk to skua populations of any species. Ongoing monitoring of the area for skua activity and interactions with WECs once installed is recommended.
12. Gannet (Morus bassanus)

**Species included:**
*Gannet (Morus bassanus)*  Ireland: Amber; Europe: Secure

**Ecological Needs**
The gannet is a large-bodied, long-lived seabird that nests on isolated islands and cliffs. As with most seabirds, populations are most sensitive to adult mortality and productivity fluctuates dramatically between years. Gannets require isolated nesting islands or cliffs to prevent disturbance from ground-based predators and humans, within commuting distance of an adequate prey base for provisioning chicks. While gannets are known to forage up to 600 km from their breeding colonies (SNH 2011), this is a maximum range and average foraging ranges are not currently known for most Irish colonies. Average foraging ranges recorded at other European gannet colonies are usually in the area of 100-155km (Grémillet *et al.*, 2006, Hamer *et al.*, 2009) and foraging ranges usually increase with colony size. Following the breeding season, gannets range widely in pursuit of prey, primarily into offshore areas. Gannets are plunge-diving seabirds, meaning that they dive rapidly from heights of around 10-30m, entering the water at high speeds and sometimes descending to depths of 10m-20m in pursuit of prey. Because they search for prey from above, gannets tend to fly between 10-30m altitude.

**Current risks**
The main current threats to gannets in Ireland include nest predation and disturbance, potential for oiling, and potential entanglement in fishing nets. The gannet population is currently increasing in Ireland.

**Use of AMETS by gannets**
Gannets were the most common bird observed within the AMETs area during the EIA surveys, though this was driven primarily by the presence of large feeding flocks in October of 2010 (see EIA document). These feeding flocks suggested high prey availability in the AMETs area during that time and it is likely that the gannets observed included young of year and adults from mixed colonies. The presence of gannets within the AMETs area was generally much lower but consistent throughout the remainder of the year (~3-5 birds/km²).

**Potential interactions with WECs and AMETS**
The SNH Guidance (Jackson and Whitfield, 2011) ranks gannets as ‘low risk’ for negative interactions with WECs. There is a risk of birds striking or entangling in underwater cables during foraging dives, but the small footprint of the cables makes the probability of such strikes unlikely, particularly given the gannet’s good eyesight. Above-water collision risk is ranked as very low as gannets have keen eyesight and good maneuverability and generally fly at heights far above the maximum height of WECs.

There is the risk that gannets will avoid WECs and thus be displaced from potential feeding grounds. The impacts of such a displacement would likely be lower for gannets as they are able to range widely in search of food, unlike less mobile species like auks, though the exact impacts would depend on the importance of the AMETs area as a feeding site. The importance of AMETs as a feeding site for gannets is currently not well described.

Gannets generally show habituation to human activities at sea and readily feed of fisheries discards. As such they are unlikely to be disturbed by boat traffic associated with installation and maintenance of WECs in the AMETS.

Gannets have a medium vulnerability to oiling events in general (Camphuysen, 1989) and are thus at medium risk of oiling in the event of a spill event in the AMETS area. The risk of accidental release of oil or hydraulic fluid into the marine environment is highest during the installation and servicing of WECs but can be managed through proper maintenance of WECs and the active use of a comprehensive spill prevention and response plan.
Reviews to date have suggested that WECs may act as de facto MPAs due to the exclusion of fishing vessels and the introduction of novel shelter for potential prey in the form of WECs (Grecian et al. 2009). It is possible that the AMETs area could have a positive effect on prey availability for gannets and thus attract rather than displace gannets, which could also in turn increase the likelihood of collision.

**Summary risk of impact from AMETS and recommendations**

Based on gannet habits and ecology and the nature of WECs, AMETS poses a low risk of a negative impact on gannets in Ireland. The main risk is potential displacement from the AMETs area. The footprint of the AMETS WEC areas is very small within the ocean and the tendency of gannets to habituate to human presence at sea indicates that they are unlikely to be disturbed by installation and maintenance activities. However it is recommended that hydraulic fluids and oils be rigorously managed and that a spill prevention and response plan be put in place. Interactions between gannets and WECs should also be monitored in the AMETS region.