East Ness Berth, Inverkeithing
Best Practicable Environmental Option (BEPO) Report

February 2026

CONTROL SHEET

Client: Forth Bridge Stevedoring Ltd
Project Title: East Ness Berth, Inverkeithing
Report Title: Best Practicable Environmental Option (BEPO) Report
Document number: 14272
Project number: 779424

Issue Record

Issue	Status	Author	Reviewer	Approver	Issue Date
1	Final	NI/MMF	FR	CCAS	03/06/2024
2	Final	NI/MMF	FR	CCAS	13/02/2026
3					

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VAT no. GB 348 6770 57.

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1 INTRODUCTION

1.1 Background

Cameron Planning, acting on behalf of Forth Bridge Stevedoring Ltd. has appointed EnviroCentre to complete a Marine Licence application for dredging at East Ness Berth in Inverkeithing Harbour, on the Firth of Forth. The berth is operated by Forth Bridge Stevedoring Ltd. as an independent port facility. As part of the application, a Best Practicable Environmental Option (BPEO) assessment requires to be undertaken. This has been informed using sediment quality results from sampling undertaken in April 2024.

The proposed dredge depth will not exceed 1 metre and is intended to bring the bed level in the berth and approaches to -0.2m bCD (below Chart Datum). A maximum quantity of 3,000m^3 is proposed to be dredged across the area shown in Drawing No. 779424-GIS002 in Appendix A. It is understood that this would be considered a capital dredge (i.e. no dredging has been undertaken on site in the last seven years).

A marine licence application for the above noted proposed dredge was granted on 11th February 2025, expiring on 12th February 2026 (ref. MS-0010858). However, the dredging activity was not progressed and the licence has since expired. The dredge therefore is considered to remain a capital dredge. As the chemical sampling was undertaken within the 3 years prior to the date of this application, it is considered suitable to inform this assessment.

The purpose of the samples analysis is to provide supporting information to Marine Scotland during the licensing process on sediment quality within the proposed dredge areas in order to assess the suitability for sea-based disposal should that be identified as a viable option. The dredging and disposal activities are regulated by Marine Scotland under the Marine (Scotland) Act 2010. The licensing conditions require representative samples to be collected and the nature (i.e. physical composition), quality and contamination status to be determined.

The results of the 2024 sediment analysis will then be used to compare the best practicable environmental options (BPEO) for each of the available potential disposal options for the dredged materials.

1.2 Scope of Report

The following report details the sampling methodology, field and laboratory analysis and provides a summary of the sediment quality present within the proposed dredge areas.

The report will then use the available sediment analysis results to compare the best practicable environmental options (BPEO) for each of the available potential disposal options for the dredged materials. The options which are not considered to be practicable are rejected and the reasons for doing so are explained. Those options which are practicable are examined in detail and assessed against the following considerations:

- Environmental;
- Strategic; and
- Cost.

The report then compares the practicable disposal options and draws a conclusion on the BPEO.

1.3 Action Levels – AL1 vs AL2

Two action levels are currently used to assess the suitability of sea-based disposal of dredged sediment material: Revised Action Level 1 (RAL1) and Revised Action Level 2 (RAL2).

Sediment with contaminant concentrations below RAL1 is generally considered to be below background levels for contamination and is suitable for disposal at sea.

For samples between RAL1 and RAL2, additional risk assessment may be required including further sampling and testing to fully identify pockets of contamination or implementation of bioassays to assess the materials suitability for sea disposal.

Material above RAL2 is generally considered to be unsuitable for disposal to sea. If the sea disposal route is to be pursued, further testing along the lines of bioassay accompanied by a robust justification for selecting sea disposal as the BPEO may be required. This would need to be supported further with additional information regarding any mitigation measures which could be put in place as part of these works. This would require further discussion and agreement with Marine Scotland.

1.4 Report Usage

The information and recommendations contained within this report have been prepared in the specific context stated above and should not be utilised in any other context without prior written permission from EnviroCentre.

If this report is to be submitted for regulatory approval more than 12 months following the report date, it is recommended that it is referred to EnviroCentre for review to ensure that any relevant changes in data, best practice, guidance or legislation in the intervening period are integrated into an updated version of the report.

2 SAMPLING LOCATIONS AND METHODOLOGY

Sediment sampling works (comprising collection of three grab samples) were undertaken on 4th April 2024. The following sections detail the sampling methodology used to retrieved sediment samples, including details of the analytical suite.

2.1 Sample Locations

Grab samples were collected at three locations during the April 2024 sampling round, as per the Sampling Plan agreed with the Marine Directorate. The locations are outlined in Table 2-1 below.

Table 2-1: Sample Station Locations

Sample Station ID	Latitude	Longitude	Sample Type
Grab A	56°1.473’	-3° 23.367’	Grab
Grab B	56° 1.467’	-3° 23.319’	Grab
Grab C	56° 1.468’	-3° 23.271’	Grab

Sample locations are shown in Drawing No. 779424-GIS002 in Appendix A.

2.2 Navigation and Sample Location

Pre-determined sample station locations were programmed into a Trimble TDC600 GPS device. Upon successful recovery of sample, the location was logged on the GPS device before moving to the next location.

2.3 Sample Collection

Grab samples were obtained using a 0.045m^2 stainless steel Van Veen grab sampler. Grab samples were collected by hand from the sampling vessel, operated by Forth Logistics. Where required, the grab was deployed multiple times to ensure enough sample was recovered for testing. Recovered material was emptied into a plastic bucket ready for sub-sampling.

2.4 Field Information

The following field data was recorded for each sample obtained:

- A unique sample ID;
- Sample location;
- Sample coordinate in latitude and longitude in degrees, minutes and decimals of minutes;
- Date, time and depth of collection;
- Sampler’s ID;
- Sediment description;
- Sample photographs; and,
- Details of any deviation from sampling protocol.

2.5 Sample Preparation

Grab samples were photographed and logged prior to sub-sampling.

Samples for metals and particle size analysis were sub-sampled using a plastic spoon and stored in plastic tubs. Samples for organic analysis were collected using stainless steel spoons and stored in amber glass jars.

Sampling equipment (spoons etc.) were cleaned with fresh water between samples to minimise the risk of cross contamination.

Once samples had been placed within appropriate containers, they were labelled and placed immediately into cool boxes. Samples were dispatched to the project laboratory (Socotec) on the day after sampling.

2.6 Analysis Requirements

The laboratory analysis required by Marine Scotland (MD-LOT), and undertaken as part of this investigation, was as follows:

- Metals - Arsenic, Chromium, Cd, Copper, Mercury, Nickel, Lead, Zn;
- Organotins - Tributyl Tin & Dibutyl Tin (TBT);
- Polycyclic Aromatic Hydrocarbons (PAH USEPA 16);
- Polychlorinated Biphenyls (PCB ICES 7);
- Total Hydrocarbons (THC);
- Moisture Content;
- Total Organic Carbon (TOC);
- Particle Size Analysis (PSA); and
- Asbestos (presence/absence).

Samples were dispatched to the Socotec Marine Laboratory for analysis.

3 RESULTS

The following section details sample results. Sediment sample logs are provided in Appendix B. The laboratory certificate is provided in Appendix D and a summary sheet highlighting exceedances above the RALs in Excel format accompanies this report in the submission to Marine Scotland.

3.1 Physical Analysis

3.1.1 Particle Size Analysis

The Particle Size Analysis dataset for each sample is given in Table 3-1.

Table 3-1: Particle Size Analysis Data

Sample ID	Gravel % (>2 mm)	Sand % (>63 µm<2 mm)	Silt % (<63 µm)
Grab A	23.54	25.90	50.56
Grab B	3.88	30.80	65.31
Grab C	0.0	19.28	80.72

Particle size across all three samples were primarily noted to comprise silt sized particles, with the greatest proportion of silt recorded in Grab C. The proportion of sand in the samples ranged from 19% to 31%. Grab A contained 24% gravel, with a negligible gravel content recorded in Grab B. No gravel sized particles were recorded in Grab C.

3.2 Chemical Analysis

3.2.1 Chemical Analysis Assessment Criteria

All chemical analysis results were assessed against Revised Action Levels (RAL) criteria as adopted by Marine Scotland. The results are summarised below. Summary reports detailing exceedances in the Marine Scotland format have been submitted along with the supporting information for the application. The laboratory certificates are provided in Appendix D.

Where contaminants have RALs as adopted by Marine Scotland, exceedances above these criteria are summarised in Table 3-2, along with the maximum concentration recorded for each parameter.

Table 3-2: Exceedances of Revised Action Levels

Contaminant	No. of Exceedances (of 3 samples)		Maximum Concentration (mg/kg) and Location
	RAL 1	RAL 2	
Arsenic	0	0	15.9 at Grab A
Cadmium	0	0	0.2 at Grab C
Copper	1	0	31.2 at Grab C
Chromium	0	0	40.8 at Grab C
Lead	1	0	56.5 at Grab C
Mercury	2	0	0.52 at Grab C
Nickel	0	0	25.8 at Grab C

Contaminant	No. of Exceedances (of 3 samples)		Maximum Concentration (mg/kg) and Location
	RAL 1	RAL 2	
Zinc	2	0	137 at Grab B
PAH (All Species)	3	N/A	0.85 at Grab C (Pyrene)
PCBs	1	0	0.023 at Grab C
TBT	0	0	<0.005 at all locations
THC	3	N/A	478 at Grab A

3.3 Asbestos

Asbestos detected in Grab A in the form of amosite (thermal insulation). Asbestos was not detected in Grab B and Grab C.

3.4 Chemical Results Summary

All three grab samples recorded exceedances above RAL1 for at least one metal, for various PAHs and THC. Grab C also recorded a marginal exceedance of RAL1 for PCBs. In addition, asbestos was identified within Grab A.

Note that on the results provided in the Marine Scotland Excel form, a formatting error means that one sample is incorrectly shown as being in exceedance of RAL2 for dibutyltin (DBT).

No results were recorded which exceeded RAL 2, where an action level is available.

4 DISCUSSION OF AVALIABLE DISPOSAL OPTIONS

The BEPO process is geared towards identifying a preferred overall strategy from the perspective of the environment, as opposed to detailed optimisation of any one selected scheme. It is a structured and systematic process to identify and compare strategic options and transparent manner. Alternatives are evaluated in terms of their projected implications for the environment together with consideration of practicability, social and economic issues as well as within a wider strategic context.

The key stages of a BEPO are:

- Identification of options;
- Screening of options;
- Selection of assessment criteria;
- Analysis and evaluation of criteria; and
- Evaluation of BEPO.

Further details on methodology are provided within each section.

4.1 Identification of Available Disposal Options

A number of options are available for disposal of dredged sediments. The options considered are provided in Table 4-1 along with justification for screening out those options which have not been taken forward for further consideration.

Table 4-1: Initial Best Practicable Available Options

Location	Options	Screening Assessment	Carry forward?
Coastline	Leave in Situ	Not an option due to the requirements to maintain depth to allow vessels to access and berth in the harbour.	No
	Infilling of an existing dry dock/harbour facility (Re-use)	No current or proposed dock/harbour infilling projects are known within a reasonable distance of the dredge site. In addition, given the relatively small volume of sediment to be dredged (~3,000 m^3), it is most likely that this would not be a sufficient amount of material to complete any infilling project and would provide only a small part of the total amount of sediment that would be required. Once material is brought on to land it falls under the jurisdiction of SEPA. Further geotechnical and chemical testing would likely be required before it is permitted for use on any such development.	No
	Beach Nourishment	While sediments with high sand content are suitable for beach replenishment, material with a high silt content are not generally considered suitable. Material sampled and analysed from the site are noted to consist predominantly of silt with smaller fractions of sand and gravel. Typically, the material used in replenishment projects needs to be of a similar nature i.e. grain size proportions similar to that of the receiving beach. Much of the Forth coastline are designated sites (SSSI, SPA) and hold both national and international importance to nature conservation. Specific beach nourishment projects would need to be supported by Environmental Assessments to inform how the project could affect the environment as a result of disturbance to the intertidal area, changes to the sediment levels, the variable composition and quality of the material and measures devised from the assessment outcomes to minimise impacts on the environment.	No
Land	Landfill Disposal	This is possible but it is unlikely that this option will offer a long-term solution due to lack of space at landfills, with other waste types likely to be prioritised. Landfill space is currently at a premium and does not offer a sustainable solution either financially or environmentally for the disposal of dredged arisings. Dredged material is likely to require treatment first in a dewatering facility. Significant cost associated with set up of dewatering facility at the quayside plus transportation and additional costs associated with gaining the necessary planning and regulatory consents.	No
	Land Incineration	The dredged material consists of non-combustible material (silts, sands, gravels, shells) with a low combustible component.	No

Location	Options	Screening Assessment	Carry forward?
	Application to Agricultural Land	The dredged material would need to be treated to reduce salt concentrations to acceptable levels. Would require detailed chemical analysis and assessment as well as a Waste Management License Exemption. Would require special precautions during spreading in relation to the risk of odour and watercourses / aquifers. Disposal of sediments in this manner would potentially have a detrimental effect on existing terrestrial habitats.	No
	Recycling	Recycling of dredged material is theoretically possible, however, due to the varied lithology there would need to be either segregation during dredging works, or energy and water rich processing on land. EnviroCentre have not been made aware by the harbour authority of an established disposal and reuse route in the Forth at present. In addition, given the relatively small volume of sediment, and the logistics involved, this unlikely to be a cost-effective option.	No
Sea	Aquatic disposal direct to seabed.	The closest spoil ground is Oxcars Extension B (FO043), which is located within the Firth of Forth at approx. 6km to the east. The proposed dredge method is to utilise a deck-mounted grab or cutter section unit on a bottom-emptying barge. Overall disposal costs associated with sea disposal are generally lower than land-based disposal, with low environmental risk due to appropriate sediment quality screening measures applied during the licensing process.	Yes

4.2 Summary of Identified BPEO Options

Following review of the available options, sea disposal has been identified for further detailed BPEO assessment.

A brief summary of the necessary works and methodology for the option being taken forward for detailed BPEO assessment is provided below.

4.2.1 Sea Disposal

A licenced sea disposal site is located within proximity of the East Ness Berth – Oxcars Ext B (FO043) which is located ~6km east of the proposed dredging area.

It is anticipated that dredging will be undertaken using a grab dredger with a split hull hopper barge, or a similar configuration. This would mean that dredging and disposal can take place without the need for double handling of material or bringing the dredged material ashore.

Sea disposal is the traditionally accepted sediment disposal method which generally has a low cost and low environmental impact.

5 FURTHER CONSIDERATION OF REMAINING DISPOSAL OPTIONS

5.1 Detailed BPEO Assessment

Each of the identified options was assessed against the criteria detailed in Table 5-1 below.

Table 5-1: BPEO Detailed Assessment Criteria

Primary Criteria	Description and Attributes
Strategic	• Operational aspects, including handling, transport etc. • Availability of suitable sites/facilities • General Public/local acceptability • Legislative Implications • Summary of the outcome of consultation with third parties
Environmental	• Safety Implications • Public Health Implications • Pollution/ Contamination Implications • General Ecological Implications • Interference with other legitimate activities e.g. fishing • Amenity/Aesthetic Implications
Costs	• Operating costs e.g. labour, site operations, • environmental monitoring • Capital *e.g*. Transport, equipment hire

5.1.1 BPEO Strategic Assessment

Table 5-2 below provides details of the strategic assessment for the option taken forward for the detailed BPEO assessment:

Table 5-2: BPEO Strategic Assessment

Criteria	Sea Disposal
Operational Aspects (inc. handling and transport)	There would be no double handling of the dredged material. Transportation to the disposal site would be by dredger or barge(s) depending on methodology.
Availability of suitable sites/ facilities	Marine disposal sites nearby have been designed to accommodate the quantities of material typically generated by dredging operations. The total dredge volume for this project is considered to be relatively low. The chemical analysis of the sediments from the proposed dredge sites would indicate that the material is likely to be acceptable for disposal via this route pending further risk assessment for contaminants present at levels between Action Level 1 and Action Level 2.
General Public / Local Acceptability	Traditionally accepted disposal route for dredged material with limited public impact.
Legislative Implications	This is an accepted disposal route as long as a Marine Licence is obtained.

5.1.2 BPEO Environmental Assessment

Table 5-3 details the environmental assessment for each option taken forward for the detailed BPEO assessment.

Table 5-3: BPEO Environmental Assessment

Criteria	Sea Disposal
Safety Implications	Low amount of material handling required as it is directly placed at the disposal site. Work would be undertaken in accordance with H&S legislation.
Public Health	Low potential for human contact during dredging and disposal operations. Once deposited at disposal site pathways for human contact greatly reduced.
Pollution/contamination	Pollutant concentrations in dredged material to be disposed are limited to acceptable levels through regulatory licensing processes. Information with regards to the type of disposal site with regards to its effects on sediments has not been provided. Correspondence with Marine Scotland has previously concluded that disposal sites in Scotland are Dispersive. Transport by sea to disposal site would increase the project carbon footprint.
General Ecological Implications	Oxcars Ext B (FO043) is a licensed disposal site for dredged material. This disposal site is within the *Outer Firth of Forth and St Andrews Bay Complex* and *Forth Islands* Special Protection Areas (SPA).
Interference with other legitimate activities	The Oxcars and Extension B disposal site is a licenced disposal site. It is likely that interference with other activities (such as commercial vessels or fishing) will have been considered as part of the disposal site licencing process. Therefore, the likelihood of significant disruption is considered to be low. Associated risks would likely be managed through the standard Notice to Mariners system via Forth Ports which notifies of activities within the local area.

Criteria	Sea Disposal
Amenity / Aesthetic Implications	Some potential for temporary visual / odour / noise effects while marine plant is in the harbour. However, no significant additional visual/ odour/noise effects following disposal as this occurs at sea.

5.1.3 BPEO Cost Assessment

Given that one option (sea disposal) has been taken forward for detailed BPEO assessment, a comparison of costs with other disposal methods is not considered appropriate or necessary.

5.1.4 BPEO Assessment Discussion

Deposition of the dredged material at a licensed marine disposal site has traditionally been deemed acceptable. The nearby licensed marine disposal site has been designed to allow easy access as well as being capable of accommodating the quantities of material typically generated by dredging activities. Material handling is limited to transportation thereby reducing the risk for pollution incidences occurring. Pollutant concentrations within sediments are also limited to acceptable levels through regulatory requirements.

5.2 Conclusion

The Best Practicable Environmental Option for disposal of the East Ness Berth dredged material has been assessed as sea disposal.

As identified in the sediment chemical quality section, further assessment is deemed necessary to confirm the suitability of the sediment for disposal to the wider environment. The following section details this assessment.

6 FURTHER ASSESSMENT

As detailed in Section 5.2, on the basis of the exceedances of Action Level 1, further assessment to determine the suitability of the material for sea disposal is deemed a requirement.

The approach for this further assessment is outlined as follows:

- Provide an overview of the proposed dredge works and the identified disposal site including existing chemical monitoring data for the site where available; and
- Compare existing chemical data with other recognised sediment assessment criteria including those listed below. Summary tables are provided in Appendix C.

Background Assessment Concentration (BAC) - BACs were developed by the OSPAR Commission (OSPAR) for testing whether concentrations are near background levels. Mean concentrations significantly below the BAC are said to be near background. However, it should be noted that river catchments have their own unique geochemical fingerprints and are also governed by the geology within the catchment, so in theory one set of background level values is not applicable to all situations;

Effects Range Low (ERL) - ERLs were developed by the United States Environmental Protection Agency (USEPA) for assessing the ecological significance of sediment concentrations. Concentrations below the ERL rarely cause adverse effects in marine organisms. Concentrations above the ERL will often cause adverse effects in some marine organisms;

Probable Effects Level (PEL) – PELs (Marine) have been adopted from the Canadian Environmental Quality Guidelines (http://www.ccme.ca/en/resources/canadian_environmental_quality_guidelines/). If a concentration is recorded above the PEL this is the probable effect range within which adverse effects frequently occur. The Threshold Effect levels (TELs) have been included in the summary table in Appendix C, but have not been used as part of the further assessment as they typically fall below the RAL1.

The following section contains a review of potential risks to the list of receptors identified in “Water Framework Directive Assessment: estuarine and coastal waters” (https://www.gov.uk/guidance/waterframework-directive-assessment-estuarine-and-coastal-waters). The conclusions drawn from the available information will provide a recommendation on the proposed disposal route.

6.1 Dredge and Disposal Site

The dredge is to be undertaken within the East Ness Berth, Inverkeithing, as shown on drawing No.779424-GIS002 in Appendix A.

The dredged material with be taken to the Oxcars Extension B disposal site located ~6km east of the dredge site within the Firth of Forth. The dredge and disposal sites are shown in Drawing No. 779424-GIS003 in Appendix A.

6.2 Analytical Data Review

Analytical data for the proposed dredge site is provided in Summary Table A in Appendix C. This data has been summarised against RAL 1 & 2, the BAC, ERL and PEL. As detailed previously, the data has

not been reviewed against the Canadian TEL as these numbers are typically lower than RAL1. A summary of the exceedances is detailed below:

6.2.1 Action Level 1

Exceedances of RAL1 can be summarised as follows:

- Copper – 1 of 3 samples recorded copper concentrations above RAL1;
- Mercury – 2 of 3 samples recorded mercury concentrations above RAL1;
- Lead – 1 of 3 samples recorded lead concentrations above RAL1;
- Zinc – 2 of 3 samples recorded zinc concentrations above RAL1;
- PAHs – 3 of 3 samples recorded at least one PAH species above RAL1;
- THC – 3 of 3 samples recorded total hydrocarbon concentration above RAL1; and
- PCBs – 1 of 3 samples recorded total PCB concentrations above RAL1.

6.2.2 BAC Review

Exceedances of the BAC can be summarised as follows:

- Copper – 2 of 3 samples recorded copper concentrations above the BAC;
- Mercury – 3 of 3 samples recorded mercury concentrations above the BAC;
- Lead – 2 of 3 samples recorded lead concentrations above the BAC;
- Zinc – 2 of 3 samples recorded zinc concentrations above the BAC; and
- PAHs – 3 of 3 samples recorded at least one PAH species above the BAC.

6.2.3 ERL & PEL Review

Exceedances of the ERL can be summarised as follows:

- Mercury – 3 of 3 samples recorded mercury concentrations above the ERL;
- Lead – 1 of 3 samples recorded lead concentrations above the ERL; and
- PAHs – 3 of 3 samples recorded at least one PAH species above the ERL.

Exceedances of the PEL can be summarised as follows:

- PAHs – 1 of 3 samples recorded a concentration of Phenanthrene above the ERL.

6.2.4 Action Level 2

No exceedances of RAL2 were recorded in any of the samples analysed.

6.3 Averages

Review of the averaged data for all the samples has been undertaken *i.e.* considering the material as a single volume for disposal. The review of average data against the available adopted assessment criteria can be summarised as follows:

- Averaged concentrations of Mercury, PAHs and THC exceeded RAL1;
- All other parameters recorded averaged concentrations below RAL1 where they exist;

- Averaged concentrations exceeded the BAC for Copper, Mercury, Lead, Zinc and several PAH species;
- Averaged concentrations exceeded the ERL for Mercury and several PAH species;
- Averaged concentrations were recorded below the PEL where one is available; and
- Averaged concentrations were recorded below RAL2 where they exist.

6.4 Chemical Assessment Conclusions

All three samples recorded exceedances above RAL1 for at least one metal; and all three recorded exceedances above RAL1 for PAHs and THC. Grab C recorded a result for PCBs marginally in exceedance of RAL1 (recorded concentration of 0.023 mg/kg against RAL1 of 0.02 mg/kg). Averaged concentrations, which account for the dredged material as a single volume for disposal, also exceeded RAL1 for mercury, PAHs and THC. No samples recorded contaminant levels in exceedance of RAL2.

Exceedances of the ERL were recorded in individual samples for mercury, lead and several PAH species. One exceedance of the PEL was recorded only for Phenanthrene at Grab C. Averaged concentrations exceeded the ERL for mercury and several PAH species. Averaged concentrations did not exceed the PEL.

The dredge averages have been reviewed against available disposal site analytical data for two nearby disposal sites, Oxcars and Bo'ness. The data was provided by Marine Scotland to ERM and is published in the 2022 BPEO report for the Port of Grangemouth maintenance dredge.

Table 6-1: Average Metals and PCBs from Nearby Disposal Grounds in Firth of Forth and Proposed Dredge Area (mg/kg)[1]

Site Name	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn	PCBs ICES 7
Oxcars 2015	15.7	0.3	79.6	41.6	1.0	35.8	78.1	141.7	0.008
Bo'ness 2015	18.6	0.1	59.6	26.5	0.7	27.5	54.2	114.0	0.000
East Ness Berth	12.4	0.17	32.6	27.3	0.37	22.93	44.9	128.7	0.015

Note: blue highlight shows exceedances above RAL1.

Table 6-1 shows that the average concentrations of metals and PCBs in samples collected from the proposed dredge area are comparable, and in most cases lower than, the concentrations recorded in the nearby disposal sites.

Further consideration of the potential risks associated with the proposed disposal with regards to the water environment is considered in the following sections.

[1] Disposal site data obtained from Marine Scotland, as published in Table A2.1 of *Port of Grangemouth Maintenance Dredge Spoil Disposal License Application 2022 – Best Practicable Environmental Option Report 2022*, ERM Report 0.352017
https://marine.gov.scot/sites/default/files/best_practicable_environmental_option_report.pdf

6.5 Water Framework Directive Assessment

As outlined in the Water Framework Directive Assessment: estuarine and coastal waters guidance (Environment Agency, 2017), there are several key receptors which can be impacted upon including the following:

- Hydromorphology;
- Biology – habitats;
- Biology – fish;
- Water quality; and
- Protected areas

Each of these points are considered in Table 6-2 below, in the context of disposal of dredged material at one of the Oxcars licenced disposal sites.

Table 6-2: Receptor Risk Assessment

Key Receptor[2]	Brief Summary of Potential Effects on Receptor	Further Consideration Required?	Comment
Hydromorphology (Source Area and Disposal Site)	Morphological conditions, for example depth variation, the seabed and intertidal zone structure tidal patterns, for example dominant currents, freshwater flow and wave exposure	No	The East Ness Berth dredge site is located within the Lower Forth Estuary coastal water body (ID: 200435), which is classified as having a "Good" overall status and a classification of "Good" for hydromorphology[3]. Part of the proposed dredge area is located within the Firth of Forth SSSI, SPA and Ramsar sites. These classifications are protective of bird populations as opposed to morphological features. No further assessment considered necessary. The Oxcars Ext B disposal site is located within the Kinghorn to Leith Docks coastal water body (ID: 200041), which has an overall classification status of "Good", and a classification of "Good" for hydromorphology. The classification of this water body takes into account the presence of the disposal site, so no further assessment is considered to be required.
Biology - habitats	Included to assess potential impacts to sensitive/high value habitats.	Yes	The dredge area and disposal areas are noted to have a classification for overall ecology of "Good". The Lower Forth Estuary (covering the dredge area) has a classification of "High" for invertebrates. A "Good" classification for invertebrates is noted for the disposal site. Both the dredge and disposal sites are located within designated protected areas for their bird populations. Further consideration is given to these below.

[2] https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters
[3] https://www.sepa.org.uk/data-visualisation/water-classification-hub/

Key Receptor[2]	Brief Summary of Potential Effects on Receptor	Further Consideration Required?	Comment
Biology – fish	Consideration of fish both within the estuary and also potential effects on migratory fish in transit through the estuary	No	The Lower Forth Estuary (covering the dredge area) has a classification of "Good" for fish. The Keithing Burn (which flows into Inverkeithing Harbour) has a classification of "High" for fish and fish barriers. The small scale of the works proposed, which are to be undertaken in an industrial area mean that significant impacts on fish are considered unlikely. The harbour is an active site, so activities are ongoing on a daily basis. The works will not affect the migration of fish within the wider estuary as they are contained largely within the confines of the harbour and sea deposit is limited to a small volume of material. Considering the width of the estuary at the point of dredge and deposit site, fish will have plenty of scope to avoid the works and continue their migration unhindered. The Kinghorn to Leith Docks water body (covering the disposal site) does not have a classification for fish and is located in the wider Forth estuary with no obvious constraints. The establishment of the disposal site will have considered the potential presence of fish in the estuary. No further assessment is considered necessary.
Water Quality	Consideration must be given to water quality when contaminants are present in exceedance of CEFAS RAL1.	Yes	Both the dredge and disposal sites have a water quality classification status of "Good" and a classification of "Pass" for Specific Pollutants. A number of sediment samples recorded results in exceedance of CEFAS RAL1. Potential effects are considered to be both localised and temporary. Further consideration of potential effects are discussed in section 6.6.1 for completeness.

Key Receptor[2]	Brief Summary of Potential Effects on Receptor	Further Consideration Required?	Comment
Protected Areas	If your activity is within 2km of any WFD protected area, include each identified area in your impact assessment. • special areas of conservation (SAC) • special protection areas (SPA) • shellfish waters • bathing waters • nutrient sensitive areas	Yes	The proposed dredge area is partially covered by the Firth of Forth Site of Special Scientific Interest (SSSI), Special Protection Area (SPA and Ramsar sites. The Oxcars Ext B disposal site is located within the *Forth Islands* and *Outer Firth of Forth and St Andrews Bay Complex* SPAs. The are no designated bathing waters within 2km of the proposed dredge or disposal sites. There are no shellfish harvesting waters within 2km of either the dredge or disposal sites. Further discussion with regard to protected areas is given in Section 6.6.2.

6.6 Potential Risk to Water Quality and Habitats/Protected Areas

The potential risks to water quality and habitats/protected areas at the dredge and disposal sites are further considered as all other receptors have been screened out of the assessment.

6.6.1 Water Quality

Both the dredge and disposal sites have a water quality classification status of “Good” and a classification of “Pass” for Specific Pollutants.

Although concentrations of some contaminants of concern were recorded above the RAL1 within the sediment for disposal, it is considered that these levels will not contribute to an overall degradation of water quality at the disposal site. While any effects are considered to be both localised and temporary, the potential for dilution in the open waters beyond the disposal site is considerable. The disposal site is assumed to be dispersive in nature. Additionally, when the sediment results are reviewed as an average to assess all of the dredged sediment as a single unit for disposal, then RAL1 is exceeded only for mercury, total hydrocarbons and marginally for most PAHs. Averaged concentrations exceeded the BAC for several metals and PAHs. The BAC is intended to be used to determine if concentrations are near to background concentrations, rather than qualify any potential environmental impact. It should also be noted that the BACs for PAH and some metals are generally lower than the Marine Scotland RAL1, therefore it is considered to be a very conservative assessment criterion. No sediment results were recorded in exceedance of RAL2. Averaged concentrations did not record any exceedances of the PEL, which is primarily protective of marine life.

In addition, PAHs and hydrocarbons are hydrophobic with low aqueous solubility and will naturally remain associated with organic sediment fractions, rather than become dissolved within the water column. On this basis, the risks associated with impact to water quality from chemical contaminants in sediment are considered to be low, with the associated dilution potential providing further mitigation.

The key risk to water quality is considered to be an increase in turbidity/suspended solids during the disposal activity (*i.e.* placement on the seabed at the Oxcars disposal site). Although this is likely to cause localised increase in suspended solids at the disposal site, it is considered that this will be both local and temporary in nature.

The sediment material primarily comprises sand and silt and negligible quantities of gravel. Table 6-3 summarises the average physical sediment type from all three samples from the dredge area.

Table 6-3: Averaged PSA Data for Dredge Area

Gravel % (>2 mm)	Sand % (>63 µm<2 mm)	Silt % (<63 µm)
9.81	25.33	65.53

The dominant grain size in the material to be dredged is silt, with a lesser quantity of sand. Sands and gravel will fall from suspension quickly, along with any clumps of cohesive material. Silts and clays, being finer grained will suspend and have the potential for dispersal due to longer times in suspension, however it is expected that the majority will quickly fall quickly to the seabed. It is assumed that the Oxcars disposal sites will have been utilised to dispose of similar fine-grained sediments from other dredging projects undertaken previously in the Firth of Forth and the SEPA water quality classification remains as “good” since 2014. As a result, it is considered unlikely that this dredging campaign will result in a change in the classification status of coastal water bodies at both the dredge and disposal sites.

6.6.2 Protected Areas

The following section gives further discussion on each of the designated protected areas that have been identified within 2km of the dredge and disposal areas.

The dredge area partially overlaps with the following designated areas (as shown in Drawing No. 779424-GIS002 in Appendix A):

- Firth of Forth SPA;
- Firth of Forth SSSI; and
- Firth of Forth Ramsar.

The Oxcars Extension B disposal site is located within the following designated areas:

- Forth Islands SPA; and
- Outer Firth of Forth and St Andrews Bay Complex SPA.

All of the above features are designated for their bird populations.

The NatureScot Area Operations Officer was consulted prior to the sediment sampling works being undertaken, who provided the following advice in email correspondence to EnviroCentre dated 13th March 2024. It is noted that this was provided in the context of the sediment sampling works and not for the dredge and disposal works, but the advice notes that the sites are protected largely for non-breeding wintering birds.

> *"The proposed work is directly adjacent to the Firth of Forth SSSI, SPA and RAMSAR. The Firth of Forth protected sites are largely designated for non-breeding wintering birds, therefore your proposed sampling work is scheduled when the lowest number of qualifying interest birds will be present. Of the relevant breeding species, all are wide-ranging and able to access a wide area over which to forage. Most occur in greater numbers further offshore than where the samples are proposed to be taken and if disturbed by the proposed activities they will be able to compensate by moving to another area. Therefore, we anticipate one vessel will not have a disturbance impact on these seabird species."*

The Conservation and Management Advice document for the Outer Firth of Forth and St Andrews Bay Complex SPA[4] (NatureScot, June 2022) gives specific advice for capital and maintenance dredging, and is reproduced below:

> *"No additional management for existing maintenance dredging (ports and harbours).*
>
> *Reduce or limit pressures (disturbance, damage of supporting habitat) associated with new capital dredging projects and associated maintenance dredging through appropriate mitigation such as:*
>
> - *spatial limitations to avoid damaging supporting habitat within foraging dive ranges of protected features and/or;*
> - *seasonal restrictions."*

Given that industrial activities are already undertaken in Inverkeithing Harbour, it is considered that that the dredging works will not result in significant disturbance for wintering birds, beyond what is

[4] https://sitelink.nature.scot/site/10478

already experienced during normal harbour operations. The requirement for any mitigation, however, will be determined by NatureScot during the statutory consultation process should it be considered necessary.

7 BPEO CONCLUSIONS AND RECOMMENDATIONS

Cameron Planning, acting on behalf of Forth Bridge Stevedoring Ltd appointed EnviroCentre Ltd. to complete a Marine Licence application and BPEO assessment for dredging at East Ness Berth in Inverkeithing. This has been informed using sediment quality results from sampling undertaken in June 2024.

The proposed dredge depth will not exceed 1 metre and is intended to bring the bed level in the berth and approaches to -0.2m bCD (below Chart Datum). A maximum quantity of 3,000m^3 is proposed to be dredged across the area shown in Drawing No.779424-GIS002 in Appendix A. It is understood that this would be considered a capital dredge (i.e. no dredging has been undertaken on site in the last seven years).

Results from analysis of sediment samples from across the harbour recorded copper, mercury, lead, zinc, PAHs and total hydrocarbons in exceedance of RAL 1. One marginal exceedance above RAL1 for PCBs was also recorded. However, assessment of key receptors identified from the Water Framework Directive assessment for estuarine and coastal waters concluded that there is a low risk of the sediments impacting upon the overall ecological or chemical status upon disposal.

Based on the multiple lines of evidence approach adopted to further assess the exceedances identified in the sediment assessment, the material as a whole is considered to be suitable for disposal at sea, at the Oxcars Extension B (FO043) licenced disposal site.

This option is considered to have no significant long-term impact on the marine environment due to the nature of the dredged material and relatively small volume.

REFERENCES

Environment Agency (2017). Water Framework Directive assessment: estuarine and coastal waters. https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters

Marine Scotland (2017). Pre-Dredge Sampling Guidance Version 2: Scottish Government.

Marine Scotland (2015). Guidance for Marine Licence Applicants Version 2: Scottish Government.

APPENDICES

A FIGURES

313500

313600

682200

682100

East Ness

Slip

East Ness Berth

56°1'30"N

Grab A

Grab B

Grab C

Berth box:
85m x 15m

Fl.R.3s

Imagery Source: Bing Maps © 2024 TomTom, © OpenStreetMap, © Vexcel Imaging
Chart Shown: Forth Ports, Firth of Forth, Inverkeithing Harbour (Ref. 400-405-004A_20230207_InverkeithingHarbour_Bathy_A1_1250), provided by client.
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Legend

- Dredge Area
- Sample Stations
- Protected Area

Notes
1. "Protected Area" marked on map refers to:
 - Firth of Forth SSSI
 - Firth of Forth SPA
 - Firth of Forth Ramsar

Do not scale this map

Client
Forth Bridge Stevedoring Ltd.

Project
East Ness Berth, Inverkeithing
Pre-Dredge Sediment Sampling

Title
Dredge Area and Sample Stations

Status
Final

Drawing No.	Revision	Date
779424-GIS002	-	30 May 2024
Drawn	**Checked**	**Approved**
FR	CCAS	CCAS

Scale
1:750 @ A3

Rev	Date	Amendment	Initials
-	-	-	-

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Edinburgh Park, Edinburgh, EH12 9DT. T: 0131 516 2652
E: info@envirocentre.co.uk W: www.envirocentre.co.uk

315000

320000

685000

680000

Oxcars Ext B (FO043)

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Legend

- Dredge Area
- Disposal Site Centre
- Disposal Site Extent

Do not scale this map

Client
Forth Bridge Stevedoring Ltd.

Project
East Ness Berth, Inverkeithing
Pre-Dredge Sediment Sampling

Title
Dredge Area and Disposal Site

Status
Final

Drawing No.	Revision	Date
779424-GIS003	-	30 May 2024
Drawn	**Checked**	**Approved**
FR	CCAS	CCAS

Scale
1:25,000 @ A3

Rev	Date	Amendment	Initials
-	-	-	-

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B SEDIMENT SAMPLE LOGS

envirocentre 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	**Project Name**	East Ness, Inverkeithing	**Location ID**
	Project No.	779424	**Grab A**
	Client	Forth Bridge Stevedoring Ltd.	

GRAB SAMPLE LOG

Date/Time	04/04/2024 10:25am	**Latitude**	56° 1.472709
Dredge Area	-	**Longitude**	-3° 23.366883
Method	0.045m² Van Veen Grab Sampler	**Sampled/logged by**	MMF

Remarks: Very soft dark grey/brown slightly sandy silt with fine gravel. Several twigs within sample.

Biota: Single live brown crab.

Odours: None noted.

Anthropogenic Inputs: None noted

Notes: -

envirocentre 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	**Project Name**	East Ness, Inverkeithing	**Location ID**
	Project No.	779424	**Grab B**
	Client	Forth Bridge Stevedoring Ltd.	

GRAB SAMPLE LOG

Date/Time	04/04/2024 10:35am	**Latitude**	56° 1.467229
Dredge Area	-	**Longitude**	-3° 23.319488
Method	0.045m² Van Veen Grab Sampler	**Sampled/logged by**	MMF

Remarks: Soft dark grey/brown silty sand with fine angular gravel and frequent fine shell fragments.

Biota: None noted.

Odours: None noted.

Anthropogenic Inputs: None noted.

Notes: -

envirocentre 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	**Project Name**	East Ness, Inverkeithing	**Location ID**
	Project No.	779424	**Grab C**
	Client	Forth Bridge Stevedoring Ltd.	

GRAB SAMPLE LOG

Date/Time	04/04/2024 10:42am	**Latitude**	56° 1.468329
Dredge Area	-	**Longitude**	-3° 23.271330
Method	0.045m² Van Veen Grab Sampler	**Sampled/logged by**	MMF

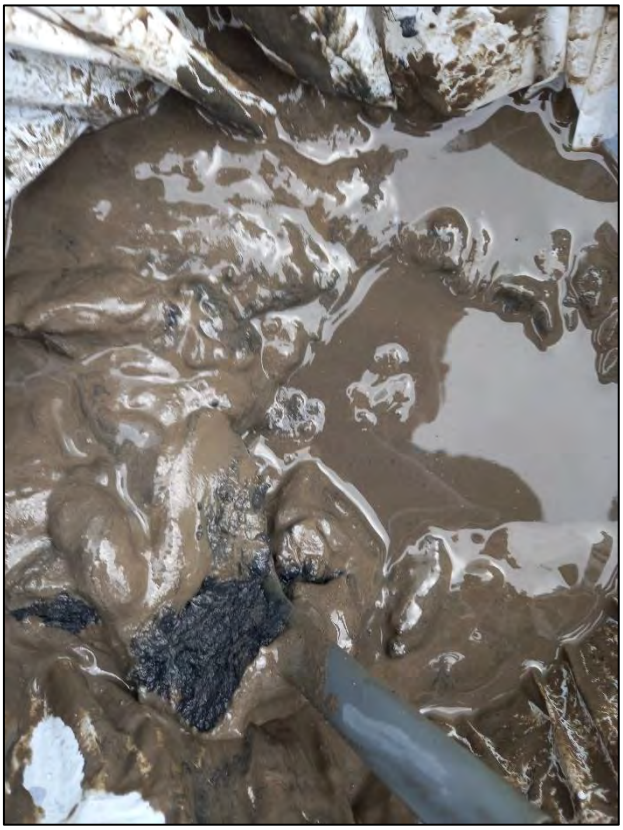
Remarks: Soft brown silty sand with frequent lenses of firmer black silt and several fine shell fragments.

Biota: None noted.

Odours: None noted.

Anthropogenic Inputs: None noted.

Notes: -



C SUMMARY TABLES

Summary Table A

Sampling Results Incorporated with BPEO Assessment (mg/kg)

						East Ness Berth									
	AL1	AL2	BAC	ERL	PEL										
Source			CSEMP	CSEMP	Canada	GRAB A	GRAB B	GRAB C	Max	AVERAGE	No. Exceed RAL 1	No. Exceed RAL 2	No.Exceed BAC?	No. Exceed ERL	No. Exceed PEL?
Arsenic	20	70	25		41.6	15.9	8.4	12.8	15.9	12.37	0	0	0	N/A	0
Cadmium	0.4	4	0.31	1.2	4.2	0.16	0.15	0.2	0.2	0.17	0	0	0	0	0
Chromium	50	370	81	81	160	33.1	23.8	40.8	40.8	32.57	0	0	0	0	0
Copper	30	300	27	34	108	23.7	27	31.2	31.2	27.30	1	0	2	0	0
Mercury	0.25	1.5	0.07	0.15	0.7	0.36	0.24	0.52	0.52	0.37	2	0	3	3	0
Nickel	30	150	36	-	-	24.3	18.7	25.8	25.8	22.93	0	0	0	N/A	N/A
Lead	50	400	38	47	112	44.6	33.6	56.5	56.5	44.90	1	0	2	1	0
Zinc	130	600	122	150	271	116	137	133	137	128.67	2	0	2	0	0
Napthalene	0.1		0.08	0.16	0.391	0.198	0.15	0.265	0.265	0.20	3	N/A	3	2	0
Acenaphthylene	0.1		-	-	0.128	0.0667	0.0448	0.0766	0.0766	0.06	0	N/A	N/A	N/A	0
Acenaphthene	0.1		-	-	0.0889	0.0636	0.0408	0.0721	0.0721	0.06	0	N/A	N/A	N/A	0
Fluorene	0.1		-	-	0.144	0.0881	0.0828	0.135	0.135	0.10	1	N/A	N/A	N/A	0
Phenanthrene	0.1		0.032	0.24	0.544	0.324	0.328	0.627	0.627	0.43	3	N/A	3	3	1
Anthracene	0.1		0.05	0.085	0.245	0.153	0.146	0.238	0.238	0.18	3	N/A	3	3	0
Fluoranthene	0.1		0.039	0.6	1.494	0.0881	0.0828	0.135	0.135	0.10	1	N/A	3	0	0
Pyrene	0.1		0.024	0.665	1.398	0.807	0.622	0.853	0.853	0.76	3	N/A	3	2	0
Benzo(a)anthracene	0.1		0.016	0.261	0.693	0.315	0.213	0.379	0.379	0.30	3	N/A	3	2	0
Chrysene	0.1		0.02	0.384	0.846	0.407	0.247	0.409	0.409	0.35	3	N/A	3	2	0
Benzo(b)fluoranthene	0.1		-	-	-	0.422	0.245	0.451	0.451	0.37	3	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	0.1		-	-	-	0.28	0.215	0.378	0.378	0.29	3	N/A	N/A	N/A	N/A
Benzo(a)pyrene	0.1		0.03	0.384	0.763	0.346	0.252	0.535	0.535	0.38	3	N/A	3	1	0
Indeno(1,2,3cd)pyrene	0.1		0.103	0.24	-	0.203	0.143	0.296	0.296	0.21	3	N/A	3	1	N/A
Benzo(ghi)perylene	0.1		0.08	0.085	-	0.285	0.189	0.43	0.43	0.30	3	N/A	3	3	N/A
Dibenzo(a,h)anthracene	0.01		-	-	0.135	0.0402	0.0322	0.069	0.069	0.05	3	N/A	N/A	N/A	0
TPH	100		-	-	-	478	294	415	478	395.7	3	N/A	N/A	N/A	N/A
PCBs	0.02	0.18	-	-	0.189	0.01157	0.01005	0.023	0.023	0.0149	1	0	N/A	N/A	0
TBT	0.1	0.5	-	-	-	0.005	0.005	0.005	0.005	0.0050	0	0	N/A	N/A	N/A

Note: Underlined Values are <LOD. Values highlighted red are equal to or greater than AL1.

PEL Data Source: http://ceqg-rcqe.ccme.ca/en/index.html#void

Summary Table

East Ness Berth Average Concentrations
All units in mg/kg

	AL1	AL2	BAC	<ERL	PEL	Dredge Average	Exceed AL1?	Exceed AL2?	Exceed BAC?	Exceed ERL ?	Exceed PEL?
Source			CSEMP	CSEMP	Canada						
Arsenic	20	70	25	-	41.6	12.4	No	No	No	N/A	No
Cadmium	0.4	4	0.31	1.2	4.2	0.2	No	No	No	No	No
Chromium	50	370	81	81	160	32.6	No	No	No	No	No
Copper	30	300	27	34	108	27.3	No	No	**Yes**	No	No
Mercury	0.25	1.5	0.07	0.15	0.7	0.4	**Yes**	No	**Yes**	**Yes**	No
Nickel	30	150	36	-	-	22.9	No	No	No	N/A	N/A
Lead	50	400	38	47	112	44.9	No	No	**Yes**	No	No
Zinc	130	600	122	150	271	128.7	No	No	**Yes**	No	No
					-						
Napthalene	0.1	-	0.08	0.16	0.319	0.2	**Yes**	N/A	**Yes**	**Yes**	No
Acenaphthylene	0.1	-	-	-	0.128	0.1	No	N/A	N/A	N/A	No
Acenaphthene	0.1	-	-	-	0.0889	0.1	No	N/A	N/A	N/A	No
Fluorene	0.1	-	-	-	0.144	0.1	**Yes**	N/A	N/A	N/A	No
Phenanthrene	0.1	-	0.032	0.24	0.544	0.4	**Yes**	N/A	**Yes**	**Yes**	No
Anthracene	0.1	-	0.05	0.085	0.245	0.2	**Yes**	N/A	**Yes**	**Yes**	No
Fluoranthene	0.1	-	0.039	0.6	1.494	0.1	**Yes**	N/A	**Yes**	No	No
Pyrene	0.1	-	0.024	0.665	1.398	0.8	**Yes**	N/A	**Yes**	**Yes**	No
Benzo(a)anthracene	0.1	-	0.016	0.261	0.693	0.3	**Yes**	N/A	**Yes**	**Yes**	No
Chrysene	0.1	-	0.02	0.384	0.846	0.4	**Yes**	N/A	**Yes**	No	No
Benzo(b)fluoranthene	0.1	-	-	-	-	0.4	**Yes**	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	0.1	-	-	-	-	0.3	**Yes**	N/A	N/A	N/A	N/A
Benzo(a)pyrene	0.1	-	0.03	0.384	0.763	0.4	**Yes**	N/A	**Yes**	No	No
Indeno(1,2,3cd)pyrene	0.1	-	0.103	0.24	-	0.2	**Yes**	N/A	**Yes**	No	N/A
Benzo(ghi)perylene	0.1	-	0.08	0.085	-	0.3	**Yes**	N/A	**Yes**	**Yes**	N/A
Dibenzo(a,h)anthracene	0.01	-	-	-	0.135	0.0	**Yes**	N/A	N/A	N/A	No
TPH	100	-	-	-	-	395.7	**Yes**	N/A	N/A	N/A	N/A
PCBs	0.02	0.18	-	-	0.189	0.015	No	No	N/A	N/A	No
TBT	0.1	0.5	-	-	-	0.005	No	No	N/A	N/A	N/A

D LABORATORY CERTIFICATES

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID MAR02266

Issue Version: 1

Customer: Envirocentre, Craighall Business Park, 8 Eagle Street, Glasgow, G4 9XA

Customer Reference: 779424 - East Ness, Inverkeithing

Date Sampled: 04-Apr-24

Date Samples Received: 10-Apr-24

Test Report Date: 09-May-24

Condition of samples: Cold Satisfactory

Opinions and Interpretations expressed herein are outside the scope of our UKAS accreditaion
The results reported relate only to the sample tested
The results apply to the sample as received

JMColbourne

Authorised by: Jane Colbourne

Position: Customer Service Specialist

UKAS TESTING 1252

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR02266
Issue Version	1
Customer Reference	779424 - East Ness, Inverkeithing

		Units	%	%	%	%	%	N/A
		Method No	ASC/SOP/303	ASC/SOP/303	SUB_01*	SUB_01*	SUB_01*	SUB_02*
		Limit of Detection	0.2	0.2	N/A	N/A	N/A	N/A
		Accreditation	UKAS	UKAS	N	N	N	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Total Moisture @ 120°C**	**Total Solids**	**Gravel (>2mm)**	**Sand (63-2000 µm)**	**Silt (<63 µm)**	**Asbestos**
Grab A	MAR02266.001	Sediment	60.8	39.2	23.54	25.90	50.56	AM
Grab B	MAR02266.002	Sediment	44.4	55.6	3.88	30.80	65.31	NAIIS
Grab C	MAR02266.003	Sediment	55.9	44.1	0.00	19.28	80.72	NAIIS
		Reference Material (% Recovery)	N/A	N/A	N/A	N/A	N/A	N/A
		QC Blank	N/A	N/A	N/A	N/A	N/A	N/A

* See Report Notes

NAIIS - No Asbestos Identified In Sample

AM - Amosite (Thermal Insulation)

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR02266
Issue Version	1
Customer Reference	779424 - East Ness, Inverkeithing

		Units	% M/M
		Method No	WSLM59*
		Limit of Detection	0.02
		Accreditation	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**TOC**
Grab A	MAR02266.001	Sediment	15.3
Grab B	MAR02266.002	Sediment	2.18
Grab C	MAR02266.003	Sediment	3.94
		Reference Material (% Recovery)	107
		QC Blank	<0.02

* See Report Notes

NAIIS - No Asbestos Identified In Sample

AM - Amosite (Thermal Insulation)

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR02266
Issue Version	1
Customer Reference	779424 - East Ness, Inverkeithing

		Units	mg/Kg (Dry Weight)							
		Method No	ICPMSS*							
		Limit of Detection	0.5	0.04	0.5	0.5	0.01	0.5	0.5	2
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Mercury**	**Nickel**	**Lead**	**Zinc**
Grab A	MAR02266.001	Sediment	15.9	0.16	33.1	23.7	0.36	24.3	44.6	116
Grab B	MAR02266.002	Sediment	8.4	0.15	23.8	27.0	0.24	18.7	33.6	137
Grab C	MAR02266.003	Sediment	12.8	0.20	40.8	31.2	0.52	25.8	56.5	133
Certified Reference Material SETOC 768 (% Recovery)			92	96	101	97	99	103	98	98
QC Blank			<0.5	<0.04	<0.5	<0.5	<0.01	<0.5	<0.5	<2

* See Report Notes

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR02266
Issue Version	1
Customer Reference	779424 - East Ness, Inverkeithing

		Units	µg/Kg (Dry Weight)	
		Method No	ASC/SOP/301	
		Limit of Detection	1	1
		Accreditation	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Dibutyltin (DBT)**	**Tributyltin (TBT)**
Grab A	MAR02266.001	Sediment	<5	<5
Grab B	MAR02266.002	Sediment	10.2	<5
Grab C	MAR02266.003	Sediment	18.1	<5
Certified Reference Material BCR-646 (% Recovery)			123	108
QC Blank			<1	<1

* See Report Notes

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR02266
Issue Version	1
Customer Reference	779424 - East Ness, Inverkeithing

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**ACENAPTH**	**ACENAPHY**	**ANTHRACN**	**BAA**	**BAP**	**BBF**
Grab A	MAR02266.001	Sediment	63.6	66.7	153	315	346	422
Grab B	MAR02266.002	Sediment	40.8	44.8	146	213	252	245
Grab C	MAR02266.003	Sediment	72.1	76.6	238	379	535	451
Certified Reference Material Nist 1941b (% Recovery)			92	108	64	64	64	86
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries

~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.

As the method uses surrogate standards to correct for losses, the RM results are reported as percentage trueness, not recovery.

*See report notes

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Test Report ID	MAR02266
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		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**BENZGHIP**	**BKF***	**CHRYSENE ***	**DBENZAH**	**FLUORANT**	**FLUORENE**
Grab A	MAR02266.001	Sediment	285	280	407	40.2	760	88.1
Grab B	MAR02266.002	Sediment	189	215	247	32.2	548	82.8
Grab C	MAR02266.003	Sediment	430	378	409	69.0	740	135
Certified Reference Material Nist 1941b (% Recovery)			63	81	84	90	78	58
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries

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As the method uses surrogate standards to correct for losses, the RM results are reported as percentage trueness, not recovery.

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Test Report ID MAR02266
Issue Version 1
Customer Reference 779424 - East Ness, Inverkeithing

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/306
		Limit of Detection	1	1	1	1	100
		Accreditation	UKAS	UKAS	UKAS	UKAS	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**INDPYR**	**NAPTH**	**PHENANT**	**PYRENE**	**THC**
Grab A	MAR02266.001	Sediment	203	198	324	807	478000
Grab B	MAR02266.002	Sediment	143	150	328	622	294000
Grab C	MAR02266.003	Sediment	296	265	627	853	415000
Certified Reference Material Nist 1941b (% Recovery)			55	56	73	67	92~
QC Blank			<1	<1	<1	<1	<100

For full analyte name see method summaries
~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.
As the method uses surrogate standards to correct for losses, the RM results are reported as percentage trueness, not recovery.
*See report notes

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Test Report ID	MAR02266
Issue Version	1
Customer Reference	779424 - East Ness, Inverkeithing

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.08	0.08	0.08	0.08	0.08	0.08	0.08
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS	N*
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB28**	**PCB52**	**PCB101**	**PCB118**	**PCB138**	**PCB153**	**PCB180**
Grab A	MAR02266.001	Sediment	2.60	1.50	1.41	1.75	1.54	1.89	0.88
Grab B	MAR02266.002	Sediment	1.83	1.27	1.49	1.53	1.38	1.79	0.76
Grab C	MAR02266.003	Sediment	4.44	3.01	2.89	3.05	3.16	4.07	2.38
Certified Reference Material Nist 1941b (% Recovery)			82	105	102	118	90	105	100
QC Blank			<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08

For full analyte name see method summaries

~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.

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Test Report ID MAR02266
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Customer Reference 779424 - East Ness, Inverkeithing

REPORT NOTES

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
WSLM59*	MAR02266.001-003	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
ICPMSS*	MAR02266.001-003	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
SUB_01*	MAR02266.001-003	Analysis was conducted by an approved subcontracted laboratory.
SUB_02*	MAR02266.001-003	Analysis was conducted by an approved subcontracted laboratory.
ASC/SOP/301	MAR02266.001-003	The matrix of this sample has been found to interfere with the result for this test. The sample has therefore been diluted, but in doing so, the detection limit for this test has been elevated.
ASC/SOP/302	MAR02266.001-003	The Primary process control data associated with this Test has not wholly met the requirements of the Laboratory Quality Management System QMS with one or more target analytes falling outside acceptable limits. The remaining data gives the Laboratory confidence that the test has performed satisfactorily and that the validity of the data may not have been significantly affected.However in line with our QMS policy we have removed accreditation, where applicable, from the affected analytes (PCB180) . These circumstances should be taken into consideration when utilising the data.
ASC/SOP/303/304	MAR02266.001-003	Benzo[k]fluoranthene is known to coelute with Benzo[j]fluoranthene and these peaks can not be resolved. It is believed Benzo[j]fluoranthene is present in these samples therefore it is suggested that the Benzo[k]fluoranthene results should be taken as a Benzo[k]fluoranthene (inc. Benzo[j]fluoranthene). Benzo[j]fluoranthene is not UKAS accredited. This should be taken into consideration when utilising the data.
ASC/SOP/303/304	MAR02266.001-003	Chrysene is known to coelute with Triphenylene and these peaks can not be resolved. It is believed Triphenylene is present in these samples therefore it is suggested that the Chrysene results should be taken as a Chrysene (inc. Triphenylene).This should be taken into consideration when utilising the data.

DEVIATING SAMPLE STATEMENT

Deviation Code	Deviation Definition	Sample ID	Deviation Details. The following information should be taken into consideration when using the data contained within this report
D1	Holding Time Exceeded	N/A	N/A
D2	Sample Contaminated through Damaged Packaging	N/A	N/A
D3	Sample Contaminated through Sampling	N/A	N/A
D4	Inappropriate Container/Packaging	N/A	N/A
D5	Damaged in Transit	N/A	N/A
D6	Insufficient Quantity of Sample	N/A	N/A
D7	Inappropriate Headspace	N/A	N/A
D8	Retained at Incorrect Temperature	N/A	N/A
D9	Lack of Date & Time of Sampling	N/A	N/A
D10	Insufficient Sample Details	N/A	N/A
D11	Sample integrity compromised or not suitable for analysis	N/A	N/A

Certificate of Analysis

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Method	Sample and Fraction Size	Method Summary
Total Solids	Wet Sediment	Calculation (100%-Moisture Content).Moisture content determined by drying a portion of the sample at 120°C to constant weight.
Particle Size Analysis	Wet Sediment	Wet and dry sieving followed by laser diffraction analysis.
Total Organic Carbon (TOC)	Air dried and ground	Carbonate removal and sulphurous acid/combustion at 1600°C/NDIR.
Metals	Air dried and seived to <63µm	Aqua-regia extraction followed by ICP analysis.
Organotins	Wet Sediment	Solvent extraction and derivatisation followed by GC-MS analysis.
Polyaromatic Hydrocarbons (PAH)	Wet Sediment	Solvent extraction and clean up followed by GC-MS analysis.
Total Hydrocarbon Content (THC)	Wet Sediment	Solvent extraction and clean up followed by GC-FID analysis.
Polychlorinated Biphenyls (PCBs)	Air dried and seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS analysis.

Analyte Definitions

Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name
ACENAPTH	Acenaphthene	C2N	C2-naphthalenes	THC	Total Hydrocarbon Content
ACENAPHY	Acenaphthylene	C3N	C3-naphthalenes	AHCH	alpha-Hexachlorcyclohexane
ANTHRACN	Anthracene	CHRYSENE	Chrysene	BHCH	beta-Hexachlorcyclohexane
BAA	Benzo[a]anthracene	DBENZAH	Dibenzo[ah]anthracene	GHCH	gamma-Hexachlorcyclohexane
BAP	Benzo[a]pyrene	FLUORANT	Fluoranthene	DIELDRIN	Dieldrin
BBF	Benzo[b]fluoranthene	FLUORENE	Fluorene	HCB	Hexachlorobenzene
BEP	Benzo[e]pyrene	INDPYR	Indeno[1,2,3-cd]pyrene	DDD	p,p'-Dichlorodiphenyldichloroethane
BENZGHIP	Benzo[ghi]perylene	NAPTH	Naphthalene	DDE	p,p'-Dichlorodiphenyldichloroethylene
BKF	Benzo[k]fluoranthene	PERYLENE	Perylene	DDT	p,p'-Dichlorodiphenyltrichloroethane
C1N	C1-naphthalenes	PHENANT	Phenanthrene		
C1PHEN	C1-phenanthrene	PYRENE	Pyrene		