Ayesa

# Annex IV Risk Assessment

## Haulbowline Naval Base

[redacted]

COMMERCIAL IN CONFIDENCE

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# Contents

## List of Figures

## List of Tables

# 1 Introduction

## 1.1 Purpose of the Document

Ayesa (Formally ByrneLooby), on behalf of the Department of Defence, wishes to carry out regular maintenance dredging at the Haulbowline Naval Base in County Cork, Ireland, as part of its regular maintenance dredging works. Alongside the dredging works, subsequent disposal of dredging material off Roches Point will need to be carried out as part of the project. As a result, consent is required from the Maritime Area Regulatory Authority (MARA) for the dredging works alongside an Assessment of Impacts of the Maritime Usage (AIMU) and Risk Assessment for Annex IV Species (RAAIVS).

Ayesa has engaged APEM Ltd. to conduct an Annex IV Species Risk Assessment for the proposed dredging (herein referred to as the Works) at the Haulbowline Naval Base. Aspects of these Works could potentially affect Annex IV species identified as having the potential to be present in the Works area, as well as other species including pinnipeds (seals) which are protected by law under the Wildlife Act, 1976 from killing and intentional or reckless disturbance. The potential for impacts on these species are mainly via generation of underwater noise. Article 12 of the Habitats Directive (92/42/EEC) lists all cetaceans (whales, dolphins, and porpoises), otters and marine turtles as Annex IV species. As Annex IV species are protected by law, any risk of impacts to such species because of the Works must be assessed. Consequently, this Annex IV Species Risk Assessment has assessed the risk of impact from the activities associated with the Works and provides recommendations on mitigation measures if needed, and if a derogation licence is likely to be required.

This Annex IV Species Risk Assessment has been produced in accordance with the Department of Arts, Heritage, and the Gaeltacht (DAHG) 2014 'Guidance to manage the risk to marine mammals from man-made sound sources in Irish Waters'. Furthermore, the Annex IV Species Risk Assessment also draws on the most recent relevant scientific publications and other guidance documents to inform the assessment and recommendations herein, as the DAHG (2014) guidance is in the process of being reviewed and updated.

This report will assess the potential impacts of maintenance dredging of the Haulbowline Basin. The Project encompasses maintenance of the Haulbowline Basin, entrance to the channel and Graving Dock, with the non-contaminated dredge material being transported to a designated dump site south of Roches Point for disposal at sea. The contaminated material dredged from the site will be stored on site to allow controlled dewatering and desalination before being loaded and transported to a licenced facility, with a total of 105,630 $m^3$ of dredged material to be removed and approximately 90,000 $m^3$ disposed at sea.

## 1.2 Project Background

The Haulbowline Naval Base, is located on Haulbowline Island within Cork Harbour, Co. Cork, Ireland. Cork Harbour is one of the largest natural harbours in the world. The harbour has a large volume of vessel traffic, and as a result there is a considerable amount of daily transient and ambient noise. The harbour is an industrial hub with commercial shipping from three bulk cargo and Roll-on/Roll-off locations (City Quays, Tivoli and Ringaskiddy), passenger ferry and cruise line services (Ringaskiddy

and Cobh), fuel import facilities (Whitegate), the Irish Naval Service base (Haulbowline) and several commercial boatyard facilities which emit continuous anthropogenic sounds such as engine noise, sonar, amongst others. It is also home to at least six public and private marinas for recreational boating, highlighting that there is constant land and sea activity already established within the local marine environment.

The naval basin and approach channel ("the Basin") are planning to undergo maintenance dredging over a eight year period (from 1st January 2025 to 31st December 2032) running approximately every three years (executing four campaigns) to maintain navigable water depth crucial for the Naval fleet at all tidal levels for use within the Haulbowline Harbour. Previous dredging campaigns were carried out in 2010 and 2016. This Licence Application Area consists of the Basin, Entrance Channel, and Graving Dock. The Basin will be dredged to a level of -5.5 m *Chart Datum*. The proposed dredged site is within an active naval base (**Error! Reference source not found.**) and will be operational throughout this project.

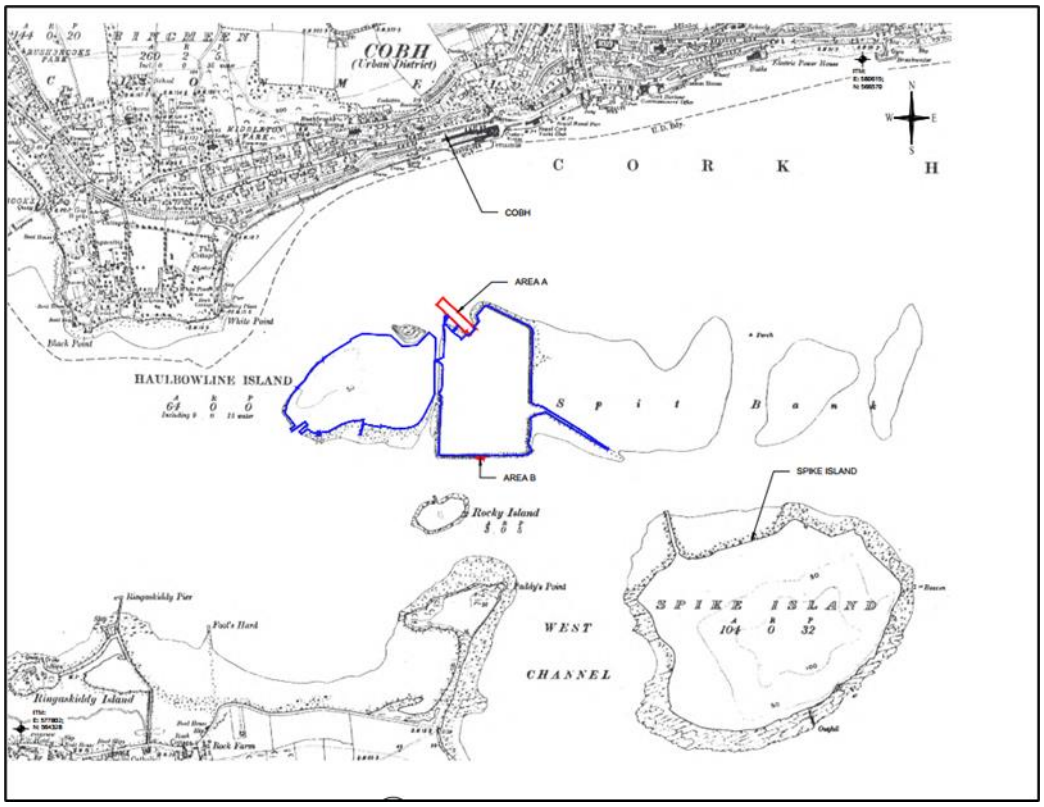


**Figure 1. Project site for the proposed dredging works at Haulbowline Naval Base in Cork Harbour, on behalf of The Department of Defence**

# 2 The Proposed Activities

## 2.1 Details of proposed dredging and dumping works.

The dredge area is located at Haulbowline Naval Base on Haulbowline Island in Cork Harbour, Co. Cork (Figure 1). The dredge area is enclosed within Haulbowline Island except to the north where the approach channel provides access to Cork Harbour.

The dredge area is approximately 4,800 $m^2$ in size. The dredging works are planned within two areas of the Licence Application Area (Figure 2); Area A (4,600 $m^2$) is the main dredging location within the extent of the Basin, and Area B (200$m^2$) being the Graving Dock within the Naval Dockyards. A total estimated dredge volume of 105,630 $m^3$ is expected to be removed from the site, with the majority of this material being disposed of at sea. Department of Defence will apply for a Dumping at Sea (DaS) licence (Report No. CM1265-MA-R0901) from the Environmental Protection Agency (EPA) to dispose of the uncontaminated spoil material at sea. Any spoil which is classified as contaminated and unsuitable for disposal at sea, will be removed from site, dried and transported to a specialist treatment facility. An eight year permit has been proposed in order to eliminate repeated licensing procedure, reduce administrative overhead, and ensure long-term maintenance planning without disruptions.

The duration of each dredge campaign is approximately four months (including mobilisation and demobilisation). This includes approximately three weeks of mobilisation and preparatory works, 12 weeks of dredging operations and one week of demobilisation following completion of the works. The works are assumed to commence in Q4 2024/Q1 2025 (see submitted AIMU).

The dredger that is proposed to be used is a backhoe dredger (long reach back-hoe excavator) due to the characteristics of the material being dredged and the tidal accessibility. These dredgers employ a bucket or grab lowered to the seabed to excavate the intended sediment material and lifted to the surface. The dredged sediment is then collected and transported utilising 'hopper barges' of to the licenced disposal site.

All uncontaminated material, presumed to be the bulk of material removed from the site, will be disposed of at sea. Where possible, material from the dredging will be disposed of at sea at a spoil site. The Roches Point spoil site is expected to be an existing spoil ground area located south of Power Head, at the edge of the approaches to Cork Harbour (Figure 3). This spoil site lies at least 3.7 km outside of the limit of the Cork Harbour Authority, in open water of between 25 m and 50 m water depth *chart datum* which has been utilised in the past by the applicant and by the Port of Cork. This well-established dump site has been used since 1978 and reports demonstrate that the condition of the site has not undergone any significant changes since 1999 The loading of dredged material will be restricted to those areas of the navigation channel, basins and berthing pockets which contain sediments which are suitable for disposal at sea (Class 1: uncontaminated, no biological effects likely). Confirmation of the suitability of the dredged sediments for disposal at sea is made through a programme of sediment chemistry sampling and analysis and eco-toxicological testing and has been already assessed and presented within the DaS Application.

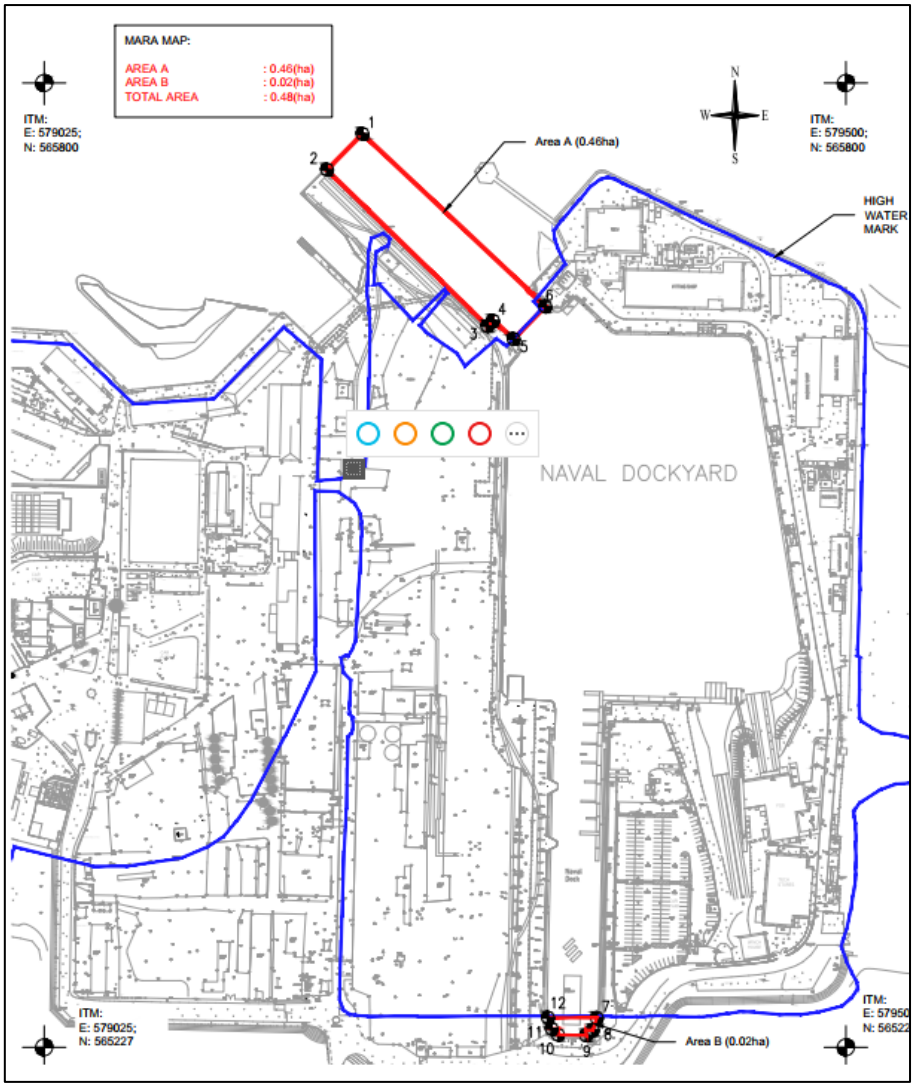


**Figure 2. Haulbowline Application Licence Area**

The route between the dredge and the dump site could also cause impacts through increased noise associated with the movement of the dredger as it transits to and from the dump site. The receiving environment includes the benthos, the benthic, demersal and pelagic fish in the area, otters and marine mammals and to a lesser extent seabirds. Here we only consider the risk to Annex IV species from the dredging operations and especially at the dump site and during transit between the dredge and dump site.


**Figure 3. Cork Harbour and highlighted disposal site**

### 2.1.1 Dredging

Mechanical dredgers include all plant which makes use of mechanical excavation equipment for cutting and raising material. In general, mechanical dredging techniques can be split into bucket line dredgers (BLD), backhoe dredgers (BHD) and grab dredgers (GD). Naturally, each technique has different environmental attributes in respect of accuracy, creation of spill and output rates.

In general, BHD is used for relatively small projects in areas with consolidated soil conditions as the mechanical forces which can be applied are considerable. Recent developments in sophisticated monitoring and control equipment have significantly improved the accuracy of BHD. As such, this dredging technique is particularly attractive for more precise dredging projects in areas where debris is expected or where physical constraints such as surrounding infrastructure prevent the use of more traditional equipment with very limited overspill.

Trailing Suction Hopper Dredger (TSHD) trails its suction pipe when working and loads the dredge spoil into one or more hoppers in the vessel. When the hoppers are full, the TSHD sails to a disposal area and either dumps the material through doors in the hull or pumps the material out of the hoppers.

Part of Dredging Campaign 1 aims to restore the Graving Dock (Area B) within Hawlbowline Harbour to its designed depth by removing the sedimentation material, however, this material has been designated as unsuitable (16 Class 2 and two Class 3 contamination) for disposal at sea and therefore

requires stabilisation and drying before being disposed of at a licenced facility. Sampling within the site revealed the Class 3 contaminants exceeding upper limits are copper and lead, and PCBs were identified throughout all samples (see AIMU Report for further detail). This is planning to undergo Waste Acceptance Criteria (WAC) at a later date in order to determine the materials specific methodology required for the contaminated material, ensuring that the most effective and compliant approach is implemented in adherence to regulatory standards.

The bed profile consists of soft, slightly sandy silt on top of a layer of slightly sandy, slightly gravelly clay. While the exact base level of the Graving Dock is unknown. Dredging will occur up to the lesser of the Graving Dock base or -5.5 m CD, eliminating the need for rock dredging in the Basin and ultimately minimising associated vibration and noise of the works. It is not anticipated that there will be any requirement to dredge rock from the Basin.

Todd *et al.* (2015) provides a review on the state of current knowledge and potential impacts of dredging on marine mammals. Dredging operations are known to produce non-pulsed low-frequency omnidirectional sounds of 20 Hz to 20 kHz at sound pressure levels of 135–186 dB re 1 µPa (e.g. Richardson *et al*. 1995, OSPAR 2009 cited in DAHG 2012). Richardson *et al*. (1995) recorded source levels from 160 to 180 dB re 1 µPa at 1 m with a maximum ca. 100 Hz from a backhoe dredger. The bandwidth was between 20 Hz and 1 kHz, with most energy below 500 Hz. More recently, for backhoe dredging Reine *et al*. (2012) recorded the maximum measurement of engine and / or generator noise of 167 dB re 1 µPa at 1m rms and of the noise generated by the bottom scoop action was 179.4 dB re 1 µPa at 1m rms.

Previous studies on sound production by TSHDs in silt/mud substrates have found that maximum source levels from the various activities associated with TSHD dredging (including the dredging process, transit to dump site, placement, pumping and rainbowing) to be very similar with dredging itself and not producing sounds louder than those produced by the dredger during transit (de Jong *et al*. 2010). This study was carried out on the sound production by seven TSHDs during construction of a 2,000 ha harbour extension of the Port of Rotterdam. More recently, Robinson *et al.* (2011), found that emitted sound levels from TSHDs at frequencies below 500 Hz were similar to a deep-draft draught cargo ship travelling at a moderate speed.

During operation the vessel will be underway whilst dredging with main engines, generators and other machinery operating. Tests carried out by World Organisation of Dredging Associations (WODA) indicate that noise levels produced by engines/machinery when a vessel is underway exceed those produced by the pump or drag head (de Jong *et al*. 2010). Nedwell *et al.* (2008) measured a large backhoe dredger at Lerwick, Shetland (UK). Based on a 'conservative' 10 log (R/1 m) scaling, the estimated 'affected or equivalent' source level during excavation was 163 dB re 1 µPa2 $m^2$. Underwater sound was recorded at frequencies from 20 Hz to ca. 20 kHz, with consistent sound being recorded over the low frequency range from 20 to 80 Hz and peak spectral levels of sound occurring between 35 and 45 Hz.

### 2.1.2 Dumping at Sea

The proposed disposal site has been routinely used for the dumping of dredged material. Dumping will be carried out from the dredge vessel in the prescribed dump site, around 8 km south of Roches Point. This site has been used for many years with an estimated seven million tonnes of dredged material dumped over the last 35 years. The hopper barge will take around one - two hours to transit to the site, and a similar time to return to the dredge site. During dumping the TSHD or barge will sail at between 0-3 knots depending on sea conditions, dredged material, etc. During this period the bottom valves are opened and all material is discharged from the hopper in a very controlled short period taking only a few minutes. The sequential slow movement of the dredger or barge within the disposal area and utilising vessel onboard tracking systems to select different areas within as much of the disposal site as possible, spreads out the material over the disposal site, preventing accumulation in one isolated area.

The volume to be dredged in any specific year is not fixed, instead it is proposed to set a maximum permitted limit that should not be exceeded based on the maximum dredge volumes for the Works in their entirety. This is proposed to be performed over four campaigns, with the initial campaign constituting the largest volume of material to be dumped (approximately 32,000 $m^3$) (1). The initial campaign for the non-contaminated material is proposed for 32 dumping activities, each involving 1,000 $m^3$ per activity.

**Table 1. Quantity of proposed dredged material from the Works**

| Description | Dredged Volume ($m^3$) Non-Contaminated Material | Dredged Volume ($m^3$) Contaminated Material | Dredged Volume ($m^3$) Total |
|---|---|---|---|
| Dredging Campaign 1 | 32,000 | 15,630 | 47,630 |
| Dredging Campaign 2 | 16,500 | - | 16,500 |
| Dredging Campaign 3 | 16,500 | - | 16,500 |
| Dredging Campaign 4 | 25,000 | - | 25,000 |
| Total | 90,000 | 15,630 | 105,630 |

Relevant studies on the potential impacts to marine mammals from dredging give little consideration to the impact of the actual dumping of dredge material as opposed to removal of material from the site to be dredged. This is likely to be the result of extremely low impact of the dumping of dredged material on marine mammals when in comparison to the effects of dredging itself. OSPAR (2008) suggest that the dumping of dredge materials are likely irrelevant with respect to environmental impact and the issues are confined to disturbance due to underwater noise emissions during the dumping process and during the transport.

# 3 Legal Requirements

Annex IV of the EC Habitats Directive (European Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna) lists species of European interest in need of strict protection; these are termed European Protected Species (EPS). All species of cetacean, marine turtles and otters are EPS. The Habitats Directive has been transposed into Irish law by the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011). Consequently, it is an offence to kill, injure or disturb cetaceans and marine turtles and if any such offence is likely to occur, an EPS or derogation licence is required.

Derogation licences for Annex IV species may be granted by the Minister for Arts, Heritage and the Gaeltacht, which would allow otherwise illegal activities to go ahead, provided that:

- There is no satisfactory alternative.
- The action authorised will not be detrimental to the maintenance of the population of the species concerned at a Favourable Conservation Status (FCS) in their natural range.

FCS is defined in the Habitats Directive as when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable element of its natural habitats.
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

The following guidance documents have been used when undertaking this risk assessment:

- Guidance on the Strict Protection of Certain Animal and Plant Species under the Habitats Directive in Ireland (NPWS, 2021)
- Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (DAHG, 2014)
- EU Commission's Guidance document on the strict protection of animal species of Community interest under the Habitats Directive (EU, 2021).

Previous DaS Applications for Haulbowline:

- 2009 (Granted 2010): DaS Application (No. S050005-01)
- 2016 (Granted 2017): DaS Application (No. S0005-02)
- 2024 (Currently under review): DaS Application (CM1265-MA-R0901)

# 4 Annex IV species

### 4.1.1 Cetaceans

More than 25 species of cetaceans have been recorded in Irish waters (NBDC, 2024), with seven of these commonly sighted within the Cork Harbour area and at the proposed spoil ground located south of Roches Point (harbour porpoise (*Phocena phocoena*), common dolphin (*Dephinus delphis*), bottlenose dolphin (*Tursiops* trunctus), Risso's dolphin (*Grampus griseus*), minke whale (*Balaenoptera acutorostrata*), fin whale (*Balaenoptera physalus*), and humpback whale (*Megaptera novengliae*)) (Berrow *et al.*, 2018; Rogan *et al.*, 2018; IWDG, 2022; NBDC, 2024).

Other cetacean species, which are infrequently recorded include the Atlantic white-sided dolphin (*Leucopleurus acutus*), striped dolphin (*Stenella coeruleoalba*), sei whale (*Balaenoptera borealis*), Cuvier's beaked whale (*Ziphius cavirostris*), killer whale (*Orcinus orca*), long-finned pilot whale (*Globicephala melas*), northern bottlenose whale (*Hyperoodon ampullatus*), pygmy sperm whale (*Kogia breviceps*), blue whale (*Balaenoptera musculus*), Sowerby's beaked whale (*Mesoplodon bidens*) and sperm whale (*Physeter macrocephalus*) (Reid *et al*., 2003; Rogan *et al.,* 2018; NBDC, 2024).

### 4.1.2 Marine Turtles

There have been five species of marine turtle recorded in Irish waters, with most records being on the west and south coasts of Ireland (King and Berrow, 2009; Botterell *et al.,* 2020). Of these, the leatherback turtle (*Dermochelys coriacea*) is the only species that is considered resident, and sightings are concentrated off the southwest coast of Ireland (King and Berrow, 2009; Doyle *et al.*, 2007). They are listed as a vulnerable species on the IUCN Red List (Wallace *et al.*, 2013) They are most commonly recorded between June and October when they forage on jellyfish (*Medusozoa* spp.) (Doyle, 2007; Botterell *et al.*, 2020).

### 4.1.3 Otters

The Eurasian otter (*Lutra lutra*) is widespread throughout Ireland, occurring along rivers, lakes and coasts (Reid *et al.* 2013). Coastal otters predominantly feed on marine species and their diet mainly consists of rockling (*Gadidae*), wrasse (*Labridae*), crustaceans, molluscs, European eel (*Anguilla anguilla*), gobies (*Gobiidae*), sea scorpions (*Cottidae*) and blennies (*Blenniidae*) (Murphy and Fairley 1985; Kingston *et al.* 1999). Coastal dwelling otters require access to a freshwater source as they must regularly cleanse their fur of salt as this can affect its insulating properties and therefore their territorial range will be directed by access to freshwater.

Otters usually feed in shallow, sheltered waters within 100 m of the shore (Kruuk *et al*., 1998) and avoid deeper waters (Scottish Executive, 2007). Otters are particularly sensitive to disturbance in the vicinity of natal dens or holts, and they usually have multiple dens located up to 500 m from watercourses. Any changes to holts or dens may have a larger scale effect on otter populations. They may also travel inland via estuaries to feed on brackish or freshwater food sources (Reid *et al.* 2013). They are listed as Near Threatened on the IUCN Red list (Loy *et al.* 2022).

### 4.1.4 Non-Annex IV species

Although pinnipeds are not Annex IV species, they have been included in this assessment as they are protected under the Wildlife Act, 1976 where it is an offence to hunt, injure or wilfully interfere with, disturb or destroy the resting or breeding place of a protected (listed) species in Irish territorial seas. Further legal protection of seals in Ireland is provided by the EC Directive where they are listed as an Annex II species whose conservation requires the designation of Special Areas of Conservation (SACs). Any proposed mitigation measures for the species included in this assessment will also be appropriate and / or relevant to these seals, as well as any other species of cetacean and turtle not taken forward in this assessment.

Two species of pinniped, the grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*), inhabit Irish waters year-round and are recorded along the south Irish coast. Both are listed as species of Least Concern on the IUCN Red List (Bowen, 2016; Lowry, 2016).

Both species have established haul-out sites along all coastlines of Ireland for resting, breeding, and engaging in social activity (Cronin *et al*., 2004; Ó Cadhla *et al*.,2007). The largest proportion of the grey seal population is hauled out ashore during the annual moult which begins in November and continues until April (Ó Cadhla and Strong, 2007). Grey seals also aggregate in large colonies during the breeding season between August and December (Ó Cadhla *et al.,* 2013), with peak pup production during October and November (Lyons, 2004). Grey seals tend to breed on exposed rocky shores, on sandbars or in sea caves with ready access to deeper water.

Haul-out sites for harbour seals have tended historically to be found among inshore bays and islands, coves and estuaries (Cronin *et al.,* 2007), particularly around the hours of lowest tide. Seasonal and critical life-history events are shown to influence haul-out behaviour, with a maximum time ashore occurring during the moult and post-moult season between July and October. The females give birth to their pups in June and July (Lyons, 2004).

The diet of grey and harbour seals in Irish coastal waters are broadly similar, with both species having a highly variable diet. Sandeels make up a large percentage of prey for both grey and harbour seals, with other prey species including salmonids, squid, dragonets and flatfish species (Hernandez-Milian *et al.,* 2012). The majority of foraging trips for grey and harbour seals fall within 100 km and 50 km from a haul-out site, respectively (Carter *et al.*, 2022; Cunningham *et al.* 2009; Cronin 2010; SCOS, 2021).

# 5 Approach to risk assessment

The general approach and terminology used in this document is consistent with the Environmental Impact Assessment Report (EIAR) guidelines produced by the Environment Protection Agency (EPA, 2022, Section 3 Table 3.4 and Figure 3.4 therein), in terms of describing the effects and determining significance.

The approach is complemented by the receptor specific guidance 'Guidance to Manage the Risk to Marine Mammals from Man-Made Sound Sources in Irish Waters' (DAHG, 2014) which has been used to inform this risk assessment. This guidance will also be applied to other species, specifically marine turtles that are included within this risk assessment. This guidance recommends that coastal and marine activities undergo a risk assessment for anthropogenic sound-related impacts on relevant protected marine mammal species to address any area-specific sensitivities, both in timing and spatial extent, and to inform the consenting process. The guidance states that an evidence-based risk assessment for each marine mammal species that occurs in and around the Works area needs to consider the nature of the sound source, its likely and / or potential effects on individuals and / or populations and on their likely habitats, and could usefully address the following questions where appropriate:

- Do individuals or populations of marine mammal species (or marine turtles or pinnipeds or otters) occur within the proposed area?
- Is the plan or project likely to result in death, injury or disturbance of individuals?
- Is it possible to estimate the number of individuals of each species that are likely to be affected?
- Will individuals be disturbed at a sensitive location or sensitive time during their life cycle?
- Are the impacts likely to focus on a particular section of the species' population, e.g., adults vs. juveniles, males vs. females?
- Will the plan or project cause displacement from key functional areas, e.g., for breeding, foraging, resting or migration?
- How quickly is the affected population likely to recover once the plan or project has ceased?

Where appropriate, consideration will be given to the sensitivity of marine mammals and marine turtle to the impacts. The magnitude and likelihood of impacts will also be considered, the latter relating to the probability that an impact will occur as a result of a receptor being exposed to a discernible impact. The risk will be determined by considering the sensitivity of a receptor along with the magnitude and likelihood of the impact to which the receptor is exposed.

Where an effect is considered likely and significant, appropriate mitigation will be proposed to manage the risk.

# 6 Baseline

The environmental baseline for Annex IV species and other protected species reviews the available information on the occurrence and distribution of cetaceans, marine turtles, otters, and pinnipeds within or near to the Works area.

## 6.1 Data Sources

Information on Annex IV species and pinniped occurrence, distribution and abundance in the Licence Application Area was collected through a detailed review of existing studies and datasets. These desk study sources are summarised below:

- Northern Ireland Mammal database;
- Irish Whale and Dolphin Group (IWDG) offshore marine mammal atlas (IWDG, 2022);
- IWDG casual cetacean sightings database (IWDG, 2024);
- IWDG cetacean standings database;
- Biodiversity Maps (NBDC, 2024);
- Irish cetacean review (2000-2009) (Berrow *et al*., 2010);
- Aerial surveys of cetaceans and seabirds in Irish waters: Occurrence, distribution and abundance in 2015-2017 (Rogan *et al*., 2018);
- The Natural Environment and Research Council (NERC) appointed Special Committee on Seals' (SCOS) most recently available annual report (SCOS, 2022; 2023);
- Habitat-based predictions of at-sea distribution for grey and harbour seals in the UK and Ireland (Carter *et al*., 2022);
- APEM ByreLooby Marine Mammal Risk Assessment (2022); and,
- Sightings of marine mammals during previous dredging campaigns in Cork Harbour:
    - Russell and Levesque (2014)
    - O'Dwyer (2017)
    - Risk Assessment for Annex IV Species for Port of Cork (IDWG, 2022a)
    - Risk Assessment for Annex IV Species for Port of Cork Company (IDWG, 2024c)

## 6.2 Defining Zone of Influence (ZoI)

The environmental baseline for Annex IV species and other protected species reviews the available information on the occurrence and distribution of cetaceans, marine turtles, otters, and pinnipeds within or near to the Proposed Activities and surrounding Irish waters. For this desk-based review, the zone of influence (ZoI) was defined as the survey area plus a 10-km buffer zone. This area has been determined considering the worst-case scenario based on the potential impacts of dredging and disposal campaigns.

During the proposed dredging campaigns, the main impact pathways of concern to Annex IV and other protected species relate to underwater noise. Therefore, consideration was given to the propagation of noise from dredging, and the potential impact on Annex IV and other protected species. Studies have shown that ambient underwater noise is on the rise globally, mainly from increased commercial shipping traffic, along with a surge in coastal developments. Dredging tends to be at similar sound

levels to ambient shipping noise, with soft-silt dredging at lower sound levels than those measured for gravel dredging. The level of ambient noise in the Works area is relatively high already, as it is situated within a working harbour with a constant presence of vessel traffic.

Therefore, the addition of a 10 km buffer zone within the Licence Application Area is considered as a precautionary ZoI considering the NPWS (2014) guidelines that coastal dredging operations can be detected at received levels exceeding ambient sound more than 10 km from shore. While sound exposure levels from such operations are thought to be below that expected to cause injury to a marine mammal, they have the potential to cause lower level disturbance, masking or behavioural impacts, for example. Dredging activity tends to occur in a fixed area for a prolonged period of days or weeks. Therefore, it has the potential to introduce continuous anthropogenic sound at levels that may impact upon marine mammal individuals and/or local populations and the risk of acoustic impacts associated with this activity should be considered to ensure good environmental management.

It is important to note that the actual immediate ZoI during each survey activity associated with the Works will be localised and often short in duration. The ZoI used here is to ensure that the baseline study considered the area in which an impact may occur at any point in time during the Proposed Activities, and in doing so, taking a precautionary approach to extending that boundary beyond the range in which an impact would occur. As such, there is confidence in the assessment with respect to detailing relevant designated sites in the area and the Annex IV and other protected species present.

## 6.3 Cetaceans

### 6.3.1 Harbour porpoise

The harbour porpoise is the most widespread and frequently recorded species in Irish waters, sighted largely in inshore waters in the Celtic Sea throughout the entire year (Ó Cadhla *et al*., 2004; Berrow *et al*., 2010; Wall *et al*., 2013; Rogan *et al*., 2018). Known for being generally shy, avoiding other species and rarely interacting with boats, limiting observation in anything other than calm waters and rarely occurring in deep water but have been observed in overly shallow (<200 m) offshore banks (DAHG, 2009). Porpoise sightings in the Celtic Sea differ by season, with densities peaking in summer (Berrow *et al.*, 2010). They are listed as a species of Least Concern on the International Union for Conservation of Nature (IUCN) Red List (Braulik *et al.,* 2020). Harbour porpoises are opportunistic foragers with a varied diet and are known to forage at high energy, near-shore sites, where their distribution is linked to year-round proximity to small shoaling fish species, such as sandeel (*Ammodytidae*) (Santos and Pierce, 2003). Harbour porpoise are typically observed as individuals or in small groups of two to three animals throughout the year and will tend to avoid medium and large vessels (IWDG, 2024a).

### 6.3.2 Common dolphin

Deemed the second most frequently reported species of cetacean after the harbour porpoise, common dolphins are widely distributed within Irish waters, with higher abundances off the south and southwest coasts, as well as, in deeper waters and over the continental shelf (Reid *et al.*, 2003; Berrow *et al.*, 2010; Wall *et al.*, 2013; IWDG, 2024b). They are gregarious and commonly occur in groups of tens of animals that readily approach vessels and may bow ride for extended periods (IWDG, 2022). They are listed as a species of Least Concern on the IUCN Red List (Braulik *et al.*, 2021). It is reported

that common dolphins have a seasonal presence occurring in low densities over summer and autumn, with sightings peaking between September and January off Co. Cork (Berrow *et al.*, 2010). They are then almost absent over the winter period due to an eastward movement along the south coast (Wall *et al.,* 2013, Berrow *et al.*, 2010). They prey on a variety of fish and cephalopod species, particularly schooling fish such as herring and sprat (Brophy *et al.,* 2009). Common dolphins are thought to calve in Irish waters, with calves primarily sighted from late summer to late autumn (Wall *et al.,* 2013).

### 6.3.3 Bottlenose dolphin

Bottlenose dolphins are one of the most frequently recorded cetaceans in Ireland (NPWS, 2019) and have been observed throughout Irish waters year-round. They are listed as a species of Least Concern on the IUCN Red List (Wells *et al*., 2019). Bottlenose dolphins are typically encountered in group sizes of five to thirty animals, larger group sizes have been recorded but predominately in offshore areas. Inshore animals will readily approach vessels but are less likely to engage in extended periods of bow riding than common dolphins (IWDG, 2022).

In Ireland, there are thought to be at least three distinct populations of bottlenose dolphin, as determined by genetic studies (Mirimin *et al*., 2011). One of these populations is highly mobile and the same individuals have been recorded off all Irish coasts, with individuals recorded in Dublin Bay recaptured (i.e., sighted and identified through photographic identification (hereafter 'photo-ID') using distinctive features) in Galway Bay, approximately 650 km away (O'Brien *et al*., 2010). Comparison of images within bottlenose dolphin photo-ID catalogues confirm movement of individuals through prospective corridors linking designated Special Areas of Conservation (SACs) in the Moray Firth (Scotland), Cardigan Bay (Wales) and Shannon Estuary (Ireland) (Robinson *et al.,* 2012). There is a small 'semi-resident' group described in Cork Harbour (Berrow *et al.,* 2010, Ryan *et al.,* 2010). Recent photo-ID of bottlenose dolphins by IWDG have recorded the same individuals off counties Dublin, Cork, Kerry, Galway, Mayo, Donegal and Antrim (Berrow *et al.,* 2010), suggesting that inshore dolphins recorded within and / or near the Works area potentially use the entire Irish coast. Most coastal sightings around Ireland fall within 10 km from shore (O'Brien *et al*., 2010; Robinson *et al*., 2012). Irish coastal bottlenose dolphins have a widely variable diet including benthic and pelagic species; prey includes, but is not limited to, hake (*Merluccius merluccius*), whiting (*Merlangius merlangus*), haddock (*Melanogrammus aeglefinus*), conger eel (*Conger conger*), gadoids, flatfish, and cephalopods (Hernandez-Milian *et al.,* 2012; 2015). Bottlenose dolphins with calves in Irish waters were recorded primarily in the summer months (Berrow *et al.,* 2010).

### 6.3.4 Risso's dolphin

Risso's dolphin are primarily recorded in oceanic waters off the continental shelf in the Celtic Sea (Berrow *et al.*, 2010; Rogan *et al.,* 2018). Their distribution is more clustered inshore off the northwest and southeast coasts of Ireland with most records being within 11km of the coast (DAGH, 2009). They are known to seasonally migrate to coastal waters in late spring to summer around the entire Irish coast, with higher relative abundances recorded off the southwest and southeast coasts (Berrow *et al.*, 2010). The dolphins are listed as a species of Least Concern on the IUCN Red List (Kiszka and Braulik, 2018). Risso's dolphins primarily feed on cephalopods, including squid, octopus, and cuttlefish (Clarke,

1996). Young calves have been sighted within Irish waters, with numbers peaking between March and June (Wall *et al.*, 2013; IWDG, 2018).

### 6.3.5 Minke whale

Minke whales are the most abundant baleen whale species within Irish waters and occur throughout the coast of Ireland (Berrow *et al*., 2010; Wall *et al*., 2013; NPWS, 2019). Usually encountered singly or in small groups, they use both coastal and offshore waters around southern Ireland (Healy *et al.,* 2013), and can be seen off the southern Irish coast through autumn and early winter (Berrow *et* al., 2010). Seasonal inshore movement of whales along the southwest coast was observed in summer (Rogan *et al*., 2018) and autumn (Wall *et al.*, 2013), where foraging activity on concentrations of pelagic schooling fish is often reported (Wall *et al.,* 2013). There is currently no evidence of minke whales calving in Irish waters (Wall *et al.*, 2013). The minke whale is currently listed as a species of Least Concern on the IUCN Red List (Cooke *et al.*, 2018). They do not tend to approach large vessels but can be quite inquisitive and may approach slow moving or static vessels (IWDG, 2022a).

### 6.3.6 Fin whale

Fin whales are the second-largest animal in the world after the blue whale (*Balaenoptera musculus*) and the largest baleen whale likely to be present close to shore off Ireland. In Irish waters, nearshore sightings cluster have been recorded to the south and southwest of the country, with peaks in the number of animals in the autumn and early winter (Berrow *et al*., 2010; DAGH, 2009) but are also well-represented off the shelf edge in deeper waters (Wall *et al*., 2013). Photo-identification studies indicate a significant degree of site fidelity by fin whales using these foraging grounds (Whooley *et al*., 2011).Fin whales are typically encountered as individuals or in small groups of animals (two to three) but during autumn and winter months have been seen to gather in feeding aggregations of up to 10 or 12 animals. Wall *et al*., (2013) found fin whale abundance in the vicinity of Cork Harbour coincides with the presence of pelagic schooling fish.

### 6.3.7 Humpback whale

At least 92 individual humpback whales (*Megaptera novaeangliae*) have been recorded in Irish waters up to 2019, often returning to the same areas and have been identified with photo-identification with some individuals being recorded for over three decades (IWDG, 2024c). Sightings of humpback whales are becoming more frequent in the Celtic Sea particularly between December and March (IWDG, 2022). Their distribution in the Celtic Sea is likely related to prey hot spots, where they feed on small pelagic fish such as sprat and herring (Volkenandt *et al.*, 2015). Fin and humpback whales are migratory species that travel from mating and calving grounds to nutrient-rich feeding grounds at high latitudes (Corkeron and Connor, 1999; Edwards *et al.*, 2015; Kennedy *et al.,* 2014).

## 6.4 Marine turtles

Leatherback turtles have been frequently recorded off Cork Harbour, with records throughout the year but most between July and September. Loggerhead turtles have also been recorded in the area but these occurrences are very rare (King and Berrow 2009).No marine turtles were sighted off the south coast of Ireland during the ObSERVE surveys (Rogan et al., 2018). There was no leatherback

turtle record made in the last twelve months (between April 2023 and April 2024) according to the IWDG sightings app (IWDG, 2024. Two sightings were made near Rocky Bay, Co. Cork in 2000 and off Ballybrannigan Strand in 2015 (NBDC, 2024).

## 6.5 Otters

No site specific surveys of otters are available but Eurasian otters are known to be widespread around Cork Harbour, although in lower densities than other parts of Ireland. The east side of Cork Harbour has been surveyed extensively and shown to be good habitat for otters (Smiddy, 1993). Otters are also common in nearby Cork city (Walsh, 2018). It is therefore likely that otters occur adjacent to the site. While data on Eurasian otter hearing is lacking, a study by Ghoul and Reichmuth (2014) demonstrated that sea otters (*Enhydra lutris*) show significantly reduced hearing underwater when compared to pinnipeds, suggesting that otter hearing is primarily adapted for airborne sounds. In-air hearing ranges for Eurasian otters is thought to between 0.2 and 32 kHz (Voight *et al.*, 2019) meaning they would hear in the low frequency range but are less sensitive than other marine mammals. Otters would need to be in the marine waters to be exposed to noise from dredging activity.

## 6.6 Pinnipeds

Grey seals are the most frequently observed marine mammal species at the dredging site followed by harbour porpoise and common dolphin at the disposal site. No breeding or moulting sites for grey or harbour seals occur in Cork Harbour. The APEM MMR (2022) listed three common grey seal haul-outs around the Licence Application Area, these are situated on the south of Haulbowline island itself, and on Rocky Island but no known harbour seal haul-out sites have been recorded within Cork Harbour.

Aerial surveys of the Celtic Sea (Morris and Duck, 2019) show that some grey seal sightings were made outside Cork Harbour, e.g., 2017/18 sightings within South-west Region Area 1, while more grey seals and harbour seals were sighted on the southwest coast of the same survey region compared to sea area near Cork Harbour. This aligns with abundance estimates by Russell *et al.* (2017) generated from count and telemetry data. Slight increases in the number of harbour seals counted along the southwest Irish coast were identified between 2003 to 2017/18, and the increases in grey seal numbers over this time period were even more prominent (Morris and Duck, 2019). Telemetry data and habitat preference modelling indicate both species occur in low densities within the Works area (Carter *et al.,* 2022).

Three sightings of grey seals were made in close proximity to the Works area in 2018 and nine in 2020 (APEM, 2022**Error! Reference source not found.**).There were 156 sightings of grey seals in proximity to the spoil site (Table 3). The closest known breeding site for grey seals is within the Roaringwater Bay and Island SAC (for which the grey seal is qualifying feature (Ó Cadhla *et al.,* 2013)), which is 90 km from the Works area (Table 4).

In comparison, harbour seals are much less frequently recorded within Cork Harbour and the disposal site. Two sightings of harbour seal were made in close proximity to the Works area 2017 (APEM 2022**Error! Reference source not found.**). No harbour seal sightings have been recorded in proximity to the spoil site (**Error! Reference source not found.**). The closest known breeding site for harbour

seals is within the Slaney River Valley SAC (for which the harbour seal is listed as qualifying interest (NPWS, 2013)), which is 166 km from the Works area (Table 4).

## 6.7 Abundances within the Works area

The Basin is not regularly visited by marine mammals. The outer harbour area (20 km) is home to a wide variety of marine mammals, with the highest occurring being the harbour porpoise common dolphin, grey seal, as well as the harbour seal. Outside the harbour, in the location of the spoil grounds outside Roches Point, larger species occur such as the minke, fin and humpback whales.

All of these species have been frequently recorded along the eastern and southern coastline of Ireland. All marine mammals should be considered during the dredging activities in Haulbowline, with the most common being pinnipeds (grey seals and harbour seals), harbour porpoise and possibly, bottlenose dolphin. Marine mammals have been sighted during past dredging campaigns in nearby Cork harbour. In the most recent campaign (O'Dwyer, 2017), 32 sightings were recorded over 36 days from 25 September 2017 to 30 October 2017 Grey seal and harbour porpoise were recorded 15 and 14 times respectively, along with two records of common dolphin and one minke whale. However, only one marine mammal, a grey seal, was recorded whilst dredging was underway. The remaining were sighted at dredging and spoil sites, or during transit (O'Dwyer, 2017).

A previous desktop study by APEM Ltd., as part of the Haulbowline Naval Base Marine Mammal Risk Assessment (2022), used sightings from the National Biodiversity Data Centre (NBDC). NBDC combines marine mammal sightings from a variety of databases (including the Northern Ireland Mammal database, IWDG Casual Cetacean Sightings database and IWDG Cetacean Standings database), into 10 km grid squares. Highest and subsequent range of abundances of marine mammal sightings within Cork Harbour and occurring year are outlined in **Table 2**. Marine mammals sightings in the location of the spoil site are shown in

Table 3. Sightings numbers are higher in the spoil site than in Cork Harbour, highlighting the avoidance of the harbour by marine mammals. However, it is acknowledged that absence of record does not provide conclusive evidence that marine mammals are absent from an area.

**Table 2. Record data of marine mammals sightings within Licence Application Area taken from National Biodiversity Data Centre (NBDC), areas W76 and W86 (NBDC, 2024)**

| Species | Count | Year |
|---|---|---|
| Harbour porpoise (*Phocoena phocoena*) | 17/8 | 2015/2018 |
| Common dolphin (*tursiops truncatus*) | 1/6 | 2018/2020 |
| Bottlenose dolphin (*Delphinus delphis*) | 1/17 | 2006/2020 |
| Risso's dolphin (*Grampus griseus*) | 1 | 2002 |
| Minke whale (*Balaenoptera acturostrata*) | 1 | 2001 |
| Grey seal (*Halichoerus grypus*) | 3/9 | 2018/2020 |
| Harbour seal (*Phoca vitulina*) | 2 | 2017 |

**Table 3. Record data of marine mammals sightings near the disposal site; taken from Biodiversity Maps, area W85 (NBDC, 2024)**

| Species | Count | Year |
|---|---|---|
| Harbour porpoise (*Phocoena phocoena*) | 32 | 2019 |
| Common dolphin (*tursiops truncatus*) | 21 | 2020 |
| Bottlenose dolphin (*Delphinus delphis*) | 50 | 2020 |
| Risso's dolphin (*Grampus griseus*) | 1 | 2012 |
| Minke whale (*Balaenoptera acturostrata*) | 10 | 2017 |
| Grey seal (*Halichoerus grypus*) | 156 | 2012 |
| Fin Whale (*Balaenoptera physalus*) | 6 | 2016 |
| Humpback whale (*Megaptera novaeangliae*) | 3/1/4 | 2016/2017/2020 |

## 6.8 Designated Sites

Cork Harbour is an important ecological site with two designated Natura 2000 sites covering large areas within the ZoI: Great Island Channel SAC and Cork Harbour SPA (Special Protected Areas). These designated sites cover a range of habitats and species that require protection, although, marine mammals are not qualifying interests and are therefore not part of the consideration of this assessment.

Marine mammals are highly mobile and tend to range outside the sites designated to protect them. There are three SAC with marine mammal as qualifying interests along the south coast of Ireland possibly relevant to these Works (Table 4). However, as these sites are not within the ZoI for the Works it is extremely unlikely that any disturbance associated with dredging or disposal of soil would lead to any significant effects to the sites Conservation Objectives (CO) and thus will not be taken forward to scope of impacts for this assessment.

**Table 4. SACs which list marine mammals as a qualifying feature within potential foraging range of Cork Harbour (Carter *et al.*, 2022)**

| Site | Closest Distance to Loading or Dump Site (km) | Qualifying Features |
|---|---|---|
| Roaringwater Bay and Islands SAC (IEOO0101) | 90 | [1364] Grey Seal<br><br>[1351] Harbour porpoise |
| Saltee Islands SAC (IE000707) | 107 | [1364] Grey seal |
| Slaney River Valley SAC (IE000781) | 166 | [1365] Harbour seal |

## 6.9 Summary of baseline

No precise abundance estimates for marine mammals exposed to the Works are available but there are a large number of site-specific survey records and desk-based studies of similar reports utilised for Haulbowline and its neighbour Port of Cork Company (POCC) all within the immediate vicinity of Cork Harbour basin (APEM, 2022; APEM 2023; IWDG, 2022a; IWDG, 2024a; Russel and Levesque, 2014; O'Dwyer, 2017;). Marine mammal sightings within the harbour itself are generally low predominately due to the large presence of anthropogenic activity in and out of the harbour. Pinnipeds are the most frequently recorded animals within the harbour are low, but site-specific counts are available at breeding and moulting sites outside of Cork Harbour (Table 4). Cetaceans have been sighted in small numbers within the harbour (**Error! Reference source not found.**) and in larger numbers offshore at the disposal site but presence still appears to be low (up to 50 individuals for any one species) (**Error! Reference source not found.**). Otters are likely to be within the Works area due to preferred habitat presence, however, there are no previous sightings during past dredging campaigns and site-specific desk-based studies. Any disturbance to active holts is unlikely as these would be on land away from dredging activity. Marine turtles are extremely rare with very few past sightings.

Considering Annex IV and other protected species' sightings, distribution and density within the area of the Works and nearby, the species taken through to the risk assessment are harbour porpoise, bottlenose dolphin, common dolphin, minke whale, grey seal, and harbour seal. Eurasian otter, Risso's dolphin, fin whale, humpback whale and leatherback turtle have been excluded due to their infrequent occurrence and (where data exist) their relatively low density and abundance within the Works area and the wider region. Nonetheless, any proposed mitigation measures for the species assessed will also be appropriate and / or relevant to the species not taken forward in this assessment.

# 7 Risk Assessment

This risk assessment will assess the risk to Annex IV species and other protected species outlined in Section **Error! Reference source not found.** during the Works, with the intention of addressing two key questions:

- Is the activity likely to result in death, injury or disturbance of individuals?
- Is mitigation required?

## 7.1 Introduction

NPWS (2014) provides guidance on mitigating the impact of sound sources on marine mammals, including from dredging activity. Dredging is defined as "the excavation of sand, gravel, loose rock and other material from the seabed". The concern for dredge activities is due to the potential of the operation to produce noise sources up to 190 dB re 1 µPa and at frequencies which can overlap with some marine mammal hearing and therefore has the potential to impact and disturb these species (NPWS, 2014). The guidance requests that sound from the attendant vessels also to be considered but provide no detail on the actual dumping of dredged material. This report considers dredging to include both the excavation and dumping of material as the same operation. Once dredging has commenced, following the effective visual monitoring by a qualified Marine Mammal Observer (MMO), the operation should be able to continue if dredging and / or dumping or either activity is underway. Once dredging is underway "there is no need to halt operations at night time or if weather conditions deteriorate" unless there is a break in sound output from the TSHD of >30 minutes (NPWS, 2014). No such guidelines exist for otters or marine turtles.

The ecological effects of dumping dredge material on marine mammals are not well studied. Widdows *et al.* (2007) carried out an assessment of the likely effects of annual maintenance dredging on the Tamar Estuary, southwest England as it is a SAC. The study concluded that there was no evidence of ecological changes related to the dredging activity in the Tamar Estuary and any significant changes to fish catches, and the number of over-wintering ducks appeared to be related to large scale climatic events rather than anthropogenic factors within the Tamar Estuary. They did not consider the effects on marine mammals as they did not occur in the estuary. Messiaeh *et al.* (1991) considered the greatest impact of dumping on marine fish and mammals in continental shelf waters of eastern Canada was the re-suspension of contaminants that had become fixed in the sediment. There are no studies on the effects of dredging and disposal at sea on otter and marine turtles.

During the dredging and disposal campaigns to be conducted for the proposed Works there is potential for Annex IV species and other protected species (i.e., pinnipeds) to be affected. The potential impact pathways are:

- Underwater noise.
- Vessel collision.
- Changes in water quality.
- Pollution events.

### 7.1.1 Marine mammals and sound

#### *7.1.1.1 Potential effects, functional hearing groups and auditory weighting*

It is widely documented that marine mammals are sensitive to underwater noise (e.g. Hildebrand, 2009; Nowacek *et al*., 2007; OSPAR 2009; Richardson *et al*., 1995; Southall *et al*., 2019; Southall *et al*., 2021), with a wealth of evidence that many anthropogenic sound sources, such as vessels and related construction activity (Culloch *et al*., 2016; Dunlop, 2016; Pirotta *et al.,* 2012; Wisniewska *et al*., 2018), impact pile driving (e.g. Brandt *et al*., 2011; Graham *et al.,* 2019), seismic surveys (Pirotta *et al*., 2014; Stone *et al*., 2017) and acoustic deterrent devices (ADDs) (e.g. Basran *et al*., 2020; Schaffeld *et al.,* 2019) do have impacts on marine mammals. Indirect impacts may also occur through direct impacts to prey species (e.g., Sivle *et al.,* 2021). These impacts have varying degrees of observed and / or predicted severity, ranging from changes in behaviour and masking (affecting communication and listening space, and / or locating prey; (Basran *et al.,* 2020; Dunlop, 2016; Erbe *et al.,* 2016; Heiler *et al.,* 2016; Pine *et al.,* 2019; Pirotta *et al*., 2012; Wisniewska *et al.,* 2018)), to displacement and disturbance (e.g. Brandt *et al.,* 2011; Culloch *et al.,* 2016; Graham *et al.,* 2019; Pirotta *et al*., 2014; Stone *et al.,* 2017) to injury and even mortality (e.g. Reichmuth *et al*., 2019; Schaffeld *et al*., 2019). The severity of these potential impacts will depend, in part, on the hearing range of the species affected. These are divided into generalised hearing ranges across broad species categories, based on various data sources, such as captive studies (e.g., harbour porpoises) and anatomy-based predictions (NMFS, 2018; **Table 5**).

**Table 5. Generalised hearing ranges for species groups (adapted from NMFS, 2018 and Southall *et al*., 2019)**

| Species Group | Species examples | Generalised hearing ranges (kHz) | Estimated region of peak sensitivity (kHz) |
|---|---|---|---|
| Balaenoptera | Minke whale | 0.007 – 35 | 0.2 – 19 |
| Dephinidae | Bottlenose dolphin, common dolphin | 0.15 – 160 | 8.8 – 110 |
| Phocoenidae | Harbour porpoise | 0.275 – 160 | 12 – 140 |
| Phocids (in water) | Harbour seal, grey seal | 0.05 – 86 | 1.9 – 30 |

To assess impacts of underwater noise, marine mammal species are separated into functional hearing groups, which reflect the broad differences in hearing capabilities among the taxa (e.g., Southall *et al.,* 2019). The classifications by Southall *et al*. (2019) have used the most recent data on marine mammal hearing; it is considered current best practice and supersedes previous works (i.e., Southall *et al*. (2007), which has been used in the DAHG (2014) guidance). There are five functional hearing groups, with the harbour porpoise hearing group categorised as 'very high frequency (VHF)', bottlenose dolphin and common dolphin as 'high frequency (HF)', minke whale as 'low frequency (LF)' and both seal (phocid) species covered by two groups (phocids in air and phocids in water) (Table 6). As the in-air thresholds for seals are not relevant to underwater noise assessments, these are not presented here. Southall *et al.* (2019) also applied weighting functions, which account for the frequency-dependent effects of noise, to each of the different functional hearing groups (see Southall *et al.,* 2019 for more details on how weightings were derived).

#### *7.1.1.2 Sound sources, exposure criteria, and temporary and permanent threshold shifts (TTS / PTS) in hearing*

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

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

Consequently, the criteria used by Southall *et al*. (2019) for TTS and PTS have different thresholds (see Table 6). The exposure metrics used by Southall *et al*. (2019) are:

- frequency weighted Sound Exposure Level (SEL), to the reference value of 1 µPa2-s; and
- unweighted peak SPL, to the reference value of 1 µPa,

where the different exposure metrics are required to account for different aspects of exposure level and duration.

SEL is a measure of sound energy over multiple exposures and exposures accumulated over time and SPL is a measure of absolute exposure. In relation to the TTS and PTS thresholds, for impulsive sound sources, both metrics are used, and for non-impulsive sound sources only the SEL exposure metric is used. The rationale being, for non-impulsive sounds, given the very high peak SPL values required to induce TTS or PTS, the SEL criterion would be met before an exposure exceeding the peak SPL criteria (which are not presented by Southall *et al.* (2019) for this reason).

With respect to undertaking a quantitative assessment, should one be required, the SEL values would be calculated over the duration of a discrete noise exposure and would be cumulative over multiple repeated noise exposures occurring in relatively quick succession, and would be weighted for the relevant functional hearing group. For example, SEL could be calculated for impulsive sound sources; this could be multiple hammer strikes during installation of a monopile or several air guns firing on a transect line during seismic surveys, and for non-impulsive sound sources, this could be operational noise of vessels.

In terms of instantaneous onset of TTS or PTS, the peak SPL exposure metric is used and as explained above, is applied to impulsive sound sources only. Loud instantaneous noises, particularly if the animals are close to the source, such as a high-order detonation when clearing unexploded ordnance, air guns firing on a seismic survey, or hammer strikes during pile driving, all have the potential to induce TTS or PTS instantaneously.

The VHF functional hearing group is the most sensitive to both impulsive and non-impulsive sound sources. We can conclude this because all the exposure criteria for this group are lower than those of the other functional hearing groups for the respective sound source and exposure criteria (Table 6). In the context of the proposed Works, the only VHF cetacean species in this region is the harbour porpoise, which is considered abundant in inshore waters in the Celtic Sea (Ó Cadhla *et al*., 2004; Berrow *et al*., 2010; Wall *et al.,* 2013; Rogan *et al*., 2018). Typically, a risk assessment would consider the most acoustically sensitive species first and, if it is concluded that the risk of TTS and PTS to VHF species is negligible, then the risk to less acoustically sensitive functional hearing groups would be reduced still.

**Table 6. Noise exposure criteria from Southall *et al.* (2019) for temporary threshold shift (TTS) and permanent threshold shift (PTS) in hearing by the respective functional groups**

| Functional hearing group | Species examples | Impulsive | | | | Non-impulsive | |
|---|---|---|---|---|---|---|---|
| | | TTS | | PTS | | TTS | PTS |
| | | SEL | Peak SPL | SEL | Peak SPL | SEL | SEL |
| Low Frequency (LF) | Minke whale | 168 | 213 | 183 | 219 | 179 | 199 |
| High Frequency (HF) | Bottlenose dolphin, common dolphin | 170 | 224 | 185 | 230 | 178 | 198 |
| Very High Frequency (VHF) | Harbour porpoise | 140 | 196 | 155 | 202 | 153 | 173 |
| Phocids in water (PCW) | Harbour seal, grey seal | 170 | 212 | 185 | 218 | 181 | 201 |

### 7.1.2 Behavioural responses to underwater noise

Behavioural responses to underwater noise are challenging to assess for a number of reasons (Gomez *et al*., 2016; Southall *et al.,* 2021). Changes in behaviour can be driven by the condition of individuals, the age-class of individuals, the context (e.g., transiting an area vs. present at an important foraging ground). As such, deriving a threshold for disturbance has proven far more challenging than for TTS and PTS onset (Gomez *et al.,* 2016; Southall *et al*., 2021). There is a growing body of literature on experimental and observational studies which has expanded our understanding of behavioural responses to discrete underwater noise events, such as vessel presence (e.g., Nowacek *et al.,* 2001; Hastie *et al*., 2003; Lusseau, 2003; Benhemma-Le Gall *et al*., 2022; Pirotta *et al*., 2012; Culloch *et al.,* 2016), across situations and contexts, for individuals and groups. However, these studies only serve to highlight that attempts to derive thresholds for single noise exposure parameters and behavioural responses across broad taxonomic and sound categories is unlikely to be appropriate and can lead to significant errors in predicting impacts (Southall *et al*., 2021).

There are more studies on the impacts of underwater noise on harbour porpoise (e.g., Brandt *et al.* 2011, Carstensen *et al.,* 2006, Dyndo *et al*. 2015, Lucke *et al.,* 2009, Schaffeld *et al*. 2019; Tougaard *et*

*al.,* 2015; Wisniewska *et al.,* 2016) than on other marine mammal species, in part because they are the most acoustically sensitive, and because they are the most ubiquitous species of marine mammal in UK and Irish waters. In a recent study, Benhemma-Le Gall *et al*. (2021) investigated the broad-scale responses of harbour porpoises to construction works at an offshore windfarm site and found that porpoise displacement (assessed using passive acoustic monitoring) was observed up to 12 km from pile-driving activities and up to 4 km from construction vessels. A study in Danish waters investigated the high intensity pulses from an air gun on a small sample size (n = 5) of harbour porpoises that were captured and tagged with high resolution location and dive loggers (van Beest *et al.,* 2018). They used a single 10 inch$^3$ underwater air gun producing high intensity noise pulses (2-3 second intervals) for one minute, at ranges of 420 to 690 m, with noise level estimates of 135-147 dB re 1µPa2-s (SEL). They reported noise-induced movements (directly away from the sound source and / or shorter and shallower dives than usual) for three of the five individuals, with the effects lasting less than eight hours. There was no quantifiable behavioural response for the other two individuals. These examples, and particularly the latter study by van Beest *et al*. (2018), illustrate the challenges in the experimental design of *in situ* studies, obtaining these data, analysing them (e.g., accounting for extrinsic and confounding parameters, spatial and temporal autocorrelation) and making inferences on behaviour based on the context of the situation.

In areas of repeated exposure to anthropogenic noise, marine mammals may become habituated with a decline in avoidance responses and thus become less sensitive to noise and disturbance (Richardson *et al*., 1995). Thus, dredging appears to have less effect on marine mammals than moving sound sources, although, avoidance behaviour of whales exposed to high levels of activity have been documented. Documented reactions have only occurred when sounds are recorded well above ambient levels. Sini *et al.* (2005) observed that bottlenose dolphins resident in the Moray Firth exhibited a positive reaction to larger vessels and some evidence of habituation. An exposure level of 110-120 dB from vessel noise showed no observable effect on bottlenose dolphins (Buckstaff, 2004) and minor changes to orientation in minke whales (Palka and Hammond, 2001). Seals show considerable tolerance to vessel activity and anthropogenic structures within the marine environment, often observed hauling out on man-made coastal structures and are the highest observed marine mammal within the Haulbowline Basin compared to near the disposal site.

Pirotta *et al.* (2013) carried out a study on the potential effects of dredging on bottlenose dolphins during and after maintenance of Aberdeen Harbour off northeast Scotland. The resident group of bottlenose dolphins demonstrated a clear avoidance response to dredging at a foraging area despite it being a highly urbanised site, resulting in dolphins spending less time in the harbour as the intensity of dredging increased. Group size was not affected suggesting that all individuals were affected equally and were likely to leave the area, however, the mechanisms leading to displacement was not clear as the indirect impacts such as prey abundance within the location were not monitored. As pinnipeds have a lower frequency hearing range, they are more at risk than other marine mammal species. However, studies have shown little behavioural reactions to dredging or construction vessel traffic from a range of pinniped species (Todd *et al*., 2015; Anderwald *et al.,* 2013).

## 7.2 Underwater noise

As discussed in Section 7.1.1, it is widely documented that marine mammals are sensitive to underwater noise, with their sensitivity being dependent on the hearing ability of the species. There is a substantial quantity of literature describing the potential effects of sound on marine mammals; this is summarised in e.g. Southall *et al*. (2007), OSPAR (2009) and Southall *et al*. (2019). The main types of potential effect include fatal effects, caused by significant levels of noise in close proximity, hearing impairment, behavioural effects, such as avoidance, displacement and changes in travelling routes, and masking effects.

The presence of a dredger in the harbour will lead to increased vessel traffic and associated noise. Received levels of dredging noise by marine mammals can exceed ambient levels to considerable distances depending on the type of dredger used (Richardson *et al.,* 1995). Hopper dredges produced broadband sounds between 0.02 and 1 kHz and the highest level occurred during loading. Because of rapid attenuation of low frequencies in shallow water dredge noise is normally undetectable underwater at ranges beyond 20 – 25 km (Richardson *et al*., 1995). Soft silt dredging is generally at the lower level of sound output as opposed to gravel dredging; however, as dredging often occurs over a period of days or weeks it has the potential to introduce continuous anthropogenic sound at levels that may impact marine mammal individuals and / or local populations.

McKeown (2016) carried out underwater noise assessments during a 2016 maintenance dredging campaign in Dublin Port. It highlighted that dredging operations had a higher frequency output in comparison to the dumping operation and concluded that sound levels for dredging operations at ranges over 213m were below the disturbance threshold for harbour porpoises (140 dB re 1 µPa SPLRMS) and below the NOAA general behavioural threshold for marine mammals of 160 dB re 1 µPA SPLRMS. Therefore, McKeown (2016) suggests an exclusion buffer zone of 100m from dredging and disposal activities is sufficient, beyond which marine mammals are unlikely to detect the activity over ambient noise.

The potential for marine mammals to be present within the basin during dredging is low, however, the most abundant species are seals which have been noted in and around the dredging area. However, as indicated above, the sound level produced by a backhoe dredger is well below the TTS and PTS levels given in Table 6. Any animals outside of the site would receive even lower levels than this.

The sound pressure levels of the dredging, vessels and disposal are considered highly unlikely to result in mortality of any cetacean or seal and the operating dredger frequencies are at the lower reported auditory range of cetaceans. The likelihood of seals being present in the basin is low, especially considering the existing traffic and noise level; therefore, the risk of auditory injury and disturbance effects are considered to be **low**.

Behavioural responses by cetaceans and seals in the area would be limited to avoidance or habituation over the 12-week dredging phase per campaign. Consequently, these effects are considered to be low risk and in the outer area would be of even lower risk as the sound will likely remain in the basin itself due to the contained area and narrow passage.

During disposal operations the vessel will be moving at a slow speed (ca. 1 knot), and there will be a short timeframe involved (ca. 12 weeks). Also, the dredging pumps will be turned off; therefore, the risks of disturbance to marine mammals during the disposal operations are **low**. Resident marine mammals will be habituated to local noise from ship traffic and would likely remain in or temporarily vacate the area surrounding the site but are unlikely to enter or stay in the site.

Provision of MMOs during dredging activities will provide opportunities to record sightings of marine mammal during dredging, on transit and while disposing at the spoil ground. While sound exposure levels from such operations are below that able to cause injury to a marine mammal, the noise generated by dredging and from the physical presence of the dredger, have the potential to cause low level disturbance, masking or behavioural impacts.

The hopper once filled with dredged material will transit to the disposal site. This increase in vessel noise relative to the daily traffic accessing Cork Harbour is very low and is unlikely to cause any significant disturbance as other vessels regularly use this area.

The presence of an additional vessel and the associated noise produced, is very unlikely to have any significant impact on marine mammals, though it may lead to short term displacement of seals from the dump site.

Localised disturbance to marine mammals by the Works may occur during operations, but current evidence from recent dredging operations suggests no disturbance occurs and indeed dredging may provide increased foraging opportunities for grey seals. Given the known spatial and / or temporal activity patterns of species in the area, and the fact that this is an area of high vessel traffic, there will be minimal to no displacement of marine mammals from key functional areas during dredging and disposal works. The main project site is in an enclosed area, surrounded by an area of high traffic and relatively high ambient noise.

The dumping of material at Roches Point increases sound pressure associated with soil dispersal that is above that of ambient noise levels in the area for short durations but is restricted to a very small area (<100 m).

### 7.2.1 Conclusion

The impact assessment concludes there is no risk of instantaneous or cumulative TTS or PTS to Annex IV species or other protected species during the proposed Works; therefore, this effect is assessed as **Negliglible**. The proposed Works **are considered unlikely to present a risk** to Annex IV species and / or other protected species and do not require specific mitigation.

The effect of behavioural responses from Annex IV and / or other protected species as a result of the proposed Works is assessed as **low,** nothing any such behavioural responses are likely to be localised, short-term and reversible**.** The proposed Works **are considered unlikely to present a risk** to Annex IV species and other protected species following the application of mitigation measures described in Section 8.

## 7.3 Vessel collision

Collisions between marine mammals and vessels are widely reported, with one of the key parameters influencing this being vessel speed (NOAA, 2008). Slow speeds and predictable movement are known to be key factors in minimising collision risk between vessels and marine mammals (Nowacek *et al.,* 2001; Lusseau, 2003; 2006). When considering slow speeds and the predictable movement, animals have the opportunity to react to the vessel. This has been demonstrated with similarly slow vessels as used in dredging (Todd *et al.,* 2015). The marine mammal species potentially present in the vicinity of the project site are grey seal and harbour seal, harbour porpoise and bottlenose dolphin. These species are agile and have fast swimming speeds which could help them evade collisions with vessels and vessel propellers.

Despite being fast and agile, grey seals can collide with anthropogenic structures such as fishing gear and vessels (Scottish Government, 2013). Reduced perception levels of a collision threat through distraction, whilst undertaking other activities such as foraging and social interactions, are possible reasons for collisions (Wilson *et al*., 2007) and seals can also be very curious of new foreign objects placed in their environment which could also increase the risk of collision. Seals are relatively robust to potential strikes as they have a thick sub-dermal layer of blubber which can defend their vital organs from the worst of any blows (Wilson *et al*., 2007). In general, incidents of mortality or injury of grey seals caused by vessels remain a very rare occurrence in UK waters, although numerous instances are expected to remain unreported (Thompson *et al*., 2013).

To evade a strike, marine mammals tend to require acoustic information to be able to determine in which direction and at what speed a vessel is moving. Where there is erratic movement of watercraft (e.g., private personal watercraft) the risk of collision is considerably greater than that associated with other watercraft (e.g., a dredger) travelling on a direct course. The vessels involved in the Works are anticipated to transit relatively slowly and would travel in a direct course as far as possible minimising collision risk.

The risk of injury or mortality to marine mammals is considered **Negligible** as marine mammals in the immediate vicinity of the site are exposed to human activity on a daily basis and would be well habituated to vessel presence. The dump vessel is slow moving , meaning any animal in the area would have sufficient time to avoid any collisions and thus injury or mortality.

### 7.3.1 Conclusion

The potential effect of vessel collision is assessed to be **Negligible** and the risk of collision between vessels and Annex IV species and / or other protected species is assessed to be unlikely; therefore, no specific mitigation is required.

## 7.4 Change in water quality

The dredging activities within the Basin combined with the dumping of spoil material outside of the harbour, will result in disturbance of the substrata on the surface of the seabed through the generation of sediment plumes into the water column and may result in disturbance or displacement of certain mobile prey species which, in turn, may affect their availability for Annex IV species or other

protected species. Combined with the strong tidal currents and exposed nature of the area, the impact of the dumping on the spoil ground area will not have a significant long-term impact on the benthic environment and the communities that are found there, limiting further indirect impacts on marine mammal prey species.

As marine mammals often inhabit turbid and dark environments, increased turbidity from dredging is thought not to affect marine mammals significantly as they utilise senses other than sight when foraging, as well as being highly mobile and generalist feeders (Todd *et al*., 2015). Harbour porpoises, the most abundant cetacean species within the Works area, use echolocation to navigate and locate prey and thus would not be affected by increased turbidity. Even when increased turbidity has been shown to substantially reduce visual acuity in seals, which do not use sonar for prey detection, there is no evidence of reduced foraging efficiency (Todd *et al.,* 2015). These effects will, however, be short-term and highly localised and are expected to have minimal impact. Any sediments will be disposed in an appropriate licenced waste facility on land.

### 7.4.1 Conclusion

The potential effect of changes in water quality is assessed to be **Negligible** and the risk to Annex IV species and other protected species is unlikely; therefore, no specific mitigation is required.

## 7.5 Pollution events

Marine mammals can be affected by pollution events or marine litter that can lead to death or a reduced level of health or fitness (e.g., through reduced breeding or feeding success) in populations. Should any litter and pollutants be released in the marine or intertidal environments within the Works area, these would have the potential to result in injury or mortality to marine mammals. In order to ensure no adverse effects on marine mammals resulting from littering or pollution associated with the Works, all vessels undertaking survey works will adhere to (International Convention for the Prevention of Pollution from Ships) MARPOL requirements, which provide an international standard for the safe management and operation of ships for pollution prevention requiring a mandate of a Shipboard Marine Pollution Emergency Plan. This will involve adoption of routine measures and standard best practice in terms of waste management, auditing, pollution prevention measures and implementation of a dropped object protocol. Oil and fuel shall be stored securely in bunded containers. Chemicals will be stored securely, and good housekeeping practices will be adhered to always. With this best practice approach, there will be **Negligible** impact from the Works for litter and pollution to impact marine mammals.

All vessels will be complaint with the MARPOL and the Marine Pollution Contingency Plan (MPCP), which contain the necessary steps to initiate an external response for any oil-related discharges, or in the case of a maritime accident / collision that results in an oil spill. Published guidelines and best working practices will be adhered to, to ensure that the likelihood of accidental spills is extremely low. Additionally, the dredging activities align with the Water Framework Directive (WFD) objectives, and there is no anticipation of long-term deterioration in the designated water body. In the unlikely event of a spill, the volumes of potential contaminants released would likely be **Negligible** and would be rapidly gathered and disposed appropriately.

### 7.5.1 Conclusion

The potential effect of pollution events is assessed to be **Negligible**, and the risk to Annex IV and other protected species is assessed to be unlikely; therefore, no specific mitigation is required.

## 7.6 Summary of risk assessment

It is expected that marine mammals would habituate to vessels during dredging and dumping campaigns, and thus would resume to foraging in the affected areas once operations has ceased. However, given the volumes of material to be dumped and the long time scale of these planned operations, mitigation measures to reduce and avoid the potential impact of dredging and dumping on marine mammals are recommended.

Annex IV and other protected species have been recorded within Cork Harbour, in which Haulbowline Naval Base is located, all year round with harbour porpoise, bottlenose dolphin, minke whale, grey and harbour seal being the species most commonly recorded within the vicinity of the Works area. The assessment has followed a precautionary approach when assessing impacts of dredging and dumping campaigns on these most commonly recorded species, and has concluded that the proposed works are unlikely to present a risk to Annex IV and / or other protected species.

Assessment of the potential for impacts from increased anthropogenic noise during dredging and disposal campaigns concluded that the effect of instantaneous and cumulative TTS and PTS (auditory injury) in hearing to harbour porpoise, minke whale, grey and harbour seal from these activities was **Negligible.** The assessment of behavioural responses found a **low** potential effect; however, any behavioural responses from the dredging campaigns is likely to be localised, short-term, intermittent and reversible. Utilising previous site-specific survey observations from the Works area and its vicinity, it has been estimated the number of potential marine mammals to be disturbed at both the dredging and dumping sites to be minimal, with the current populations habituated to the large presence of vessel activity and noise. Therefore, the impact of sound produced by operation of equipment used during the dredging and dumping campaign is unlikely to be detrimental to the maintenance of the populations of the species concerned at an FCS in their natural range. In conclusion, mitigation measures required are limited and a derogation licence is not required for the dredging campaigns assessed as part of the proposed Works. The mitigation measures put forth by DAHG guidelines (2014), would minimise the potential impacts on marine mammals and allow animals to move away from the area of dredging operations reducing the risk of impact of the Works to **Negligible**.

Assessment of the potential risk of collision with vessels, changes in water quality, and pollution events concluded that the effects were **Negligible** and risk of impact on Annex IV and other protected species was unlikely. In conclusion, mitigation measures are not required, nor is a derogation licence required for these assessed impacts.

# 8 Mitigation Measures

The risks to marine mammals and the potential impacts due to the Works are low and temporary. This is considered to be the case without Project-specific mitigation; however, it is recommended that best practice guidance outlined in 'Guidance to Manage the Risk to Marine Mammals from Man-Made Sound Sources in Irish Waters' (DAHG 2014) is applied to further reduce risk as far as possible. These measures include recommendations for the provision of a qualified and experienced MMO to monitor the works when underwater noise could be generated. Specific recommendations are provided in DAHG (2014) along with monitoring proformas. As the Basin is enclosed, the monitored zone would be contained within the Basin itself as it is unlikely that sound will propagate far beyond the narrow passage.

The following mitigation measures are proposed to minimise the potential impacts on marine mammals and to allow animals to move away from the area of dredging operations:

- All personnel will be appropriately trained about environmental issues prior to the start of the operation;
- All equipment will be in good condition to avoid spillage or discharge of oil, smoke and excessive noise;
- Refuelling will be carried out by competent and trained people away from any environmentally sensitive areas; the dredger to be moored up securely;
- An appropriate waste container will be placed to collect waste before the final disposal by the authorised company, and hazardous material storage will be identified, labelled, properly marked and fitted will spill containment systems;
- Excavators and barges will be reported immediately to the site agent/authorities;
- A dedicated MMO will conduct a 30-minute watch for marine mammals within 500m of the excavator before start-up. If a seal or cetacean is sighted to move outside the mitigation zone or 15 minutes have passed without the animal being sighted within the mitigation zone;
- A dedicated MMO will conduct a watch for marine mammals before disposal at sea. If a seal or cetacean is sighted within 50 m of the vessel once it has reached the dump site, disposal must be delayed until the animal(s) are observed to move outside this mitigation zone or the 15 minutes have passed without the animal(s) being sighted within the mitigation zone; and
- The excavator will be started at the lowest revs of the pump, with pump revs increasing over a 15-minute period to allow wildlife to move further away from away from the vessel before the pumps reach full power.

## 8.1 Other impacts

It is recognised that other similar activities may be ongoing in Cork Harbour, ca. 1 km from the project site, and that the programmes have the potential to overlap.

No dredging or supplementary dumping activities will occur from the Haulbowline site while maintenance dredging is underway in the Port of Cork. The Port of Cork's dredging program started in the second quarter of 2024 and is scheduled to end in the middle of the third quarter of 2024, with the anticipated maintenance campaigns roughly every three years.

Under the current programme no overlap is expected. Based on the considerations above; however, the conclusions of low risk for marine mammals it is not likely to be changed as a result of other projects in the area.

All other risks to Annex IV species and other protected species assessed in this report have been assessed as **Negligible.** It is therefore concluded that no specific mitigation is required in relation to vessel presence, changes in water quality or pollution events.

# 9 Conclusion

Previous dredging campaigns in the area and vicinity of Cork Harbour have provided a good understanding of the marine community potentially exposed to dredging and dumping and the likely effects.

Overall, a precautionary assessment of the impacts and risk to Annex IV species and other protected species from the proposed dredging of Haulbowline Naval Base concluded that there were no adverse effects to Annex IV species or other protected species, or their FCS for any of the activities associated with the Works. It is therefore concluded that:

- The potential for PTS and TTS from increased anthropogenic noise is **Negligible**
- The potential for behavioural response to increased anthropogenic noise is considered to be **Low**
- The potential for increased collision risk is considered **Negligible**
- The potential for indirect impacts relating to change in water quality is considered **Negligible**
- The potential for impacts relating to pollution events is considered **Negligible**

The assessment of effects to Annex IV species and other protected species from the dredging and dumping at sea has been assessed as **Negligible** in relation to the main impact pathway of underwater noise by the effect of instantaneous and cumulative TTS and PTS (auditory injury).

The assessment of behavioural responses found a **Low** potential effect; however, any behavioural responses from the dredging campaigns is likely to be localised, short-term, intermittent and reversible. It is recommended that best practice mitigation measures detailed in DAHG (2014) and NPWS Guidelines are applied to these dredging and dumping campaigns alongside MMO assistance (outlined in Section **8**) to enable the Works to be carried out would further reduce any risks to Annex IV species to **Negligible**.

Overall, a precautionary assessment of the impacts and risk to Annex IV species and other protected species from the dredging campaigns and disposal concluded that there were no adverse effects to Annex IV species or other protected species, or their FCS because of any of the Works intended.

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