Note

Grutness Best Practicable Environmental Option (BPEO)

Introduction

A proposal for the replacement of the existing ferry between Fair Isle and Grutness will require the pier at Grutness, Shetland, to be upgraded to facilitate the new roll-on roll-off (Ro-Ro) vessel. This includes navigational dredging to -4.5 m Chart Datum (CD) to provide a sufficient water depth for the new vessel around the proposed pier extension. The total volume of dredge material will be approximately 16,500 m^3 (including a 15% contingency) or <47,000 wet tonnes. A marine licence is required for the dredging operations. To support the marine licence application there is a need for a Best Practicable Environmental Option (BPEO) assessment. The following sections provide this BPEO assessment.

Dredge Material Characterisation

Sediment sampling has been carried out to support this marine licence application. Samples were obtained during the geotechnical investigations undertaken for the proposed works between 28 March and 09 April 2023, from five locations across the proposed dredge areas as shown in Figure 1. The pre-dredge sampling plan (submitted on 03 February 2023) was agreed with the Marine Scotland Licensing and Operations Team (MS-LOT) prior to the surveys and subsequent sample analysis. Samples were either sub-sampled from the cores collected at each location (where this was possible) or collected using a Van Veen grab where core sampling was not feasible (either due to the absence of sediment, i.e. driving directly onto loose or bed rock, or not sufficient volume of sediment retrieved, or where a driven tube sample was lost on recovery from a thin deposit).

The dredge area boundary has been refined since collection of the sediment samples and comprises a smaller footprint compared to the dredge boundary presented in the sampling plan. As such, two of the sampling locations (i.e. BH204 and BH206) are outside the refined dredge; however, the analysis results from these two sites have still been considered within this BPEO due to their close proximity to the dredge boundary (<10 m). However, all calculations characterising the dredge material have been based on the samples located within the dredge area only (i.e. BH201, BH205 and BH207).

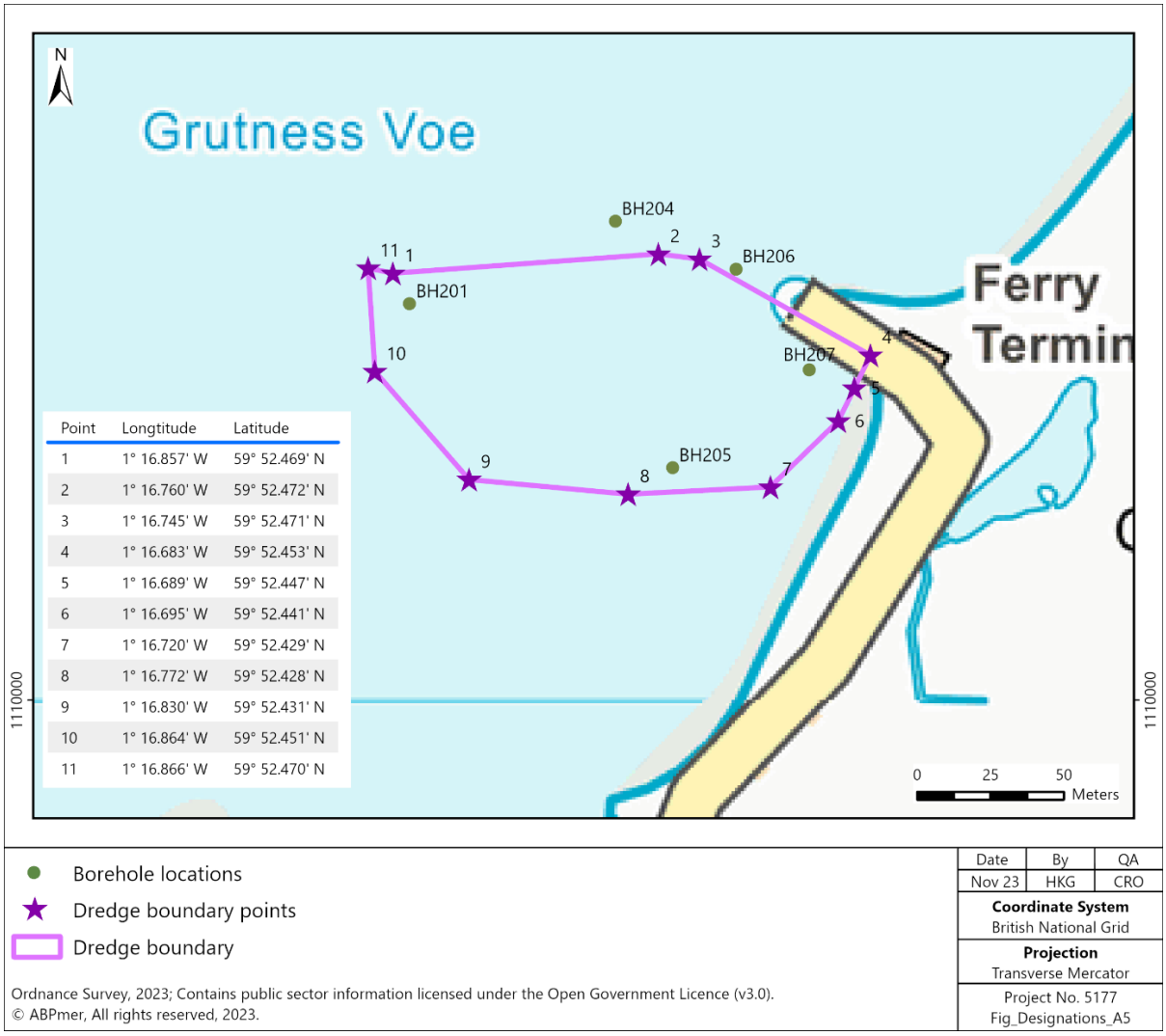

Figure 1 **Sediment sample locations across dredge area**

At sampling location BH201 the seabed depth is already -3.84mCD; therefore, the depth of the proposed dredge at this location is <1 m and as such only one sample was collected i.e. from the 0.0-0.25 m layer of the driven tube. At sampling location BH205 the sediment changed to boulder clay/ till at -0.62mCD and a further driven tube sample was not obtainable, with deposits below this depth representing quaternary deposits. Nevertheless, the dredge depth as this location is also <1 m (the seabed depth is -2.50mCD and this location will be dredged to -2.80mCD as it is within the sloped transition); as such the retrieved core sample is considered representative of the dredge material. At sampling location BH207 the volume of sediment retrieved in the driven tube was not sufficient to complete analysis of the full suite of contaminants; therefore, the grab sample was analysed instead. Table 1 details the percentage of each material type for the different samples obtained.

Table 1 **Sediment sample characteristics**

Sample ID	Type of sample	Sample depth (m)	Gravel (>2 mm) (%)	Sand (63-2000 µm) (%)	Silt (<63 µm) (%)
BH201@0.0-0.25	Core	0-0.25	4.86	47.9	47.23
BH204SeaBed	Grab	0	11.69	48.7	39.59
BH205@0.0-0.62	Core	0-0.62	16.88	47.03	36.1
BH205ESeaBed	Grab	0	15.5	49.28	35.23
BH206SeaBed	Grab	0	1.45	57.53	41.03
BH207SeaBed	Grab	0	19.52	38.13	42.37

Sediment within the dredge area comprised roughly equal parts sand and silt. Based on geotechnical investigations it is anticipated that the total volume of the dredged material will comprise 50% sediment and 50% rock. The dredge material characteristics, accounting for the bedrock within the >64 mm fraction, are shown in Table 2.

Table 2 Dredge material characteristics

Dredge area	Pebbles, cobbles and boulders (including bedrock) (>64 mm)	Gravel (>2 - <64 mm)	Sand (>63 µm - <2mm)	Silt (<63 µm)
Grutness Harbour	50%	7%	23%	20%

Samples exceeding Action Levels

Analysis of sediment collected during sampling in 2023, indicated the below contaminant exceedances in a number of samples:

- Chromium marginally exceeded the respective Action Level (AL) 1 in three samples; and
- Six of the Polyaromatic Hydrocarbons (PAHs) exceeded the respective AL1 in one of the samples; these were Benz(a)anthracene; Benzo(a)pyrene; Benzo(a)fluoranthene; Chrysene; Diben(ah)anthracene and Phenanthrene.

All other contaminants analysed were below their respective ALs (Marine Scotland, 2017).

Figure 2 shows the levels of chromium identified in the sediment samples in 2023 against AL1 and AL2. It can be seen that the elevated chromium concentrations in three of the samples (BH201, BH205 and BH207) is marginal, with the remaining sample having a chromium concentration of just below AL1.

The presence of AL1 exceedances of chromium in the sediment from surface samples could potentially indicate that elevated concentrations of these metals are from a recent source.

The presence of a number of PAHs at concentrations higher than their respective AL1 were recorded at one location (BH205) within the depth integrated sample only, potentially indicating historic contamination. PAHs can enter the marine environment through atmospheric deposition, run-off, industrial discharges and as a result of oil spills.

It is possible that historic and recent pollution incidents have contributed to elevated contamination levels at these three locations.

The average concentrations of all contaminants across all sediment samples are well below the respective AL1, with the exception of chromium for which the average concentration is just above the respective AL1.

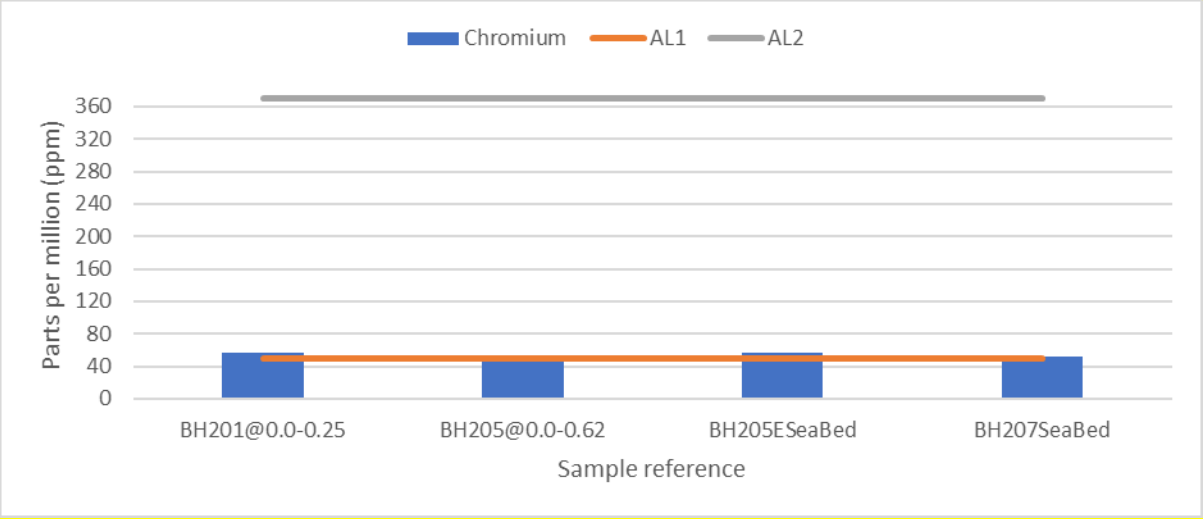

Figure 2 Chromium levels in samples in 2023

Prevention

There are three main alternatives for the prevention of generating waste material, including:

- Do Nothing (i.e. do not undertake capital dredging);
- Reduce the dredging requirement; and
- Reduce the disposal requirement.

The main approach to avoiding the generation of waste would be to not undertake the proposed capital dredging. Without capital dredging there would not be sufficient depth to accommodate the new vessel which is essential to replace the existing vessel, as this is approaching the end of its life and does not meet modern standards. The 'do nothing' scenario is therefore not appropriate.

The design minimises the volume of sediment to be dredged, only dredging the necessary volume to accommodate the proposed vessel draft. Detailed bathymetric surveys have informed the selection of the dredge area.

In summary, all measures to prevent and/or reduce the volume of waste generated by the dredging activities have been fully considered.

Re-use, recycling and other recovery

Few cost-effective re-use and/or recycling options have been identified due to the nature of much of the material arising from capital dredging at Grutness. The surface layer of the dredge area comprises of mixed sand and silts (Table 1). As shown in Table 2, approximately 50% of the total dredge volume will comprise of the rock underlying the top layer of sediment. It is considered that this material could represent a good resource for general fill material that could be used as backfill in the local area. However, the material does not meet the standards for beach nourishment purposes or good quality aggregate.

Consideration has been given to use the dredge material as backfill for the pier extension. However, it is estimated that the volume required for backfill is too small to require all of the dredge material. There are not currently any other planned developments in the local area which would be able to use the material from Grutness. Shetland Island Council will continually look to re-use a proportion of this material wherever possible to minimise the dredging requirement and also reduce the need of using a more valuable natural aggregate resource in any future developments. No other practical methods for cost effective recovery of the material have been identified at this time, given the type of material and the known developments in the area.

Disposal

The above assessment has considered the options available for management of the capital dredge arisings from Grutness. No beneficial use options have been identified and therefore the BPEO for the material is considered to be disposal. However, the context in which disposal is achieved has been further considered in the following sections.

Disposal on shore

The nature of the dredged material (a mixture of sand, silt and rock) is unsuitable for sacrificial landfill without involving an extensive transport and treatment process. Disposal to landfill would involve a complicated material handling operation involving sea to land transfer, de-watering, loading to trucks and transport to site. In addition, there would need to be a change in dredger type, for example from a vessel designed for maintenance dredging to one designed for aggregate recovery or a change to a mechanical form of dredger, unless a settling lagoon could be constructed.

Each existing dredger load would produce *circa* 1,000 m^3 of 'semi- wet' material after water has been 'weired-off' from the dredger or de-watered in a settling lagoon on land. This volume equates to *circa* 50-60 lorry loads of material produced at the quayside in a time of 1 – 2 hours to several hours depending on the method of de-watering the dredge arisings. This transport requirement is impractical, very costly and has a high carbon footprint as a significant fleet of lorries would be required to prevent significant delays in dredging operations.

Disposal at sea

The identified deposit ground FI095 (Scalloway) is located approximately 38 km to the northwest and is the nearest to the area where dredging will take place; thus, relocation in terms of distance is minimised. The main effects of the disposal are all short term and transient in nature. Disposal of the material at this site will not result in any significant impacts on the hydrodynamics, water and sediment quality, marine habitats and ecology of the disposal area. A detailed assessment of the dredge disposal is provided within the Environmental Report submitted in support of the construction works (including dredging) marine licence application for the Grutness Pier Improvement Works (Ref. no. 00010318, Licence ID MS-00010318).

Summary

The BPEO assessment has not identified any immediate opportunities for the re-use of the dredge material. Without any suitable uses available at present, disposal in the marine environment at a licenced disposal ground is considered the BPEO. The optimum disposal location is determined through consideration of practical, environmental and economic parameters. The disposal site has been selected to be as close as practical to the dredge site. This minimises transport time to each site and reduces the carbon footprint whilst minimising transportation cost. The disposal site has no current exclusions that would preclude the deposition of the dredge material, including dredged rock.

Reference

Marine Scotland, 2017. Pre-disposal Sampling Guidance. Version 2 – November 2017.