

# Marine Mammal Risk Assessment in relation to a Proposed Cruise Liner Berth in Dún Laoghaire Harbour, Co. Dublin.

*Report prepared for:*

Scott Cawley,  
Suites 401-404,  
127 Lower Baggot Street,  
Dublin 2,  
Ireland.

**John T. Brophy B.A. (Mod.), M.Sc. MCIEEM**

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 **CONSULTANTS**  
**Botanical, Environmental & Conservation Consultants Ltd.**  
Ground Floor Office, Loft 31, South Cumberland Street, Dublin 2.  
Tel: 01 6619713  
Website: [www.botanicalevironmental.com](http://www.botanicalevironmental.com)  
Email: [info@botanicalevironmental.com](mailto:info@botanicalevironmental.com)





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## 1 Introduction

BEC Consultants Ltd was commissioned by Scott Cawley, on behalf of Dún Laoghaire Cruise Stakeholder Group to carry out a Marine Mammal Risk Assessment (MMRA) in relation to the construction of a proposed berth for cruise liners in Dún Laoghaire Harbour, Co. Dublin.

The concept of MMRA was introduced by the *Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters* (DAHG, 2014), which replaced the *Code of Practice for the Protection of Marine Mammals during Acoustic Seafloor Surveys in Irish Waters* (DEHLG, 2007). The new guidance was expanded to include additional sound-generating activities such as dredging, drilling, pile driving and blasting, as well as acoustic surveys. A number of these activities will be undertaken in the course of the construction of the proposed cruise berth; this MMRA aims to address the risk of significant effects on marine mammals in the area.

## 2 General Information

### 2.1 Works profile

Works will consist of two main elements that need to be considered with regard to marine mammals:

- a) A channel will be dredged within Dún Laoghaire Harbour, a turning circle outside the harbour, and a channel east from the turning circle into deeper waters. The channel will be to a depth of 10.5 m below CD, with a 500 m diameter turning circle to the same depth. It is proposed that dredging will be carried out by a Trailing Suction Hopper Dredger (TSHD) and that approximately 710,000 m<sup>3</sup> of material will be removed. A small amount of dredge material (~20,000 m<sup>3</sup>) is planned to be retained within the harbour and used to infill a hollow east of the proposed berth. The remaining dredge spoil will be dumped at the Burford Bank spoil ground.
- b) The construction of the berth itself will involve the driving of piles within Dún Laoghaire Harbour. The majority of piles will be 750 – 1000 mm in diameter, while the moorings will comprise eight 3 m diameter piles to take load away from the main quay. The piles will be installed using a drive-drill-drive method, with the piling machinery operating from a barge. The piling will be carried out using a vibrating hammer or hydraulic piling hammer.

### 2.2 Area profile

The dredging works will take place within Dún Laoghaire Harbour, Co. Dublin and to a distance of approximately 1.5 km from the harbour mouth, while the piling works will be limited to within the harbour. The seabed is sedimentary in nature, dominated by fine sands and mud.

The Burford Bank spoil dumping ground is located just west of the Burford Bank at the outer edge of Dublin Bay.

Dún Laoghaire Harbour is located approximately 2.5 km from the Rockabill to Dalkey Island Special Area of Conservation (SAC. Site code: 003000), while the spoil dumping ground is located within the SAC.

### 2.3 Duration

The dredging operation is expected to take approximately 14-17 weeks based on a 24/7 summertime (September – March) work schedule. The dredging cycle will last 1.5 hours, comprising 0.5 hrs dredging, followed by 1 hr transit to the disposal grounds and return (ABP Mer, 2014).

The piling operation is expected to take approximately 12 weeks, with extended work hours.

There is expected to be a 4 week overlap between the dredging operations and the pile driving operations.

## 3 Project

### 3.1 Platform

The dredging will be carried out by a medium-sized Trailing Suction Hopper Dredger (TSHD), with a loaded draft of approximately 7 m and a hopper capacity of 5,000 m<sup>3</sup>.

The piling operations will be based on a work barge or jack-up platform.

### 3.2 Location

The dredging works will take place within Dún Laoghaire Harbour, Co. Dublin and to a distance of approximately 1.5 km from the harbour mouth, while the piling works will be limited to within the harbour. Dredge spoil dumping will occur in the designated spoil dump site to the west of the Burford Bank.

### 3.3 Sound source

Both the operation of the dredger and the piling equipment will introduce sound into the water column.

#### 3.3.1 Dredger

The operation of the dredger will generate noise that may impact upon marine mammals. The noise generated by dredging tends to be continuous (non-pulse) and broadband in nature, mainly in a frequency range of <1 kHz (Thomsen *et al.*, 2009). The exact sound levels and signature depends on the dredger type, the individual dredger and the operation it is carrying out at the time. A review of the literature suggests that sound levels of 170 – 190 dB re 1µPa @ 1 m can be expected to be generated by a TSHD while operational, with a peak frequency of 100 – 350 Hz (Thomsen *et al.*, 2009). While in transit and during dredge dumping operations, the sound levels will be comparable to the operation of a normal ship of similar size.

#### 3.3.2 Piling

The likely impact of the piling operations will depend mainly on the type of pile driving method used, with vibration piling having considerably less of an impact on the acoustic environment than impact piling (Nedwell *et al.*, 2003). Impact piling generates pulse sound (though in this case the drilling element will introduce a non-pulse element), while vibration piling generates non-pulse sound.

Impact piling can generate high sound levels, which depend on various elements including the substratum and the pile diameter (smaller piles generate lower sound levels) (Matuschek & Betke, 2009). Pile-driving operations using a 6.5 m pile have been estimated to generate sound levels of 201 - 204 dB re 1 µPa (Peak) and 175 – 178 dB re 1µPa (Sound Exposure Level- SEL) at 500 m in 20 m deep water (Nehls *et al.*, 2007). Impact piling a pile of diameter 1 m would have a sound level of approximately 185 dB re 1µPa @ 750 m (peak) and 160 dB re 1µPa @ 750 m (SEL) (Matuschek & Betke, 2009). The German Federal Maritime and Hydrographic Agency (BSH) has set limits for pile-driving noise of 190 dB (peak) and 160 dB (SEL) at a distance of 750 m from the pile for the protection of harbour porpoises.

Vibration piling generates lower sound levels than impact piling. Nedwell *et al.* (2003) found that vibration piling could not be detected above ambient noise at a range of 417 m.

## 4 Marine Mammal Ecology

Marine mammals frequently, or even continuously, present within the study area include harbour porpoise (*Phocoena phocoena*) and grey seal (*Halichoerus grypus*). Other species that may occasionally occur include bottlenose dolphin (*Tursiops truncatus*), common seal (*Phoca vitulina*), common dolphin (*Delphinus delphis*), Risso's dolphin (*Grampus griseus*), striped dolphin (*Stenella coeruleoalba*), minke whale (*Balaenoptera acutorostrata*), humpback whale (*Megaptera novaeangliae*), fin whale (*Balaenoptera physalus*), pilot whale (*Globicephala melas*) and killer whale (*Orca orcinus*), all of which have been recorded along the Dublin coast on occasion (IWDG, 2015).

### 4.1 Harbour porpoise

The harbour porpoise is Ireland's smallest cetacean, and also the most commonly recorded around the Irish coast. The harbour porpoise population in the Irish Sea in 2005 was estimated to be 15,230 (CV = 0.35) (Hammond & MacLeod, 2006), while the Celtic Sea population was calculated as 36,280 (CV = 0.57) in 1994 and 80,616 (CV=0.50) in 2005 (the Celtic Sea survey area boundary varied somewhat between surveys) (Hammond *et al.*, 2002, Hammond & MacLeod, 2006). The harbour porpoise population in Irish coastal waters outside the Irish Sea was calculated to be 10,716 (CV = 0.37; CI 95% = 5,010 - 21,942) in 2005 (Hammond & MacLeod, 2006). The surveys carried out by the Irish Whale and Dolphin Group (IWDG) in 2008 estimated an overall abundance of 211 (CV = 0.22, CI 95% = 137 – 327) in North County Dublin and 138 (CV 0.24, CI 95% = 86 – 221) in Dublin Bay (Berrow *et al.*, 2008). North County Dublin recorded the highest density of harbour porpoise of the sites surveyed and also the highest ratio of young to adults (8%), an important consideration when selecting a site for designation as an SAC (Berrow *et al.*, 2008). There have been 49 recorded sightings of harbour porpoises in the Dún Laoghaire area in the period 2010-2014, with the majority number of sightings (67%) and animals (78%) occurring in the period October-December (IWDG, 2015).

No studies have been carried out to estimate the home range, or movements, of individual harbour porpoises in Irish waters, but data are available from the Bay of Fundy on the east coast of North America and Denmark (Johnston *et al.*, 2005, Sveegaard *et al.*, 2011). These studies have shown that harbour porpoise distribution is spatially and temporally variable. Harbour porpoises have been shown to range across large areas (7,738 – 11,289 km<sup>2</sup>) over the course of a month, with movements tending to be focused over a smaller area (250 – 300 km<sup>2</sup>), often around islands, headlands, or restricted channels (Johnston *et al.*, 2005). In Danish waters, harbour porpoises have also been shown to range over large areas, with seasonal shifts in their distribution (Sveegaard *et al.*, 2011).

Calving in harbour porpoise occurs between May and August, with a strong peak in June (IWDG, 2014b). It is thought that harbour porpoises move offshore in the period March – June to calving/breeding areas (IWDG, 2014b).

Harbour porpoises are listed under Annex II of the EU Habitats Directive as an animal species of community interest whose conservation requires the designation of SACs. Three SACs have harbour porpoises listed as a Qualifying Interest in Ireland; two of these are in the southwest, while a further SAC has been designated on the east coast extending from Rockabill to Dalkey Island (Table 1). Dún Laoghaire Harbour is approximately 2.5 km from the boundary of this SAC, while the Burford Bank dredge spoil dump site is located within the SAC.

Harbour porpoises are also protected under Section 23 of the Wildlife Acts 1976 to 2012 and listed under Annex IV of the Habitats Directive as a species requiring strict protection.

**Table 1.** List of Special Areas of Conservation for harbour porpoises in Ireland (NPWS, 2015a).

County	Site code	SAC name
Cork	000101	Roaringwater Bay and Islands
Kerry	002172	Blasket Islands
Dublin	003000	Rockabill to Dalkey Island



The Status of EU Protected Habitats and Species in Ireland report (NPWS, 2008) assessed harbour porpoises as being in Favourable Conservation Status. The species has retained its Favourable Conservation Status for the most recent reporting period (NPWS, 2013a).

## 4.2 Grey seal

The grey seal is one of two seal species that breed in Irish waters, the other being the harbour or common seal (*Phoca vitulina*). Recent population estimates for grey seals in Ireland put the population (based on a breeding survey) in the range 5,509 - 7,083 (Ó'Cadhlá *et al.*, 2007), with a minimum population estimate (based on a moult survey) of 5,343 (Ó'Cadhlá & Strong, 2007). The most up-to-date data put the population between 7,284 and 9,365 (NPWS, 2013b). The main colonies are located on the Atlantic seaboard, with Inishkea North (Co. Mayo) and Great Blasket Island (Co. Kerry) supporting 45% of the population (Ó'Cadhlá & Strong, 2007). The Lambay Island population was estimated to be 45 - 60 in 1995 (NPWS, 1995) and 203 - 261 in 2005 (Ó'Cadhlá *et al.*, 2007) and most recently 196-252 (NPWS, 2014), indicating an increasing population.

Thirty-six grey seals were recorded on Dalkey Island during the 2007 moult survey (Ó'Cadhlá & Strong, 2007), while two pups were recorded during the 2005 breeding survey (Ó'Cadhlá *et al.*, 2007). Ten seals were recorded by the NPWS on Dalkey Island, and six on The Muglins, just east of Dalkey Island, during the 2003 harbour seal population assessment (NPWS, 2013b). Grey seals are frequently seen within Dún Laoghaire Harbour, by the fish shop on Coal Quay (pers. obs.).

Grey seals are highly mobile predators, with studies showing movement of seals across the Irish Sea between Ireland and Wales and also between Irish sites, though female grey seals may show a degree of inter-annual site fidelity (Kiely *et al.*, 2000). Grey seals spend more time hauled-out during the breeding season (September – December) and the moulting season (November – April) than other times of the year (Kiely *et al.*, 2000). The peak moult period in Ireland appears to be February to March, beginning as early as November for adult females and juveniles and continuing up to April for adult males (Kiely, 1998 in Ó'Cadhlá & Strong, 2007).

Grey seals are listed under Annex II of the EU Habitats Directive as an animal species of community interest whose conservation requires the designation of Special Areas of Conservation and also under Annex V (Animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures). Ten SACs in Ireland have grey seals listed as a Qualifying Interest, with only Lambay Island SAC located on the east coast (Table 2). They are also protected under Section 23 of the Wildlife Acts 1976 to 2012.

**Table 2.** List of Special Areas of Conservation for grey seals in Ireland (NPWS, 2015a).

County	Site code	SAC name
Cork	000101	Roaringwater Bay and Islands
Donegal	000147	Horn Head and Rinclevan
Donegal	000190	Slieve Tooney/Tormore Island/Loughros Beg Bay
Dublin	000204	Lambay Island
Galway	000278	Inishbofin and Inishshark
Galway	000328	Slyne Head Islands
Mayo	000495	Duvillaun Islands
Mayo	000507	Inishkea Islands
Wexford	000707	Saltee Islands
Kerry	000509	Blasket Islands

The Status of EU Protected Habitats and Species in Ireland report (NPWS, 2008) assessed grey seals as being in Favourable Conservation Status. The species has retained its Favourable Conservation Status for the most recent reporting period (NPWS, 2013a).

### 4.3 Bottlenose dolphin

Bottlenose dolphins have been recorded all around the Irish coast, predominantly on the west coast, though the only confirmed resident population is found in the Shannon Estuary (O'Brien *et al.*, 2009). Three bottlenose dolphins were regularly occurring in the vicinity of Killiney Bay, Co. Dublin since 2010, and had gained 'semi-resident' status; however, they have not been recorded in the area since July 2012 (IWDG, 2012). Photo-identification has confirmed that two of these individuals were recorded in Ventry Harbour, Co. Kerry in mid-July 2012 (IWDG, 2012).

Bottlenose dolphins are listed under Annex II of the EU Habitats Directive as an animal species of community interest whose conservation requires the designation of SACs and are listed as a Qualifying Interest in two SACs in Ireland (Table 3).

**Table 3.** List of Special Areas of Conservation for bottlenose dolphin in Ireland (NPWS, 2015a).

County	Site code	SAC name
Clare/Limerick/Kerry	002165	Lower River Shannon
Mayo/Galway	002998	West Connacht Coast

As bottlenose dolphins are no longer regularly recorded in the study area, are considerably less sensitive to noise and human disturbance (often seeking out interaction with boats and humans) than harbour porpoises and are not a qualifying interest for any SAC on the east coast, they will not be specifically considered further.

### 4.4 Other marine mammals

Common seals and other cetacean species, including common dolphin, Risso's dolphin, striped dolphin, minke whale, humpback whale, fin whale, pilot whale and killer whale have all been recorded along the Dublin coast (IWDG, 2015). All cetaceans are listed under Annex IV of the Habitats Directive and are protected under the Wildlife Acts 1976 to 2012. However, due to the low numbers of records of these species in the area, generally some distance offshore, and therefore the very low likelihood that they will occur during the proposed development period, or that any significant impact would occur on them, they are not considered further.

## 5 Assessment of Risk

### 5.1 Do individuals or populations of marine mammal species occur within the proposed area?

Harbour porpoise, grey seal, harbour seal, bottlenose dolphin, common dolphin, Risso's dolphin, minke whale, pilot whale, killer whale, humpback whale and fin whale have all been recorded in the greater Dublin Bay area, but only harbour porpoises and grey seals occur frequently within the bay, while minke whales are regularly recorded further offshore (IWDG, 2015). Grey seals are regularly seen even within the harbour itself.

### 5.2 Is the project likely to result in the death, injury or disturbance of individuals?

It is extremely unlikely that the proposed works would result in death or injury to marine mammals. Some level of disturbance to harbour porpoise in the vicinity of the dredger is expected, while the effects of piling are likely to be more far-reaching if impact piling is used.

A review of the literature suggests that sound levels of 170 – 190 dB re 1 $\mu$ Pa @ 1 m can be expected to be generated by a TSHD while operational, with a peak frequency of 100 – 350 Hz (Thomsen *et al.*, 2009). As non-pulse sound, this is below the levels that are considered likely

to cause Temporary Threshold Shift (TTS) in submerged marine mammals (Table 4). Defra (2003) found that the TSHD 'Arco Adur' was not detectable above ambient levels at a range of 500 m.

**Table 4.** Injury criteria proposed by Southall *et al.* (2007) for individual marine mammals

Marine mammal group	Sound type		
	Single pulses	Multiple pulses	Nonpulses
Low-frequency cetaceans	Cell 1	Cell 2	Cell 3
Sound pressure level	230 dB re: 1 µPa (peak) (flat)	230 dB re: 1 µPa (peak) (flat)	230 dB re: 1 µPa (peak) (flat)
Sound exposure level	198 dB re: 1 µPa <sup>2</sup> -s (M <sub>lr</sub> )	198 dB re: 1 µPa <sup>2</sup> -s (M <sub>lr</sub> )	215 dB re: 1 µPa <sup>2</sup> -s (M <sub>lr</sub> )
Mid-frequency cetaceans	Cell 4	Cell 5	Cell 6
Sound pressure level	230 dB re: 1 µPa (peak) (flat)	230 dB re: 1 µPa (peak) (flat)	230 dB re: 1 µPa (peak) (flat)
Sound exposure level	198 dB re: 1 µPa <sup>2</sup> -s (M <sub>mr</sub> )	198 dB re: 1 µPa <sup>2</sup> -s (M <sub>mr</sub> )	215 dB re: 1 µPa <sup>2</sup> -s (M <sub>mr</sub> )
High-frequency cetaceans	Cell 7	Cell 8	Cell 9
Sound pressure level	230 dB re: 1 µPa (peak) (flat)	230 dB re: 1 µPa (peak) (flat)	230 dB re: 1 µPa (peak) (flat)
Sound exposure level	198 dB re: 1 µPa <sup>2</sup> -s (M <sub>hr</sub> )	198 dB re: 1 µPa <sup>2</sup> -s (M <sub>hr</sub> )	215 dB re: 1 µPa <sup>2</sup> -s (M <sub>hr</sub> )
Pinnipeds (in water)	Cell 10	Cell 11	Cell 12
Sound pressure level	218 dB re: 1 µPa (peak) (flat)	218 dB re: 1 µPa (peak) (flat)	218 dB re: 1 µPa (peak) (flat)
Sound exposure level	186 dB re: 1 µPa <sup>2</sup> -s (M <sub>pw</sub> )	186 dB re: 1 µPa <sup>2</sup> -s (M <sub>pw</sub> )	203 dB re: 1 µPa <sup>2</sup> -s (M <sub>pw</sub> )
Pinnipeds (in air)	Cell 13	Cell 14	Cell 15
Sound pressure level	149 dB re: 20 µPa (peak) (flat)	149 dB re: 20 µPa (peak) (flat)	149 dB re: 20 µPa (peak) (flat)
Sound exposure level	144 dB re: (20 µPa) <sup>2</sup> -s (M <sub>pa</sub> )	144 dB re: (20 µPa) <sup>2</sup> -s (M <sub>pa</sub> )	144.5 dB re: (20 µPa) <sup>2</sup> -s (M <sub>pa</sub> )

Note: All criteria in the "Sound pressure level" lines are based on the peak pressure known or assumed to elicit TTS-onset, plus 6 dB. Criteria in the "Sound exposure level" lines are based on the SEL eliciting TTS-onset plus (1) 15 dB for any type of marine mammal exposed to single or multiple pulses, (2) 20 dB for cetaceans or pinnipeds in water exposed to nonpulses, or (3) 13.5 dB for pinnipeds in air exposed to nonpulses. See text for details and derivation.

Impact piling can generate high sound levels, which depend on various elements including the substratum and the pile diameter (smaller piles generate lower sound levels) (Matuschek & Betke, 2009). Pile-driving operations using a 6.5 m pile have been estimated to generate sound levels of 201 - 204 dB re 1 µPa (Peak) and 175 – 178 dB re 1µPa (SEL) at 500 m in 20 m deep water (Nehls *et al.*, 2007). Impact piling a pile of diameter 1 m would have a sound level approximately 185 dB re 1µPa @ 750 m (peak) and 160 dB re 1µPa @ 750 m (SEL) (Matuschek & Betke, 2009). These levels are below the levels that are considered likely to cause TTS in submerged marine mammals (Table 4).

Vibration piling generates lower sound levels than impact piling. Nedwell *et al.* (2003) found that vibration piling could not be detected above ambient noise at a range of 417 m. There would be minimal risk of death, injury or disturbance to marine mammals where vibration piling is used.

The piling operations will include an element of drilling in order to remove material from within the pile. Sound pressure levels from drilling are thought to be below those expected to cause injury, though disturbance may still occur (DAHG, 2014).

Overall, there is little risk of injury to marine mammals from the dredging and drilling activities, while the potential does exist at close range where impact piling is used. Localised, temporary disturbance is likely to be caused to harbour porpoise by dredging, while piling may have a more widespread effect. This effect will be reduced due to the location of the piling within the confines of the harbour and the small diameter of the majority of the piles. All effects will be temporary in nature.

As noted in the Rockabill to Dalkey Island SAC Conservation Objectives supporting document (NPWS, 2013c), temporary or short-term restrictions of access or range do not affect Target 1 of the Conservation Objectives related to harbour porpoise in the SAC.

### **5.3 Is it possible to estimate the number of individuals of each species that are likely to be affected?**

As marine mammals are highly mobile animals, it is difficult to estimate the number of individuals likely to be affected by the proposed works. The following describes the numbers of grey seals and harbour porpoises recorded in surveys of the surrounding areas.

The Lambay Island grey seal population was estimated to be 45 - 60 in 1995 (NPWS, 1995) and 203 - 261 in 2005 (Ó'Cadhlá *et al.*, 2007), indicating an increasing population. Thirty-six grey seals were recorded on Dalkey Island during the 2007 moult survey (Ó'Cadhlá & Strong, 2007), while two pups were recorded during the 2005 breeding survey (Ó'Cadhlá *et al.*, 2007). Ten seals were recorded by the NPWS on Dalkey Island, and six on The Muglins, just east of Dalkey Island, during the 2003 harbour seal population assessment (NPWS, 2013b).

Surveys carried out by the Irish Whale and Dolphin Group (IWDG) in 2008 estimated an overall harbour porpoise abundance of 211 (CV = 0.22, CI 95% = 137 – 327) in North County Dublin and 138 (CV 0.24, CI 95% = 86 – 221) in Dublin Bay (Berrow *et al.*, 2008).

Based on these figures, it is estimated that approximately 20 grey seals and 138 harbour porpoises may be affected by the piling works, with the dredging works having a more limited effect.

### **5.4 Will individuals be disturbed at a sensitive location or sensitive time in their life cycle?**

There are limited haul-out opportunities for grey seals in the vicinity of Dún Laoghaire Harbour due to the potential for human disturbance. Dalkey Island is the closest important haul-out site, with low levels of breeding activity. Breeding (mating and pupping) occurs in the period September – December (Kiely *et al.*, 2000). Grey seals will not be disturbed at a sensitive time or location due to the proposed works.

Harbour porpoises forage throughout Dublin Bay, but breeding is thought to occur offshore in the period March – June. Mother-calf pairs are more common along the North Dublin Coast, indicating this area is more important as a nursery area for harbour porpoise. The proposed works will not disturb harbour porpoises at a sensitive location or sensitive time in their lifecycle due to the fact that breeding occurs offshore and the focus of nursery activity is north Dublin.

### **5.5 Are the impacts likely to focus on a particular section of the species' population e.g. adults vs juveniles, males vs females?**

Any impact of the proposed works is likely to impact equally on all sections of the grey seal population, with the exception of a small number of males who frequent Dún Laoghaire Harbour looking for food at the fish shop on Coal Quay and may face greater disturbance.

Any effect of the proposed works is likely to impact equally on all sections of the harbour porpoise population, with the exception of calves, which are less likely to occur in the area, as they are most often recorded in north Dublin.

### **5.6 Will the project cause displacement from key functional areas?**

The proposed works are within Dún Laoghaire Harbour out to a distance of 1.5 km from the harbour mouth. There is no indication that the open water habitat outside the harbour is a key functional area for grey seals or harbour porpoises. Some level of temporary disturbance is likely to occur in the Rockabill to Dalkey Island SAC during piling operations, but the highest

harbour porpoise sightings rates were around Howth Head and Dalkey Island (Berrow *et al.*, 2008).

In relation to the dumping of dredge spoil at the Burford Bank, harbour porpoises avoid ships at some distance (1-1.5 km) with stronger reaction at 400 m (Richardson, *et al.*, 1995) and therefore will move away from the dredger as it arrives on station at the Burford Bank, minimising the possibility of any interaction between the two. This will only lead to small, temporary disturbance from an area that appears to be of lower importance to harbour porpoises than the areas around Howth Head and Dalkey Island (Berrow *et al.*, 2008).

## **5.7 How quickly is the affected population likely to recover once the project has ceased?**

Any displacement caused by the proposed works would be expected to cease within hours of the cessation of works.

## **6 Mitigation**

In-keeping with best practice, it is proposed that the *Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters* (DAHG, 2014) will be implemented in full for the protection of marine mammals from potential injury due to the noise generated during piling operations.

It is proposed that dredging will be carried out with a slight deviation from the guidance in that dredging will be carried out 24/7 during summertime (March – September) and therefore a number of dredging cycles will commence outside of daylight hours in order to minimise the duration of the dredging. With 24/7 dredging in the summer, where daylight hours are long, the work programme is expected to be completed in 14-17 weeks. If dredging is only carried out during daylight hours, this would be expected to increase to 32 weeks. The proposed dredging programme balances the very low risk of injury or disturbance to marine mammals of commencing some dredging cycles outside daylight hours with minimising the overall duration of the disturbance. The following was considered in proposing this course of action:

- Sound generated by dredging is predominantly low frequency and below levels that would cause temporary or permanent injury to marine mammals (Richardson *et al.*, 1995, Southall *et al.*, 2007). The soft sediment within the footprint of the works would mean the sound levels generated would be at the lower end of the range for dredging.
- Berrow *et al.* (2008) recorded peak harbour porpoise activity at Howth Head & Dalkey Island, with few sightings close to Dún Laoghaire Harbour limit. Numerous harbour porpoise sightings have been made by members of the public outside Dún Laoghaire Harbour (IWDG, 2015); however, the number of records here is reflective of the large number of people using the piers. The majority of sightings occur in the period October-December (IWDG, 2015), thus the proposed dredging programme (March – September) will avoid the peak sightings period.
- It is thought that harbour porpoises move offshore in the period March – June to calving/breeding areas (IWDG, 2014), which would reduce the level of interaction between the proposed works and breeding individuals, as the dredging programme would overlap with this period.
- Harbour porpoises avoid ships at some distance (1-1.5 km) with stronger reaction at 400 m (Richardson *et al.*, 1995) and therefore will move away from the dredger as it arrives on station at the harbour or the Burford Bank.
- Grey seals that frequent Dún Laoghaire Harbour will not show strong disturbance reactions to the dredger, as they will be habituated to boats and shipping in the area and move away accordingly.

Where impact piling is used, mitigation measures such as bubble curtains or cofferdams will be used to reduce the sound levels transmitted to the wider aquatic environment.

## 7 Summary

The potential for impact on marine mammals from the proposed works is likely to be restricted to grey seals and harbour porpoises. Given the sound levels expected to be generated, physical effects would be limited to temporary threshold shifts at very close range in the case of impact piling, while proposed mitigation measures would effectively eliminate this risk.

Some level of disturbance to grey seals and harbour porpoises is expected for the duration of the dredging and piling works, but this will be a slight, temporary impact and is rapidly reversible and therefore does not constitute a significant effect.

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