


Codling Bank Wind Park Foreshore Licence Application

Supporting Information

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1 INTRODUCTION

1.1 Aims and Objectives

The objective of this document is to outline proposed investigative works as part of developing the Codling Bank Wind Park and to inform the potential impacts this work may have on Foreshore users, Natura 2000 sites, European Protected Species (EPS) and any other environmental or human resources that may be impacted by the works. This information is part of the Investigative Foreshore Licence Application (Offshore Renewable Energy) that has been submitted to the Department of Environment, Community and local Government and covers the area shown in Figure 1.

The specific aims of this document are to:

- Provide details of the proposed works;
- Assess the impacts on human and environmental resources within the vicinity;
- Propose appropriate mitigation measures to minimise any impacts; and
- Summarise any residual impacts.

Contact details and company experience can be found at the end of this document in the Appendix.

The proposed investigative works is to commence in Autumn 2013 and aspects of the work will carry on for one year.

1.2 Project Background

Codling Wind Park Ltd (CWP) is a joint venture company between Fred Olsen Renewables Ltd and Hazel Shore Ltd and has been established to develop the Codling Bank Wind Park, an offshore wind farm located off the east coast of Ireland.

Codling Bank Wind Park is located approximately 13 km off the east coast of Ireland (off Co, Wicklow) between Greystones and Wicklow, Codling Bank Wind Park is comprised of two phases:

- Codling Wind Park - a consented development of 220 turbines;
- Proposed Codling Wind Park Extension - comprises 200 turbines for which a licence for consent has been submitted.

The turbines will be situated on the Codling sand bank in water depths ranging between 9 and 18 m.

1.3 Planned Work

In order to undertake these surveys, a range of vessels will be mobilised with a suite of survey equipment and devices. Where possible, all of the vessels will be local to the area, using local crews, and will naturally minimise any negative interactions with other foreshore users through their inherent knowledge and understanding of local activities and sea conditions.

As described in the Investigative Foreshore Licence Application (Offshore Renewable Energy), the involvement of a Fisheries Liaison Officer (FLO) for every aspect of the consultation around the works, the production of a Mariners Notice and updating the Codling Wind Park website with all past, current and imminently proposed works will ensure information on the timings and extent of surveys is disseminated efficiently. In this way, every effort will be made to reduce negative interactions with other foreshore users.

The specific requirements and location of the survey work, including methodologies, lighting and mooring arrangement etc. would be agreed with the Department of Environment, Community and Local Government prior to the commencement of any survey works. Further information on survey works proposed is presented in Section 3 below. An indicative layout for the CPOD devices is shown in Figure 2. Whilst the final layout is still to be determined, this figure shows the scale of the survey required and hence the size of the area under application.

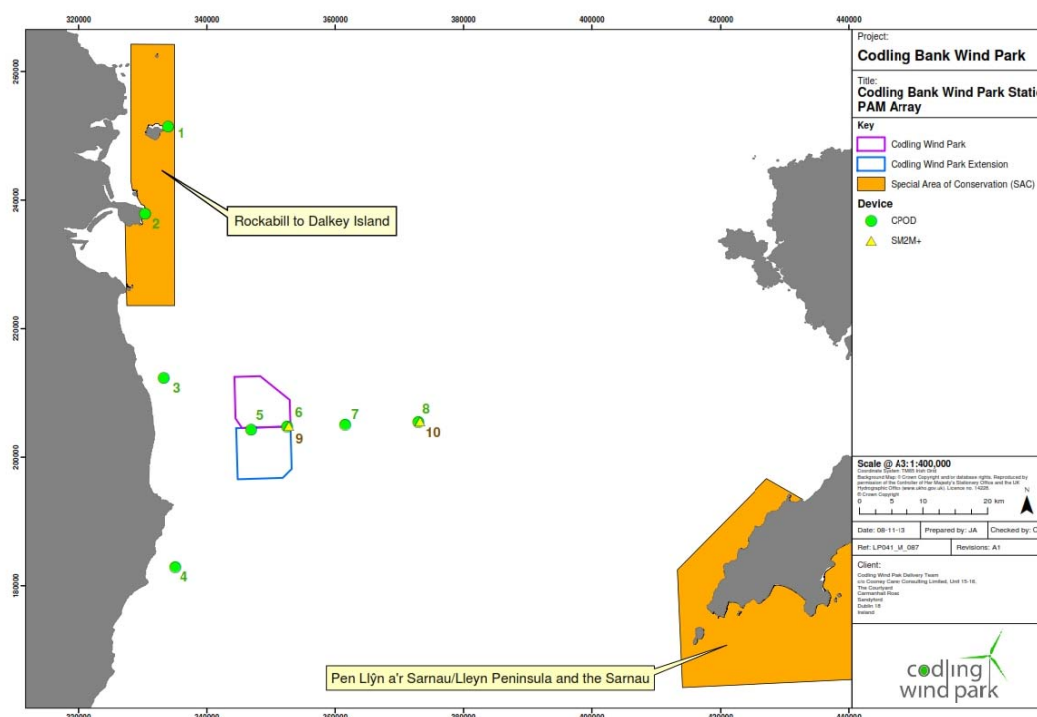


Figure 2: Indicative arrangement of C-PODS

1.3.1 Summary of Work

Table 1 below provides a summary of the proposed work and gives brief details of each different activity. These are further discussed throughout this document.

Please note Table 1 includes seal haul out counts and drop down video which are not intrusive and are understood to be outside the requirements of this investigative licence application. The full suite of surveys have been included for completeness.

Table 1: Summary of proposed investigative work covered in the Investigative Foreshore Licence Application (Offshore Renewable Energy)

Method	Details
Passive acoustic monitoring	Up to 15 C-PODs deployed in locations within the proposed sites and surrounding area, targeting recording of vocalisations of harbour porpoise and other cetaceans.
Seal haul out counts	Count number of seals hauled out at sites local to Codling Bank Wind Park and other Offshore Wind Farm sites.
Drop-Down Video	Up to 40 stations within the wind farm boundary, 40 stations within one tidal excursion and 10 – 20 reference stations beyond one tidal excursion.
Seabed sampling using a 0.1 m2 Hamon grab	The grab gear will be deployed following recovery of the drop-down video equipment where seabed conditions are suitable for grab sampling. All 90-100 drop down video stations will be sampled if possible.

Epibenthic Beam/ prawn Trawl	Up to 20 trawl stations (up to one survey every quarter,) will be surveyed within the wind farm sites, 4 stations within one tidal excursion and 2 reference sites beyond one tidal excursion.
Commercial Otter Trawl Survey	Sampling of commercially important species will be conducted using commercial otter trawl gear. Eight trawls will be conducted within the wind farm sites and 4 within one tidal excursion. Trawl durations will be approximately 30 minutes. The surveys will be repeated quarterly; once during each season.
Metocean Characteristics	One year measurement campaign to determine the met-ocean characteristics. Data gathered to include: wave data, turbidity data, tidal range and speed, sediment collection to inform settling velocity.

2 MARINE RECEPTORS AROUND CODLING BANK WIND PARK

This section identifies the potential marine receptors around Codling Bank Wind Park. It identifies both the potential natural resources and designated sites, and the other foreshore users that may or are likely to be encountered during the investigative works.

2.1 Natura 2000 sites 2.1.1 Special Protection Areas

There are seven Special Protection Areas (SPAs) designated for breeding or migrating seabirds located within 60 km of the zone (Figure 3 and Table 2). These SPAs are designated for various gull, tern and auk species in addition to fulmar, cormorant and shag.

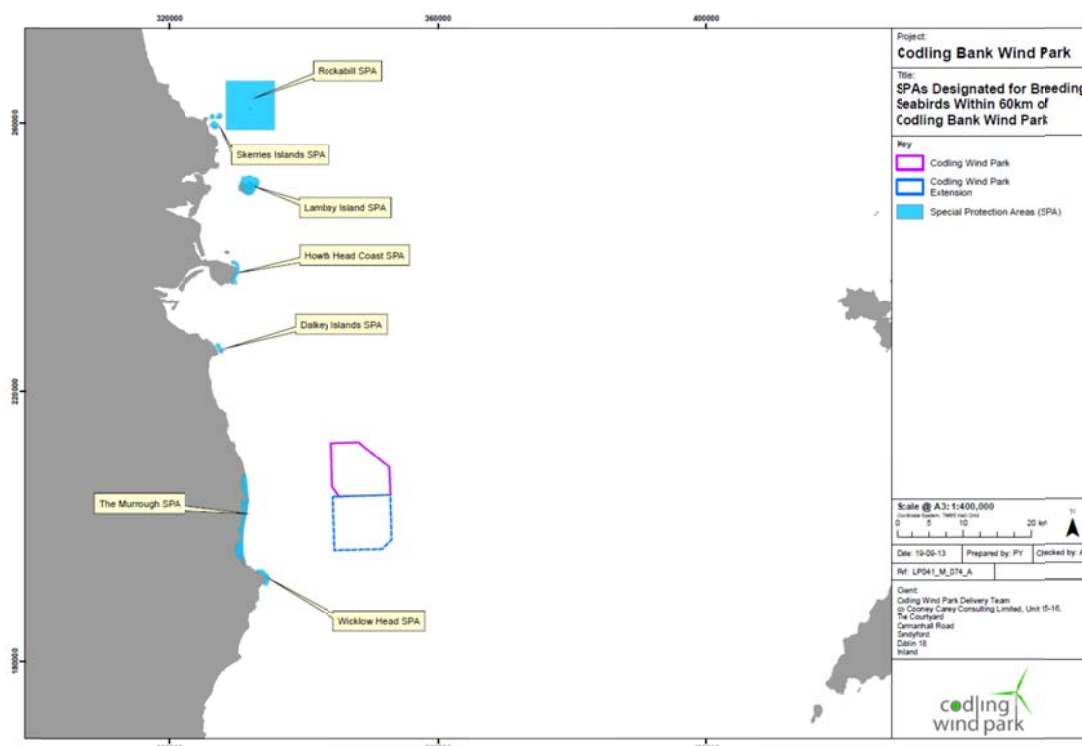


Figure 3: Map of SPAs within 60km of Codling Bank Wind Park

Table 2: SPAs within 60km of Codling Bank Wind Park
(Key: pr – pairs; ind – individuals).

SPA	Distance from site	Designated species (population sizes per SPA citations)
The Murrough	13.5 km	Herring gull (506 pr) Little tern (30 pr average 1999-2002, 100 pr in 2005)
Wicklow Head	19 km	Kittiwake (956 pr)
Lambay Island	44 km	Fulmar (635 pr) (2009 – 530 prs) Cormorant (675 pr) (2009 - 363 pr) Shag (1122 pr) (2009 - 1129 pr)

		Kittiwake (4091 pr) (2009 – 4182 pr) Lesser black-backed gull (309 pr) (476pr) Herring gull (1806 pr) (766pr) Great black-backed gull (193 pr) (236 pr) Guillemot (59824 ind.) (67300 ind.) Razorbill (4337 ind.) (6400 ind.)
Rockabill	56 km	Roseate tern (611 pr) Common tern (610 pr) Arctic tern (89 pr)
Dalkey Islands	21 km	Important autumn staging area for common, Arctic and roseate terns. (small numbers also breed: common tern 62 pr, Arctic tern 24 pr, roseate tern 11pr)
Howth Head Coast	27.5 km	Kittiwake (2269 pr)
Skerries Islands	50 km	Cormorant (558 pr) Herring gull (150 pr) Great black-backed gull (25 pr)

2.1.2 Special Area of Conservations

Under the Habitats Directive, six SACs with marine mammals as qualifying features have been designated within the Irish Sea and two SACs located just outside the Irish Sea regions which are of importance to grey seals. Further to this there have been six SACs designated for habitats within close proximity of the Codling Bank Wind Park (Figure 4 and Table 3 and 4)

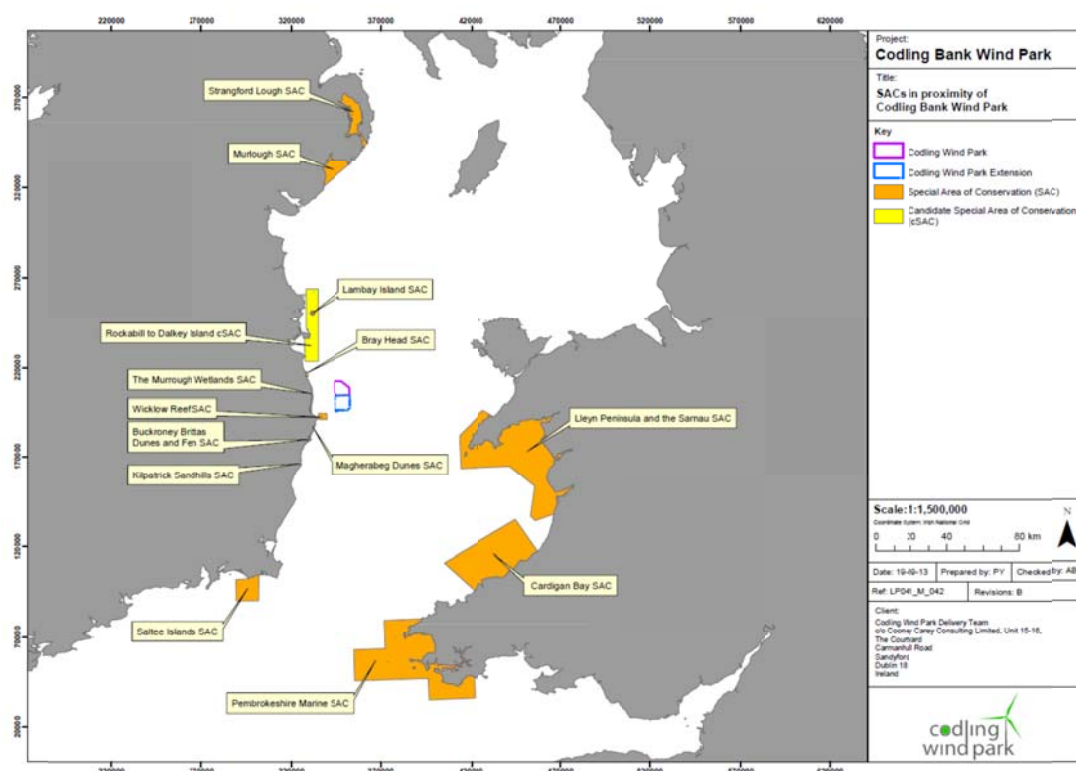


Figure 4: SACs in proximity to Codling Bank Wind Park

Table 3: Marine Mammal SACs in proximity to Codling Bank Wind Park

Special Area of Conservation (SAC)	Location	Relevant Notified Features	Approximate Distance from site (km)
Rockabill to Dalkey Island Reefs (Proposed)	Irish Sea (East coast of Ireland from Rockabill to Dalkey Island)	Harbour porpoise (<i>Phocoena phocoena</i>)	20
Lambay Island	Irish Sea (Ireland)	Grey seal (<i>Halichoerus grypus</i>)	46
Llyn Peninsula and the Sarnau/ Pen Llyn a'r Sarnau	Irish Sea (Wales)	Bottlenose dolphin (<i>Tursiops truncatus</i>), grey seal (<i>Halichoerus grypus</i>)	70
Cardigan Bay/Bae Ceredigion	Irish Sea (Wales)	Bottlenose dolphin (<i>Tursiops truncatus</i>), grey seal (<i>Halichoerus grypus</i>)	112
Murlough	Irish Sea (Northern Ireland)	Harbour seal (<i>Phoca vitulina</i>)	113
Saltee Islands	Close proximity to the Irish Sea (Ireland)	Grey seal (<i>Halichoerus grypus</i>)	121
Pembrokeshire Marine	Close proximity to the Irish Sea (Wales)	Grey seal (<i>Halichoerus grypus</i>)	131

Strangford Lough	Irish Sea (Northern Ireland)	Harbour seal (<i>Phoca vitulina</i>)	134
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Table 4: Habitat SACs in proximity to Codling Bank Wind Park

Special Area of Conservation (SAC)	Location	Relevant Notified Features	Distance from site (km)
Bray Head	Coastal site is situated in north-east Co. Wicklow between the towns of Bray and Greystones.	European dry heaths and Vegetated sea cliffs.	16
The Murrogh Wetlands	Coastal wetland complex which stretches for 15 km from Ballygannon to north of Wicklow town, and in parts, extends inland for up to 1 km.	The site supports a number of habitats listed on Annex I of the EU Habitats Directive	12
Wicklow Reef	Situated just to the north of Wicklow Head on the east coast of county Wicklow.	Reefs	6
Magherabeg Dunes	Situated at Ardmore Point, about 5 km south of Wicklow Head. The Three Mile Water River enters the sea through the dunes.	The site supports a number of habitats listed on Annex I of the EU Habitats Directive	15
Buckronev Brittas Dunes and Fen	Complex of coastal habitats located about 10 km south of Wicklow town.	Ten habitats listed on the EU Habitats Directive, including two priority habitats, occur within the site.	23
Kilpatrick Sandhills	8km south of Arklow town, and just south of the Wicklow/ Wexford county border.	The site supports a mosaic of coastal habitats listed on Annex I of the EU Habitats Directive, but primarily a mature sand dune system.	

2.2 European Protected species

Published data shows that 26 marine mammal species have been recorded in the Irish Sea – including 24 cetaceans. Most of these species, however, are considered to be rare or occasional visitors, or are documented only from stranding's (for example white beaked dolphins, killer whales and humpback whales; Irish Whale and Dolphin Group, 2013).

Of the cetacean species recorded, only those observed regularly are considered relevant to the work and location of this work are: minke whale, Risso's dolphin, bottlenose dolphin, common dolphin and harbour porpoise.

2.3 Natural Fish

There is a large amount of information relating to fish populations in the Irish Sea, and this is covered in detail in the Codling Wind Park Environmental Statement². The EIS identified the following species (Table 5) as of particular importance, and these constitute species that are benthic / demersal or pelagic but will include species that utilise the local area as a spawning / nursery ground. The sensitivity may come from:

- Commercial importance;
- Rarity, and in many cases protected status;
- Importance in the local ecosystem

Table 5: Important fish Habitat SACs in proximity to Codling Bank Wind Park

Species	Sensitivity*	Level of Importance
Plaice	Medium	Local Area
Dab	Medium	Local Area
Dover Sole	Medium	Local Area
Cod	Medium	Regional
Haddock	Medium	Local Area
Poor Cod	Medium	Local Area
Herring	Medium	Local Area
Sprat	Low	Local Area
Sandeel	Low	Local Area
Mackerel	Medium	Local Area
Whiting	Medium	Local Area
Common Goby	High	International
Bass	Medium	Local Area
Dragonet	Medium	Local Area
Basking Shark	High	International
Tope	Medium	Local Area
Lesser spotted dog fish	Medium	Local Area

Thornback Ray	Medium	Local Area
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2.3.1 Important spawning grounds

Fish spawning data is limited in the immediate area around Codling Bank possibly reflecting the low importance of the area as a fishing ground.

Ellis et al. (2012) conducted a review of all extant data to determine the distribution of potential spawning grounds for a number of marine fish species. The spawning grounds are provided as indicative only and may be liable to vary as a result of changing population sizes and environmental conditions since this review. A number of species have been reported to use the Codling Bank area as spawning or nursery grounds (table 6). The EIS for Codling Wind Park reports anecdotal information that the Codling Bank represents an important spawning ground for sea bass (*Dicentrarchus labrax*) (NPC, 2004). The species may take advantage of tidal currents to rapidly disperse eggs during spawning. Bass tend to spawn in estuarine habitats with varying salinity (Fahy et al., 2000), therefore, due to the location the site is unlikely to be an important spawning resource for the population.

Table 6: Potential Important fish Habitat SACs in proximity to Codling Bank Wind Park

Species	Potential Resource Use
Plaice	Low intensity spawning and nursery grounds.
Sole	Low intensity spawning and nursery grounds.
Cod	At the southern edge of low intensity spawning grounds. At the southern edge of high intensity nursery grounds.
Sandeel	Low intensity spawning and nursery grounds.
Mackerel	At the southern edge of low intensity spawning grounds.
Whiting	At the southern edge of low intensity spawning grounds. At the southern edge of high intensity nursery grounds.
Tope	Low intensity ground.
Thornback Ray	Low intensity ground.
Spotted Ray	Low intensity ground.
Angler Fish	Low intensity ground.
Ling	At the southern edge of low intensity spawning grounds.

2.1 Other Foreshore Users

2.1.1 Commercial and Recreational Fisheries

Due to the physical characteristics and it's, location Codling Bank area is not trawled commercially, and recreational angling is also very unlikely to occur. Therefore, the direct impacts from the proposed survey works for interference on both commercial and recreational fisheries will be highly unlikely. Indirect effects through disturbance of fish species has been considered in the natural fish and spawning section of this document.

The Investigative Foreshore Licence Application encompasses an area up to the coast line, which is likely to be subject to greater recreational fishery interests.

2.1.2 Shipping

The Irish Sea contains very busy shipping routes in both north/south and east/west directions, and traffic separation schemes are in operation in the North Channel and St Georges Channel. As ships are not obliged to report their origins and destinations to a central authority, precise information on routes and traffic densities are not available¹.

Sea navigation in the area of the Codling Bank is generally limited to commercial fishing vessels, recreational fishing and recreational sailing vessels. The shallow nature of the bank means that it is a potential hazard to larger vessels.

Consultations with the local Harbour Master at Wicklow Port, for the EIS for Codling Wind Park, has determined that there are no specific navigation routes in the vicinity of the proposed wind farm site. There are a number of vessels entering in and out of the Wicklow and Dublin ports which pass by the Codling Bank, smaller vessels tend to stay inshore (approximately 6km west of the wind farm area) and larger vessels keep beyond the bank in the deep channel which exists approximately 6km to the east².

2.1.3 Recreational Sailing

The dominant sea users in the Codling Wind Park area are related to leisure and fishing activity. There are 21 sailing clubs on the east coast affiliated to the Irish Sailing Association, with Greystones SC being the closest. This is predominantly a dinghy sailing club whose normal area for racing lie within 3-4 km of the shore. The other clubs in the area would not normally use the area around Codling Bank as their normal racing area. There is however one race to Codling Bank area once a year by Wicklow Sailing Club².

¹ Marine Institute, Ireland's Marine and Coastal Areas and Adjacent Seas- An Environmental Assessment (1999).

² Codling Wind Park, Environmental Statement (1999).

3 PROPOSED WORKS AND LIKELY IMPACTS

The following information identifies the different types of activities proposed in the Foreshore Investigative Works and the likely impacts on foreshore users and Natura 2000 sites.

3.1 Passive Acoustic Monitoring Survey Work

3.1.1 Proposed Duration:

The acoustic monitoring surveys will take place for a year to ensure the devices collect data that are representative of a year, ensuring seasonal variability of cetaceans are recorded.

3.1.1 Methodology

CPODs/ SM2s are static acoustic monitoring devices with automated data-loggers deployed on moorings and used to detect the echolocation sounds produced by dolphins and porpoises (cetaceans), by recording the ultrasonic tonal sounds (clicks) that they produce. For each click detection, the time of occurrence, centre frequency, intensity, duration, bandwidth and frequency trend is recorded. The data gathered are processed offline to identify click train patterns attributable to cetacean echolocation signals, which can then be used to assess distribution and relative use of the site.

Devices will be placed at locations within the survey area. Each mooring will consist of a seabed weight marked with an International Association of Lighthouse Authorities (IALA) compliant buoy. The acoustic device will be tethered by a rope spur 10m from the seabed, allowing the acoustic device to be orientated vertically in the tidal stream.

The devices will be lifted every three months to service and in order to download data from the internal SD memory card and to swap over the battery.

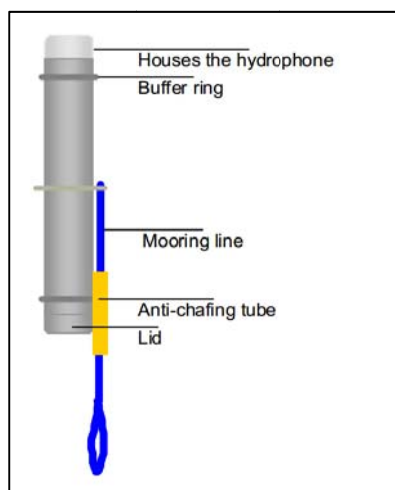


Figure 5: Schematic of C-POD and its constituent components.



Figure 6: Photograph of an SM2M+ device, taken from the Wildlife Acoustics Website - <http://www.wildlifeacoustics.com/products/song-meter-sm2-plus-submersible>.

The proposed methodology for use of passive acoustic monitoring at the CWP site is attached in Appendix 1, to help provide an understanding of the reason for the extent of the

survey and hence the boundary of the Foreshore Licence application. The indicative layout is also provided in Figure 7 below.

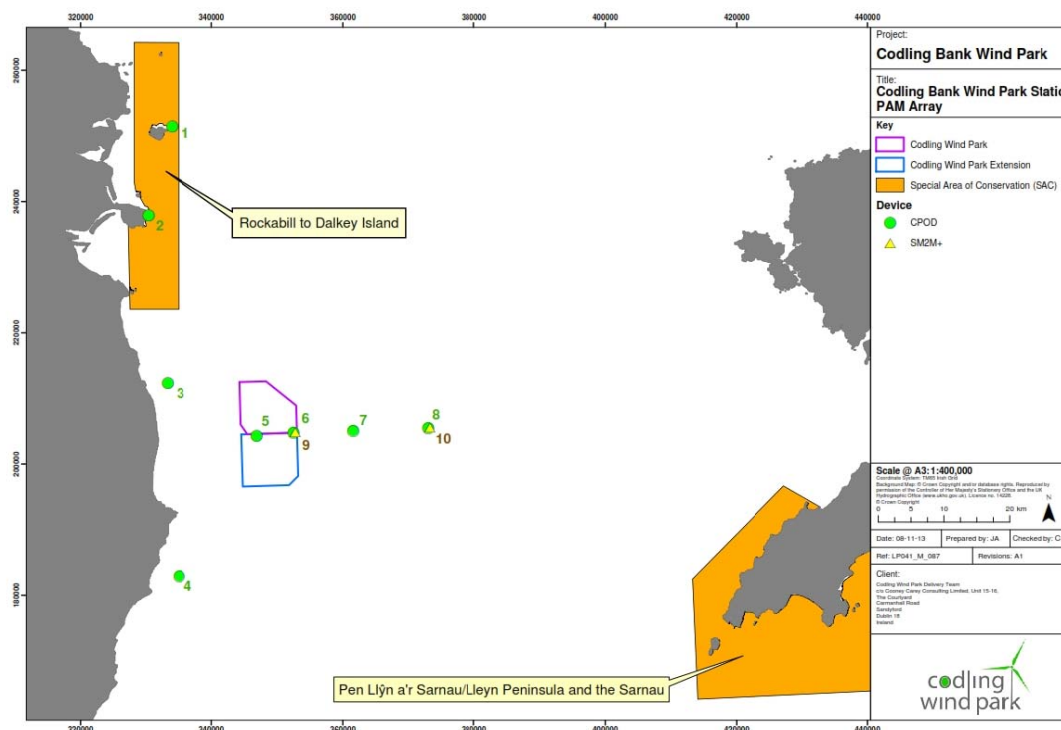


Figure 7: Proposed locations of static PAM devices at Codling Bank Wind Park.

3.1.2 Mooring methodology

Due to the busy nature of the proposed deployment area, and its use by local fishermen and other vessel traffic, NPC proposes to deploy the PAM devices using moorings located on the seabed with no surface presence. This should minimise disruption to vessels operating at the surface.

Devices will be deployed on the seabed using a 100 kg (approx.) anchor weight and weighted groundline (Figure). The groundline will be attached to a polypropylene rope riser to which is attached an acoustic release and the PAM device. At the top of the riser will be a small trawl-float to aid in finding the device during retrieval. The overall height of the riser will not exceed 5 m from the seabed. Exact height will vary with water depth at individual locations.

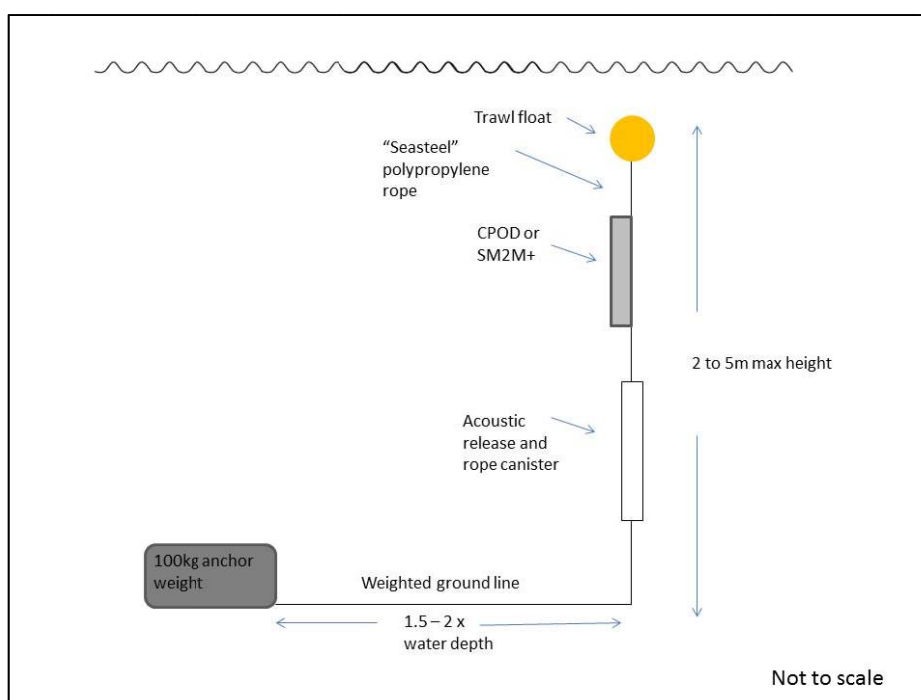


Figure 8: Schematic drawing of the mooring components intended for use at for the Codling Bank Wind Park deployments. The mooring is made up of an anchor, groundline, and riser which will sit on the seabed and have no presence above the sea-surface.

An acoustic release (Figure) is a device used to recover equipment deployed on the seabed. Upon receiving a command from a control device contained on the vessel, the release will trigger an electric motor which will propel the device to the surface. The device is not strong enough to lift the anchor weight, but will be sufficient to lift the ground-line and riser which will be recovered at the surface. The PAM unit will then be serviced and re-deployed.

The use of a ground-line also facilitates the possibility of grappling for the device in the event of an acoustic release malfunction, increasing the likelihood of retrieving the device. Upon completion of the year-long deployment, anchor weights can be retrieved using a winch on-board the service vessel, ensuring nothing is left on the seabed.

The devices will be lifted every three months to service and in order to download data from the internal SD memory card and to swap over the battery.



Figure 9: Photograph of a Sonardyne acoustic release and rope canister; an example of the type of device under consideration for use at the Codling Bank Wind Park

3.1.3 Likely interactions and impacts with natural resources and other foreshore users

Devices will be deployed at various locations throughout the Foreshore Application Area. The exact locations will be made available after detailed consultation with relevant stakeholders has been undertaken and a survey design is agreed. . A mariners notice will be prepared to ensure other foreshore users are made aware of the operations.

The acoustic devices do not emit any noise frequency and therefore the impacts to marine mammals and fish using the vicinity in which they are placed is minimal. During the deployment, service and the final retrieval of the devices there will be a short and limited disturbance impact. This impact will neither be long-term or significant.

The devices will be in place for one year. Industry standard marking and lighting of the moored devices will be deployed to ensure other users of the marine environment will be made aware. Due to the small number and actual footprint of the devices, the impact during the year in which the devices are in place will be minimal.

The devices will need to be installed, calibrated and maintained and after one year removed. This will involve the use of a vessel which has the ability to temporarily disturb other users. Due to the frequency, small vessel required and the location of the site these interactions will be minimal and therefore have limited impact to other foreshore users.

Natura 2000 sites: negligible; due to the type and small footprint of the surveys.

European Protected Species: negligible; due to the type and small footprint of the surveys.

Natural Fish: negligible; due to the type and small footprint of the surveys.

Other Foreshore Users: negligible; due to the type and small footprint of the surveys

3.2 Natural Fish Survey

3.2.1 Proposed Duration:

Quarterly over one year to ensure annual variation is accounted for.

3.2.1 Methodology

The Otter Trawls surveys will use set gill or trammel nets to characterise the fish assemblages in the region. This method has been considered most suitable due to the potentially high number of boulders across the site limiting the efficacy of trawl gear. Numerous net locations will be surveyed (number and location to be confirmed) across the development footprint, with an additional four net locations within one tidal excursion (all locations will fall within Investigative Foreshore Licence Application area identified in Figure 1).

At each sampling station the nets will be deployed for 24 hours. The position, time and haul and depth at deployment and recovery location will be recorded. All fish species retained in the net will be identified to species level and enumerated. Fish assemblages in the Irish Sea are known to fluctuate seasonally as a result of reproductive and feeding behaviour. To ensure adequate characterisation of the fish assemblages throughout the year one survey will be completed within each season.

Exact survey methodology and locations will be consulted upon and agreed prior to work commencing.

3.2.2 Likely interactions and impacts with natural resources and other foreshore users

Natura 2000 sites: negligible; due to the type and small footprint of the surveys. The surveys will not take place in any of the designated sites and will be cited sufficiently far away not to have an impact. There's the potential for indirect impacts on species qualifying for the SACs or SPAs, through the disturbance and displacement of prey species during the survey work. However due to the low frequency of the work and the small number of proposed nets the impacts on prey species will be negligible.

European Protected Species: negligible; due to the type and small footprint of the surveys.

Natural Fish: negligible; due to the small number and extent of the netting sites proposed. of haulage sites type and small footprint of the surveys.

Other Foreshore Users: negligible; due to the type and small footprint of the surveys

3.3 Benthic Survey

3.3.1 Proposed Duration:

Periodically throughout the course of one year.

3.3.2 Methodology

Benthic survey work is needed to ensure consistent and confident assignment of biotopes across Codling Bank Wind Park. To do this, both infaunal and epifaunal components of the benthos will be investigated using survey techniques suited to sampling the substrate type present across the site.

Drop-down Video surveys will be required throughout the wind farm boundary and at reference stations on one tidal excursion and one reference station beyond one tidal excursion.

Grab surveys will be carried out using a 0.1m² Hamon grab (Figure 10). The grab gear will be deployed following recovery of the drop-down video equipment where seabed conditions are suitable for grab sampling. All drop down video stations will be sampled if possible Epibenthic Beam Trawl surveys (Figure 11) will be carried out within the within the wind farm site, 4 within one tidal excursion and reference sites beyond one tidal excursion.

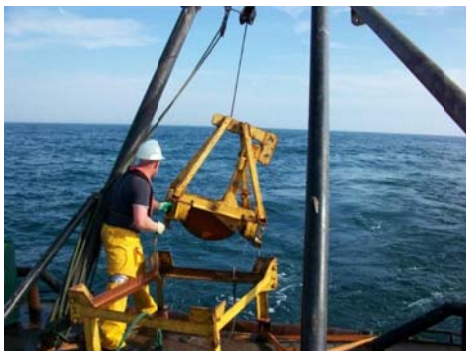


Figure 10: Hamon Grab



Figure 11: Beam Trawl

3.3.3 Likely interactions and impacts with natural resources and other foreshore users

Natura 2000 sites: negligible; due to the type and small footprint of the surveys. Siltation related to the grab surveys will be very localised and short-lived and will be cited at a sufficient distance not to cause impact on Natura 2000 sites.

European Protected Species: negligible; due to the type and small footprint of the surveys.

Natural Fish: negligible; due to the type and small footprint of the surveys.

Other Foreshore Users: negligible; due to the type and small footprint of the surveys

3.4 Met Ocean and coastal Survey

3.4.1 Proposed Duration:

Data collection for one year is required to gather sufficient information to give a representative account of the met ocean conditions in the development area to inform coastal processes modelling.

3.4.2 Methodology

The devices will be in place for one year. Industry standard marking and lighting of the moored devices will be deployed to ensure other users of the marine environment will be made aware. Due to the small number and actual footprint of the devices the impact during the year in which the devices are in place will be minimal.

The monitoring campaign will involve the measurement of deployment of:

- Wave measurement over 12 months
- Tidal measurement over 12 months including currents
- Turbidity measurement over 12 months
- Sediment transport and settling velocity measurement campaigns every 3 months over a 12 month cycle

It is likely that 4 sampling stations will be required throughout the site.

Acoustic Doppler Current Profiler (ADCP) (Figure 12) and Waverider devices (Figure 14) are most likely to be used.

Devices will be attached to moorings or to the seabed (Figure 13) and will be in place for one year. Periodic calibration and maintenance of the devices will be required involving a small vessel to visit each of the devices in place. A vessel will be required at the initial deployment and when fetching the devices at the end of the year's survey.

Turbidity will be measured using an optical backscatter sensor (OBS) used to determine the turbidity of the water in-situ. The instrument will be deployed with an automated wiper system, allowing it to collect good quality data over long periods of time between service intervals, without fouling occurring.



Figure 12: ADCP and Frame

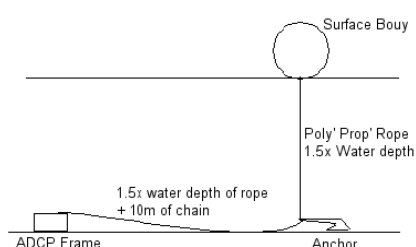


Figure 13: ADCP Basic Mooring



Figure 14: Waverider buoy with mooring chain and bungee

The exact instruments and locations will be agreed through consultations prior to the deployment and commencement of works.

Sediment sampling will be carried out to inform the settlement settling velocity and will be collected during the benthic surveys (see section 3.3 above).

3.4.3 Proposed Equipment

Acoustic Doppler Current Profiler; is a hydroacoustic current meter similar to a sonar which will measure water current velocities. The ADCP transmits and receives sound signals.

As an acoustic device it contributes to noise pollution in the ocean and may interfere with cetacean navigation and echolocation. Although the exact device has not been determined, in general the ADCPs range in frequency for use on site will be from 600 kHz – 1 MHzs.

Likely Interactions and Impacts with Natural resources and other Foreshore users The use of ADCP devices and the associated works with deploying them into position, periodic calibrations and maintenance can increase anthropogenic noise in the marine environment. This in turn has the potential to impact species designated by Natura 2000 sites and other marine receptors. However due to the range of sound emitted by the devices there will be negligible impacts on any species sensitive to sound disturbance.

Natura 2000 sites: negligible; due to the type and small footprint of the surveys.

European Protected Species: negligible; due to the footprint of the surveys. The peak hearing sensitivity of species most likely to be encountered falls outwith the noise produced by the devices, and therefore will not have an adverse effect on any EPS.

Natural Fish: negligible; due to the type and small footprint of the surveys

Other Foreshore Users: negligible; due to the type and small footprint of the surveys

4 SUMMARY

The assessment presented here predicts that the primary response to the proposed surveys will be a potential short-lived and localised disturbance and behavioural response from some animals. Potential impacts of this are predicted to have a no or minor effect on Natura 2000 sites, species designated at these sites, EPS populations in the vicinity of the Codling Bank Wind Park, fish populations and other foreshore users. The other impacts will be the potential for short term siltation due to some of the investigative works, however due to the limited intrusive works, the small scale operations the impact from this is also believed to be minor. Through the use of the FLO, and consultations with relevant bodies throughout the duration of the works impacts on other foreshore users will be minimised. It is anticipated there will be **no residual impacts**.

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APPENDIX 1

PROPOSED METHODOLOGY – PASSIVE ACOUSTIC MONITORING



Passive Acoustic Monitoring

Proposed Methodology for use at Codling Bank Wind Park
Codling Wind Park Ltd.

Document Classification

For Release

Issued to

Codling Wind Park Ltd and Codling Wind Park Delivery Team

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1 INTRODUCTION

The purpose of this document is to provide the Departments of Environment, Community and Local Government and Arts, Heritage and the Gaeltacht (DHAG) with further information on the proposed passive acoustic monitoring survey at Codling Bank Wind Park. This document supplements the 'Codling Wind Park 1 & 2 Fish and Benthic Habitats; Birds and Marine Mammals Methodologies for Baseline and Pre-construction Surveys' (February 2013) report that was provided to the DAHG in March 2013. Following on from the introductory meeting with department on the 24th May 2013 this document provides greater detail on the proposed methodology, locations and equipment needed to carry out the passive acoustic monitoring.

Natural Power Consultants Ltd (NPC) have been contracted by Codling Wind Park Ltd to propose a passive acoustic monitoring (PAM) array design and layout to aid in the environmental site characterization for the proposed Codling Bank Wind Park. This document details the devices recommended for use, as well as the design of the array in which it is proposed they are deployed.

PAM is the name given to the monitoring of animals by listening to the noise they make whilst foraging, navigating and communicating. This has proven to be a particularly useful technique for detecting small cetaceans such as harbour porpoises and other delphinids. These species spend the majority of their time underwater, generally occur in smaller groups, and present a low profile at the water surface which can make them difficult to observe in the wild by visual methods.

PAM has become increasingly useful in studies of cetacean habitat use and behaviour. Most whales and dolphins are generally highly vocally active, regularly producing sounds for orientation, foraging, communication and navigation. These vocalisations can be picked up using underwater microphones (hydrophones), and vocalisations can be used as an indicator of the presence of animals when they may not be available to be seen. Importantly, these PAM systems can operate 24 hours a day, 365 days a year, allowing for activity to be recorded continually for the duration of deployment.

The following document will provide information on the two devices proposed for use for PAM at Codling Bank Wind Park, techniques for mooring these, and the array design to be used. Additional information concerning the vocalisation characteristics of the cetacean species to be considered is also included.

2 SPECIES REVIEW

2.1 Marine Mammal Vocalisations

Of the 26 marine mammal species recorded within the Irish Sea, seven are considered to occur regularly in the vicinity of Codling Bank year-round. These seven are harbour porpoise, bottlenose dolphin, Risso's dolphin, common dolphin, minke whale, grey seal and harbour seal (De Silva & Blyth 2013). Of these species, four (harbour porpoise, Risso's dolphin, bottlenose dolphin, common dolphin) produce regular vocalisations which are suitable for detection using PAM (Table 1). Although likely to occur within the Codling Bank Wind Park area of interest, PAM cannot be conducted for minke whales or seals as these species do not produce regular enough underwater vocalisations to ensure detection. A combination of PAM and visual observations by boat are proposed for harbour porpoise, Risso's dolphin, common dolphin and bottlenose dolphin. Visual observations by boat will be used, along with existing data, for site characterisation by seals and minke whale.

Table 1: Vocalisation characteristics of the four cetacean species recorded within the Irish Sea for which PAM can be conducted.

Species	Vocalisation characteristics
Harbour porpoise (<i>Phocoena phocoena</i>)	Harbour porpoises produce high frequency, narrowband signals, called clicks. Measurements of animals in the wild have shown these vocalisations to be characterised by peak frequencies in the region of 120-140 kHz, with back calculated source levels range from 178 to 205 dB re 1 μ Pa at 1m (Villadsgaard <i>et al.</i> 2007).
Bottlenose dolphin (<i>Tursiops truncatus</i>)	Bottlenose dolphins produce both click and whistle type vocalisations. They produce short broadband clicks with a peak frequency of around 125 kHz (Akamatsu <i>et al.</i> 1998). In addition, bottlenose dolphins also produce tonal vocalisations known as whistles. Measurements in the Moray Firth found these vocalisations to have a mean source level of 158 dB re 1 μ Pa at 1m (Janik 2000). Whistle fundamental frequencies typically range from 4 kHz – 18 kHz (eg Herzing 1996).
Common dolphin (<i>Delphinus delphis</i>)	Common dolphins also produce a variety of tonal and click vocalisations. Whistle frequencies range between 0.5 and 18 kHz (Richardson <i>et al.</i> 1995). They have been quoted to echolocate at a frequency of 65 kHz (Richardson <i>et al.</i> , 1995).
Risso's dolphin (<i>Grampus griseus</i>)	Risso's dolphins communicate with whistles and rasps/pulse burst using frequencies in the range 0.1-8 kHz with dominant frequency of 3.5 to 4.5 kHz for whistles and 2.5 kHz for pulse sounds (Richardson <i>et al.</i> , 1995). They echolocate at frequency of 65 kHz with a; source level ~120 dB re 1 μ Pa at 1 m (Richardson <i>et al</i> 1995).

2.2 Special Areas of Conservation

The Habitats Directive requires the designation of Special Areas of Conservation (SACs) for certain species. Marine mammals are wide ranging and travel significant distances between feeding areas. As a consequence, designated sites within these commuting distances will require consideration for impact assessments for Codling Wind Park. Of relevance to the Codling Bank Wind Park EIA, two species of cetacean (harbour porpoise and bottlenose dolphin) and two species of seal (grey seal and harbour seal) are listed as designating features for SACs. The relevant designations are shown on Figure 1. Of the eight SACs shown in this figure, three are designated for species which can be monitored using PAM. These are Rockabill to Dalkey Island Reefs candidate SAC (relevant qualifying interest feature: harbour porpoise), Llyn Peninsula (relevant qualifying interest feature: bottlenose

dolphin) and Cardigan Bay (relevant qualifying interest feature: bottlenose dolphin). The remaining five sites, designated for grey or harbour seals, will not be discussed further.

Rockabill to Dalkey Island Reefs cSAC is the closest to the Codling Bank Wind Park site at approximately 20 km distance. Harbour porpoise use of the site was assessed using both visual methods and T-PODS (the predecessor to the C-POD) in 2008 (Berrow *et al.* 2008), which formed part of the supporting information for the SAC application.

The Llein Peninsula and the Sarnau SAC is located on the coast of Wales, at approximately 70 km from Codling Bank Wind Park. Although not the primary reason for site selection, bottlenose dolphins are a qualifying feature of this SAC and thus require consideration.

The Cardigan Bay SAC is located on the west coast of Wales, approximately 112 km from Codling Bank Wind Park. This site was designated primarily for bottlenose dolphin, although other species are present as qualifying features.

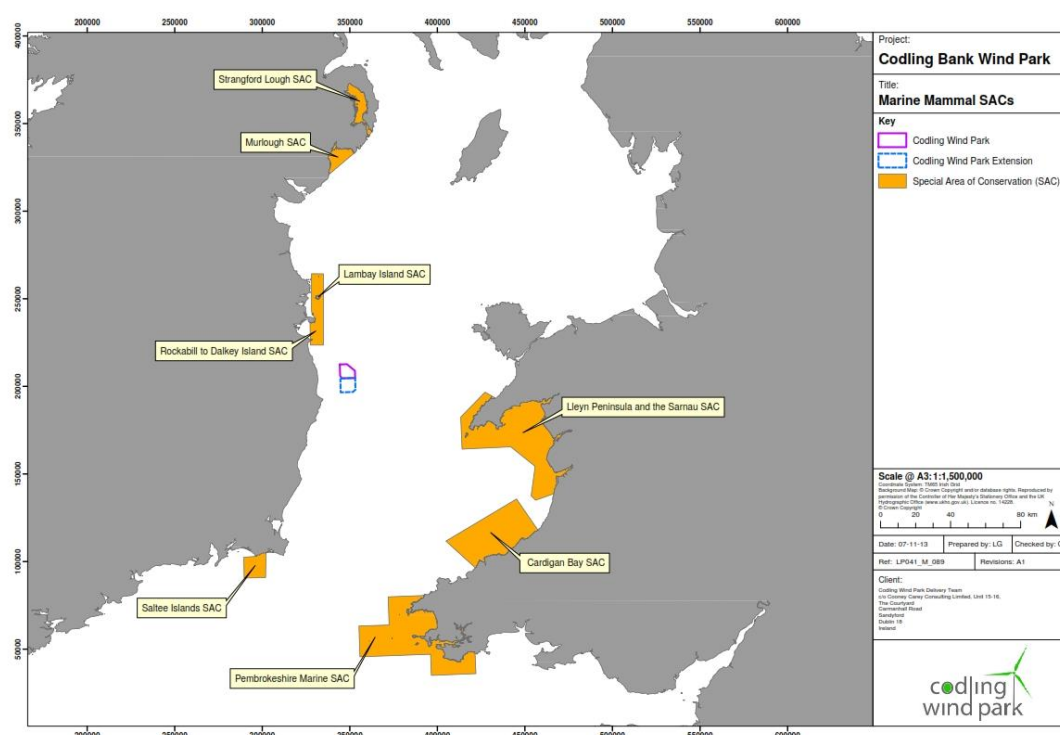


Figure 1: SACs with marine mammal notified interest features within or adjacent to the Irish Sea.

2.3 Codling Bank Wind Park Survey work to date

Surveys of the Codling Bank area were conducted by Coveney Wildlife Consulting Ltd in 2001, 2002, 2003 and 2008 (Codling Wind Park Extension; 2009). Surveys recorded harbour porpoises, Risso's dolphins and minke whales, with harbour porpoise being the most commonly sighted species.

In order to comply with the Foreshore Lease conditions for Codling Wind Park and support the additional information being prepared to support Codling Wind Park Extension, boat-based surveys of the site designed to collect marine mammal and ornithological data

3 DEVICES REVIEW

3.1 C-PODS

C-PODs (Chelonia Limited, see www.chelonia.co.uk) and their predecessor T-PODS, are commonly used passive acoustic monitoring devices, that have been used throughout the UK and Europe on marine renewable impact assessments and site characterization studies (e.g., Tougaard *et al.* 2005; Carstensen *et al.* 2006; Brandt *et al.* 2011; Scheidat *et al.* 2011). C-PODs incorporate a hydrophone, batteries, memory and a hardware data-logger which detects and logs cetacean echolocation clicks (Figure 3).

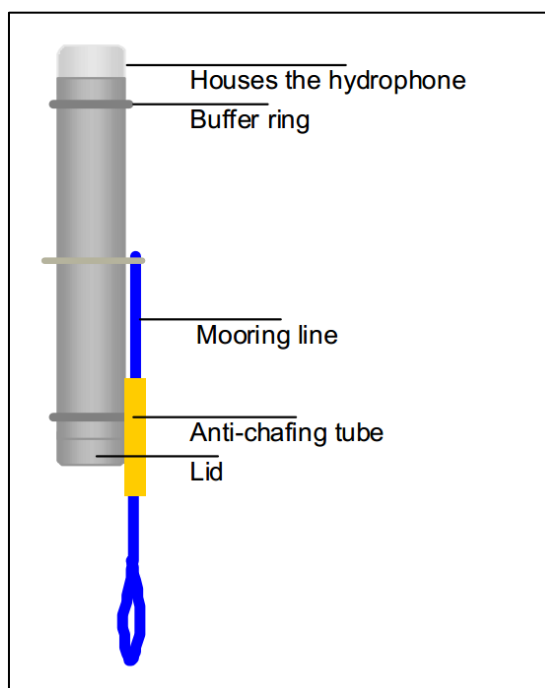


Figure 3: Schematic of C-POD and its constituent components. Taken from the C-POD User Guide (Chelonia, 2011).

C-PODs can log data 24 hours a day and are therefore useful at providing continuous data on cetacean activity over extended periods. They are relatively small, but are robust and are usually deployed on bottom-mounted moorings for periods of up to three months (duration dependent on battery life), after which they need to be recovered, data downloaded, and then redeployed. C-POD hydrophones, and software are configured to detect click trains of porpoises, as well as other echolocating species (for example bottlenose dolphins) using characteristics of the vocalisations which differentiate the sounds from background noise. Although the device is capable of differentiating between porpoise clicks and dolphin clicks (as they are acoustically distinct), it is not possible to use these devices to distinguish between different dolphin species which have more similar vocalisation types.

For both dolphins and porpoises, clicks can also provide basic information on behaviour, such as feeding, using the interval between clicks which shortens as animals focus in on an object of interest, creating 'feeding buzzes'. The C-POD specifications claim a detection range for porpoises of approximately 400 m, and approximately 1 km for dolphins (http://www.chelonia.co.uk/cpod_specification.htm); and research has confirmed C-PODs detecting porpoise activity within a radius of up to ~300 m, with 100% detection within a ~100 m radius (Tougaard *et al.* 2006). It should be noted that while useful in determining relative changes in frequency of occurrence or behaviour between sites or through time, C-

PODS cannot provide a count of the number of animals recorded or be used for estimating absolute abundance.

The key use of C-PODs devices will be to determine relative importance of the Codling Bank Wind Park area relative to the surrounding area, and in particular relative to the Rockabill to Dalkey Island Special Area of Conservation (cSAC) to the north.

3.2 SM2M+

The SM2M+ Submersible (Wildlife Acoustics – www.wildlifeacoustics.com) is a relatively newly available device and as such does not occur yet in the publication record, although the terrestrial equivalent, the Song Meter SM2+, has been used extensively for bird and bat studies. Similar in size and shape to a C-POD (Figure 4), it is also able to conduct 24 hour per day monitoring, providing continuous data on cetacean activity over extended periods.



Figure 4: Photograph of an SM2M+ device, taken from the Wildlife Acoustics Website - <http://www.wildlifeacoustics.com/products/song-meter-sm2-plus-submersible>.

Like C-PODS, SM2M+ devices also incorporate a hydrophone, batteries and memory, but unlike C-PODs, which can only log the presence of clicks and their acoustic parameters, the SM2M+ is able to make continuous recordings of dolphin and porpoise vocalisations. Discussions with the manufacturer indicate that the maximum recording frequency is 384 kHz, sufficient for harbour porpoise detection, but operation at this sample speed will likely result in maximum deployment lengths of approximately 16 days (Wildlife Acoustics, pers. comm). However, the collection of full recordings at a lower sample speed (96 kHz) will enable the detection of dolphin whistle vocalisations, which may enable the differentiation of dolphin species should sufficient numbers of whistles be recorded. Anticipated deployment duration at this sampling rate would be approximately 100 days (Wildlife Acoustics, 2013).

Detection ranges for these devices have not yet been published, although it is likely they will be similar to those cited for C-PODS.

As with C-PODS, while useful in determining relative changes in frequency of occurrence or behaviour between sites or through time, these devices cannot provide a count of the number of animals recorded or be used for estimating absolute abundances.

The key use of SM2M+ devices will be to determine between dolphin species occurring within the proposed Codling Bank Wind Park area. Table 2 below compares the two devices.

3.3 Device Comparison

Table 2: A comparison of the different features of the two PAM devices under consideration for utilisation at Codling Bank Wind Park.

	C-POD	SM2M+ Submersible
Capable of detecting / recording porpoise clicks	Y	No
Capable of detecting / recording dolphin clicks	Y	Y
Capable of detecting / recording dolphin whistles	N	Y
Data useable for differentiation between dolphin species	N	Possibly, if sufficient whistles recorded
Capable of continuous sampling?	Y	Y
Detection distance – porpoise	400 m ¹	Not yet available – estimated to be equivalent to C-POD
Detection distance - dolphin	1000 m ¹	Not yet available – estimated to be equivalent to C-POD
Recommended deployment length	3 months	100 days

¹ Taken from http://www.chelonia.co.uk/cpod_specification.htm (accessed 01/11/2013). It should be noted that detection range for cetacean vocalisations is dependent on many factors, not just the device: these include levels of ambient noise and orientation of the vocalising animal.

4 DEVICES AND DEPLOYMENT METHODOLOGY AT CODLING BANK

Due to the different properties and capabilities of the two devices, as well as the combination of species to be taken into consideration (harbour porpoise, bottlenose dolphin, common dolphin, Risso's dolphin) it is proposed that an array comprising both C-PODS and SM2M+ devices would be the most effective in providing a robust baseline for site characterisation and for subsequent Environmental Impact Assessment.

The proposed array is made up of eight C-PODS and two SM2M+ devices. In order to sample at a high enough frequency to detect harbour porpoises, SM2M+ devices would require a higher rate of service interval than is practical or desirable at this site, and as such the devices will be used only to detect dolphins. As a consequence, it is considered more appropriate to have a larger array of C-PODS, which will detect the clicks of both harbour porpoises and dolphins (dolphin presence), and use the two SM2M+ devices to collect auxiliary data (whistles) which may enable classification of dolphin vocalisations to species level. These will be deployed at what are considered to be key locations for determining dolphin species present in the vicinity of Codling Bank.

4.1 Array design

It is proposed that devices are deployed according the overall array design in Figure 5. However, it should be noted that this figure represents approximate locations and not exact positions. Individual devices may need to be micro-sited according to navigational, bathymetric or political considerations out with the control of Codling Wind Park. The rationale behind the placement of each device is summarised in Table 3 at the end of this section.

The array is based on collecting data to facilitate comparison between areas of known higher porpoise density, e.g. within the Rockabill to Dalkey Island cSAC, with locations in the Codling Bank Wind Park footprint and along the coast. Consequently, C-PODS have been located at two sites within the SAC:

- The southern-most of the two is at the location at which a T-POD was located during the 2008 research described by Berrow *et al.* (2008) and which was used as a basis of the supporting information for the SAC.
- The northern-most of the two is at the location at which the majority of harbour porpoise sightings were made during the visual survey part of the work conducted by Berrow *et al.* (2008). Whilst harbour porpoises were recorded on these surveys, there were no records of dolphins and consequently, no SM2M+ units have been placed in the SAC footprint.

As porpoises have been known to react to pile driving at distances exceeding 20 km (Tougaard *et al.* 2009), a pair of devices has been placed this distance away from the centre of the development footprint.

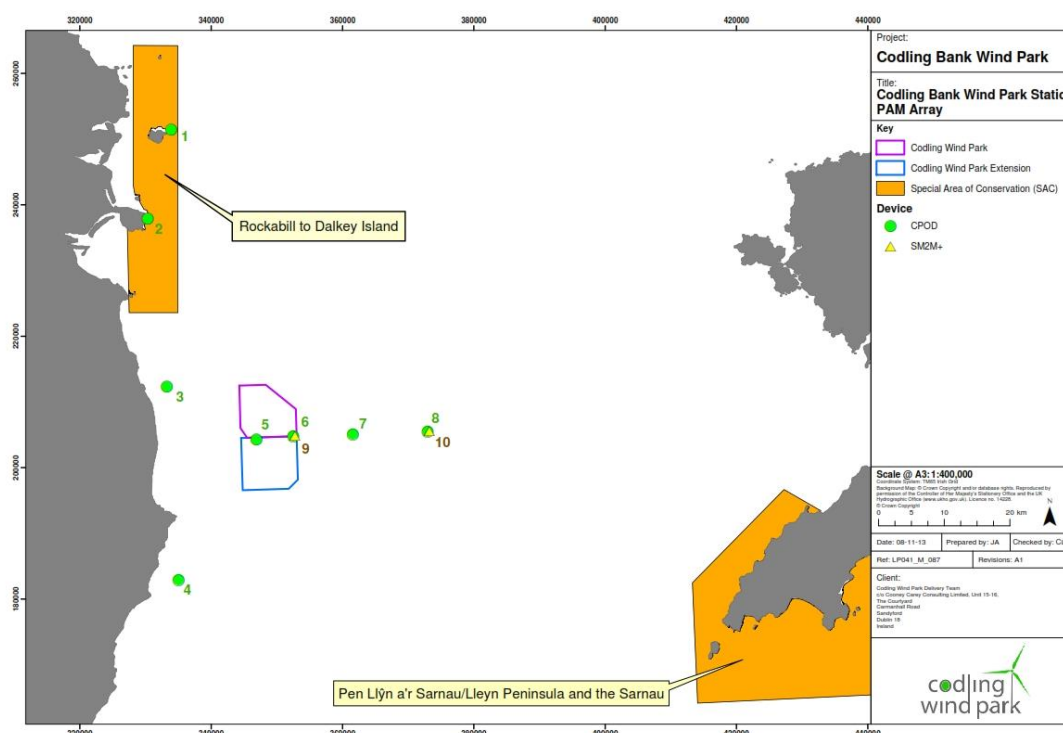


Figure 5: Proposed locations of static PAM devices at Codling Bank Wind Park.

The array design incorporates a line of devices running parallel with the shore with a line of devices running perpendicular to the shore, through the centre of the Wind Park footprint. This facilitates comparison of the use of inshore and offshore areas by harbour porpoise and dolphin species, as well as providing the ability to investigate movement up and down the coast. The array will also enable collection of baseline data to inform the relative abundance of the species using the Codling Bank Wind Park site to the deeper waters to the east of the site and to Rockabill to Dalkey Island cSAC.

The use of the SM2M+ device within the site boundary will maximise the likelihood of establishing which species of dolphin, if any, occur within the immediate vicinity of the footprint.

Placement of C-POD 6 is on the eastern boundary of the Wind Park footprint. During the six months of vessel data available from Natural Power surveys (as described in section 2.3, Figure 2), the eastern edge of the survey area has provided most sightings. By placing a C-POD as close to this area as possible within the footprint, it is hoped this will provided a “high-density” location for comparison of the Wind Park footprint with the densities recorded within the SAC.

Table 3: Explanation of device placement.

Device number	Device type	Rationale for placement
1	C-POD	C-POD located where the maximum number of sightings were made during the 2008 visual surveys for SAC designation surveys.
2	C-POD	C-POD located where the 2008 T-POD was located during SAC designation surveys.
3	C-POD	C-POD located along coast to assess use of area between site boundary and coast.

Device number	Device type	Rationale for placement
4	C-POD	C-POD located along coast to assess use of area between site boundary and coast.
5	C-POD	C-POD located in centre of development footprint in an area where few porpoises have been seen during NPC vessel surveys – facilitating comparison with both 1 & 2 and 6.
6	C-POD	C-POD located on eastern boundary of development footprint as this area has higher density of porpoise sightings whilst still being in footprint.
7	C-POD	C-POD located approx. 10km east of development footprint. This will facilitate relative comparison of porpoise sightings to establish baseline use of the site to inform the assessments for Codling Wind Park Extension application.
8	C-POD	C-POD located approx. 20km east of development footprint – work has been done suggesting changes in porpoise distribution can be monitored using C-PODS up to this distance from piling noise. This will facilitate relative comparison of porpoise sightings to establish baseline use of the site to inform the assessments for Codling Wind Park Extension application.
9	SM2M+	SM2M+ located on eastern boundary of development footprint as this area has higher density of dolphin sightings whilst still being in footprint.
10	SM2M+	SM2M+ located at furthest offshore location in use, which is closest to Llyn peninsula SAC, designated for dolphins.

4.2 Mooring methodology

Due to the busy nature of the proposed deployment area, and its use by local fishermen and other vessel traffic, NPC proposes to deploy the PAM devices using moorings located on the seabed with no surface presence. This should minimise disruption to vessels operating at the surface.

Devices will be deployed on the seabed using a 100 kg (approx.) anchor weight and weighted groundline (Figure 6). The groundline will be attached to a polypropylene rope riser to which is attached an acoustic release and the PAM device. At the top of the riser will be a small trawl-float to aid in finding the device during retrieval. The overall height of the riser will not exceed 5 m from the seabed. Exact height will vary with water depth at individual locations.

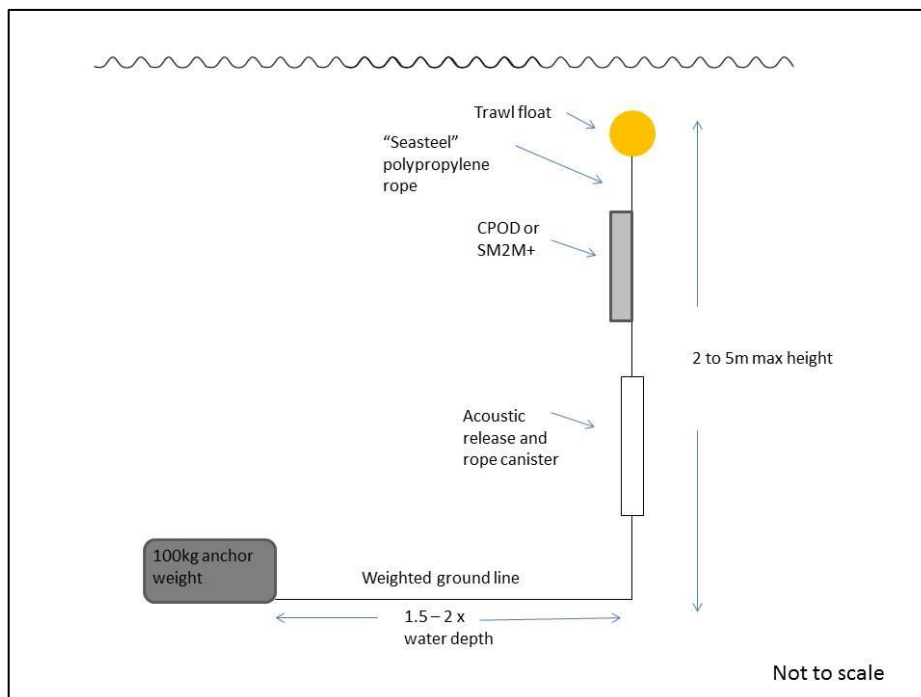


Figure 6: Schematic drawing of the mooring components intended for use at for the Codling Bank Wind Park deployments. The mooring is made up of an anchor, groundline, and riser which will sit on the sea-bed and have no presence above the sea-surface.

An acoustic release (Figure 7) is a device used to recover equipment deployed on the seabed. Upon receiving a command from a control device contained on the vessel, the release will trigger an electric motor which will propel the device to the surface. The device is not strong enough to lift the anchor weight, but will be sufficient to lift the ground-line and riser which will be recovered at the surface. The PAM unit will then be serviced and re-deployed.

The use of a ground-line also facilitates the possibility of grappling for the device in the event of an acoustic release malfunction, increasing the likelihood of retrieving the device. Upon completion of the year-long deployment, anchor weights can be retrieved using a winch on-board the service vessel, ensuring nothing is left on the seabed.

The devices will be lifted every three months to service and in order to download data from the internal SD memory card and to swap over the battery.



Figure 7: Photograph of a Sonardyne acoustic release and rope canister; an example of the type of device under consideration for use at the Codling Bank Wind Park.

4.3 Likely interactions and impacts with natural resources and other foreshore users

4.3.1 Potential for impact on other sea and foreshore users

The PAM devices are passive acoustic devices and therefore do not emit any noise. Therefore the impacts to marine mammals and fish using the vicinity in which they are operational is negligible.

The devices will need to be installed and maintained, and after one year removed. This will involve the use of a vessel which has the ability to temporarily disturb other users. Due to the frequency and nature of maintenance activities, a small vessel will be required and therefore interactions will be minimal.

As the devices are located offshore there is limited potential for impact to foreshore users.

The overall impact of deployment and operation of the devices will be very short term (days) and very localised (within the transit route from harbour and within metres of the PAM device) and is therefore deemed to be negligible.

4.3.2 Potential for impact on the natural heritage

As detailed above, the deployment, operation or maintenance of C-POD devices is considered to have only a very localised impact. It is considered highly unlikely that the deployment of the PAM devices will have any impact on the natural heritage of the area other than in a very localised area and for a very short duration (see section 4.3.1 above).

It is however proposed to deploy two devices within the boundary of a cSAC. Whilst acknowledging the sensitivities and importance of the Rockabill to Dalkey Head cSAC, it is not thought that the deployment of PAM devices within the cSAC has the potential to affect the qualifying interests of the SAC in any way. Monitoring of this sort is routinely conducted at similar sites, including the Moray Firth SAC (designated for bottlenose dolphins; e.g. Bailey *et*

al. 2010), the Shannon Estuary SAC (bottlenose dolphin listed as feature of interest; e.g. Philpott *et al.* 2007) and the Cardigan Bay SAC (site designated primarily for bottlenose dolphin; e.g. Evans & Pesante, 2012).

A summary of assessment of impacts is provided in Table 4: A summary of Table 4 below.

Table 4: A summary of the assessment of impacts of deploying PAM devices for different receptors.

Receptor group	Potential impact	Significance
Natura 2000 sites	Disturbance from maintenance operations	Negligible; due to the type and small footprint of the moorings.
European Protected Species	Disturbance from maintenance operations	Negligible; due to the type and small footprint of the moorings.
Natural Fish	Disturbance from maintenance operations	Negligible; due to the type and small footprint of the moorings.
Other sea users	Disturbance from maintenance operations	Negligible; due to the type and small footprint of the moorings.
Foreshore Users	Disturbance from maintenance operations	Negligible; due to the type and small footprint of the moorings.

4.4 Timings

The following timeline is proposed based on agreement for the deployment being received prior to the end of 2013 (Table 5).

Table 5: PAM deployment timeline.

Initial deployment of the devices	April 2014 (or sooner if possible)
Service visit one	July 2014 (or three months after initial deployment)
Service visit two	October 2014 (or three months after service visit one)
Service visit three	January 2015 (or three months after service visit two)
Final retrieval	April 2015 (or three months after service visit three)

Deployment of devices will be dependent on the timely granting of a Foreshore Licence, agreement with all stakeholders, and lead time on obtaining devices.

5 SUMMARY

PAM has become increasingly useful in studies of cetacean habitat use and behaviour, and can be used to determine harbour porpoise presence, spatial distribution, seasonality and relative abundance throughout the site and surrounding area. This method has already been used to provide the data required for the proposal for designation of the Rockabill and Dalkey Island Reefs cSAC. It is proposed to deploy an array of PAM devices in order to inform the baseline conditions of Codling Wind Park Extension and pre-monitoring of the proposed Codling Wind Park development.

The following list summaries the aims of the C-POD and SM2M+ deployment proposed:

- It is anticipated that harbour porpoise are likely to be detected in the deployment area for a significant percentage of the time, and thus quantification against the use of the proposed development area against the use of the SAC will be important for this species, particularly in relation to Habitats Regulations Appraisal process (HRA).
- The acoustic monitoring devices would also record dolphin communication, and thus data collected for the harbour porpoise study will also be used to inform the HRA process on impacts upon bottlenose dolphin, by supplementing the boat based baseline data collection for this species.
- The proposed array design will provide the possibility of comparing data of known high porpoise density with areas of unknown porpoise density; allow the investigation of the near-shore area for porpoise and dolphin movements along the coast, and compare the number of detections within the development footprint with the number in the SAC. This will provide data for a robust assessment of cetacean distribution in the area to inform Environmental Impact Assessment (EIA).
- The use of two SM2M+ devices will allow the collection of dolphin whistle data from the eastern edges of the array and the development footprint. This will maximise the chances of acoustic determination of species of dolphin present at the site. This will inform HRA for the populations of animals from the Llyn Peninsula and Cardigan Bay SACs.
- The proposed devices will have a negligible impact on the existing environment; with the use of acoustic releases ensuring no surface presence. Following the year-long deployment, anchor weights will be removed from the seabed.
- Deployment will commence as soon as all licences are in place and devices can be obtained. It is anticipated that this will be early in 2014.

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