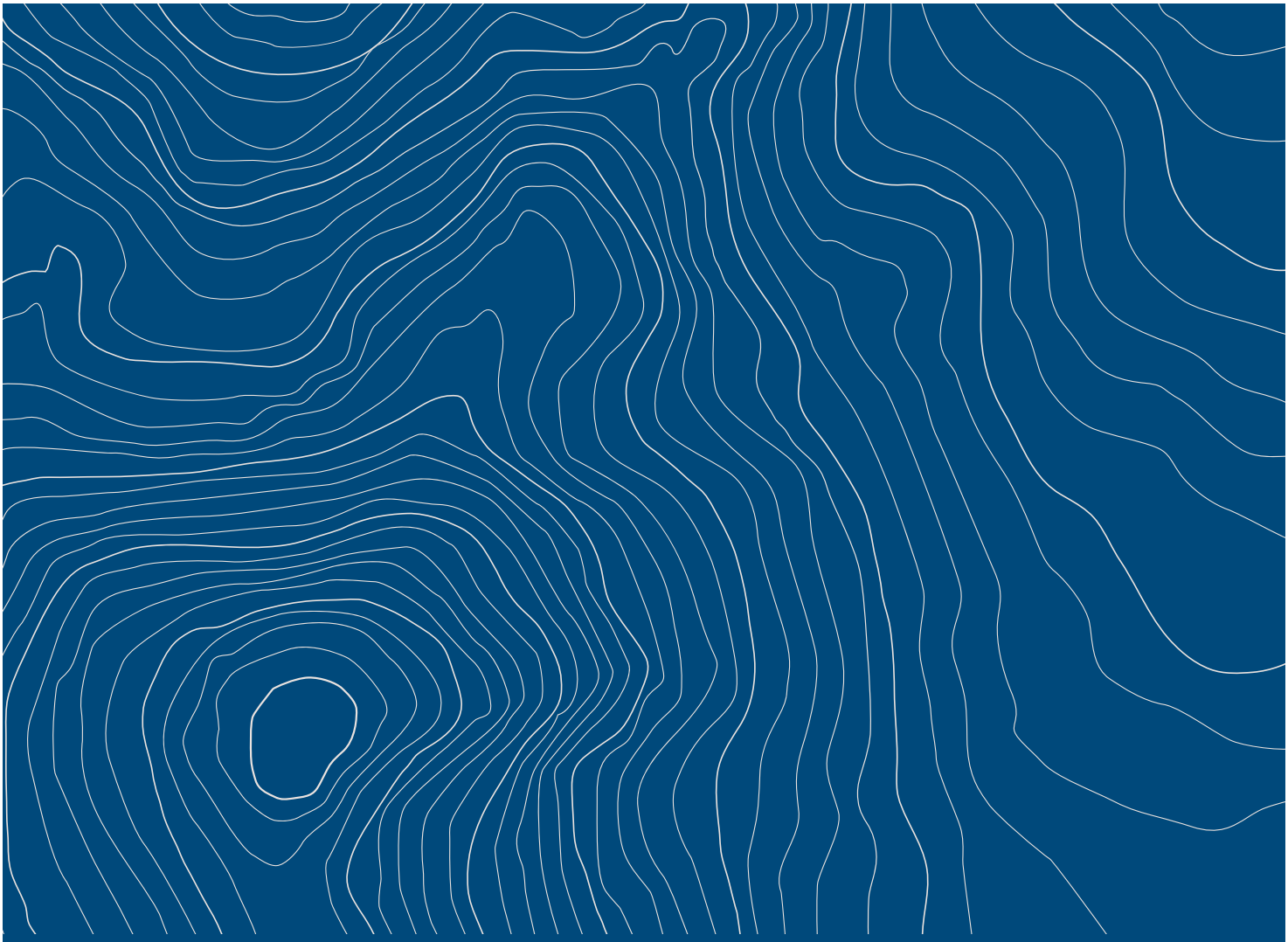

DublinArray
Generation for generations

EIAR Volume 3: Offshore Infrastructure Assessment Chapters Chapter 20: Offshore Assessment - Operations and Maintenance Base

Kish Offshore Wind Ltd

RWE SLR GoBe APEM Group

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Dublin Array Offshore Wind Farm

Environmental Impact Assessment Report

Volume 3, Chapter 20: Offshore Assessment – Operations and Maintenance Base

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N/A

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Glossary

Term	Definition
Array Area	The area within which the WTGs and OSP's will be located.
Benthic ecology	Benthic ecology encompasses the study of the organisms living in and on the sea floor, the interactions between them and impacts on the surrounding environment.
Biotope	A region of habitat associated with a particular ecological community.
COWRIE	COWRIE is an independent body set up by the Crown Estate who carry out research into the impacts associated with offshore wind farm development on the environment and fauna.
Diadromous	Migrating between fresh and saltwater habitats.
EIAR	Environmental Impact Assessment Report – a report to inform an Environmental Impact Assessment.
Offshore Export Cable Corridor (Offshore ECC)	Corridor for an export transmission cable from the array to landfall.
Elasmobranch	Cartilaginous fish of the subclass Elasmobranchii; comprises sharks, rays and skates.
Flatfish	Bony fish of the order Gadiformes; includes plaice, soles, flounders, turbot and their relatives.
Geophysical Survey	A geophysical survey is a method of collecting data about the physical properties of
Intertidal	The area of the shoreline which is covered at high tide and uncovered at low tide.
Invasive alien species (IAS)	This is a species which has been introduced outside its natural range and has the ability to negatively alter its new habitat and out-compete native flora and fauna. The (EU) Invasive Alien Species Regulation 1143/2014 provides for the publication and updating of a list of Invasive Alien Species of Union concern - (EU) Regulation 2016/1141 as revised and updated from time to time. S.I. No. 374/2024 - European Union (Invasive Alien Species) Regulations 2024 gives effect to the (EU) Invasive Alien Species Regulation and includes a further list of Invasive Alien Species of National concern, which may be revised and up-dated from time to time.
Mean High-Water Springs (MHWS)	MHWS is the highest level that spring tides reach on the average over a period of time (often 19 years). The height of MHWS is the average throughout the year (when the average maximum declination of the moon is 23.5°) of two successive high waters during those periods of 24 hours when the range of the tide is at its greatest.
Onshore Electrical System (OES)	Collective term for all onshore infrastructure from the Mean Low Water Spring to the GCP which are likely to be necessary to connect the development to the national grid i.e. the TJB, onshore ECC and OCC.
OES Works	Works to construct and install the OES.
Operation and Maintenance Base (O&M Base)	This is the location from where the daily operations and normal repairs, replacement of parts and structural components, and

Term	Definition
	other activities needed to preserve the offshore assets will be conducted.
Offshore Infrastructure	Wind turbine generators, offshore substation platforms, inter array cables offshore export cables and landfall works below MHWS.
Ornithology	The study of birds.
Permanent Threshold Shift	Permanent Threshold Shift (PTS) is a permanent increase in the threshold of hearing (minimum intensity needed to hear a sound) at a specific frequency above a previously established reference level.
Rock armour	Rock armour consists of large, robust boulders or rocks placed to protect shoreline structures against scour and water, wave erosion. In the context of the document it refers to the rock placed on the seabed to protect the existing quay wall from scouring during ferry operations.
Shellfish	Shell-bearing aquatic vertebrates used as food; includes various species of crustaceans, bivalves and gastropods.
Subtidal	The region where the seabed is below the lowest tide.
Temporary Threshold Shift	Temporary Threshold Shift (TTS) is a temporary increase in the threshold of hearing (minimum intensity needed to hear a sound) at a specific frequency above a previously established reference level.
Zone of Influence (ZoI)	The area or 'zone' where impacts from the proposed development may impact upon benthic and intertidal ecology receptors.

Acronyms

Term	Definition
cm	Centimetres
DLR	Dún Laoghaire-Rathdown
Dublin Array	Dublin Array Offshore Wind Farm
EC	European Commission
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environment Protection Agency
EU	European Union
ha	Hectares
HWM	High-Water Mark
km	Kilometres
MW	Megawatts
NBDC	National Biodiversity Data Centre
NI	Northern Ireland
O&M	Operations and maintenance
OCC	Onshore Compensation Compound
OES	Onshore Electrical System
Onshore ECC	Onshore Export Cable Corridor
ROI	Republic of Ireland
RWE	RWE Renewables Ireland Ltd (a wholly owned subsidiary of RWE AG)
SAC	Special Areas of Conservation
SPA	Special Protection Areas
UN	United Nations
WTG	Wind Turbine Generators

20 Operations and Maintenance Base – Offshore

20.1 Introduction

20.1.1 This chapter of the Environmental Impact Assessment Report (EIAR presents the results of the Environmental Impact Assessment (EIA) for the potential impacts specific to the marine-based infrastructure and activities associated with the Dublin Array Offshore Wind Farm (Dublin Array) Operations and Maintenance (O&M) Base (referred to in this document as the O&M Base). For the avoidance of doubt, the land-based infrastructure and activities are assessed across the relevant onshore EIA chapters in volume 5.

20.1.2 The O&M Base will be located at Dún Laoghaire Harbour (see Figure 1 and Figure 2) and is the location from which the daily operations needed to preserve the offshore assets will be conducted. The O&M Base will also provide supporting services (control, monitoring, storage, welfare) for the offshore wind farm during the project's lifecycle. Furthermore, once the O&M Base is operational, it will also be used to support the construction, operation and maintenance and decommissioning of the offshore wind farm. The O&M Base will be located within the administrative boundary of Dún Laoghaire-Rathdown County Council (DLRCC).

20.1.3 This chapter should not be read in isolation as it relies upon, and makes reference to, other elements of the Planning Application. Relevant accompanying Volumes and Chapters are referred to in order to avoid unnecessary duplication. Primarily this chapter should be read in conjunction with the following document included within the EIAR:

- Volume 4, Appendix 4.3.20-1: Offshore Technical Baseline Report – Operations and Maintenance Base: to be referenced for a description of the receiving environment in the vicinity of the O&M Base development for the following receptors:
  - Physical processes (see Volume 3, Chapter 1: Marine Geology, Oceanography and Physical Processes - hereafter referred to as the Physical Processes Chapter);
  - Marine water and sediment quality (see Volume 3, Chapter 2: Marine Water and Sediment Quality - hereafter referred to as the Marine Water and Sediment Quality Chapter);
  - Benthic ecology (see Volume 3, Chapter 3: Benthic Subtidal and Intertidal Ecology - hereafter referred to as the Benthic Subtidal and Intertidal Ecology Chapter);
  - Fish and shellfish ecology (see Volume 3, Chapter 4: Fish and Shellfish Ecology - hereafter referred to as the Fish and Shellfish Ecology Chapter);
  - Marine mammals (see Volume 3, Chapter 5: Marine Mammals - hereafter referred to as the Marine Mammals Chapter);
  - Offshore ornithology (see Volume 3, Chapter 6: Offshore and Intertidal Ornithology - hereafter referred to as the Ornithology Chapter);
  - Nature conservation (see Volume 3, Chapter 8: Nature Conservation - hereafter referred to as the Nature Conservation Chapter);

- Marine Archaeology (see Volume 3, Chapter 13: Marine Archaeology - hereafter referred to as the Marine Archaeology Chapter); and

20.1.4 The assessment of the onshore works for the O&M Base is undertaken for all onshore receptors and topics within the relevant topic chapters within Volume 5 of the EIAR with baseline characterisations provided in supporting appendices in Volume 6: Onshore Technical Appendices. The assessment of the onshore works for Dublin Array takes an integrated approach to assessing the development of the O&M Base alongside the Onshore Electrical System (OES) and onshore ECC, where it is considered therein and is therefore not repeated here where no pathway exists for potential impacts to arise from offshore works.

20.1.5 A number of offshore topics have not been considered within this chapter where other chapters of the EIAR comprehensively present the baseline receiving environment and cover all potential effects.

20.1.6 The receptors/topics not presented herein with reference to relevant chapters provided are;

- Bats (see Volume 5, Chapter 2, Biodiversity Chapter – hereafter referred to as the Onshore Biodiversity Chapter - and accompanying Appendix Volume 6, Appendix 6.5.2-1);
- Commercial Fisheries (see Volume 3, Chapter 9 Commercial Fisheries – hereafter referred to as the Commercial Fisheries Chapter);
- Shipping and Navigation (see Volume 3, Chapter 10 Shipping and Navigation - hereafter referred to as the Shipping and Navigation Chapter);
- Marine Infrastructure and Other Users (see Volume 3, Chapter 11: Marine Infrastructure and Other Users - hereafter referred to as the Marine Infrastructure and Other Users Chapter);
- Aviation and Radar (see Volume 3, Chapter 12, Aviation and Radar - hereafter referred to as the Aviation and Radar Chapter); and
- Seascape, Landscape and Visual Impact Assessment (SLVIA) (see Voume 3, Chapter 15 SLVIA - hereafter referred to as the SLVIA Chapter).

Planning Application Boundary

DRAWING STATUS

PUBLIC

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MAP NOTES / DATA SOURCES:

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PROJECT TITLE

Dublin Array

DRAWING TITLE

Existing Dún Laoghaire Harbour Site Plan

DRAWING NUMBER: **005532727-01**

FIGURE NUMBER: **1**

VER	DATE	REMARKS	DRAW	CHEK	APRD
01	2025-01-10	Ready for release	DB	PM	PK

0 20 40 60 80 Meters

0 20 40 60 80 Yards

GRID NORTH

SCALE 1:2,500 PLOT SIZE A3

DATUM WGS 1984 VERTICAL REF LAT

PRJ WGS 1984 UTM Zone 29N

Dublin Array
Generation for generations

Kish Offshore Wind Limited - Bray Offshore Wind Limited

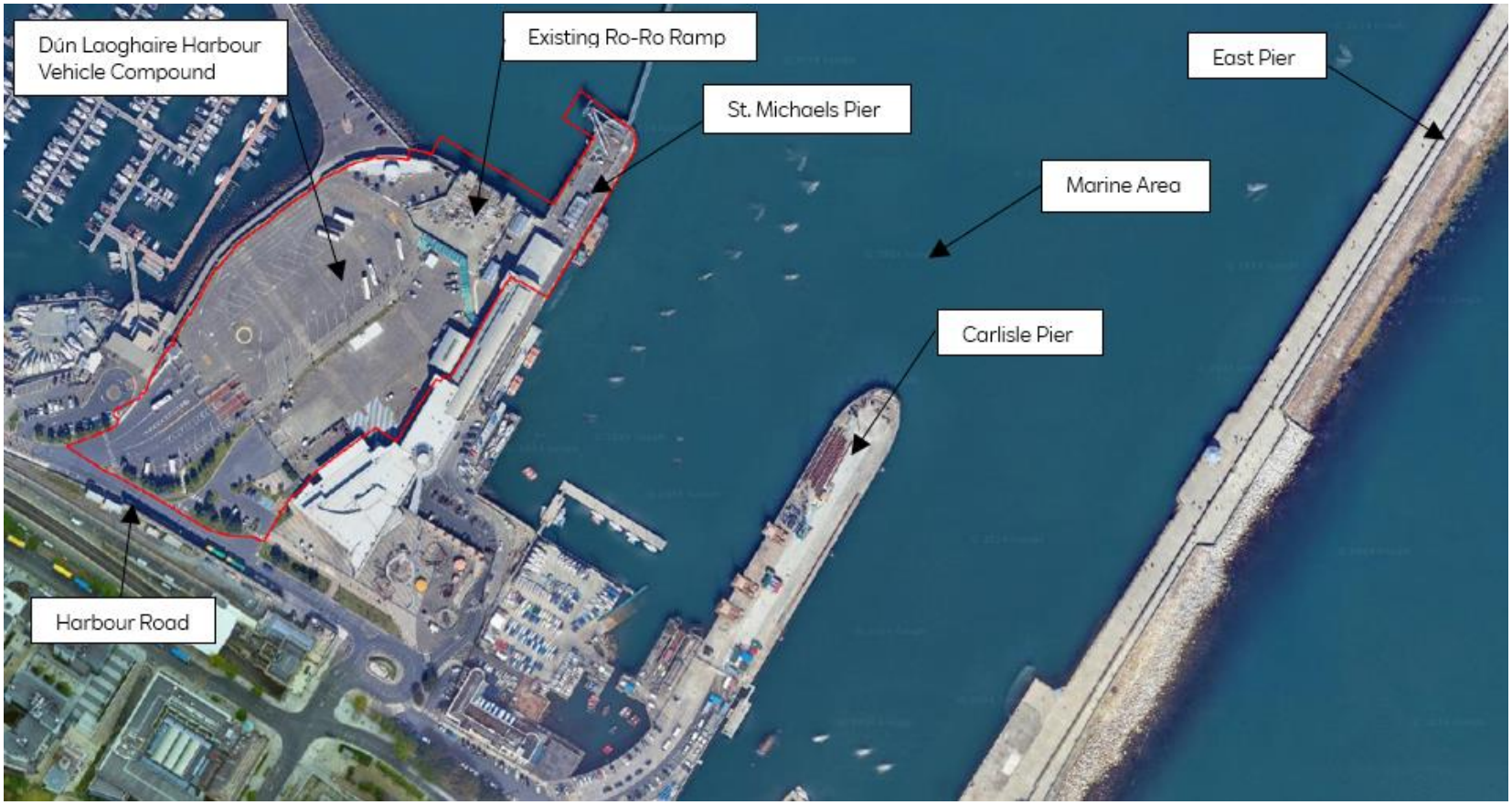

Figure 2 - Location of the proposed O&M Base (Source: Google Maps)

20.2 Regulatory background

20.2.1 The principal legislation, policy and guidance that is relevant to the planning application is set out in Volume 2, Chapter 2: Consents, Legislation, Policy and Guidance (hereafter referred to as the Policy Chapter). In addition, the specific legislation, policy and guidance that is relevant only to particular receptors is set out within the relevant EIA chapter.

20.2.2 For the purpose of this chapter, and the assessment of impacts specific to the marine-based infrastructure and activities associated with the O&M Base, the specific legislation, policy and guidance that has been considered is set out across the relevant chapters of the EIAR:

- Physical Processes Chapter;
- Marine Water and Sediment Quality Chapter;
- Benthic Subtidal and Intertidal Ecology Chapter;
- Fish and Shellfish Ecology Chapter;
- Marine Mammals Chapter;
- Nature Conservation Chapter;
- Offshore Ornithology Chapter; and
- Marine Archaeology Chapter.

20.2.3 It is considered appropriate to cross refer to the relevant EIA chapters, in relation to legislation policy and guidance, because of the breadth and length of the list that applies, given the number of relevant chapters, as opposed to duplicating.

20.3 Methodology

Study area

20.3.1 Acknowledging the location of all the marine -based infrastructure and activities within the confines of Dún Laoghaire Harbour and the limited scale of these activities within the planning application boundary shown in Figure 1, the study areas used to inform the baselines and assessment section of this chapter (Section 20.4) have been defined on a receptor specific basis taking into account all potential pathways for effect to define a zone of influence (ZoI) that has been used to inform the extent of the study area. It should be noted that in the absence of project specific modelling for the activities considered herein the definition of ZoI and therefore study areas have taken a precautionary approach as noted throughout.

20.3.2 The study areas for each topic assessed herein are described within Appendix 4.3.20-1: Operations and Maintenance Base Offshore Technical Baseline.

Assessment Criteria

20.3.3 For a full description of the methodology as to how this EIAR was prepared, see Volume 2 Chapter 3, Methodology Chapter (hereafter referred to as the EIA Methodology Chapter.

Sensitivity criteria

20.3.4 The criteria for determining the sensitivity of the receiving environment and the magnitude of impacts draws upon the topic chapters (as noted in Section 20.2) noting the differing approaches to sensitivities that consider the best available science and guidance therein.

Magnitude of impact criteria

20.3.5 It is noted here that a distinction is made throughout the assessment between the magnitude, as defined by the spatial extent, duration[1], frequency, likelihood and consequences/ reversibility of the impact and the resulting significance of the potential 'effects' upon receptors. The descriptions of magnitude are specific to the assessment of each topic impacts and are considered against the magnitude descriptions presented in Table 1. Potential impacts have been considered in terms of whether they are adverse or beneficial effects.

20.3.6 Where an effect could reasonably be assigned more than one level of magnitude, professional judgement has been used to determine which rating is applicable with the primary judgement relating to the potential consequences of the impact. The level has been assigned based on the most appropriate potential consequences of the impact as defined for each level of magnitude (see Table 1).

20.3.7 The assessment of magnitude draws upon the project parameters set out in Volume 2, Chapter 6: Project Description as relevant to the marine-based infrastructure and activities associated with the O&M Base.

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[1] This is the duration of the impact and not the time taken for the receptor to recover.

Table 1 Magnitude of the impact

Magnitude	Definition
High	**Extent:** Impact extends beyond the confines of the Dún Laoghaire harbour entrance **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 receptor character or distinctiveness.
Medium	**Extent:** The maximum extent of the impact is restricted to within the harbour walls. **Duration:** The impact is anticipated to be 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 receptor character or distinctiveness.
Low	**Extent:** The maximum extent of the impact is restricted to the Footprint of all activities and immediately adjacent area (ie within 100 m) **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 receptors' character or distinctiveness.
Negligible	**Extent:** The maximum extent of the impact is restricted to the footprint of all activities **Duration:** The impact is anticipated to be momentary (seconds to minutes) to brief (lasting less than a 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 receptor particular environmental aspect's character or distinctiveness.

Defining the significance of effect

20.3.8 The significance of effect associated with the impact will be dependent upon the sensitivity of the asset and the magnitude of the effect. The assessment methodology of the significance of potential effects is described in Table 2. For the purposes of this assessment receptors that are unable to adapt to change and potential effects identified to be of moderate significance or above are considered to be significant in EIA terms and additional mitigation will be required. Any effect that is slight (minor) or below is not significant.

Table 2 - Significance of potential effects

			Existing Environment - Sensitivity			
			High	Medium	Low	Negligible
Description of Impact - Magnitude	Adverse impact	High	Profound or Very Significant	Significant	Moderate*	Imperceptible
		Medium	Significant	Moderate	Slight	Imperceptible
		Low	Moderate	Slight	Slight	Imperceptible
	Neutral impact	Negligible	Not significant	Not significant	Not significant	Imperceptible
	Positive impact	Low	Moderate	Slight	Slight	Imperceptible
		Medium	Significant	Moderate	Slight	Imperceptible
		High	Profound or Very Significant	Significant	Moderate	Imperceptible

*Moderate levels of effect have the potential, subject to the assessor's professional judgement, to be significant. Moderate will be considered as significant or not significant in EIA terms, depending on the sensitivity and magnitude of change factors evaluated. These evaluations are explained as part of the assessment, where they occur.

20.4 Offshore O&M: Environmental Assessment

20.4.1 A description of the significance of effects upon the relevant marine-based receptors identified as part of the receiving environment likely to be caused by each identified impact is provided below.

Physical Processes Assessment

Baseline Overview

20.4.2 Dublin Bay's orientation provides shelter from offshore waves and wind from the southwest through to northerly directions, with exposure to waves from the east. Inside Dún Laoghaire Harbour, most waves result from local wind fetch, though waves can enter from the north to south-easterly directions, affecting the outer harbour. Offshore tidal currents flow north on the flood tide and south on the ebb tide, but the harbour's East and West Piers obstruct these currents. Generally, the current speeds near Dún Laoghaire Harbour entrance are between 0.35 and 0.5 m/s (max 0.6 m/s) during mean spring tides and between 0.2 and 0.35 m/s (max 0.4 m/s) during mean neap tides. Inside the harbour, currents are more benign, ranging between 0.02 and 0.05 m/s (ABPmer, 2014) whilst between the main and inner entrances currents ranging between 0.1 and 0.25 m/s, and 0.05 to 0.1 m/s occur during flood and ebb tides, respectively (ABPmer, 2014). Weak recirculating patterns present throughout (ABPmer, 2014). The superficial seabed sediments within the harbour are mainly sandy mud, while outside sandy mud, sand, gravel, and boulders are present. Quaternary deposits in Dublin Bay feature Pleistocene diamicton and granite bedrock transitioning to limestone.

Scope of the Assessment

20.4.3 The potential impacts identified for scoping out of the EIA, and the justification for doing so are set out within Table 3.

Table 3 Summary of Impacts Scoped out the EIAR

Impact	Justification
Impacts on seabed morphology due to indentations on the seabed from installation vessels	The proposed development will use jack-up vessels for installation activities within Dún Laoghaire Harbour. The harbour's high mud content makes it susceptible to localised indentations from the jack-up vessels. However, the harbour's heavily modified, man-made nature, with minimal natural features, means that the seabed is of limited significance as a physical process receptor. Given these factors, the impact of jack-up vessel induced indentations on seabed morphology is considered negligible and can be scoped out of further detailed assessment.
Seabed Scouring	The proposed development will not induce significant seabed scouring. The low current speeds at the site are insufficient to generate scouring conditions, and the levelling of the rock armour will not modify the underlying seabed to hydrodynamic forces, thus preventing the initiation of new

Impact	Justification
	scour. Therefore, the potential impact of seabed scouring associated with the project is considered negligible and can be scoped out of further detailed assessment.
Modifications to the tidal regime, and associated impacts to morphological features.	the harbour lacks any significant natural morphological features, changes to tidal patterns will not result in adverse effects on the existing seabed conditions. Therefore, the impact of modifications to the tidal regime on morphological features is considered negligible and can be scoped out of further detailed assessment.
Potential impacts to the seabed morphology	Dún Laoghaire Harbour is an already heavily modified marine environment, primarily consisting of man-made structures like rock armour, harbour walls and regularly dredged area. The site preparation works which include levelling of the existing rock armour, will have a negligible impact on natural seabed features and a minor impact on the man-made structures. due to the limited nature of the intervention and the existing modified conditions of the seabed, a detailed assessment of potential effects to seabed morphology is not necessary and can be scoped out.
Increase in suspended particulate matter (SPM) during construction activities.	While a slight increase in SPM is expected during construction activities, disturbance to the seabed sediments will be limited due to the primarily focus on being on levelling the top rock armour. Additionally, background SPM levels can reach 8 mg/l due to terrestrial runoff so any increase will likely be within the background levels experienced within the area of Dublin Bay.

Impact Assessment

20.4.4 One impact has been identified for physical processes and has been scoped in for assessment of construction phase impacts.

Impact 1: Temporary increase in SSC and sediment deposition

20.4.5 Temporary localised increases in SSC and associated sediment deposition are expected from the levelling of the rock armour under the pontoon with material both deposited on the rock armour and beneath being disturbed.

20.4.6 Given the small scale and localised nature of works, no project specific sediment plume modelling was undertaken. In the absence of site specific data sediment plume modelling in support of the Dún Laoghaire Harbour cruise liner terminal development EIAR (Stephen Little and Associates (2015) was used as a proxy although it is recognised that the levels of suspended sediment generated by the levelling works within the footprint of existing rock armour are significantly smaller in comparison to seabed dredging. The modelling indicated that dredging will cause a localised, temporary increase in suspended sediment concentration (SSC)[2] at the dredge site. Re-suspended sandy material will deposit rapidly (minutes), while silts will settle within a few hours. Finer particles could remain suspended for several hours to a day, increasing SSC within the harbour and potentially dispersing beyond the harbour mouth during ebb tides. However, SSC levels will decrease rapidly to negligible levels within 2 km (ABPmer, 2014).

20.4.7 The ABPmer model indicated that sands will be redeposited within 10 m of the dredge site, while silts might be transported up to 250 to 500 m before redeposition, with a maximum thickness of 10 mm. Finer particles will be transported further but with a negligible deposition thickness of less than 1 mm.

20.4.8 The volume of material disturbed during O&M Base construction phase will be significantly lower than that considered in the above modelling given the works will not interact directly with the seabed but occur within the existing footprint of the rock armour. Any resulting sediment plume is expected to dissipate rapidly after cessation of activities due to settling, with SSC concentrations quickly returning to background levels. The depth of any redeposited material will be negligible.

Table 4 Determination of magnitude of temporary increase in SSC and sediment deposition.

Definition	Maximum design option
Extent	The temporary impact of increased SSC and deposition from construction activities is expected to be restricted to the vicinity of the development area and Dún Laoghaire Harbour.
Duration	The impact will be restricted to the construction phase of the project and will therefore be short-term.
Frequency	This impact is not considered to be a frequent occurrence at the site and will only occur during rock armour removal/reinstatement.
Probability	The impact upon the subtidal benthic habitats can reasonably be expected to occur in relation to rock armour removal/reinstatement.
Consequence	Sediment plumes are expected to quickly dissipate after cessation of the activities, due to settling with the concentrations reducing quickly to background levels. Therefore, the consequence will be barely discernible to noticeable change in SCC concentrations and deposition occurring during the construction phase within Dún Laoghaire Harbour and adjacent coastal habitats.
Overall magnitude	*The potential magnitude of the predicted changes is rated as **Low.***

[2] Suspended Particulate Matter (SPM) is a broad term encompassing all solid particles suspended in a liquid, including organic and inorganic matter. Suspended Sediment Concentration (SSC) is a more specific term referring to inorganic particles, such as clay, silt, and sand, suspended in water.

20.4.9 The impacts from temporary increases in SSC and sediment deposition during O&M construction have been assessed as insignificant. Therefore, no further mitigation is required.

Cumulative effects

20.4.10 Given the effects are predicted to be localised, temporary and SSC concentrations quickly returning to background levels, and the significance of effects is assessed as insignificant the potential for cumulative effects has been screened out.

Summary of Impacts

20.4.11 A summary of the significant impacts assessed within this assessment for Physical Processes are presented in Table 5.

Table 5 Summary of impacts for physical processes

Description of Effect	Effect	Possible mitigation measures	Residual impact
Impact 1	Temporary increase in SSC and sediment deposition	Not Applicable – no additional mitigation identified	No significant adverse residual effects

Marine Water and Sediment Quality Assessment

Baseline Overview

20.4.12 The Marine Water and Sediment Quality (MW&SQ) O&M Base study area encompasses both the (i) immediate area of the proposed works in Dún Laoghaire Harbour; and (ii) area of secondary impact Zone of Influence (ZoI) out to 2 km from the marine-based infrastructure and activities which defines the distance over which material released from the proposed works may be dispersed over a spring tidal cycle.

20.4.13 Sediment data revealed sand and fine sediment within Dún Laoghaire Harbour. Sediment plume modelling indicates that while sands redeposit quickly, fines can remain suspended for hours to a day, having the potential to temporarily increase SPM within the harbour. Analysis of the sediment revealed most samples were below the Irish Action Levels, with some exceptions surpassing them like nickel and copper which was above AL 1 and Zinc which was higher than AL 2. Water quality assessments indicate generally good conditions, with temperature and salinity fluctuating seasonally, and nutrient levels monitored to prevent eutrophication.

Scope of the Assessment

20.4.14 The impacts identified for scoping out of the EIA, and the justification for doing so are set out within Table 6.

Table 6 Potential Impacts Scoped out and Justification

Impact	Justification
Deterioration in water quality due to re-suspension of sediment bound contaminants	Release of suspended sediments is expected during the levelling of the rock matrices. However, as minimal disturbance is anticipated to the seabed, less sediment will be released into suspension. Due to the higher SPM in the coastal waters, particularly in Dublin Bay where levels can reach around 8 mg/l, any additional sediment released during the operation is likely to be rapidly dispersed and settle with heavier sediments settling relatively quickly within a few hours, while finer sediments will be suspended for a longer period but at significantly reduced concentrations, below background levels. Therefore, this potential impact can be scoped out of the detailed impact assessment for this chapter.
Accidental releases or spills of materials or chemicals	The potential for accidental releases of substances such as grease, oil, fuel, anti-fouling paints, and grouting materials into the marine environment exists. Dublin Array is committed to implementing preventative measures to minimise such incidents. No discharges of chemicals or construction materials are proposed during the project lifetime. Therefore, this potential impact can be scoped out of the detailed impact assessment for this chapter. All works will comply with measures outlined within the Project Environmental Management Plan (PEMP) Volume 7, Appendix 1 relevant to offshore works and the Construction Environmental Management Plan, Volume 7, Appendix 8 relevant to all onshore works. The likelihood of an incident will be reduced by implementation of the project PEMP and Construction Environmental Management Plan (CEMP) which will include a marine pollution contingency plan addressing the risks, methods and procedures to deal with any spills and a chemical risk review including information regarding how and when chemicals are to be used, stored and transported.

Impact Assessment

20.4.15 No impacts have been identified for Marine Water and Sediment Quality impacts during the construction phase.

Cumulative Effects

20.4.16 As no impacts have been identified for MW&SQ (see Table 6) in the alone assessment, there is no potential for cumulative effects.

Benthic Ecology Assessment

Baseline Overview

20.4.17 Subtidal sediments in Dún Laoghaire Harbour and near shore areas in the vicinity of the O&M Base were predominantly sandy muds with generally low levels of sediment contaminants recorded. The communities present reflected the substrates and were analogous with those found inhabiting similar habitats elsewhere in the region.

20.4.18 The benthic subtidal and intertidal ecological features as outlined below are located within the O&M Base study area[3], and thus carried forward for assessment:

- *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment (SS.SSa.CMuSa.AalbNuc / EUNIS Code MC5214);
- *Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock (LR.HLR.MusB.Sem / EUNIS Code MA1223);
- Barnacles and fucoids on moderately exposed shores (LR.MLR.BF / EUNIS Code MA124); and
- *Fucus spiralis* on full salinity sheltered upper eulittoral rock (LR.LLR.F.Fspi / EUNIS Code MA123C1).

Scope of the Assessment

20.4.19 The following impacts will be assessed for the construction phase:

- Impact 1 - Temporary increase in SSC and sediment deposition;
- Impact 2 - Temporary habitat loss/disturbance; and
- Impact 3 - Increased risk of introduction or spread of Marine Invasive Non-native species (IAS).

20.4.20 The potential for seabed disturbance leading to the release of sediment contaminants and /or accidental contamination was scoped out for water and sediment quality as defined in Table 6, as such is not considered here for benthic ecology.

Impact Assessment

Impact 1: Temporary increase in SSC and sediment deposition

20.4.21 Temporary localised increases in SSC and associated sediment deposition are expected from the levelling of the rock armour under the pontoon, with material that has settled on the rock armour and beneath being disturbed.

20.4.22 As detailed in the assessment of physical processes, Sediment plume modelling undertaken in relation to a cruise liner terminal development in Dún Laoghaire Harbour indicated that dredging will result in a localised and temporary increase in SSC at the dredge location, with rate of subsequent deposition of resuspended sandy material being in the order of minutes, although silts will be deposited in the order of a few hours from the end of dredging activity; fines may persist in suspension in the order of hours to a day within the harbour.

[3] As defined by Dún Laoghaire Harbour Company, 2011 and Stephen Little and Associates, 2015

20.4.23 The ABPmer model indicated that sands will be redeposited within of 10 m of the dredge site, while silts might be transported up to 250 to 500 m before being redeposited, with the maximum thickness of redeposited material being 10mm. As discussed above, fines will be transported further before redeposition, although with a resulting thickness of less than 1mm. As such the extent of any plume generated by the marine-based infrastructure and activities will be confined to the harbour itself with no impact on habitats identified outwith.

20.4.24 The magnitude of the impact (temporary increase in SSC and sediment deposition) is assessed as low (See Table 4).

Table 7 MarESA[4] assessment for the benthic subtidal and intertidal biotopes for temporary increase in SSC and sediment deposition

Biotope code (JNCC and EUNIS 2022)	MarESA sensitivity assessment	Assessment confidence
Subtidal		
SS.SSA.CmuSa.AalbNuc / MC5214 – *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment	▪ Low sensitivity to changes in SSC; ▪ Low sensitivity to light smothering (< 5 cm); and ▪ Medium sensitivity to heavy smothering (5 – 30 cm)	▪ Confidence is low for changes in SSC. ▪ Confidence is medium for light smothering. ▪ Confidence is low of heavy smothering because the peer reviewed papers are based on a proxy for the pressure.
Intertidal		
LR.HLR.MusB.Sem / EUNIS Code MA1223 - *Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock	▪ Low sensitivity to changes in SSC; ▪ Medium sensitivity to light smothering (< 5 cm); and ▪ Medium sensitivity to heavy smothering (5 – 30 cm)	▪ Confidence is low for changes in SSC. ▪ Confidence is high for light smothering and heavy smothering because the evidence is based on peer reviewed papers.
LR.MLR.BF / EUNIS Code MA124 - Barnacles and fucoids on moderately exposed shores	▪ Medium sensitivity to changes in SSC; ▪ Medium sensitivity to light smothering (< 5 cm); and ▪ Medium sensitivity to heavy smothering (5 – 30 cm)	▪ Confidence is medium for changes in SSC. ▪ Confidence is medium for light smothering and heavy smothering
LR.LLR.F.Fspi / EUNIS Code MA123C1 - *Fucus spiralis* on full salinity sheltered upper eulittoral rock	▪ Not sensitive to changes in SSC; ▪ Low sensitivity to light smothering (< 5 cm); and ▪ Medium sensitivity to heavy smothering (5 – 30 cm)	▪ Confidence is medium for changes in SSC. ▪ Confidence is medium for light smothering and heavy smothering

[4] Marine Evidence-based Sensitivity Assessment (MarESA) approach is a sensitivity assessment which involves a systematic process to examine the biology or ecology of a feature, the compiling the evidence of the effect of a given pressure on the feature (species or habitat) in question, the assessment of the likely sensitivity of the feature to the pressure against standard scales, and to document the evidence used and justify assessments made

20.4.25 All biotopes present within the O&M study area have been assessed according to the MarESA criteria as presented in the Benthic Subtidal and Intertidal Ecology Chapter. The sensitivity of biotopes range from 'not sensitive' to having a 'medium' sensitivity[5] to a disturbance of this nature. All biotopes identified to be present in Dún Laoghaire Harbour and across the wider benthic subtidal ecology study area are acclimated to high levels of SSC that occur naturally within this region and consequently, are naturally subject to and able to tolerate variations in SSC and some degree of sediment deposition.

20.4.26 The magnitude of the impact to biotopes identified within the region has been assessed as Low, with the maximum sensitivity of the receptors being medium (range: not sensitive to medium). Therefore, the maximum significance of effect from SSC and deposition occurring as a result of construction activities in the benthic subtidal ecology study area is slight, which is not significant in EIA terms. Table 7 identifies that the confidence for the sensitivity of the specified habitats to temporary increase in SSC and sediment deposition is low in some instances. For all habitats, the low confidence is associated with the resistance measure, with high confidence associated with the recovery (resilience) of the habitats. Since the evidence agrees in terms of direction and magnitude of the impact the assessment is considered a conservative and robust assessment.

Impact assessment

20.4.27 The impacts on subtidal and intertidal ecology receptors associated with temporary SSC and sediment deposition as a result of the construction phase of the O&M have been assessed as 'not significant' in EIA terms. Therefore, no further mitigation is considered necessary. No significant adverse residual effects on benthic ecology have therefore been predicted.

Impact 2: Temporary habitat loss/disturbance

20.4.28 Direct temporary habitat loss/disturbance is expected to occur as a result of levelling the rock armour beneath the pontoon and jack up operations. Temporary loss/disturbance of benthic habitats will be restricted to discrete subtidal areas only within the rock armour and adjacent seabed within the confines of Dún Laoghaire Harbour. Physical impacts to the seabed during jack-up operations will be restricted to the footprint of the spud cans.

20.4.29 The magnitude of the impact (temporary habitat disturbance) is assessed in Table 8, for the identified benthic biotope receptors, the sensitivity of the receptor to the potential effect is assessed in Table 9.

Table 8 Determination of magnitude of temporary increase in temporary habitat disturbance.

Definition	Maximum design option
Extent	The temporary impact of habitat disturbance from construction activities is expected to be restricted to subtidal areas the vicinity of the development area and Dún Laoghaire Harbour.
Duration	The impact will be restricted to the construction phase of the project and anticipated to take a few days (less than a week) and will therefore be short-term.

[5] MarESA sensitivity scores use a combination of resistance (tolerance) and resilience (recovery) assigned to habitats and species.

Definition	Maximum design option
Frequency	This impact is not considered to be a frequent occurrence at the site and will only occur during rock armour levelling.
Probability	The impact upon the subtidal benthic habitats can reasonably be expected to occur in relation to rock armour levelling.
Consequence	Subtidal habitat is expected to recover quickly after cessation of the activities, due to recolonisation by biota from immediate surrounding area. Therefore, the consequence will be barely discernible habitat disturbance occurring during the construction phase within Dún Laoghaire Harbour and adjacent coastal habitats.
Overall magnitude	*The potential magnitude of the predicted changes is rated as **Low.***

Table 9 MarESA assessment for the benthic subtidal and intertidal biotopes for temporary habitat disturbance.

Biotope code (JNCC and EUNIS 2022)	MarESA sensitivity assessment	Assessment confidence
Subtidal		
SS.SSA.CmuSa.AalbNuc / MC5214 – *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment	▪ Low (based on medium resistance and high resilience)	▪ Confidence is low as the assessment is based on expert judgement

20.4.30 As demonstrated in Table 9, the biotope characterising the subtidal habitats is determined as having a low sensitivity to habitat disturbance. This biotope is typical of high energy environments and are therefore naturally subject to, and tolerant of, high levels of physical disturbance. The faunal communities are characterised by mobile species such as burrowing bivalve species which can re-enter the substratum following temporary habitat disturbance. The recoverability of such communities is therefore likely to occur rapidly (<2 years (MarESA) predominantly as a result of adult migration from surrounding unaffected areas, as well as via larval settlement.

20.4.31 No intertidal habitats will be affected by habitat loss in relation to rock armour levelling which is located below the high water mark.

20.4.32 The magnitude of the impact has been assessed as low, with the sensitivity of the receptors being low. For the receptors identified, the significance of effect from temporary habitat loss/disturbance as a result of Dublin Array is Slight which is not significant in EIA terms.

Impact 3: Increased risk of introduction or spread of Invasive Alien Species (IAS)

20.4.33 The movement of project vessels to undertake the construction work and during operation of the O&M Base to fulfil the required maintenance has the potential to impact upon benthic ecology and biodiversity by contributing to the risk of introduction or spread of IAS through ballast water discharge. However, movement of commercial vessels is common in Dún Laoghaire Harbour and across the wider region (see the Shipping and Navigation Chapter) and represents an existing and potentially more likely method of transport for IAS species (due to the higher variety of ports and passage routes). Therefore, any contribution of O&M Base construction vessels will be negligible in comparison to the impacts of other marine users.

20.4.34 All project vessels will comply with the measures contained within the PEMP which will include a Marine Biosecurity Plan to minimise the risk of potential introduction and spread of IAS. During the lifetime of the project the Applicant and its contractors will comply with all measures outlined in the Marine Biosecurity Plan to include all vessels of 400 gross tonnage and above to be in possession of a current international Anti-fouling System (AFS) certificate and all vessels to be compliant (where applicable) with the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention, developed and adopted by the International Maritime Organisation (IMO).

20.4.35 The magnitude of the impact is assessed in Table 10,for the identified benthic biotope receptors, sensitivity of receptor to the potential effect is assessed in Table 11. For several of the identified benthic biotope receptors, the sensitivity of the receptor is not assessed on a biotope basis because there is lack of research and the pressures are not assessed within the Marlin MarESA sensitivity assessment (see the Benthic Subtidal and Intertidal Ecology Chapter). The sensitivity is therefore determined to be High (as a worst-case precaution). The sensitivity of benthic species to the introduction or spread of IAS that may be disturbed is therefore determined to be High (as a worst-case precaution).

Table 10 Determination of magnitude of risk of introduction of IAS during O&M

Definition	Maximum design option
Extent	The extent of the impact will be restricted to the movement of O&M construction vessels within Dún Laoghaire Harbour and transit to and from the construction site.
Duration	The impact will be restricted to the construction phase of the project and will therefore be short-term (18 months).
Frequency	The impact will occur intermittently throughout the construction phase of the development.
Probability	The introduction of IAS is not anticipated to occur given the nature of O&M vessels and the controls in place through the PEMP and Biosecurity Plan.
Consequence	The number of vessels and embedded mitigation will ensure that the risk of potential introduction and spread of IAS will be negligible.
Overall magnitude	*The potential magnitude of the predicted changes is rated as* ***Negligible.***

Table 11 MarESA assessment for the introduction or spread of IAS.

Biotope code (JNCC and EUNIS 2022)	MarESA sensitivity assessment	Assessment confidence
Subtidal		
SS.SSA.CmuSa.AalbNuc / MC5214 – *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment	▪ Medium (based on medium resistance and very low resilience)	▪ Not relevant
Intertidal		
LR.HLR.MusB.Sem / EUNIS Code MA1223 - *Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock	▪ Not sensitive	▪ Confidence is high
LR.MLR.BF / EUNIS Code MA124 - Barnacles and fucoids on moderately exposed shores	▪ Not sensitive	▪ Confidence is medium
LR.LLR.F.Fspi / EUNIS Code MA123C1 - *Fucus spiralis* on full salinity sheltered upper eulittoral rock	▪ Not sensitive	▪ Confidence is medium

20.4.36 The magnitude of the impact has been assessed as Negligible, with the maximum sensitivity of the receptors being Medium. Therefore, the impact significance from increased risk of introduction or spread of IAS as a result of Dublin Array is Not Significant.

Cumulative Effects for benthic and intertidal ecology

20.4.37 Given the effects are predicted to be localised and temporary, and the significance of all effects is assessed as not significant the potential for cumulative effects has been screened out.

Summary of Effects

20.4.38 A summary of the significant impacts assessed within this assessment for Benthic Ecology and the residual effects are presented in Table 12.

Table 12 Summary of effects assessed for benthic subtidal and intertidal ecology

Description of Effect	Effect	Possible mitigation measures	Residual impact
Impact 1	Temporary increase in SSC and sediment deposition	Not Applicable – no additional mitigation identified	No significant adverse residual effects
Impact 2	Temporary habitat loss/disturbance	Not Applicable – no additional mitigation identified	No significant adverse residual effects
Impact 3	Increased risk of introduction or spread of Marine Invasive Non-native Species (IAS).	Not Applicable – no additional mitigation identified	No significant adverse residual effects

Fish and Shellfish Ecology Assessment

Baseline Overview

20.4.39 Trawl and grab surveys conducted between 2014 and 2020 have revealed a rich community of fish and shellfish within Dublin Bay and thus the wider portions of the study area, surrounding Dún Laoghaire Harbour. The 2014 trawl surveys were dominated primarily by juvenile flatfish with gobies and sandeels also present. Beam trawl surveys conducted from 2016 – 2020 displayed similar results with flatfish having the highest relative abundance of species recorded as well as gobies, dragonets, sea scorpions, cod and mullet.

20.4.40 Fish stock surveys in the Lower River Liffey conducted in 2008 and 2010 recorded high numbers of sprat (*Sprattus sprattus*), sand goby and juvenile thick-lipped grey mullet (*Chelon labrosus*). Other species included sand smelt (*Osmerus eperlanus*), 3-spined stickleback (*Gasterosteus aculeatus*), flounder, dab, plaice, long-spined sea scorpion (*Taurulus bubalis*), cod, whiting, pollack (*Pollachius pollachius*) and European eel (*Anguilla anguilla*) (IFI, 2008a; IFI, 2010a).

20.4.41 Several diadromous fish species are known to migrate through Dublin Bay such as Atlantic salmon (*Salmo salar*), sea trout (*Salmo trutta*), river lamprey (*Lampetra fluviatilis*), and European eel. Fish counter data indicates that salmon stocks in the Liffey are currently below river-specific conservation limits (Millane *et al.*, 2023).

20.4.42 Van Veen grab surveys conducted in 2014 recorded a number of molluscs species across 12 stations in Dublin Bay and thus the wider portions of the study area, surrounding Dún Laoghaire Harbour. Samples were dominated by the white furrow shell, *Abra alba*.

Scope of the Assessment

20.4.43 The potential impacts associated with the marine based infrastructure and works that will be considered in the fish and shellfish impact assessment are as follows:

- Impact 1 - Temporary increase in SSC and sediment deposition;
- Impact 2 - Temporary habitat loss/disturbance; and
- Impact 3 - Introduction of underwater noise and vibration.

20.4.44 The potential for impact on fish and shellfish communities from seabed disturbance leading to the release of sediment contaminants and /or accidental contamination was scoped out for water and sediment quality as defined in Table 8.

Impact Assessment

Impact 1: Temporary increase in SSC and sediment deposition

20.4.45 Temporary localised increases in SSC and associated sediment deposition are expected from the levelling of the rock armour under the pontoon with material both deposited on the rock armour and beneath being disturbed.

20.4.46 As detailed in the assessment of physical processes, sediment plume modelling undertaken in relation to cruise liner terminal development Dún Laoghaire Harbour indicated that dredging will result in a localised and temporary increase in SSC at the dredge location with rate of deposition of resuspended sandy material being in the order of minutes, although silts will be deposited in the order of a few hours from the end of dredging activity; fines may persist in suspension in the order of hours to a day within the harbour.

20.4.47 The ABPmer model indicated that sands will be redeposited within of 10 m of the dredge site, while silts might be transported up to 250 to 500 m before being redeposited, with the maximum thickness of redeposited material being 10mm. As discussed above, fines will be transported further before redeposition, although with a resulting thickness of less than 1mm. As such the extent of any plume generated by the marine-based infrastructure and activities will be confined to the harbour itself with no impact on habitats identified outwith.

20.4.48 The magnitude of the impact (temporary increase in SSC and sediment deposition) is assessed as low (See Table 6).

20.4.49 The sensitivity of fish and shellfish receptors to increases in SSC and sediment deposition is assessed in detail in Section 1.16 of the Fish and Shellfish Ecology Chapter (Impact 1: Temporary increase in SSC and sediment deposition during construction activities). This assessment is based on the predicted changes in SSC and sediment deposition during offshore construction activities of Dublin Array offshore infrastructure, including the drilling of foundations and seabed levelling activities. The volume of material potentially being resuspended during marine-based infrastructure and activities at the O&M Base will be significantly less compared to the volumes of suspended sediments predicted for offshore construction activities of the offshore windfarm. Consequently, it is considered that the sensitivity of fish, shellfish and marine turtle receptors to the impact will remain as that being described for offshore construction activities, with the maximum sensitivity of the receptors assessed as being Medium.

20.4.50 The maximum magnitude of the impact for fish, shellfish and marine turtle receptors has been assessed as Low, with the maximum sensitivity of the receptors being Medium. Therefore, the maximum significance of effects arising from temporary increases in SSC and deposition on fish, shellfish and marine turtle receptors is slight adverse, which is not significant in EIA terms.

Impact 2: Temporary habitat loss/disturbance

20.4.51 During the marine-based infrastructure and activities of the O&M Base, activities will result in temporary disturbances to the seabed, which may alter the distribution of fish and shellfish species. It is anticipated that all rock levelling activities will be undertaken within the footprint of the existing rock armour and as such there will be no additional impact on the adjacent seabed. Physical impacts to the seabed during jack-up operations will be restricted to the footprint of the spud cans.

20.4.52 Many fish and elasmobranch species present within the wider study area are highly mobile and are expected to move away from seabed disturbances. Any potential displacement will likely to be temporary, with individuals able to return after construction activities have ceased. Seabed disturbances may however injure or kill individuals of less mobile receptors, such as shellfish. However, given the discrete nature of the impact, any effects will be highly localised. The receptors are widely distributed across the greater Dublin Bay area, and any damages or loss to the seabed during construction activities are considered small compared to the overall extent of suitable fish and shellfish habitats. Based on the above, the impact is considered to result in temporary, highly localised changes in the distribution of fish and shellfish receptors, which are assessed to be at most barely discernible from baseline conditions. Therefore, the magnitude of impact is deemed to be Negligible, and the impact is not considered to result in significant effects to fish and shellfish species. No significant adverse impacts on fish, shellfish and marine turtle receptors have therefore been predicted.

Impact 3: Introduction of underwater noise and vibration

20.4.53 The introduction of underwater noise and vibration during the construction phase of the O&M Base is expected to arise from vessel movements and during the levelling of rock armour under the pontoon. All these activities are expected to produce non-impulse sounds, which are characterised by relatively continuous sound waveforms with slow signal rise times.

20.4.54 The marine-based infrastructure and activities at Dún Laoghaire Harbour will involve the excavation and levelling of rock by means of a backhoe dredger. It is expected that given the depths in the harbour, existing rock is unlikely to be removed, rather just re-profiled across the existing rock armour profile. The underwater sounds produced throughout the levelling process are likely to be repetitive and will include grinding and scraping sounds as rock material is removed by the dredge bucket and placed onto adjacent sections of the rock armour (Reine *et al.*, 2014). In addition, the machinery of the dredger will produce various sounds throughout the levelling process, which is likely to include sounds emitted by winches, hydraulic pumps and the bucket support arm (Reine *et al.*, 2014).

Sensitivity of receptors

20.4.55 Fish and shellfish may be impacted by underwater sounds through mortality, injury, temporary threshold shift (TTS), physiological stress responses, alteration to behaviour and/ or the auditory masking of acoustic cues used for foraging and communication (Popper *et al.*, 2014). A detailed account of hearing in fish and shellfish and the differences in hearing sensitivities among species is provided in Section 1.16 of the Fish and Shellfish Ecology Chapter (Impact 4: Introduction of underwater noise and vibration leading to mortality, injury, TTS and/or behavioural changes, or auditory masking). For the impact assessment presented below, the fish and shellfish receptors were classified into groups based on their sound detection mechanism and hearing capabilities, following the categories recommended by Popper *et al.* (2014). The categories proposed by Popper *et al.* (2014) for each of the key fish and shellfish species relevant to the O&M Base are presented in Table 13.

Table 13 Hearing categories of fish and shellfish receptors (Popper *et al.*, 2014; Popper and Hawkins, 2019)

Hearing category	Fish receptors relevant to Dublin Array O&M Base
Group 1: Fishes lacking swim bladders or other gas chamber. These species are sensitive only to sound particle motion within a narrow band of frequencies. Some barotrauma may occur from the exposure to sound pressure.	Common dab, plaice, flounder, lemon sole, sole, scaldfish, brill, dragonet, sea scorpions, Atlantic mackerel, Atlantic horse mackerel, elasmobranchs, river lamprey, sea lamprey
Group 2: Fishes with a swim bladder or other gas filled cavities that are not involved in hearing. Hearing in these species only involves sound particle motion within a narrow band of frequencies. Some barotrauma may occur from the exposure to sound pressure.	Atlantic salmon, brown/sea trout, sand gobies*, gurnards*
Group 3: Fishes with swim bladders that are close but not intimately connected to the ear. These species can detect both particle motion and sound pressure and show a more extended frequency range than groups 1 or 2, extending up to about 500 Hz. These species are susceptible to barotrauma.	Atlantic cod, poor cod, whiting, pollack, saithe, 3-bearded rockling*, 5-bearded rockling*, European bass*, European eel*, anglerfish*
Group 4: Fishes that have special structures mechanically linking the swim bladders to the ear. These species are sensitive primarily to sound pressure, although they also detect sound particle motion. They have a wider frequency range, extending to several kHz and generally show higher sensitivity to sound pressure than fishes in groups 1, 2, or 3. These species are susceptible to barotrauma.	Herring, sprat
Marine turtles	Leatherback turtle, loggerhead turtle, Kemp's Ridley turtle, hawksbill turtle, green turtle.
Eggs and larvae	All species.
Shellfish species	Common whelk, brown crab, European lobster

20.4.56 Underwater noise generation during rock armour activities is largely unknown. One study of rock placement activities in the Yell Sound in Shetland found that rock placement noise produced low frequency tonal noise from the machinery, but that measured noise levels were within background levels (Nedwell and Howell, 2004). Therefore, it is highly likely that any generated noise is likely to be dominated by the vessel from which activities are taking place.

20.4.57 Rock placement activities and vessel operations produce predominantly low-frequency sounds below 1000 Hz, which overlap with the hearing range of many fish species (Nedwell and Howell, 2004; Reine *et al.*, 2014). There is currently no evidence that these activities cause instantaneous or delayed mortality in fish and elasmobranch species (Popper *et al.*, 2014), and therefore the relative risk of lethal effects in these receptors during construction of the O&M Base is considered to be low. The limited data on other effects on fish hearing from non-impulse sounds including vessel and dredging noise indicate the potential for auditory tissue injuries and associated TTS in species with enhanced sensitivities to sound pressure (e.g., Group 3 and 4 species) (reviewed in Popper *et al.*, 2014).

20.4.58 The possible consequences of TTS in fishes are currently unknown, but it is suggested that TTS may decrease a receptor's fitness by impairing its ability to communicate, detect predators or prey and/ or assess its environment (Popper *et al.*, 2014). Observations of behavioural responses of fish to continuous noise sources are also sparse but so far have included avoidance reactions (e.g., Handegard *et al.*, 2003; Vabø *et al.*, 2002), physiological stress responses (Celi *et al.*, 2016; Wysocki *et al.*, 2006) and alteration of schooling behaviour such as changes in school cohesion, swimming speed and direction (e.g., van der Knaap *et al.*, 2022). Like TTS, the consequences of behavioural reactions in fish are largely unknown but may include changes in energy expenditure, foot intake and reproductive output (Popper and Hawkins, 2019; Soudijn *et al.*, 2020).

20.4.59 Taking the above into consideration including the non-lethal nature of any potential effects, fish and elasmobranch receptors within the study area are assessed as having a medium to high tolerance to underwater noise emitted during the construction of the O&M Base. Recoverability from behavioural changes is assessed as high, as any behavioural responses will likely be temporary, with affected individuals anticipated to resume normal behaviours and/ or recolonise areas shortly after activities have ceased. Any potential damage and/ or loss of sensory hair cells and associated shifts in hearing thresholds (TTS) are also likely to be temporary (high recoverability), with recovery of hair bundle density and hearing thresholds in fish exposed to continuous noise sources found to occur within several days to two weeks following noise exposure (reviewed in Popper *et al.*, 2014).

20.4.60 The effects of underwater noise on marine invertebrates are relatively sparsely studied, with assumed sensitivity of many species based on a limited number of studies on a small number of species (Lewandowski *et al.*, 2016). Available evidence indicates that underwater noise may cause behavioural and physiological changes close to the sound source, while mortality or recoverable injury are unlikely to occur (for a full review see Section 1.16 in the Fish and Shellfish Ecology Chapter). On this basis, shellfish are also assessed as having a medium to high tolerance to the impact. All shellfish species have some measure of mobility and will be able to recolonise any affected areas from adjacent locations following the cessation of construction noise. Any potential effects on shellfish as a result of underwater noise are therefore considered to be temporary (high recoverability).

20.4.61 Taking into consideration the regional to international importance of the fish and shellfish receptors within the study area together with their medium to high tolerance and high recoverability, the maximum sensitivity of fish and shellfish species to underwater noise emitted during the construction of the O&M Base is deemed to be Low.

Magnitude of impact

20.4.62 Sound levels associated with marine construction activities other than piling and vessel operations have received little attention and limited monitoring data are available. Using available noise measurement data, offshore backhoe dredging activities associated with Dublin Array have been estimated to generate unweighted source levels of 165 dB re 1µPa @ 1 m (RMS), while rock placement activities are estimated to generate sound levels of 172 dB re 1 µPa @ 1 m (RMS) (Underwater Noise Modelling Report).

20.4.63 In the absence of studies of the effects of rock placement, it is considered that underwater noise generated during rock levelling and other construction activities at the O&M Base will be comparable to that produced during offshore construction activities at Dublin Array (with the exception of piling and UXO clearance). Using the unweighted SEL_{rms} thresholds recommended by Popper *et al.* (2014), underwater noise modelling predicts that recoverable injuries and TTS in the most sensitive fish species (i.e., Group 3 and Group 4 species) as a result of non-impulse sounds generated during offshore construction activities at Dublin Array will occur less than 50 m from the noise source (Underwater Noise Modelling Report). For such effects to occur, an animal will have to stay within the immediate vicinity of the noise source for 12 hours to induce TTS and 48 hours to incur recoverable injury.

20.4.64 The risk of non-lethal injuries in the remaining receptors is considered to be low at all distances from the sound source, while the risk of TTS is likely to be moderate near (10s of meters) the noise source and low at intermediate (100s of meters) and far (1,000s meters) distances (Popper *et al.*, 2014). The relative risk of behavioural changes in marine turtles and Group 3 and Group 4 receptors is likely to be high at the near field (10s of meters) distance from the noise source, moderate at intermediate (100s of meters) distances and low at far (1,000s meters) distances from the construction activities (Popper *et al.*, 2014). For the remaining receptors (Group 1 and Group 2 receptors and eggs and larvae), the likelihood of behavioural responses is considered to be moderate at near and intermediate distances and low at far field distances from the noise source (Popper *et al.*, 2014).

20.4.65 As discussed above, there is currently no evidence that non-impulse (i.e., continuous) underwater sounds, such as those emitted during dredging activities and vessel operations, cause mortality or potential mortal injury in fish and shellfish receptors, while recoverable injuries, including damage to sensory hair cells and associated TTS, are likely to be restricted to the most hearing sensitivity species (e.g. Group 3 and 4 species) and confined to the immediate vicinity of the works. Behavioural reactions are likely to occur over wider areas but are like TTS expected to be temporary.

20.4.66 Factoring in the temporary nature of the impact (likely to occur over a number of days but predicted less than a week) together with the lower hearing capabilities and the low risk of recoverable injury and lower risk of TTS of marine turtles, shellfish, eggs and larvae and Group 1 and Group 2 receptors, any effects on these receptors are expected to be indiscernible from baseline conditions, and consequently the magnitude of the impact for these receptors is deemed to be Negligible. Given their better hearing capabilities and subsequently higher susceptibility to injuries, TTS and behavioural reactions, Group 3 and 4 receptors may exhibit barely discernible changes in baseline condition, and therefore the magnitude of the impact for these receptors is deemed to be Low adverse.

20.4.67 The maximum magnitude of the impact for all fish, shellfish and marine turtle receptors has been assessed as Low, with the maximum sensitivity being Low. Therefore, the maximum significance of effects on fish and shellfish receptors from non-impulse sounds generated during construction activities at the O&M Base is slight adverse, which is not significant in EIA terms.

Cumulative Effects for fish and shellfish ecology

20.4.68 Given the effects are predicted to be localised and temporary and the significance of all effects is assessed as not significant the potential for cumulative effects has been screened out.

Summary of Effects

20.4.69 A summary of the significant impacts assessed within this assessment for fish and shellfish ecology are presented in Table 14.

Table 14 Summary of effects assessed for fish and shellfish ecology

Description of Effect	Effect	Possible mitigation measures	Residual impact
Impact 1	Temporary increase in SSC and sediment deposition	Not Applicable – no additional mitigation identified	No significant adverse residual effects
Impact 2	Temporary habitat loss/disturbance	Not Applicable – no additional mitigation identified	No significant adverse residual effects
Impact 3	Introduction of underwater noise and vibration	Not Applicable – no additional mitigation identified	No significant adverse residual effects

Marine Mammals Assessment

Baseline Overview

20.4.70 The existing environment for marine mammals in the area of the Dublin Array Offshore Wind Farm includes several species commonly found in the region, such as harbour porpoises, bottlenose dolphins, common dolphins, minke whales, grey seals, and harbour seals. Harbour porpoises are the most frequently sighted marine mammals, inhabiting the Celtic and Irish Seas. Sightings are common from June through the autumn/winter, but reduced encounter rates from well-watched sites such as Howth Head, Dublin suggest they move offshore in spring between March and June (IWDG, 2010). Encounter rates typically increase in June, when calves are first recorded, which suggests they move to offshore calving/breeding grounds.

20.4.71 Berrow et al (2024) conducted surveys of haul-out sites close to Dublin Port between June 2023 and January 2024 during period with increased construction activity in the area related to Dublin Port's Masterplan 2040. These surveys included sites within Dublin Bay (and of relevance to Dún Laoghaire Harbour), included Sandy Cove which lies to the south, between the harbour and the Dalkey & Maidens Islands. Of the sites within Dublin Bay, a maximum of 79 grey seals were counted at Dalkey Island in Nov 2023, a maximum of 4 were counted in Sandy Cove and a maximum of 25 were counted at Bull Island. Grey seals were counted in highest numbers on Lambay Island and Ireland's Eye. The number of seals counted in the Dublin Bay and adjacent waters (Skerries to Dalkey Islands) were consistent with those counted in 2017 (Morris and Duck, 2019). Harbour seals were counted in highest numbers on Lambay Island and at Rush Head. The number of seals counted in the Dublin Bay and adjacent waters (Skerries to Dalkey Islands) were consistent with those counted in 2017 (Morris and Duck, 2019

Scope of the Assessment

20.4.72 The potential impacts associated with the construction activities that will be considered in the marine mammal impact assessment are as follows:

- Impact 1 – Introduction of underwater noise from rock movement;
- Impact 2 - Introduction of underwater noise and vibration from vessel activity; and
- Impact 3 - Changes in prey availability and distribution

Impact 1: Introduction of underwater noise from rock movement

20.4.73 The loudest underwater noise source for those activities proposed at the O&M Base is the levelling of the rock armour under the pontoon at the O&M Base, which will be undertaken to remove the risk of the crew transfer vessels (CTVs) hitting the rock armour when berthed at the pontoon at low tide. It is understood that the levelling is required across entire length and rock will be levelled / excavated by means of a backhoe. Given the depths in the harbour, rock is unlikely to be removed, rather just reprofiled across the existing rock armour profile. These reprofiling works will generate underwater noise levels that are similar to or less than rock placement activities.

20.4.74 Underwater noise generation during rock armour activities is largely unknown. One study of rock placement activities in the Yell Sound in Shetland[6] found that rock placement noise produced low frequency tonal noise from the machinery, but that measured noise levels were within background levels (Nedwell and Howell, 2004). Therefore, it is highly likely that any generated noise is likely to be dominated by the vessel from which activities are taking place. The sensitivity of harbour porpoise, dolphins and seals to PTS and disturbance from rock placement is expected to be Low. The low frequency noise produced during rock placement may be more likely to overlap with the hearing range of low frequency cetacean species such as minke whales. Therefore, the sensitivity of minke whale to PTS and disturbance from rock placement is precautionarily assessed as Medium.

Auditory injury

20.4.75 It is considered that the noise production from rock levelling will be similar to or less than that produced during underwater rock placement activity. Using the non-impulsive weighted SELcum permanent threshold shift (PTS) thresholds from Southall et al. (2019) resulted in estimated PTS impact ranges of <100 m for all marine mammal species for all non-piling construction noise. These values mean that almost any marine mammal will need to be closer than 100 m from the continuous noise source at the start of the activity to acquire the necessary exposure to induce PTS as per Southall et al. (2019). Therefore, the magnitude of the impact is Negligible. With the greatest sensitivity of Medium and magnitude of Negligible, the significance of effects is assessed as Not Significant in EIA terms.

[6] https://tethys.pnnl.gov/sites/default/files/publications/Nedwell-Howell-2004.pdf

Behavioural disturbance

20.4.76 There is no information available on marine mammal behavioural responses to rock placement activities. To be conservative, information on responses to dredging works in ports/harbours can be used instead. Modelling potential impacts of dredging using a case study of the Maasvlatke port expansion (assuming maximum source levels of 192 dB re 1 µPa) predicted a disturbance range of 400 m, while a more conservative approach predicted avoidance of harbour porpoise up to 5 km (McQueen et al., 2020). Studies have assumed that dredging activities exclude dolphins from a 1 km radius of the dredging site (Pirotta et al., 2013 and 2015). Given the works will be undertaken within the confines of a working harbour with very few sightings of marine mammals within the confines of the harbour, the magnitude of the impact is assessed as Low. With the greatest sensitivity of Medium and magnitude of Low, the significance of effects is assessed as Slight, which is not significant in EIA terms.

Impact 2: Introduction of underwater noise and vibration from vessel activity

20.4.77 Vessel noise is not a novel impact pathway for Dún Laoghaire Harbour or the Dublin Bay area. It is expected that marine mammals present in the area are already habituated to vessel noise.

20.4.78 Due to the already high volume of vessel traffic transiting in and out of the harbour, the introduction of vessels to be utilised during the construction of the O&M Base is not a novel impact for marine mammals present in the area. Furthermore, vessel activities at the O&M Base will be limited to the harbour itself.

20.4.79 Berrow et al (2024) conducted surveys of haul-out sites close to Dublin Port between June 2023 and January 2024 during a period with increased construction activity in the area related to Dublin Port's Masterplan 2040. The study concluded that despite the high levels of vessel activity associated with the major infrastructure redevelopment at Dublin Port, there is no evidence of a change in harbour seal haul-out usage in the area, and there is no evidence of a change in grey seal haul-out usage in the area. In fact, the haul-out site closest to the construction activity (Bull Island) showed a continued increase in haul-out usage during this period.

20.4.80 Given these levels of activity, there is unlikely to be the potential for significant disturbance as a result of vessels relating to the construction of the O&M base. The magnitude of disturbance from vessels within the harbour is assessed as Low, with the maximum sensitivity of receptors to the disturbance being Low. Therefore, the significance of effect from vessel noise is Slight, which is not significant in EIA terms.

20.4.81 The potential for an increase in vessel numbers during operation of the Dublin Array offshore wind farm that will utilise the O&M Base has been considered within the Marine Mammals Chapter under Impact 11, where the magnitude of the impact has been assessed as Low adverse, with the maximum sensitivity of the receptors being Low. Therefore, the significance of effect from disturbance from vessel noise is Slight adverse, which is not significant in EIA terms.

Impact 3: Changes in prey availability and distribution

20.4.82 Based on the sightings data, there is no evidence that Dún Laoghaire Harbour or the wider study area is an important foraging area for any marine mammal species.

20.4.83 While there may be certain species that comprise the main part of their diet, all marine mammals in this assessment are considered to be generalist feeders and are thus not reliant on a single prey species. Therefore, the sensitivity of all marine mammals to changes in prey abundance and distribution is assessed as Low.

20.4.84 The Fish and Shellfish ecology assessment above (Paragraphs 20.4.39 to 20.4.69) concludes that the effects of construction of the offshore O&M Base on fish and shellfish are not significant for any species. Therefore, the potential magnitude of impact on marine mammals is rated as Negligible.

20.4.85 Given the Low sensitivity and Negligible magnitude, the significance of effect from changes in prey availability and distribution from construction of the O&M Base is assessed as Not Significant.

Cumulative Effects for marine mammals

20.4.86 Given there is no potential for significant effects from the marine infrastructure and activities on marine mammals the potential for cumulative effects has been screened out

Summary of Effects

20.4.87 A summary of the significant impacts assessed within this assessment for marine mammals and the residual effects are presented in Table 15.

Table 15 Summary of effects assessed for marine mammal ecology

Description of Effect	Effect	Possible mitigation measures	Residual impact
Impact 1	Temporary habitat loss/disturbance	Not Applicable – no additional mitigation identified	No significant adverse residual effects
Impact 2	Reduction in water and sediment quality through the release of contaminated sediments and/or accidental pollution	Not Applicable – no additional mitigation identified	No significant adverse residual effects
Impact 3	Introduction of underwater noise and vibration	Not Applicable – no additional mitigation identified	No significant adverse residual effects

Offshore and Intertidal Ornithology Assessment

20.4.88 It should be noted that the onshore ornithological receptors are assessed fully as part of the onshore assessment (see Onshore Biodiversity Chapter for details of the survey methodology and results).

Baseline Overview

20.4.89 A full description of the receiving environment is outlined within Appendix 4.3.20-1 Operations and Maintenance Base Offshore Technical Baseline.

20.4.90 Dedicated field surveys (reported within Volume 6, Appendix 6.5.2-2, O&M Base Intertidal Bird Surveys Report) reported a number of species present across the site. The Onshore Biodiversity Chapter includes an overview of species sighted and their use across the site.

20.4.91 Of note for the assessment of offshore works is the use of the adjacent pier from the O&M Base (Carlisle Pier) by breeding black guillemot (*Cepphus grylle*), which also use the surrounding marine habitats for foraging. The peak count of black guillemot was 10 birds, suggesting that potentially 10 nesting pairs may be present (Walsh *et al.,* 1995). The recordings did not show that the black guillemot were using St Michael's Pier for nesting and they do not use this pier for breeding. Black guillemot are not considered an SCI species for any nearby SPAs. However, they are amber-listed[7] according to the latest Birds of Conservation Concern in Ireland (BoCCI4) assessment.

20.4.92 Herring gull (*Larus argentatus*) chicks were recorded on the roof of the existing Ferry Terminal Building, near the proposed O&M Base, indicating that gulls use the roof for nesting and breeding. The potential impacts of the demolition of the buildings as part of the O&M works on breeding herring gull have been assessed fully within the Onshore Biodiversity Chapter.

20.4.93 In addition, other species recorded, but not assessed for offshore works given their onshore range, include: house martin (*Delichon urbicum*), house sparrow (*Passer domesticus*) and starling (*Sturnus vulgaris*). These species were assessed as possibly breeding within the study area due to their presence in suitable nesting habitat. A remaining eight species were recorded as non-breeding within the study area. The surrounding marine and terrestrial habitats were found to support a range of other offshore species, which are considered likely to use the study area for foraging and roosting purposes including: common guillemot (*Uria aalge*), common tern (*Sterna hirundo*), northern gannet (*Morus bassanus*) and great cormorant (*Phalacrocorax carbo*).

Scope of the Assessment

20.4.94 The following impacts on offshore ornithological receptors are assessed:

- Impact 1 - Disturbance and displacement on key bird species as a result of construction activity for the O&M Base in Dún Laoghaire Harbour.

Impact Assessment

Impact 1: Disturbance and displacement on key bird species as a result of construction activity for the Operations and Maintenance base in Dún Laoghaire Harbour

20.4.95 Direct temporary disturbance or displacement of birds within the vicinity of the proposed O&M Base within Dún Laoghaire Harbour may occur during the construction period. Cutts *et al.* (2013) developed a toolkit to assist flood protection managers and ports developers in relation to waterfowl disturbance impacts arising from construction works within or adjacent to Natura 2000 sites, recognising the disturbance can occur from both visual and aural stimuli up to 500 m from the source.

[7] Gilbert, G., Stanbury, A. and Lewis, L., 2021. Birds of Conservation Concern in Ireland 4: 2020-2026.

20.4.96 Overall, baseline surveys recorded low numbers of birds in the vicinity of the proposed O&M Base within Dún Laoghaire Harbour. The Harbour does not lie within any designated SPA for birds, although the West Pier wall forms the southern border for the South Dublin Bay and River Tolka Estuary SPA (Site Code: 4024). The SPA boundary is located beyond the 500 m disturbance buffer for waterfowl (Cutts *et al.,* 2013). Roseate tern (*Sterna dougallii*), common tern, Arctic tern (*Sterna paradisaea*) and black-headed gull (*Chroicocephalus ridibundus*) designated at South Dublin Bay and River Tolka Estuary SPA may forage in the vicinity of the offshore area associated with the O&M Base, however, black-headed gull and tern species have very low vulnerability to disturbance from vessel movements associated with construction activity (Fliessbach *et al.,* 2019).

20.4.97 The most abundant species recorded across the wider study area that are likely to be present within the habour are (dunlin (*Calidris alpina*), herring gull, great black-backed gull *(Larus marinus*), black-headed gull, and sanderling (*Calidris alba*)). These species are considered to have a low sensitivity to disturbance with the exception of oystercatcher (*Haematopus ostralegus*) who are classed as having medium disturbance potential up to 200 m to a potential disturbance source but are relatively tolerant of disturbance stimuli and will habituate rapidly to ongoing activity (Cutts *et al*, 2013). Moreover the O&M Base is situated within an existing developed area that currently experiences high levels of artificial lighting, noise and activities which may create local vibrations. Any increase in noise from the marine-based infrastructure and activities will also be temporary, for the duration of the construction of the O&M Base. Birds will be able to disperse to other areas away from the O&M Base, where other foraging habitat exists.

20.4.98 Baseline surveys estimated that up to 10 pairs of black guillemots were confirmed to be breeding within the underside of Carlisle Pier, which is an adjacent pier to where the O&M Base will be located, approximately 190 m from the development footprint. A peak count of 10 birds was recorded during baseline surveys, suggesting that potentially 10 nesting pairs may be present. Black guillemots were not recorded using St Michael's Pier (O&M Base location) for breeding on baseline surveys.

20.4.99 The O&M base will be located within a working harbour with there being no loss of breeding or foraging habitat within the O&M Base study area as a result of the construction, operation, or decommissioning phases of the O&M Base. The construction of the pontoon and levelling of the rock armour is expected to generate underwater noise that will be short term and localised.

20.4.100 As detailed within the Onshore Biodiversity chapter, to mitigate any impact on breeding success of the black guillemots, construction works will be planned to avoid the most sensitive breeding seasonal timings from March to August inclusive. Where construction activities are required during this time, an Ecological Clerk of Works (ECoW) will be employed to monitor potential effects to black guillemot and cease works activities if disturbance is deemed to be too great. Alternatively, the ECoW will create an appropriate buffer zone for the birds (e.g., from identified breeding locations) in which construction activities cannot occur.

20.4.101 Assuming that construction activities are only conducted in the non-breeding season, then it is considered that the potential sensitivity of black guillemots will be Low (Table 16).

Table 16 Determination of sensitivity of black guillemots in the non-breeding season to disturbance and displacement from construction activity for the Operations and Maintenance base in Dún Laoghaire Harbour

	Justification
Context	**Adaptability:** As black guillemots will not be tied to the breeding site at this time of year, it is considered that they will be able to adapt their behaviour to avoid any effects from disturbance so that individual survival and reproduction rates are not affected. **Tolerance:** It is is considered that black guillemots will be able to tolerate the effect in the non-breeding season without any impact on individual reproduction and survival rates. **Recoverability:** As construction activities will not be conducted during the breeding season, then breeding birds will be able to return to previous behavioural states/activities for the breeding season. **Importance:** The breeding population of black guillemots in Dún Laoghaire Harbour is considered to be of local importance.
Receptor sensitivity	The potential sensitivity is rated as Low.

20.4.102 The magnitude of any disturbance effect during the non-breeding season has been assessed as Low (Table 17).

Table 17 Determination of magnitude for Impact 4

	Justification
Extent	Local spatial extent.
Duration	The impact will be restricted to the non-breeding season within the construction phase of the project and will therefore be short-term (18 months), as defined by EPA (2022). Thus the duration of any effect is considered to be temporary.
Frequency	The effect is anticipated to occur intermittently within the construction area during the proposed construction activities.
Probability	Temporary disturbance effects are considered likely in the vicinity of the construction activities.
Consequence	As disturbance will be temporary, and tied to the non-breeding season, the degree of potential disturbance will be low.
Overall magnitude	The potential magnitude is rated as Low.

20.4.103 For black guillemot, the magnitude of the impact is deemed to be **Low** and the overall sensitivity of this species in the non-breeding season is considered to be **Low**, as the receptor is of local importance only, with no SPAs designated for this species. The effect will therefore be of **Slight Adverse** significance, which is not significant in EIA terms.

Cumulative Effects for offshore ornithology

20.4.104 Given the effects are predicted to be localised and temporary and temporal restrictions in place during sensitive periods, the significance of all effects is assessed as not significant, the potential for cumulative effects has been screened out.

Summary of Effects

20.4.105 A summary of the significant impacts assessed within this assessment for Ornithology presented in Table 18.

Table 18 Summary of effects assessed for ornithology

Description of Effect	Effect	Possible mitigation measures	Residual impact
Impact 1	Disturbance and displacement on key bird species as a result of construction activity for the Operations and Maintenance base in Dún Laoghaire Harbour	Not Applicable – no additional mitigation identified	No significant adverse residual effects

Nature Conservation Assessment

Baseline Overview

20.4.106 There are no designated sites within Dún Laoghaire Harbour, the nature conservation sites that occur within the wider study area for the O&M Base are Sandymount Strand/Tolka Estuary Ramsar site, Dublin Bay Biosphere core zone at Sandymount Strand, Dalkey Coastal Zone and Killiney Hill pNHA and South Dublin Bay pNHA. Impacts Assessment

Impacts Assessment

20.4.107 Given the assessment identified above for birds, benthic habitats and species and habitats for which the identified sites are designated concluded no significant impacts, it can be determined the impacts associated with construction and operation of the O&M Base in Dún Laoghaire Harbour will not result in a significant impact on nature conservation sites.

Marine Archaeology and Cultural Heritage Assessment

Baseline Overview

20.4.108 A study area out to 1 km from the marine-based infrastructure and activities was used to identify shipwreck records and previous investigations that are present to identify known archaeological sites. There are seven recorded losses within the O&M Base study area, the closest of which is recorded approximately 400 m from the proposed O&M Base (see Offshore O&M technical baseline). A total of eight archaeological investigations have occurred within the O&M Base study area, only one of these investigations produced any archaeological results, recording the remains of a wreck (licence no. 14D0441). These wreck remains are recorded at two locations and attributed to two recorded wrecks W01966, W01967.).. They were described as scattered remains with only sections of wreckage visible on the seabed.

20.4.109 This study area has been assessed for archaeological potential using the National Monuments Service (NMS)[8] datasets and publicly available literature to inform the baseline within the O&M Base study area at Dún Laoghaire Harbour.

20.4.110 No project specific geophysical or geotechnical surveys were conducted over the area given the scale and nature of the works in an already busy, operational harbour.

Scope of the Assessment

20.4.111 The impacts outlined below have been scoped in and will be assessed, no impacts will be scoped out of the assessment.

20.4.112 Impacts are expected to potentially arise from site preparation works including the levelling of rock armour under the pontoon at the O&M Base and jack-up effects from construction vessels.

20.4.113 Impacts scoped in for the construction phase:

- Impact 1 - Disturbance of sediment containing potential marine archaeological receptors from the reprofiling of rock armour;
- Impact 2 - Compression of stratigraphic contexts containing marine archaeological receptors from reprofiled rock armour, the use of anchors and jack-up vessels during construction activities; and
- Impact 3 - Cumulative disturbance of sediment containing potential marine archaeological receptors during all phases of O&M Base works.

Sensitive Receptors

20.4.114 Sensitive receptors include the seven locations for recorded losses, all unknown wrecks: W01966; W01967; W11481; W11584; W11594; W11604 and W11611.The remains of the wreck identified in previous archaeological investigations (licence no. 14D0441), recorded at two locations and attributed to two recorded wrecks (W01966, W01967). In addition, there is potential for sediments containing evidence of palaeolandscapes and environments within the study area.

20.4.115 Of note for this assessment are the measures set out in the Archaeological Management Plan (Volume 7, Appendix 7 and Annex A: Protocol for Archaeological Discovery) which require all works to have regard to the archaeological potential and archaeological significance. Continued investigation through survey and the specifications for investigation and reporting set out in the AMP and Protocol for Archaeological Discoveries (PAD) documents, respectively, work to embed measures for use throughout the life of the project. These commitments are based on relevant guidance and consultation between the Applicant and the UAU to discuss approaches to mitigation and potential mitigation measures to be proposed within the AMP (see Marine Archaeology Chapter for additional details).

[8] Datasets used include; Archaeological Survey of Ireland - https://data.gov.ie/dataset/national-monuments-service-archaeological-survey-of-ireland (including SMR & SMRZones) data and Wreck Inventory of Ireland - https://data.gov.ie/dataset/national-monuments-service-wreck-inventory-of-ireland

Impacts Assessment

Impact 1: Disturbance of sediment containing potential marine archaeological receptors from the reprofiling of rock armour

20.4.116 Disturbance of sediment containing potential marine archaeological receptors (material and contexts) during the reprofiling of rock armour can lead to direct or indirect impact on marine archaeological receptors by impacting and exposing such receptors to natural, chemical or biological processes.

20.4.117 If any marine archaeological receptors are subject to an increase in sediment cover and protection as a result of the construction phase, the marine archaeological receptor might benefit from the conditions which may provide a higher level of preservation *in situ*. However, exposure of sites and receptors due to sediment movement may lead to partial or total loss of the same.

20.4.118 To facilitate the installation of the pontoon, rock levelling will be required at locations across the length of the pontoon. The rock will be levelled / excavated by means of backhoe. Given the depths in the harbour, rock is unlikely to be removed, rather just reprofiled across the existing rock armour profile. Within the study area, the closest archaeological remains identified within the harbour lies 400m from the O&M infrastructure, however it cannot be excluded that unknown archaeological remains may be found within the immediate footprint of the marine-based infrastructure and activities.

20.4.119 The magnitude of impact on marine archaeological receptors taking into account the extent, duration, frequency, probability and consequence of impact is rated as high, however when assessed with the implementation of all measures contained within the AMP and PAD, the magnitude is assessed as imperceptible.

20.4.120 The baseline potential sensitivity of marine archaeological receptors considering the context of adaptability, tolerance and recoverability, and value of the receptor is rated as high.

20.4.121 Therefore, the significance of effect from the disturbance of sediment containing potential marine archaeological receptors (material and contexts) during the reprofiling of rock armour leading to total or partial loss of the receptor is profound or very significant, which is significant in EIA terms.

20.4.122 Following the utilisation of all Project Design Features (see Project Description Chapter) and Avoidance and Preventative Measures (as secured in Volume 8, Chapter 2: Schedule of Commitments and detailed within the AMP and PAD), there should be no impacts, meaning that the sensitivity of the marine archaeological receptor will be low, and the magnitude of impact is imperceptible. The significance of effect is therefore not significant, in EIA terms.

Impact 2: Compression of stratigraphic contexts containing marine archaeological receptors from reprofiled rock armour, the use of anchors and jack-up vessels during construction activities

20.4.123 Compression of stratigraphic contexts containing potential marine archaeological receptors as a result of the construction vessels (such as jack-up vessels and as a result of the reprofiled rock armour) can lead to the direct impact on marine archaeological receptors.

20.4.124 Impacts from compression can result in total or partial loss of marine archaeological receptors contained in the sediments below the construction vessels and below the reprofiled rock armour.

20.4.125 The baseline potential magnitude of impact on marine archaeological receptors considering the extent, duration, frequency, probability and consequence of impact is rated as high, however with the implementation of all measures contained within the AMP and PAD, the magnitude of impact has been assessed as imperceptible.

20.4.126 The baseline potential sensitivity of marine archaeological receptors considering the context of adaptability, tolerance and recoverability, and value of the receptor is rated as high.

20.4.127 Therefore, the significance of effect from the disturbance of sediment containing potential marine archaeological receptors (material and contexts) during the reprofiling of rock armour leading to total or partial loss of the receptor is assessed that no impacts should occur, the significance of effect is therefore not significant, in EIA terms.

Summary of Effects

20.4.128 A summary of the effects presented above relating to marine archaeology is presented in Table 19 below.

Table 19 Summary of effects assessed for marine archaeology

Description of Effect	Effect	Possible mitigation measures	Residual impact
Impact 1	Disturbance of sediment containing potential marine archaeological receptors from the reprofiling of rock armour.	Not applicable – no additional mitigation identified	No significant adverse residual effects
Impact 2	Compression of stratigraphic contexts containing marine archaeological receptors from reprofiled rock armour, the use of anchors and jack-up vessels during construction activities archaeological receptors.	Not applicable – no additional mitigation identified	No significant adverse residual effects

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