Grutness Pier Improvement Works

Environmental Report

On behalf of

Shetland Islands Council

Project Ref:332511168| Rev: A | Date: March 2023

Front Cover Photograph provided by Brian Gray

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A					
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1 Introduction

1.1 Overview

1.1.1 This Environmental Report has been managed by Stantec UK Ltd (Stantec) on behalf of Shetland Islands Council ('the Applicant'). It relates to a full planning application and associated marine consents (MS-LOT) for the improvements to the existing ferry pier (hereafter referred to as 'the Proposed Development') at Grutness, Shetland to facilitate a new ferry (hereafter referred to as 'the Site', which is defined on the Site Location Plan included in **Appendix 1.1**). The Site is located within the administrative boundary of Shetland Islands Council (SIC).

1.1.2 Fair Isle is the UK's most remote community and is facing serious challenges in terms of economic and social sustainability. The island has been owned by the National Trust for Scotland since 1954. Fair Isle is renowned for its wildlife and cultural heritage. The current ferry is estimated to reach the end of its serviceable life by 2026 and must be replaced as a matter of growing urgency. The ferry link is the single most important feature in supporting a sustainable future for the island. This redevelopment will provide improved transport links between Fair Isle and Shetland mainland by increasing the resilience of both the vessel and the ferry terminal infrastructure at both ends of the ferry route. A separate planning application / Marine License application is also being prepared for the Fair Isle Harbour Improvement Works.

1.1.3 The Proposed Development description refers to the need to replace the existing ferry, which will therefore require the pier at Grutness, Shetland to be upgraded to facilitate this new roll-on roll-off (Ro-Ro) vessel. The details of the works required are described below:

- An extension to the existing pier (sheet piled structure) and rock armour protection in a 'dog-leg' shape to provide shelter for a new linkspan structure (a steel deck (bridge) linking the ferry to the shore) that will be used by the new Ro-Ro vessel;
- An increase to the height of the existing rock armour to the north of the pier to reduce the frequency and severity of swell overtopping during storm events;
- Dredging to provide a sufficient water depth for the new vessel around the proposed pier extension and linkspan; and
- Improved marshalling facilities.

1.1.4 This Environmental Report has been prepared following the receipt of the Screening Opinion from SIC (May 2022) and Marine Scotland (June 2022) (**Appendix A: Screening Opinion**) which acknowledged that the works do not require a formal Environmental Impact Assessment under the Town and Country Planning (Scotland) (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) for works on land and to the mean low water springs mark, and The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended), for the Marine Scotland Act 2010 (Marine Licenses) to be consented by Marine Scotland for the deposit or removal of a substance or object below the mean high water springs mark.

1.1.5 However, both Shetland Island Council and Marine Scotland have stated that any planning application submitted will require to be accompanied with an Environmental Report that sets out the environmental issues and mitigation measures outlined within the Screening Report (Stantec) April 2022.

1.2 Environmental Report Structure

1.2.1 The Screening Opinion stated that the following documents should be submitted as part of the planning application:

- Ecological Appraisal Report (incorporating Baseline Ecological Surveys);
- Report to Inform the Appropriate Assessment (RIAA);

- First Iteration of the Environmental Management Plan (fiEMP);
- Planning Statement;
- Planning Application Drawings; and
- Completed Planning Application Forms and Landownership Certificate.

1.2.2 This Environmental Report consequently includes the Ecological Appraisal Report (incorporating the Baseline Ecological Surveys) and any other mitigation measures that are to be incorporated within the works.

2 The Site and Surrounding Area

2.1 Site Location, Context and Access

2.1.1 Grutness ferry terminal is located near Sumburgh Head on the southern tip of the Shetland Mainland, opposite Sumburgh Airport[1]. The pier is generally sheltered from the south and west by land and open to the north and east. It is very exposed from the east through to the north-east. An aerial photograph is shown below to identify the site in relation to neighbouring land.

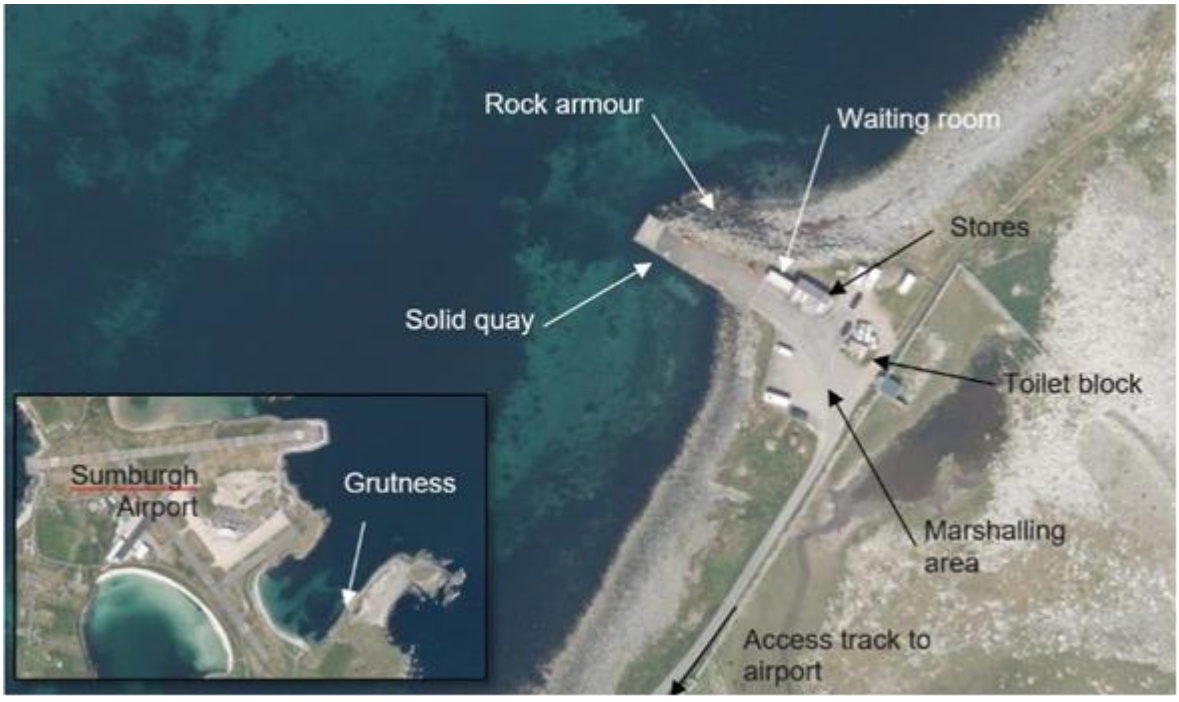
2.1.2 The current operation of the Good Shepherd IV carries twelve passengers, the journey takes about two and a half hours. In summer the ferry sails three times a week to /from Grutness (Tuesday, Thursday and Saturday) and once a fortnight it sails to Lerwick. In winter there is only one sailing per week (Tuesday).

2.1.3 Existing pier facilities at the site include:

- 30m long berthage;
- 2.1m water depth shown on Admiralty Chart (although it is known that the berth has been dredged to remove the tidal restriction, but to an unknown extent and at an unknown time);
- single track access road with limited space for parking / marshalling and a bus pickup; and
- heated waiting room (portacabin), stores block, toilet block and waste disposal skips.

2.1.4 The quayside storage unit has capacity for about a week's worth of deliveries for almost all goods, including retail, coal, timber etc. The store is always locked but suppliers are able to access the key to the unit when required. For larger loads that cannot be held in the storage unit, hauliers keep in contact with the ferry operator and coordinate the delivery of these loads to meet the ferry when she operates. The island population and businesses rely on these deliveries fundamentally for their survival on the island.

Image 2.1 Aerial Photograph showing Grutness Ferry Terminal and Sumburgh Airport.



[1] Grid reference 59 52' N 01 17' W and Admiralty Chart 3283

2.1.5 The area of intended works within the existing pier for the purpose of this Environmental Report has been set at a maximum of 1.65 ha as outlined in red in **Appendix B**, ***Figure 2.1***. and ***Figure 2.3***.

Relevant Environmental Characteristics and Designations

2.1.6 The site is situated within an area with the following nearby or overlapping designations as shown in **Appendix B**, ***Figure 2.2***:

- Sumburgh Head Special Protection Area (SPA) – designated for breeding Arctic Tern, Kittiwake, Fulmar and Guillemot (boundary overlaps with proposal site);
- Sumburgh Head Site of Special Scientific Interest (SSSI) – notified for its geological interest and breeding colonies of Puffin, Shag, Guillemot, Kittiwake, Fulmar and Arctic Terns (approx. 30m from the proposal site); and
- Grutness lighthouse store, including boundary wall, gate and gate piers (LB44543) – a listed building category C approx. 200m from the existing pier.

2.1.7 There are no other statutory designations covering any part of the site or the immediate surrounding area. A Report to Inform the Appropriate Assessment (RIAA) has also been prepared to accompany the Planning Application.

2.1.8 Otters [redacted] (**Appendix C Otter Survey Report**), a survey will be required prior to construction and European Protected Species (EPS) license will be sought if required.

2.1.9 Further afield from the proposal area are:

- Pool of Virkie SSSI – notified for its intertidal mudflats (approx. 1km outside of the bay and along the coastline to the north)
- Moussa to Boddam MPA – designated for sand eel (approx. 4km to the northwest of the proposal site)

2.1.10 In relation to planning policy, the site is covered by the Shetland Local Development Plan (LDP) 2014 which was adopted by the SIC on 26th September 2014 and is the established planning policy for Shetland. SIC is currently updating the LDP[2], which has recently been out for consultation. SIC is currently reviewing consultation responses.

2.2 The Surrounding Area

Context

2.2.1 Grutness is a small settlement and headland at the southern tip of the main island of the Shetland Islands. The settlement is within the parish of Dunrossness. It is located close to Sumburgh Head and is the terminus of the ferry service between the Shetland Mainland and the Fair Isle.

2.2.2 Sumburgh Airport is the main airport serving Shetland and is located to the northwest of the pier, there are approximately 7 scheduled passenger flights per day arriving at the airport, with the same number departing, plus helicopter traffic (servicing the Oil and Gas industry, over 100 flights each month) and cargo flights each day.

2.2.3 The geography of the area is an extremely complex series of deeply indented bays, cliffs, beaches and settlements. Adjacent to the site is a stony beach.

[2] https://www.shetland.gov.uk/planshetland

3 The Proposed Development

3.1 Construction Details

3.1.1 The proposed scope of works comprises (as shown on **Appendix B: Figure 2.4 Overview of Works, Figure 2.6 Proposed Linkspan, Figure 2.7 Proposed Pier Structure**)

- An extension to the existing pier (sheet piled structure) and rock armour protection in a 'dog-leg' shape to provide shelter for a new linkspan structure (steel deck with concrete supports and bankseat) that will be used by the new Ro-Ro vessel;
- An increase to the height of the existing rock armour to the north of the pier to reduce the frequency and severity of swell overtopping during storm events;
- Dredging to provide a sufficient water depth for the new vessel around the proposed pier extension and linkspan; and
- Improved marshalling facilities.

3.1.2 The new Ro-Ro vessel will be a maximum of 24 m in length and the draught is likely to be similar to the existing (Good Shepherd IV service draught 2.7m) with the aim of limiting dredging through appropriate vessel design choice.

3.1.3 Image 3.1 shows land-based and water-based boundaries. Area 1 Water-based boundary (shown in green) measures 14,356m2 (1.44ha), and Area 2 Land-based boundary (red) measures 2,091m2 (0.21 ha). Image 3.2 shows photograph of land-based facilities. A more detailed plan is within **Appendix B: *Figure 2.5* Marine and Terrestrial Works**.

Image 3.1 Land based, and water based boundaries.

Image 3.2 Land-based facilities

3.1.4 It is expected that up to 328 sheet piles driven into the sea bed will be required to construct the extension to the pier. While there will likely be a mixture of impact from vibro piling, as a worst-case scenario it is assumed that impact piling will be required throughout the duration of the construction period. It is anticipated that piling activities will likely be spread out allowing 4 days of piling for each section (cell) of the pier, followed by 12 days of non-piling activities to complete that cell and move on to the next (3 days to install waling beams[3], 2 days to install tie rods, 3 days to backfill, 4 days to set up temporary works for next cell).

3.1.5 Piling activity will be carried out for a maximum of 10 hours per day (between 07:00 and 19:00) for an anticipated 4 days, followed by 12 days of non-piling activities, repeated for up to 10 cells. The proposed methodology is to install piles “end over” using land-based piling plant sitting on the end of the existing pier. As each cell is completed and backfilled, the plant can move onto the cell and construct the next. It is estimated that piling activities will take a maximum of 6 months, between April and September and will start no later than the 7th May.

3.1.6 While it is assumed that piling would be carried out from the land side (on pier), if the contractor prefers to use a barge-mounted piling rig, the total duration of piling will be approximately 3 months. However, as a worst-case option, the Report to Inform Appropriate Assessment (RIAA) assumes that piling activities would be 6 months.

3.1.7 The maximum size of the area to be dredged at Grutness is approximately 12,000 m², which will be the Capital dredging for the works, including transition slopes between the dredge pocket and the existing seabed. This area is only an estimate based on indicative drawings and is subject to change once the designs and position of the pier extension is finalised. The final dredged depth will also be based on the vessel draught and will unlikely exceed 4.5 m below chart datum (BCD). However, the vessel design will look to minimise an increase in draught to avoid dredging where possible.

3.1.8 As with piling, dredging activity will be carried out for a maximum of 10 hours per day (between 07:00 and 19:00) using up to two barges working simultaneously. Allowing for weather downtime the maximum duration of dredging activities would be 7 months, between April and October, acknowledging that this would not be continuous.

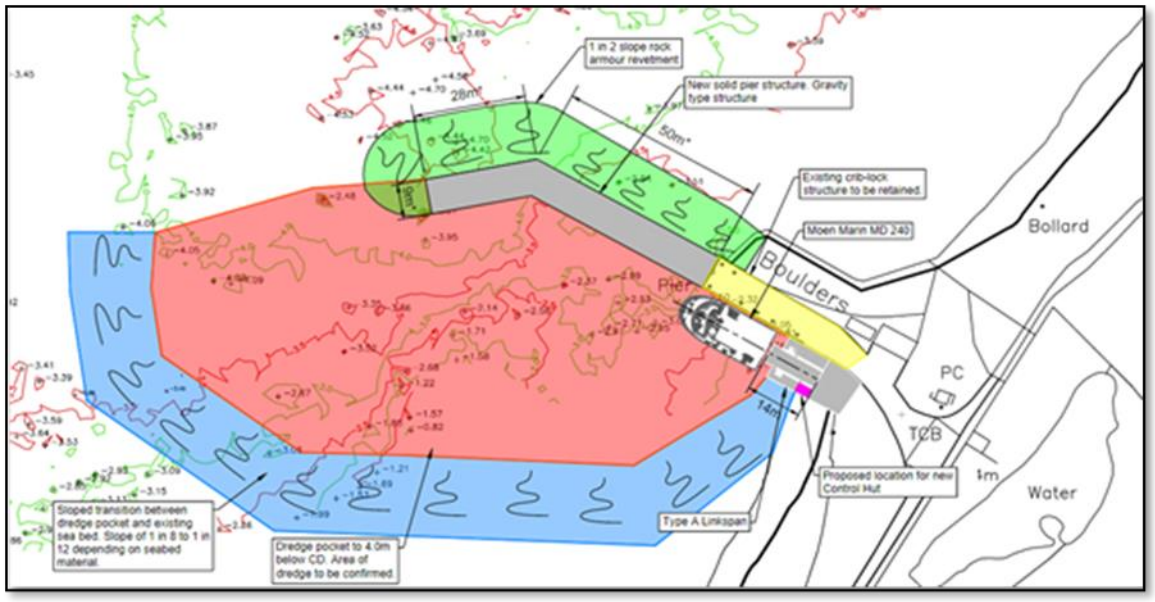
3.1.9 It is estimated that the dredged volume of material will not exceed 15,000m³. It is currently anticipated that dredged material will be removed by a combination of backhoe dredger (for soft material) and excavator for rock and transported by barge to an offshore disposal site, likely Scalloway, Shetland. There may also be a requirement to inject rock with liquid CO_2 (Cardox) and then ‘pecker’ or “rip” to remove rock material. A separate dredging license will be applied for following the results of the Ground Investigation work.

[3] Waling beams are used in combination with tie bars for anchoring sheet pile walls. They allow to spread the load on sheet pile and to concentrate them onto the tie bars.

3.1.10 While there is potential for the dredging activity to happen concurrent with the piling activity over a single year, for bird receptors (including Arctic Tern and Fulmar) a worst-case scenario has been assumed, namely that these activities will take place in separate years (piling in 2024, dredging in 2025) as otherwise this would result in an increased potential for disturbance/displacement effects on seabirds. However, for marine mammal receptors (harbour seal) consideration is given to both scenarios (piling and dredging occurring in a single year and in separate years) and their potential for disturbance/displacement effects from underwater noise and presence.

3.1.11 Rock armour will be placed on the existing breakwater and also alongside the pier to create a new breakwater along the northern edge of the pier. Rock armour for the breakwater may be delivered by vessel or could be brought by road if this is sourced from a local quarry. A crane will be used to place each individual rock for the armouring. The rock armouring activity will take place in 2024 and therefore is anticipated to coincide with the piling works and pier extension, with the potential to also coincide with dredging.

Image 3.3 Showing Construction details.



3.1.12 As it is yet to be determined how much of the work will be carried out from sea and the likely requirements for vessel movements, a worst-case scenario has been adopted which assumes the following for marine-based vessel activity:

2024

- Barge mounted piling rig (on site for 3 months);
- Vessel movement for delivery of materials/equipment/plant (maximum, on average, two vessels per week from February to October); and
- Two dredgers (on site for 7 months) (assuming dredging runs concurrently).

2025

- Two dredgers (on site for 7 months); and

  Vessel movement for delivery of materials/equipment/plant (maximum, on average, two vessels per week from March to September).

3.1.13 Although a detailed construction methodology is yet to be determined, it is reasonable to assume that in addition to the marine works outlined above, the construction is likely to utilise lorries and plant associated with road construction including material deliveries and removal, road pavers and rollers, excavators, dozers and dump trucks. The precise nature and quantity of plant employed during construction will vary with each stage of the project.

3.2 Construction Project Timescales

3.2.1 The current indicative programme proposed is:

- Contractor mobilising February / March 2024;
- Construction Phase 1 (pier extension and piling) April to October 2024 (Piling to start no later than the 7th May); and
- Construction Phase 2 (linkspan installation, dredging, surfacing of marshalling area) April to September 2025.

3.2.2 Construction is expected to take place on Monday to Friday 07.00 to 19.00 and Saturday 07.00 to 13.00, with no working on Sundays or Bank Holidays. The workforce will arrive about 15 minutes before shift start and leave some15 minutes after the shift finishes.

3.2.3 By exception some construction activities may need to be undertaken outside these hours, for which agreement would be sought from SIC and MS-LOT.

3.2.4 During this period there will be a combination of Heavy Goods Vehicles (HGVs) for the component deliveries and Light Goods Vehicles (LGVs) for construction staff. Material/component delivery times will be limited to between 08:00 and 17:00 Monday to Friday and 08:00 to 12:00 on Saturday.

3.2.5 Any additional traffic movements will likely be restricted to construction workers getting to site outside the hours stated above. The Construction workforce is likely to be approximately 8-10 workers and they are likely to car share from their accommodation so will not result in a significant amount of additional traffic at Grutness.

3.2.6 Outside of these times, works will be limited to those required in an emergency where there is the potential of harm or damage to personnel, plant, equipment or the environment, provided that the Principal Contractor (yet to be appointed) retrospectively notifies of such works within 24 hours of their occurrence.

3.3 Embedded Mitigation Measures

3.3.1 As part of the design process suitable mitigation measures were incorporated into the Proposed Development to mitigate any potential environmental effects. This mitigation is termed "embedded mitigation. As detailed in Section 2, the site and surrounding area contain a number of environmental sensitivities which have the potential to interact with the proposed development. Accordingly, the proposed development will be sited and designed to respond to its environmental context to allow protection to the vessel when moored and to minimise the potential for adverse effects on sensitive receptors.

3.3.2 The Site is large enough to provide flexibility in design to incorporate mitigation. A framework of design principles and environmental mitigation measures will guide the detailed design and construction of the proposed development in order to avoid or prevent any likely significant environmental effects. The design principles adopted for the proposed development are:

- **Avoidance** of the loss of sensitive environmental (including but not limited to ecological) features and assets through careful siting decisions and options appraisals;
- **Minimisation** through siting and design of likely direct and indirect adverse environmental effects where these cannot be avoided;
- **Mitigation** through the incorporation of appropriate measures into the construction and operation of the proposed development to address likely direct and indirect adverse environmental effects where these cannot be reduced to an acceptable level through siting or design; and

3.3.3 The implementation of all embedded mitigation measures requires to be confirmed through the content of the planning application and marine license and any subsequent permissions granted for the proposed development.

3.3.4 A range of good practice and management measures will be adopted by the successful contractor to minimise the potential for environmental effects and any disruption that could be caused by the construction works. These will include:

- The site supervisor will give a general talk/briefing prior to construction starting plus specific tool box talks prior to specific work activities starting. These talks will highlight any sensitive features, including the designated sites (SPA and SSSI) and qualifying features.
- In line with good practice, the contractor will follow the updated and relevant Guidance for Pollution Prevention (GPPs) including GPP 5 (Works and maintenance in or near water). Pollution Prevention Guidance (PPGs) will be followed if no corresponding GPP is available.
- Oils, fuels and chemicals will be stored in fully bunded areas.
- Spill kits will be available on site and workers trained in their use.
- The contractor will produce a contingency plan for dealing with spills or environmental incidents.
- Any waste generated will be removed from site and either recycled or disposed of in compliance with Waste Management Regulations.
- The successful Contractor will ensure vessels and plant involved in the operational activities for the works adhere to the industry recommended guidelines for preventing the introduction of Invasive Non-Native Species (INNS).
- Prior to and during construction activities, appropriate staff will be informed of relevant marine and terrestrial INNS. These staff will also be cognisant of guidance produced by NatureScot for the prevention of introduction of non-native species (Cook et al., 2014) and draft guidance on biosecurity for the Outer Islands (RSPB, 2021).
- The Contractor will produce a Ballast Water Management Plan (if relevant) to prevent the risk of introducing invasive non-native species into Grutness.
- Prior to use, all equipment will be washed and cleaned to ensure that no contaminants are brought into contact with the marine or terrestrial environment.
- Vehicle numbers and movement on the vegetation will be kept to a minimum.
- Vessels used for the works will adhere to the general principles in the Scottish Marine Wildlife Watching Code.
- The Contractor will contact the Sumburgh Head warden prior to works commencing and inform the warden once works have finished.

3.3.5 The following represent additional measures to reduce or minimise potential significant adverse behavioural effects for marine mammals during piling activities and acknowledge JNCC (2010) draft guidance:

- Soft start: The gradual increase of piling power, incrementally, until full operational power is achieved will be used as part of the piling methodology. This will give marine mammals (specifically harbour/common seal) the opportunity to move away from the area before the onset of full impact strikes. The duration of the soft start is proposed to be 20 minutes in line with the JNCC piling protocol (JNCC, 2010);
- Vibro piling: Vibro piling is proposed to be used where possible (which produces lower peak source noise levels than percussive piling). However, in order to drive the piles to the required design level percussive (impact) piling is likely to be required given the underlying geology and depth of piling that is required to ensure the required structural integrity and stability of the new pier wall;
- Marine Mammal Observer (MMO): In addition, the JNCC “Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals during piling” (JNCC, 2010) will be followed during percussive piling. The following procedures will be adhered to by the successful contractor:
    - Establishment of a ‘mitigation zone’ of a pre-defined radius (e.g. 500 m) from the piling locations, prior to any percussive piling. Within this mitigation zone,

observations of marine mammals will be undertaken by a trained member of the construction team using marine mammal identification resources;

- Thirty minutes prior to the commencement of percussive piling, a search should be undertaken by the MMO to determine that no cetaceans are within the mitigation zone. Percussive piling activity should not be commenced if cetaceans are detected within the mitigation zone or until 20 minutes after the last visual detection;
- Thirty minutes prior to the commencement of percussive piling, a search should be undertaken by the MMO to determine whether seals are within the mitigation zone. Experience has shown that seals can be attracted to noise and/or human presence. The commitment to a soft start (see above) will minimise effects to seals and allow them to move away from the noise source;
- During percussive piling, the MMO should observe the mitigation zone to determine whether marine mammals are within this area. Construction workers will be alerted if marine mammals are identified. If marine mammals arrive in the works area once works have commenced then works can continue as marine mammals have moved into the area with a known noise level being generated; and
- If there is a pause in percussive piling operations for any reason over an agreed period of time, then another search (and soft-start procedures for piling) should be repeated before activity recommences. If, however, the mitigation zone has been observed while piling has ceased and no marine mammals have entered the zone, piling activity can recommence immediately.

3.3.6 The following represent additional measures to mitigate any adverse effect to disturbance of the Arctic Tern and are acknowledged within the assessment conclusions:

- Between the 15 April and 1 August in each construction year, a buffer zone will be established along the eastern edge of the proposal boundary (as demarcated by an existing stone wall adjacent to the road). The Contractor will ensure that workforce and equipment/plant do not cross this buffer zone
- Between the 15 April and 1 August in each construction year, a gradual ramping up of construction activities will take place between the hours of 07:00 and 08:00 each morning, with no work activity before 07:00 and after 19:00 in any given day under normal operations.
- The successful Contractor will ensure that piling operations will commence no later than 7 May in any given year.
- A soft start to piling operations at the beginning of the working day will be followed for a minimum of 20 minutes. Piling power will be gradually increased, incrementally, until full operational power is achieved.
- The successful Contractor will contact the site warden a minimum of 4 weeks before planned commencement of the works. The Contractor will outline the planned steps to the works and the measures (management and/or mitigation) which will be adhered to during the works.
- During the period 15 April – 1 August, a suitably qualified observer (ECoW with relevant bird monitoring experience) must be present to monitor for disturbance and ensure that the above measures are adhered to.

3.3.7 Additionally, commencement of the piling works no later than 7th May will ensure that this noise generating activity has already started before Arctic Terns have nested in the colony adjacent to the proposed works (see Section 5.9).

3.3.8 The additional mitigation measures relating to marine mammal and bird receptors which are outlined above, have been considered in Section 5.8 and Section 5.9, respectively.

3.3.9 To accompany the Planning Application, a first iteration Environmental Management Plan (fiEMP) has been prepared **(Appendix D: FiEMP)** and will be discussed with Marine Scotland and SIC prior to any construction works commencing.

3.3.10 The fiEMP has been produced at an appropriate and proportionate level of detail for the design stage. The fiEMP will be developed into the second iteration EMP (siEMP), a more detailed EMP by the Principal Contractor (when appointed) once the detailed design has been finalised, subject to the consents being granted. The siEMP will be used on site to manage environmental measures and commitments. The project will then be operated and maintained in accordance with SIC ferry operations team. **Table 3.1** provides a summary.

Table 3.1 Summary of stages of the Environmental Management Plan

Project Stage	Iteration	Produced / refined
Design	The fiEMP (previously called the Outline EMP) is produced during the design stage of the Proposed Development.	Produced
Construction (refined for the consented Scheme)	The siEMP (previously called the construction EMP) is refined during the construction stage.	Refined
End of construction	Finalise the siEMP at the end of the construction stage to support the future management and operation of the Proposed Development.	Refined

3.3.11 The fiEMP details the mitigation measures that have been included to ensure that there are no significant impacts as a result of the construction of the pier at Grutness.

3.4 Operational Phase

3.4.1 The current operation of the Good Shepherd IV carries twelve passengers, the journey takes about two and a half hours. In summer the ferry sails three times a week to /from Grutness (Tuesday, Thursday and Saturday) and once a fortnight it sails to Lerwick. In winter there is only one sailing per week (Tuesday).

3.4.2 Once constructed the ferry timetable is expected to be the same as the existing timetable, however as the new vessel will be larger and built to modern standards, it will have improved reliability (i.e., seakeeping) and resilience. Due to this improvement, there will be a slight increase in crossings as a result of the new vessel being able to sail in conditions considered too adverse for the existing vessel. Combined with a greater service speed, overall return journey and turnaround times will be reduced leading to improved reliability through the ability to exploit shorter weather windows. It will also safeguard the island-based service and the essential local employment attached to it. Please note it is not the intention to significantly increase the volume of tourist vehicles to the island, a Traffic Restriction Order (TRO) will be prepared to control visitor traffic by roads department within SIC.

4 Overview of Terrestrial Environmental Effects and Mitigation Measures

4.1 Introduction

4.1.1 **Table 4.1** below provides a high-level assessment of environmental effects anticipated to occur due to the interaction of the proposed development with identified environmental sensitivities of the site and surrounding area. It takes account of all mitigation measures identified at this stage, for the terrestrial environment.

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Table 4.1 Assessment of Potential Effects

Environmental Topic	Relevant Environmental Topic	Potential Construction and Operation Effect	Proposed Approach and Mitigation	Significance of Likely Effects
Air and Climate	Air Quality, Noise, Vibration and Climate Change	Noise from piling operations and plant activities during construction. Once operational noise is not expected to be an issue as it will be similar to existing noise levels.	An assessment of airborne noise from construction works at the proposed development will be undertaken, in particular in relation to the ecological designated sites (included within Section 5.0). Strategies to minimise noise impacts on nearby sensitive receptors will be considered, including the phasing of works and delivery of rock to specific areas for the proposed development, and the working hours of the site.	Not significant with appropriate mitigation incorporated within Ecological Appraisal and the fiEMP.
		Dust emissions from construction of the pier. There will be no additional dust emissions during operation.	During construction, dust from on-site activities and off-site trackout by construction vehicles has the potential to impact on sensitive human and ecological receptors within the study area. The main potential impacts include loss of amenity (as a result of dust soiling) and possible deterioration of human health (as a result of concentrations of particulate matter 10 micrometres or less in diameter (PM_{10})). However, with appropriate dust mitigation measures in place and the fact that there are no receptors in close proximity to the site, the effects of construction dust will not be significant (IAQM 2014).	Not Significant
Biodiversity, Flora, Fauna, Land and Soil	Ground Conditions, Land Use	Disturbance to ground conditions and land use during construction or operation.	There is no likelihood of significant effects arising in relation to land use, ground conditions and geology as a result of the works, as a fiEMP will be prepared to provide construction mitigation	Not Significant

Environmental Topic	Relevant Environmental Topic	Potential Construction and Operation Effect	Proposed Approach and Mitigation	Significance of Likely Effects
			measures during construction and operation phase of the project.	
	Ecology	Disturbance to o[ters [redacted]	[redacted] An EPS license will reduce impact and will be applied for pre-construction.	Not Significant
Water	Hydrology and Flood Risk	Additional flood risk as a result of the scheme or pollution to water quality,	The design and construction methodology to be adopted for the proposed development will incorporate appropriate physical mitigation measures and procedures to protect against flood risk or pollution release into the sea.	Not Significant
Population, Human Health and Material Assets	Socio-economics, Tourism and Recreation	**Employment:** The construction phase is likely to generate direct employment, and gross value added However the scale of the employment and economic activity generated by the proposed development would be temporary and not materially affect the wider likely socio-economic effects. There are only expected to be 8-10 permanent employees during the construction works. **Land Use:** As there is an existing pier that is being extended and no other works proposed the other land would remain unaffected and this land change would not itself generate a likely significant socio-economic effect. **Tourism and Recreation:** The works are unlikely to generate a likely significant effect in relation to tourism and recreation.	No mitigation or enhancement measures are considered to be necessary in relation to economic, employment or land use effects. In relation to effects on tourism and recreation, an Access Mitigation Plan will be prepared by the contractor to manage public access to affected recreational routes during the construction phase. A Traffic Regulations Order (TRO) will be applied for in relation to number of vehicles allowed on the ferry to protect Fair Isle's roads prior to it being operational.	Not Significant

Environmental Topic	Relevant Environmental Topic	Potential Construction and Operation Effect	Proposed Approach and Mitigation	Significance of Likely Effects
	Traffic, Transport and Material Assets	All materials are likely to be consolidated at an appropriate port or ports (which will be determined by the mobilisation plan of the appointed contractor). Any land-based traffic impacts associated with construction are also expected to be negligible.	No mitigation measures are considered to be necessary in relation to traffic and transport. Appendix B: Figure 2.4 shows how the proposed marshalling area will be marked out. A TRO will be applied for in relation to number of vehicles allowed on the ferry to protect Fair Isle's roads prior to it being operational.	Not Significant
	Human Health	Potential health effects are expected to be minimal in terms of noise effects arising from the pier construction.	As noted above, noise and ground conditions assessments will be carried out to identify assess and mitigate potential effects associated with construction activities. These assessments will identify any required mitigation to safeguard human health.	Not Significant
Cultural Heritage and Landscape	Cultural Heritage	Adjacent to the pier the Grutness lighthouse store, including boundary wall, gate and gate piers (LB44543) is a listed building category C. No works are proposed to the heritage assets and during the operation phase it is unlikely to result in any adverse effects on the setting of these assets.	The design and construction methodology to be adopted will incorporate appropriate mitigation measures to ensure that the Category C listed building or setting is not affected during the works. This will avoid any adverse effects on the integrity of the heritage asset and its setting such that no significant effects are likely to occur.	Not Significant
	Landscape and Visual	It is anticipated that the Proposed Development would not result in any significant landscape / seascape or visual effects during construction or operation. This is due to the context of the existing landscape and site and the nature of the Proposed Development, being small scale and of limited geographical extent. Whilst the Proposed Development is considered to be permanent this is located within a working ferry terminal in which the	The design and construction methodology to be adopted for the proposed development will incorporate appropriate mitigation measures to minimise landscape and visual impacts, such as maintaining an orderly, tidy site, no residual significant effects on landscape or visual amenity are considered likely to occur.	Not Significant

Environmental Topic	Relevant Environmental Topic	Potential Construction and Operation Effect	Proposed Approach and Mitigation	Significance of Likely Effects
		elements comprising the Proposed Development are present.		

5 Overview of Marine Environmental Effects and Mitigation Measures

5.1 Introduction

5.1.1 This section considers any potential effects in the context of the following receptors:

- Otter;
- Coastal processes and geomorphology;
- Marine water and sediment quality;
- Nature conservation;
- Benthic habitats and species;
- Fish and shellfish;
- Marine mammals;
- Seabirds and coastal waterbirds; and
- Navigation.

5.2 Otter

5.2.1 The majority of the proposed works will be carried out within the marine environment or from the existing pier. A small area of the rocky upper intertidal and supralittoral will be lost to accommodate the linkspan. A very small area of scrub adjacent to the existing road and parking area will be lost.

5.2.2 It is anticipated that lay down areas will be secured on the existing parking areas available around the pier.

5.2.3 The otter surveys (see **Table 4.1**) will determine if otter are likely to be present in the area and given the nature of the works and the existing environment, no significant effects are anticipated on terrestrial features.

5.3 Coastal Processes and Geomorphology

5.3.1 The following sections consider the Coastal Processes and Geomorphology topic for this environmental report. A summary of the existing (baseline) conditions is provided, followed by consideration of the potential effects arising from the proposed works.

Baseline description

Bathymetry and morphology

5.3.2 Grutness is located on a headland at the southern tip of the main island of the Shetland Isles. Forming a small embayment just to the southeast of Sumburgh airport, the local orientation of the coastline results in the bay opening to the northeast. The mouth of the bay is around 350 m across and defined by rocky outcrops on both sides. To the north of the mouth, a number of smaller embayments are present, leading to the extension of the Sumburgh airport runway, which is protected by rock armour. Further north lies the large intertidal embayment known as the Pool of Virkie.

5.3.3 Within the Grutness embayment, the east and west coastlines are characterised by rocky hinterland fronted by cobble beaches. Along the eastern coastline is the existing pier, which provides the current ferry terminal for vessels between Grutness and Fair Isle. The existing structure is around 40 m in length and its north-eastern side is protected by rock armour. Further to the southwest is a small slipway, around 30 m in length. At the base of the Grutness

embayment is a sandy beach backed by dunes. The curved beach is around 540 m in length and up to 35 m wide at low water.

5.3.4 The local bathymetry within the embayment slopes gently from the sandy beach at the base, reaching around 5 m below Chart Datum (mCD) at the mouth before deepening further to around 20 mCD approximately 800 m offshore of the mouth. To the east of the main island coastline, depths tend to deepen more rapidly, with the 20 mCD contour situated around 100 to 200 m offshore. Across the approaches to Grutness, within the northern North Sea, water depths reach upwards of 100 mCD.

Tides and water levels

5.3.5 The embayment at Grutness is macro tidal with a mean spring tidal range of 1.4 m and a mean neap tidal range of 0.7 m. Tides are semi diurnal with standard tidal levels at Sumburgh provided in **Table 5.1**.

Table 5.2 Standard tide levels for Sumburgh

Tide level	Elevation	
	mCD	mOD
Highest Astronomical Tide (HAT)	2.20	1.14
Mean High Water Spring (MHWS)	1.80	0.74
Mean High Water Neap (MHWN)	1.40	0.34
Mean Sea Level (MSL)	1.06	0.00
Mean Low Water Neap (MLWN)	0.70	-0.36
Mean Low Water Spring (MLWS)	0.40	-0.66
Lowest Astronomical Tide (LAT)	0.00	-1.06
	Range (m)	
Astronomical Tide Range	2.20	
Mean Spring Range	1.40	
Mean Neap Range	0.70	

Source: UKHO Tide Tables 2022

Meteorological surge

5.3.6 In addition to the astronomical tides, the influence of meteorological surge events will affect the actual water levels experienced on site. These surges can be both positive and negative (increasing or decreasing the tidal elevations, respectively).

5.3.7 Measured water level data from the NTSLF Class A Tide Gauge at Lerwick (around 33 km to the north of Grutness) has been analysed to assess the influence of this surge component. **Table 5.2** provides the total, predicted and surge components for each of the ten highest total water levels and the ten highest surge events at Lerwick (since 1990).

5.3.8 The results of the tide gauge analysis indicate that the largest water level events are primarily driven by a high predicted tidal elevation coincident with a moderate meteorological surge. By contrast, the largest surge events in the tidal record tend to occur alongside smaller predicted tidal heights, resulting in overall water levels that only occasionally (3 out of the top ten events) exceed the HAT elevation for Sumburgh.

Table 5.2 Top 10 total water level and surge events at Lerwick (1990 to 2022)

Date Time	Top 10 largest total water levels		
	Total (mOD)	Predicted (mOD)	Surge (m)
11/01/1993 13:00	1.934	1.358	0.576
27/02/1990 12:00	1.866	1.255	0.611

Date Time	Top 10 largest total water levels		
	Total (mOD)	Predicted (mOD)	Surge (m)
12/01/2005 12:00	1.802	1.316	0.486
25/12/1999 00:44	1.777	1.239	0.538
12/01/2009 11:30	1.763	1.341	0.422
04/01/2014 12:45	1.756	1.372	0.384
01/02/1995 11:29	1.747	1.303	0.444
02/01/1991 12:00	1.731	1.329	0.402
25/11/2011 11:00	1.728	1.216	0.512
25/01/2008 12:45	1.724	1.273	0.451
Date Time	Top 10 largest surge levels		
	Total (mOD)	Predicted (mOD)	Surge (m)
29/01/2016 20:45	0.522	-0.338	0.860
11/01/1993 03:00	1.276	0.495	0.781
25/12/2013 01:15	1.107	0.377	0.730
12/01/2015 20:15	0.63	-0.082	0.712
19/02/1990 22:00	0.912	0.202	0.710
12/06/2001 23:15	0.802	0.096	0.706
25/12/1999 03:29	0.983	0.291	0.692
25/02/1997 11:30	1.596	0.905	0.691
01/01/1992 12:00	0.903	0.223	0.680
08/12/1994 12:44	1.455	0.778	0.677

Source: NTSLF Class A Tide gauge data from Lerwick (1990 to 2022)

Extreme water levels

5.3.9 Current extreme predictions determined by the Environment Agency for Grutness are the most up-to-date and appropriate for this review (Environment Agency, 2018). These are provided in **Table 5.3** for a baseline year of 2017.

Table 5.3 Predicted extreme water levels offshore of Grutness

Return Period (Years)	Annual Exceedance Probability (%)	Extreme Water Level (mOD)
1	100	1.29
2	50	1.33
5	20	1.39
10	10	1.43
20	5	1.48
25	4	1.49
50	2	1.53
75	1.3	1.55
100	1	1.57
150	0.67	1.59
200	0.5	1.61
250	0.4	1.62
300	0.33	1.63
500	0.2	1.66

Return Period (Years)	Annual Exceedance Probability (%)	Extreme Water Level (mOD)
1,000	0.1	1.69
10,000	0.01	1.80

Source: EA Coastal Flood Boundary Dataset (CFBD) 2018

Sea level rise

5.3.10 The above data do not allow for sea level rise in the future. In order to take into account future sea level rises from 2023, the latest UKCP18 relative sea level research (Met Office, 2018) (assuming a Representative Concentration Pathway (RCP) 8.5, 95%ile scenario) will add 0.96 m to the water levels provided in Table 3 by 2100.

Flows

5.3.11 Flow conditions offshore of the headland at Grutness are available from the UKHO Admiralty tide tables. Summary information on flow speed and direction, across mean spring and neap tides, is provided in **Table 5.4**.

5.3.12 Flows offshore tend to be orientated approximately 40°N on the flood tide and around 210°N on the ebb. Peak flow speeds are observed on the spring flood tide, at up to 0.57 m/s. Peak spring ebb flow is around 0.46 m/s. By contrast, peak flow speeds on the neap tides are around half the magnitude of those on the spring. As a result of its more sheltered nature, local flow speeds within the bay itself are likely to be lower than those provided here offshore.

Table 5.4 Typical flow regime under spring and neap tides offshore of Grutness headland

Time (h relative to HW)	Spring		Neap	
	Flow speed (m/s)	Direction (°N)	Flow speed (m/s)	Direction (°N)
-6	0.46	52	0.21	52
-5	0.51	26	0.21	26
-4	0.57	35	0.21	35
-3	0.41	8	0.15	8
-2	0.36	344	0.15	344
-1	0.15	225	0.05	225
HW	0.31	205	0.10	205
+1	0.31	210	0.10	210
+2	0.31	212	0.10	212
+3	0.36	207	0.15	207
+4	0.41	199	0.15	199
+5	0.21	200	0.10	200
+6	0.46	66	0.21	66

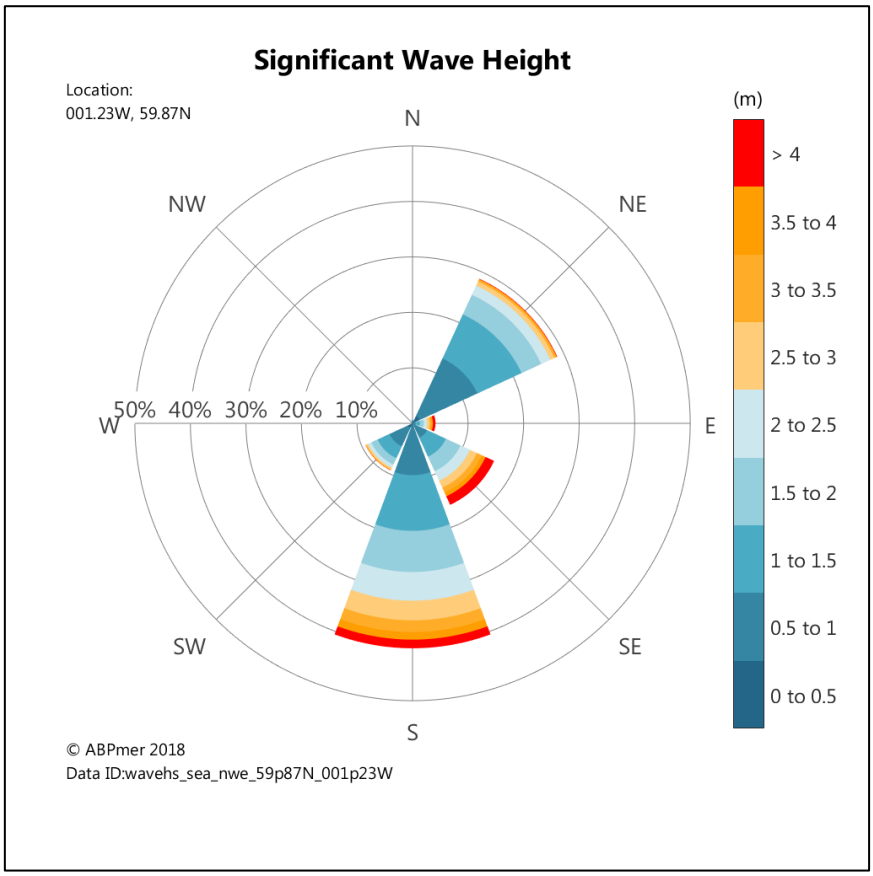
Source: UKHO Admiralty Tide Tables 2023

Waves

5.3.13 Grutness embayment is exposed to waves approaching from a range of directions across the northern North Sea. The mouth of the embayment is oriented such that long fetch lengths exist from north-north-easterly through to easterly directions.

5.3.14 Modelled hindcast wave data from a point offshore (east) of the approaches to Grutness has been used to provide the wave rose shown in **Figure 5.1**. This reveals that the offshore wave regime at the proposed site is dominated by waves approaching from the northeast and the

south (coincident with the longest offshore fetch lengths). Largest waves tend to approach from the southeast, although the orientation of the Grutness embayment is such that the wave climate at the proposed works site will be dominated by a generally north-easterly wave direction.

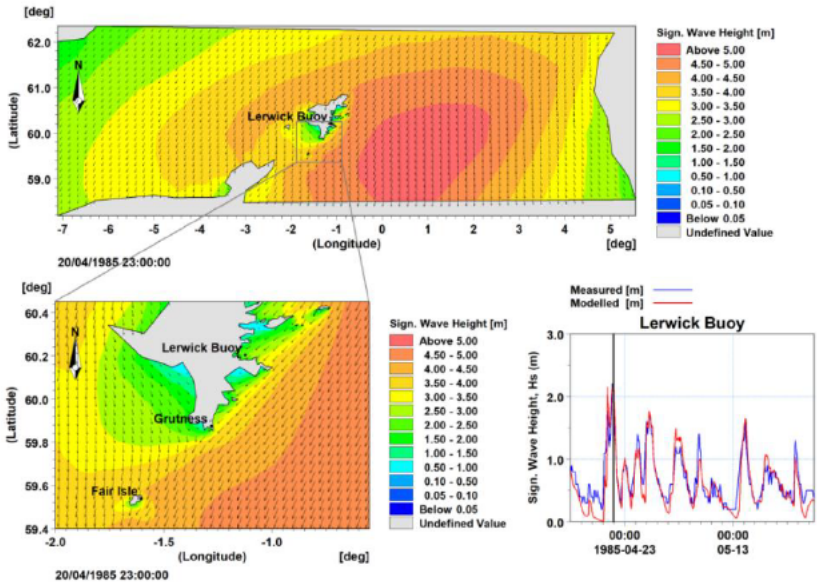


Source: ABPmer SEASTATES

Figure 5.1 Wave rose offshore (east) of Grutness

5.3.15 An example of the modelled wave event during a peak storm period measured at Lerwick during May 1985 is shown in **Figure 5.2**. This also provides the comparison of significant wave height (Hs) between the model and the measurements during the storm event. Peak heights measured over this period reached around 2 m.

Figure 5.2 An example of the modelled wave event during a peak storm period measured at Lerwick during May 1985. Source: Mott Macdonald, 2023 (**Error! Reference source not found.**)



5.3.16 An extreme value analysis of offshore wave conditions has been carried out as part of the Grutness wave modelling study (Mott Macdonald, 2023; **Appendix E Wave Modelling Study**). The results of this analysis are provided in **Table 5.5** and indicate offshore extreme wave heights of the 1 in 100-year event of around 8 m.

Table 5.5 Summary of extreme offshore wave conditions applied within the wave modelling study

Sector	Item	AEP (%)			
		100	50	10	1
W (240-300°N)	Hs (m)	7.59	8.20	9.40	10.68
	Tp (s)	16	16	17	17
	WS (m/s)	22	22	23	25
SW (210-240°N)	Hs (m)	5.89	6.41	7.56	9.16
	Tp (s)	17	18	19	20
	WS (m/s)	20.3	21	22.5	24.3
S (160-210°N)	Hs (m)	6.08	6.68	8.10	10.14
	Tp (s)	13	13	14	15
	WS (m/s)	20.6	21.4	23.1	25.3
SE (110-160°N)	Hs (m)	6.66	7.37	8.76	10.46
	Tp (s)	13	14	14	15
	WS (m/s)	19.8	20.5	21.8	23.3
E (60-110°N)	Hs (m)	3.60	4.22	5.63	8.07
	Tp (s)	12	12	13	15
	WS (m/s)	15.9	16.8	18.6	21.2
NE (10-60°N)	Hs (m)	4.04	4.52	5.76	7.99
	Tp (s)	11	12	13	15
	WS (m/s)	17.2	17.8	19.3	21.4

Source: Mott Macdonald, 2023 (Error! Reference source not found.**)**

Geology and sediments

5.3.17 Local seabed and foreshore sediment cover across the Grutness embayment is dominated by rocky outcrops and coarse sediment. To the east and west of the existing ferry terminal, the foreshore is made up of rocky shore conditions, with large cobbles and boulders present (**Figure 5.3** and **Figure 5.4**).

Figure 5.3 Rocky shore to the east of Grutness Ferry Terminal

Figure 5.4 Rocky shore to the west of Grutness ferry terminal

5.3.18 The sandy beach at the base of the Grutness embayment is made up of coarse sand material (**Figure 5.5A**), whilst the presence of a nearshore, intertidal rocky outcrop at the southern end of the beach (**Figure 5.5B**) results in a tombolo beach being formed at this location.

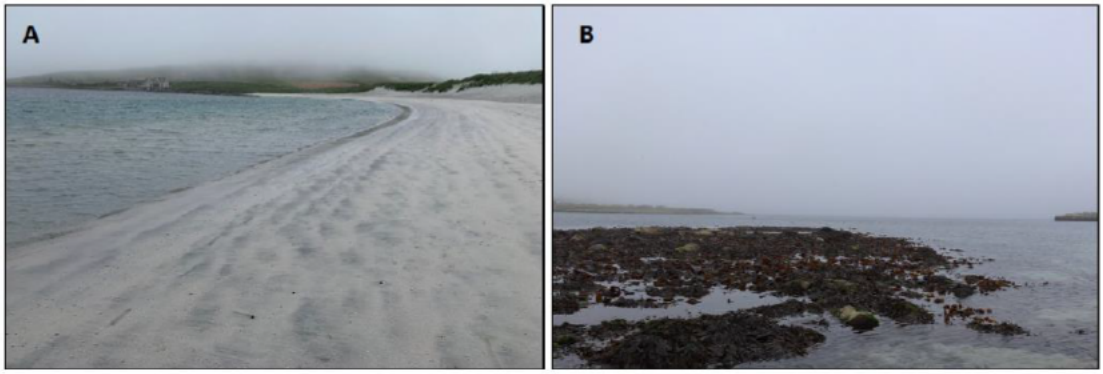


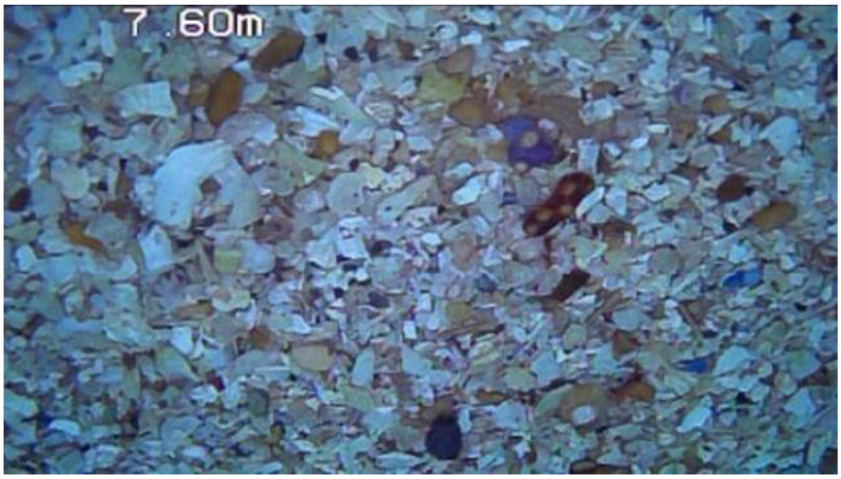
Figure 5.5 Coarse sand beach at the base of Grutness embayment (A) and rocky outcrop to the southern end of the beach (B)

5.3.19 Offshore, in the subtidal region adjacent to the existing ferry terminal, the local seabed is a combination of rocky outcrops, cobbles and coarse, gravelly sand sediment (**Figure 5.6**). Of the four planned grab samples, only two could be collected (ABPmer, 2023; **Appendix G: Benthic Survey**) as a result of outcropping/ cobbles at the unsuccessful sample sites. The particle size distribution of the successful grab samples is shown in **Table 5.6**. The analysis results show that there is little evidence of any significant fine component (mud) at either location, with the seabed in both sites being dominated by gravelly sand. Mean grain diameter (D50) of the samples is also provided, ranging between 1.0 and 1.1 mm.

Table 5.6 Particle size distribution from subtidal Grutness grab samples

Station	GG04	GG02
Textural Group	Gravelly Sand	Gravelly Sand
% Gravel	12.1	14.3
% Sand	87.9	84.9
% Mud	0.0	0.7
D10 (µm)	443.1	480.1
D50 (µm)	1,013.6	1,103.9
D90 (µm)	3,779.4	6,094.0

Figure 5.6 Subtidal grab sample GG04



Future baseline environment

5.3.20 Hydrodynamic and sedimentary processes will continue to be influenced by natural and human-induced variability, ongoing cyclic patterns and trends with or without the proposed works.

5.3.21 The future baseline will also be influenced by climate change and, in particular, increased rates of mean sea level rise. Projections of change for Grutness up to 2100 are of sea level increase (from 2023 levels) by 0.96 m (based on UKCP18 RCP 8.5 95%ile climate change scenario, (Met Office, 2018)). Water levels in the future, as now, will also be affected by unpredictable meteorological surge and weather-related events.

Potential effects

5.3.22 The following impact pathways have been considered with respect to coastal processes and geomorphology in the construction phase:

- Changes to the suspended sediment concentrations (SSC) and sediment deposition as a result of piling, dredging activity and associated dredge disposal; and
- Changes to local hydrodynamics at the disposal site as a result of changes to local water depth.

5.3.23 The following impact pathways have been considered with respect to coastal processes and geomorphology in the operation phase:

- Changes to hydrodynamics (flow speeds and wave conditions) and associated sediment transport pathways as a result of the new pier extension and newly dredged berth pocket;
- Changes to the suspended sediment concentrations (SSC) and sediment deposition as a result of maintenance dredging activity and associated dredge disposal

5.3.24 Assessment of the potential effects has been informed by bespoke numerical wave modelling studies (Mott Macdonald, 2023, see **Appendix E**), local survey data (ABPmer, 2023a, see **Appendix G**), the baseline characterisation and desk-based calculation methods.

Construction phase

Changes to the suspended sediment concentrations (SSC) and sediment deposition as a result of dredging activity and associated dredge disposal

5.3.25 The construction phase elements considered include the proposed on-site dredging activity and the resultant disposal of any dredged material at the nearest licensed disposal site (assumed to be Scalloway (FI095)).

5.3.26 The proposed dredging activity alongside the proposed new berth pier has the potential to result in the development and dispersion of a dredge plume, as the bed material is disturbed. The characteristics of this dredge plume will be determined by the particle size distribution of the bed material, the local flow conditions and the dredging methodology.

5.3.27 Regional flow conditions and local seabed sediment cover are described above. Whilst the dredging methodology is yet to be determined, this assessment assumes a worst-case whereby disturbed bed material is input to the water column at the surface (similar to a dredging overspill process). In this way, any subsequent calculation of potential plume dispersion assumes the greatest possible water depth over which disturbed sediment can settle (and, consequently, assumes the sediment particles remain in suspension for the longest possible time). In reality, the bed disturbance is likely to be mostly constrained to within around 2 m of the bed (unless overspill is used), meaning the material will settle out of suspension much quicker and the extent of the dredge plume will be smaller than that considered herein.

5.3.28 Offshore flow conditions off the Grutness headland are described in the baseline section. The relatively sheltered nature of the embayment itself suggests local flows will be lower than

those offshore. However, to assess a conservative worst case, these larger offshore flow speeds have been used to inform the potential plume dispersion assessment. Mean grain diameter information from the local grab sampling (as described in the baseline section) has also been used in the assessment.

5.3.29 At its deepest, the local bed across the proposed dredge area is around 3 mCD. On the assumption that dredging takes place over high water on a spring tide (MHWS at Sumburgh is 1.8 mCD), the resultant water depth at the site would be 4.8 m. Peak spring flow speeds (offshore) are up to 0.57 m/s and average mean grain diameter (D50) is 1,058 µm. Using industry standard formulae provided by Van Rijn (1993), these grains would have a settling velocity of 0.14 m/s, resulting in them settling to the bed in around 34 seconds. In this time, the peak spring flow speed would transport the particles less than 20 m from the point of origin. Consequently, it is considered that any dredge plume that develops on site would be highly temporary in nature and constrained in extent to within the dredge pocket itself.

5.3.30 Taking an even more conservative approach, and considering only the finer particle fraction (D10), the equivalent set of calculations gives a settling velocity of 0.06 m/s, a settling time of 80 seconds and dispersion distance of less than 50 m. As a result of the low fines content in the seabed material and the limited temporal and spatial extent of any dredge plume, increased suspended sediment concentrations (SSC) within any plume are likely to be very low (order of a few tens of mg/l). As a result of the low increase in SSC, associated sedimentation beneath any potential plume is also expected to be minimal (order of a few mm). As soon as the dredging activity ceases, the local SSC would be expected to return to baseline (existing) values.

5.3.31 Any potential effects arising from the construction of the pier and the dredging of the berth pocket are expected to be highly temporary in nature and highly localised in extent, only extending around 20 to 50 m from the pier and berth pocket themselves. Once the dredging is completed, local SSC conditions will revert quickly to their existing (baseline) values. Consequently, across the wider Grutness embayment, including offshore areas, the western coastline and the coarse sand beach to the south, any changes to SSC and sediment deposition as a result of the proposed dredging activities are considered likely to be **negligible**.

5.3.32 There is also a potential for the piling works to result in increased SSC values local to the proposed works. Given the nature of the seabed sediments (as described above) any increase in SSC resulting from piling will be considerably smaller than that arising from the dredging (and disposal) works. Hence, any potential effects will be less than those already described for dredging and also considered.to be **negligible**, either alone or coincident with dredging operations.

5.3.33 Following on from the proposed dredge activity, it is likely that dredged material will be disposed of at sea at a licensed disposal site (assumed to be Scalloway). Similar to the dredge itself, this activity also has the potential to result in a sediment plume and material settling through the water column at the disposal site.

5.3.34 The local character of any disposal site (water depth, flow conditions etc.), will ultimately influence any plume characteristics. However, given the coarse nature of the seabed sediment at the potential dredge site, any disposal of material will be dominated by (relatively) large, coarse particles, with a (relatively) high settling velocity. Consequently, any material deposited at sea would be expected to settle to the bed within a matter of a few minutes, with the spatial extent of any plume likely to be constrained to within a few hundred metres of the disposal site.

5.3.35 Taking account of the scale of the disposal volume, the nature of the dredge material and the local conditions at the Scalloway disposal site, the spatial and temporal magnitude of change in SSC is considered **negligible**.

Changes to local hydrodynamics at the disposal site as a result of changes to local water depth.

5.3.36 Any rock material that is disposed of at the disposal site is likely to remain in situ and could potentially result in a change to the local hydrodynamics as a result of changes to local water depth. However, given the volume of the dredge material (16,500 m3), a worst case (conservative) assumption that all the material is rock, would only shallow the bed across the disposal site by around 0.5 m. In a water depth of 62 m, that would equate to a change in depth of <1%. The change in depth would remain the same (<1%) even when considering disposal of rock from both Grutness and Fair Isle due to the very small dredge volume at Fair Isle (maximum of 3,000 m3).

5.3.37 Consequently, any changes in hydrodynamics at the disposal site as a result of changes to local water depth are considered to be **negligible**.

Operational phase

Changes to hydrodynamics (flow speeds and wave conditions) and associated sediment transport pathways as a result of the new pier extension and newly dredged berth pocket

5.3.38 The operational phase elements appraised include the newly constructed pier extension and the potential deepening of bed levels following the dredging of the berth pocket.

5.3.39 The construction of the pier (on the site of the existing pier structure) has the potential to result in local changes to hydrodynamics (flow speeds and wave conditions) and associated sediment transport pathways.

5.3.40 When considering changes to local flow speeds, the proposed pier extension is slightly longer than the existing one, extending further out form the shoreline and into slightly deeper water. This extended pier will result in a higher level of sheltering to the coastline to the west, leading to a larger area of generally benign tidal flow conditions than currently. Whilst some degree of flow acceleration around the end of the pier extension might be expected to result in slightly higher flow speeds in this area (than existing baseline conditions), the local seabed sediment cover (coarse, gravelly sand, cobbles and rocky outcrops) indicates that any associated changes to sediment transport are likely to be **negligible**.

5.3.41 The new pier structure has been the subject of a local wave modelling study (Mott Macdonald, 2023, see Appendix E). This study applied a range of extreme and typical annual wave conditions, modelled both the existing (baseline) scenario and the proposed new pier extension and dredge. Analysis of wave conditions at a range of locations behind and off the end of the pier extension was then conducted. The results of the study indicated that:

- Significant wave height (Hs) values decreased at locations behind the extended pier as a result of the increased sheltering offered by the structure to waves approaching the embayment from the dominant north-easterly direction.
- Closest to the shore, in areas already sheltered by the existing pier, changes to Hs as a result of the new structure are minimal (baseline Hs values for the range of wave events range from 0.3 to 0.5 m and reduce by around 0.1 m as a result of the proposed scheme).
- In offshore areas, off the end of the new pier structure, baseline wave heights are only slightly reduced, by around 0.2 to 0.3 m from a baseline Hs ranging from 1.0 to 1.4 m. Baseline wave heights at these locations range across events from 1.1 to 1.5 m. Following the extension of the existing pier, these wave heights reduce to 0.2 to 0.3 m.
- To the east of the existing pier, wave conditions are typically unaffected by the newly extended structure.
- In between these nearshore and offshore areas (at sites that are currently unsheltered, but which become sheltered by the newly extended pier), the predicted changes to Hs are greatest.

- The dominant wave approach direction changed for sites that are newly sheltered by the extended pier. Where baseline conditions indicate a dominant approach direction from northeast, the additional sheltering of the extended pier (and dredged berth pocket) results in a much more benign wave climate, with dominant approaches from the northwest (across the Grutness embayment).

5.3.42 The impact of the predicted changes to local wave conditions is to create a larger sheltered area behind the newly extended breakwater. This has the potential to lead to more benign sediment transport conditions across the newly dredged berth pocket. However, as discussed above, given the coarse nature of the substrata and the generally low SSC, it is considered unlikely that the changes to wave climate will have anything more than a **negligible** effect on the erosion and accretion patterns across the area.

5.3.43 Any changes to hydrodynamics and associated sediment transport arising from the operational pier and the newly dredged berth pocket are expected to be local in extent, only covering the pier and berth pocket themselves. Consequently, across the wider Grutness embayment, including offshore areas, the western coastline and the coarse sand beach to the south, changes to hydrodynamics and associated sediment transport as a result of the proposed works is considered to be **negligible**. As such, any effects relating to changes to hydrodynamics and associated sediment transport will not be considered further for other receptors.

Changes to the suspended sediment concentrations (SSC) and sediment deposition as a result of maintenance dredging activity and associated dredge disposal

5.3.44 There are no historic records of any dredging activities in the bay; Marine Scotland has confirmed that no dredging has taken place within the pier area for many years (if ever) (Marine Scotland Licensing Operations Team, pers comm.). Considering there has been no requirement for capital or maintenance dredging at Grutness Pier in the past, it is anticipated that minimal maintenance dredging will be required during the operational phase, if any. Therefore, any effects arising as a result of potential maintenance dredging would be smaller in magnitude compared to those of the construction phase and as such are considered **negligible**. As such, any effects relating to potential maintenance dredging will not be considered further for other receptors.

5.4 Marine Water and Sediment Quality

5.4.1 The following sections consider the Marine Water and Sediment Quality topic for this environmental report. A summary of the existing (baseline) conditions is provided, followed by consideration of the potential effects arising from the proposed works.

Baseline description

Sediment quality

5.4.2 As stated in Section 5.3, there are no historic records of any dredging activities in the bay. Therefore, no historic baseline sediment quality data exists for the area of the proposed works.

5.4.3 As part of the project survey campaign, subtidal grab samples were collected from Grutness Pier area in July 2022. Only two of four planned grab samples were obtained due to the presence of cobbles at two of the sampling sites. Particle size analysis (PSA) of the retrieved grab samples indicated the presence of gravelly sands. The full PSA results are shown in the Benthic Survey Report (ABPmer, 2023a, see **Appendix G**).

5.4.4 Geotechnical investigations at Grutness Pier are scheduled to be undertaken in 2023, including sediment sampling (Licence Number: MS-00009624) for PSA and sediment contaminant analysis. A sediment contamination sampling plan was submitted to and agreed with Marine Scotland. Contaminant concentrations will be compared against the Action Levels (AL) used to assess the exceedances of contaminant concentrations as set out by Marine

Scotland (2017). The results of these analyses will inform further any particular environmental considerations which may be required during dredging and disposal activities. It is highly likely that concentrations of sediment-bound contaminants will be low, due to the coarse nature of the seabed material. Additionally, industrial use of the bay and thus contamination through run-off is considered to be minimal. Potential contaminant sources are restricted to those from marine vessels.

Water quality

5.4.5 The area of the proposed works is within the Scotland river basin district and overlaps the Isle of Noss to Sumburgh Head coastal water body (ID: 200256). The Isle of Noss to Sumburgh Head coastal water body is currently (2020) at 'good' overall status with water quality assessed as 'good' (SEPA, 2023a).

5.4.6 Dredged material will most likely be disposed of at the closest licensed disposal site, Scalloway (FI095), which is situated approximately 38 km to the northwest. Scalloway disposal site is within the Scotland river basin district and overlaps the Sumburgh Head to Kettla Ness coastal water body (ID: 200508). The Sumburgh Head to Kettla Ness coastal water body is currently (2020) at 'good' overall status with water quality assessed as 'good' (SEPA, 2023b).

5.4.7 There are no designated bathing waters in the vicinity of the proposed works or Scalloway disposal site, the closest being Dunnet bathing water located more than 180 km to the southwest.

5.4.8 The closest classified shellfish harvesting area to the proposed works is Clift Sound Houss situated approximately 30 km northwest, on the west coast of Shetland. There are a number of classified shellfish harvesting areas within 3 km of the Scalloway disposal site, including West of Langa, Stream Sound: Ux Ness and others, though all are separated from the disposal site by land.

5.4.9 No historic baseline water quality data exists for the area of the proposed works; however, it is expected that SSC are low due to the coarse nature of the seabed. The SEPA water classification data (2020) indicate physicochemical, dissolved inorganic nitrogen and water quality status for the Isle of Noss to Sumburgh Head coastal water body are assessed as 'good'.

Potential effects

5.4.10 The following impact pathways have been considered with respect to water and sediment quality in the construction phase:

- Potential changes to dissolved oxygen (DO);
- Potential changes to levels of chemical contaminants (including accidental spillages) in water; and
- Potential effects from redistribution of sediment-bound chemical contaminants.

5.4.11 There are no potential effects anticipated on water and sediment quality during the operational phase.

5.4.12 Alternative and beneficial use of the dredged material will be considered through a Best Practicable Environmental Options (BPEO) report submitted alongside any future marine licence application for dredging activities at the area of the proposed works. The BPEO will be informed by the results of the geotechnical investigations. As a worst-case scenario when considering effects on water and sediment quality it has been assumed that all dredged material will be comprised of soft sediment and will be disposed of at the Scalloway licenced disposal site.

Construction phase

Potential changes to dissolved oxygen (DO)

5.4.13 The increase in chemical and biological oxygen demand associated with elevated SSCs in the water column during the dredging may have the potential to reduce dissolved oxygen (DO) concentrations. This is most relevant when organic rich material is present in the sediment to be dredged. The material within the proposed dredge areas (including side slopes) comprise gravelly sands and cobbles and it is anticipated that rock is underlying this superficial layer of coarse sediment (to be confirmed by the geotechnical investigations). Therefore, it is anticipated that there is no to very little organic rich surface layer present within the dredge area that could contribute to oxygen depletion.

5.4.14 The volume of material to be dredged is considered to be relatively small, with the maximum dredge volume estimated to be 16,500 m3. Assuming a layer of 1 m thick sediment deposit overlying the rockhead, it is currently estimated that approximately 9,000 m3 of the dredge volume will comprise soft sediments, with approximately 7,500 m3 being rock. A better indication of these ratios will be obtained following the results of the geotechnical investigations. As a worst-case scenario for this impact pathway it is assumed that all of the estimated dredge volume (16,500 m3) would comprise soft sediments.

5.4.15 It is anticipated that either a backhoe or cutter suction dredger will be used to dredge soft sediment. The use of a backhoe reduces the surface area of material exposed to the water column and transfers the material quickly and directly to a barge with little time in the water column, minimising the potential resuspension and deposition of sediment. Furthermore, most of the sediment disturbance from the cutter suction will be from near the bed and a large proportion of the disturbed material will re-deposit local to the dredge (see **Section 5.3**).

5.4.16 Considering the coarse nature of the sediment (see **Table 5.6** in **Section 5.3**), the relatively small dredge volume and the dredging methodology, it is anticipated that any change to DO will be minimal, localised and highly temporary. The potential changes to DO as a result of dredging are, therefore, considered **negligible**.

5.4.17 During the placement of dredged material at Scalloway disposal site, the potential for reduction in DO concentrations in the water column is low given the anticipated negligible proportion of organic material present in the dredge arisings (see **Section 5.3**). Due to its coarse nature the dredged material is anticipated to settle quickly and within a short distance (see **Section 5.3**). Any changes in DO would be localised and very short-lived given the dynamic nature of the site and the water depth, which would rapidly be re-oxygenated. The potential changes to DO at the disposal site are, therefore, considered **negligible**.

Potential changes to levels of chemical contaminants (including accidental spillages) in water

5.4.18 As sediment is disturbed and re-distributed into the water column, any sediment-bound contaminants may be partitioned from the solid phase (i.e., bound to sediments or suspended matter), to the dissolved or aqueous phase (i.e., dissolved in pore water or overlying water) (Luoma, 1983).

5.4.19 The main source of sediment disturbance during construction will be capital dredging. The material within the proposed dredge areas (including side slopes) comprises gravelly sands and cobbles and it is anticipated that rock is underlying this superficial layer of coarse sediment (to be confirmed by the geotechnical investigations). Coarse sediments are generally associated with low levels of sediment-bound contaminants and therefore concentrations of such contaminants are anticipated to be low in the area of the proposed works. Consequently, any changes in water contaminant concentrations as a result of sediment disturbance during dredging are expected to be small.

5.4.20 Good practice measures, such as the updated and relevant Guidance for Pollution Prevention (GPPs) including GPP 5 (Works and maintenance in or near water), will be used to prevent/reduce the potential for accidental spillages throughout construction and therefore, the proposed works will not directly introduce contaminants to the marine environment.

Additionally, the rock used for the rock armour will be free of contaminants and consist of a suitably inert material.

5.4.21 The potential changes to levels of chemical contaminants in the water during construction are, therefore, considered **negligible**.

5.4.22 The levels of contaminants present in the dredge deposits are likely to be low (see paragraph 5.4.4). It is assumed that sediment contamination sampling and analysis (as carried out through the geotechnical investigations) will confirm the low levels of contaminants, with the material thus being suitable for disposal at sea. Furthermore, the total volume of the dredge is relatively small compared to the volume of deposits usually received at disposal sites. Due to the highly dispersive nature of the likely disposal site (Scalloway), and water depth at this location, the deposits are unlikely to cause a measurable change in the levels of chemical contamination in the water at or around the disposal site. Furthermore, the disposal of the dredge material will be subject to a Marine Licence which would only be granted if the dredge material meets the criteria for acceptable sea disposal. Overall, the potential changes to levels of chemical contaminants in the water as a result of the disposal of dredge arisings associated with the proposed works are considered **negligible**.

Potential effects from redistribution of sediment-bound chemical contaminants

5.4.23 The potential to impact the marine environment as a result of any sediment-bound contaminants arises primarily when the sediment that is released into the water column disperses and deposits elsewhere.

5.4.24 The material within the proposed dredge areas (including side slopes) comprises gravelly sands and cobbles and it is anticipated that rock is underlying this superficial layer of coarse sediment. It is anticipated that concentrations of sediment-bound contaminants will be low due to the coarse nature of the sediments. This will be confirmed by the sediment contamination sampling and analysis which will be undertaken as part of the geotechnical investigations. It is, therefore, unlikely that redistribution and deposition of dredged material will result in exceedance of sediment quality criteria elsewhere. Overall, the potential effects from the redistribution of sediment-bound chemical contaminants at the dredge site are, therefore, considered **negligible**.

5.4.25 It is estimated that approximately 16,500 m3 of capital dredge material will need to be disposed at the Scalloway disposal site, as a worst-case scenario. During disposal, any sediment-bound contaminants will initially concentrate over the deposit ground and then in reduced concentrations over the areas where material finally settles following redistribution by currents and waves, which will potentially be over a wide area.

5.4.26 Contaminated material is generally associated with the finest sediments, which will have the most widespread dispersal and the greatest dilution. Due to the coarse nature of the sediments present in the dredge area and anticipated low levels of contaminants, the deposits are unlikely to cause a measurable change to the chemical quality of sediments at and around the disposal site. Furthermore, the disposal of this material will be subject to a Marine Licence which would only be granted if the dredge material meets the criteria for acceptable sea disposal.

5.4.27 Overall, the potential effects from the redistribution of sediment-bound chemical contaminants at the disposal site are considered **negligible**.

Operational phase

5.4.28 There are no potential effects anticipated on water and sediment quality during the operational phase. Ferry operations are anticipated to remain largely the same as pre-construction, with perhaps a small increase in crossings as a result of the larger new vessel being able to sail in conditions considered too adverse for the existing vessel, and therefore no new environmental effects are expected as a result of ferry operations.

5.5 Nature Conservation

5.5.1 The following sections consider the Nature Conservation topic for this environmental report. A summary of the existing (baseline) conditions is provided, followed by consideration of the potential effects and effects arising from the proposed works.

Baseline description

International designations

5.5.2 There are a number of Special Protection Areas (SPAs) with seabird qualifying features in the vicinity of and overlapping the proposed works (see Appendix B).

5.5.3 The proposed works overlap with Sumburgh Head SPA. This SPA is 25 km2 running along the coast of Shetland including the coast of Sumburgh Head and Grutness extending seaward ~2 km. This SPA is designated for:

- Arctic Tern Sterna paradisaea
- Fulmar Fulmarus glacialis
- Guillemot Uria aalge
- Kittiwake Rissa tridactyla
- Seabird assemblage

5.5.4 The next nearest SPAs to Grutness with seabird qualifying features are Mousa SPA, Seas off Foula SPA and Noss SPA.

5.5.5 Mousa SPA (~14 km to the northeast of Grutness) is designated for its internationally important breeding populations of:

- European Storm Petrel Hydrobates pelagicus (breeding)
- Arctic Tern Sterna paradisaea (breeding)

5.5.6 Seas off Foula SPA (~23 km to the west of Grutness) is designated for its important feeding grounds to a range of breeding and non-breeding seabirds:

- Great Skua Stercorarius skua (breeding and non-breeding)
- Fulmar Fulmarus glacialis (breeding and non-breeding)
- Arctic Skua Stercorarius parasiticus (breeding)
- Guillemot Uria aalge (breeding and non-breeding)
- Puffin Fratercula arctica (breeding)
- Assemblage of seabirds (breeding and non-breeding)

5.5.7 Noss SPA (~29 km to the northeast of Grutness) is designated for breeding populations of:

- Great Skua Stercorarius skua
- Kittiwake Rissa tridactyla
- Fulmar Fulmarus glacialis
- Guillemot Uria aalge
- Puffin Fratercula arctica
- Assemblage of seabirds

5.5.8 The next nearest SPAs with seabird qualifying features are over 30 km away from Grutness: East Mainland Coast (~33 km), Fair Isle (~37 km) and Foula (~47 km).

5.5.9 Lochs of Spiggie and Brow SPA is ~7 km northwest of Grutness and is designated for its nationally important wintering population of Icelandic Whooper Swan Cygnus cygnus.

5.5.10 Mousa Special Area of Conservation (SAC) is located ~13 km from Grutness. Mousa SAC is designated for 'Reefs' and 'Submerged or partially submerged sea caves', as well as Common/Harbour Seal Phoca Vitulina.

5.5.11 The next nearest marine SAC is Pobie Bank SAC ~53 km from Grutness; this SAC is designated for 'Reefs'. Papa Stour SAC is ~60 km from Grutness and is designated for 'Reefs' and 'Submerged or partially submerged sea caves'.

5.5.12 Scalloway disposal site does not overlap with any international designations, the closest being East Mainland Coast SPA (~10 km), Noss SPA (~16 km), Seas off Foula SPA (~25 km), Papa Stour SAC (~31 km) and Mousa SAC (~49 km) (see Appendix B).

National designations

5.5.13 The following national designations are present in the vicinity of the proposed works.

5.5.14 Sumburgh Head Site of Special Scientific Interest (SSSI) is located less than 100 m from the proposed works and is notified for its geological interest and colonies of breeding:

- Arctic Tern Sterna paradisaea (approx. 30 m from the proposed works).
- Kittiwake Rissa tridactyla
- Fulmar Fulmarus glacialis
- Guillemot Uria aalge
- Puffin Fratercula arctica
- Shag Phalacrocorax aristotelis

5.5.15 Pool of Virkie SSSI is ~1.2 km from Grutness and is notified for mudflats.

5.5.16 Other SSSIs or other national designations are located more than ~2 km from Grutness.

5.5.17 There are no SSSIs or other national designations within 6 km of the Scalloway disposal site.

5.5.18 Approximately 4 km to the northeast of Grutness, between Noss SPA and Grutness, are recognised areas of important sandeel habitat, providing prey resource to seabirds. These are known as the Mousa to Boddam sandeel grounds and are designated Marine Protected Areas.

Potential effects

5.5.19 A Report to Inform an Appropriate Assessment (RIAA) under the Habitats Regulations is included in **Appendix F**. This provides an assessment of the potential impact of the proposed works on European and Ramsar designated sites and their interest features. The RIAA concluded that the proposal will not lead to an adverse effect on site integrity on any European/Ramsar site.

5.5.20 The following sections review the potential effects of the proposed works on marine ecology receptors (including relevant protected habitats/species and interest features of nature conservation sites), specifically benthic habitats and species (Section 5.6), fish and shellfish (Section 5.7), marine mammals (Section 5.8) and seabirds and coastal waterbirds (Section 5.9).

5.6 Benthic Habitats and Species

5.6.1 The following sections consider the Benthic Habitats and Species topic for this environmental report. A summary of the existing (baseline) conditions is provided, followed by consideration of the potential effects arising from the proposed works.

Baseline description

5.6.2 The intertidal areas around the existing pier are dominated by rocky habitat overlaying gravelly sands. Large boulders (rock armour) are present along the north face of the pier and to the north east. Seaweed communities are poorly developed, likely as a result of scouring, as are lichen communities within the supralittoral zone.

5.6.3 The subtidal environment around the pier is dominated by sand and gravel habitats with small boulders present. To the east and north are occasional bedrock areas which become more dominant around the headlands around the mouth of the bay.

5.6.4 Marine Scotland National Marine Plan interactive NMPi data (accessed February 2023) show the only Priority Marine Feature (PMF) in the vicinity of the proposed works to be Kelp beds. This PMF is recorded as a point location at the mouth of Grutness bay, approximately 200 m from the proposed works, with the biotope at this location characterised as 'Grazed Laminaria hyperborea forest with coralline crusts on upper infralittoral rock'. The next closest record of this PMF is just over 1 km to the northeast of the proposed works. The Kelp bed PMF is also recorded approximately 700 m southwest of the Scalloway disposal site. The next closest records of this and other PMFs are more than 1.5 km away from the proposed disposal site. The kelp bed feature at the mouth of Grutness bay is coincident with a point location for Annex I reef habitat. No other reef features are recorded in or around the bay.

5.6.5 Benthic ecology surveys to characterise the benthic habitats and species present at Grutness were completed in July 2022. Intertidal surveys included walkover surveys to map the biotopes surrounding the pier and at the beach to the west of the proposed site. Subtidal surveys, consisting of grabs and underwater video operations, were carried out in the marine environment within and around the footprint of the proposed site. Details of the benthic surveys are in the Benthic Survey Report (ABPmer, 2023a, see **Appendix G**). A summary of the findings is provided below.

5.6.6 The rocky areas of the shore extending either side of the existing pier followed a typical zonation, from upper shore barnacle dominated littoral rock to Fucus vesiculosus, F. serratus and lower shore Laminaria digitata and Saccharina latissima kelp communities. The beach to the far west of Grutness bay was identified as barren littoral coarse sand.

5.6.7 In the subtidal, 'Laminaria hyperborea forest and foliose red seaweeds on tide-swept upper infralittoral mixed substrata' was recorded. This biotope, which was identified at three subtidal locations, both within and outside the footprint of the proposed works, was considered to be a relatively poor example of the Kelp bed PMF due to its patchy extent and presence. The biotope 'Infralittoral mobile clean sand with sparse fauna' was also recorded within the footprint of the proposed works

5.6.8 There were also a variety of other biotopes recorded primarily north of the existing pier, including 'Mixed kelps with scour-tolerant and opportunistic foliose red seaweeds on scoured or sand-covered infralittoral rock', 'Alaria esculenta on exposed sublittoral fringe bedrock' and 'Mixed Laminaria hyperborea and Saccharina latissima forest on sheltered upper infralittoral rock'.

5.6.9 Subtidal sediment grab samples at Grutness recorded a moderately abundant infaunal assemblage characterised primarily by nematodes and annelids (polychaetes and oligochaetes), as well as benthic copepods, gammarids and amphipods. A total of 62 taxa were recorded from the samples.

Invasive Non-native Species

5.6.10 Invasive non-native species (INNS) are not considered to be receptors in themselves; however, the potential effects associated with non-native species have been discussed as part of the marine ecology impact assessments and, where appropriate, the potential effects on the other receptors have been considered. The main vectors for many marine non-native species are the hulls of marine vessels or within the ballast water and consideration is given to their effects under vessel movements in both the construction and operation phase.

5.6.11 In Scotland, there is a growing problem with marine invasive non-native species and specific acknowledgement is given to the following species which have all been found in Scottish waters: 'Wakame' (Undaria pinnatifida); 'Wireweed' (Sargassum muticum); the red alga (Heterosiphonia japonica); 'Orange-striped anemone' (Haliplanella lineata); 'Darwin's barnacle' (Eliminius modestus); 'Striped barnacle' (Balanus amphitrite); 'Japanese skeleton shrimp' (Caprella mutica); 'Slipper limpet' (Crepidula fornicata); 'Leathery sea squirt' (Styela clava); 'Carpet sea squirt' (Didemnum vexillum); 'Pacific oyster' (Crassostrea gigas); 'Chinese mitten crab' (Eriocheir sinensis). A desk-based search of the species listed above showed no records of any of these species in Grutness.

5.6.12 The red alga Bonnemaisonia hamifera has been previously recorded at Fair Isle and the green alga Codium fragile has been recorded at Grutness bay, thus a potential pathway exists for transmission between the two sites via the passenger ferry.

5.6.13 The following species have been recorded on Shetland at a distance greater than 3 km of Grutness: Orange-striped anemone' (Haliplanella lineata); 'Darwin's barnacle' (Eliminius modestus); Striped barnacle' (Balanus amphitrite); Japanese skeleton shrimp' (Caprella mutica).

5.6.14 No INNS were recorded during the benthic surveys at Grutness (ABPmer, 2023a, see Appendix G).

Potential effects

5.6.15 The following impact pathways have been considered with respect to benthic habitats and species in the construction phase:

- Changes in habitat and loss of benthic habitat and species during dredging and disposal operations;
- Changes in water and sediment quality; and
- Non-native species transfer and introduction.

5.6.16 The following impact pathways have been considered with respect to benthic habitats and species in the operation phase:

- Habitat loss under the footprint of the new breakwater and pier extension.

Construction phase

Changes in habitat and loss of benthic species during dredging and disposal operations

5.6.17 Capital dredging causes a direct physical removal of seabed sediments, causing a modification to the existing seabed habitat. The fauna associated with the removed material will, therefore, be damaged, killed or relocated to the disposal ground. Dredging also has the potential to result in localised physical disturbance and smothering of benthic habitats and species where the material settles out of suspension back onto the seabed. This potential smothering of benthic species may cause stress, reduced rates of growth or reproduction and in the worst cases the effects may be fatal (Pineda et al., 2017).

5.6.18 Habitats within coastal environments have highly fluctuating conditions including the resuspension and deposition of sediments on a daily basis (through tidal action), lunar cycles (due to the differing influences of spring and neap tides) and on a seasonal basis (due to storm activity and conditions of extreme waves). Subtidal and intertidal habitats are, therefore, characterised by such perturbations and the biological communities of these environments are well adapted to survival under fluctuating conditions.

5.6.19 If the amount of sediment deposited is too great to allow species to survive burial, then recovery occurs via re-colonisation and/or migration to the new sediment surface (Bolam et al., 2006a; 2006b). In general, the rate of recovery is dependent upon just how stable and diverse the assemblage was in the first place. A regularly disturbed sedimentary habitat with a

low diversity benthic assemblage is likely to recover more quickly (i.e., return to its disturbed or 'environmentally-stressed' baseline condition) than a stable habitat with a pre-existing mature and diverse assemblage. Furthermore, in cases where the quantity and type of sediment deposited does not differ greatly from natural sedimentation, e.g., of similar particle size, the effects are likely to be relatively small as many species are capable of migrating up through the deposited sediments.

5.6.20 The proposed works will result in the removal of an estimated 16,500 m³ of material from an area of approximately 1.1 ha of subtidal habitat. It is estimated that just over half of this volume (9,000 m³) constitutes soft material, with the rest of the dredged volume anticipated to be rock. This will be confirmed following the geotechnical investigations. Due to the coarse nature of the soft dredged material (gravelly sand), it is anticipated that any sediment suspended in the water column will settle very quickly and any resulting sediment plume will be localised around the footprint of the dredge area (see Section 5.3 and Section 5.4). Additionally, considering the relatively small dredge volume, even if assuming the unlikely scenario of all 16,500 m³ being soft material, any resulting sedimentation following resettlement of suspended sediments in the vicinity of the dredge area is anticipated to be minimal (of the order of a few mm; see Section 5.3). Sedimentation away from the local dredge area would be almost undetectable, and short-lived as it will be redispersed by physical processes. Sedimentation on adjacent intertidal areas will be negligible and undetectable from the existing natural variability of the system. Additionally, strong wave and tidal action in the wider study area is likely to rapidly disperse any deposited sediments.

5.6.21 The habitats present within the dredge footprint are a mosaic of gravelly sand with sparse fauna and patches of kelp. The biotopes found both within and outside the footprint of the works are considered to be insensitive to light deposition of fine material (up to 5 cm) and to have no/ low sensitivity to heavy deposition of up to 30 cm of fine material in a single event (Stamp, 2015; Stamp and Hiscock, 2015; Tillin et al. 2019). The key characterising benthic faunal species of these biotopes are considered likely to be able to burrow through a 5 cm layer of fine sediments (Tillin et al. 2019). Therefore, considering the very low deposition levels anticipated, it is considered that overall any effects from sediment deposition during dredging on benthic habitats and species will be **negligible**.

5.6.22 Dredging activities will result in the removal of the top layer of gravelly sand and cobbles/gravel from a relatively small area of the bay, equivalent to 1.1 ha. The rock underlying this sediment will be dredged/removed until the required depth is reached It is assumed that this will result in a mosaic of gravels and rocky substrata within the dredge footprint once the dredging is complete. Extraction of the cobble/gravel substratum which supports kelp, would result in loss of Laminaria hyperborea and the associated community. However, the rocky substrata is likely to be recolonised by macroalgae and kelp in the medium term (Stamp, 2015). The gravelly sand habitats removed from the dredge footprint are common and widespread in the surrounding area. Strong tidal and wave actions will redistribute some of these sediments back onto the dredged footprint. Characterizing species of the gravelly sand habitat are likely to recover and recolonise the area through transport of adults in the water column or migration from adjacent patches (Tillin et al. 2019). Considering the small footprint of the dredge area, the patchy nature of the kelp habitat within the footprint and the widespread presence of this and the gravelly sand habitat in the wider Grutness bay, as well as good potential for recolonisation, it is considered that overall the changes to benthic habitats and species as a result of seabed removal during dredging will be **negligible**.

5.6.23 It is assumed that all 16,500 m³ of the dredged material, both sediment and rock, will be disposed of at the Scalloway licensed disposal site. This disposal site is located approximately 38 km from Grutness. The water depth is 62 m and the site covers an area of approximately 3.1 ha[4] , i.e. approximately three times the size of the dredge footprint. Two scenarios are considered below, where all dredged material comprises either: 1) sediment or 2) rock.

5.6.24 The scenario where all dredged material comprises sediment has the highest potential for effects from sediment dispersal on benthic habitats and species outside the disposal site. However, due to the predominantly coarse nature of the material to be dredged (gravelly

[4] www.gov.scot.xlsx (live.com)

sand), sediment will quickly settle out of suspension within the boundaries of the disposal site with the spatial extent of any plume likely to be constrained to within a few hundred metres of the disposal site (see Section 5.3). The relatively small dredge volume is unlikely to result in significant sediment deposition within the disposal site or within the extent of any sediment plume. Considering the water depth at the disposal site and its exposed nature, sediment deposition in the wider area surrounding the disposal site is expected to be minimal. Consideration is also given to any cumulative effects from disposal of dredge material arising from the Fair Isle (North Haven) dredging operations. The maximum dredge volume arising from the Fair Isle proposed works is approximately 3,000 m3; this is a very small volume and when considered alongside the maximum dredge volume arising from the Grutness proposed works (16,500 m^3) it is unlikely to change the above conclusions.

5.6.25 The scenario where all dredged material comprises rock has the highest potential for effects from physical changes to the substrata at the disposal site. Disposed rock will fall through the water column directly onto the seabed at the location it is disposed. Considering the relatively small dredge volume of rock (even cumulatively alongside dredged rock from Fair Isle) it will result in a mosaic of rock and sediment within the footprint of the disposal site. This will result in some habitat loss under the footprint of the disposed rock. However, as a historic and open disposal site it is considered that any habitats therein will not be of high value and are likely to be widespread in the surrounding area. Therefore, the small area of habitat loss at the disposal site under the disposed rock footprint is considered to be **negligible**.

5.6.26 In both scenarios, it is considered unlikely that there will be any significant bathymetric changes at the disposal site due to the small volume of the dredge material and the considerable depth at the disposal site (see Section 5.3). If dredged rock from both Grutness and Fair Isle was to equally cover the whole area of the disposal site this would result in a reduction in water depth by approximately 0.6 m, which is negligible when considering the existing water depth of 62 m (see Section 5.3). In reality, it is unlikely that the dredged rock material will be distributed equally over the disposal site, but it is also unlikely that all of the dredged material will comprise rock, with the maximum rock volume estimated to be no more than 10,000 m3.

5.6.27 The subtidal habitats and species within the disposal site have been subject to changes brought about by ongoing disposal activities over the course of the years. These benthic communities, therefore, will be tolerant to sediment deposition and capable of rapid recoverability. On this basis, any effects from sediment deposition at the disposal site are considered to be temporary and short term. Any habitat loss under the disposed rock is also considered negligible, when taking into account the likely low value of the existing habitats within the disposal site and their widespread occurrence in the surrounding area. Overall, based on these factors, effects on benthic species and habitats as a result of the disposal activities are considered to be **negligible**.

Changes in water and sediment quality

5.6.28 The worst case considered for potential effects from changes to water and sediment quality would be to assume that all dredged material is soft sediment.

5.6.29 There is the potential for effects on benthic habitats and species associated with changes in water quality during the proposed works, as a result of increases in SSC, changes to DO, changes to levels of chemical contaminants and the release of toxic contaminants bound in sediments.

5.6.30 The previous sections have considered the potential for increases in SSC (Section 5.3) and changes to water and sediment quality (Section 5.4).

5.6.31 Any changes to SSC and DO will be temporary, lasting the period of the soft sediment dredging (approximately 8 to 12 weeks). Overall, the spatial and temporal magnitude of change in SSC is considered to be negligible locally and further afield (Section 5.3). Any changes in DO are expected to be localised and very short-lived, and considered negligible (Section 5.4). The potential changes to levels of chemical contaminants in the water and the potential redistribution of sediment-bound chemical contaminants are considered negligible (Section 5.4).

5.6.32 Thus, in physical terms, any plumes resulting from dredging are expected to have a minimal and very localised effect on water and sediment quality at Grutness. The benthic communities present within and adjacent to the dredge area, would be tolerant to the minimal changes in water and sediment quality that will occur during dredging operations. Furthermore, best practice pollution prevention guidelines will be followed to minimise the risk of accidental spillages and the risk of introduction of contaminants throughout construction. Overall, the potential effect to benthic habitats and species arising as a result of changes in water and sediment quality during dredging and other construction activities is considered to be **negligible.**

5.6.33 Taking account of the scale of the disposal volume at the Scalloway disposal site, the spatial and temporal magnitude of change in SSC is considered to be negligible (Section 5.3). In turn, the potential changes to DO at the disposal sites are considered to be negligible (Section 5.4). Due to the highly dispersive nature of the site and the coarse nature of the dredged material, the deposits are unlikely to cause a measurable change to the chemical quality of sediments within and around the area of the disposal site. The potential changes to levels of chemical contaminants in the water as a result of the disposal of dredge arisings and the potential redistribution of sediment-bound chemical contaminants are, therefore, considered to be **negligible** (Section 5.4). Overall, the potential impact to benthic habitats and species arising as a result of changes in water and sediment quality at the disposal site is considered to be **negligible**.

Non-native species transfer and introduction

5.6.34 There is a potential risk that the proposed works could result in the introduction or spread of invasive non-native species (INNS). The dredgers and attendant barges will not be carrying ballast water and, therefore, there is no risk that invasive non-native species will be transported via this pathway during construction. Non-native species have the potential to be transported into the local area on the hulls of construction related vessels if they have operated in differing water bodies. Potential biosecurity risks will be managed through biosecurity management procedures, as required.

5.6.35 Overall, given the scale and nature of the proposed works, the risk in terms of introducing or transferring INNS and potential effects on marine habitats and benthic species is considered **negligible.**

Operational phase

Habitat loss under the footprint of the new breakwater and pier extension

5.6.36 The impact of direct habitat loss (e.g., piling or land reclamation) relates to the permanent physical removal of the substratum and associated organisms from the seabed.

5.6.37 Intertidal and subtidal habitats are sensitive to physical loss at locations where new structures are introduced onto the seabed (i.e., within the development 'footprint' of these structures). The significance of such losses will vary on a site by site basis in response to differences in the extent and duration of the losses as well as the relative value of the habitats in question. The value of the habitats is, in turn, reflected by the species that are present and level of statutory and non-statutory protection afforded to them.

5.6.38 The proposed works include extension of the existing pier, installation of the linkspan structure as well as new rock armour along the exposed side of the new pier. The new pier will be sheet-piled and backfilled. Therefore, there will be permanent habitat loss under the footprint of both the new pier and rock armour as well as the permanent linkspan structure. Approximately 0.07 ha of subtidal habitat is estimated to be lost under the footprint of the new pier and linkspan structure, with an additional 0.14 ha lost under the footprint of the rock armour. A very small area of intertidal habitat (0.003 ha) would be lost under the new rock armour.

5.6.39 The habitats present within the footprint of the proposed pier extension, rock armour and linkspan structures include gravelly sand with sparse fauna and patches of 'Laminaria hyperborea forest and foliose red seaweeds on tide-swept upper infralittoral mixed substrata'

biotope which was considered a poor example of the Kelp bed PMF due to its patchy extent and presence within the subtidal area. Additionally, non-PMF biotopes were recorded in the vicinity of the proposed new pier and rock armour including 'Mixed kelps with scour-tolerant and opportunistic foliose red seaweeds on scoured or sand-covered infralittoral rock', 'Alaria esculenta on exposed sublittoral fringe bedrock' and 'Mixed Laminaria hyperborea and Saccharina latissima forest on sheltered upper infralittoral rock'.

5.6.40 These biotopes were recorded to be patchy within the small permanent footprint of the proposed works and interspersed with faunally sparse gravelly sands. Moreover, kelp biotopes are common and widespread in the wider area and it is considered that the likely permanent habitat loss of these biotopes is of very small scale. Additionally, the new rock armour will provide a suitable surface for recolonisation by macroalgae and kelp in the medium term (Stamp, 2015). Overall, the effect of benthic habitat loss under the permanent footprint of the works is considered to be **minimal**.

5.7 Fish and Shellfish

5.7.1 The following sections consider the Fish and Shellfish topic for this environmental report. A summary of the existing (baseline) conditions is provided, followed by consideration of the potential effects arising from the proposed works.

Baseline description

5.7.2 Consideration is given to those fish and shellfish species that could be present within 3 km of the proposed works. The sheltered nature of the bay compared to the headlands may provide some benefit for juvenile fish; however, as indicated in Section 5.3, the bay experiences regular wave disturbance as is evidenced from the dominant substrata (coarse sands and gravels).

5.7.3 Specific acknowledgement is given to those fish and shellfish with spawning grounds that overlap or are proximal to the development, with additional consideration to those fish species with nursery areas in the vicinity.

5.7.4 To understand the utilisation of the wider area by fish and shellfish species a number of data sources were interpreted including published Cefas reports (i.e., Coull et al., 1998; Ellis et al., 2012). Both of these reports contain information on the geographical locations of spawning and nursery grounds of many fish and shellfish species around the UK. Spawning and nursery grounds were assigned a level of intensity within these studies (high, low or undetermined) depending on the level of activity thought to occur at each location.

5.7.5 Of the fish and shellfish investigated within the Cefas reports seven have spawning grounds that overlap with Grutness and are therefore proximal to the proposed works. These taxa are haddock (Melanogrammus aeglefinus), lemon sole (Microstomus kitt), sprat (Sprattus sprattus), sandeel (Ammodytidae spp.), cod (Gadus morhua), Norway pout (Trisopterus esmarki) and whiting (Merlangius merlangus). The spawning density of all taxa is low, except for lemon sole, haddock and sprat for which it is undetermined.

5.7.6 In terms of nursery areas the work by Coull et al. (1998) and Ellis et al. (2012) identified a number of species that have nursery grounds that overlap with the waters near to Grutness including lemon sole (Microstomus kitt), haddock (Melanogrammus aeglefinus), Sandeel (Ammodytidae spp.), cod (Gadus morhua), herring (Clupea harengus), mackerel (Scomber scombrus), Norway pout (Trisopterus esmarki), whiting (Merlangius merlangus), blue whiting (Micromesistius poutassou), ling (Molva molva), Saithe (Pollachius virens), European hake (Merluccius merluccius), spurdog (Squalus acanthias), anglerfish (Lophius piscatorius) and spotted ray (Raja montagui). The nursery density of all taxa is low except anglerfish and blue whiting for which it is high and lemon sole, haddock, saithe and Norway pout for which it is undetermined.

5.7.7 Basking shark are infrequently sighted (approximately one every two years) off the coast from Grutness to Sumburgh Head. The closest sightings to the site was off Grutness bay in 2017,

whilst the most recent record (2022) as well as the majority of sightings, have occurred further afield (>2 km) from Grutness (Sea Watch Foundation).

5.7.8 NMPi data show no PMF shellfish species, shellfish protected areas or classified shellfish harvesting areas within 1 km from Grutness or from Scalloway disposal site. Scallops are present approximately 1.5 km from Grutness bay and 1.5 km from Scalloway disposal site.

Potential effects

5.7.9 The following impact pathways have been considered with respect to fish and shellfish in the construction phase:

- Effects of habitat change on fish and shellfish receptors;
- Effects of changes in water quality on fish and shellfish receptors; and
- Effects due to underwater noise and vibration on fish and shellfish receptors.

5.7.10 The following impact pathways have been considered with respect to fish and shellfish in the operation phase:

- Effects due to habitat loss under the footprint of the new breakwater and pier extension

5.7.11 Whilst entrainment of fish during dredging construction is usually considered for large dredging campaigns, this impact pathway is not considered here due to the very small scale of the anticipated dredge volume (16,500 m3) and the low-density fish spawning and nursery grounds within the vicinity of the proposed works.

Construction phase

Effects of habitat change on fish and shellfish receptors

5.7.12 Dredging and dredged material disposal have the potential to result in localised physical disturbance and smothering of seabed habitats and species. These changes have the potential to impact on fish and shellfish species through changes in prey resources and the quality of foraging, nursery and spawning habitats. However, changes to benthic habitats are considered negligible (see Section 5.6).

5.7.13 Kelp habitats can provide important spawning and nursery habitat for fish (Kelly, 2005). However, the density of spawning and nursery grounds for the majority of fish using the waters within 3 km of Grutness is low or undetermined (Coull et al., 1998; Ellis et al., 2012). Only Anglerfish and Blue Whiting are considered to have high density nursery areas around Grutness. However, considering the very shallow nature of the proposed works site (<5 m) and the preference of both of these species for deeper waters, it is unlikely that Grutness bay constitutes an important nursery ground for either of these species. Additionally, all of the species mentioned in the baseline section have extensive spawning and nursery grounds spanning several hundreds of kilometres around Shetland and the waters north of mainland Scotland. The patchy distribution of kelp biotope at the proposed works site, interspersed with faunally sparse gravelly sands suggests that overall the habitats present in the area of the proposed works are not of particularly high importance for fish and shellfish. Similar habitats are present throughout Grutness bay and only a small area of habitat (approximately 1.1 ha of subtidal habitat) would be affected by the proposed dredge works with any effects from the sediment plume considered to be negligible beyond the dredge area (see Section 5.3). The disposal area is already considered to be disturbed as a result of use of this existing licensed disposal site and any effects from a resultant sediment plume is considered to be negligible (see Section 5.3). In addition, consideration is given to the mobile nature of the majority of fish and shellfish species and the widespread availability of other habitats and prey throughout the region. Most species are opportunistic and generalist feeders meaning they are not reliant on a single prey item. Consequently, the effect of any change in habitat on fish and shellfish, overall, is considered to be **negligible** for both the dredging operations and disposal.

Effects of changes in water quality on fish and shellfish receptors

5.7.14 Changes in water quality during dredging and dredged material disposal could potentially impact fish species, by increasing SSC, resulting in changes to DO and releasing toxic contaminants bound in sediments. These changes could either impact fish directly or indirectly by resulting in the displacement of fish from the area.

5.7.15 Increased suspended sediments can lead to physiological effects in adult finfish resulting from the abrasion of sediment particles on gill tissues, causing reduced gill function and possible mortality (Wenger et al., 2017; Kjelland et al., 2015). Such effects on fish are considered to occur at suspended sediment levels of around 10,000 mg/l (Britwell, 2000). High SSC levels may also impact spawning and nursery grounds through damage to eggs and planktonic larvae, as well as causing abrasion or clogging of the fragile gills of larval and juvenile fish, resulting in mortality or reduced growth rates.

5.7.16 Because turbidity often impairs visual acuity, activities and processes that require vision can be inhibited, leading to behavioural responses. For example, foraging in both planktivorous and piscivorous fish can be negatively affected by suspended sediments. Piscivores are especially sensitive to increasing turbidity because many are visual hunters that detect prey from a distance. An increase in suspended sediment reduces both light and contrast, decreasing encounter distances between predator and prey (Wenger et al., 2017).

5.7.17 Elevated suspended sediments can also influence the movements of fish. However, such responses can cease if fish become acclimatised. Fish in high latitude coastal areas typically have to contend with variable turbidity and often poor visual conditions, resulting from fluctuations in ambient light levels, suspended sediments and in the light transmission properties of the water. The mobile nature of fish species generally allows avoidance of areas of adverse conditions which are unlikely to significantly affect a population provided such conditions are temporary.

5.7.18 Any changes to SSC will be limited to the immediate vicinity of the proposed dredge area and disposal site (Section 5.3). The resultant changes in DO are also considered to be localised and short-lived and overall negligible (Section 5.4). The increase in dissolved concentrations of contaminants from redistribution of sediment-bound chemical contaminants during dredging and disposal is also expected to be negligible (Section 5.4).

5.7.19 Overall, fish are not considered to be sensitive to the negligible changes in water quality predicted (see Section 5.4), and the proposed dredging and disposal will, therefore, not result in significant displacement of fish. Furthermore, fish feed on a range of food items and, therefore, their sensitivity to a temporary change in the availability of a particular food resource is considered to be low. Their high mobility enables them to move freely to avoid areas of adverse conditions and to use other prey resources in the local area. Best practice pollution prevention guidelines will also be followed to minimise the risk of accidental spillages and the risk of introduction of contaminants throughout construction (see Section 3.3).

5.7.20 There are no PMF shellfish species, shellfish protected areas or classified shellfish harvesting areas within 1 km from Grutness or from Scalloway disposal site. Scallops are present approximately 1.5 km from Grutness bay and 1.5 km from Scalloway disposal site. The plumes generated during dredging and disposal are anticipated to be localised to the dredge and disposal sites and do not overlap with any commercial shellfish beds or the distribution of sensitive shellfish species.

5.7.21 The overall effect of changes in water quality on fish and shellfish species during both dredging and disposal is, therefore, considered **negligible**.

Effects due to underwater noise and vibration on fish and shellfish receptors

5.7.22 Elevated underwater noise and vibration levels during construction activities can potentially disturb fish by causing physiological damage and/or inducing adverse behavioural reactions.

5.7.23 For most piling activities, the main source of noise and vibration relates to where piles are hammered or vibrated into the ground. Percussive piling involves hammering the pile into the seabed resulting in an impact blow and high levels of noise. Vibro-piling produces lower levels

of noise as piles are vibrated into the seabed. For the purposes of this environmental report it has been assumed that all piling will be percussive/ impact piling, which is the worst case in terms of noise generation.

5.7.24 The dredging process involves a variety of sound generating activities which can be broadly divided into sediment excavation, transport and placement of the dredged material at the disposal site (CEDA, 2011; WODA, 2013; Jones and Marten, 2016). For most dredging activities, the main source of sound relates to the vessel engine noise.

5.7.25 A detailed Underwater Noise Assessment has been undertaken for the proposed works (ABPmer, 2023b, see Appendix H) and is briefly summarised in this section. Engine noise associated with the operation of construction vessels has also been considered in the Underwater Noise Assessment.

Impact Piling

5.7.26 It is expected that up to 328 no. AZ 40-700 sheet piles will be installed in the subtidal marine environment to construct the extension to the pier at Grutness. While piling will likely involve a combination of impact (percussive) and vibratory installation methods, as a worst-case it is assumed that impact piling will be required throughout. Piling activities will be intermittent involving 4 days to pile each sheet pile cell, followed by 12 days of non-piling activities to complete that cell (3 days to install waling beams, 2 days to install tie rods, 3 days to backfill, 4 days to set up temporary works for next cell), before another 4 days of piling to create the next sheet pile cell and so on. Piling activity will be carried out for a maximum of 10 hours per day (between 07:00 and 19:00) for 4 days, followed by 12 days of non-piling activities, repeated for 10 cells. The likely anticipated maximum impact piling scenario is for 8 piles to be installed per day.

5.7.27 The proposed methodology is to install piles “end over” using land-based piling plant sitting on the end of the existing pier. As each cell is completed and backfilled, the plant can move onto the cell and construct the next. It is estimated that piling activities will take a maximum of 6 months, between April and September. While it is assumed that piling would be carried out from the land side (on pier), if the contractor prefers to use a barge mounted piling rig, the total duration of piling will be approximately 3 months, with piling activities undertaken for 5.5 days followed by 1.5 day of no piling. However, as a worst-case option, this environmental report assumes that piling activities would be 6 months.

5.7.28 The distances at which potential mortality/injury and behavioural effects in fish are theoretically predicted to occur during impact piling activities associated with the construction of the proposed works are shown in Table 13 of the Underwater Noise Assessment (ABPmer, 2023b, see Appendix H).

5.7.29 The distances at which peak Sound Pressure Level and cumulative Sound Exposure Level thresholds for mortality/potential mortal injury and recoverable injury are reached for fish are all well within the pier area and local to the piling activity. Given the mobility of fish, any individuals that might be present within the relatively localised areas associated with potential mortality/injury during pile driving activities would be expected to move away and avoid harm. Overall, the Underwater Noise Assessment concluded that the potential mortality/injury effects of the proposed percussive piling activities on fish are not considered to be significant.

5.7.30 Behavioural reactions are anticipated to be limited to within the wider bay at Grutness. The scale of the behavioural response within this predicted zone of influence is partly dependent on the hearing sensitivity of the species. Fish with a swim bladder involved in their hearing (e.g., herring and sprat) may exhibit a moderate behavioural reaction within distance in which a behavioural response is predicted (e.g. a sudden change in swimming direction, speed or depth). Fish with a swim bladder not involved in hearing (e.g., cod and whiting) are likely to display a milder behavioural reaction. Fish without a swim bladder (e.g., lemon sole and skate) are anticipated to only show very subtle changes in behaviour in this zone.

5.7.31 The scale of the behavioural effect is also dependent on the size of fish (which affects maximum swimming speed). Smaller fish, juveniles and fish larvae swim at slower speeds and are likely to move passively with the prevailing current. Larger fish are more likely to actively swim and, therefore, may be able to move out of the behavioural effects zone in less time,

although it is recognised that the movement of fish is very complex and not possible to define with a high degree of certainty.

5.7.32 The effects of piling noise on fish also need to be considered in terms of the duration of exposure. Piling noise will take place over a period of approximately 6 months. However, piling will not take place continuously as there will be periods of downtime, pile positioning and set up. Furthermore, the piling works will be undertaken for a maximum of 10 hours per day (between 07:00 and 19:00) for 4 days, followed by 12 days of non-piling activities, repeated for 10 cells; or for 5.5 days in any one week if piling is undertaken from a barge mounted piling rig. There will, therefore, be extended periods when fish will not be disturbed by any impact piling noise. The actual proportion of impact piling over a 24-hour period is estimated to be around 42%. In other words, any fish that remain within the predicted behavioural effects zone at the time of percussive piling will be exposed to this disturbance only 42% of the time.

5.7.33 It is also important to consider the noise from piling against existing background or ambient noise conditions. The area in which the construction will take place already experiences regular vessel operations, and, therefore, fish are likely to be habituated to a certain level of intermittent anthropogenic background noise.

5.7.34 In summary, there is not considered to be a risk of significant injury or disturbance to fish from the proposed piling activities at Grutness. Mitigation such as soft start and gradual ramp up for piling will also be implemented (see Section 3.3) which will further enable fish to evade the area of impact before full piling operations start. Overall, any effects on fish and shellfish as result of underwater noise during piling activity is considered **negligible**.

Dredging

5.7.35 Dredging activity at Grutness is anticipated to involve the dredging of rock (rock breaking) and the dredging of soft material(sand/silts). It is assumed that there will be up to 10 hours of dredging per day. Allowing for weather downtime the maximum duration of dredging activities would take a maximum of 7 months, between April and October, acknowledging that this would not be continuous dredging operations. The dredging activities are likely to involve the use of two barge-mounted excavators working concurrently.

5.7.36 The relative risk and distances at which potential mortality/injury and behavioural effects in fish are predicted to occur as a result of the concurrent dredging associated with the proposed works at Grutness are included in Table 14 of the Underwater Noise Assessment (ABPmer, 2023b, see Appendix H).

5.7.37 Overall, there is considered to be a low risk of any injury in fish as a result of the underwater noise generated by concurrent dredging, although recoverable injury could potentially occur in very close proximity to the dredgers (within 15 m) in fish where the swim bladder is involved in hearing (e.g., herring). The level of exposure will depend on the position of the fish with respect to the sources, the propagation conditions which will be influenced by the tidal state, and the individual's behaviour over time. However, it is unlikely that a fish would remain in the vicinity of a dredgers for extended periods. Behavioural responses are anticipated to be spatially negligible in scale and fish will be able to move away and avoid the sources of the noise as required. Furthermore, the proposed concurrent dredging activities involved during construction will be temporary and take place over a period of 7 months acknowledging that this would not be continuous dredging operations.

5.7.38 In summary, there is not considered to be a risk of significant injury or disturbance to fish and shellfish from the proposed dredging activities at Grutness. Any effects on fish and shellfish as result of underwater noise during dredging activity is considered **negligible**.

Vessel movements

5.7.39 Rock armour for the breakwater may be delivered by vessel during the construction phase of the project. As it is yet to be determined how much of the work will be carried out from sea and the likely requirements for vessel movements during construction, a worst-case scenario has been adopted which assumes the following for marine based vessel activity:

2024

- Barge mounted piling rig (on site for 3 months); and
- Vessel movement for delivery of materials/equipment/plant (maximum, on average, two vessels per week from February to October).

2025

- Two dredgers (on site for 7 months); and
- Vessel movement for delivery of materials/equipment/plant (maximum, on average, two vessels per week from March to September).

5.7.40 The relative risk and distances at which potential mortality/injury and behavioural effects in fish are predicted to occur as a result of the vessel movements associated with the construction and operation of the upgraded ferry facility at Grutness are included in Table 7 of the Underwater Noise Assessment (ABPmer, 2023b, see Appendix H).

5.7.41 In summary, there is considered to be a negligible risk of any injury in fish as a result of the underwater noise generated by the vessels involved during construction and the operation of the new ferry. Behavioural responses are anticipated to be spatially negligible in scale and fish will be able to move away and avoid the source of the noise as required. Any effects on fish and shellfish as result of underwater noise generated by the vessels involved during construction is considered **negligible**.

Operational phase

Effects due to habitat loss under the footprint of the new breakwater and pier extension

5.7.42 There is the potential for effects to fish and shellfish as a result of habitat loss due to the footprint of the proposed works. The proposed works include extension of the existing pier, installation of the linkspan structure as well as new rock armour along the exposed side of the new pier. The new pier will be sheet-piled and backfilled. Therefore, there will be permanent habitat loss under the footprint of both the new pier and rock armour as well as the permanent linkspan structure. Approximately 0.07 ha of subtidal habitat is estimated to be lost under the footprint of the new pier and linkspan structure, with an additional 0.14 ha lost under the footprint of the rock armour. A very small area of intertidal habitat (0.003 ha) would also be lost under the new rock armour. These changes have the potential to impact on fish species through potential changes in prey resources and the quality of foraging, nursery and spawning habitats.

5.7.43 As discussed in Section 5.6, overall, the effect of benthic habitat loss under the permanent footprint of the works on benthic communities is considered to be minimal. The habitats present within the footprint of the proposed pier extension, rock armour and linkspan structures include gravelly sand with sparse fauna and patches of ‘Laminaria hyperborea forest and foliose red seaweeds on tide-swept upper infralittoral mixed substrata’ biotope which was considered a poor example of the Kelp bed PMF due to its patchy extent and presence within the subtidal area. Additionally, non-PMF biotopes were recorded in the vicinity of the proposed new pier and rock armour including ‘Mixed kelps with scour-tolerant and opportunistic foliose red seaweeds on scoured or sand-covered infralittoral rock’, ‘Alaria esculenta on exposed sublittoral fringe bedrock’ and ‘Mixed Laminaria hyperborea and Saccharina latissima forest on sheltered upper infralittoral rock’.

5.7.44 Even though kelp habitats can provide important spawning and nursery habitat for fish (Kelly, 2005), these biotopes were recorded to be patchy within the small permanent footprint of the proposed works and interspersed with faunally sparse gravelly sands. Moreover, kelp biotopes are common and widespread in the wider area and it is considered that the likely permanent habitat loss of these biotopes is of very small scale.

5.7.45 As previously described (paragraph 5.7.11), the density of spawning and nursery grounds for the majority of fish using the waters within 3 km of Grutness is low or undetermined, however, these grounds are extensive spanning several hundreds of kilometres around Shetland and the waters north of mainland Scotland (Coull et al., 1998; Ellis et al., 2012). Consideration is

also given to the mobile nature of the majority of fish and shellfish species and the widespread availability of other habitats and prey throughout the region. Additionally, the new rock armour will provide a suitable surface for recolonisation by macroalgae and kelp in the medium term (Stamp, 2015), which means habitat loss will be temporary. Consequently, it is considered that any effects from habitat loss on fish and shellfish will be **negligible**.

5.8 Marine Mammals

5.8.1 The following sections consider the Marine Mammals topic for this environmental report. A summary of the existing (baseline) conditions is provided, followed by consideration of the potential effects arising from the proposed works.

Baseline description

5.8.2 The most frequently sighted cetacean species from Shetland include harbour porpoise Phocoena phocoena, risso's dolphin Grampus griseus, white-sided dolphin Lagenorhynchus acutus, white-beaked dolphin Lagenorhynchus albirostris, orca Orcinus orca, minke whale Balaenoptera acutorostrata, sei whale Balaenoptera borealis, humpback whale Megaptera novaeangliae, and long-finned pilot whale Globicephala melaena. With regards to pinnipeds, both seal species (harbour Phoca vitulina and grey Halichoerus grypus) are broadly speaking resident in the waters around Shetland, with harbour seal a qualifying feature of the Mousa SAC.

5.8.3 Increases in orca sightings from Shetland started to occur in the 1990s and it is well-known as a hot-spot for this species, with orcas observed most frequently between the months of April-July (Weir 2002). There are four known pods of between 4-9 animals known to occur around the island, and a successful photo identification scheme is run by the Shetland Sea Mammal Group[5] .

5.8.4 It is suspected that warming waters have led to increased usage of this area by Risso's dolphin, which now appears to be resident in the waters around Shetland. Conversely, warming temperatures may be responsible for declines in white-beaked dolphin sightings. This species was abundant in the 1970s, but over the last 20 years sightings have been far less frequent.5

5.8.5 Although many marine mammal sightings are from Sumburgh Head, with a number also from the MV Good Shepherd ferry itself, marine mammal sightings from Grutness and the area immediately offshore are less frequent.

5.8.6 Marine mammal sightings from the local area around Grutness have been collated from various sources and are presented in Table 7. Species are classified as very rare, rare, infrequent or regular based on frequency of sightings. The criteria used are as follows:

- Very rare, only 1 recorded sighting to date
- Rare, a low number of sightings (2 to 5) recorded over multiple years
- Infrequent, a low number of sightings seen every year
- Regular, several sightings recorded every year

5.8.7 Data sources include the Sea Watch Foundation, Shetland Record Centre, Fair Isle Bird Observatory annual reports (2014 to 2020 inclusive), Defra MAGIC map, and NBN atlas.

[5] Cetaceans | Nature in Shetland (nature-shetland.co.uk)

Table 7.1 Summary of marine mammal sightings from Grutness and the surrounding area

Species	Frequency	Sighting description
Harbour Porpoise (*Phocoeaa phocoeana*)	Regular	Low number of annual sightings (1-3) recorded from Grutness, Compass Head (1 km from Grutness), and Sumburgh Head (2 km from Grutness).
Harbour seal (*Phoca vitulina*)	Regular	No records, but not uncommon to see individuals in the vicinity of Grutness (P. Harvey SRC, *pers. comm.*). Recent analysis of telemetry data indicates that usage the offshore area around Grutness is low (Hague *et al.* 2020).
Grey seal (*Halichoerus grypus*)	Regular	No records, but not uncommon to see individuals in the vicinity of Grutness (P. Harvey SRC, *pers. comm.*). Recent analysis of telemetry data indicates moderate activity in the offshore area around Grutness (Hague *et al.* 2020).
Risso's dolphin (*Grampus griseus*)	Infrequent seasonal visitor	Maximum of 5 sightings per year, seen annually (2017 to 2021). Pod size ranges from 1 - 20 individuals, only one sighting from Grutness, the majority are from Sumburgh Head.
Minke Whale (*Balaenoptera acutorostrata*)	Infrequent seasonal visitor	Up to 12 sightings annually (2017 – 2022) of pods between 1 - 3. Most sightings occur from Sumburgh Head (only a small number from Grutness). Species density is classified as low (MAGIC map).
Killer Whale (*Orcinus orca*)	Infrequent visitor	Up to 14 sightings every year (2017-2022) in pods varying from 1 - >10 individuals. Vast majority of sightings from Sumburgh, although a small number occur from Grutness. Many sightings have noted the presence of bulls, calves and hunting of grey seals.
White-beaked dolphin (*Lagenorhynchus albirostris*)	Rare	4 sightings from 2015 to 2022, all of small groups south off Sumburgh Head (>2 km from Grutness). MAGIC map indicates occurrence at low density.
Humpback whale (*Megaptera novaeangliae*)	Rare	Low number of sightings (1 to 3) every year from 2018 – 2021, all from either Compass Head (1 km from Grutness) or Sumburgh Head (2 km from Grutness).
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	Very rare	Low number of sightings <1 per year than annually. All sightings have been from Sumburgh thus at least 2km from Grutness. MAGIC map suggests a low density.
Long-finned pilot whale (*Globicephala melas*)	Very rare	Single sighting (2018) of 40-60 individuals off Sumburgh Head (>2 km from Grutness).
Bottlenose dolphin (*Tursiops truncatus*)	Very rare	No confirmed sightings (SRC, Sea Watch Foundation or Fair Isle Bird Observatory). MAGIC map suggests a low density.

5.8.8 Further detail is provided below for the three species that occur regularly, and are therefore considered broadly speaking to be resident: grey seal, harbour seal and harbour porpoise.

Grey seal

5.8.9 The UK supports about 40% of the world population of grey seal and 95% of the EU population. Historically, grey seals were hunted for food, and regular culls were conducted, driven by fishing interests. Since the late 1970s, no licences have been issued in the UK for commercial hunting or large-scale culling, and the population has increased rapidly[6] . Seals are protected under The Conservation of Seals Act 1970, The Seal Products Regulations 2010 and the Conservation of Offshore Marine Habitats and Species Regulations 2017 and the Wildlife and Countryside Act 1981. The Protection of Seals (Designated Sea Haul-out

[6] Grey seal (Halichoerus grypus) - Special Areas of Conservation (jncc.gov.uk)

Sites) (Scotland) Order 2014 introduced additional protection for seals at 194 designated haul-out sites [7].

5.8.10 There are three designated haul-out sites within reasonable proximity of Grutness: Toab & Scatness 2 km away (harbour & grey seal), Lady's Holm 3 km away (harbour & grey seal), and Horse Island 3 km away (grey seal). There are two small grey seal breeding colonies that fall within these protected haul-out areas, both within reasonable proximity to Grutness at Lambs Holm (3 km away) and Fitful Head (6.5 km away)[8] .

5.8.11 Recent analysis of tagging data indicates that offshore usage of the area around Grutness by grey seal is moderate (Hague et al. 2020). This is unsurprising as grey seal is now abundant along the east coast of the UK from Shetland to Norfolk. However, use of Shetland in general is still low relative to major haul-out sites around Orkney, the Farne Islands, Donna Nook and Norfolk (Blakeney Point, Horsey). Although grey seal numbers have peaked in the Shetland, numbers are still increasing exponentially in the southern North Sea (Thomas et al. 2019).

Harbour seal

5.8.12 There are two designated haul-out sites within reasonable proximity of Grutness, that are used by harbour seal: Toab & Scatness 2 km away and Lady's Holm 3 km away. However, although these sites are relatively close, recent analysis of tagging data indicates that offshore usage of the area around Grutness and extending south around Sumburgh Head by harbour seal is low, with greater densities occurring to the north around Mousa and Bressay (Hague et al. 2020).

Harbour porpoise

5.8.13 Predicted density surfaces for harbour porpoises within Scottish waters (based on SCANS III data) indicate that the density of animals around Shetland is low at 0.10-0.30 ind. m-2 (Hague et al. 2020).

Potential effects

5.8.14 The following impact pathways have been considered with respect to marine mammals in the construction phase:

- Effects of changes to habitat and prey resource on marine mammal receptors;
- Effects of changes in water quality on marine mammal receptors;
- Effects due to noise and vibration on marine mammal receptors; and
- Collision risks due to vessel movements.

5.8.15 The following impact pathways have been considered with respect to marine mammals in the operation phase:

- Effects of habitat loss on marine mammal receptors; and
- Collision risks due to vessel movements.

Construction phase

Effects of changes to habitat and prey resource on marine mammal receptors

5.8.16 Dredging has the potential to alter the prey resource for marine mammals through changes to habitats and fish populations. However, the likely numbers of marine mammals foraging within the vicinity of the proposed works is considered to be low. As discussed in Section 5.7, the habitats present in the area of the proposed works are not considered to be of particularly high importance for fish and shellfish and consequently are not of high foraging value for marine mammals. Similar habitats are present throughout Grutness bay (see Section 5.6) and only a

[7] https://marine.gov.scot/maps/1585

[8] Marine Scotland - National Marine Plan Interactive (atkinsgeospatial.com), Natural England Magic map.

small area of habitat (approximately 1.1 ha of subtidal habitat) would be affected by the proposed dredge works with any effects from the sediment plume considered to be negligible beyond the dredge area (see Section 5.3). In addition, the footprint of habitat change is considered to only constitute a very small fraction of the known foraging ranges of these highly mobile species (typically in the range of hundreds to thousands of km²) and would be expected to have a negligible effect on the overall foraging resource available in the region.

5.8.17 The Scalloway disposal site covers an area of circa 3.14 ha. The disposal site footprint is, therefore, a very small area in the context of the foraging ranges of marine mammals.

5.8.18 It was concluded that the effect of any change in habitat on fish and shellfish and subsequently on prey availability for marine mammals, overall, is considered to be negligible for both the dredging operations and disposal (see Section 5.7). Consequently, the overall effect of habitat change on marine mammals during both dredging and disposal is considered to be **negligible**.

Effects of changes in water quality on marine mammal receptors

5.8.19 Marine mammals are considered to be well adapted to living in areas with a high suspended sediment load and are regularly recorded in such environments in the UK. Furthermore, marine mammals are highly mobile and can avoid areas of high SSC if required.

5.8.20 Changes in water quality will be localised and temporary and considered to be negligible and not of a scale that will be harmful to marine mammals or their prey (see Sections 5.4 and 5.7). Furthermore, best practice pollution prevention guidelines (Section 3.3) will be followed to minimise the risk of accidental spillages and the risk of introduction of contaminants throughout construction.

5.8.21 The overall effect of changes in water quality on marine mammals during construction and disposal is, therefore, considered to be **negligible**.

Effects due to noise and vibration on marine mammal receptors

5.8.22 Marine mammals are particularly sensitive to underwater noise at higher frequencies and generally have a wider range of hearing than other marine fauna, namely fish (i.e., their hearing ability spans a larger range of frequencies). The hearing sensitivity and frequency range of marine mammals varies between different species and is dependent on their physiology.

5.8.23 As described in Section 5.7, the proposed works include a number of underwater noise generating activities, including piling (assumed to be percussive/ impact piling as a worst case), dredging and engine noise associated with the operation of construction vessels.

5.8.24 A detailed Underwater Noise Assessment has been undertaken for the proposed works (ABPmer, 2023b, see Appendix H) and is briefly summarised in this section. Descriptions of piling and dredging activities as well as vessel movements considered in the underwater noise assessment have been described in Section 5.7 and are not repeated here.

Impact piling

5.8.25 The distances at which permanent threshold shift (PTS) and temporary threshold shift (TTS) in marine mammals are theoretically predicted to occur during impact piling activities associated with the construction of the proposed works are shown in Table 16 of the Underwater Noise Assessment (ABPmer, 2023b, see **Appendix H**).

5.8.26 There is theoretically predicted to be a risk of instantaneous PTS and TTS in minke whales and seals within 2 m and 4 m respectively from the source of the percussive/ impact piling noise, and in harbour porpoise within 15 m and 32 m respectively. The propagation of noise will be significantly limited by the existing shallow bathymetry and physical constraints of the study area at Grutness and potential effects on marine mammals will be largely limited to within the pier and wider bay area.

5.8.27 It is estimated that the maximum time that would take marine mammals to leave the PTS and TTS injury zones is 4 %, 5 % and 3 % of the time that would be required for a temporary injury

to occur in minke whales, harbour porpoise and seals respectively. Therefore, given marine mammals are able to evade the injury effects zone, they are not considered to be at risk of any permanent or temporary injury during impact piling.

5.8.28 Any marine mammals present are likely to evade the area. Behavioural responses could include movement away from a sound source, aggressive behaviour related to noise exposure (e.g., tail/flipper slapping, fluke display, abrupt directed movement), visible startle response and brief cessation of reproductive behaviour (Southall et al., 2007). Mild to moderate behavioural responses of any individuals within these zones could include movement away from a sound source and/or visible startle response (Southall et al., 2007).

5.8.29 The effects of piling noise on marine mammals also need to be considered in terms of the duration of exposure. Piling noise will take place over a period of approximately 6 months. However, piling will not take place continuously as there will be periods of downtime, pile positioning and set up. Furthermore, the piling works will be undertaken for a maximum of 10 hours per day (between 07:00 and 19:00) for 4 days, followed by 12 days of non-piling activities, repeated for 10 cells. There will, therefore, be extended periods when marine mammals will not be disturbed by any impact piling noise. The actual proportion of impact piling over a 24-hour period is estimated to be around 42%. In other words, any marine mammals that remain within the predicted behavioural effects zone at the time of percussive piling will be exposed to this disturbance only 42% of the time in any 24-hr period. There is a possibility that piling works will be undertaken from a barge mounted piling rig; in this case piling works would be undertaken 5.5 days per week (with similar working hour patterns as above) for approximately 3 months.

5.8.30 It is also important to consider the noise from piling against existing background or ambient noise conditions. The area in which the construction will take place already experiences regular vessel operations from the existing ferry, the nearby shipping lane and recreational vessel activity within the bay, and, therefore, marine mammals are likely to be habituated to a certain level of intermittent anthropogenic background noise.

5.8.31 With implementation of mitigation described in Section 3.3, including soft start, vibro piling where possible and use of a MMO as per JNCC (2010) draft guidance, it is considered that any effects from underwater noise on marine mammals as a result of piling will be **minimal**.

Dredging

5.8.32 The distances at which PTS and TTS in marine mammals are predicted to occur during the concurrent dredging associated with the construction of the proposed works are shown in Table 18 of the Underwater Noise Assessment (ABPmer, 2023b, see Appendix H).

5.8.33 There is predicted to be no risk of PTS in any of the key marine mammal species found in the study area. The risk of TTS in minke whale is limited to within 49 m from the concurrent dredging activity, and within 89 m in harbour porpoise and 23 m in seals.

5.8.34 Overall, there is not considered to be any risk of injury or significant disturbance to marine mammals from the proposed concurrent dredging activities at Grutness. Furthermore, the proposed activities will be temporary and take place over a period of 7 months. Consequently, it is considered that any effects from underwater noise on marine mammals as a result of dredging operations will be **minimal.**

Vessel movements

5.8.35 The distances at which PTS and TTS in marine mammals are predicted to occur during vessel movements associated with the construction phase and operation of the new ferry terminal are shown in Table 11 of the Underwater Noise Assessment (ABPmer, 2023b, see Appendix H).

5.8.36 There is predicted to be no risk of PTS or TTS in any of the marine mammal species found in the study area. Overall, there is not considered to be any risk of injury or significant disturbance to marine mammals from underwater noise resulted from the proposed vessel activities at Grutness or at the disposal site even if the vessel movements were to take place continuously 24/7. Consequently, it is considered that any effects from underwater noise on marine mammals as a result of vessel operations during construction will be *negligible*.

Collision risks due to vessel movements

5.8.37 Seals and cetaceans can potentially collide with vessel propellers and machinery, possibly leading to physical injury (such as propeller wounds) and, in the worst cases, fatalities (ASCOBANS, 2003; Pace et al., 2006). In general, incidents of mortality or injury of marine mammals caused by vessels remain a very rare occurrence in UK waters (ABP Research 1999; CSIP, 2011).

5.8.38 Many of the materials and equipment will come by road. The workforce will also arrive by road. However, some materials and equipment will arrive by sea. Over the duration of each construction season, vessel movements will not exceed 2 per week on average, in addition to the existing ferry service. Vessels will also be operating immediately adjacent to the jetty to support key construction activities (i.e., barge mounted piling rig (if required) and up to two dredgers). The dredgers and barge mounted piling rig would be operating for several months but within a highly localised area around the pier. As indicated by AIS data, baseline vessel movements in the area of the bay show over 200 vessel transits a year on average, while further offshore there is a significant increase in vessel traffic (>600 transits per year).

5.8.39 Vessels involved in dredging and piling are likely to be mainly stationary or travelling at slow speeds (typically around 3 to 5 knots). Furthermore, marine mammals utilising the Grutness area would have regular exposure to a high number of existing vessel movements, and will routinely need to avoid collision. AIS shipping traffic data covering the period 2012-2017 indicates that the bay and surrounding area have on average 208 vessel transits a year. About a one kilometre east of the bay, AIS data shows vessel traffic to increase notably, with more than 600 transits a year. Small recreational boats which are unlikely to provide AIS data also use the bay, and to the north of the airport is a small marina just over a kilometre from the proposal. The addition of two vessel movements is, therefore, unlikely to increase the collision risk substantially. Similarly, the addition of one dredger transiting to Scalloway disposal site is not considered to substantially increase the risk of collision within an already relatively busy area for shipping traffic.

5.8.40 Consequently, the change in collision risk for marine mammals as a result of increased vessel movements during construction and disposal activities is considered to be **negligible**.

Operational phase

Effects of habitat loss on marine mammal receptors

5.8.41 Effects from habitat loss on marine mammal receptors are anticipated to be similar to the ones described for habitat change during construction.

5.8.42 Overall the habitats present in the area of the proposed works are not considered to be of particularly high importance for fish and shellfish and consequently are not of high foraging value for marine mammals.

5.8.43 It was concluded that any effects from habitat loss on fish and shellfish and subsequently on prey availability for marine mammals, is considered to be negligible (see Section 5.7). Consequently, the overall effect of habitat loss on marine mammals is considered to be negligible.

Collision risks due to vessel movements

5.8.44 While the larger size of the vessel could enable crossings in weather conditions that would be too inclement for the existing vessel, the frequency of crossings would not increase in any given day. Considering the existing vessel traffic as described in the construction phase section, the potential increase in the frequency of the ferry crossings would have a negligible effect on collision risk. Consequently, the change in collision risk for marine mammals as a result of increased vessel movements during operation is considered to be **negligible**.

5.9 Seabirds and Coastal Waterbirds

5.9.1 The following sections consider the Seabirds and Coastal Waterbirds topic for this environmental report. A summary of the existing (baseline) conditions is provided, followed by consideration of the potential effects arising from the proposed works.

Baseline description

5.9.2 Shetland supports a significant proportion of the UK's seabird populations, in excess of one million birds covering 22 species, which are protected in 13 different SPAs. Two of Britain's largest seabird colonies can be found at Hermaness and Noss, supporting 80,000 and 100,000 breeding seabirds respectively.

5.9.3 However, many of Shetland's seabird populations have suffered substantial declines due to declines in sandeel populations caused by climate change and warming seas (Wright et al. 2017, Régnier et al. 2017). Sandeels are the main prey item of several species including Kittiwake, Guillemot, Razorbill and Arctic Tern. For example, Kittiwake, one of the most severely impacted species, declined by 87% at Foula between 2001 and 2019, and by 97% at Noss during the same period[9] . Avian influenza outbreaks during the breeding season in both 2021 and 2022 have also resulted in substantial losses of some species, primarily Great Skua and Gannet. Although losses are currently unquantified, surveys at Bressay revealed a decline in Great Skua of 93%. Gannet colonies at Noss and Hermanness are also known to have been significantly impacted (Falchieri et al. 2022).

5.9.4 Sumburgh Head SPA and SSSI are the only designated sites that overlap with the works area. Sumburgh Head is designated for Arctic Tern, Fulmar, Guillemot and Kittiwake. In addition to these species Puffin and Shag are listed on the Sumburgh Head SSSI designation. Other protected species that utilise the local area are described below.

Arctic Terns

5.9.5 Shetland supports significant colonies of Arctic Tern, with some 16,800 pairs breeding in various locations around the coastline (Brindley et al. 1999)[10] . The main colonies are at Foula (up to 1,500 pairs), Fetlar (1065 pairs), Mousa (up to 1000 pairs), and Papa Stour (850 pairs)[11] .

5.9.6 There is a smaller Arctic Tern colony between Grutness and Laward. Although data from 2017 and 2018 indicates that the nesting area may vary slightly between years, the general location of the colony lies between 150-400m from the works area. Flush counts from both years indicate the main colony numbers 500-600 birds (250-300 pairs). There is also a small satellite colony on the Point of Taingpool (1.2 km from the works area), which supported 25 AON in 2017 and 42 AON in 2018. In 2018, a small number of pairs (flush count of 7) were confirmed nesting on the beach on the north side of Grutness Voe, 350m from the works area[12] .

Kittiwake

5.9.7 Kittiwakes nest in various locations around Shetland's coastline, although numbers are a fraction of what was present 20 years ago before mass sandeel failures.

5.9.8 The 274 AON associated with the Sumburgh Head SPA are distributed between several nesting areas, with a small number nesting ~2 km to the north of the works area at Point of Blo-geo – Virkie (1 AON in 2017 and 5 AON in 2019). The closest nesting area to the works is at Compass Head, with the nearest nests located ~750m from the works area and extending south along the coastline for up to 1 km. This stretch of coastline supported 32 AON in 2021[13] . The nesting area around Sumburgh Head itself supported 41 AON along the eastern cliffs

[9] Black-legged Kittiwake (Rissa tridactyla) | JNCC - Adviser to Government on Nature Conservation

[10] Although numbers have since declined significantly since this publication due to sandeel failures.

[11] Counts taken from SPA designation citations.

[12] Data from search carried out by Shetland Records Office.

[13] It supported 35 AON in 2019, 49 AON in 2018 and 14 AON in 2017 (data from SRC).

and 27 AON along the western cliffs (count data from 2017 supplied by SRC). The nests in this area are ~2 km from the works site.

Fulmar

5.9.9 Shetland supports large numbers of Fulmars, with the largest colonies at Hermanness (12,228 AOS), Foula (8,438 AOS) and Noss (5,092).

5.9.10 Fulmars are present along much of the coastal cliffs from Grutness south to Sumburgh Head. Searches within a 3km radius of Grutness showed a total of 6,332 AOS along the coastline with the majority located between Laward and Muldri Geo (1,223 AOS) and around Sumburgh Head itself (2,946 AON)9. Most birds of these birds are nesting on cliffs some distance from the works area with the closest at Compass Head some 750 m away. However, there are around 89 pairs that nest within a disused quarry some 300 m from the pier. A few pairs also nest on the ground in the area around the quarry. It is possible that a small number of nests could be located in close proximity to the works.

Guillemot

5.9.11 The main Guillemot colonies on Shetland are Foula (24,799 individuals), Noss (24,456 individuals), Sumburgh Head (7,749 individuals) and Hermaness (5,808 individuals).

5.9.12 With regards to the local area, the largest concentrations of Guillemot are around Sumburgh Head itself, with the two main count sections to the east and west of Sumburgh supporting 3,412 and 4,502 individuals respectively[14] . The colonies in this area are at ~2 km from the works site.

Puffin

5.9.13 The main Puffin colony on Shetland is at Foula, which supported 48,000 pairs at the time of site designation, although by 2016 it had declined to just 5,055 individuals.

5.9.14 The closest Puffin to the works site are along the stretch of coastline between Loos Laward and Muldri Geo. This area is between 550-750m from the works area. In 2017, a total of 21 birds were observed along this coastline, although 20 were offshore and only 1 on land. It is therefore likely that these birds were from the Sumburgh Head colony 2km to the south, which is the closest nesting site.

5.9.15 Counts of Puffin from along the Sumburgh Head coastline conducted in 2017 showed a total of 800 individuals in May and 500 in June. Some of these birds were at on the cliffs, some loafing on sea around the cliffs, whilst others were in flight.

Shag

5.9.16 Shetland is of significant importance for this species, which has undergone severe declines over the past 20 years.

5.9.17 The largest colony on Shetland is at Foula, although various smaller colonies are distributed around Shetland's coastline. In the local area, there are a small number of nests at Compass Head (~750m away from the works area) numbering 26 AON in 2019 and 36 AON in 2021. Outside of the breeding season 17 were sighted at Taingpool. The only other colony nearby is at Sumburgh Head (93 incubating adults in 2021), although this is >2km from the works site.

Other seabirds

5.9.18 Other seabird species that occur within the Grutness area include Common Tern Sterna hirundo, although breeding has only been recorded in one year (3 AON in 2018). Other species that nest within the wider local area along the coastline between Loos Laward and Compass Head include Common Gull Larus canus (150 pairs observed in 2014 but not in subsequent surveys) and Herring Gull Larus argentatus (1 AOT observed in 2017)[15].

Coastal waterbirds

[14] Data from search carried out by Shetland Records Office.

[15] Data from Shetland Records Office.

5.9.19 In terms of coastal waterbirds, the only breeding species known to occur in Grutness itself is Ringed Plover Charadrius hiaticula (1 pair breeding on Grutness beach in 2020 and 2022). Species that regularly occur outside of the breeding period include Sanderling Calidris alba (maximum count 175 individuals), Long-tailed Duck Clangula hyemalis, and Red-Throated Diver Gavia stellata. Other species that have been recorded on single occasions include Goldeneye Bucephala clangula, Red-breasted Merganser Mergus serrator, Great Northern Diver Gavia immer, Knot Calidris canutus, and Purple Sandpiper Calidris maritima5. Many records occur during the months of most severe weather (December-February), and it may be that birds are Grutness Voe, which has a sheltered aspect, to sit out poor weather.

Summary

5.9.20 Although there are substantial colonies of protected seabird species nesting in the vicinity of Sumburgh Head, there are relatively few that occur within 1km of the proposed works area[16] . Therefore, the species of primary concern that nest near the works area are:

- Arctic Tern – colony of 300 pairs between Grutness and Laward, with 7 pairs at Grutness beach (total 307 pairs).
- Fulmar – 89 AON in quarry and 1223 AON between Compass Head and Muldri Geo (total 1312 pairs).
- Kittiwake – 32 AON between Compass Head and Muldri Geo.
- Shag - 36 AON Compass Head (36 pairs).

5.9.21 Species that do not use the area consistently, or which have not been encountered recently (such as Common Tern and Common Gull) are not included in the assessment. Neither are species such as Ringed Plover and Herring Gull, which occur as single pairs. Furthermore, a breeding bird survey would be conducted prior to the commencement of work to confirm that protected species are not nesting in the works area. Puffin has also not been included, as the birds recorded in 2017 were (all except a single individual) were offshore, and therefore most likely from the breeding colony at Sumburgh Head.

5.9.22 Since Arctic Tern, Fulmar and Kittiwake are qualifying features of the Sumburgh Head SPA they are considered of High importance. Shag is also considered as being of high importance as it is a BoCC red-listed species and is a qualifying feature of the Sumburgh Head SSSI. Use of the Grutness tideline by coastal waterbirds, particularly during the non-breeding season is acknowledged and considered where relevant, although usage is temporary and unpredictable.

Potential effects

5.9.23 The following impact pathways have been considered with respect to seabirds and coastal waterbirds in the construction phase:

- Airborne noise and visual disturbance;
- Underwater noise disturbance; and
- Changes to value of habitat for foraging.

5.9.24 No potential effects are anticipated during the operational phase. Habitat loss under the footprint of the new breakwater and pier extension is considered very small and negligible for both benthic habitats and fish and shellfish receptors (See Section 5.6 and Section 5.7) and therefore it has not been considered further in relation to bird receptors.

[16] A distance of 1km was used, as this is the greatest distance at which piling levels could reach 70 dB, the threshold for behavioural effects.

Construction phase

Airborne noise and visual disturbance

5.9.25 Construction activities have the potential to result in noise and visual disturbance to seabirds and coastal waterbirds that routinely utilise the Grutness area.

5.9.26 Disturbance often occurs through a combination of visual and noise stimuli simultaneously, although some occurrences may be through separate visual or noise stimuli (Wright et al., 2013). Birds will also vary their response to human activities depending on the type of the activity, the noise produced, the speed and randomness of approach, the distance to which the disturbance factor approaches and the frequency of disturbance (Burton et al., 2002., Rees et al., 2005, Liley et al., 2010, Stillman et al., 2012).

5.9.27 A number of disturbance monitoring studies have investigated the effects of pile driving on coastal waterbirds through establishing the relationship between activity source levels and the disturbance responses elicited by birds. Research suggests that irregular construction noise at levels typically above 70 dB can cause behavioural responses in some waterbird species with flight responses generally occurring above 80 dB (IECS, 2009; Xodus, 2012; Wright et al., 2013; ABPmer, 2002; IECS, 2013).

5.9.28 Much of this work has focussed on coastal waterbirds, and the effects of disturbance on breeding seabirds are less well-studied. The potential effects and likely consequences may also vary considerably between species. For example, whilst Fulmars are unlikely to exhibit any detectable response to disturbance, they may avoid nesting in the same area in the following year if they experience a disturbed breeding season. By contrast, unexpected disturbance of a colony nesting species such as Arctic Tern may, in a worst-case scenario, lead to colony abandonment. Temporary displacement of adults from nests (in all species) can lead to exposure of eggs/chicks and subsequent breeding failure.

5.9.29 Although the works will be present over 2 years, April-October 2024 and April-October 2025, the most disturbing phase of the construction work, in terms of airborne noise, is pile driving to install the foundations for the new pier (April-October 2024). Other activities such as dredging, rock armour placement and increased vessel movements would also contribute to a more generally disturbed environment for the birds. However, these activities are in general far less noisy and impactful than pile driving.

5.9.30 Although it is anticipated that the pile driving will be limited to 2024, it is possible that if the project is delayed it may need to be finished in 2025. If this is the case, similar procedures will be required as specified for 2024 (see below). However, the planned construction programme for April-October 2025 is much less impactful from a nose perspective. Although some activities associated with the construction of the linkspan will involve increased noise, such as installing steel dowels into the rockhead, backfilling, drilling and ‘silent’ non-explosive methods of rock breaking using either a ‘Cardox’ CO2 rock breaking system, expanding concrete or similar, the anticipated noise levels are low in comparison with pile driving. Although there will be a continued human presence around the works area and low levels of noise, as already described in Section 3.3, between the 15 April and 1 August in each construction year, a buffer zone will be established along the eastern edge of the proposal boundary (as demarcated by an existing stone wall adjacent to the road). The Contractor will ensure that workforce and equipment/plant do not cross this buffer zone. This will ensure that there is minimal disturbance both to the Arctic Tern colony and to any Fulmars nesting on the ground within the vicinity of the works.

5.9.31 The following assessment is focussed on the effects of pile driving and construction over a single season on the species that nest within 1km of the works area. Species nesting >1km away would not be expected to experience noise levels of >70dB, and therefore are not considered within this assessment.

5.9.32 The pile driving will either be done over a period of 6 months using a land-based plant from the pier, or over a period of 3 months using a jack-up barge in the bay. If the former method is used, then the pile driving will take place for 4 days, with a rest period of 12 days in between. If using the barge, piling would be 5.5 days on and 1.5 days off and would take 3 months.

Piling would be undertaken for 12 hours per day, with no work on Sundays and 0.5 day on Saturday. Construction activity between piling will be continuous. Mitigation such as soft start and gradual ramp up for piling will also be implemented (see Section 3.3), which it is anticipated will help in reducing disturbance of birds.

5.9.33 Airborne noise modelling was carried out assuming percussive piling using a Junttan HHK 5A #21171 hammer at a location nearest the main Arctic Tern colony (i.e. a worst case scenario). Technical details and results of the modelling exercise are included in Appendix I. The mapped a-weighted L_{max} contours (in dBA) are also included in Appendix I.

Arctic Tern

5.9.34 Whilst guidelines such as Goodship & Furness (2022) are useful in establishing whether an effect is likely or not, the response of birds to disturbance may vary considerably between sites. For example, Arctic Terns at a colony in Canada were found to have a mean flight initiation distance of 1km in response to a helicopter (Mallory, 2016). However, the Arctic Terns at Grutness nest 700m away from of one of the main runways at Sumburgh Head Airport. Similarly, on the Farne Islands, Sandwich terns have habituated to presence of people on limited footpaths around the perimeter of their colony and continue to incubate when people are no more than 20m away. At many other Sandwich tern colonies where people are not normally present, Sandwich terns will leave their nests and chicks when people approach at much greater distances (Goodship & Furness, 2022). The extent to which birds respond to noise and disturbance is influenced by a range of site-specific factors including ambient (background) noise levels, time of year, levels of existing activity and the species assemblage.

5.9.35 Terns may abandon a colony en masse in response to unfavourable conditions. The appearance of new predators is often cited as a reason for colony abandonment[17] [18], although the colony abandonment due to other disturbance sources can also occur.

5.9.36 Although terns typically prefer isolated sites, they can successfully nest in surprisingly disturbed locations, such as the Common Tern colony at Imperial Dock (Leith). However, even in these situations it cannot be assumed that they will automatically tolerate increased and/or unexpected disturbance. For example, the Leith Common Tern colony of 2,000 pairs is located in a busy port and in close proximity to port operations, although the colony itself is on a man-made island. Studies of anthropogenic disturbance at this site indicate that noise and shipping prompted the greatest reactions from the birds (Jennings, 2012). More recently in 2019 this colony suffered total abandonment, with vessel disturbance again implicated as a potential cause[19] .

5.9.37 As mentioned above, irregular construction noise at levels typically above 70 dB can cause behavioural responses in some waterbird species with flight responses generally occurring above 80 dB. However, the noise associated with Sumburgh Airport routinely experienced by the birds may lie within this range. For example, a medium aircraft descending at 1000ft (~300m) is known to measure 70 dBA[20] . Without further information on the precise flight paths of aircrafts and take-off/descent procedures, it is difficult to quantify exactly how much noise the birds are receiving. However, assuming a distance of 700m from the colony and aircraft take off measuring ~140 dB, then the birds would receive 63 dB[21] . However, this is likely to be an underestimate as planes may pass over the colony when ascending/descending. Furthermore, Sumburgh Airport is very active. Although its operations are limited to small planes and short-haul flights within Scotland and to various oil rigs, there are ~30 arrivals per day and a similar number of departures. The airport also has three runways, which can be used by two planes consecutively, meaning that a maximum of six planes can be using the runways at any single time. It is possible that Arctic Terns may

[17] Falcon blamed for Arctic Terns abandoning Welsh islands - BBC News

[18] Arctic Terns abandon famous Farne Islands colony - BirdGuides

[19] Edinburgh tern colony was lost to negligence, Chris Packham claims | Scotland | The Times

[20] Measuring noise - NATS

[21] https://www.omnicalculator.com/physics/distance-attenuation

choose to nest at Grutness because the noise and disturbance associated with the airport makes it an unattractive area to predators.

5.9.38 The mapped L_{max} contours (Appendix I) show that in a worst case scenario the Arctic Tern colony would receive peak noise levels of 71.4 dB(A) during percussive piling activity. This is considered likely to be a similar level to the noise received from the airport.

5.9.39 However, whilst the Arctic Terns are habituated to aircraft noise it cannot be assumed that the pile driving would also be tolerated. It is a new and different type of noise, and it would occur continuously, whilst noise from an aircraft taking-off/landing is a discrete event. Although it is considered very unlikely that the Artic Terns would abandon the colony due to increased disturbance from piling, it cannot be completely discounted.

5.9.40 Therefore, to avoid this risk, the piling will commence before the birds begin nesting. Accordingly, the successful Contractor will ensure that piling works commence no later than 7 May. If the noise prevents birds from nesting at Grutness it is likely that they will nest elsewhere. There are several other colonies on Shetland including a small colony nearby on the Point of Taingpool. Further afield there are larger colonies at Mousa, Noss, Foula, Fetlar and Papa Stour. If birds nest at one of these locations they would be unaffected by the works.

5.9.41 It is possible that the terns may nest at Grutness despite the noise. However, if the piling is underway when the birds return to nest, then they have a choice as to whether to nest there or whether to move on to another location. It is important that the piling commences no later than 7 May, well before the first nests, which typically occur in late May (21-28 May – Megson, 1986)[22] .

5.9.42 If the Arctic Terns do nest at Grutness, then it is considered likely that the noise will be tolerated, and the colony will habituate. However, the mitigation measures described in Section 3.3 will ensure disturbance is minimized.

5.9.43 Overall, any impact caused by the noise on colony productivity (should the birds choose to nest at Grutness) would be temporary, reversible and limited to the period when piling is in operation. It is also noted that the Arctic Terns choose to nest near to the ferry terminal and an airport runway. With the measures described above in place to minimize the risk of colony abandonment and also human presence in the vicinity of the colony, the effects are considered to be **negligible**.

Fulmar

5.9.44 A small number of Fulmars nest on the ground between the quarry and the works area, and there may therefore be a small number of nests within close vicinity to the works. It is also possible that Fulmars nesting in the quarry (~350m from works site) and further afield between Compass Point and Muldri Geo (~750m from the works) could also be affected by construction noise and disturbance.

5.9.45 The birds nesting in the quarry are about 400m away from the airport runway, in this sense similar arguments apply as presented above for Arctic Terns. Assuming that an aircraft taking off emits ~140 dB, then the birds would receive ~68 dB 400m away[23] . As described above, this is probably an underestimate as planes may pass over the birds at low altitude, and it is also possible that there may be up to 6 planes taking-off/landing at the same time. Pairs of ground nesting Fulmars may also be located closer to the runway than the quarry.

5.9.46 The mapped L_{max} contours (Appendix I) show that the Fulmars nesting at the quarry would receive peak noise levels of only 66.1 dB(A) during percussive piling activity, which is below the 70 dB threshold where behavioural effects occur. Fulmars nesting between Compass Head and Muldri Geo ~750m away would receive even less noise and therefore no effects would be anticipated from airborne noise disturbance.

[22] Shetland Bird report (2019) describes 'large chicks at Grutness on 14th July, suggesting a nesting date of early June. The report also records first eggs on 24th May at Noss. However, it is understood that nesting was later in 2022, with first eggs on Noss recorded on 9th June (NatureScot, *pers. comm.*)

[23] https://www.omnicalculator.com/physics/distance-attenuation

5.9.47 As described above, the piling would start no later than 7 May, which would mean that the Fulmars can choose whether to accept the noise or nest elsewhere. The first Fulmar eggs were observed in 2019 on 16 May (at Noss), so assuming a similar pattern at Grutness, piling would be underway prior to the nesting period (Shetland Bird Club 2019). If the Fulmars nest elsewhere, they would not be impacted by the works. If they persist nesting within the vicinity of the construction area, then it is considered likely that they would tolerate the noise and breed successfully. Unlike Arctic Terns, Fulmars tend not to abandon nests due to disturbance but may elect to nest elsewhere the following year if they experience a disturbed breeding season. Since Fulmars do not abandon a colony, in this sense they can be considered more resilient.

5.9.48 In a worst-case scenario it is possible that a small number of Fulmar pairs may nest on the ground in close vicinity to the works as they are highly site faithful. These birds could experience reduced productivity due to noise and disturbance. If birds are disturbed it is possible that some pairs may not return to the area the following season to breed. However, if this occurred it would only affect a few pairs.

5.9.49 Overall, the impacts of construction would be temporary and reversible. On this basis the effects of reduced productivity for a small number of birds over a single breeding season are considered **negligible**. If birds are deterred from using the area in future breeding seasons, this would only affect a few pairs at most, and on this basis is considered **negligible** on the grounds that that these birds would probably nest elsewhere in the local area.

Kittiwake

5.9.50 Since the Kittiwakes are located between Compass Head and Muldri Geo (~750m from the works) the mapped L_{max} contours (Appendix I) show that they would receive peak noise levels of below 61 dB(A) during percussive piling activity and therefore they would not be expected to be affected by airborne noise (see Appendix I). Therefore, the potential effect on this species is considered **negligible**.

Shag

5.9.51 Since Shags are nesting between Compass Head and Muldri Geo (~750m from the works) the mapped L_{max} contours (Appendix I) show that they would receive peak noise levels of below 61 dB(A) during percussive piling activity and therefore they would not be expected to be affected by airborne noise (see Appendix I) . Therefore, the potential effect on this species is considered **negligible**.

Coastal waterbirds

5.9.52 Outside of the breeding period, shorebirds such as Sanderling, Knot and Purple Sandpiper may forage along the tideline. Within the bay itself sea-duck such as Long-tailed Duck and Eider occur, at times in large numbers. Small numbers of Red-Throated Diver and Great Northern Diver also occur. Since the works are scheduled to continue into October, potential effects on these species have been considered as Purple Sandpiper and Long-tailed Duck are red-listed, whilst both diver species are listed on Schedule 1 of the W&C Act.

5.9.53 In general, the occurrence of any individual species in the non-breeding season is unpredictable and temporary. Sanderling occur consistently post-breeding (July onwards), with flock sizes ranging from 6-175, but typically numbering >50 birds. If these birds were displaced, there is ample alternative habitat on Shetland that they could utilise.

5.9.54 Red-throated divers are consistently sighted most years, although all sightings have occurred between December and February and therefore no overlap with the works is anticipated. Records of Red-breasted Merganser and Long-tailed Duck also appear to be limited to the winter period with records in December and January only. Given the sheltered aspect of Grutness, it is likely that birds are using the bay to sit out poor weather.

5.9.55 Temporary displacement of coastal waterbirds from Grutness would not affect many species (as most usage occurs during the winter, from December to February). There is ample

alternative habitat were birds to be displaced. Therefore, the effects of temporary displacement on coastal waterbirds are considered to be **negligible**.

Underwater noise disturbance

5.9.56 In general, there is limited evidence on the effects of underwater noise on seabirds. Observations of effects to seabirds from pile driving during the construction of Offshore Windfarm Egmond aan Zee, in the North Sea, concluded that underwater noise effects were negligible. However, this may be in part due to the application of appropriate mitigation measures, including the use of pingers and soft start techniques to encourage potentially sensitive birds to disperse away from the site (Leopold & Camphuysen, 2007).

5.9.57 Recent research generally suggests that diving seabirds could be more sensitive to underwater noise than previously assumed. For example, hearing thresholds for great cormorant were found to be comparable to seals and toothed whales in the frequency band 1 to 4 kHz (Hansen et al. 2017).

5.9.58 Several assessments have, based on the limited information available, and the similar frequency ranges between seabirds and phocid pinniped and cetacean species, applied methodologies developed for pinnipeds or low frequency cetaceans in assessing seabird sensitivity to underwater noise (Teachout, 2012). The response criteria for low frequency cetaceans and phocid pinnipeds have, therefore, been applied to the underwater noise assessment as a worst-case approximation for considering potential effects on seabirds (see Underwater Noise Assessment; ABPmer, 2023b, see Appendix H).

5.9.59 There are a number of activities associated with the proposed works that are expected to generate underwater noise levels which may affect marine fauna. These are piling, dredging, rock armour placement and vessel movements. Other potential sources of underwater noise include installing steel dowels into the rockhead (linkspan lifting dolphins and wing walls), backfilling the pier with granular fill, drilling, and 'silent' non-explosive methods of rock breaking using either a 'Cardox' CO2 rock breaking system, expanding concrete or similar. However, in summary only dredging and piling are considered to have the potential for any significant effects on marine fauna (ABPmer, 2023b, see Appendix H), and therefore considered in detail below.

Piling

5.9.60 NOAA's user spreadsheet tool (NOAA, 2022) has been used to predict the range at which the NOAA (2018) weighted cumulative SEL and instantaneous peak SPL acoustic thresholds for the onset of PTS and TTS are reached during the proposed impact piling activity at Grutness (ABPmer, 2023b, see Appendix H).

5.9.61 There is theoretically predicted to be a risk of instantaneous PTS and TTS in diving seabirds within 2 m and 4 m respectively, from the source of the percussive piling noise. If the propagation of underwater noise from impact piling were unconstrained by any boundaries, the maximum theoretical distance at which the predicted cumulative SEL weighted levels of underwater noise during impact piling is within the limits of PTS in diving birds is 494 m to 834 m. The maximum distance for TTS is 3.4 to 5.7 km. The propagation of noise, however, will be significantly limited by the existing bathymetry and physical constraints of the study area at Grutness and potential effects will be largely limited to within the pier and wider bay area (ABPmer, 2023b, see Appendix H).

5.9.62 In a worst-case scenario diving bird species may not forage in the bay during piling operations due to the likely displacement of fish[24] (see Section 5.7 and changes to value of foraging habitat section below). However, even if they were to be actively foraging at the time of piling, they would only be within the water column for a very short period of time (seconds to minutes) and well below the 24-hour period required for a permanent or temporary injury to

[24]However, it is possible that fish may temporarily be present in the area before piling commences in the morning or after it finishes in the evening, and that some use of the area for foraging may be possible.

occur within the predicted distances. Therefore, diving birds are not considered to be at risk of any permanent or temporary injury during impact piling.

5.9.63 The effects of piling noise on diving birds also needs to be considered in terms of the duration of exposure. Piling noise will either take place over a period of 6 months or 3 months depending on whether a land-based plant is used from the pier, or whether a jack-up barge is used offshore. However, piling will not take place continuously as there will be periods of downtime, pile positioning and set-up. The piling works will either be undertaken for a maximum of 10 hours per day (for 4 days, followed by 12 days of non-piling activities, repeated for 10 cells) or 5.5 days on 1.5 days off depending on whether the land-based plant or the barge is used respectively. Under both scenarios there would be a maximum of 10 hours per day, with no work on Sundays and 0.5 day on Saturdays. The recommended marine mammal mitigation detailed in Section 3.3 will be followed and therefore the piling procedure will include the use of soft starts.

5.9.64 There will, therefore, be periods when diving birds will not be disturbed by any impact piling noise. The actual proportion of impact piling over a 24-hour period during one of the '5.5 days of piling periods' (a worst-case scenario) is estimated to be around 42%. In other words, any diving birds that are feeding below the water surface within the predicted behavioural effects zone at the time of percussive piling will be exposed to this disturbance only 42% of the time in any 24-hr period. It is, however, important to recognise that diving seabirds are diurnal feeders and therefore will be able to feed undisturbed during any periods of daylight outside of the piling working day (between 07:00 and 19:00). As the breeding period, when food requirements are highest, overlaps with the longer summer days this will allow several hours of undisturbed feeding each day within the confines of the bay.

5.9.65 It is also important to consider the noise from piling against existing background or ambient noise conditions. The area in which the construction will take place already experiences regular vessel operations, and, therefore, diving birds are likely to be habituated to a certain level of intermittent anthropogenic background noise.

5.9.66 Since noise modelling indicates that diving birds are neither at risk of permanent or temporary injury during pile driving, likely effects are limited to potential temporary displacement from the pier and wider bay. This is considered a reasonable worst-case scenario on the basis that potential displacement of fish will in turn reduce the value of the habitat for foraging birds. Of the species present within the Grutness area, piling is considered most likely to affect breeding species that forage coastally, that is Arctic Tern and Shag. Although it is possible that other species such as Fulmar, Kittiwake, Guillemot and Puffin may also be displaced from the bay, the effects of potential displacement from a small coastal area are considered to be negligible as these species are pelagic with foraging activity typically taking place far offshore. Similarly, during the non-breeding season sea-ducks and divers may be displaced from the bay during pile driving, although the consequences would be negligible as these birds are not tied to a breeding colony and could move onto other suitable habitat with little consequence.

5.9.67 For Arctic Tern and Shag, breeding species that forage coastally, the consequences of even temporary habitat loss may be significant as poor prey availability is driving population declines. Therefore, the scale of temporary habitat loss is considered as a proportion of home range.

5.9.68 Grutness bay measures 0.83 km2, which is taken to be the area of habitat from which Arctic Tern and Shag could be temporarily displaced. Based on 95% kernel areas calculated for Arctic Terns (n=22) tracked from the southern Reykjanes Peninsula (Iceland) between 2019-2021, then home range estimates (pooling tagged birds by year) range between 4308-68477 km2 (Morten et al. 2022). Therefore, loss of the bay for foraging would represent only 0.003-0.02% of the estimated home range. On this basis the consequences of habitat loss are considered to be **negligible**.

5.9.69 GPS tagging conducted on Shags from Puffin Island indicates that they have a home range of ~139 km2 (based on mean maximum foraging range – see Soanes et al. 2016) so assuming a similar home range for birds at Grutness, an area the size of Grutness bay would constitute only 0.60% of available habitat. Whilst Shag, having a small foraging range compared to other seabird species, is potentially vulnerable, there is no indication that Grutness bay is a

preferred foraging area. However, whilst it is potentially more vulnerable than the other species, effects are still considered to be **negligible**.

Dredging

5.9.70 NOAA's user spreadsheet tool (NOAA, 2022) has been used to predict the range at which the weighted cumulative SEL acoustic thresholds (NOAA, 2018) for PTS and TTS are reached during the proposed dredging at Grutness. The methods are described in further detail in the Underwater Noise Assessment (ABPmer, 2023b, see Appendix H).

5.9.71 Based on using the predicted distances at which PTS and TTS in LF cetaceans and phocid pinnipeds (a worst-case approximation for considering potential effects on seabirds) are predicted to occur during the planned dredging at Grutness, there is predicted to be no risk of PTS in diving birds. The risk of TTS is limited to within 23 to 49 m assuming diving birds were to remain within the water column for 24 hours, which is not realistic.

5.9.72 Overall, there is not considered to be any risk of injury or significant disturbance to diving birds from the proposed concurrent dredging activities at Grutness. Furthermore, the proposed activities will be temporary and take place over a period of up to 7 months depending on the amount of overlap between the different dredging requirements.

5.9.73 As described above, since there is no risk of injury to diving birds, the potential effects of dredging on all species are considered **negligible**.

Changes to value of habitat for foraging

5.9.74 It is possible that dredging and pile driving could affect the value of the habitat for foraging birds during the construction phase when dredging and pile driving are underway. Species such as seabirds may not be able to utilise Grutness bay for foraging when pile driving and/or dredging are underway if key prey species, such as sandeels and clupeids are displaced either underwater noise or by increased suspended sediments. Dredging may also affect the abundance of benthic species, which could constitute prey for regularly occurring coastal waterbirds such as Sanderling and Ringed Plover. Since these different species groups take different prey, they are discussed separately below.

Seabirds

5.9.75 Although it is acknowledged that a range of species could utilise the bay, perhaps foraging opportunistically, many of the seabird species known to occur in the area (Guillemot, Razorbill, Puffin, Fulmar and Kittiwake) have large foraging ranges and would typically forage further offshore. Therefore, the effects of temporary displacement from a small area of coastal habitat for these pelagic species are considered to be negligible. Arctic Tern and Shag are the only species that forage coastally and occur within the Grutness area. Therefore, assessment is focussed on these two species.

5.9.76 In a worst-case scenario Arctic Terns, Shag and any other birds may be deterred from using the bay for foraging during the construction period due to noise, disturbance and increased suspended sediments, which may hinder foraging[25] .

5.9.77 Displacement would be temporary and reversible, with fish returning once the works are complete. Increased suspended sediments due to dredging alone are likely only to affect a limited area and not the whole bay and may dissipate relatively rapidly following cessation of work.

5.9.78 Assuming a worst-case scenario that Arctic Terns were unable to use the bay for foraging during the construction period, the consequences of this temporary habitat loss were considered. Tagging studies carried out on Arctic Terns (n=22) from the southern Reykjanes Peninsula (Iceland) between 2019-2021 show that they have a foraging range of 4,308-68,477 km2 (using 95% kernel areas – see Morten et al. 2022). Therefore, loss of the bay would

[25] However, it is possible that fish may temporarily be present in the area before piling commences in the morning or after it finishes in the evening, and that some use of the area for foraging may be possible.

represent only 0.003-0.02% of home range. On this basis the effects of temporary displacement are considered to be **negligible**.

5.9.79 Assuming a worst-case scenario that Shag were be unable to use the bay for foraging during the construction period, the consequences of temporary habitat loss were considered. GPS tagging conducted on Shags from Puffin Island indicates that they have a home range of ~139 km2 (based on mean maximum foraging range – see Soanes et al. 2016) so assuming a similar home range for birds at Grutness, an area the size of Grutness bay would constitute only 0.28% of available habitat. Whilst Shag, having a remarkably small foraging range compared to other seabird species, is potentially vulnerable, there is no indication that Grutness bay is a preferred foraging area. On this basis the effects of temporary displacement would also be **negligible**.

Coastal waterbirds

5.9.80 Species such as Ringed Plover and Sanderling that forage along the tideline may be affected by declines in prey associated with increased suspended sediments resulting from dredging. Both species will take polychaete worms, such as Hediste diversicolor, crustaceans (e.g., Corophium spp.) and molluscs (e.g. Peringia ulvae). It is possible that dredging may temporarily decrease the abundance of prey, although any effects would be temporary and reversible.

5.9.81 Since there is only one pair of Ringed Plovers at Grutness, any effects on this single pair would be negligible when considered against regional populations. Although flocks of Sanderling occur regularly post-breeding, sometimes in number, it is unlikely that temporary reduction in prey would result in any impact. There are many other beaches on Shetland in close proximity where waders occur in number and which would offer optimal foraging habitat, such as the Lochs of Spiggie and Brow SPA (for waterfowl) and the East Mainland Coast SPA, which supports a number of sheltered bays with a high diversity of fish, polychaete worms, gastropods and bivalve molluscs, representing optimal foraging habitat for waders[26] .

5.9.82 On the basis that any effects would be temporary, the occurrence of over-wintering species in itself is temporary and unpredictable, and that there is availability of alternative high quality foraging habitat nearby, the potential effects of reduced prey availability are considered to be **negligible** for coastal waterbirds.

Operational phase

5.9.83 There are no potential effects anticipated on seabirds and coastal waterbirds during the operational phase.

5.10 Navigation

5.10.1 The following considers the Navigation topic for this environmental report. A summary of the existing (baseline) conditions is provided, followed by consideration of the potential effects arising from the proposed works.

Baseline description

5.10.2 Grutness is operated and managed by Shetland Islands Council. The pier facility does not have local legislation granting it with the designation as a Statutory Harbour Authority under the Harbours Act 1964. As such the pier facility does not have statutory jurisdiction limits or powers to give direction for management of navigation.

5.10.3 Shetland Council Small Ports & Harbours as the Harbour Authority operate to the standard required in the Port Marine Safety Code (PMSC) and in accordance with the guidance provided in the Guide to Good Practice for Port Marine Operations. Shetland Island Councils

[26] SPA_Citation_10482 (1).pdf

Small Ports Marine Safety Management System provides the system by which the Small Ports & Harbours complies with the requirements of the PMSC.

5.10.4 The marine terminal at Grutness is listed within the Marine Safety Management System (MSMS) as one of sixteen Ferry Terminals & Piers inside and outside the Statutory Harbour Authority areas of jurisdiction. The Port Engineer takes executive management responsibility for the running of all ferry terminals and they, or the appointed deputy, meet regularly with the Harbour Master to provide updates on any operational marine safety issues. The Duty Holder receives regular reports from the Port Engineer and Harbour Master and quarterly reports are sent to their Designated Person, which provides proportional compliance with the PMSC.

5.10.5 The navigation in the waters around, and adjacent to the terminal falls within UK Territorial Waters and fall within the Maritime and Coastguard Agency's area for navigational oversight. Vessel traffic in the proximity of the terminal is considered light, with the dedicated ferry providing the main traffic for the area of immediate navigation. Leisure traffic is not considered to be an impact and is not considered to be significant as to have an impact on the development.

Potential effects

5.10.6 The following potential navigation effects have been considered for the construction and operational phase.

Construction phase

Potential increase in hazards to navigation

5.10.7 Ferry operations will continue during the construction phase. De-confliction between ferry and vessels involved in construction activities has been considered. This includes timing of works and alternative arrangement for mooring the vessel at different locations along the pier or at a different harbour (potentially Scalloway or Lerwick, depending on suitability). The effect on the ferry's navigation would be considered acceptable and the operations should be included in the procedures for maintaining safe navigation within the Marine Safety Management System by Shetland Council Small Ports & Harbours.

5.10.8 As it is yet to be determined how much of the work will be carried out from sea and the likely requirements for vessel movements, a worst-case scenario has been adopted which assumes the following for marine based vessel activity:

2024

- Barge mounted piling rig (on site for 3 months);
- Vessel movement for delivery of materials/equipment/plant (Maximum, on average, two vessels per week from February to October);
- Two dredgers (on site for 7 months) (assuming dredging runs concurrently)

2025

- Two dredgers (on site for 7 months)
- Vessel movement for delivery of materials/equipment/plant (maximum, on average, two vessels per week from March to September)

5.10.9 De-confliction of operations may need to be considered if the piling rig and dredging vessel are working simultaneously. The management and control of harbour works is a requirement under the PMSC and would be addressed within the Shetland Council Small Ports & Harbour Safety Management System. There may also be a requirement to assess the risk of navigational impact on working within proximity of each other if works are undertaken at the same period of time. Rock armour for the breakwater may be delivered by vessel or could be brought by road if this is sourced from a local quarry. A crane will be used to place each

individual rock for the armouring. The rock armouring activity will take place in 2024 and therefore is anticipated to coincide with the piling works and pier extension, with the potential to also coincide with dredging.

5.10.10 The additional operations of the dredger and piling rig are not considered to increase the hazard to navigation significantly and any increase is viewed as minimal when factoring in deconfliction of operations, and the inclusion of the terminal within the Shetland Council Small Ports & Harbour Safety Management System.

Operational phase

Potential increase in hazards to navigation

5.10.11 The extension of the pier, changes to linkspan and operation of larger vessel (similar draft) may have a possible impact on the current route taken to and from the berth. Given the lack of interaction with vessel traffic in the area, this would not be viewed as an increased hazard to navigation. The improvements to the facility and changes to navigation for the ferry and local craft are expected to be considered as part of the ongoing management as outlined in Shetland Island Councils Small Ports Marine Safety Management System.

5.10.12 In summary, it considered that neither the introduction of the larger vessel, nor the increase in length of the pier would significantly affect the navigation of other vessels using the area. The improvements to the pier are to facilitate the berthing of the larger vessel and as such it is viewed that this will not negatively affect navigation for this operation.

6 Summary and Conclusion

6.1.1 This Environmental Report has considered potential environmental effects associated with the proposed works on all relevant environmental receptors. The potential effects that can be attributed to the proposed works are very localised and considered to be negligible/minimal for all receptors both alone and cumulatively/in-combination with other plans, projects and ongoing activities.

6.1.2 Included within the Planning Application are the following studies and supporting documents:

- Ecological Appraisal Report (incorporating Baseline Ecological Surveys);
- Report to Inform the Appropriate Assessment (RIAA);
- First Iteration Environmental Management Plan (fiEMP);
- Planning Statement;
- Planning Application Drawings; and
- Completed Planning Application Forms and Landownership Certificate.

Appendix A Screening Opinion

Appendix B Site Plans

Appendix C Otter Survey Report

Appendix D First Iteration of the Environmental Management Plan

Appendix E Wave Modelling Report

Appendix F Report to Inform the Appropriate Assessment

Appendix G Benthic Report

Appendix H Underwater Noise Report

Appendix I Airborne Noise Assessment