MWP

REMEDIAL ENVIRONMENTAL IMPACT ASSESSMENT (rEIAR)

Ros an Mhíl Deep Water Quay

Chapter 8 Marine

Department of Agriculture, Food and the Marine

October 2025

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Project No.	Doc. No.	Rev.	Date	Prepared By	Checked By	Approved By	Acceptance Code / Status
24984	6002	A	28/10/2025	JP	WM/MT/JP	CF/MT	FINAL

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8. Marine

8.1 Introduction

This chapter considers the potential effects on the existing marine environment arising from the development. A full description of the development and the associated works elements are provided in **Volume II, Chapter 2** Project Description of this remedial Environmental Impact Assessment Report (rEIAR). The nature and probability of effects on the existing marine environment arising from the works completed to date have been assessed. The assessment comprises:

- A review of the existing receiving environment prior to commencement of works in 2023;
- Prediction and characterisation of likely effects;
- Evaluation of significance of effects;
- Review of mitigation measures for completed works, and
- Consideration of need for remedial mitigation measures.

8.2 Competency of Assessor

John Power is a senior marine ecologist and director of Emerald Marine Environmental Consultancy Ltd. with over 12 years' experience working in a variety of fields, in both public and private sectors. His core competencies are in the fields of commercial fisheries, fish and shellfish ecology, seabird ecology and marine mammal ecology.

John has extensive marine experience and has been responsible for the delivery of numerous cetacean and seabird surveys to NPWS, he has frequently been engaged in fisheries acoustic and trawl surveys with the Marine Institute and has managed the delivery of intertidal bird surveys to clients in the offshore wind industry. John has also contributed to marine chapters of numerous EIARs, produced many scientific technical reports and provided expert ecological opinion to An Bord Pleanála (now An Coimisiún Pleanála).

8.3 Methodology

8.3.1 Legislation and Best Practice Guidelines

The following section sets out the legislative context of the assessment in relation to marine ecology, and the relevant guidelines with further legislation used to inform the preparation and assessment of impacts from the development on marine ecology.

The assessment of likely significant effects upon marine ecology has been made with specific reference to the following identified relevant guidance:

- Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (Department of Arts, Heritage and the Gaeltacht (DAHG), 2014)
- Guidelines on the information to be contained in Environmental Impact Assessment Reports (Environmental Protection Agency (EPA), 2022)
- Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.3. (Chartered Institute of Ecology and Environmental Management (CIEEM), 2018)

- Guidelines for the assessment of dredge material for disposal in Irish water (Cronin, *et al*., 2006).
- Marine Evidence-based Sensitivity Assessment (MarESA) – Guidance Manual. Marine Life Information Network (MarLIN). (Tyler-Walters, *et al.*, 2018)
- Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects (Southall, *et al*., 2019)
- Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by American National Standards Institute (ANSI) Accredited Standards Committee S3/SC1 and registered with ANSI (Popper *et al*., 2014)

This chapter has been prepared in the context of the following European, National and Regional Plans and Policies;

- EU Marine Strategy Framework Directive - Directive 2008/56/EC of the European Parliament and of the Council of 17th June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive)
- EU Water Framework Directive - Directive 2000/60/EC of the European Parliament and of the Council of 23rd October 2000 establishing a framework for Community action in the field of water policy
- EU Habitats Directive - Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora
- EU Birds Directive - Directive 2009/147/EC of the European Parliament and of the Council of 30th November 2009 on the conservation of wild birds
- Wildlife Acts 1976 - 2023
- National Marine Planning Framework – Project Ireland 2040
- National Development Plan 2018 - 2027
- National Biodiversity Action Plan 2023 - 2030
- Galway County Development Plan 2022 - 2028
- Galway County Heritage and Biodiversity Plan 2024 – 2030

Marine Strategy Framework Directive (MSFD) (2008/56/EC)

The Marine Strategy Framework Directive (MSFD) (2008/56/EC) requires Member States to reach good environmental status (GES) in the marine environment by the year 2020 at the latest, by applying an ecosystem-based approach to the management of human activities, while enabling the sustainable use of the marine environment for present and future generations.

At the core of the MSFD is the determination, achievement, and maintenance of Good Environmental Status (GES) according to 11 qualitative condition descriptors which describe the state of the marine environment and anthropogenic pressure on the marine environment. Annex I the Directive sets out these eleven qualitative descriptors which describe what the environment will look like when GES has been achieved.

- **Descriptor 1:** Biodiversity is maintained
- **Descriptor 2:** Non-indigenous species do not adversely alter ecosystems
- **Descriptor 3:** Populations of commercial fish and shellfish species are healthy
- **Descriptor 4:** Food webs ensure long-term abundance and reproduction of species
- **Descriptor 5:** Eutrophication is reduced
- **Descriptor 6:** Sea floor integrity ensures the proper functioning of ecosystems
- **Descriptor 7:** Permanent alteration of hydrographical conditions does not adversely affect ecosystems
- **Descriptor 8:** Concentrations of contaminants give no pollution effects
- **Descriptor 9:** Contaminants in seafood are at safe levels
- **Descriptor 10:** Marine litter does not cause harm

- **Descriptor 11:** Introduction of energy (including underwater noise) does not adversely affect the ecosystem

Water Framework Directive (WFD) (2000/60/EC)

The Water Framework Directive (WFD) (2000/60/EC) establishes an integrated and coordinated framework for the sustainable management of water. Under the WFD[1], the island of Ireland has been divided into a number of River Basin Districts (RBD) in order to facilitate the effective implementation of the WFD objectives. The development site is located within the Irish River Basin District (IRBD) in Hydrometric Area No. 31.

The strategies and objectives of the WFD in Ireland have influenced a range of national legislation and regulations, since its inception in the year 2000.

The WFD (1st Cycle) was transposed into national legislation in 2003, with the aims to:

- Prevent deterioration of status for surface and groundwaters and the protection, enhancement and restoration of all water bodies;
- Achieve good ecological status and good chemical status for surface waters and good chemical and good quantitative status for groundwaters;
- Progressively reduce pollution of priority substances and phase-out of priority hazardous substances in surface waters and prevention and limitation of input of pollutants in groundwaters;
- Reverse any significant upward trend of pollutants in groundwaters; and
- Achieve standards and objectives set for protected areas in Community legislation.

The objective for each surface water and groundwater body is to prevent deterioration, maintain high and good status waters, restore waters to at least good status where necessary, and ensure that the requirements of associated protected areas are met, tying in with the goal of Good Environmental Status under the Marine Strategy Framework Directive.

Birds Directive (2009/147/EC) and Habitats Directive (92/43/EEC)

The Birds Directive (2009/147/EC) seeks to conserve all wild birds in the EU by setting out rules for their protection, management and control. The Directive covers birds, their eggs, nests and habitats. Member states must take action to maintain or restore the populations of endangered species to a level, which is in line with ecological, scientific and cultural requirements, while taking into account economic and recreational needs. The Birds Directive requires Member States to create special protected areas (SPAs) for the protection of threatened species and migratory birds, with conditions favourable to their survival, situated in the birds' natural area of distribution.

The Habitats Directive (92/43/EEC) The Habitats Directive contributes to ensuring biodiversity in the European Union by conserving natural habitats and wild fauna and flora species. Annex I and Annex II of the Habitats Directive list the types of habitats (Annex I) and species of flora and fauna (Annex II) require the designation of special areas of conservation (SACs). Under Annex IV of the Directive, Member States must establish a system of strict protection for listed species.

The Habitats Directive also sets up the 'Natura 2000' network, the largest ecological network in the world. Natura 2000 comprises special areas of conservation (SACs) designated by EU countries under this directive and special protection areas (SPAs) classified under the Birds Directive.

[1] Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy.

Wildlife Acts (1976 – 2023)

The Wildlife Act, 1976, is the principal national legislation providing for the protection of wildlife and the control of some activities that may adversely affect wildlife. The aims of the Wildlife Act, 1976, are to provide for the protection and conservation of wild fauna and flora, and to conserve a representative sample of important ecosystems.

The Wildlife (Amendment) Act 2010 broadened the scope of the Wildlife Acts to include aquatic species excluded from the 1976 Act, provided a mechanism to give statutory protection to natural heritage areas (NHAs), strengthened protection for SACs, and gave statutory underpinning to Ireland's commitments under the UN Convention on Biological Diversity (CBD).

The Wildlife (Amendment) Act 2023 put the National Biodiversity Action Plan on a statutory footing and to place a biodiversity duty on public bodies.

Currently all bird species, 23 other animal species or groups of species and 157 species of flora are afforded protected status under the Wildlife Acts.

Convention on Biological Diversity (CBD)

The Convention on Biological Diversity (CBD) sets out commitments for maintaining the world's ecosystems in parallel with economic development. The Convention establishes three main goals: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources. Ireland is a signatory to the CBD and as such undertook to promote the conservation and sustainable use of biological diversity.

Bonn Convention

The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or The Bonn Convention) aims to conserve terrestrial, marine and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale. The main pieces of legislation to ensure that the provisions of the Bonn convention are applied include the Birds Directive and the Habitats Directive.

Bern Convention

The European Community is a contracting party to the Convention on the conservation of European wildlife and natural habitats (known as the Bern Convention). The aim of the Bern Convention is to ensure the conservation of European wildlife and natural habitats by means of cooperation between member States. The Bern Convention co-ordinates the action of European States in adopting common standards and policies for the sustainable use of biological diversity, thus contributing to the improvement of the quality of life of Europeans and the promotion of sustainable development.

OSPAR Convention

The 1992 OSPAR Convention is the current instrument guiding international cooperation on the protection of the marine environment of the North-East Atlantic. It combined and up-dated the 1972 Oslo Convention on dumping waste at sea and the 1974 Paris Convention on land-based sources of marine pollution. With the adoption of Annex V in 1998, the convention embraced a more holistic responsibility for environmental protection in the region, including its biodiversity.

The OSPAR Commission identifies species and habitats in need of protection and has developed the OSPAR List of Threatened and/or Declining Species and Habitats.

8.3.2 Definition of Study Area

Following a desktop review and field survey, the study area was defined as the full extent of Cashla Bay from Cashla Point to Clynagh Bay encompassed by the 2km National Grids; L92F, L92K, L92L-N, and L92Q-T, and surrounding coastal waters encompassed by the 10km National Grid L91. This broad area of study was identified in recognition of the fact that marine species can be highly mobile. The study area also encompasses all known seal haul-out sites in the bay. The zone of impact of certain pressures can be extensive, for example, suspended sediments can be transported over extended distances due to tidal action, while underwater noise from construction projects can be above ambient noise levels several kilometres from the noise source.

The baseline environment prior to January 2023 was assessed following a comprehensive desk-based assessment and field survey program.

The development does not take place in any Natura 2000 site; however, several SACs and SPAs have been identified within 15km of the development, which could potentially be affected by the development, these are presented in **Table 8-1**. In recognition of the highly mobile nature of marine mammals, a further six SACs with marine mammals as Qualifying Interests (QIs) and within 50km of the development which could potentially be affected by the development, are presented in **Table 8-2**.

Table 8-1: Designated Sites within 15km of the Development

Site Name	Site Code	Distance to project area (km)	Qualifying Interests (* denotes a priority habitat)
Connemara Bog Complex SAC	2034	2.22	**Habitats** Coastal lagoons* Reefs Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or *Isoeto-Nanojuncetea* Natural dystrophic lakes and ponds Water courses of plain to montane levels with the *Ranunculion fluitantis* and Callitricho-Batrachion vegetation Northern Atlantic wet heaths with *Erica tetralix* European dry heaths Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) Blanket bogs (* if active bog) Transition mires and quaking bogs Depressions on peat substrates of the Rhynchosporion Alkaline fens Old sessile oak woods with Ilex and Blechnum in the British Isles **Species** Marsh Fritillary (*Euphydryas aurinia*) Salmon (*Salmo salar*)

Site Name	Site Code	Distance to project area (km)	Qualifying Interests (* denotes a priority habitat)
			Otter (*Lutra lutra*) Slender Naiad (*Najas flexilis*)
Kilkieran Bay and Islands SAC	2111	2.58	**Habitats** Mudflats and sandflats not covered by seawater at low tide Coastal lagoons* Large shallow inlets and bays Reefs Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) Mediterranean salt meadows (*Juncetalia maritimi*) Machairs (* in Ireland) Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or *Isoeto-Nanojuncetea* Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) **Species** Harbour Porpoise (*Phocoena phocoena*) Otter (*Lutra lutra*) Harbour Seal (*Phoca vitulina*) Slender Naiad *(Najas flexilis*)
Inishmore Island SAC	213	12.90	**Habitats** Coastal lagoons* Reefs Perennial vegetation of stony banks Vegetated sea cliffs of the Atlantic and Baltic coasts Embryonic shifting dunes Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) Fixed coastal dunes with herbaceous vegetation (grey dunes)* Dunes with Salix repens ssp. argentea (*Salicion arenariae*) Humid dune slacks Machairs (* in Ireland) European dry heaths Alpine and Boreal heaths Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) Limestone pavements* Submerged or partially submerged sea caves **Species**

Site Name	Site Code	Distance to project area (km)	Qualifying Interests (* denotes a priority habitat)
			Narrow-mouthed Whorl Snail (*Vertigo angustior*) Harbour Porpoise (*Phocoena phocoena*)
Connemara Bog Complex SPA	4181	5.87	**Birds** Cormorant (*Phalacrocorax carbo*) Merlin (*Falco columbarius*) Golden Plover (*Pluvialis apricaria*) Common Gull (*Larus canus*)
Slyne Head to Ardmore Point Islands SPA	4159	14.32	**Birds** Barnacle Goose (*Branta leucopsis*) Sandwich Tern (*Sterna sandvicensis*) Arctic Tern (*Sterna paradisaea*) Little Tern (*Sterna albifrons*)

Table 8-2: Designated Sites with Marine Mammals that are Qualifying Interests (QI) within 50km of the Development

Site Name	Site Code	Distance to project area (km)	Qualifying Interests
Kilkieran Bay and Islands SAC	2111	2.60	Harbour Porpoise (*Phocoena phocoena*) Harbour Seal (*Phoca vitulina*)
Inishmore Island SAC	213	12.90	Harbour Porpoise (*Phocoena phocoena*)
Galway Bay Complex SAC	268	27.62	Harbour Seal (*Phoca vitulina*)
Slyne Head Peninsula SAC	2047	37.09	Common Bottlenose Dolphin (Tursiops truncatus)
West Connacht Coast SAC	2998	42.85	Common Bottlenose Dolphin (*Tursiops truncatus*) Harbour Porpoise (*Phocoena phocoena*)
Slyne Head Islands SAC	328	42.90	Common Bottlenose Dolphin (*Tursiops truncatus*) Grey Seal (*Halichoerus grypus*)

8.3.3 Desktop Study

A comprehensive desk-based assessment of the receiving environment was conducted by Emerald Marine Environmental Consultancy. The desktop assessment was sourced from published references, datasets, and resources. A selection of key resources is provided below.

- Ireland's Marine Atlas
- ICES Database on Trawl Surveys (DATRAS)
- Inland Fisheries Ireland, National Shore Marks
- Irish Whale & Dolphin Group, Casual Cetacean Sightings Database
- Irish Whale & Dolphin Group, IWDG Chondrichthyan Database
- National Biodiversity Data Centre
- National Parks and Wildlife Service, Seal Database
- National Parks and Wildlife Service, Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish
- Aquafact, 2017. Rossaveel Deep Water Quay Environmental Impact Statement, Chapter 10 Marine, and Appendix E – Benthic Survey Results. DAFM, Co. Galway (see Volume III, Appendix 8A of this rEIAR)
- Aquafact, 2025. Ros an Mhíl Benthic Survey Results Report. DAFM, Co. Galway (see Volume III, Appendix 8B of this rEIAR)
- Marine Mammal Monitoring Report, Ros an Mhíl Deep Water Quay, 2024. (see Volume III, Appendix 8C of this rEIAR)

8.3.4 Field Surveys

Aquafact undertook two macrofaunal and sediment analysis surveys at the Ros an Mhíl harbour study area. One in October 2016 to inform the EIS for the 2018 planning application (see Volume III, Appendix 8A Aquafact Marine Survey Report 2016 of this rEIAR), and the second in June 2025 as part of the rEIAR for the substitute consent application for the completed works (see Volume III, Appendix 8B Aquafact Marine Survey Report 2025 of this rEIAR).

The 11th October 2016 survey was conducted from RPS Marine's Puffin (see Volume III, Appendix 8A Aquafact Marine Survey Report 2016 of this rEIAR), while the June 2025 survey was conducted from the MV Madelen.

The primary objective of these two surveys was to characterise the benthic environment in terms of biological community structure and sediment composition. To achieve this, a series of grab samples were collected and subjected to macrofaunal analysis, granulometry, chemistry and radiology of sediments that could be impacted by the development.

8.3.4.1 Benthic Grab Survey

In order to carry out the 2016 subtidal benthic assessment of the development area, Aquafact sampled a total of 7 stations. Sampling took place on the 11th October 2016 from RPS Marine's Puffin (see Volume III, Appendix 8A Aquafact Marine Survey Report 2016 of this rEIAR). The location of the stations are shown on Figure 8-1. The 2025 survey targeted the same locations but for the sites close to the quay wall construction area some minor changes in locations were needed due to the project related changes in the seabed and substrates. The detection of unsuitable habitat for grab sampling and presence of reclaimed land from previous works necessitated the relocation of grab stations relative to the locations previously sampled. These are shown in Figure 8-1.

A $0.1m^2$ Day grab was used to sample the dredge sites. Two replicate grab samples were taken at each of the stations for faunal analysis and a third sample was collected for sediment grain size and organic carbon analysis. The same equipment and sampling method was used for both sets of surveying in 2016 and 2025.

Figure 8-1: 2016 and 2025 Sampling Locations

Sample Processing

Benthic Fauna Analysis

The fauna was sorted into four main groups: Polychaeta, Mollusca, Crustacea and others. The 'others' group consisted of echinoderms, nematodes, nemerteans, cnidarians and other lesser phyla. After identification and enumeration, specimens were separated and stored to species level.

Aquafact followed standard in-house SOPs for faunal sampling and analysis, ensuring comparability of results with the survey previously undertaken at the site. Additionally, Aquafact follows the Northeast Atlantic Marine Biological Analytical Quality Control (NMBAQC) standard for benthic sampling and analysis (Worsfold et al., 2010).

Uni- and multi-variate statistical analysis of the faunal data was undertaken using PRIMER v.6 (Plymouth Routines in Ecological Research). Epifaunal and colonial fauna was removed from the dataset prior to analysis.

8.3.4.2 Drop Down Video Survey

A drop-down video (DDV) survey of the area was carried out by AQUAFACT on the 22nd February 2017 from AQUAFACT's 6.8m Lencraft RIB. A total of 11 no. locations were surveyed and the location of these transects can be seen in Figure 8-2. The majority of these stations were located along the western shoreline as this was the area Zostera was encountered in a 2002 study of the study area (RPS, 2002). Zostera bed habitats are included on the OSPAR List of threatened and/or declining species and habitats (OSPAR agreement 2008-6). In addition, two sites were located within the dredge area.

A DDV survey was conducted to assess the suitability of the subtidal substrate for a benthic faunal and sediment contaminants survey. The video survey was carried out on the 30th of June 2025 from the RPS Marine Vessel, *MV Madelen*, the methodology used was consistent with methods used during the 2017 drop-down video survey. A number of grab stations were moved as a result of the drop-down video survey due to unsuitable substrate or inaccessibility due to tidal conditions on the day (Figure 8-3).

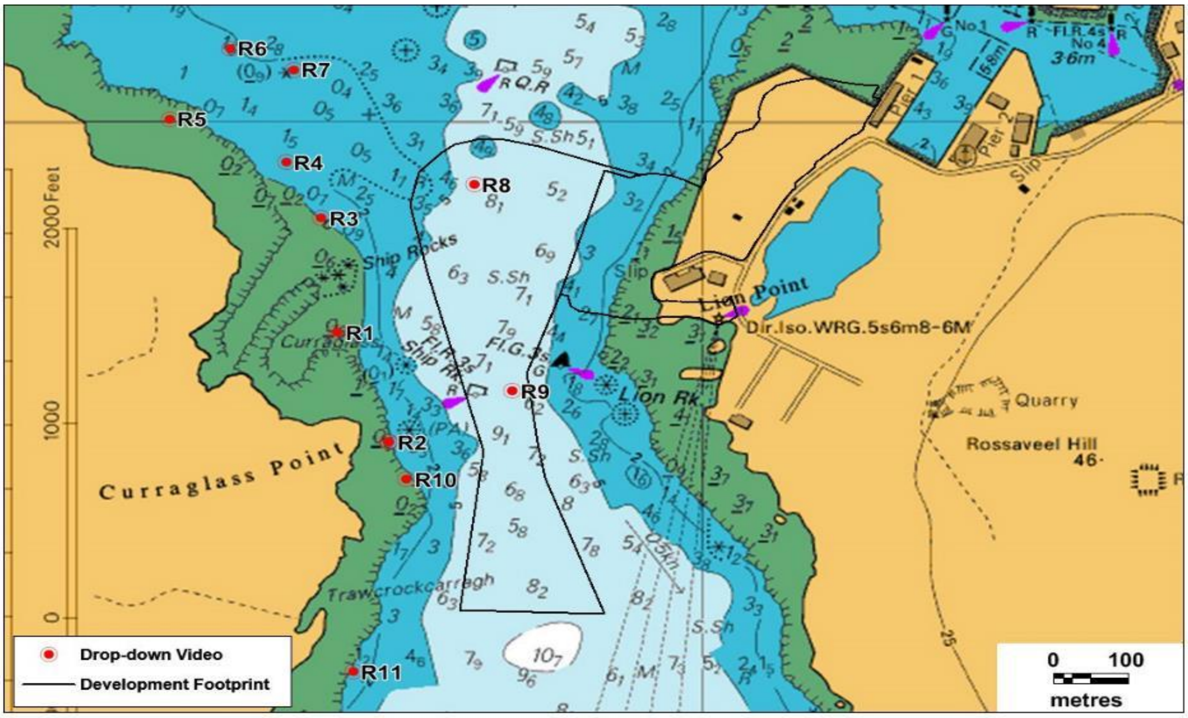

Figure 8-2: Location of Drop Dowen Video Sites 2017

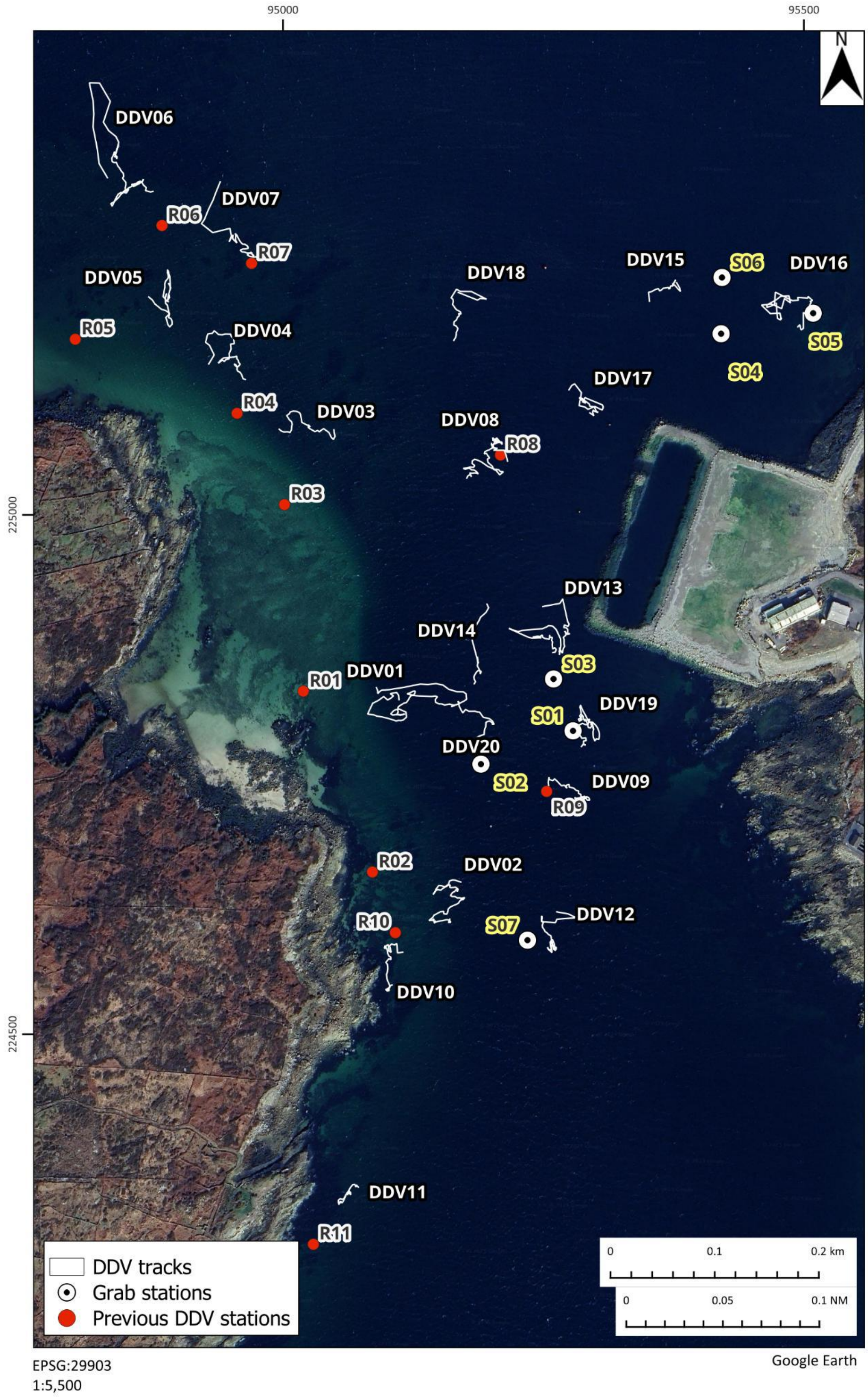

Figure 8-3: Location of Dropdown video tracks for 2025 survey

8.3.4.3 Sediment Sampling

AQUAFACT sampled sediment chemistry at 5 no. stations. Sampling took place on the 11th October 2016 from RPS Marine's Puffin. This survey was carried out in conjunction with the benthic grab survey. Figure 8-1 shows the stations sampled in 2016 and 2025.

A 0.1m² Day grab was used to collect the sediment samples at each station. The sediment samples were divided up for contaminant analysis, radiological analysis (Stations S1 and S2 only), sediment granulometry, sediment density and moisture content.

Samples were couriered to the National Laboratory Service in the UK for the analysis of the parameters. Samples for radiological analysis were sent to the Radiological Protection Institute of Ireland where analysis was carried out by high resolution gamma spectrometry.

The sediment granulometric analysis was carried out by AQUAFACT using the traditional granulometric approach. The process involved the separation of the sediment fractions by passing them through a series of sieves. Table 8-3 shows the classification of sediment particle size ranges into size classes.

Particle size distribution was carried out by the accredited laboratory SOCOTECH UK Ltd. using traditional granulometric techniques for the 2025 survey. Sediment was classified into size classes by sediment particle size range using sieves, which corresponded to the range of particle sizes.

All samples were tested for total organic carbon using the Loss on Ignition method. All testing was carried out by SOCOTECH UK Ltd. following standard methodology.

Table 8-3: Classification of Sediment Particle Size Ranges

Range of Particle Size	Classification	Phi Unit
<63µm	Silt/Clay	>4 Ø
63-125 µm	Very Fine Sand	4 Ø, 3.5 Ø
125-250 µm	Fine Sand	3 Ø, 2.5 Ø
250-500 µm	Medium Sand	2 Ø, 1.5 Ø
500-1000 µm	Coarse Sand	1 Ø, 1.5 Ø
1000-2000 µm (1 – 2mm)	Very Coarse Sand	0 Ø, -0.5 Ø
2000 – 4000 µm (2 – 4mm)	Very Fine Gravel	-1 Ø, -1.5 Ø
4000 -8000 µm (4 – 8mm)	Fine Gravel	-2 Ø, -2.5 Ø
8 -64 mm	Medium, Coarse & Very Coarse Gravel	-3 Ø to -5.5 Ø
64 – 256 mm	Cobble	-6 Ø to -7.5 Ø
>256 mm	Boulder	< -8 Ø

8.4 Baseline Characterisation

8.4.1 Benthic Communities

The littoral zone within this study area comprises of boulders and is relatively sheltered to wave action. The upper shore consists of a narrow band of *Pelvetia canaliculata* with the spiral wrack *Fucus spiralis* below it. In parts, barren rock or yellow and grey lichens dominate the upper shore. The mid-shore is dominated by dense knotted wrack *Ascophyllum nodosum*, which supports the epiphytic algae *Vertebrata lanosa*. The green algae *Cladophora rupestris* is present on the rocks below the *A. nodosum* zone. Within the *A. nodosum* zone, raised areas of bedrock are colonised by barnacles and limpets. A narrow band of the serrated wrack *Fucus serratus* is present below the A. nodosum zone and below that kelp *Laminaria digitata* is present in the sublittoral fringe.

Intertidal surveys carried out by Aquafact in 2013 provided very similar results to those identified above.

Beyond the *L. digitata* zone, a band of sheltered infralittoral rock (SIR) is present which is dominated by sugar kelp *L. saccharina*. The main channel is predominantly coarse gravel and sand with decaying red and green seaweeds with tunicates on them and anemones buried in the sand and the starfish *Asterias rubens* on the substrata. The pinnate sea pen *Virgularia mirabilis* was also recorded from the area. There is also a patch of circalittoral muds in the centre of the channel.

The western margin of the channel is mainly dominated by a mixed substratum with *L. saccharina* and mixed filamentous algae (SS.SMp.KSwSS.SlatR). There are also patches of sandy gravel dominated by seagrass *Zostera marina* along this western margin (SS.SMp.SSgr.Zmar). The Zostera beds in the southern part of the western margin are extensive whereas the beds in the northern part are quite sparse.

Aquafact re-surveyed the study area in October 2016 (grab survey) and February 2017 (drop- down video) to reconfirm the habitats and communities present and the results of this survey are presented in the following sections. Further surveys were carried out to establish if the baseline had significantly changed, with the grab survey and drop-down video surveys undertaken on the 30th of June 2025.

8.4.1.1 Benthic Fauna

2016 Survey Results

The taxonomic identification of the benthic infauna across all 7 stations sampled at the dredge site yielded a total count of 236 taxa and 6,648 individuals ascribed to 10 phyla. Of the 236 taxa recorded, 179 were identified to species level. The remaining 57 could not be identified to species level as they were either juveniles, partial, damaged or indeterminate.

Of the 236 taxa present, 1 was a foraminiferan (hole bearer), 4 were cnidarians (corals, anemones, jellyfish etc), 1 was a nematode (roundworm), 1 was a nemertean (ribbon worms), 106 were annelids (segmented worms including sipunculids), 1 was a chelicerate (sea spider), 77 were crustaceans (crabs, shrimps, prawns), 35 were molluscs (mussels, cockles, snails etc.), 2 were phoronids (horseshoe worm) and 8 was an echinoderm (brittlestars, starfish, sea cucumbers).

Univariate statistical analyses were carried out on the station-by-station faunal data to assess species richness, evenness and diversity at each of the seven stations sampled. The same dataset was used to for the multivariate analyses which revealed two statistically significant groupings between the seven stations (46.47% dissimilarity).

Group A (stations 1, 2, 3 and 7) can be classified as exhibiting many of the characteristics of the JNCC biotope 'SS.SCS.CCS.MedLumVen *Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel (EUNIS code MC3212) (Tillin & Watson, 2024).

Group B (stations 4, 5 and 6) can be classified as exhibiting many of the characteristics of the JNCC biotope 'SS.SMu.ISaMu.MelMagThy *Melinna palmata* with *Magelona* spp. and *Thyasira* spp. in infralittoral sandy mud' (EUNIS code MB6244) (De-Bastos & Watson, 2023).

<u>2025 Survey Results</u>

Taxonomic identification of benthic fauna across all seven subtidal grab stations surveyed in the vicinity of the Ros an Mhíl Harbour yielded a total count of 255 taxa comprising 6,052 individuals ascribed to nine phyla. Of the 225 taxa identified, 155 were identified to species level. The remaining 70 taxa could not be identified to species level due to life stage (juveniles) or damage.

Of the 255 taxa recorded (225 infaunal taxa infauna and 33 epifaunal or colonial taxa), 1 was a foraminiferan, 2 were poriferans (sponges), 3 were cnidarians (anemones, soft-corals), 3 were nemertean (ribbon worm), 1 was a nematode (round worm), 112 were annelids (segmented worms), 63 were arthropods (crabs, shrimps, insects *etc*.), 52 were molluscs (mussels, cockles, snails *etc.*), 7 were echinoderms (brittle stars, sea urchins *etc.*), 3 were ascidians (sea squirts), 7 were bryozoans (moss animals), and 1 was a phoronid (horse shoe worm).

Univariate statistical analyses were carried out on the station-by-station faunal data to assess species richness, evenness and diversity at each of the seven stations sampled.

The same dataset was used for the multivariate analyses which revealed three statistically significant groupings between the seven stations. A clear divide (66.39% dissimilarity) was observed between Groups A & B which had a gravelly muddy sand substrate and Group C which had a higher silt content.

Group A (station 2) and Group B (stations 1, 3 and 7) can be classified as exhibiting many of the characteristics of the JNCC biotope 'SS.SCS.CCS.MedLumVen *Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel' (EUNIS code MC3212) (Tillin & Watson, 2024).

Group C (stations 4, 5 and 6) can be classified as exhibiting many of the characteristics of the JNCC biotope 'SS.SMu.ISaMu.MelMagThy *Melinna palmata* with *Magelona* spp. and *Thyasira* spp. in infralittoral sandy mud' (EUNIS code MB6244) (De-Bastos & Watson, 2023).

The different biotopes identified from the faunal grabs within the vicinity of Ros an Mhíl Harbour are shown in Figure 8-4.

8.4.2 Sediment Characteristics

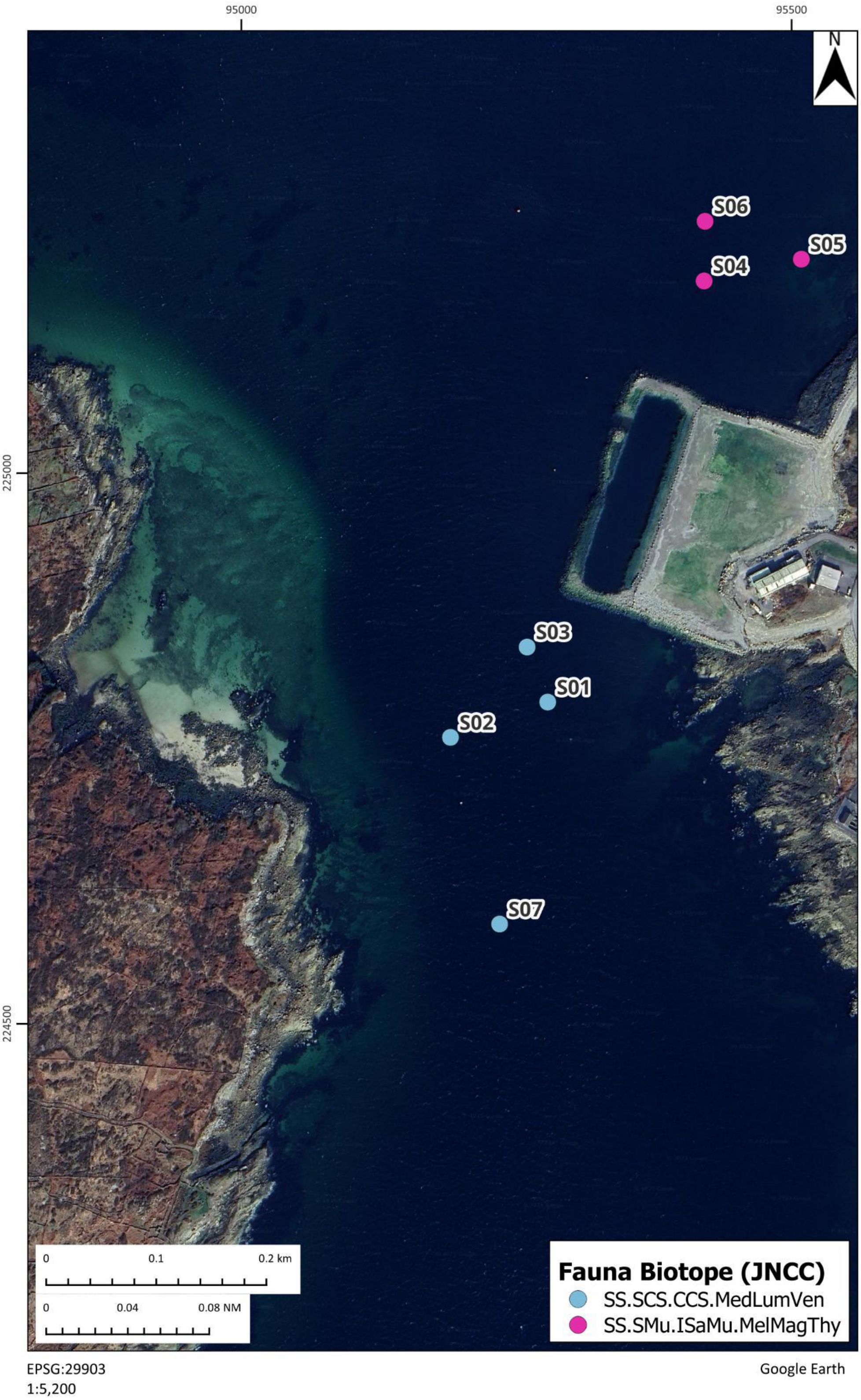

Figure 8-4: Biotopes Classification based on infauna species identified at sample locations

2016 Survey Results

Table 8-4 shows the sediment characteristics of the 7 no. faunal stations.

Table 8-4: Sediment Characteristics

Station	Fine Gravel (>4mm)	Very Fine Gravel (2-4mm)	Very Coarse Sand (1-2mm)	Coarse Sand (0.5-1mm)	Medium Sand (0.25-0.5mm)	Fine Sand (125-250µm)	Very Fine Sand (62.5-125µm)	Silt - Clay (<63µm)	Folk (1954)	LOI
S1	1.7	7.4	20.5	22.9	27.6	12.8	3.6	3.6	Gravelly sand	6.66
S2	3.5	6.2	11.7	17.5	26.2	15.7	9.4	9.7	Gravelly muddy sand	7.36
S3	1.3	5.0	16.8	28.4	30.5	12.3	2.6	3.2	Gravelly sand	5.52
S4	2.2	6.3	10.7	13.0	19.9	23.7	11.8	12.4	Gravelly muddy sand	6.71
S5	3.9	10.0	20.6	24.6	22.2	9.3	4.5	4.8	Gravelly sand	7.72
S6	0.0	0.0	0.0	0.6	16.4	21.2	26.7	35.1	Muddy sand	22.5
S7	3.7	9.5	24.5	28.7	19.9	6.4	3.6	3.7	Gravelly sand	8.61

2025 Survey Results

Granulometry results for the sediment composition in percentages for gravel (>2 mm), sand (63-2000 µm), and silt (<63 µm) are shown in **Table 8-5**. Gravel percentage composition ranged from 5.50 % (Station 6) to 21.71 % (Station 3). Sand percentage composition ranged from 27.49 % (Station 6) to 69.70 % (Station 3). Silt percentage composition ranged from 8.59 % (Station 3) to 67.0 % (Station 6). Sediment particles varied between gravelly muddy sand to gravelly mud (see **Table 8-5**).

Table 8-5: Sediment characteristics and Folk (1954) classification of each station

Stations	% Gravel (>2 mm)	% Sand (63-2000 µm)	% Mud (<63 µm)	Folk (1954)
Station 1	10.22%	63.44%	26.33%	Gravelly Muddy Sand
Station 2	12.25%	69.18%	18.56%	Gravelly Muddy Sand
Station 3	21.71%	69.70%	8.59%	Gravelly Muddy Sand
Station 4	11.65%	31.76%	56.59%	Gravelly Mud
Station 5	7.57%	59.94%	32.49%	Gravelly Muddy Sand
Station 6	5.50%	27.49%	67.00%	Gravelly Mud

Stations	% Gravel (>2 mm)	% Sand (63-2000 µm)	% Mud (<63 µm)	Folk (1954)
Station 7	12.36%	65.82%	21.82%	Gravelly Muddy Sand

8.4.3 Sediment Physio-chemistry

<u>2016 Survey Results</u>

Table 8-6 shows the physical properties of the analysis results from the sediment chemistry sampling.

Table 8-6: Sediment Physical Properties

Station	Visual	% Gravel (>2mm)	% Sand (<2mm)	% Silt-Clay (<63µm)	Moisture %	Density (g/ml)
S1	Brown clay sediment	9.1	87.4	3.6	31.26	1.56
S2	Brown clay sediment	9.7	80.5	9.7	35.95	1.81
S3	Brown sandy clay sediment	6.3	90.6	3.2	28.79	1.64
S4	Brown clay sediment	8.5	79.1	12.4	37.99	1.86
S5	Brown sandy clay sediment	13.9	81.2	4.8	30.61	1.57

Table 8-7 shows the chemical properties of the analysis results from the sediment chemistry sampling.

Table 8-7: Sediment Chemical Properties

Analyte	Units	S1	S2	S3	S4	S5
Carbonate as C: Dry Wt.	%	60	55	72	53	59
Carbon, Organic: Dry Wt. as C	%	1.59	2.3	3	2.03	1.66
Hydrocarbons: Total: Dry Wt. as Ekofisk	mg/kg	20.7	25.7	-	-	-
Mercury: Dry Wt.	mg/kg	0.0208	0.0264	<0.01	0.0278	0.0168
Aluminium, Dry Wt.	mg/kg	6180	11500	3200	10200	4960
Arsenic, Dry Wt.	mg/kg	4.76	5.96	3.16	6.64	5.35
Cadmium, Dry Wt.	mg/kg	0.113	0.159	0.069	0.194	0.087
Chromium, Dry Wt.	mg/k	12.8	22.2	17.2	20.2	11.6

Analyte	Units	S1	S2	S3	S4	S5
	g					
Copper, Dry Wt.	mg/kg	4.5	6.93	2.65	7.27	3.32
Lead, Dry Wt.	mg/kg	7.85	11.1	5	12.3	7.15
Lithium, Dry Wt.	mg/kg	10.6	14.3	6.03	14	9.59
Nickel, Dry Wt.	mg/kg	7.5	19.4	7.33	13.6	8.36
Zinc, Dry Wt.	mg/kg	20.7	30.2	11	33.5	17.3
Aldrin: Dry Wt.	µg/kg	<0.5	<0.5	-	-	-
DDE -pp: Dry Wt.	µg/kg	<0.1	<0.1	-	-	-
DDT-op: Dry Wt.	µg/kg	<0.1	<0.1	-	-	-
DDT -pp: Dry Wt.	µg/kg	<0.1	<0.1	-	-	-
Dieldrin: Dry Wt.	µg/kg	<0.5	<0.5	-	-	-
Endrin: Dry Wt.	µg/kg	<0.5	<0.5	-	-	-
HCH -alpha: Dry Wt.	µg/kg	<0.1	<0.1	-	-	-
HCH -beta: Dry Wt.	µg/kg	<0.1	<0.1	-	-	-
HCH -delta: Dry Wt.	µg/kg	<0.1	<0.1	-	-	-
HCH -gamma: Dry Wt.: {Lindane}	µg/kg	<0.1	<0.1	-	-	-
Hexachlorobenzene: Dry Wt.	µg/kg	<0.1	<0.1	-	-	-
Hexachlorobutadene: Dry Wt.	µg/kg	<0.1	<0.1	-	-	-
Isodrin: Dry Wt.	µg/kg	<0.5	<0.5	-	-	-
TDE - pp: Dry Wt.	µg/kg	<0.1	<0.1	-	-	-
Acenaphthene: Dry Wt.	µg/kg	<1	<1	-	-	-

Analyte	Units	S1	S2	S3	S4	S5
Acenaphthylene: Dry Wt.	µg/kg	<1	<1	-	-	-
Anthracene: Dry Wt.	µg/kg	2.41	1.82	-	-	-
Benzo(a)anthracene: Dry Wt.	µg/kg	3.8	4.93	-	-	-
Benzo(a)pyrene: Dry Wt.	µg/kg	4.55	5.38	-	-	-
Benzo(b)fluoranthene: Dry Wt.	µg/kg	4.8	7.8	-	-	-
Benzo(ghi)perylene: Dry Wt.	µg/kg	5.82	5.56	-	-	-
Benzo(k)fluoranthene: Dry Wt.	µg/kg	3.32	4.39	-	-	-
Chrysene: Dry Wt.	µg/kg	4.12	4.56	-	-	-
Dibenzo(ah)anthracene: Dry Wt.	µg/kg	<1	1.5	-	-	-
Fluoranthene: Dry Wt.	µg/kg	9.35	9.92	-	-	-
Fluorene: Dry Wt.	µg/kg	<5	<5	-	-	-
Indeno(1,2,3-c,d)pyrene: Dry Wt.	µg/kg	3.65	5.93	-	-	-
Naphthalene: Dry Wt.	µg/kg	<5	<5	-	-	-
Phenanthrene: Dry Wt.	µg/kg	6.13	5.08	-	-	-
Pyrene: Dry Wt.	µg/kg	7.69	7.45	-	-	-
PCB - 028: Dry Wt.	µg/kg	<0.1	<0.1	-	-	-
PCB - 052: Dry Wt.	µg/kg	<0.1	<0.1	-	-	-
PCB - 101: Dry Wt.	µg/kg	<0.1	<0.1	-	-	-
PCB - 118: Dry Wt.	µg/kg	<0.1	<0.1	-	-	-
PCB - 138: Dry Wt.	µg/kg	<0.1	<0.1	-	-	-
PCB - 153: Dry Wt.	µg/kg	<0.1	<0.1	-	-	-

Analyte	Units	S1	S2	S3	S4	S5
PCB - 180: Dry Wt.	µg/kg	<0.1	<0.1	-	-	-
Dibutyl Tin: Dry Wt. as Cation	µg/kg	<5	7.57	<4	<5	<5
Tributyl Tin: Dry Wt. as Cation	µg/kg	<5	<5	<4	<5	<5

<u>2025 Survey Results</u>

The results of physio-chemical analysis of the parameters; moisture content, sediment density, total organic carbon and carbonate, are presented in **Table 8-8** below.

Table 8-8: Physio-chemical results of each station

Station	Total Moisture @120°C (%)	Total Solids	Gravel (>2mm) (%)	Sand (63-2000 µm) (%)	Silt (<63 µm) (%)	Particle Density mg/m3	TOC (%m/m)	Carbonate Equivalent (% CO3) (%m/m)
Station 1	47.2	52.8	10.22	63.44	26.33	2.69	1.46	40.0
Station 2	42.3	57.7	12.25	69.18	18.56	2.68	1.50	41.5
Station 3	45.2	54.8	21.71	69.70	8.59	2.75	1.08	41.0
Station 4	53.1	46.9	11.65	31.76	56.59	2.57	2.76	32.3
Station 5	44.7	55.3	7.57	59.94	32.49	2.67	2.14	31.8
Station 6	68.6	31.4	5.50	27.49	67.00	2.54	4.47	22.3
Station 7	39.7	60.3	12.36	65.82	21.82	2.68	1.36	42.0

All sediments tested for contaminants were below the lower and upper-level guidance values outlined in Cronin *et al*. (2006). The following tables present the guidance values and results of measured levels of trace metals (**Table 8-9**), organochlorides and polychlorinated biphenyls (PCBs) (**Table 8-10**), total extractable hydrocarbon (**Table 8-11**), tributylin (TBT) and dibutylin (DBT) (**Table 8-12**), and polycyclic aromatic hydrocarbons (**Table 8-13**).

Table 8-9: Trace metals results and guidance values (Cronin, et al., 2006; 2019)

Determinant mg/kg	Lower Level	Upper Level	St. 1	St. 2	St. 3	St. 4	St. 5	St. 6	St. 7
Al	N/A	N/A	15900	12500	16700	19300	19800	28500	14600

Determinant mg/kg	Lower Level	Upper Level	St. 1	St. 2	St. 3	St. 4	St. 5	St. 6	St. 7
Cd	0.7	4.2	0.14	0.08	0.08	0.35	0.33	0.35	0.08
Hg	0.2	0.7	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
As	20	70	8.4	9.1	17.9	9.8	12.1	13.5	9.6
Cr	120	370	15.4	13.8	21.7	24.3	28.2	39.2	13.2
Cu	40	110	7.1	3.3	2.5	7.7	8.1	12.2	3.4
Pb	60	218	18.3	11.3	30.4	15.8	19.2	25.6	10.4
Ni	40	60	7.3	5.9	4.1	12.4	13.5	18.2	5.3
Zn	160	410	29.6	23.2	28.1	52.9	48.4	59.1	21.8

Table 8-10: Organochlorides and PCBs results and guidance values (Cronin, et al., 2006)

Determinant µg/kg	Lower Level	Upper Level	St. 1	St. 2	St. 3	St. 4	St. 5	St. 6	St. 7
AHCH	N/A	N/A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BHCH	N/A	N/A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
GHCH	0.3	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DIELDRIN	N/A	N/A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HCB	0.3	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DDE	N/A	N/A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DDT	N/A	N/A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DDD	N/A	N/A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
PCB28	1	180	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
PCB52	1	180	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
PCB101	1	180	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
PCB118	1	180	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
PCB138	1	180	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
PCB153	1	180	<0.08	<0.08	<0.08	<0.08	<0.08	0.09	<0.08
PCB180	1	180	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08

Table 8-11: Total Extractable Hydrocarbon results and guidance values (Cronin, et al., 2006)

Determinant g/kg	Lower Level	Upper Level	St. 1	St. 2	St. 3	St. 4	St. 5	St. 6	St. 7
TEH	1.0	N/A	0.0463	0.0135	0.0231	0.0626	0.0594	0.178	0.0368

Table 8-12: TBT and DBT results and guidance values (Cronin, et al., 2006)

Determinant mg/kg	Lower Level	Upper Level	St. 1	St. 2	St. 3	St. 4	St. 5	St. 6	St. 7
DBT	N/A	N/A	<5	<5	<5	<5	<5	<5	<5
TBT	N/A	N/A	<5	<5	<5	<5	<5	<5	<5

Table 8-13: Polycyclic Aromatic Hydrocarbons results and guidance values (Cronin, et al., 2006)

Determinant µg/kg	Lower Level	Upper Level	St. 1	St. 2	St. 3	St. 4	St. 5	St. 6	St. 7
Acenaphthene	N/A	N/A	<5	<5	<5	<5	<5	<5	<5
Acenaphthylene	N/A	N/A	<5	<5	<5	<5	<5	<5	<5
Anthracene	N/A	N/A	<5	<5	<5	<5	<5	<5	<5
Benzo (a) anthracene	N/A	N/A	25.8	<5	<5	<5	<5	<5	<5
Benzo (a) pyrene	N/A	N/A	18.2	<5	<5	<5	<5	<5	<5
Benzo (b) fluoranthene	N/A	N/A	15.7	<5	<5	11.1	<5	<5	<5
Benzo (ghi) perylene	N/A	N/A	<5	<5	<5	<5	<5	<5	<5
Benzo (k) fluoranthene ug kg-1	N/A	N/A	19.2	<5	<5	<5	<5	20.3	<5
Chrysene	N/A	N/A	25.8	<5	<5	<5	<5	16.5	<5
Dibenz (a,h) anthracene	N/A	N/A	<5	<5	<5	<5	<5	<5	<5

Determinant µg/kg	Lower Level	Upper Level	St. 1	St. 2	St. 3	St. 4	St. 5	St. 6	St. 7
Fluorene	N/A	N/A	<5	<5	<5	<5	<5	<5	<5
Fluoranthene	N/A	N/A	38.8	<5	<5	17.0	<5	29.4	<5
Indeno (1,2,3–cd) pyrene	N/A	N/A	9.47	<5	<5	<5	<5	<5	<5
Naphthalene	N/A	N/A	<5	<5	<5	11.8	<5	<5	<5
Phenanthrene	N/A	N/A	<5	<5	<5	14.0	<5	<5	<5
Pyrene	N/A	N/A	35.1	<5	<5	14.2	<5	23.3	<5
Σ 16 PAHs	4000	N/A	< 228.07	< 80	< 80	< 123.1	< 80	< 149.5	< 80

8.4.4 Sediment Radiological Analysis

2016 Survey Results

The radiological analytical results for the two sampled stations are presented in **Table 8-14.**

Table 8-14: Radiological analysis results

Stations	K-40	I-131	Cs-134	Cs-137	Ra-226	Ra-228
1	172 ± 19	Nd	Nd	1.1 ± 0.1	6.7 ± 1.2	6.1 ± 0.9
2	208 ± 23	Nd	Nd	1.7 ± 0.2	9.7 ± 1.7	10.1 ± 1.5

2025 Survey Results

This section intends to present the radiological analytical results for 2025. However, as analysis takes approximately three months to complete, this section will be updated once results are received from the analytical laboratory. Refer to **Table 8-14** for 2016 results.

8.4.5 Marine Mammals and Marine Megafauna

2016 & 2025 Survey Results

Irish waters represent one of the most important marine habitats for cetaceans in Europe (Berrow, 2001) and are utilized by a wide range of marine mammal species. At present, there are twenty-six species of cetaceans known to occur in Ireland (Whooley, 2016), along with two species of seals (NPWS, 2013).

Marine mammals in Ireland are protected under the EU Habitats Directive (92/43/EEC). All cetaceans are listed under Annex IV of the Habitats Directive as species requiring strict protection in their natural range (Article 12, EC Council Directive 92/43/EEC). The harbour porpoise *Phocoena phocoena* and the bottlenose dolphin *Tursiops* *truncatus*, together with both seal species occurring in Irish waters, the grey seal *Halichoerus grypus* and the harbour seal *Phoca vitulina*, are listed in Annex II and further protected under Article 3 of the Directive, as species whose conservation requires the designation of Special Areas of Conservation (SACs).

Harbour seals feed at sea but regularly haul out on rocky shore to rest, breed, suckle their young, and moult (Lyons, 2004). The breeding season runs from June to July, and the annual moult take place shortly after, from late July through August (Lyons, 2004; Cronin *et al*., 2007). Harbour seals are known to haul out at several locations in Cashla Bay (Cronin *et al*., 2004), these haul out locations are presented in **Figure 8-5.** A robust baseline population assessment was conducted in 2003, numbers at haul out sites in Cashla Bay ranged from 1 to 12 individuals (Cronin *et al*., 2004). Subsequent monitoring surveys recorded maximum counts in inner Cashla Bay of 108, 77 and 77 in 2009, 2010 and 2011 respectively (NPWS, 2012), while counts of 74 and 72 were recorded in inner Cashla Bay in 2012 and 2013 respectively (NPWS, 2025). Harbour seals are a qualifying interest of the Kilkieran Bay & Islands SAC and Galway Bay Complex SAC.

Grey seals are recorded within Cashla Bay; however, this species prefers remote rocky skerries and uninhabited islands as haul out and breeding sites (O'Cadhla, *et al*., 2005). Grey seals haul out to moult in spring, and to breed in the Autumn, with peak pup production occurring in October or November (Lyons, 2004). There are no known grey seal haul out or breeding sites in Cashla Bay (O'Cadhla et al., 2005; O'Cadhla & Strong, 2007), however, individuals are known to frequent the area to forage within the active fishing port of Ros an Mhíl. Grey seal is a qualifying interest of the Slyne Head Island SAC.

A number of cetaceans have the potential to occur in the vicinity of the development. A search of the IWDG casual cetacean sightings database (IWDG, 2025a), accessed through the National Biodiversity Centre portal revealed that five species of cetacean were recorded in Cashla Bay and adjacent waters in Galway Bay, species recorded were bottlenose dolphin, common dolphin *Delphinus delphis*, harbour porpoise, minke whale *Balaenoptera acutorostrata* and humpback whale *Megaptera novaeangliae*. Of these species, only bottlenose dolphins were recorded in inner Cashla Bay (record count n=2), while bottlenose dolphin (record count n=5) and minke whale (record count n=1) were recorded in at Cashla Point. The remaining records were noted in adjacent waters of Galway Bay within 10km grid reference L91. A summary of these records is presented in **Table 8-15.**

Table 8-15: Summary of cetacean records in Cashla Bay, Cashla Point and adjacent waters of Galway Bay, all numbers refer to number of records rather than number of individual animals (IWDG, 2025a)

Species name	Inner Cashla bay[1]	Cashla Point[2]	Adjacent waters of Galway Bay[3]
Bottlenose dolphin (*Tursiops truncatus*)	2	5	4
Common dolphin (*Delphinus delphis*)	0	0	22
Harbour porpoise (*Phocoena phocoena*)	0	0	10
Humpback whale (*Megaptera novaeangliae*)	0	0	2
Minke whale (*Balaenoptera acutorostrata*)	0	1	16

[1] Defined as areas covered by the national 2km grid references; L92L, L92M, L92N L92R, L92S and L92T.
[2] Defined as areas covered by the national 2km grid references; L92F, L92K and L92Q.
[3] Defined as areas covered by the national 10km grid reference L91F.

Harbour porpoise is a qualifying interest of the Kilkieran Bay & Islands SAC, Inishmore Island SAC, Galway Bay Complex SAC, and West Connacht Coast SAC. Berrow et al. (2008) showed an overall density of porpoises of 0.73 per km² with an abundance of 402 ± 84 in outer Galway Bay. Subsequent boat-based harbour porpoise surveys conducted on behalf of NPWS have focused on SACs on the east and southwest coasts. Using aerial survey techniques, Rogan et al. (2022) estimated a summer abundance of 623.8 individuals (95% CI 258.4 – 1506.1) and winter abundance of 4422.1 individuals (95% CI 1796.9 – 10882.8) in strata seven, an inshore stratum encompassing west Galway, Clare, and west Kerry.

Bottlenose dolphin is a qualifying interest of Slyne Head Island SAC, Slyne Head Peninsula SAC, West Connacht Coast SAC, and Lower River Shannon SAC. Three distinct populations of bottlenose dolphin are recognised in Ireland: resident in Shannon estuary, coastal and offshore. The coastal population are wide ranging, and their populations are not contained within the limits of SACs, similarly the resident Shannon estuary population are frequently recorded outside of the estuary. Rogan et al. (2022) estimated a summer abundance of 18,704 individuals (95% CI 5,425 – 64,484) and winter abundance of 2,762 individuals (95% CI 498 – 15,317) in strata seven.

While minke whale and humpback whale have been recorded in outer Cashla Bay, it is considered unlikely that these species or any other mysticete would occur in the inner bay. Other delphinid species occurring in outer Galway Bay include Atlantic white-sided dolphin *Lagenorhynchus acutus*, killer whale *Orcinus orca*, Risso's dolphin *Grampus griseus* and white-beaked dolphin *Lagenorhynchus albirostris*, however these species are infrequently recorded and also unlikely to occur within Cashla Bay.

Otter *Lutra lutra*, an Annex II species, which is a qualifying interest of the Kilkieran Bay and Islands SAC and the Connemara Bog Complex SAC, occurs within Cashla Bay (NBDC, 2025) and may forage in the vicinity of the development site.

Basking shark *Cetorhinus maximus* occur around all Irish coasts with greatest numbers occurring on our Atlantic seaboard. A number of records are noted in outer Galway Bay, while a single basking shark was also recorded in in Cashla Bay in 2012, grid reference L961233 (IWDG, 2025b). Basking sharks are protected under the Irish Wildlife Act 1976 and listed on the OSPAR list of threatened and/or declining species and habitats (OSPAR Agreement 2008-06).

Five species of marine turtle are recorded in Irish waters, of these, three species; leatherback turtle *Dermochelys coriacea*, loggerhead turtle *Caretta caretta* and Kemp's ridleys turtle *Lepidochelys Kempii* are recorded in Galway Bay, with a single dead stranded Leatherback turtle also recorded in inner Cashla Bay. All five species of marine turtle are Annex IV species, while leatherback turtle and loggerhead turtle are also listed on the OSPAR list of threatened and/or declining species and habitats (OSPAR Agreement 2008-06).

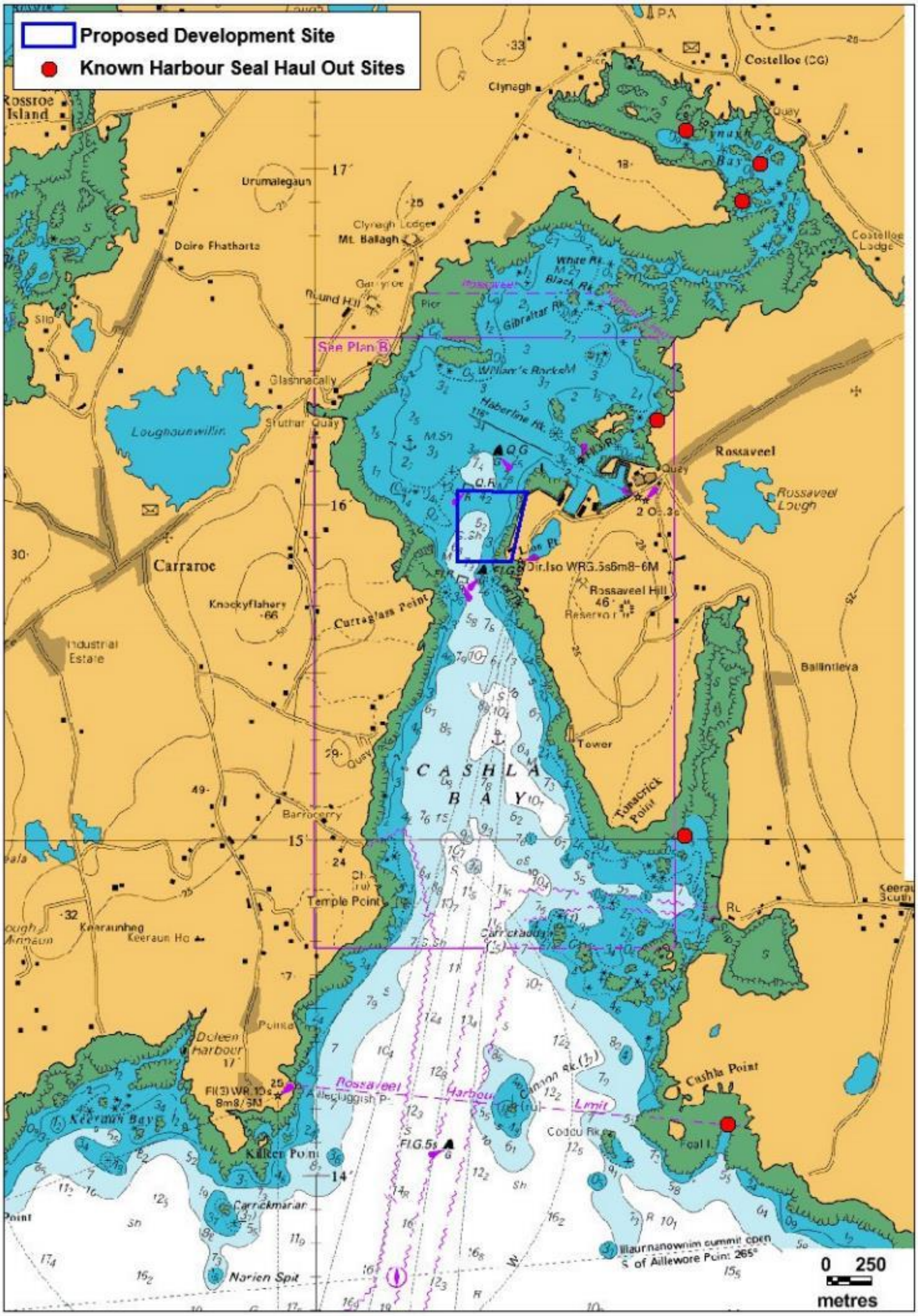

Figure 8-5: Known harbour seal haul out sites

8.4.6 Fish and Shellfish

2016 & 2025

8.4.6.1 Anadromous and Catadromous Species

The Cashla system is a good example of western acidic spate river which supports both Atlantic salmon *Salmo salar* and sea trout *Salmo trutta* (McGinnity, 2003). The Atlantic salmon is listed under Annex II of the E.U. Habitats Directive and is a qualifying interest of the Connemara Bog Complex SAC, while sea trout stocks have collapsed in Ireland and are subject to controls under the national salmon and sea trout fisheries management regulations and a bye-law prohibiting the retention of rod caught sea trout from Galway Bay to Achill Head (King, *et al.,* 2011). Salmon and sea trout will pass through the development area when migrating to and from the Cashla River.

Juvenile salmon spend two years in freshwater before migrating to the sea as smolts in April or May (Borland, *et al.*, 2025). From January to May, spring (multi-sea winter, MSW) salmon return to Irish rivers, from June to October summer salmon (1SW or 'grilse') are present (King, 2011). Grilse generally make up the majority of the spawning stock, with spring salmon contributing a smaller proportion. The spawning stock in the Cashla river varied between circa 500-1000 individuals from 2019-2023 and is currently assessed as above the advised Conservation Limits for the river (TEGOS, 2025).

Juvenile sea trout spend four years in freshwater before migrating to the sea as smolts between March and May. Some sea trout may return later the same year or can spend a number of years at sea as adults. The majority of adult sea trout return from June to August.

IFI (2024b) fish counter data for the year 2023 reported; 69 spring salmon, 389 grilse, 68 late summer salmon, and 827 sea trout in the Cashla river.

European eel *Anguilla anguilla* are reported from numerous sites in Connemara and potentially occur within the Cashla catchment also. European eel is listed on the OSPAR list of threatened and/or declining species and habitats (OSPAR Agreement 2008-06) and listed as critically endangered on the IUCN Red List. Adult European eels leave Irish rivers between September and January with juvenile 'glass eel' returning from January to March.

8.4.6.2 Marine Species

A search of Irish Ground Fish Survey (IGFS) survey data for the closest survey station (station no. 58) in the North Sound revealed a fish assemblage typical of Irish Atlantic shelf waters (DATRAS, 2025). Species most frequently recorded in terms of catch per unit effort (CPUE) included the commercially exploited demersal gadoids; haddock *Melanogrammus aeglefinus*, hake *Merluccius merluccius* and whiting *Merlangius merlangus* non-commercial demersal species recorded included poor cod *Trisopterus minutus*, Norway pout *Trisopterus esmarkii*, grey gurnard *Eutrigla gurnardus*, common dragonette *Callionymus lyra* and spotted dragonette *Callionymus maculatus*. The most abundant flatfish recorded are witch *Glyptocephalus cynoglossus*, long rough dab *Hippoglossoides platessoides* and thickback sole *Microchirus variegatus*, while cephalopods such as *Alloteuthis subulata, Loligo forbesii* and *Todaropsis eblanae* are also abundant. Pelagic species occurring in the greatest abundance are blue whiting *Micromesistius poutassou*, horse mackerel *Trachurus trachurus* and sprat *Sprattus sprattus*. Many of these species are likely to occur in Cashla Bay also, however, larger demersal and pelagic species may be entirely absent or replaced by the young of the species. While offshore species are replaced by inshore species such as wrasse species *Labridae,* blennies *blenniidae*, gobies *gobiidae* and similar typical inshore species.

Elasmobranchs such as the common skate *Dipturus batis*, flapper skate *Dipturus intermedius*, spotted ray *Raja montagui*, spurdog *Squalus acanthias* and lesser spotted dogfish *Scyliorhinus canicula* were recorded at the closest IGFS station, and these species could potentially occur with Cashla Bay also. The common skate complex (which includes both the common skate and flapper skate) is listed on the OSPAR list of threatened and/or declining species and habitats and is considered to be 'critically endangered' globally on the IUCN Red List (Clarke, *et al.,* 2016).

Cashla Bay is a nursery ground for a number of commercially important fish species, including Atlantic cod *Gadus morhua,* Atlantic herring *Clupae harengus*, Atlantic mackerel *Scomber scombrus*, horse mackerel, white-bellied monkfish *Lophius piscatorius* and whiting (ICES, 2009). Ellis *et al.* (2012) predicted nursery grounds of hake, ling *Molva molva*, spurdog and common skate complex occurring in Cashla Bay also. Historical herring spawning grounds are located at Cashla point and Keeran Bay with spawning traditionally occurring in October – November (O'Sullivan *et al.* 2013).

Common shellfish species occurring within Cashla Bay include the commercial species European lobster *Hommarus gammarus,* brown crab *Cancer pagurus* and common shrimp *Palaemon serratus* and various non-commercial species.

8.4.6.3 Commercial and Recreational Fisheries

A number of commercially important shellfish species also occur within the bay. Ros an Mhíl is an active fishing port with an active inshore fishing fleet, larger inshore vessels (>10m) from Ros an Mhíl generally fish along the north shore of Galway Bay and out to the Aran Islands, however a number of smaller inshore vessels (<10m) operate within Cashla Bay. These vessels may target European lobster and brown crab throughout the year with creels or shrimp with shrimp pots from September to December. A set net fishery targeting bait, crayfish *Palinurus elephans* or pollack *Pollachius pollachius* (pending availability of quota) may also occur in outer Cashla Bay and Galway Bay. Line fishing for Mackerel or Pollack can also occur depending on availability of quota. A mixed demersal fishery and seasonal pelagic mid-water trawl fishery are also noted in the North Sound and north shore of Galway Bay.

Two recreational shore mark locations are reported within Cashla Bay: at Ros an Mhíl harbour and Carraroe. Reported species include cod, pollack, dogfish species, thornback ray *Raja clavata*, black pollack *Pollachius virens*, mackerel, wrasse species, whiting, European conger eel *Conger conger*, mullet *Chelon spp.* and European flounder *Platichthys flesus* (IFI, 2024a).

8.4.7 Important Ecological Features

<u>2016 & 2025</u>

The importance of ecological features is dependent upon their biodiversity, social, and economic value within a geographic framework of appropriate reference (CIEEM, 2018). Following baselines characterisation, nine important ecological features (IEFs) were identified. The identified IEFs are presented in Table 8-16.

Table 8-16: Important ecological features

Ecological Feature	Protected status	Importance
Harbour seal	Annex II & V, Wildlife Act	International, National
Grey seal	Annex II & V, Wildlife Act	International, National
Harbor porpoise & bottlenose dolphin	Annex II & IV, OSPAR, Wildlife Act	International, National

Ecological Feature	Protected status	Importance
Other marine megafauna, including cetaceans, basking shark, marine turtles, otter	Annex IV, Wildlife Act	International, National
Anadromous and catadromous species; salmon, sea trout, European eel	Annex II & V, OSPAR, IUCN	International, National
Zostera beds	Annex I, OSPAR	International, National
Benthic subtidal and intertidal habitats & associated communities		Regional, Local
Demersal fish, cephalopod and elasmobranch assemblage which form an important component of marine food webs, including commercial and non-commercial species, and species with nursery grounds occurring in the area.		Regional, Local
Pelagic fish, cephalopod and elasmobranch assemblage which form an important component of marine food webs, including commercial and non-commercial species, and species with nursery grounds occurring in the area, and herring which has spawning grounds at Cashla Point		Regional, Local

8.5 Criteria for Assessment of Likely Effects

The sensitivity of receptors (species and habitats) identified in the baseline characterisation to pressures arising as a result of the development was assessed. Sensitivity is determined by the capacity of the feature to remain unchanged under the influence of the pressure (termed resistance) and, if changed, the amount of time needed for a full recovery once the activity has stopped (termed resilience) (MPAAG, 2024). The sensitivities assigned to receptors were arrived at by reference to available sensitivity assessments such as the Marine Evidence-based Sensitivity Assessment (MarESA) (Tyler-Waters *et al.* 2003), Feature Activity Sensitivity Tool (FeAST) (FeAST Working Group, 2023), and sensitivity analysis of the Celtic Sea and Irish Sea conducted by the Marine Protected Area Advisory Group. Sensitivities were assigned to one of four categories which are defined in **Table 8-17.**

Table 8-17: Sensitivity of receptors

Receptor Sensitivity	Description
High	Habitats or species with a resistance of ‘None’ or ‘Low’ and resilience of ‘Very Low’ (i.e. negligible or prolonged recovery of over 25 years or not at all) Habitats or species with a resistance of ‘None’ or ‘Low’ and resilience of ‘Low' (i.e. recovery within 10 to 25 years)
Medium	Habitats or species with a resistance of ‘None’ and resilience of ‘Medium'(i.e. recovery in 2 to 10 years) or 'High' (i.e. recovery within 2 years) Habitats or species with a resistance of ‘Low’ and resilience of ‘Medium' (i.e. recovery in 2 to 10 years)

Receptor Sensitivity	Description
	Habitats or species with a resistance of 'Medium' and resilience of 'Very Low' (i.e. recovery over 25 years or not at all), 'Low'(i.e. recovery within 10 to 25 years) or 'Medium' (i.e. recovery in 2 to 10 years)
Low	Habitats or species with a resistance of 'Low' and resilience of 'High' (i.e. recovery within 2 years) Habitats or species with a resistance of 'Medium' and resilience of 'High' (i.e. recovery within 2 years) Habitats or species with a resistance of 'High' and resilience of 'Very Low' (i.e. recovery over 25 years or not at all), 'Low'(i.e. recovery within 10 to 25 years) or 'Medium' (i.e. recovery in 2 to 10 years)
Negligible	Habitats or species with a resistance of 'High' and resilience of 'High' (i.e. recovery within 2 years)

Pressures are defined as 'the mechanism by which a human activity or natural event affects the ecosystem' (Robinson, *et al.*, 2008). The pressures used are based on the pressure definitions developed by the OSPAR Intercessional Correspondence Group on Cumulative Effects (ICG-C) – Amended 25th March 2011 (OSPAR, 2011) using benchmarks as defined in MarESA (Tyler-Waters *et al.* 2003).

The magnitude of impact was assessed based on; the scale of the impact, spatial extent, duration, frequency, and consequences (see **Table 8-18**).

Table 8-18: Magnitude of the impact

Magnitude	Definition
High	**Extent:** Impact across the near-field and far-field areas beyond the study area. **Duration:** The impact is anticipated to be permanent (i.e., over 60 years). **Frequency:** The impact will occur constantly throughout the relevant project phase. **Consequences:** Permanent changes to key characteristics or features of the particular environmental aspect's character or distinctiveness.
Medium	**Extent:** The greatest extent of the impact is restricted to the near-field and far-field (i.e., the defined study area). **Duration:** The impact is anticipated to medium-term (i.e., seven to 15 years) to long-term (15 to 60 years). **Frequency:** The impact will occur constantly throughout a relevant project phase. **Consequences:** Noticeable change to key characteristics or features of the particular environmental aspect's character or distinctiveness.

Magnitude	Definition
Low	**Extent:** The greatest extent of the impact is restricted to the near-field and adjacent far-field areas. **Duration:** The impact is anticipated to be temporary (i.e., lasting less than one year) to short-term (i.e., one to seven years). **Frequency:** The impact will occur frequently throughout a relevant project phase. **Consequences:** Barely discernible to noticeable change to key characteristics or features of the particular environmental aspect's character or distinctiveness.
Negligible	**Extent:** The greatest extent of the impact is restricted to the near-field and immediately adjacent far-field areas. **Duration:** The impact is anticipated to be momentary (seconds to minutes) to brief (lasting less than one day). **Frequency:** The impact will occur once or infrequently throughout a relevant project phase. **Consequences:** No discernible to barely discernible change to key characteristics or features of the particular environmental aspect's character or distinctiveness.

The significance of likely effects was assessed by combining the magnitude of impact with the sensitivity of the receptor as per EPA 2022 Guidelines. The description of the likely significant effects follows Table 3.4 of the EPA 2022 guidance. In general, "significant", "very significant" and "profound" effects are interpreted as "likely significant effects" in EIA terms. "Moderate" effects may or may not be considered "likely significant effects" in EIA terms, this is determined as appropriate on each particular assessment. The assessment methodology for determining the significance of likely significant effects is described in **Table 8-19.**

Table 8-19: Significance of likely significant effects

			Sensitivity of receptor			
			High	Medium	Low	Negligible
Magnitude of Impact	Positive	High	Profound or very significant	Significant	Moderate	Imperceptible
		Medium	Significant	Moderate	Slight	Imperceptible
		Low	Moderate	Slight	Slight	Imperceptible
		Negligible	Not significant	Not significant	Not significant	Imperceptible
	Negative	Negligible	Not significant	Not significant	Not significant	Imperceptible

		Sensitivity of receptor			
		High	Medium	Low	Negligible
	Low	Moderate	Slight	Slight	Imperceptible
	Medium	Significant	Moderate	Slight	Imperceptible
	High	Profound or very significant	Significant	Moderate	Imperceptible

8.6 Construction Phase Activities Overview

According to the 2017 EIS and the development construction works were expected to take 25 months in total. A total of 16 months of construction works were completed between January 2023 and the 20th May 2024.

The previous development works included:

- Mobilisation and development of the construction compound and facilities;
- Reclamation works – Rock fill material was imported to reclaim land from the sea and raise the ground level to the high-water mark (+5mCD). This reclaimed land was then used as a construction surface;
- Sequential construction and movement of the 20 drilling and blasting platforms over the quay wall and berthing pocket using imported quarry rock;
- Dredging works to remove the blasted seabed and construct the protective berm around the quay wall trench;
- Installation of 75m of rock armour revetments on the northern and southern ends of the reclamation area;
- Installation of the on-site concrete batching plant;
- Offsite manufacture and delivery of precast concrete caissons. 358 were manufactured and 92 were delivered to site;
- Offsite manufacture of the L-shaped blocks for wall and foundation beams;
- Installation of 48m of quay wall foundations.

Upon confirmation that the planning permission had expired and would not be extended, all construction materials, equipment and facilities were dismantled and removed from the site.

There are several factors that could affect water quality in the vicinity of the development. This includes effects from reclamation, dredging, blasting, pollution from oil/fuel spills, and sedimentation from flood events.

8.7 Construction Phase Mitigation Measures

8.7.1 Pollution Control

There was potential for accidental spills or leaks of fuels, oils, or hydraulic fluids from construction equipment operating near or on the water. Such events, though unlikely if not managed properly, could have caused localised contamination and acute toxicity to marine organisms.

To mitigate these risks, best-practice construction environmental management was maintained. Key measures included bunded fuel storage, spill kits, and regular equipment checks to prevent hydrocarbon leaks and timing in-water works outside biologically sensitive periods, where possible. With these controls in place, the residual impact to marine ecology was predicted to be low, temporary, and localised.

8.7.2 Invasive Alien Species

The construction works completed thus far at Ros an Mhíl present potential pathways for the introduction and spread of invasive alien species (IAS) in the marine environment. Marine infrastructure developments often act as vectors for IAS through increased vessel traffic, ballast water discharge, and the attachment of non-native organisms to construction materials, equipment, and vessel hulls (Minchin and Nunn, 2013). Submerged surfaces can also serve as new hard substrates for colonisation by opportunistic non-native fouling organisms, which may subsequently spread to surrounding natural habitats.

Species of concern in Irish coastal waters include *Didemnum vexillum* (carpet sea squirt), *Crepidula fornicata* (slipper limpet), and *Undaria pinnatifida* (wakame), all of which can outcompete native flora and fauna, alter benthic community structure, and impact commercial aquaculture and fisheries (BIM, 2023). The risk is heightened when construction involves equipment or materials transported from other regions, particularly from areas where IAS are already established.

To minimise the introduction and spread of IAS, a suite of biosecurity measures were implemented during the construction phase. These included cleaning and inspection of all marine plant, vessels, and construction equipment before deployment on site, sourcing materials such as rock fill from terrestrial, non-marine locations and avoiding material with prior aquatic exposure, ensuring that ballast water management practices comply with IMO Ballast Water Management Convention standards, and Development of a Biosecurity Risk Assessment.

8.7.3 Marine Mammal Mitigation

In accordance with the 'Guidance to Manage the Risk to Marine Mammals from Man-made Sounds Sources in Irish Waters' (NPWS, 2014), marine mammal mitigation guidelines were applied for drilling, blasting and dredging operations. An outline of these guidelines is presented below.

8.7.3.1 Dredging

- A 30-minute pre-watch prior to operations was undertaken.
- A WMO sea state four or less, 1km or more of visibility beyond the limits of the mitigation zone, and daylight, was required for the MMO to conduct a pre-watch.
- A mitigation zone of 500m radius from the sound source was implemented.
- Following the detection of a marine mammal within the mitigation zone during the pre-watch, a delay in commencement of operations was adhered to until at least 30 minutes elapsed since the animal was last detected in the mitigation zone.
- During any breaks in sound of >30 minutes, a full 30-minute pre-watch was conducted prior to recommencement of operations.

8.7.3.2 Drilling

- A 30-minute pre-watch prior to operations was undertaken.

- A WMO sea state four or less, 1km or more of visibility beyond the limits of the mitigation zone, and daylight, was required for the MMO to conduct a pre-watch.
- A mitigation zone of 500m radius from the sound source was implemented.
- Following the detection of a marine mammal within the mitigation zone during the pre-watch, a delay in commencement of operations was to be adhered to until at least 30 minutes elapsed since the animal was last detected in the mitigation zone.
- During any breaks in sound of >30 minutes, a full 30-minute pre-watch was conducted prior to recommencement of operations.

8.7.3.3 Blasting

- A 30-minute pre-watch prior to operations was undertaken.
- A WMO sea state four or less, 1km or more of visibility beyond the limits of the mitigation zone, and daylight, was required for the MMO to conduct a pre-watch.
- A mitigation zone of 1,000 radius from the sound source was implemented.
- Following the detection of a marine mammal within the mitigation zone during the pre-watch, a delay in commencement of operations was to be adhered to until at least 30 minutes elapsed since the animal was last detected in the mitigation zone.

8.7.4 Compliance with Marine Mammal Mitigation Measures

Marine mammal mitigation for blasting works commenced on 26th June 2023 and is reported on in full in Volume III, Appendix 8C Marine Mammal Observer Report 2024 of this rEIAR. All blasting operations strictly adhered to the prescribed mitigation measures. However, there was a delay reported between the end of the pre-watch and the blast taking place on a number of occasions. At the end of every blasting pre-watch, and before blasting commenced, the MMO had to be relocated to a secure area due to health and safety requirements. As a result, there were 3-15 minutes windows between the end of the pre-watches and the times the blasts commenced where restricted monitoring took place.

Marine mammal mitigation for drilling commenced on 20th March 2024. Prior to this date, no mitigation for drilling was applied as there was no MMO on site. There were at least two occasions, on 07th March 2024, and on 14th March 2024, where drilling was conducted without an MMO.

Underwater noise generated while dredging is mainly related to the removal mechanism, in the case excavators, underwater noise is generated by the mechanical action of the bucket on the substrate (MTE, 2020). Thus any activity where an excavator bucket impacts the substrate, whether that be the removal of material or repositioning of previously deposited material, can be expected to generate similar noise levels, and NPWS Guidelines should be applied. The most straightforward way to implement this is to ensure an MMO is on site and NPWS Guidelines are implemented for all operations where an excavator bucket is expected to make contact with the seabed or material on the seabed. This was not a condition of the licence, nor was it prescribed in the 2017 EIA. As a result, the implementation of mitigation measures for excavator operations was not consistent throughout the construction phase. The operator attempted to implement mitigation measures to more specific activities of the excavator, which resulted in mitigation measures varying depending on (a) the location of the dredger (i.e. barge-based or land-based), (b) location of the barge (within the berm or outside the berm) or (c) the activity of the dredger (i.e. dredging of sediment/fractured rock, construction of blasting platforms, or placement/repositioning of material during reclamation works).

Marine mammal mitigation for the barge-based excavator operating outside the berm commenced on 7th February 2024. Marine mammal mitigation for the barge-based excavator operating within the open berm commenced on 19th April 2024. Prior to this date, no mitigation measures for the barge-based excavator, operating within the open berm, were applied. The barge-based excavator conducted operations within the berm on occasion without an MMO during this time. Marine mammal mitigation for land-based excavators commenced on 24th April 2024. Prior to this date, no mitigation measures for land-based excavators were applied. Most land-based excavator activity on site prior to 24th March 2024 involved placement of imported stone for the reclamation process which was deemed by the operator not to require marine mammal mitigation. This complicated approach to mitigation resulted in confusion on site and resulted in a number of non-compliances (see points no. 5-7 in **Table 8-20**). A summary of non-compliances and compliance related incidences reported during dredging, drilling and blasting operations are presented below in **Table 8-20.**

Table 8-20: Summary of non-compliance and compliance related incidences reported during dredging, drilling and blasting operations

#	Non-compliance	Dates	Explanation & Corrective Action
1	No MMO on site for **barge-based excavation within the berm**	Prior to 19/04/2024	-
2	No MMO on site for **land-based excavation** (fill activities for reclamation)	Prior to 24/04/2024	Fill and reclamation activities were not considered dredging works that would require MMO.
3	**Drilling** was conducted without the presence of an MMO.	07/04/2024	-
4	**Drilling** was conducted without the presence of an MMO.	14/04/2024	-
5	**Barge-based excavation within the berm** commenced while there was a harbour seal in the mitigation zone (500m from noise source).	19/04/2024	**Dredging from the barge (within the berm)** commenced at 07:30 UTC while there was a harbour seal in the mitigation zone. The excavator operator was confused by seeing a land-based excavator operating in the water (also within the berm) and as a result thought that they could commence operations also.
6	**Barge-based excavation within the berm** commenced without allowing the prescribed 30 minutes for seals to leave the mitigation zone (500m from noise source).following a sighting.	22/04/2024	Five sightings of harbour seals and one sighting of an unidentified seal in the mitigation zone resulted in a delay of 37 minutes to commencing **dredging from the barge (within the berm).** Sightings of the seals were observed between 07:29 UTC and 08:09 UTC, and **dredging from**

#	Non-compliance	Dates	Explanation & Corrective Action
			the barge (within the berm) commenced at 08:17 UTC as the contractor decided they could wait no longer and as a land-based excavator was already operating in the water (also within the berm) prior to the barge commencing operations.
7	**Barge-based excavation within the berm** commenced without allowing the prescribed 30 minutes for seals to leave the mitigation zone (500m from noise source).following a sighting.	23/04/2024	Thirteen sightings of harbour seals and two sightings of grey seal in the mitigation zone resulted in a delay of 1 hour and 24 minutes to commencing **dredging from the barge (within the berm)**. Sightings of the seals were observed between 07:10 UTC and 08:52 UTC and **dredging from the barge (within the berm)** commenced at 08:54 UTC as the contractor decided they could wait no longer and as a land-based excavator was already operating in the water (also within the berm) prior to the barge-based excavator commencing operations
8	A delay reported between the end of the pre-watch and the **blast** taking place on a number of occasions. At the end of every blasting pre-watch, and before blasting commenced, the MMO had to be relocated to a secure area due to health and safety requirements. As a result, there were 3-15 minutes windows between the end of the pre-watches and the times the blasts commenced where restricted monitoring took place.	On a number of blasting occasions.	Practical safety requirement that could not be avoided. Only 3-15 minutes of inadequate monitoring.

8.8 Current Site Status Mitigation

The site was completely cleared of all equipment, facilities and materials when works ceased on the 20th May 2024. The site remains un-used and has been fenced off.

The flood risk to the development is coastal, from either tide surge events in isolation or tides in combination with wave climate. Based on the results of the FRA, the minimum level of the deep water quay was recommended to be +6.7mCD (+3.8m OD Malin) to protect against the present day 200-year return period tidal flood level. The current level of the site is +5mCD. Consequently, the site is susceptible to occasional inundation during spring high tides and other extreme weather events. The clearing of the site has reduced the potential for any contamination of water if the vacant site were to experience a flood event in this period between previous construction works and works to be completed.

There is consequently no operational phase for the development and no additional effects on the marine environment and species are expected.

8.9 Assessment of Construction Phase Post-Mitigation Effects

Relevant pressures were identified based on the OSPAR (2011) pressure definitions; these were aggregated into the following pressures for the purpose of this assessment.

- Habitat disturbance or structure change
- Suspended sediments, smothering and siltation rate changes
- Underwater noise
- Death or injury by collision

The likely significant effect on receptors was assessed for each of the above listed pressures where a realistic impact pathway exists, not all pressures are relevant for each identified receptor.

8.9.1 Habitat Disturbance or Structure Change

Habitat structure change relates to the physical removal of a portion of the sediment as a result of dredging where a residual layer of sediment similar to the pre-dredge structure is retained (Tyler-Walters et al., 2023). Excavation by dredging in the berthing pocket and quay wall trench would have resulted in the abrasion, penetration and removal of substrate and compaction of substrate from mechanical action of dredgers, from placement of spuds or as consequence of rock blasting.

Reclamation of land and the presence of infrastructure would also have resulted in habitat loss and disturbance, however, as this is a permanent impact it is assessed as an operational phase impact (see **Section 8.10.1**).

8.9.1.1 Sensitivity of IEFs

Dredging works were undertaken in areas of infralittoral mixed sediments and circalittoral muds within the berthing pocket and quay wall trench (Aquafact, 2017). This dredging resulted in a temporary change to the habitat where a residual layer of sediment similar to the pre-dredge structure is retained (Tyler-Walters et al., 2023), allowing for recolonisation to occur.

The sensitivity of identified benthic biotopes to habitat disturbance or structural change are presented in **Table 8-21** below. Habitat disturbance is assessed as two separate pressures: abrasion of the surface of the substratum and penetration of substratum subsurface.

Table 8-21: Sensitivity of biotopes to habitat disturbance or structural change

Biotope	Habitat structure change	Abrasion/disturbance of the surface of the substratum	Penetration or disturbance of the substratum subsurface
SS.SCS.CCS.MedLumVen *Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel	Medium	Low	Low
SS.SMu.ISaMu.MelMagThy *Melinna palmata* with *Magelona* spp. and *Thyasira* spp. in infralittoral sandy mud	Medium	Low	Low
SS.SMp.SSgr.Zmar - *Zostera marina/angustifolia* beds on lower shore or infralittoral clean or muddy sand.	High	Medium	High

The impacts of dredging activities (removal of seabed substratum) may have impacted the characterising species of the biotope SS.SCS.CCS.MedLumVen. Extraction of the sediment would have resulted in the removal of characterising and associated species present and therefore resistance is assessed as 'None'. Resilience is assessed as 'Medium' as some species may require longer than two years to re-establish and sediments may need to recover (where exposed layers are different). The sensitivity of the biotope SS.SCS.CCS.MedLumVen to habitat structure change is therefore assessed as 'Medium' (Tillin & Watson, 2024).

The biological assemblage present in the biotope SS.SCS.CCS.MedLumVen is characterized by species that are relatively tolerant of penetration and disturbance of the sediments, therefore resistance is assessed as 'Medium' as some species would likely have been displaced and may have been predated or injured and killed. Resilience is assessed as 'High' as most species will recover rapidly and the biotope was still classified as SS.SCS.ICS.MedLumVen during the recent benthic survey of the area (Aquafact, 2025). Biotope sensitivity to habitat disturbance is therefore assessed as 'Low' (Tillin & Watson, 2024).

The impacts of dredging activities may have removed characterizing and associated species of the biotope SS.SMu.ISaMu.MelMagThys. Resistance is assessed as 'None', resilience is therefore judged as 'Medium', based on the recruitment dispersal limitation of the characterizing fauna (De-Bastos & Watson, 2023). The sensitivity of this biotope to habitat structure change has been assessed as 'Medium' (De-Bastos & Watson, 2023).

The characterizing species of the biotopes SS.SMu.ISaMu.MelMagThys are also likely to have been damaged by abrasion or penetration. Resistance is therefore considered 'Low'. Resilience of the biotopes is likely to be 'High', therefore, the biotopes sensitivity to habitat disturbance is likely to be 'Low' (De-Bastos & Watson, 2023).

Typically, the extraction of sediments to 30 cm (the benchmark) within the pressure footprint of dredging causes the complete removal of seagrass beds from the biotope SS.SMp.SSgr.Zmar. The resistance of this biotope to habitat structure change is assessed as 'None', resilience is considered 'Very Low' resulting in a sensitivity score of 'High' (d'Avack, *et al.*, 2024). Similarly, the biotope SS.SMp.SSgr.Zmar has limited resistance to habitat disturbance in the form of abrasion and penetration, sensitivity to these pressures is 'Medium' to 'High' depending on the nature and extent of the pressure. Given that this biotope falls outside of the immediate footprint of the dredging zone, it is unlikely that seagrass beds would have been impacted in this way. Therefore, for the purpose of this assessment, this pressure is not considered relevant to the biotope SS.SMp.SSgr.Zmar (d'Avack, *et al.*, 2024).

Benthic fish and invertebrate species occurring within this area are assessed collectively as 'Medium' sensitivity. These species are closely associated with benthic habitats, and some species or life stages have limited mobility and may have been unable to avoid this impact, however, recovery of species is expected within 2 years.

Demersal fish, cephalopod and elasmobranch species occurring within this area are assessed collectively as 'Medium' sensitivity. The adults of these species are highly mobile and are unlikely to have been directly affected by this pressure; however, the juveniles or eggs of certain species present in the area may have reduced ability to relocate. Recovery is anticipated to be rapid (within 2 years).

8.9.1.2 Magnitude of Impact

Dredging caused the temporary change of the structure of the benthic habitat. Marine invertebrates quickly re-colonise the seabed after a disturbance such as burial under sediment deposition and it is anticipated that the same species that were previously recorded will be re-establishing themselves within two or more years after remaining dredging activities for the development. The extent of the impact is equal to the total dredge area within the berthing pocket and quay wall trench which is low in comparison to the total area of available benthic habitats in Cashla Bay supporting similar biotopes. The duration of the activity is short; recolonisation of the habitat by epifauna and infauna is expected to occur in the short term, 1-7 years. The magnitude of impact from habitat structure change is therefore assessed as 'Low' for all benthic habitats and species, demersal fish, cephalopod and elasmobranch species.

8.9.1.3 Significance of Habitat Disturbance/Change Effect

For the purpose of this assessment, the likely significant effect of habitat structure change, abrasion of the surface of the substratum, and penetration of the substratum subsurface have been collectively assessed as a single pressure; 'habitat disturbance or structure change'. The overall sensitivity of receptors to this pressure was determined as the highest sensitivity score assigned for any single pressure.

The biotope SS.SCS.CCS.MedLumVen was assessed as having 'Medium' sensitivity to habitat disturbance or structure change, the magnitude of the impact was assessed as 'Low'. Therefore, the likely significant effect of habitat structure change on circalittoral mud community is assessed as 'Slight negative'.

The biotope SS.SMu.ISaMu.MelMagThys was assessed as having 'Medium' sensitivity to habitat disturbance or structure change, the magnitude of the impact was assessed as 'Low'. Therefore, the likely significant effect of habitat structure change on circalittoral mud community is assessed as 'Slight negative'.

The benthic fish and invertebrate species assemblage is assessed as having 'Medium' sensitivity to habitat structure change, the magnitude of the impact was assessed as 'Low'. Therefore, the likely significant effect of habitat structure change on circalittoral mud community is assessed as 'Slight negative'.

The demersal species assemblage is assessed as having 'Medium' sensitivity to habitat structure change, the magnitude of the impact was assessed as 'Low'. Therefore, the likely significant effect of habitat structure change on circalittoral mud community is assessed as 'Slight negative'.

The rating of pre-mitigation likely significant effect of habitat disturbance or structure change from construction phase dredging and blasting and remedial mitigation, if required, for all relevant receptors is presented in Table 8-22.

Table 8-22: Rating of pre and remedial mitigation LSE of habitat disturbance or structure change from construction phase dredging and blasting

Ecological Feature Affected	Quality of Effect	Sensitivity	Duration	Magnitude	Significance	Remedial Mitigation Measures	Residual Significance Rating
SS.SCS.CCS.MedLumVen	Negative	Medium	Short-term	Low	Slight	None	Slight
SS.SMu.ISaMu.MelMagThys	Negative	Medium	Short-term	Low	Slight	None	Slight
Benthic fish and invertebrate species	Negative	Medium	Short-term	Low	Slight	None	Slight
Demersal fish, cephalopod and elasmobranch species	Negative	Medium	Short-term	Low	Slight	None	Slight

8.9.2 Suspended Sediments, Smothering and Siltation Rate Changes

Land reclamation, drilling and blasting of rock, and excavation by dredging in the quay wall trench and berthing pocket would have caused the resuspension of fine sediment and hence potential increased suspended sediments, smothering and siltation rate changes in the surrounding environment.

Turbidity monitoring was undertaken during the development works at Ros an Mhíl using two Toroidal buoys equipped with Hydrolab MS5 probes. A number of peaks in turbidity were reported which were attributed to blasting operations, dredging works of the blasted rock, placement of fill material for reclamation, and installation of quay wall foundations. The spikes in data turbidity from April until May 2023 were attributed to the reclamation works that occurred at the site. Dredging works of the blasted rock did not occur until after the 11th of July 2023, which the increase in turbidity can be attributed to during that period. Subsequent spikes in turbidity up until May 2024 can be associated with the remaining dredging works of blasted rock in the berthing pocket and quay wall trench, fill material for reclamation, and remaining blasting works.

8.9.2.1 Sensitivity of IEFs

The main environmental effects of increased turbidity levels as a result of increase in suspended solids are a reduction in penetration of light into the water column, suspended-sediment impacts on filter-feeding organisms and increased deposition of particulates in low-energy environments. The pressure benchmark for changes in suspended sediments is “a change in one rank on the Water Framework Directive scale for one year”. The pressure benchmark for ‘light’ smothering and siltation rate change is “light deposition of up to 5 cm of fine material added to the habitat in a single, discrete event” and ‘heavy’ smothering and siltation rate change is “heavy deposition of up to 30 cm of fine material added to the habitat in a single discrete event” (Tyler-Walters et al., 2023). The sensitivities of biotopes to suspended sediments, smothering and siltation rate changes are presented in **Table 8-23.**

Table 8-23: Sensitivity of biotopes to suspended sediments, smothering and siltation rate changes

Biotope	Changes in suspended solids	Smothering & siltation rate changes (Light: <5cm)	Smothering & siltation rate changes (Heavy: <30cm)
SS.SCS.CCS.MedLumVen *Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel	Low	Low	Medium
SS.SMu.ISaMu.MelMagThy *Melinna palmata* with *Magelona* spp. and *Thyasira* spp. in infralittoral sandy mud	Low	Not sensitive	Low
SS.SCS.CCS.SpiB *Spirobranchus triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	Not sensitive	Not sensitive	Low
CR.HCR.XFa.FluCoAs.SmAs - *Flustra foliacea*, small solitary & colonial ascidians on tide swept circalittoral bedrock or boulders	Not sensitive	Low	Medium
SS.SMx.CMx.FluHyd - *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	Not sensitive	Not sensitive	Low
SS.SMp.SSgr.Zmar - *Zostera marina/angustifolia* beds on lower shore or infralittoral clean or muddy sand.	High	Medium	High

The biotope SS.SCS.CCS.MedLumVen is considered to have 'Medium' sensitivity to 'heavy' deposition of fine material added to the seabed in a single discrete event (Tillin & Watson, 2024). However, for 'light' deposition, this biotope is considered to have 'Low' sensitivity at the benchmark threshold (Tillin & Watson, 2024).

The biotope SS.SCS.CCS.MedLumVen is assessed as 'Medium' resistance to changes in suspended sediments as there may have been some shift in the structure of the biological assemblage although the biotope was still present and characterized as SS.CCS.MedLumVen during the most recent benthic survey (Aquafact, 2025). Resilience is assessed as 'High' (following restoration of typical conditions) and sensitivity is assessed as 'Low' (Tillin & Watson, 2024).

The biotope SS.SMu.ISaMu.MelMagThy is likely resistant to 'light' smothering at the benchmark level. The majority of the associated fauna are burrowing infauna making them adaptive to light sediment deposition conditions. Their resistance 'light' deposition is therefore assessed as 'High', and resilience 'High' with their overall sensitivity assessed as 'Not Sensitive' at benchmark level (De-Bastos & Watson, 2023). Under 'heavy' deposition conditions, bivalves and polychaetes have been reported to migrate through depositions of sediment greater that the benchmark level (De-Bastos & Watson, 2023). Some mortality of the characterizing species is likely to have occurred depending on the characteristics of the substrate deposited. Resistance to 'heavy' deposition is therefore assessed as 'Low' (25-75% loss) and resilience as 'High' and the biotopes are considered to have 'Low' sensitivity to a 'heavy' deposition of up to 30 cm of fine material in a single discrete event (De-Bastos & Watson, 2023).

Changes to suspended sediments can alter the infauna of a deposit feeding community which is essentially food limited. This may have led to a shift in the community structure at Ros an Mhíl with increased abundance of deposit feeders and a lower proportion of suspension feeders (as feeding is inhibited where suspended particulates are high and the sediment is destabilised by the activities of deposit feeders), however, the biotope was still present and characterized as SS.SMu.ISaMu.MelMagThy during the most recent benthic survey (Aquafact, 2025). The characterizing species of the biotope SS.SMu.ISaMu.MelMagThy are likely to resist a change in one rank on the WFD (Water Framework Directive) scale e.g. from clear to intermediate. But some species, such as *Melinna palmata, Thyasira* spp. and *Abra* spp., would be adversely impacted where a change from intermediate to medium (100-300 mg/l) turbidity occurred. Resistance is therefore assessed as 'Low'. Resilience is likely to be 'High', so the biotopes are considered to have 'Low' sensitivity to a change in suspended solids at the pressure benchmark level (De-Bastos & Watson, 2023).

The biotope SS.SMp.SSgr.Zmar, containing the characterising seagrass *Zostera marina,* can be significantly impacted by both 'light' and 'heavy' deposition depending on the depths of burial and sediment type (d'Avack, *et al.*, 2024). Several studies have investigated the impact of smothering on *Zostera* beds, with most studies indicating that some degree of mortality and biomass loss will occur at burial depths of 5cm. Munke *et al.* (2015) noted that the effect of burial depended on the actual leaf length rather than species size. In their experimental field study in Kiel Bight, Munke *et al.* (2015) found negative effects on shoot mortality, delayed growth and flowering and reduced carbohydrate storage even after burial under the sand at 5 cm (ca 10% of plant height). The effects were significant enough to affect the next year's growth. Burial by greater than 5 cm resulted in shoot mortality but burial by 5 cm reduced maximum biomass, leaf length, starch storage and flowering capacity.

The SS.SMp.SSgr.Zmar biotope is assessed as having low resistance to 'light' deposition; however, some plants may survive, and rhizome reestablishment may occur, resilience is therefore assessed as 'Medium' at the pressure benchmark. In addition, seagrass beds occur in low energy environments, suggesting that silt deposition may not be quickly flushed away. Therefore, sensitivity of this biotope is considered as 'Medium' to siltation at the pressure benchmark (d'Avack, *et al.*, 2024). 'Heavy' siltation is likely to cause significant damage to such biotopes with all individuals highly likely not to survive. Resistance to 'heavy' sedimentation at the pressure benchmark (30 cm of added material) is therefore assessed as 'None', with resilience as 'Low' to 'Very Low'. Sensitivity of this biotope is therefore assessed as 'High' (d'Avack, *et al.*, 2024).

Water clarity is a vital component for seagrass beds as it determines the depth-penetration of photosynthetically active radiation of sunlight. Seagrasses have light requirements an order of magnitude higher than other marine macrophytes making water clarity a primary factor in determining the maximum depth at which seagrasses can occur. Increases in turbidity over a prolonged period of time are therefore highly likely to impact seagrass species. The growth of both *Zostera marina* and its associated epiphytes are reduced by increased shading due to turbidity and intensive shading inhibits flowering in *Zostera marina* plants. Thus, turbidity is an important factor controlling production and ultimately survival and recruitment of seagrasses. Seagrass populations are likely to survive short-term increases in turbidity, however, a prolonged increase in light attenuation, especially at the lower depths of its distribution, will probably result in loss or damage of the population. Therefore, resistance to changes in suspended sediments is assessed as 'Low'. A loss of seagrass beds will promote the re-suspension of sediments, making recovery unlikely as seagrass beds are required to initially stabilise the sediment and reduce turbidity levels. A high turbidity state appears to be a highly resilient alternative stable state; hence return to the seagrass biotope is unlikely resulting in 'Low' resilience. *Zostera marina* is considered intolerant of any activity that changes the sediment regime where the change is greater than expected due to natural events, and sensitivity is assessed as 'High' (d'Avack, *et al.*, 2024).

While marine mammals are not directly dependent on water clarity for navigation or communication, elevated turbidity can influence them indirectly through effects on their prey base (e.g., fish, cephalopods), reducing foraging efficiency. These impacts are of particular relevance during periods of high marine mammal activity such as the harbour seal moulting season (August–September), when animals may spend extended periods in nearshore waters. The sensitivity of harbour seal to changes in suspended sediments is therefore assessed as 'Medium', while the sensitivity of all other marine mammals is assessed as 'Low'.

Many fish and shellfish species are sensitive to increased levels of suspended sediments, this can include direct mortality, behavioural changes and impacts to foraging ability (Wenger, *et al.,* 2017), the impacts are species and life stage specific. Adult individuals of these species would have been able to relocate; however, eggs, larvae and juveniles may have been greater affected. However, considering the relatively small scale and short duration of this pressure, sensitivity to changes in suspended sediments is assessed as 'Low' for all fish and shellfish species. Habitats and species sensitivity is shown in Table 8-24.

8.9.2.2 Magnitude of Smothering Effect

Drilling and blasting of rock, and excavation by dredging in the quay wall trench and berthing would have temporarily resuspended fine particular matter within the vicinity of the activity. The dredged material consisted largely of rock fragmented by blasting which was then used to construct the blasting platform at the next blast location. However, smaller sediment particles would have also been part of the sediment particle composition. Larger material would have dropped out of suspension rapidly, while finer material will have been dispersed over a broader area. The extent to which turbidity is affected is a function of particle size and flow velocity (Earle, 2014), the maximum extent of the impact is estimated to be equivalent to one tidal excursion. The scale of this pressure was low since the non-rock portion of the removed sediment was minimal, the majority of which would have been retained in the dredge bucket. As the majority of works were undertaken within the protective berm there was reduced potential for significant quantities of suspended sediments to disperse beyond the confines of the semi enclosed berm.

Considering the relatively small quantities and large particle size of material being removed, short duration of the pressure, the presence of a protective berm, and since the dispersion of suspended sediment is limited by tidal flow and direction, the magnitude of impact to benthic communities as a result of changes in suspended sediments and siltation rates is assessed to have been 'Negligible'.

Suspended sediments, smothering and siltation rate changes are unlikely to have affected the *Zostera* beds, which are located on the shallow western shore of Cashla Bay, as the as the current flows in and out in a north to south direction, and therefore sediment suspension is likely to have been carried and deposited south of the development in Cashla Bay. The magnitude of impact is therefore assessed as 'Negligible'.

Considering the relatively small quantities and large particle size of material removed, the presence of a protective berm, and short duration of the impact, the magnitude of impact to all other IEFs as a result of changes in suspended sediments and siltation rates is assessed to have been 'Negligible'.

8.9.2.3 Significance of Smothering Effect

For the purpose of this assessment, the likely significant effect of changes in suspended solids, 'light' smothering and siltation rate changes, and 'heavy' smothering and siltation rate changes have been collectively assessed under the heading; 'suspended sediments, smothering and siltation rate change'.

The biotope SS.SCS.CCS.MedLumVen was assessed as having 'Low' sensitivity to changes in suspended sediments or 'light' deposition and was assessed as having 'Medium' sensitivity to 'heavy' deposition, the magnitude of the impact was assessed as 'Negligible'. Therefore, the likely significant effect of habitat structure change on circalittoral mud community is assessed as 'Not significant'.

The biotope SS.SMu.ISaMu.MelMagThy was assessed as having 'Low' sensitivity to suspended sediments, smothering and siltation rate change, the magnitude of the impact was assessed as 'Negligible'. Therefore, the likely significant effect of suspended sediments, smothering and siltation rate change is assessed as 'Not significant'.

Harbour seal was assessed as having a sensitivity of 'Medium' to changes in suspended sediments, the magnitude of the impact was assessed as 'Low'. Therefore, the likely significant effect of changes in suspended sediments on fish and shellfish is assessed as 'Slight negative'. All other marine mammals are assessed as having a sensitivity of 'Low' to changes in suspended sediments, the magnitude of the impact was assessed as 'Low'. Therefore, the likely significant effect of changes in suspended sediments on fish and shellfish is assessed as 'Slight negative'.

All fish and shellfish species are assessed as having a sensitivity of 'Low' to changes in suspended sediments, the magnitude of the impact was assessed as 'Low'. Therefore, the likely significant effect of changes in suspended sediments on fish and shellfish is assessed as 'Slight negative'.

The rating of pre-mitigation likely significant effect of suspended sediments, smothering and siltation rate changes from construction phase dredging and blasting and remedial mitigation, if required, for all relevant receptors is presented in Table 8-24.

Table 8-24: Rating of pre and remedial mitigation LSE of suspended sediments, smothering and siltation rate changes from construction phase dredging and blasting

Ecological Feature Affected	Quality of Effect	Sensitivity	Duration	Magnitude	Significance	Remedial Mitigation Measures	Residual Significance Rating
SS.SCS.CCS.MedLumVen	Negative	Low to Medium	Temporary to Short-term	Negligible	Not significant	None	Not significant
SS.SMu.ISaMu.MelMagThy	Negative	Low	Temporary to Short-term	Low	Slight	None	Slight
Harbour seal	Negative	Medium	Temporary to Short-term	Negligible	Not significant	None	Not significant
Other marine mammals	Negative	Low	Temporary to Short-term	Negligible	Not significant	None	Not significant
Anadromous species	Negative	Low	Temporary to Short-term	Negligible	Not significant	None	Not significant
Marine fish and shellfish	Negative	Low	Temporary to Short-term	Negligible	Not significant	None	Not significant

8.9.3 Underwater Noise Effects from Reclamation and Dredging

Noise from Land Reclamation and Construction of Berms and Blasting activities

The construction of the deep water quay required the reclamation of 2.4 ha of additional land along the existing shoreline. This involved the transport of approximately 390,000 tonnes (or 200,000m³) of stone from local quarries to the site. The marine area below each blasting platform for the quay wall trench and berthing pocket was filled with rocks up to the high-water level using either imported rock or rock material that was previously used as a blasting platform. The land reclamation and construction of temporary protective berms and blasting platforms was achieved using 360º excavators operating either from land, a berm or a floating barge platform.

Underwater noise generated while dredging is mainly related to the removal mechanism, in the case excavators, underwater noise is generated by the mechanical action of the bucket on the substrate (MTE, 2020). Any operation or activity involving the mechanical action of an excavator on the seabed can be expected to give rise to similar noise levels.

The plant used for land reclamation and construction of berms and blasting platforms was the same plant used for dredging operations, and the material used for construction was either dredged material or similar local rock. The underwater noise associated with these activities is therefore considered similar to underwater noise associated with dredging undertaken during the development, and the impacts of these activities are considered in the section which follows.

Noise from Dredging

The dredging of the blasted rock began just after the 11th July 2023 using excavators on the platform and/or on floating pontoons. The dredger used had the power and the bucket size to rip out boulders, as well as the ability to dislodge any blasted rock which was not bulked up after blasting. The dredged rock was used to create each new blasting platform and the protective temporary berm on the sea (west) side of the quay wall trench, and in some cases to fill the remaining depressions in the reclaimed area. All the dredged material was rock rather than sand or silt. Some dredging has also been conducted in the channel just outside the berthing pocket. This was for the creation of the berthing pocket on the seaward side of the quay wall.

Dredging activities are omni-directional, low frequency, continuous sound sources. Dredging generally produces continuous broadband frequencies concentrated at or below 1kHz. Noise produced during dredging varies depending on the type of dredger used, operational phase and the characteristics of the dredged material (MTE, 2020). Sound pressure levels (SPL) from dredging can range from 160 to more than 180dB re 1 µPa at 1m (Thomsen, *et al.*, 2009). Sound pressure reported from backhoe dredgers has been reported from the Shetland islands of 163dB re 1 µPa at 1m SPL (Nedwell, *et al*., 2008), while Reine, *et al.* (2012) reported SPL of 179db re 1 µPa at 1m with maximum energy recorded between 20-300Hz. Ripping of fractured rock could be anticipated to produce sound levels similar to the operation of cutting suction dredger of 179db re 1 µPa/ √Hz at 1m (MTE, 2020).

The addition of anthropogenic underwater noise to the marine environment is recognised as a significant pressure on variety of marine species, particularly marine mammals and fish capable of detecting sound pressure. All marine mammals, fishes, and marine turtles can detect sound, however, sensitivity to sound varies greatly between species. Marine mammals are generally grouped into broad hearing groups based on frequency-specific sensitivity (Southall, *et al.*, 2019), while fish are grouped into hearing groups based on the presence of anatomical structures involved in hearing (Popper, *et al.*, 2014). Data on hearing in marine turtles is limited, however, turtles are generally understood to have hearing capabilities more similar to that of fish than marine mammals (Popper, *et al.*, 2014).

Underwater noise can impact marine species in a number of ways, including death or mortal injury, recoverable injury, permanent or temporary hearing threshold shift, behavioural impacts or masking of vocalisations. For the purpose of this assessment, the impacts of construction or operational activities are assessed based on their potential to cause; (a) injury or (b) disturbance, to an identified hearing group.

In marine mammals, an injury is defined as; mortality, mortal injury or injury to the hearing structures resulting in auditory threshold shift. Recoverable injury to these hearing structures is referred to as temporary hearing threshold shift (TTS), if recovery does not occur over a relatively long interval the injury is termed a permanent threshold shift (PTS) (Southall, et al., 2007). A disturbance is defined as a behavioural impact including; the masking of vocalisations, disturbance of normal activities and avoidance of impacted areas.

In fish, an injury is defined as; mortality, mortal injury or recoverable injury, while a disturbance is defined as; TTS, behavioural impact or masking of vocalisations. Note, in contrast to marine mammals, TTS is considered a disturbance in fish as the sensory hairs cells of the inner ear of fish are regularly replaced, thereby mitigating damage to these structures (Popper, *et al.*, 2014).

Multiple activities necessary for the completion of the development have the potential to input significant anthropogenic underwater noise to the receiving environment. These activities are;

- Land reclamation, and construction of protective berms and blasting platforms using excavators;
- Dredging;
- Drilling; and
- Blasting.

8.9.3.1 Sensitivity of IEFs to underwater noise from land reclamation and dredging

<u>Marine mammals</u>

All cetaceans and pinnipeds rely on sounds for a variety of biological and social activities and are sensitive to anthropogenic underwater noise. Marine mammals use sound to locate prey, maintain social interactions, navigate, avoid predators and communicate over large distances. Marine mammals are generally separated into broad hearing groups in recognition of differences in frequency-specific hearing sensitivities between species. **Table 8-25** presents relevant marine mammal hearing groups and species potentially occurring in Cashla Bay based on hearing groups proposed by Southall, et al. (2019).

Table 8-25: Marine mammal hearing groups from Southall, et al., 2019

Marine mammal hearing group	Auditory weighting function	Genera (or species) included
Low-frequency cetaceans	LF	Minke whale, humpback whale
High-frequency cetaceans	HF	Bottlenose dolphin, common dolphin, orca, white-sided dolphin, white-beaked dolphin, Risso's dolphin
Very high- frequency cetaceans	VHF	Harbour porpoise
Phocid carnivores in water/ Phocid carnivores in air	PCW/ PCA	Harbour seal, grey seal

Marine mammal hearing group	Auditory weighting function	Genera (or species) included
Other marine carnivores in water/ Other marine carnivores in air	OCW/ OCA	Otter

Southhall, *et al.*, (2019) generated modified noise exposure criteria for TTS and PTS onset. TTS-onset for impulsive noise was estimated using frequency weighted exposure levels. Southhall, *et al.*, (2019) proposed dual metric criteria for impulsive noise (frequency-weighted sound exposure level (SEL) and unweighted peak sound pressure level (SPL)), while only weighted SEL are presented for non-impulsive noise. **Table 8-26** shows TTS- and PTS- onset thresholds in weighted SEL for marine mammals exposed to non-impulsive noise. **Table 8-27** shows TTS- and PTS-onset thresholds in weighted SEL and peak SPL for marine mammals exposed to impulsive noise. PTS-onset threshold is the metric used to indicate injury in a marine mammal, while TTS-onset can be used as a proxy for behavioural impacts (Southall, *et al.*, 2007).

Table 8-26: TTS- and PTS-onset thresholds for marine mammals exposed to non-impulsive noise: SEL thresholds in dB re 1 µPa2s under water and dB re (20 µPa)2s in air (groups PCA and OCA only) from Southall, *et al.*, 2019

Marine mammal hearing group	TTS onset: SEL (weighted)	PTS onset: SEL (weighted)
LF	179	199
HF	178	198
VHF	153	173
PCW	181	201
OCW	199	219
PCA	134	154
OCA	157	177

Table 8-27: TTS- and PTS-onset thresholds for marine mammals exposed to impulsive noise: SEL thresholds in dB re 1 µPa2s under water and dB re (20 µPa)2s in air (groups PCA and OCA only); and peak SPL thresholds in dB re 1 µPa under water and dB re 20 µPa in air (groups PCA and OCA only) from Southall, *et al.*, 2019

Marine mammal hearing group	TTS onset: SEL (weighted)	TTS onset: Peak SPL (unweighted)	PTS onset: SEL (weighted)	PTS onset: Peak SPL (unweighted)
LF	168	213	183	219
HF	170	224	185	230
VHF	140	196	155	202
PCW	170	212	185	218
OCW	188	226	203	232
PCA	123	138	138	144

Marine mammal hearing group	TTS onset: SEL (weighted)	TTS onset: Peak SPL (unweighted)	PTS onset: SEL (weighted)	PTS onset: Peak SPL (unweighted)
OCA	146	161	161	167

Fish and Marine Turtles

Sound plays a vital role in the life of fish which also may use sounds for important biological functions such as communication, predator avoidance and environmental ques such as the location of a reef. Hearing sensitivity in fish varies between species; all fish detect the particle motion component of the sound field through the response of the otolithic organ, while some fish have gas filled structures near the ear and/or extensions of the swim bladder providing sensitivity to sound pressure (Popper, *et al.*, 2014). Popper, *et al.*, (2014) categorised the hearing of fish based on the presence of a swim bladder and its use in hearing and sound production:

- Group 1: Fishes with no swim bladder or other gas chamber (e.g. flatfish and elasmobranchs)
- Group 2: Fishes with swim bladders in which hearing does not involve the swim bladder or other gas volume (e.g., Atlantic salmon, sea trout)
- Group 3: Fishes in which hearing involves a swim bladder or other gas volume (e.g., European eel, Atlantic cod, herring and relatives)
- Sea turtles
- Eggs and larvae

Table 8-28 below provides sound exposure guidelines for fish, sea turtles and eggs and larvae exposed to noise from underwater explosions from Popper, *et al.*, (2014). Guidelines are not provided for masking since the animals are not exposed to more than a few explosive events, and masking would not last beyond the period of exposure. Relative risk was defined as high, moderate or low, and is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F). Specific distances were not ascribed to effects however "near" might be considered to be in the tens of meters from the source, "intermediate" in the hundreds of meters, and "far" in the thousands of meters (Popper, *et al.*, (2014).

Table 8-28: Sound exposure guidelines for explosions from Popper, et al., (2014)

Type of Animal	Mortality and potential mortal injury	Recoverable injury	TTS	Masking	Behaviour
Group 1 (e.g. flatfish and elasmobranchs)	229 - 234 dB peak	(N) High (I) Low (F) Low	(N) High (I) Moderate (L) Low	NA	(N) High (I) Moderate (F) Low
Group 2 (e.g. salmon and sea trout)	229 - 234 dB peak	(N) High (I) High (F) Low	(N) High (I) Moderate (F) Low	NA	(N) High (I) High (F) Low

Type of Animal	Mortality and potential mortal injury	Recoverable injury	TTS	Masking	Behaviour
Group 3 (e.g. cod, herring and relatives)	229 - 234 dB peak	(N) High (I) High (F) Low	(N) High (I) High (F) Low	NA	(N) High (I) High (F) Low
Sea turtles	229 - 234 dB peak	(N) High (I) High (F) Low	(N) High (I) High (F) Low	NA	(N) High (I) High (F) Low
Eggs and larvae	>13 mm s^{-1} peak velocity	(N) High (I) Low (F) Low	(N) High (I) Low (F) Low	NA	(N) High (I) Low (F) Low

Notes: peak and rms sound pressure levels dB re 1 µPa. All criteria are presented as sound pressure. Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F).

Table 8-29 below provides sound exposure guidelines for fish, sea turtles and eggs and larvae exposed to non-impulsive noise such dredging, drilling or shipping. Relative risk was defined as high, moderate or low, and is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F). Specific distances were not ascribed to effects however "near" might be considered to be in the tens of meters from the source, "intermediate "in the hundreds of meters, and "far" in the thousands of meters (Popper, *et al.*, (2014).

Table 8-29: Sound exposure guidelines for shipping and continuous sounds from Popper, et al., (2014)

Type of Animal	Mortality and potential mortal injury	Recoverable injury	TTS	Masking	Behaviour
Group 1 (e.g. flatfish and elasmobranchs)	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Group 2 (e.g. salmon and sea trout)	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low

Type of Animal	Mortality and potential mortal injury	Recoverable injury	TTS	Masking	Behaviour
Group 3 (e.g. cod, herring and relatives)	(N) Low (I) Low (F) Low	170 dB rms for 48 h	158 dB rms for 12 h	(N) High (I) High (F) High	(N) High (I) Moderate (F) Low
Sea turtles	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) High (I) Moderate (F) Low
Eggs and larvae	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low	(N) Moderate (I) Moderate (F) Low

Notes: rms sound pressure levels dB re 1 µPa peak and sound exposure levels; SEL dB re 1 µPa2·s. All criteria are presented as sound pressure. Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F).

Marine Invertebrates

Many marine invertebrates are also sensitive to sound, however, hearing in these species is achieved through sensitivity to particle motion component of the sound field. Studies of hearing in marine invertebrates are limited, our understanding of the impact of anthropogenic sound on marine invertebrates is also currently limited (Hawkins, 2014). Currently there are no sound exposure guidelines for injury or behavioural impacts to marine invertebrates. As such, it is not possible to assess sensitivity of these species to underwater noise, they are therefore assessed collectively with Group 1 fish for the purpose of this assessment.

Sensitivity to Injury Resulting from Underwater Noise Produced by Dredging Activities

Peak frequencies during dredging operations at Ros an Mhíl are expected to have been <1kHz. Low frequency cetaceans, such as minke whales and humpback whales, are most sensitive to noise at these frequencies. Noise levels of up to 180dB re 1 µPa at 1m may have been reached during operations, such levels have the potential to cause injury to animals but only at very close distance from the sound source (<50m). Minke whale and humpback whale are therefore assessed as having 'Negligible' sensitivity to injury as a result of underwater noise produced by dredging operations.

The peak frequencies of dredging operations at <1kHz are below the peak sensitivity of high frequency cetaceans such as common dolphin and bottlenose dolphin, very high frequency cetaceans such as harbour porpoise and both seal species. Additionally, noise levels of up to 180dB re 1 µPa at 1m are unlikely to have caused injury to species in these functional hearing groups. The sensitivity of these species to injury as a result of underwater noise produced by dredging operations is therefore assessed as 'Negligible'.

The peak frequencies of dredging operations also coincide with the peak sensitivity of many fish species. Noise from continuous sources such as dredging present a low risk of mortality, mortal injury or recoverable to fish in functional hearing Groups 1 & 2, and marine turtles (Popper, *et al.*, 2014). The sensitivity of these species to injury as a result of underwater noise produced by dredging operations is therefore assessed as 'Negligible'. The risk of mortality or mortal injury is also low for hearing Group 3 fish species, however, they could potentially have suffered recoverable injury following exposure to SPL of 170dB re 1 µPa at 1m for 48hrs. The sensitivity of these species to injury as a result of underwater noise produced by dredging operations is therefore assessed as 'Low'.

<u>Sensitivity to Disturbance Resulting from Underwater Noise Produced by Dredging Operation</u>

Low frequency noise from dredging was likely above ambient noise levels at some distance from the site of operations, potentially causing disturbance of low frequency cetaceans, however, given the paucity of records of minke whale and humpback whale in the area, sensitivity to disturbance as a result of underwater noise produced by dredging operations is assessed as 'Negligible'.

Levels of the low frequency noise from dredging operations may have been above ambient levels at extended distance from the sound source and therefore potential disturbance to other functional hearing groups of marine mammals in the area may have occurred. The sensitivity of these species to disturbance as a result of underwater noise produced by dredging operations is assessed as 'Low'.

Cashla Bay is identified as a nursery ground for a number of hearing Group 1 fish including mackerel, horse mackerel, white-bellied monkfish, spurdog and common skate complex. Salmon and sea trout (Group 2) also migrate through the bay annually. Noise levels generated posed a moderate risk of TTS in the near field, a moderate risk of behavioural impact in the intermediate field, and a high risk of masking in the intermediate field for hearing Group 1 & 2 fish and marine turtles. Group 3 fish, such as European eel, herring or cod, could have potentially suffered TTS following exposure to SPL of 158dB re 1 µPa at 1m for 12hrs. Masking is likely to have occurred over far-field distances while behavioural impacts may have occurred in the intermediate field. Cashla Bay is identified as a nursery ground for a number of Group 3 fish including cod, herring, whiting, ling and hake; and herring spawning grounds are reported at Cashla Point. European eel may also migrate through the bay annually.

The noise output from dredging at Ros an Mhíl was estimated at up to a maximum of 180dB re 1 µPa at 1m, this is a conservative estimate based on reported outputs from similar projects and does not account for the use of a protective berm. The extent of the impact of disturbance from dredging would have been largely limited to within a few hundred meters of the sound source, the species affected are mobile and capable of avoiding the area, nursery grounds identified in the area are widespread and common and rapid recovery is expected to have occurred following cessation of operations. The sensitivity of all fish and marine turtles to disturbance as a result of underwater noise produced by dredging operations is therefore assessed as 'Low'.

8.9.3.2 Magnitude of Impact

The duration of the impact was short term, and the magnitude of the works is considered low given the relatively small quantities of material dredged. The protective berm constructed around the site would have provided a degree of sound abatement, reducing the input of sound to the wider Cashla Bay to some extent. However, noise levels may have been above ambient sound levels at extended distance from the sound source and could have resulted in disturbance or masking of biologically significant communication.

Noise levels during dredging could theoretically have resulted in injury to LF cetaceans but only within extremely close range of operations. Rogan, *et al.* (2018) calculated the summer density of minke whale in western coastal waters at 0.102 animals/km^2. The total area of suitable habitat available in Cashla Bay is approximately 5.78km^2, which excludes intertidal and shallow subtidal waters. The potential abundance of minke whale in Cashla Bay is therefore estimated at 0.59 individuals. No humpback whales were recorded during surveys conducted by Rogan, *et al.*, therefore abundance of humpback whale in the area is assumed to be less than that of minke whale. No sightings of baleen whales were reported by the marine mammal observers (MMOs) on site during operations (see **Volume III, Appendix 8A** Aquafact Marine Survey Report 2016 of this rEIAR). Considering the low abundance of LF cetaceans in the area, the magnitude of impact causing injury or disturbance is assessed as 'Negligible'.

For all other functional hearing groups of marine mammals, predicted sound levels are not sufficiently high to have caused injury to any of these species at distances of more than 10-20 meters from the source, the magnitude is considered to be 'Negligible' for these species. There is, however, potential that disturbance to these species occurred as a result of noise from dredging. Since impacts would have been restricted to the near-field and adjacent far-field, the duration was short-term, and rapid recovery is expected to have occurred; the magnitude of impact is assessed as 'Low'.

Continuous sound sources such as dredging do not pose a significant risk of injury to fish and marine turtles, the magnitude of impact is thus assessed as 'Negligible'. Noise from dredging may have resulted in disturbance to fish and marine turtles, however, since impacts would have been restricted to the near-field and adjacent far-field, the duration was short-term, and rapid recovery is expected to have occurred; the magnitude of impact is assessed as 'Low'.

8.9.3.3 Significance of Likely Underwater Noise Effect from land reclamation and dredging

Injury Resulting from Underwater Noise Produced by Dredging Operations

LF cetaceans have been assessed as having 'Negligible' sensitivity to injury resulting from underwater noise produced during dredging operations, and the magnitude of impact has also been assessed as 'Negligible'. The likely significant effect of injury as a result of underwater noise produced by dredging operations is therefore 'Imperceptible'.

All other functional hearing groups of marine mammals are assessed as having 'Negligible' sensitivity to injury due to underwater noise arising from dredging operations, the magnitude of impact has also been assessed as 'Negligible'. The likely significant effect of injury as a result of underwater noise produced by dredging operations is therefore 'Imperceptible'.

Group 1 & 2 fish, and marine turtles have been assessed as having 'Negligible' sensitivity to injury as a result of noise from dredging, while Group 3 have been assessed as 'Low' sensitivity. The magnitude of impact has been assessed as 'Negligible' for all functional hearing groups. The likely significant effect of injury due to noise from dredging is therefore 'Not significant' for Group 3 fish, and 'Imperceptible' for all other functional hearing groups and marine turtles.

The rating of pre-mitigation likely significant effect of injury due to underwater noise from construction phase dredging and remedial mitigation, if required, for all relevant receptors is presented in **Table 8-30.**

Table 8-30: Rating of pre and remedial mitigation LSE of injury due to underwater noise from construction phase dredging

Ecological Feature Affected	Quality of Effect	Sensitivity	Duration	Magnitude	Significance	Remedial Mitigation Measures	Residual Significance Rating
Low Frequency cetaceans (minke or humpback whales)	Negative	Negligible	Short-term	Negligible	Imperceptible	None	Imperceptible

Ecological Feature Affected	Quality of Effect	Sensitivity	Duration	Magnitude	Significance	Remedial Mitigation Measures	Residual Significance Rating
High Frequency cetaceans (common or bottlenose dolphin)	Negative	Negligible	Short-term	Negligible	Imperceptible	None	Imperceptible
Very High frequency cetaceans (harbour porpoise)	Negative	Negligible	Short-term	Negligible	Imperceptible	None	Imperceptible
Harbour seal	Negative	Negligible	Short-term	Negligible	Imperceptible	None	Imperceptible
Grey seal	Negative	Negligible	Short-term	Negligible	Imperceptible	None	Imperceptible
Group 1 & 2 fish, and marine turtles	Negative	Negligible	Short-term	Negligible	Imperceptible	None	Imperceptible
Group 3 fish	Negative	Low	Short-term	Negligible	Not significant	None	Not significant

<u>Disturbance Resulting from Underwater Noise Produced by Dredging Activities</u>

LF cetaceans have been assessed as having 'Negligible' sensitivity to injury or disturbance from noise due to dredging, and the magnitude of impact has also been assessed as 'Negligible'. The likely significant of disturbance as a result of underwater noise produced by dredging operations is therefore 'Imperceptible'.

All other functional hearing groups of marine mammals are assessed as having 'Low' sensitivity to disturbance resulting from dredging operations, the magnitude of impact has also been assessed as 'Low'. The likely significant effect of disturbance as a result of underwater noise produced by dredging operations is therefore 'Slight negative'.

All functional hearing groups of fish and marine turtles have been assessed as having 'Low' sensitivity to disturbance as a result of noise from dredging, and the magnitude of impact has been assessed as 'Low'. The likely significant effect of disturbance due to noise from dredging is therefore 'Not significant'.

The rating of pre-mitigation likely significant effect of disturbance due to underwater noise and remedial mitigation, if required, from construction phase dredging for all relevant receptors is presented in **Table 8-31.**

Table 8-31: Rating of pre and remedial mitigation LSE of disturbance due to underwater noise from construction phase dredging

Ecological Feature Affected	Quality of Effect	Sensitivity	Duration	Magnitude	Significance	Remedial Mitigation Measures	Residual Significance Rating
Low Frequency cetaceans (minke or humpback whales)	Negative	Negligible	Short-term	Negligible	Imperceptible	None	Imperceptible
High Frequency cetaceans (common or bottlenose dolphin)	Negative	Low	Short-term	Low	Not significant	None	Not significant
Very High frequency cetaceans (harbour porpoise)	Negative	Low	Short-term	Low	Not significant	None	Not significant
Harbour seal	Negative	Low	Short-term	Low	Not significant	None	Not significant
Grey seal	Negative	Low	Short-term	Low	Not significant	None	Not significant
Fish and marine turtles	Negative	Low	Short-term	Low	Not significant	None	Not significant

8.9.4 Underwater Noise Effects from Drilling

Drilling and blasting of the berthing pocket and quay wall trench was undertaken in 20 segments. Drilling was carried out using a DT145 drilling unit operating on top of the temporary blasting platform. Blast holes were drilled into the fill material and bedrock to 2m below the required depth of the quay wall foundations level.

Drilling is considered a low frequency, continuous sound source. Drilling generally produces continuous broadband frequencies concentrated at or below 1kHz. Noise generated during drilling varies significantly depending on the type of platform used, with floating platforms and ships generating more noise than fixed or jack-up rigs (MTE, 2020). Studies of the impact of coastal drilling operations are limited, most available research relates to deep-sea drilling in the oil and gas industry (Nedwell and Howell, 2004). Erbe and McPherson (2017) reported source levels of 142–145 dB re 1 µPa rms @ 1 m (30–2000 Hz) from drilling operations from a jack-up barge during geotechnical site investigation survey. Todd, *et al.*, (2020) reported 120dB re 1 µPa @ 41 m during geotechnical drilling operations from a jack-up barge, while Huang, *et al.*, (2023) reported 155.9 dB re 1 µPa rms @ 1 m when conducting drilling operations from an anchored vessel. The higher sound levels reported by Huang, *et al*., are likely in part due to the differing platforms used, with the jack-up rigs generating less sound than the anchored vessel. Drilling operations from a range of natural or man-made drilling platforms have recorded received levels of 119-125dB re 1 µPa at distances of 115-259m (Nedwell and Howell, 2004).

The transmission of noise to the marine environment is highly dependent on the platform type. Since drilling was conducted using drilling rigs operating on top of the temporary blasting platforms some reduction in noise input to the underwater environment would be expected relative to drilling operations from floating or jack-up platforms.

8.9.4.1 Sensitivity of IEFs to Drilling

<u>Sensitivity to Injury Resulting from Underwater Noise Produced by Drilling Operations</u>

Peak frequencies during drilling operations at Ros an Mhíl are expected to have been <1kHz. Low frequency cetaceans, such as minke whales and humpback whales, are most sensitive to noise at these frequencies. Noise levels have been conservatively estimated at up to 160dB re 1 µPa at 1m, such levels have potential to cause injury to LF cetaceans but only at very close distance from the sound source (<10m). Minke whale and humpback whale are therefore assessed as having 'Negligible' sensitivity to resulting from underwater noise produced by drilling operations.

The peak frequencies of drilling operations at <1kHz are below the peak sensitivity of high frequency cetaceans such as common dolphin and bottlenose dolphin, very high frequency cetaceans such as harbour porpoise and both seal species. Additionally, the expected noise levels of up to 160dB re 1 µPa at 1m are not sufficient to cause injury to species in these functional hearing groups. The sensitivity of these species to injury resulting from underwater noise produced by drilling operations is therefore assessed as 'Negligible'.

The peak frequencies of drilling operations coincide with the peak sensitivity of many fish species. Noise from continuous sources such as drilling present a low risk of mortality, mortal injury or recoverable to fish in functional hearing Groups 1 & 2, and marine turtles (Popper, *et al.*, 2014). The sensitivity of these species to injury as a result of underwater noise produced by drilling operations is therefore assessed as 'Negligible'. The risk of mortality or mortal injury is also low for hearing Group 3 fish species, however, they could potentially have suffered recoverable injury following exposure to SPL of 170dB re 1 µPa at 1m for 48hrs. The sensitivity of these species to injury as a result of underwater noise produced by drilling operations is therefore assessed as 'Low'.

<u>Disturbance Resulting from Underwater Noise Produced by Drilling Operations</u>

Low frequency noise from drilling may have been above ambient noise levels at some distance from the site of operations, potentially causing disturbance of low frequency cetaceans, however, given the paucity of minke whale and humpback whale in the area, sensitivity to disturbance resulting from underwater noise produced by drilling operations is assessed as 'Negligible'.

Low frequency noise from drilling operations may have been above ambient levels at extended distance from the sound source and therefore there was potential disturbance to other functional hearing groups of marine mammals occurring in the area. The sensitivity of these species to disturbance resulting from underwater noise produced by drilling operations is therefore assessed as 'Low'.

Cashla Bay is identified as a nursery ground for a number of hearing Group 1 fish including mackerel, horse mackerel, white-bellied monkfish, spurdog and common skate complex. Salmon and sea trout (Group 2) also migrate through the bay annually. Noise levels generated posed a moderate risk of TTS in the near field, a moderate risk of behavioural impact in the intermediate field, and a high risk of masking in the intermediate field for hearing Group 1 & 2 fish and marine turtles. Group 3 fish, such as European eel, herring or cod, could have potentially suffered TTS following exposure to SPL of 158dB re 1 µPa at 1m for 12hrs. Masking is likely to have occurred over far-field distances while behavioural impacts may have occurred in the intermediate field. Cashla Bay is identified as a nursery ground for a number of Group 3 fish including cod, herring, whiting, ling and hake; and herring spawning grounds are reported at Cashla Point. European eel may also migrate through the bay annually.

The noise output from drilling at Ros an Mhíl was estimated at up to a maximum of 160dB re 1 µPa at 1m, this is a conservative estimate based on reported outputs from similar projects and does not account for the use of a protective berm. The extent of the impact of disturbance from drilling would have been limited to within a few hundred meters of the sound source, the species affected are mobile and capable of avoiding the area, nursery grounds identified in the area are widespread and common and rapid recovery is expected following cessation of operations. The sensitivity of all fish and marine turtles to disturbance as a result of underwater noise produced by drilling operations is therefore assessed as 'Low'.

8.9.4.2 Magnitude of Impact

The timing of operations is intermittent, the duration of the impact is short-term as works were completed in 17 months, and the magnitude is considered low given the relatively low number of days on which drilling occurred over the course of the development works. The protective berm constructed around the site would have provided a degree of sound abatement, reducing the input of sound to the wider Cashla Bay to some extent. However, noise levels may have been above ambient sound levels at extended distance from the sound source and may have caused disturbance or masking of biologically significant communication.

Noise levels during drilling could theoretically have resulted in injury to LF cetaceans but only within extremely close ranges. Rogan, *et al.* (2018) calculated the summer density of minke whale in western coastal waters at 0.102 animals/km^2. The total area of suitable habitat available in Cashla Bay is approximately 5.78km^2, which excludes intertidal and shallow subtidal waters. The potential abundance of minke whale in Cashla Bay is therefore estimated at 0.59 individuals. No humpback whales were recorded during surveys conducted by Rogan, *et al.*, therefore abundance of humpback whale in the area is assumed to be less than that of minke whale. No baleen sightings were reported by the MMOs on site during the operations. Considering the low abundance of LF cetaceans in the area, the magnitude of impact of injury or disturbance due to noise resulting from drilling activities is assessed as 'Negligible'.

For all other functional hearing groups of marine mammals, sound levels would not have been sufficient to cause injury to any of these species, the magnitude of impact from injury from noise due to drilling is considered to be 'Negligible' for these species. There was a potential for disturbance to these species as a result of noise from drilling, however, since impacts were restricted to the near-field and adjacent far-field, the duration was infrequent and short-term, and rapid recovery is expected to have occurred; the magnitude of impact is assessed as 'Low'.

Continuous sound sources such as drilling do not pose a significant risk of injury to fish and marine turtles, the magnitude of impact is thus assessed as 'Negligible'. Noise from continuous sources such as drilling may have resulted in disturbance to fish and marine turtles, however, since impacts would have been restricted to the near-field and adjacent far-field, the duration was short-term, and rapid recovery is expected to have occurred once operations ceased; the magnitude of impact is therefore assessed as 'Low'.

8.9.4.3 Significance of Likely Underwater Noise Effects from Drilling

Injury Resulting from Underwater Noise Produced by Drilling Operations

LF cetaceans have been assessed as having 'Negligible' sensitivity to injury resulting from underwater noise produced by drilling operations, and the magnitude of impact has also been assessed as 'Negligible'. The likely significant effect of injury resulting from underwater noise produced by drilling operations is therefore 'Imperceptible'.

All other functional hearing groups of marine mammals are assessed as having 'Negligible' sensitivity to injury resulting from underwater noise produced by drilling operations, the magnitude of impact from injury from noise due to drilling has also been assessed as 'Negligible'. The likely significant effect of injury due to noise from drilling is therefore 'Imperceptible'.

Group 1 & 2 fish, and marine turtles have been assessed as having 'Negligible' sensitivity to injury as a result of noise from drilling, while Group 3 have been assessed as 'Low' sensitivity. The magnitude of impact has been assessed as 'Negligible' for all functional hearing groups. The likely significant effect of injury due to noise from dredging is therefore 'Not significant' for Group 3 fish, and 'Imperceptible' for all other functional hearing groups and marine turtles.

The rating of pre-mitigation likely significant effect of injury due to underwater and noise remedial mitigation, if required, from construction phase drilling for all relevant receptors is presented in Table 8-32.

Table 8-32: Rating of pre and remedial mitigation LSE of injury due to underwater noise from construction phase drilling

Ecological Feature Affected	Quality of Effect	Sensitivity	Duration	Magnitude	Significance	Remedial Mitigation Measures	Residual Significance Rating
Low Frequency cetaceans (minke or humpback whales)	Negative	Negligible	Short-term	Negligible	Imperceptible	None	Imperceptible
High Frequency cetaceans (common or bottlenose dolphin)	Negative	Negligible	Short-term	Negligible	Imperceptible	None	Imperceptible
Very High frequency cetaceans (harbour porpoise)	Negative	Negligible	Short-term	Negligible	Imperceptible	None	Imperceptible
Harbour seal	Negative	Negligible	Short-term	Negligible	Imperceptible	None	Imperceptible

Ecological Feature Affected	Quality of Effect	Sensitivity	Duration	Magnitude	Significance	Remedial Mitigation Measures	Residual Significance Rating
Grey seal	Negative	Negligible	Short-term	Negligible	Imperceptible	None	Imperceptible
Group 1 & 2 fish, and marine turtles	Negative	Negligible	Short-term	Negligible	Imperceptible	None	Imperceptible
Group 3 fish	Negative	Low	Short-term	Negligible	Not significant	None	Not significant

Disturbance Resulting from Underwater Noise Produced by Drilling Operations

LF cetaceans have been assessed as having 'Negligible' sensitivity to disturbance resulting from underwater noise produced by drilling operations, and the magnitude of impact has also been assessed as 'Negligible'. The likely significant effect of resulting from underwater noise produced by drilling operations is therefore 'Imperceptible'.

All other functional hearing groups of marine mammals are assessed as having 'Low' sensitivity to disturbance due to underwater noise arising from drilling operations, the magnitude of impact has also been assessed as 'Low'. The likely significant effect of disturbance due to underwater noise from drilling is therefore 'Slight negative'.

All functional hearing groups of fish and marine turtles have been assessed as having 'Low' sensitivity to disturbance as a result of noise from drilling, and the magnitude of impact has been assessed as 'Low'. The likely significant effect of disturbance due to noise from drilling is therefore 'Not significant'.

The rating of pre-mitigation likely significant effect of disturbance due to underwater noise and remedial mitigation, if required, from construction phase drilling for all relevant receptors is presented in Table 8-33 below.

Table 8-33: Rating of pre and remedial mitigation LSE of disturbance due to underwater noise from construction phase drilling

Ecological Feature Affected	Quality of Effect	Sensitivity	Duration	Magnitude	Significance	Remedial Mitigation Measures	Residual Significance Rating
Low Frequency cetaceans (minke or humpback whales)	Negative	Negligible	Short-term	Negligible	Imperceptible	None	Imperceptible
High Frequency cetaceans (common or	Negative	Low	Short-term	Low	Not significant	None	Not significant

Ecological Feature Affected	Quality of Effect	Sensitivity	Duration	Magnitude	Significance	Remedial Mitigation Measures	Residual Significance Rating
bottlenose dolphin)							
Very High frequency cetaceans (harbour porpoise)	Negative	Low	Short-term	Low	Not significant	None	Not significant
Harbour seal	Negative	Low	Short-term	Low	Not significant	None	Not significant
Grey seal	Negative	Low	Short-term	Low	Not significant	None	Not significant
Fish and marine turtles	Negative	Low	Short-term	Low	Not significant	None	Not significant

8.9.5 Underwater Noise Effects from Blasting

Blasting produces broad spectrum impulsive sound at very high levels which can have significant impact on the marine environment. Sound produced is low frequency (2Hz – 1kHz) with peak frequency generally below 500Hz. Explosive charges of less than 1 kg TNT equivalent can generate emission levels (Lp,pk) above 260dB re 1 µPa @ 1 m, while explosive charges of several thousand kg of TNT equivalent may generate levels in excess of 300dB re 1 µPa @ 1 m (MTE, 2020). Near the source, the pressure rise-time for some explosives, such as TNT, is nearly instantaneous, followed by exponential decay (Popper, *et al.*, 2014).

Drilling and blasting of the berthing pocket and quay wall trench was undertaken in 20 segments on top of temporary blasting platform. Blast holes were drilled into the fill material and bedrock to 2m below the required depth of the quay wall foundations level. Explosives were used for blasting with varying numbers of explosives required per blast as the number of blast holes varied per location. The blastholes were taken to a depth at least 2m lower than the desired dredge level to ensure that fragmentation was achieved across the whole of the surface area to be blasted. Details of a blast conducted at Ros an Mhíl are provided in **Volume II, Chapter 2** Project Description of this rEIAR as an example, this blast involved the placement of 108 charges at depths of 17m.

The transmission of noise to the marine environment is highly dependent on the blast type. Since blasting was carried out placing charges in pre-drilled holes at depths of 2m below final dredge depth (e.g. at 17m as per example above), and temporary blasting platforms were constructed over blast sites, significant reduction in noise input to the underwater environment would be expected relative to surface laid charges. The protective berm constructed around the site would also have provided partial sound abatement, reducing the input of sound to the wider Cashla Bay to some extent. The size of charge used during works at Ros an Mhíl varied between blast operations but sound levels of over 260dB re 1 µPa @ 1 m are expected to have occurred. Such sound levels have potential to cause serious injury to a number of species identified as IEFs. Underwater noise levels may be above ambient sound levels at extended distance from the sound source (up to several kilometres) and could cause disturbance or masking of biologically significant communication.

8.9.5.1 Sensitivity of IEFs to Blasting

Injury Resulting from Underwater Noise Produced by Blasting Operations

Estimating potential distance at which injury can occur as a result of blasting is challenging and would be affected by factors such as charge size, number of charges, burial depth, type of rock and bathymetry. There is limited published information available to allow an accurate estimate of peak levels underwater following detonations from confined explosions. A study by Nedwell and Thandavamoorthy (1992) determined that the peak pressure from detonations in bore holes could be as low as 6% of that generated in equivalent, open water conditions. During the Miami harbour deepening project, Hempen *et al.,* (2007) showed levels of blast pressure in water following borehole detonations, falling to 19% to 41% of that recorded in open water. The use of a blasting platform in Ros an Mhíl would have increased the effective burial depth of the charges while the addition of a protective berm would have provided additional noise abatement. Considering this, it is estimated that sound levels could have been sufficient to cause PTS in marine mammals at ranges in the order of hundreds of meters, and possibly up to one kilometre. Due to the uncertainty over the range at which an impact might occur, a precautionary approach has been taken, and all marine mammals have been assessed as potentially experiencing PTS at up to 1km from the source. The total area potentially impacted in Cashla Bay would therefore equal approximately 1.5km^2.

As peak frequencies from blasting are in the range of 2Hz – 1kHz, LF cetaceans are the most susceptible to impacts of injury from noise from blasting, and sound pressure levels of >260dB re 1 µPa @ 1 m have the potential to have caused injury to LF cetaceans. LF cetaceans are therefore assessed as having 'Medium' sensitivity to injury due to underwater noise arising from blasting.

The primary acoustic energy from blasting is below the region of greatest sensitivity for porpoise, dolphins and seals (Southall et al. 2019). If PTS did occur within this low frequency range, it would be unlikely to have resulted in any significant impact to survival rates of, or population level effects in, porpoise, dolphins, and seals. Therefore, porpoise, dolphins, and grey seals have been assessed as having a 'Low' sensitivity to injury resulting from noise from blasting. A precautionary approach has been taken in assessment of sensitivity of harbour seal due to the importance of Cashla Bay to the species, harbour seals are therefore assessed as having 'Medium' sensitivity to injury due to underwater noise arising from blasting.

The peak frequencies of blasting at <1kHz coincide with the peak sensitivity of many fish species. Noise from impulsive sources such as blasting present a potential risk of mortality or potential mortal injury for all functional hearing groups of fish and marine turtles at received peak SPL of 229 - 234dB re 1 µPa at 1m (Popper, *et al.*, 2014). Due to the uncertainty over the range at which an impact might have occurred, a precautionary approach has been taken, and all fish and marine turtles are assessed as exposed to risk of injury at up to several hundred meters from the source.

The Cashla River is an important spawning and nursery ground for salmon and sea trout, IFI (2024b) fish counter data for the year 2023 reported; 69 spring salmon, 389 grilse, and 68 late summer salmon. The spawning stock of salmon in the Cashla system in 2023 was 526 individuals, the majority of these were grilse (n=389) (IFI, 2024b). The Conservation Limit for the system was 419 in 2023 with a forecasted surplus of 159 (TEGOS, 2022), and the fishery was open for harvest. A total of 827 sea trout were recorded in the Cashla river in 2023 (IFI, 2024b). The sea trout fishery is currently catch and release only due to concerns over the national sea trout stock. Atlantic salmon is listed under Annex II of the E.U. Habitats Directive and is a qualifying interest of the Connemara Bog Complex SAC, while sea trout stocks have collapsed in Ireland and are subject to controls under the national salmon and sea trout fisheries management regulations and a bye-law prohibiting the retention of rod caught sea trout from Galway Bay to Achill Head (King, *et al.,* 2011).

Salmon populations are declining across their natural range and marine survival is a key concern. Marine survival of Irish salmon has declined dramatically since the 1970s, salmon smolt survival during the coastal component of their marine migration can have an impact on subsequent marine survival of salmon (TEGOS, 2025), estuaries and the lower stretches or rivers have been identified as high mortality locations for migrating smolts due to predation and other pressures (Flavio, *et al.*, 2019). The post-smolt and at-sea movements of both species are poorly understood and the focus of much research. The sensitivity of these species to injury as a result of underwater noise produced by blasting is therefore assessed as 'Medium'.

Cashla Bay is identified as a nursery ground for a number of Group 1 fish including mackerel, horse mackerel, white-bellied monkfish, spurdog and the common skate complex. Cashla Bay is also a nursery ground for a number of Group 3 fish including cod, herring, whiting, ling and hake; and herring spawning grounds are reported at Cashla Point. European eel (Group 3) may also migrate through the bay annually. Although some of the above listed species may have experienced mortality or potential mortal injury at up to several hundred meters, the impact would have occurred at the individual level, and it is considered unlikely that a population level impact would have taken place. The nursery grounds identified in the area are widespread and common, and rapid recovery is expected to have occurred following cessation of operations. The sensitivity of these species to injury due to underwater noise arising from blasting operations is therefore assessed as 'Low'.

<u>Disturbance Resulting from Underwater Noise Produced by Blasting Operations</u>

There is limited published guidance on assessment of disturbance or behavioural impacts from blasting. A precautionary approach has therefore been taken and all individuals of a species within the bounds of Cashla Bay are assumed to potentially have been disturbed. Blasting occurred as a series of discrete events of momentary duration, noise from such events can cause a startle response but is not considered to be of sufficient duration to have caused significant disturbance in marine mammals, fish or marine turtles. Any behavioural effects would have been temporary and unlikely to alter survival or reproductive rates at the population level. The sensitivity to disturbance due to underwater noise arising from blasting is therefore assessed as 'Low' for all IEFs.

8.9.5.2 Magnitude of Impact

The duration of the impact of noise from blasting is momentary and occasional since blasting occurred as a series of discrete events separated by a number of days, the total number of blasts was also low. The maximum area in Cashla Bay where marine mammals could be potentially affected by PTS has been estimated at approximately 1.5km^2.

Rogan, *et al.* (2018) calculated the summer density of minke whale in western coastal waters at 0.102 animals/km^2. The total area of suitable habitat available in Cashla Bay is approximately 5.78km^2. The potential abundance of minke whale in Cashla Bay is therefore estimated at 0.59 individuals and 0.15 within the potentially impacted area. No humpback whales were recorded during surveys conducted by Rogan, *et al.*, therefore abundance of humpback whale in the area is assumed to be less than that of minke whale. No baleen whales were reported by the MMOs on site during blasting operations. The abundance of LF cetaceans is extremely low in the receiving environment therefore the likelihood of exposure to this impact should be considered very low also. The magnitude of the impact of injury as a result of underwater noise produced by blasting is therefore assessed as 'Negligible'.

Rogan, *et al.* (2018) calculated the winter density of common dolphin (including dolphins recorded as common/striped dolphin) in western coastal waters a 0.812 animals/km^2, while the summer density of bottlenose dolphin in western coastal waters a 1.084 animals/km^2. The total area of potential habitat in Cashla Bay is 5.78km^2, therefore the abundance of common dolphin in Cashla Bay is calculated as 4.69 individuals, and the abundance of bottlenose dolphin is calculated as 6.27 individuals. The number of common dolphins potentially present within the impacted area is 1.22, while the number of bottlenose dolphin potentially present is 1.63. The abundance of

HF cetaceans is relatively low in the receiving environment therefore the likelihood of exposure to this impact should be considered relatively low also. The magnitude of the impact of injury as a result of underwater noise produced by blasting is therefore assessed as 'Low'.

Rogan, *et al.* (2018) calculated the winter density of harbour porpoise in western coastal waters a 0.262 animals/km^2, which would result in a calculated density of 1.51 individuals within Cashla Bay and 0.39 individuals within the potentially impacted area. Since the abundance of harbour porpoise is very low in the receiving environment therefore the likelihood of exposure to this impact should be considered very low also. The magnitude of the impact of injury as a result of underwater noise produced by blasting is therefore assessed as 'Negligible'.

The median number of harbour seal reported at haul sites in Cashla Bay is 77 (NPWS, 2012; 2025). While harbour seals congregate in significant numbers at haul out site during the annual moulting season, outside of this season harbour seal would disperse across the surrounding waters 20km or more from haul out sites (Cronin, *et al*., 2008). Carter *et al*., (2020) modelled the at-sea distribution of harbour seal around British and Irish coasts and determined an at sea relative abundance of 0.1% of the joint UK and Ireland population within a 5km-by-5km grid in inner Cashla Bay. Using scalars provided by Carter *et al.,* (2020) an at-sea absolute abundance of 40 individuals was calculated for inner Cashla Bay with a further 24 individuals predicted at Cashla Point. The median number of harbour seal of 77 reported at haul-out sites in Cashla Bay and the predicted at-sea abundance of harbour seal in Cashla Bay of 64, are both significant in terms of the national population (i.e. >1%). However, underwater noise would only affect the at-sea portion of the local population within the zone of impact.

The at-sea abundance of harbour seal in the inner bay was calculated as 40 individuals based on the 25km^2 grids modelled by Carter *et al.*, (2020) which equals a density of 1.6/km^2. The number of harbour seal occurring within the 1.5km^2 potentially affected by PTS as a result of blasting is approximately 2.4 individual. Considering the importance of Cashla Bay for harbour seal and the potential for permanent injury, the magnitude of the impact of injury as a result of underwater noise produced by blasting is therefore assessed as 'Medium'.

The predicted abundance of grey seal in Cashla Bay based on modelling by Carter *et al.*, (2022) is <1 animal, however grey seals were recorded in Cashla Bay on a number of occasions by MMOs on site, the magnitude of injury as a result of underwater noise produced by blasting is therefore assessed as 'Low'.

Blasting presents a potential risk of injury for all functional hearing groups of fish and marine turtles. The duration of the impact of noise from basting is momentary since the resultant increase in underwater noise was short-term (a number of seconds), blasting occurred as a series of discrete events separated by a number of days, the total number of blasts was also low. The maximum distance at which fish and marine turtles could experience a potential risk of injury has been estimated at less than several hundred meters.

Salmon and sea trout both migrate through Cashla Bay annually, smolts transit through the bay in the spring, with adults returning throughout the summer. Smolts of both species migrate in shoals, and the number of fish migrating can vary throughout the smolt run. This shoaling behaviour is likely a predator avoidance response, however it can leave the migrating fish vulnerable to impact from man-made pressures. Due to the presence of sensitive life stages of both salmon and sea trout, and the vulnerability of these local populations, and in consideration of the temporary and infrequent nature of the impact, the magnitude of impact of injury as a result of underwater noise produced by blasting is therefore assessed as 'Medium' for both salmon and sea trout.

Cashla Bay is identified as a nursery ground for a number of commercial fish species (ICES, 2009), adults of these species are subject to directed fisheries which are managed using a variety of tools including total allowable catch (TAC) restrictions. The common skate complex is also reported as having spawning grounds in Cashla Bay, however spawning intensity is predicted to be low (Ellis, *et al.*, 2012). All of the identified species' nursery grounds are widespread in Irish waters, including the Galway coast. Any potential effect would not affect the survival of receptors to the extent that could alter the population trajectory. Considering this, and the limited extent and duration of the impact, the magnitude of impact of injury as a result of underwater noise produced by blasting is therefore assessed as ‘Low’ for all other fish IEFs.

Blasting occurred as a series of discrete events of momentary duration, noise from such events can cause a startle response but is not considered to be of sufficient duration to cause significant disturbance in marine mammals, fish or marine turtles. Any behavioural effects would be temporary and unlikely to alter survival or reproductive rates at the population level. For marine mammals, the number of potentially affected individuals was precautionarily assumed to be up to equivalent to the species at-sea abundance determined for Cashla Bay above. The total number of potentially affected individuals for each species is low (<1%) relative to national populations or management units. The abundance of all fish and marine turtles receptors was also assessed to be below nationally significant number. The magnitude of impact from disturbance is therefore assessed as ‘Low’ for all receptors, with the exception of LF cetaceans which are assessed as ‘Negligible’ in light of the very low abundance (<1 no.) in the area.

8.9.5.3 Significance of Likely Effects from Underwater Noise Effect from Blasting

Injury Resulting from Underwater Noise Produced by Blasting Operations

LF cetaceans have been assessed as having ‘Medium’ sensitivity to injury due to underwater noise arising from blasting, and the magnitude of impact has been assessed as ‘Negligible’. The likely significant effect of injury due to underwater noise arising from blasting is therefore ‘Not significant’.

HF cetaceans and grey seal have been assessed as having ‘Low’ sensitivity injury due to underwater noise arising from blasting, and the magnitude of impact has been assessed as ‘Low’. The likely significant effect of injury due to underwater noise arising from blasting is therefore ‘Slight negative’.

Harbour porpoise has been assessed as having ‘Low’ sensitivity to injury due to underwater noise arising from blasting, and the magnitude of impact has been assessed as ‘Negligible’. The likely significant effect of injury due to underwater noise arising from blasting is therefore ‘Not significant’.

Harbour seal have been assessed as having ‘Medium’ sensitivity to injury due to underwater noise arising from blasting, and the magnitude of impact has been assessed as ‘Medium’. The likely significant effect of injury due to underwater noise arising from blasting is therefore ‘Moderate negative’.

The sensitivity of salmon and sea trout to injury due to underwater noise arising from blasting operations is assessed as ‘Medium’, and the magnitude of impact is assessed as ‘Medium’. The likely significant effect of injury due to underwater noise arising from blasting is therefore ‘Moderate’.

The sensitivity of all other fish IEFs to injury due to underwater noise arising from blasting operations is assessed as ‘Low’, and the magnitude of impact is assessed as ‘Low’. The likely significant effect of injury due to underwater noise arising from blasting is therefore ‘Not significant’.

The rating of pre-mitigation likely significant effect of injury due to underwater noise and remedial mitigation, if required, from construction phase blasting and post mitigation for all relevant receptors is presented in **Table 8-34.**

Table 8-34: Rating of pre and remedial mitigation LSE of injury due to underwater noise from construction phase blasting

Ecological Feature Affected	Quality of Effect	Sensitivity	Duration	Magnitude	Significance	Remedial Mitigation Measures	Residual Significance Rating
Low Frequency cetaceans (minke or humpback whales)	Negative	Medium	Momentary & occasional	Negligible	Not Significant	None	Not Significant
High Frequency cetaceans (common or bottlenose dolphin)	Negative	Low	Momentary & occasional	Low	Slight	None	Slight
Very High frequency cetaceans (harbour porpoise)	Negative	Low	Momentary & occasional	Negligible	Not Significant	None	Not Significant
Harbour seal	Negative	Medium	Momentary & occasional	Medium	Moderate	None	Moderate
Grey seal	Negative	Low	Momentary & occasional	Low	Slight	None	Slight
Atlantic salmon and sea trout	Negative	Medium	Momentary & occasional	Medium	Moderate	None	Moderate
All other fish & marine turtles	Negative	Low	Momentary & occasional	Low	Not Significant	None	Not Significant

<u>Disturbance Resulting from Underwater Noise Produced by Blasting Operations</u>

LF cetaceans are assessed as having 'Low' sensitivity to disturbance due to underwater noise arising from blasting operations, the magnitude of impact from disturbance from noise due to blasting has assessed as 'Negligible'. The likely significant effect of disturbance due to underwater noise arising from blasting is therefore 'Not significant'.

All other functional hearing groups of marine mammals are assessed as having 'Low' sensitivity to disturbance due to underwater noise arising from blasting operations, the magnitude of impact from disturbance from noise due to blasting has also been assessed as 'Low'. The likely significant effect of disturbance due to underwater noise arising from blasting is therefore 'Slight negative'.

All functional hearing groups of fish and marine turtles are assessed as having 'Low' sensitivity to disturbance due to underwater noise arising from blasting operations, the magnitude of impact from disturbance from noise due to blasting has also been assessed as 'Low'. The likely significant effect of disturbance due to underwater noise arising from blasting is therefore 'Slight negative'.

The rating of pre-mitigation likely significant effect of disturbance due to underwater noise from construction phase blasting and remedial mitigation, if required, for all relevant receptors is presented in **Table 8-35.**

Table 8-35: Rating of pre and remedial mitigation effect of disturbance due to underwater noise from construction phase blasting

Ecological Feature Affected	Quality of Effect	Sensitivity	Duration	Magnitude	Significance	Remedial Mitigation Measures	Residual Significance Rating
Low Frequency cetaceans (minke or humpback whales)	Negative	Low	Momentary & occasional	Negligible	Not significant	None	Not significant
All other marine mammals	Negative	Low	Momentary & occasional	Low	Slight	None	Slight
All fish and marine turtles	Negative	Low	Momentary & occasional	Low	Slight	None	Slight

8.9.6 Likely Significant Noise Effect of Non-Compliance with Mitigation Measures

8.9.6.1 Likely Significant Noise Effect of Non-Compliance with Marine Mammal Mitigation Measures

There were seven non-compliances reported by the MMOs during dredging and drilling operations (see points no. 1-7 in **Table 8-36**).

Maximum expected noise levels from either dredging or drilling are not likely to have exceeded 180dB re 1 µPa at 1m. Such noise levels are generally not considered sufficient to cause injury to any functional hearing group of marine mammals (NPWS, 2014). However, low frequency noise can propagate over extended distances and noise levels above ambient levels may have extended over a broad area.

Assessment of the pre-mitigation impact of injury caused by underwater noise from drilling and dredging concluded no likely significant effect to any functional hearing group of marine mammals, fish or marine turtles.

The pre-mitigation likely significant effect of injury due to underwater noise from both drilling and dredging was assessed 'Imperceptible' for all marine mammals.

Assessment of the pre-mitigation impact of disturbance caused by underwater noise from drilling and dredging concluded no likely significant effect to any functional hearing group of marine mammals, fish or marine turtles. The pre-mitigation likely significant effect of disturbance due to underwater noise from both drilling and dredging was assessed as 'Imperceptible' for low frequency marine mammals and 'Not significant' for all other functional hearing groups of marine mammals.

As the pre-mitigation likely significant effect of underwater noise resulting from dredging or drilling operations was assessed as not significant for all receptors, any non-compliance with mitigation measures implemented for dredging or drilling operations are thus unlikely to have had a significant effect on marine mammals in the area.

The reported delays between the end of pre-watch and a blast taking place due to the relocation of the MMO for safety could potentially have resulted in an animal entering the mitigation zone unnoticed. Although this situation is not ideal, there was little alternative. Section 4.3.5. of the *Guidance to Manage the Risk to Marine Mammals from Man-made Sounds Sources in Irish Waters* (NPWS, 2014) states that ''In waters up to 200m deep, the MMO shall conduct pre-start-up constant effort monitoring at least 30 minutes before the sound-producing activity is due to commence''. All blasting pre-watches were conducted for a minimum of 30 minutes, before relocating in order for the blast to commence and were therefore compliant with NPWS guidelines. Although the possibility of a marine mammal entering the mitigation zone between the end of the pre-watch and the blast taking place cannot be excluded, this is considered unlikely. The density of marine mammals in Cashla Bay is low for all cetacean species and grey seals, while the at-sea population of harbour seal within the zone of impact was calculated at 2.4 individuals, any potential impact would therefore be unlikely to affect survival or reproductive rates at the population level. The MMOs on site maintained a visual watch as best possible during the intervening time, and no sightings were reported during this period, the pre-watch, or shortly after the blast had occurred. It is therefore considered that any delay between the end of pre-watch and a blast taking place is unlikely to have resulted in a significant impact on marine mammals.

8.9.6.2 Likely Significant Noise Effects of Non-Compliance on Atlantic Salmon and Sea Trout

To mitigate noise impacts on salmon, the 2017 project EIAR recommended that "*blasting not be carried out between April and July as this is the time of year when adult fish will be passing through Cashla Bay on their way up to the Cashla River to spawn and juveniles (smolts) will be passing southwards on their way to sea*".

Blasting was conducted on three occasions between June and July 2023, within the recommended operational restriction period. Blasts were conducted on 26th June, 7th July and 17th July.

The unmitigated impact to salmon and sea trout due to injury resulting from blasting noise was assessed as 'Moderate' in recognition of the presence of vulnerable life stages present in the area, and the sensitivity of the local population.

The CEMP mitigation measures applied limited the exposure of salmon and sea trout to this impact. In 2023, the salmon smolt migration in the River Erriff, Ireland's national index river (mouth of this river is located 47km north west of the development site), occurred throughout April and had mostly finished by May, while sea trout smolts emigrated sporadically in March and April, with the majority migrating in early May (King, *et al.*, 2025). An initial run of adult spring salmon was recorded from April to May 2023 in the River Erriff, with grilse run commencing in mid-June and peaking in July and August (King, *et al.*, 2025). The majority of upstream migrating sea trout were recorded from June to early August (King, *et al.*, 2025).

No blasts were conducted in April or May, which is the peak smolt migration period, however, blasts were conducted on 6th June, 7th July and 17th July, which coincided with the adult up-stream migration of salmon grilse and sea trout. Returning salmon grilse and sea trout migrate at varying intensity during the run, resulting in variable daily peaks of fish of each species migrating into rivers. Daily counts of up to 50 returning salmon grilse and 50 returning sea trout were reported in the River Erriff in 2023 (King, *et al.*, 2025).

Although adult salmon and sea trout were likely present in Cashla Bay during the blasting operations in June and July, it is considered unlikely that a significant number of fish would have been present in the zone of impact to result in a population level impact. The potentially impacted area would have been small relative to the total area of available habitat in the bay, and since the duration of the impact from blasting is in the order of seconds, the possibility of a significant number of salmon or sea trout occurring within the zone of impact at the moment of detonation would have been remote but could not be completely discounted.

The mitigation measures applied successfully mitigated the potential effects on smolts of both species by avoiding the peak smolt migration, thereby removing the impact pathway. The mitigation measures applied would similarly have avoided much of the adult migration. It is therefore concluded that no likely significant impact on salmon or sea trout would have resulted from the blasting conducted on 6th June, 7th July and 17th July 2023.

8.9.7 Death or Injury by Collision

Vessel collision presents a particular risk to species which spend significant time at the surface either to breath (e.g. marine mammals, and marine turtle) or while feeding (e.g. basking sharks). Vessel collisions have been documented in a wide range of marine megafauna, including; basking shark (Chapple, *et al.* 2024), marine turtles (Hazel & Gyuris, 2006), pinnipeds and cetaceans (Olson, *et al.*, 2021; Laist, *et al.*, 2001) and can have adverse effects on the health or survival of individuals (Moore, *et al.*, 2013), and pose a threat to critically endangered populations (Blondin, *et al.*, 2025).

Key factors affecting collision risk include; vessel traffic, vessel speed, size and movement patterns (Blondin, *et al.*, 2025), and can vary between species. For instance, large vessels (>80m) travelling at speeds over 14 knots have been identified as particular threats to larger whales (Laist, *et al.*, 2001; Blondin, *et al.*, 2025), while small cetaceans, delphinids and pinnipeds may be at greater risk from fast moving recreational vessels (van Waerebeek *et al.* 2007; Olson, *et al.*, 2021). The severity and type of injury resulting from a vessel collision is dependent on a number of factors such as; vessel speed, vessel size, angle of impact and anatomical site of contact (Moore, *et al.*, 2013).

Ros an Mhíl Harbour is an active port with a significant level of daily vessel movements arising from fishing vessels and passenger ferries, especially in summer months. The use of a small number of vessels and barges during construction works will not add significantly to current vessel traffic. Furthermore, the type of vessels used during construction works are typically very slow moving and will not pose a collision risk to marine fauna.

The sensitivity of all IEFs to collision risk due to increased vessel traffic due to construction vessels is assessed as 'Negligible'. The spatial extent of this pressure is limited to the immediate vicinity of individual construction vessels as they manoeuvre within the harbour, and the duration of this pressure is short term; therefore, magnitude of impact is assessed as 'Negligible'.

The rating of pre-mitigation likely significant effect of death or injury by collision during construction phase and remedial mitigation, if required, for all relevant receptors is presented in Table 8-36.

Table 8-36: Rating of pre-mitigation LSE of death or injury by collision during construction phase

Ecological Feature Affected	Quality of Effect	Sensitivity	Duration	Magnitude	Significance	Remedial Mitigation Measures	Residual Significance Rating
Marine mammals	Negative	Negligible	Short-term	Negligible	Imperceptible	None	Imperceptible
Basking shark and marine turtles	Negative	Negligible	Short-term	Negligible	Imperceptible	None	Imperceptible

8.10 Assessment of Current Site Status Effects

The site was completely cleared of all equipment, facilities and materials when works ceased on the 20th of May 2024. The site remains un-used and has been fenced off.

The flood risk to the development is coastal, from either tide surge events in isolation or tides in combination with wave climate. Based on the results of the flood risk assessment (FRA), the minimum level of the deep water quay was recommended to be +6.7mCD (+3.8m OD Malin) to protect against the present day 200-year return period tidal flood level. The current level of the site is +5mCD. Consequently, the site is susceptible to occasional inundation during spring high tides and other extreme weather events. The clearing of the site has reduced the potential for any contamination of water if the vacant site were to experience a flood event in this period between previous construction works and works to be completed.

During the operational phase the presence of infrastructure has the potential to impact on the marine ecology. Relevant pressures were identified based on the OSPAR (2011) pressure definitions; these were aggregated into the following pressure for the purpose of this assessment.

- Permanent loss of habitat or change of habitat type due to presence of infrastructure

The likely significant effect on receptors was assessed for the above listed pressure where a realistic impact pathway exists.

8.10.1 Permanent Loss of Habitat or Change of Habitat Type Due to Presence of Infrastructure

Permanent habitat loss or change is considered an operational phase impact as it has resulted in the permanent loss of marine habitat to land habitat in the case of the reclamation works, or a permanent change in habitat type in the case of the construction of revetments.

The development required the reclamation of 2.4 hectares achieved with the import of rock fill material to increase the existing ground level to the high-water level and to fill the marine area behind the quay wall (east side) to create a construction surface. The current level of the site is +5mCD.

A total 75m of revetment was constructed between 11th July 2023 and 20th May 2024, with a further 75m yet to be constructed. The presence of the revetments has resulted in a permanent change from one marine habitat to another and therefore constitutes a permanent physical loss of habitat but has an equal creation of an alternate habitat type (Tyler-Walters et al., 2023), where colonisation by certain species will occur.

8.10.1.1 Sensitivity of IEFs to Operational Effects

The reclaimed area and revetments overlie portions of the identified intertidal and subtidal communities. All marine benthic habitats and species have a sensitivity of 'High' to permanent physical loss of habitat, their resistance to this pressure is 'None' and resilience is 'Very low' as there is no possibility of recovery of the lost habitat. Benthic fish and shellfish occurring in these habitats are similarly assessed as having 'High' sensitivity to this pressure.

Atlantic salmon, sea trout and European eel are highly sensitive to physical loss of habitat crucial to key life stages (MPAAG, 2024). Estuarine habitats are crucial to these species as they must migrate through these at key life stages, therefore sensitivity of these species to this pressure is 'High'.

Demersal fish, cephalopod and elasmobranch species occurring within this area are assessed collectively as 'Medium' sensitivity. The adults of these species are mobile and unlikely to be directly affected by this pressure; however, juveniles or eggs present in the area may have reduced ability to relocate. Although the loss of benthic habitat resulting from the development may have reduced the availability of spawning or nursery habitats, similar suitable habitats are widespread in Cashla Bay and the wider Galway Bay.

Adult pelagic fish, cephalopods, and elasmobranch species are highly mobile, and not associated with littoral and shallow sublittoral habitats, thus are unlikely to be directly affected by this pressure. Juvenile sprat, herring or horse mackerel present in the area may use the *Laminaria* or fucoid habitats for shelter, however, the juveniles of these species are also highly mobile and therefore able to avoid the area and relocate to other suitable locations within the bay. These species are collectively assessed as having 'Low' sensitivity to this impact.

8.10.1.2 Magnitude of Impact

The construction of the deep water quay and associated land reclamation will result in the permanent change from one marine habitat to another. However, the extent of the impact is limited to the footprint of construction works. The total area of seabed reclaimed is *c.* 24,000m^2, which is low in comparison to the total area of available habitats in Cashla Bay and the wider Galway Bay supporting similar biotopes.

The loss of marine benthic habitat is a permanent loss with no potential for recovery; however, the extent of this impact is limited to the footprint on the development. The magnitude of impact from the physical loss of marine habitat on benthic habitats and species is assessed as 'Negligible' as the affected benthic habitats are widespread, and there are no benthic species or habitats of national or international significance dependent on the area.

The magnitude of impact from the physical loss of marine habitat on salmon, sea trout and European eel is assessed as 'Low' since these species are mobile, and the extent of the habitat lost is low relative to available habitat in the bay.

The magnitude of impact from the physical loss of marine habitat on the demersal and pelagic species assemblage is assessed as 'Negligible' since these species are mobile, the extent of the pressure is low, and there is considerable area of suitable alternate habitat available in Cashla Bay.

8.10.1.3 Significance of Likely Effect

Marine benthic habitats and species are assessed as having 'High' sensitivity to permanent loss of marine habitat to land habitat, the magnitude of the impact was assessed as 'Negligible'. Therefore, the likely significant effect of permanent loss of marine habitat to land habitat on benthic habitats and species is assessed as 'Not significant'.

Atlantic salmon, sea trout and European eel are assessed as having 'High' sensitivity to permanent loss of marine habitat to land habitat, the magnitude of the impact was assessed as 'Negligible'. Therefore, the likely significant effect of permanent loss of marine habitat to land habitat on benthic habitats and species is assessed as 'Not significant'.

The demersal species assemblage is assessed as having 'Medium' sensitivity to permanent loss of marine habitat to land habitat, the magnitude of the impact was assessed as 'Negligible'. Therefore, the likely significant effect of permanent loss of marine habitat to land habitat on demersal species is assessed as 'Not significant'.

The pelagic species assemblage is assessed as having 'Medium' sensitivity to permanent loss of marine habitat to land habitat, the magnitude of the impact was assessed as 'Negligible'. Therefore, the likely significant effect of permanent loss of marine habitat to land habitat on demersal species is assessed as 'Not significant'.

The rating of pre-mitigation likely significant effect of permanent loss of habitat or change of habitat type due to presence of infrastructure and remedial mitigation, if required, for all relevant receptors is presented in **Table 8-37.**

Table 8-37: Rating of pre and remedial mitigation permanent habitat loss or change of habitat type

Ecological Feature Affected	Quality of Effect	Sensitivity	Duration	Magnitude	Significance	Remedial Mitigation Measures	Residual Significance Rating
Marine benthic habitats and species	Negative	High	Permanent	Negligible	Not Significant	None	Not Significant
Anadromous species	Negative	High	Permanent	Negligible	Not Significant	None	Not Significant
Demersal fish, cephalopod and elasmobranch species	Negative	Medium	Permanent	Negligible	Not Significant	None	Not Significant
Pelagic fish, cephalopod and elasmobranch species	Negative	Medium	Permanent	Negligible	Not Significant	None	Not Significant

8.11 Residual Effects and Remediation Measures

The post-mitigation residual effects of construction and operation phases are assessed below. Residual effects on marine mammals, Atlantic salmon and sea trout are discussed in detail in the below sections. A summary of the post-mitigation residual effects on all other IEFs during the construction and operation phases are presented in Table 8-38 and Table 8-39, respectively. No additional or remedial mitigation measures are required, except for the development to be completed.

8.11.1 Marine Mammals

The assessment of the unmitigated impact of injury caused by underwater noise from drilling and dredging concluded no likely significant effect to any functional hearing group of marine mammals. The likely significance of injury from both drilling and dredging was assessed as ‘Imperceptible’ for all marine mammals. This assessment was based on the low abundance of low frequency cetaceans in the area, extremely small distances within which an injury could potentially occur, and the rapid attenuation of sound in coastal waters.

The assessment of the unmitigated impact of disturbance caused by underwater noise from drilling and dredging concluded no likely significant effect to any functional hearing group of marine mammals. The likely significance of disturbance from both drilling and dredging was assessed as ‘Imperceptible’ for low frequency marine mammals and ‘Not significant’ for all other marine mammals.

The mitigation measures implemented would not have further mitigated impacts of disturbance or injury to any marine mammal IEF. Residual impacts of either injury or disturbance would therefore be unchanged, remaining ‘Imperceptible’ for all marine mammals, however, the mitigation measures would have reduced the likelihood of an effect occurring.

The unmitigated likely significant effect of injury or disturbance due to underwater noise arising from blasting was evaluated as ‘Moderate’ for harbour seal. The significance of impact was assessed as ‘Slight negative’ for HF cetaceans and grey seal, and ‘Not significant’ for LF cetaceans and harbour porpoise. The mitigation measures implemented during blasting operations would have reduced the magnitude of impact for all marine mammals IEFs by ensuring there were no marine mammals in the zone of impact prior to a blast taking place. The post-mitigation magnitude of impact is assessed as ‘Negligible’ for all marine mammal IEFs, therefore, the residual likely significance effect is assessed as ‘Not significant’ for all marine mammal IEFs.

8.11.2 Atlantic Salmon and Sea Trout

The unmitigated impact on salmon and sea trout caused by injury resulting from blasting noise was assessed as ‘Moderate’ in recognition of the presence of vulnerable life stages present in the area, and the sensitivity of the local populations. To mitigate potential impacts to these species operational restrictions were implemented to restrict operations during sensitive periods. By avoiding the smolt migration in April to May, the magnitude of impact on this cohort of the population would have been reduced to ‘Negligible’. However, as three blasts were conducted between June and July 2023, adult salmon and sea trout may have been present in Cashla Bay, the magnitude of impact for this cohort is concluded to be ‘Low’. As the magnitude of impact for the most impacted cohort is ‘Low’ and the sensitivity of both species was assessed as ‘Medium’, the post-mitigation likely significant effect of the impact is assessed as ‘Slight negative’.

Table 8-38: Summary of the post-mitigation residual effects on all IEFs arising during the construction phase

Impact/Activity/Receptor	Quality of Effect	Pre-mitigation significance rating	Mitigation measures	Post-mitigation/ residual significance rating
Habitat disturbance or structure change				
Benthic habitats	Negative	Slight	None	Slight

Impact/Activity/Receptor	Quality of Effect	Pre-mitigation significance rating	Mitigation measures	Post-mitigation/ residual significance rating
Benthic fish and invertebrate species	Negative	Slight	None	Slight
Demersal fish, cephalopod and elasmobranch species	Negative	Slight	None	Slight
Suspended sediments, smothering and siltation rate changes				
Benthic habitats	Negative	Not significant to slight	Best-practice construction environmental management maintained, including phased dredging to minimise the spatial and temporal extent of sediment disturbance, real-time turbidity monitoring with defined trigger levels and stop-work thresholds	Not significant to slight
Harbour seal	Negative	Not significant	None	Not significant
Other marine mammals	Negative	Not significant	None	Not significant
Fish and shellfish	Negative	Not significant	Best-practice construction environmental management maintained, including phased dredging to minimise the spatial and temporal extent of sediment disturbance, real-time turbidity monitoring with defined trigger levels and stop-work thresholds	Not significant
Injury due to Underwater Noise from Construction Phase Dredging or Drilling				
All functional hearing groups of marine mammals	Negative	Imperceptible	MMO monitoring; 30-minute pre-watch, 500m mitigation zone, 30 min delay following detection in mitigation zone	Imperceptible

Impact/Activity/Receptor	Quality of Effect	Pre-mitigation significance rating	Mitigation measures	Post-mitigation/ residual significance rating
Group 1 & 2 fish, and marine turtles	Negative	Imperceptible	No mitigation measures proposed for fish. MMO mitigation measures as above should be applied to basking shark and marine turtles	Imperceptible
Group 3 fish	Negative	Not significant	None	Not significant
Disturbance due to Underwater Noise from Construction Phase Dredging or Drilling				
Low Frequency cetaceans (minke or humpback whales)	Negative	Imperceptible	MMO monitoring; 30-minute pre-watch, 500m mitigation zone, 30 min delay following detection in mitigation zone	Imperceptible
All other functional hearing groups of marine mammals	Negative	Not significant	MMO monitoring; 30-minute pre-watch, 500m mitigation zone, 30 min delay following detection in mitigation zone	Not significant
Fish, and marine turtles	Negative	Not significant	No mitigation measures proposed for fish. MMO mitigation measures as above should be applied to basking shark and marine turtles	Not significant
Injury due to underwater noise from construction phase blasting				
Low Frequency cetaceans (minke or humpback whales)	Negative	Not Significant	MMO monitoring; 30-minute pre-watch, 1000m mitigation zone, 30 min delay following detection in mitigation zone	Not Significant
High Frequency cetaceans (common or bottlenose dolphin)	Negative	Slight	MMO monitoring; 30-minute pre-watch, 1000m mitigation zone, 30 min delay following detection in mitigation zone	Not Significant
Very High frequency cetaceans (harbour porpoise)	Negative	Not Significant	MMO monitoring; 30-minute pre-watch, 1000m mitigation	Not Significant

Impact/Activity/Receptor	Quality of Effect	Pre-mitigation significance rating	Mitigation measures	Post-mitigation/ residual significance rating
			zone, 30 min delay following detection in mitigation zone	
Harbour seal	Negative	Moderate	MMO monitoring; 30-minute pre-watch, 1000m mitigation zone, 30 min delay following detection in mitigation zone	Not Significant
Grey seal	Negative	Slight	MMO monitoring; 30-minute pre-watch, 1000m mitigation zone, 30 min delay following detection in mitigation zone	Not Significant
Atlantic salmon and sea trout	Negative	Moderate	No blasting shall take place between 1st April and 31st August to avoid migrating fish	Slight
All other fish & marine turtles	Negative	Not Significant	No mitigation measures proposed for fish. MMO mitigation measures as above should be applied to basking shark and marine turtles	Not Significant
Disturbance due to underwater noise from construction phase blasting				
Low Frequency cetaceans (minke or humpback whales)	Negative	Not Significant	MMO monitoring; 30-minute pre-watch, 1000m mitigation zone, 30 min delay following detection in mitigation zone	Not Significant
All other functional hearing groups of marine mammals	Negative	Slight	MMO monitoring; 30-minute pre-watch, 1000m mitigation zone, 30 min delay following detection in mitigation zone	Not Significant
Atlantic salmon and sea trout	Negative	Slight	No blasting shall take place between 1st April and 31st August to avoid migrating fish	Not Significant
All other fish & marine turtles	Negative	Slight	No mitigation measures proposed for fish. MMO mitigation measures as above	Slight

Impact/Activity/Receptor	Quality of Effect	Pre-mitigation significance rating	Mitigation measures	Post-mitigation/ residual significance rating
			should be applied to basking shark and marine turtles	
Death of injury by collision				
Marine mammals	Negative	Imperceptible	None	Imperceptible
Basking shark and marine turtles	Negative	Imperceptible	None	Imperceptible
Pollution control	Negative	Slight	Best-practice construction environmental management maintained, including bunded fuel storage, spill kits, regular equipment checks to prevent hydrocarbon leaks	Not Significant
Invasive alien species	Negative	Slight	Biosecurity measures implemented, including cleaning and inspection of all marine plant, vessels, and construction equipment before deployment on site, sourcing rock fill from terrestrial, non-marine locations and avoiding material with prior aquatic exposure, ensuring that ballast water management practices comply with IMO Ballast Water Management Convention standards, and Development of a Biosecurity Risk Assessment	Not Significant

Table 8-39: Summary of the post-mitigation residual effects on all IEFs arising during the operation phase

Impact/Activity/Receptor	Quality of Effect	Pre-mitigation significance rating	Mitigation measures	Post-mitigation/ residual significance rating
Permanent loss of habitat or change of habitat type due to presence of infrastructure				
Benthic habitats	Negative	Slight	None	Slight
Fish and shellfish species	Negative	Slight	None	Slight

8.12 Cumulative Effects (rEIAR)

The likely significant cumulative effects of the project in-combination with existing or planned projects were considered and assessed. The study area was defined as the marine waters of Cashla Bay from Cashla Point to Clynagh Bay and surrounding coastal waters within 10km of Cashla Point. This broad area of study was identified in recognition of the fact that marine species can be highly mobile. The study area also encompasses all known seal haul-out sites in the bay. The zone of impact of certain pressures can be extensive, for example, suspended sediments can be transported over extended distances due to tidal action, while underwater noise from construction projects can be above ambient noise levels several kilometres from the noise source.

The Galway County Council public planning viewer and An Coimisiún Pleanála cases map viewer were both searched for relevant existing, proposed and approved marine projects within the study area. Three projects were identified for cumulative effect assessment;

1. GCC. Reg. Ref. 21/300 - Permission granted in 2021 for Phase 3 of a new small craft harbour, reclamation of foreshore and dredging of a new small craft harbour basin at Ros an Mhíl Fishery Harbour Centre, Ros an Mhíl, Co. Galway.
2. GCC. Reg. Ref. 18/547 - Permission granted in 2018 for refurbishment of existing slipway to improve low tide access. Raising and widening of slipway deck and the addition of a berthing face. Extension of existing rubble mound breakwater and re-grading of rock revetment to provide further protection of the small draft Harbour.
3. GCC Reg. Ref. 15/115 – Permission granted in 2015 for Small Craft Harbour, reclamation of foreshore and dredging of a new small craft harbour approach channel and basin.

The first phase of the Small Craft Harbour construction (Ref. 15/155) and refurbishment of the existing slipway (Ref 18/547) was completed prior to commencement of works on the deep water quay. The further development (Phase 3) of the small craft harbour (Ref. 21/300) has been approved but construction has not yet commenced. As such, no pathway exists for cumulative effects during the development works.

The identification of potential effects has been undertaken by considering the relevant characteristics of the development. The identification of potential effects has been undertaken by considering the outcome of the residual effects assessment and the potential for a pathway for those impacts to have direct and/or indirect effects on identified receptors.

Underwater noise from blasting was identified as the sole cumulative impact requiring assessment. Considering that blasting consisted of a series of 20 multiple blasts on each platform over a period of 11 months, the absence of other blasting within the bay during this time period, the momentary and occasional duration of each blast impact, the use of an MMO and recommended marine mammal mitigation measures outlined above, and the small scale of the small harbour development, it is considered unlikely that underwater noise from blasting at the development site gave rise to cumulative impacts resulting in injury or disturbance to sensitive IEFs.

8.13 Conclusion

This Chapter of the rEIAR has assessed all potential pressures on identified marine IEFs arising from the development at Ros an Mhíl.

Residual impacts were identified for the permanent loss of benthic marine habitat to land habitat resulting from the reclamation of land and blasting and dredging, however, the impacted benthic habitats are widespread in Irish waters including the Connemara coast, and are not identified as habitats of conservation concern or protected under any national or international Legislation or Agreement. No significant residual impacts were identified for any other IEF identified.

It is concluded, in light of the above presented evidence, that the development was in line with mitigation measures outlined above, had minimal adverse effects on the receiving environment either individually or cumulatively with other developments in the area.

No remedial marine mitigation measures are required for the development.

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