Port of Cromarty Firth Quay West Dredge Licence Best Practicable Environmental Option Report

Report No. 71_REP_16

Date: 14/12/2023

Document Control

	Name	Title	Signature	Date
Author	Daisy Hodge	Environmental Consultant	[Redacted]	14/12/2023
Reviewer	Sonja Brooks	Principal Consultant		14/12/2023
Authoriser	Fiona Henderson	Director		14/12/2023

Effective Date:	**14/12/2023**

Revision No:	Signature	Comments	Date
1A	[Redacted]	Issue to Internal Review	04/12/2023
1B		Issue to Client for Review	14/12/2023
1		For Issue	14/12/2023

Contents

1 Introduction

The Port of Cromarty Firth (PoCF) are in the process of applying for a dredging licence to undertake bed-levelling works immediately south of Quay West 1 & 2 (also known as Berths 5 and 6, and hereafter referred to as such) at the Invergordon Service Base (ISB). The works are required to remove some high spots on the seabed to ensure the designed berth depth of minus 12 metres (m) Chart Datum (CD) is maintained. This will allow access by large vessels supporting offshore wind projects.

This Best Practicable Environmental Option (BPEO) report has been produced to support the dredge marine licence application under the Marine Works (Scotland) Act 2010 for the proposed bed-levelling works at Berths 5 and 6 of Quay West.

1.1 Report Aims and Objectives

The purpose of this report is to identify and assess the available options for the use/disposal of materials arising from the necessary bed-levelling works at Berths 5 and 6.

The objectives are:

- To provide an overview of the required works;
- Describe the proposed areas for which a bed-levelling campaign is required, including estimated quantity of material likely to be involved;
- Describe the BPEO methodology employed to complete the assessment; and
- To identify and assess options for disposal of material to determine the BPEO.

2 Background

2.1 Works Area and Material Volumes

The area requiring bed-levelling works is south of Berths 5 and 6; see Drawing POCF_Dredge_QW_001. Material is to be removed to depths of between 0m and 0.7m below the current seabed level, involving a total material volume of under 1000 cubic metres (m^3) across the identified works area. In the majority of the works area high spots are 0.1 to 0.2m, the maximum height to be levelled is 0.7m, to achieve a uniform minimum berth depth of minus 12m CD.

2.1.1 Sampling

In conformance with the Pre-Disposal Dredge Sampling Guidance (Marine Scotland, 2017), samples have been obtained from three stations at the following locations also shown on Drawing POCF_Dredge_QW_001.

QW1 - 57° 41.049'N, 004° 10.905'W

QW2 - 57° 41.024'N, 004° 10.980'W

QW3 - 57° 41.001'N, 004° 11.096'W

Grab samples were obtained by divers, as the proposed depth of the works is less than 1m in all areas. The locations have been selected to correspond with the high points proposed to be removed, to provide a geographical spread and representative depiction of the works area.

2.1.2 Sample Analysis

All samples were analysed by the Laboratory SOCOTEC who are ISO17025 accredited for marine sediment analysis, and which takes part in intercomparison exercises such as QUASIMEME. The laboratory will also meet the limit of detection (LOD) and sensitivity requirements set out in the Clean Seas Environmental Monitoring Programme (CSEMP) Green Book (Marine Assessment and Review Group, 2020).

2.1.3 Sample Results

The sample results are summarised in this section, and the entire set of sample results are available in the spreadsheet Quay West Pre-Disposal Dredge Sampling Results Form (SOCOTEC, 2023), provided alongside this BPEO and dredge licence application. No asbestos was identified in any of the samples, and all organohalogen concentrations are below Action Level (AL) 1 and so will not be discussed further.

2.1.3.1 Physical Properties

On average the solids were 15.23% gravel, 57.34% sand and 27.43% silt. However, there was a high degree of variability across the three samples. For example, the silt content of QW1 was 14.88% compared to 45.05% in QW3. High levels of silt make the material unsuitable for reuse as a construction material. The high concentration of silt could explain the very high specific gravity, which was consistent across the three samples, at ~2.65.

2.1.3.2 Trace Metals

Sample results are shown in Table 2.1, alongside AL 1 and 2, as determined in the Marine Scotland Pre-Disposal Dredge Sampling Guidance. Contaminant levels of dredged material below AL1 are generally assumed to be of no concern, contaminant levels between AL1 and AL2 will typically trigger further investigation, and if samples exhibit contaminant levels above AL2 then they are usually considered unsuitable for at sea disposal. Only one sample breaches AL1 (highlighted in blue in Table 2.1) for Mercury (Hg), and no samples breach AL2. The sample is from QW1 sample site, which exceeds AL1 by 0.01 mg/kg (dry weight). QW1 was the most easterly of the sample points, closest to the main ISB, which has been operational for decades. No other trace metals exceeded the prescribed ALs.

Table 2.1: Trace Metals Results from Berths 5 and 6

Analyte	Units (dry weight)	AL1	AL2	QW1	QW2	QW3	Dry Weight Average	Wet Weight Average
Arsenic as As	mg/kg	20	70	4.9	4.9	8.2	6.00	3.98
Cadmium as Cd	mg/kg	0.4	4	0.12	0.11	0.14	0.12	0.08
Copper as Cu	mg/kg	30	300	9.1	4.3	10.8	8.07	5.27
Lead as Pb	mg/kg	50	400	12.4	5.2	14.9	10.83	7.06
Mercury as Hg	mg/kg	0.25	1.5	0.26	<0.01	0.13	0.13	0.09
Nickel as Ni	mg/kg	30	150	8.9	10.7	13.2	10.93	7.34
Total Chromium as Cr	mg/kg	50	370	13.4	16	19.1	16.17	10.87
Zinc as Zn	mg/kg	130	600	38.8	37.1	50.9	42.27	28.24

These samples are not expected to result in any negative environmental impacts, regardless of disposal method, as no contaminant level has exceeded AL2. To protect aquatic life in both freshwater and marine environments, Environment Canada has identified Probable Effect Levels (PELs) for a range of contaminants (Canadian Council of Ministers of the Environment (CCME), 1999), and none of these samples exceed the PELs. The PEL for Hg in marine environments is 0.70 mg/kg (dry weight). Although the QW1 sample exceeds AL1, it does not exceed the PEL, and the average Hg concentration of all three sample sites is 0.13mg/kg (dry weight) and 0.09 mg/kg (wet weight), substantially under the AL1 concentration and the PEL for Hg.

Having reviewed the results against the Marine Scotland ALs and the Environment Canada PELs, the material within the area of proposed bed-levelling works is not predicted to have a negative effect on the marine environment due to the presence of metal contaminants.

2.1.3.3 Polyaromatic Hydrocarbons

Sample results for Polyaromatic Hydrocarbon (PAH) concentrations are displayed in spreadsheet 71_FOR_01_Quay West Pre-Disposal+Sampling+Results+Form.xlsx. Results show that Fluoranthene concentration in the QW1 sample, and Perylene concentration and Total Hydrocarbon Content (THC) in the QW3 sample were slightly above AL1. However, the mean wet weight of all PAHs sampled was well below AL1 concentrations, indicating that the material is not contaminated and hence chemically suitable for any use.

3 BPEO Methodology

In identifying the BPEO for the proposed bed-levelling works, the following methodology has been employed:

- Identification of options available for material disposal;
- Screening to eliminate unsuitable options;
- Scoring of remaining options; and
- Comparison of options and identification of the BPEO.

3.1 Option Identification

Options for management of material within the proposed bed-levelling area were identified through discussions with the Port of Cromarty Firth.

3.2 Screening

All options were screened against a minimum criterion. Each option had to meet the minimum criteria in order to be taken forward for detailed consideration. Any option which failed to meet one or more of the criteria was not taken forward for detailed assessment. The criteria are as outlined below:

- The proposed option must be suitable for the physicochemical characteristics of the material;
- It must be technically viable;
- It must ensure availability of -12m CD berthing prior to 15th January 2024.

3.3 Scoring

Attributes utilised in the options assessment were identified and scored out of 5, with 1 being the worst performing and 5 being the best. Each score has been designated a colour to aid visual comparison. Attributes are outlined in Appendix 1.

Options which met minimum criteria and progressed to detailed assessment were scored against each attribute (Appendix 2). Reasoning for the corresponding scores is provided in Appendix 3.

3.4 Comparisons of Options and Identification of the BPEO

Following the scoring of the options, a detailed comparison was undertaken to identify the BPEO.

4 Assessment of Options

4.1 Identification of Options Available

Several options were identified for the management of material within the proposed bed-levelling area, including both terrestrial and marine based disposal options. Options identified are outlined below:

- Do Nothing;
- Disposal to Landfill;
- Dredge with Disposal to Sea – assumed at CR019 Deposit Site;
- Bed-Levelling by Plough Dredge; and
- Beneficial Re-Use.

4.2 Unfeasible Options

Options were screened against the minimum criteria outlined in Section 3.2. This process eliminated three of the five options as they do not meet one or more of the screening criteria. The reasoning behind discounting the three options is discussed below.

4.2.1 Do Nothing

To not undertake levelling works within the identified area at Berths 5 and 6 would impose a significant operational impact on the ISB and operators that rely on its facilities. The seabed within the area must be subject to levelling to ensure the designed depth is maintained across the berthing area to allow access by large vessels supporting offshore wind projects. This option does not meet the minimum criteria of ensuring availability of -12m CD berthing.

4.2.2 Disposal to Landfill

This option involves the disposal of material, removed from the identified area as dredge spoil, to landfill. For this option to be possible, dredged material would need to be brought to land, de-watered and stored within the harbour area, prior to loading onto trucks and transport to a landfill site. Following dewatering, the material would possess suitable physiochemical characteristics for disposal to land.

Dewatering does, however, requires space and time to be implemented effectively. As the port is operational with clients utilising laydown space currently, a suitable area for dewatering may not be available in the time scales required.

In addition, the thin layer of material required to be removed from the high points would prove challenging to remove without resulting in over-dredging and removal of excess material. Repeat surveys would be required to ensure that all high spots are removed. This technical challenge will also increase the time required to deploy this option.

The option of dredging with disposal of dredge spoil to landfill does not meet the minimum criteria of ensuring availability of -12m CD berthing by 15th January 2024, and would present additional spatial constraints during dredge spoil dewatering. With time-constraints and spatial issues considered, this option presents an unacceptable risk and will not be taken forward to assessment.

4.2.3 Beneficial Re-Use

Dredged material can be suitable for land reclamation or coastal remediation works if the appropriate particle size distribution (PSD) and chemical characteristics are available in sufficient volume. Suitable material is generally made up of sands and gravel. Large volumes are also required to ensure the costs of processing and transport are viable.

The variability of PSD across the samples, and QW3 exhibiting 45.05% silt content, indicates that the dredged material from this area would not be suitable for re-use as a construction material, for example in land reclamation. Paired with the relatively limited volume of 1000m^3 available within the identified works area is not a sufficient quantity to be of viable benefit to other developments, land reclamation or coastal remediation works.

Additionally, operational constraints could occur due to the thin layer of sediment that would need to be removed and processed for further use. As the majority of the area required to be levelled consists of high spots of only 0.1 - 0.2m, operational restrictions are likely to outweigh the benefits of reusing dredge spoil material due to it being such a thin layer to be removed. As such, this option is not suggested to be technically viable will not be taken forward for further consideration.

4.3 Assessment of Feasible Options

Following the screening process, the options to take forward for detailed assessment are to:

- Dredge with Disposal to Sea; and
- Plough Dredge.

Each of these options have been assessed against the attributes detailed in Appendix 1. The options scoring is provided in Appendix 2 with the reasoning for attribute scoring provided in Appendix 3.

4.3.1 Dredge with Disposal to Sea

There are numerous dredge spoil deposit sites in Scottish waters for the deposition of dredged material. Dredge spoil Deposit Site CR019, henceforth known as Sutors, is an open spoil deposit site which is located approximately 11 km east of the proposed bed-levelling works at Berths 5 and 6.

Sutors has been identified as the most appropriate disposal site due to its geographical location in relation to the proposed works, being located approximately 11km east. Initial mobilisation of equipment to conduct dredging operations is minimal, and the 22 km round-trip for disposal of the material is unlikely to impact timescales to complete the dredging

campaign. Subsequently, cost is also kept relatively low with this option, due to the nearby location of the disposal ground which will reduce the running cost of marine plant required for dredge and disposal.

Environmental impacts are minor but will need to be mitigated, due to the potential for physical harm to marine mammals during dredge disposal at the Sutors.

Ensuring the removal of high spots without over dredging could be challenging, multiple surveys will be required to ensure levels are being achieved, adding to the technical challenge. It is recognised that disposal of material to sea disposal sites is established industry practice and has been completed by PoCF regularly. As the activity is standard practice, the legislative complexities involved are relatively simple with little management required to comply with legislation.

Overall, the Dredge with Disposal at Sea option scores: **30 out of 40.**

4.3.2 Bed-Levelling by Plough Dredge

The plough dredge option exhibits the fewest logistical and cost impacts from all the assessed options. Material removed from the high points of the seabed will be distributed to deeper areas of the identified bed-levelling area. This will maintain water depths across the entire area of at least -12m chart datum (CD) and hence achieve an appropriate operational depth at Berths 5 and 6.

Environmentally effects on water quality are very limited, localised and temporary. As works are outwith the fish spawning season no noticeable impacts are predicted.

There are no anticipated operational constraints associated with this option. A total of less than 1,000m^3 of seabed material will be redistributed as part of the proposed plough dredge campaign, and the material does not cause concern for public health within the proposed works location.

Plough dredging is technically a simple solution to ensure that the seabed is levelled without being over dredged.

The Bed-Levelling by Plough Dredge option scores: **38 out of 40.**

4.4 Comparison of Options

As detailed in Appendix 3, Bed Levelling by Plough Dredge scores equal or higher than Dredge with Disposal to Sea on all attributes. The use of a plough is most suited to removal of high spots, as it levels the material through the area. Dredge with Disposal is more appropriate for the removal of large pockets of material. This is reflected in the scoring with the option to Dredge with Disposal to Sea scoring 30 compared to bed levelling by Pough Dredge scoring 38 out of 40. As such the latter is clearly the BPEO.

5 Conclusion

As the highest scoring of the options that passed screening, it is determined that Bed-Levelling by Plough Dredge is the BPEO for the required works at Berths 5 and 6. This option will avoid additional costs, time, and logistical constraints associated with other options that were considered, with minimal environmental disruption.

References

CCME, 1999. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life. Available at https://ccme.ca/en/res/mercury-canadian-sediment-quality-guidelines-for-the-protection-of-aquatic-life-en.pdf. *Accessed 13/12/2023*.

Marine Assessment and Review Group, 2020. Clean Seas Environmental monitoring Programme. Available at: https://www.bodc.ac.uk/resources/portals_and_links/merman/project_specific/documents/green_book_v16.pdf. *Accessed 04/12/2023*.

Marine Scotland, 2017. Pre-disposal sampling Guidance. Version 2. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2020/02/marine-licensing-applications-and-guidance/documents/guidance/pre-disposal-sampling-guidance/pre-disposal-sampling-guidance/govscot%3Adocument/Pre-disposal%2Bsampling%2Bguidance.pdf. *Accessed 04/12/2023*.

SOCOTEC, 2023. Quay West Pre-Disposal Dredge Sampling Results Form, 71_FOR_01

Glossary

Acronym	Definition
BPEO	Best Practicable Environmental Option
CD	Chart Datum
CSEMP	Clean Seas Environmental Monitoring Programme
Hg	Mercury
INNMS	Invasive Non-Native Marine Species
ISB	Invergordon Service Base
LOD	Limit of Detection
m	Metre
m^3	Metre cubed
MHWS	Mean High Water Spring
PEL	Probably Effect Level
PoCF	Port of Cromarty Firth
PSD	Particle Size Distribution

Appendix 1: Attributes

Attribute	Description	1	2	3	4	5
Alignment with Policy	How complex are the regulator requirements and what risks are posed.	In direct conflict with policy.	Does not fully align with policy.	No policy implications.	In the spirit of policy.	Positively implements policy.
Cost	Financial Cost of the Option	>£ 500,000	£300,000 to £500,000	£150,000 to £300,000	£50,000 to £150,000	<£50,000
Timescale	Impact of works on project programme.	Methodology would extend the project programme.	High risk works couldn't be completed within required timescale.	Slight risk works couldn't be completed within required timescale.	Allows works to be completed within required timescale.	Allows works to be completed comfortably within required timescale.
Distance	Impact location has on logistics for material movements.	Beyond 50 miles	40-50 miles	30-40 miles	1-30 miles	Within 1 Mile
Material Suitability	Is the chemical makeup of the dredge material suitable for the option selected?	Not all of the material is acceptable.	Requires significant mitigation to be made suitable.	Acceptable with mitigation.	Acceptable material for option.	Ideal material for option.
Technical Feasibility	Is the option within the capabilities of PoCF to carry out?	Technology not proven.	Complex requirements, but proven technology.	Simple proven technology available.	Practicable with basic management.	Standard practice
Environmental Effects	Potential environmental effects associated with implementing the option.	Very Significant	Significant	Minimal	Trivial	None
Legislative Complexity	How complex are the regulator requirements and what risks are posed.	Significant risk additional permits, licences or consents will not be granted.	Requires significant additional permits, licences or consents.	Requires additional permits, licences or consents.	Minor management required to comply with legislation	Complies with all relevant legislation.

Appendix 2: Options Scoring

Attribute	Dredging with Disposal to Sea at CR019 Deposit Site	Bed-Levelling by Plough Dredging
Alignment with Policy	2	4
Cost	4	5
Timescale	4	5
Material Suitability	5	5
Distance	4	5
Technically Feasibility	3	5
Environmental Effects	3	4
Legislative Complexity	5	5
Total	**30**	**38**

Appendix 3: Reasoning for Attribute Scoring

Attribute	Dredging with Disposal to Sea	Bed-Levelling by Plough Dredging
Alignment with Policy	Disposal at sea is low on the waste hierarchy and as such does not align to policy.	This option does not give rise to waste and therefore is aligned with the Zero Waste Scotland by 2025 Policy (Scottish Government, 2010).
Cost	There are associated costs with marine plant required to conduct a dredge and transport the spoil to the disposal site.	There costs with marine plant required to conduct a plough dredge.
Timescale	The dredge and disposal at sea could be completed within the required timeline, additional time will be required to transport material to the Sutors.	The plough dredge can be completed in line with the required timeline.
Material Suitability	The dredge spoil will be suitable for disposal at sea.	The chemical and physical properties of the dredge spoil are suitable for plough dredging.
Distance	The distance from the Sutors site is 11km from the works site, meaning a 22km round trip would be required for disposal at sea.	There is no distance aspect associated with plough dredging.
Technically Feasibility	Disposal at sea is an established industry practice. Removal of high spots could lead to over dredging and will need surveys.	Plough dredging is standard practice and can be exempt from Marine Licencing.
Environmental Effects	Due to the location of the Sutors within the Moray Firth SAC an area popular with numerous marine mammal species. There is a need to employ marine mammal observers to avoid harm. Potential temporary increase in solids in the water column at both dredge and disposal grounds. Dredging outwith salmon smolt run season (May), hence no impact on fish predicted.	Dredging outwith salmon smolt run season (May), hence no impact on fish predicted. Increases in sediment in the water column will be at deepwater levels only and reduce quickly.
Legislative Complexity	Legislative complexities around disposal at sea are relatively simple and will require minor management.	Legislative complexities around plough dredging are simple and will require minor management.