Portsoy Harbours
Best Practicable Environmental Option (BPEO) Report

September 2023

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Contents

Appendices

Figures

Tables

1 INTRODUCTION

1.1 Background

Aberdeenshire Council has appointed EnviroCentre Ltd to complete a Marine Licence application for dredging at Portsoy Harbour in Aberdeenshire. 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 July 2023.

The site was previously licenced under MS-00008914, which expired on 3rd May 2022. As such, this project is considered to be a maintenance dredge. Previous dredging works were undertaken in the spring of 2021 with dredged material used to supply a beach nourishment project at the nearby Portsoy Beach.

Dredging is proposed in the Old and New Harbours. The proposed dredge depth will not exceed 1 metre in depth and a maximum volume of 3,000 m^3 will be dredged between both harbour areas.

The purpose of the sample analysis is to provide supporting information to Marine Scotland during the licensing process on sediment quality within the proposed dredge areas 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 2023 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 was undertaken on 21st July 2023. The following sections detail the sampling methodology used to retrieve sediment samples, including details of the analytical suite.

2.1 Sample Locations

Samples were collected at location agreed in advance with Marine Scotland. The locations are outlined in Table 2-1:

Table 2-1: Sample Station Locations

Dredge Area	Sample Station ID	Latitude	Longitude
New Harbour	Sample A	57° 41.163’	-2° 41.331’
	Sample B	57° 41.156’	-2° 41.297’
	Sample C	57° 41.169’	-2° 41.327’
Old Harbour	Sample D	57° 41.085’	-2° 41.470’
	Sample E	57° 41.098’	-2° 41.465’
	Sample F	57° 41.116’	-2° 41.465’

Sample locations are shown on Drawing No. 374702-QGIS006 in Appendix A.

2.2 Sample Collection

Sampling was undertaken by the Harbourmaster under guidance from EnviroCentre.

The sediment to be dredged is often exposed at low tides. As such, sediment was sampled directly from the above locations on foot.

Samples were placed in the appropriate containers and dispatched to the project laboratory as soon as practically possible.

2.3 Analysis Requirements

The laboratory analysis required by Marine Scotland (MS-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 Socotec's Marine Laboratory for analysis, which holds UKAS accreditation.

3 RESULTS

Results of the July 2023 sediment analysis are detailed in the following section. Laboratory certificates are provided in Appendix B and summary tables highlighting exceedances above RALs are provided in Appendix C.

3.1 Physical Analysis

3.1.1 Particle Size Analysis (PSA)

The Particle Size Analysis data set for each sample is included within Appendix B.

Sediment across all sample locations predominantly comprised sand with a smaller quantity of silt sized particles and a negligible quantity of gravel. Average results of the Particle Size Analysis for each dredge area are given in Table 3-1.

Table 3-1: Average Particle Size Proportions by Dredge Area

Dredge Area	Gravel (>2mm) %	Sand (63-2000 µm) %	Silt (<63 µm) %
Old Harbour	1.8	95.1	3.1
New Harbour	0.1	97.8	2.2

3.2 Chemical Analysis

3.2.1 Chemical Analysis Assessment Criteria

All chemical analytical results were assessed against Revised Action Levels (RAL) criteria as adopted by Marine Scotland. The results are summarised in sections 3.2 and 3.3. Summary reports detailing exceedances in the Marine Scotland format have been submitted along with the supporting information for the application. Laboratory certificates are provided in Appendix B.

Where contaminants have RALs as adopted by Marine Scotland, recorded exceedances above these criteria are summarised in Table 3-2.

Table 3-2: Exceedances of Revised Action Levels

Contaminant	No. of Exceedances (of 6 samples)	
	RAL 1	RAL 2
Arsenic	0	0
Cadmium	0	0
Copper	0	0
Chromium	0	0
Lead	0	0
Mercury	0	0
Nickel	0	0
Zinc	0	0
PAH (All Species)	4	0

Contaminant	No. of Exceedances (of 6 samples)	
	RAL 1	RAL 2
PCBs	0	0
TBT	0	0
THC	0	0

Four exceedances were noted for one or more PAH species. There were no exceedances of the RALs for metals, PCBs, TBT or THC.

Parameters that exceeded RAL 1 are given for each sample location in Table 3-3.

Table 3-3: Exceedances above RAL 1 by Dredge Area and Sample Station

Dredge Area	Sample Station	Parameters Exceeding RAL 1
New Harbour	Sample A	PAH
	Sample B	PAH
	Sample C	PAH
Old Harbour	Sample D	-
	Sample E	PAH
	Sample F	-

3.3 Asbestos

Asbestos was not detected in any of the samples analysed.

3.4 Comparison with Previous Data

This section provides an assessment of the differences in the RAL1 exceedances recorded in 2023, against those recorded in 2020.

3.4.1 PAHs

Generally, an increased number of exceedances above RAL1 were recorded in samples from 2023, when compared to those recorded in 2020. The average concentration of PAHs recorded also increased. Changes are summarised in Table 3-4.

Table 3-4: PAH RAL1 Exceedances - 2020 vs. 2023

PAH Species	Exceedances (of 6 samples)		% Change	Avg. Conc. mg/kg (of 6 samples)		% Change
	2020	2023		2020	2023	
Naphthalene	0	1	∞	0.01	0.10	900
Acenaphthylene	0	0	-	0.01	0.02	100
Acenaphthene	0	0	-	0.003	0.01	233
Fluorene	0	1	∞	0.01	0.03	200
Phenanthrene	0	3	∞	0.06	0.18	200
Anthracene	0	1	∞	0.02	0.06	200
Fluoranthene	2	3	50	0.07	0.19	171

Pyrene	1	4	300	0.06	0.18	200
Benzo(a)anthracene	0	3	∞	0.03	0.09	200
Chrysene	0	3	∞	0.03	0.09	200
Benzo(b)fluoranthene	0	2	∞	0.03	0.07	133
Benzo(k)fluoranthene	0	2	∞	0.02	0.07	250
Benzo(a)pyrene	0	3	∞	0.03	0.10	233
Indeno(1,2,3cd)pyrene	0	1	∞	0.03	0.05	66
Benzo(ghi)perylene	0	1	∞	0.03	0.05	66
Dibenzo(a,h)anthracene	0	0	-	0.01	0.01	-

3.4.2 TBT

A single exceeded RAL1 in 2020 for TBT. There were no exceedances recorded in 2023.

3.4.3 Discussion

An increased number of exceedances for PAHs was recorded in the 2023 samples when compared to the 2020 analytical data. The averaged concentrations were also noted to have increased.

The samples collected in 2020 and 2023 were collected from different sampling locations, within the same dredge area, therefore it is not wholly appropriate to make a direct comparison between the two sets of data. In addition, the harbours have both dredged between the two sampling campaigns, therefore different bodies of sediment have been sampled and analysed.

PAHs will typically associate themselves with the organic matter within the sediment. On reviewing the average Total Organic Carbon (TOC) content between the two sampling campaigns (see Table 3-5), a 48% increase was noted. Given that the organic matter content within samples is higher in 2023 than in 2020, this is likely to explain (at least in part) the increase in PAH exceedances and concentrations.

Table 3-5: Average Total Organic Carbon (TOC) - 2020 vs. 2023

TOC (%)		% Change
2020	**2023**	
0.92	1.37	48

4 DISCUSSION OF AVAILABLE DISPOSAL OPTIONS

The BPEO process is geared towards identifying a preferred overall strategy from the perspective of the environment as a whole, as opposed to detailed optimisation of any one selected scheme. It is a structured and systematic process to identify and compare strategic options in a 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 BPEO are:

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

Further details on methodology are provided within each section.

4.1 Portsoy Harbours Access/Tidal Constraints

Before different dredge/disposal options are considered in the BPEO, it should be noted that the Portsoy Harbours have constrained access for vessels and marine-based plant. At low tide, water depth will be insufficient for most vessels and a significant proportion of both the Old and New Harbours dry out completely.

In addition, the tight bend required to navigate into the harbour (particularly the Old Harbour) may also be challenging/restrictive for some larger vessels, including dredgers, barges and spud leg pontoons commonly used in dredging activities.

As a result, the harbour access and use is typically restricted to small recreational/leisure craft.

4.2 Identification and Screening 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 the harbours, specifically for the Scottish Traditional Boat Festival held annually in Portsoy.	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 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	Much of the Aberdeenshire and Moray coast are designated sites (SSSI, SPA) and hold both national and international importance to nature conservation. Specific beach nourishment projects may require 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. The harbour authority (Aberdeenshire Council) have expressed an interest in the possibility of using the dredged material for a beach nourishment project on Portsoy beach. The dredge material predominantly comprises sand, which is likely to be considered suitable for beach nourishment. The previous Marine Licence permitted the use of dredged materials for a beach nourishment project and was successfully undertaken during 2021.	Yes

	Pumping or placement on to intertidal zone	This method would involve the mixing of dredged sediment with water on land before jetting the slurry on to nearby rocks for dispersal at high tide. Alternatively, it could be placed by long arm excavator on to the intertidal zone for dispersal. Minimal transportation would be required between the dredge site and disposal site. However, there may be temporary and localised impacts to water quality and local amenity associated with this process. It is understood that this practice has been undertaken and accepted historically, but Aberdeenshire Council investigated this option as a potential disposal route in recent years but concluded that the associated plant costs and logistical challenges meant that it was unlikely to be a viable option.	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.	Yes
	Land Incineration	The dredged material consists of non-combustible material (silts, sands, gravels, shells) with a low combustible component.	No
	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	Material to be dredged predominantly comprises sand, which would be ideal for recycling. However, EnviroCentre have not been made aware by the harbour authority of an established disposal and reuse route in Aberdeenshire and Moray 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 grounds are Macduff (CR050) and Buckie (CR040), 13km east and 16km west respectively. The proposed dredge method is to utilise an excavator on land to dig sediment. As noted in Section 4.1, access constraints for marine plant are likely to limit the size of vessels and equipment which can safely enter and operate within the dredge area. 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

4.3 Summary of Identified BPEO Options

Following review of the available options, four options were identified for further detailed BPEO assessment which are as follows:

- Beach Nourishment;
- Landfill Disposal; and
- Sea Disposal.

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

4.3.1 Beach Nourishment

This method would involve the following material handling stages:

- Dredging (at low tide);
- Temporary stockpiling of material on land;
- Transfer of sediment on to wagon;
- Placement of sediment on beach; and
- Distribution/profiling of sediment by excavator.

It is anticipated that dredging will be undertaken using a long-arm excavator on land. The material will then be temporarily stockpiled before being transferred into a suitable wagon for transport to the beach site before it is then suitably distributed and profiled. Aberdeenshire Council have identified Portsoy Beach as a possible site for beach nourishment. There is potential for some temporary disruption to local residents as a result of the HGV movements.

4.3.2 Landfill Disposal

Dredged material is considered to be controlled waste for the purpose of transport, storage and disposal as per Section 34 (7) of the Environmental Protection Act 1990. The Landfill (Scotland) Regulations 2003 require the classification and characterisation (*i.e.* inert, non-hazardous or hazardous) of the dredged material to be determined prior to landfill acceptance.

Disposal to landfill would require several stages in material handling operations:

- Dredging (at low tide);
- Transfer to a dewatering facility or temporary storage until it had dried to a suitable moisture content for landfilling;
- Dewatering;
- Transfer of dewatered material to storage area for stockpiling;
- Loading of lorries and transport to landfill site; and
- Disposal at Landfill site.

Dredging is proposed to be undertaken using a long-arm excavator located on land. Therefore, bringing material on to land will be straightforward. The material would then require to be transferred to the dewatering facility.

The dewatering facility would most likely require to be purpose built and capable of receiving up to 3,000 m^3 of material. We understand that no facility currently exists in Aberdeenshire or Moray.

Settlement tanks, with the aid of sluices and rotational management, would allow solids to settle out and the water element drain off and return to the sea. Temporary mobilisation of bespoke mechanical dewatering equipment could also be utilised but at greater cost. Alternatively, the material could be temporarily stored until the material dried out, resulting in a reduced cost assuming that suitable temporary storage space is readily available. The dewatered dredged sediment would then be removed from the facility and stockpiled for transfer via lorry to a suitably licensed landfill. This is dependent on space being available close to the harbour and given the close proximity of residential housing to the harbour, it may be disruptive to the local community.

We understand that the type of vehicle most suitable for transporting the dewatered dredged material is either a rigid bodied tipper or an articulated tanker both with a 16-tonne load capacity. The dredge volume will be a maximum of ~6,000 tonnes[1] of material and approximately 375 return trips would typically be required to transport the dewatered dredged material to landfill.

It is understood that the closest operational landfill to the site is Nether Dallachy Landfill near Portgordon, approximately 17 miles from Portsoy by road. Approximately 375 return trips of 34 miles each would result in an approximate total of 12,750 miles of road transport to dispose of the sediment at this location. In addition, the available capacity of each site is limited by the amount of material it can receive per annum. Nether Dallachy Landfill is a non-hazardous landfill and given that space in non-hazardous landfill is limited, it is likely that municipal waste will be prioritised over sediment where other disposal methods are available. Therefore, in reality the sediment would most likely be sent to an inert landfill a greater distance from the site.

4.3.3 Sea disposal

Two licensed sea disposal sites are located within relatively close proximity of Portsoy – Macduff (CR050) and Buckie (CR040), 13km east and 16km west respectively.

Both harbours at Portsoy are relatively small and have a relatively shallow water depth. At low tide, a significant proportion of the harbours dry out completely. Larger vessels may also have difficulty safely navigating into the Old Harbour due to its tight bend. These constraints would restrict the size and type of marine plant that could feasibly be used for the dredging and disposal of sediment. As the harbours often dry out at low tide, a spud-leg or jack-up barge would most likely be required. In addition, associated split hopper barge and associated work boats may struggle to navigate in and out of the harbours safely.

Sea disposal is the traditionally accepted sediment disposal method which generally has a low cost and low environmental impact. However, the harbour access/tidal constraints may present additional logistical challenges at Portsoy for this method.

[1] Maximum volume of dredged material is 3,000m^3. Assumed 1m^3 = 2 tonnes.

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 each option taken forward for the detailed BPEO assessment:

Table 5-2: BPEO Strategic Assessment

Criteria	Beach Nourishment	Landfill	Sea Disposal
Operational Aspects (inc. handling and transport)	This method would involve road transport by HGV through the town to the beach site. Portsoy Beach has been identified as a potentially suitable site is approximately 500m east of the harbours by road. There may be a need for additional environmental assessments would put pressure on the project timescales if they are required.	Would involve double handling of material through dewatering and transportation to landfill. A facility would need to be built for dewatering purposes. Would also increase the number of HGV's on the road network.	Due to the access/tidal constraints of Portsoy Harbour, a spud-leg/jack-up barge would likely be required to accommodate dredged material. Specialist marine plant may not be available locally within the project timescales.
Availability of suitable sites/facilities	Aberdeenshire Council have identified Portsoy Beach as a possible site, approximately 500m east of the Old Harbour by road.	The geotechnical composition of the dewatered dredged material is considered to be suitable for disposal via this route. However, there are a limited number of landfills in the area. Moreover, there is typically a limit to the amount of waste that can be accepted both on a daily and annual basis at a landfill. Due to limited space at landfills, it is possible that municipal waste will be prioritised over dredge material where other disposal routes are available.	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 testing pending further risk assessment for contaminants present at levels between Action Level 1 and Action Level 2.
General Public /Local acceptability	The beach nourishment project is likely to be generally welcomed by the public, as it will be seen as a way of bolstering and protecting the beach from erosion. However, the HGV movements required may not be looked upon favourably.	Increased traffic/HGV movements on Portsoy's narrow streets have potential to result in public complaints.	Traditionally accepted disposal route for dredged material with limited public impact.

Criteria	Beach Nourishment	Landfill	Sea Disposal
Legislative Implications	This practice has been used in the previous dredging campaign. It would require prior agreement with Marine Scotland and the relevant department of Aberdeenshire Council.	Contravenes the principles of minimising waste and long-term commitments by the government to reduce landfilling.	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 detailed BPEO assessment.

Table 5-3: BPEO Environmental Assessment

Criteria	Beach Nourishment	Landfill	Sea Disposal
Safety Implications	HGV movements between the harbours and disposal site increase potential for accidents to occur. Work would be undertaken in accordance with H&S legislation.	Double handling of material increases the potential for accidents to occur. Work would be undertaken in accordance with H&S legislation.	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	Limited potential for human contact assuming that the public are excluded from the active work area. Some potential for dust release during beach profiling works (only if the sediment dries out).	Measures will be required to limit human contact during transfer of material from dredger to dewatering facility/stockpile and transportation to landfill. Security measures typically employed at licensed landfills which will minimise human contact once accepted and emplaced at site.	Low potential for human contact during dredging and disposal operations. Once deposited at disposal site pathways for human contact greatly reduced.

Criteria	Beach Nourishment	Landfill	Sea Disposal
Pollution/ contamination	HGVs transporting material to the beach site would have implication on carbon footprint and potential for local impact on air quality. Potential also for temporary noise impacts and dust release during profiling works (if sediment dries out).	Transfer to dewatering facility and transportation to landfill will all require significant energy. Road transport increases the carbon footprint of this disposal option and would result in localised reduction in air quality in Portsoy town centre. Potential for spillages to occur.	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. Access/tidal restrictions in harbour mean that specialist marine plant may have to be brought in from further afield, further increasing carbon footprint.
General Ecological Implications	Significant ecological implications are unlikely as a result of deposition of additional sand on the beach. The beach is part of the Cullen to Stake Ness SSSI. The key feature of note in the SSSI at Portsoy is the Dalradian metamorphic rocks, which are unlikely to be adversely impacted by sediment deposition.	Licensed landfill would be away from protected species and habitats with measures in place to prevent or minimise pollution of the surrounding environment.	Macduff and Buckie are licensed disposal sites for dredged material.

Criteria	Beach Nourishment	Landfill	Sea Disposal
Interference with other legitimate activities	Significant interference or disruption with other operations would not be anticipated. Recreational beach users would require to be excluded from the beach while works are undertaken.	Potential from limited short term local impact to residents and commercial operations in the area of the dredged material handling and road hauling principally related to noise and dust potential.	The Buckie and Macduff disposal sites are licenced disposal sites. It is likely that interference with other activities (such as commercial vessels or fishing) will have been considered as part of the licencing process. Therefore, the likelihood of significant disruption is considered to be low.
Amenity / Aesthetic Implications	Temporary visual impacts during sediment placement and beach profiling works but no long-term impacts. Some potential for odour emissions and noise impact although these impacts will be short term. A caravan park is adjacent to the beach. Amenity of beach likely to be improved once beach nourishment project is completed.	Potential for odour release from dewatering facility. Increase traffic noise during transportation from dewatering facility to landfill facility. Potential for spillages on haul route. No significant additional visual/ odour/noise effects as using existing landfill site.	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

Costs were assessed for each of the options taken forward for detailed BPEO assessment. The BPEO assessment considered the typical costs associated with dredging, transportation to the disposal site, construction of treatment facilities (where applicable) and methods employed to protect the environment for each of the identified options. As costs are generally "commercially sensitive" the rates are based on best estimates and experience within industry, as opposed to formal quotations.

For the purposes of comparing costs associated with each option a benchmark of 6,000 tonnes (approximately 3,000m^3) of dredged material has been set.

The assumptions to calculate the costs are as follows:

- Dredging costs are estimated to be £3.21 per m^3;
- Ship transportation costs from the dredged area to disposal / transfer site have been calculated based on £4 per tonne;
- Due to the relatively small volume, and anticipated free draining nature of the material, i.e. sand, no cost has been included for the establishment and operation of a dewatering facility. It has been assumed that dewatering would be undertaken by temporary storage of sediment until it dried out;
- Costs associated with transfer of dewatered material to lorry are based on a wheeled shovel (costing £47 per hour) operating for 2 hours per day for 4 days (although a minimum hire charge may make this cost higher);
- Transportation costs of dewatered material to landfill are estimated to be £4.85 per tonne;
- To transport sediment from the harbour to the beach (for beach nourishment), it is anticipated that this would use a 26 tonne wagon and it is estimated that 231 return trips (0.7 mile round trip) would be required to transport 6,000 tonnes of material. The cost is assumed to be approximately £5,000.
- Landfill gate fees are estimated to be £30 per tonne for a non-hazardous landfill (Note: dredged material is currently exempt from landfill tax as defined in Section 7 of the Landfill Tax (Scotland) Act 2014[2]);
- The cost associated with the establishment and running of hopper and pump system for pumping the benchmark quantity of sediment has been estimated at £15,000; and
- The cost for an excavator to distribute sediment and profile the beach following placement of sediment has been assumed as £450 per day for 5 days.

Table 5-4 provides details on the Cost assessment for each option taken forward for detailed BPEO assessment:

[2] https://www.revenue.scot/scottish-landfill-tax/guidance/slft-legislation-guidance/whether-tax-payable/slft3005/slft3006

Table 5-4: BPEO Cost Analysis (based on 6,000 tonnes)

Activity	Beach Nourishment (£)	Landfill Disposal (£)	Sea Disposal (£)
Dredging	9,630	9,630	9,630
Mobilisation of Marine Plant for Sea Disposal	-	-	15,000
Transport by vessel to disposal site	-	-	24,000
Transfer of material to lorry	376	376	-
Transportation Cost to Landfill	-	29,100	-
Transportation Cost to Beach	5,000	-	-
Landfill Gate Fee	-	180,000	-
Establishment and running of hopper and pump system	-	-	-
Excavator for beach profiling works	2,250	-	-
Total Costs	**17,256**	**219,106**	**48,630**

Note that the above costs do not take into account the cost of additional environmental assessments, or cost associated with gaining planning or licensing consents or potentially to purchase land (where applicable). They also do not take account of the influence volumes will have on costs (economies of scale).

5.1.4 BPEO Assessment Discussion

For each of the above assessment criteria, the options were qualitatively and semi-quantitatively (for costs) assessed against feasibility/preference and awarded a ranking ranging from 1 to 4; 1 being the most acceptable and 4 being the least acceptable option. The assignment of rank was on the basis of professional judgement.

The individual assessment criteria rankings for each option were added up to give an overall hierarchy of preference. Table 5-5 provides a summary of the BPEO assessment.

Table 5-5: BPEO Summary

Criteria	Beach Nourishment	Landfill Disposal	Sea Disposal
Environment	2	4	2
Strategic	2	4	3
Costs	1	4	3
TOTAL SCORE	**5**	**12**	**8**

Disposal to landfill is considered to be the least suitable option for the dredged material. It contravenes the principles of minimising waste and reducing landfilling. Several stages in material handling operations would be required to dispose of the material by this route. The cost associated with transport and disposal of the dredged material is significant. Transportation of material by road is also

undesirable as a result of increased traffic and the potential for accidental spillages. Landfill capacity is also typically limited.

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. Pollutant concentrations within sediments are also limited to acceptable levels through regulatory requirements. However, given the aforementioned navigational, water depth and tidal constraints at Portsoy, then this option becomes strategically very challenging as standard dredging plant is unlikely to be able to gain access to the harbours. Specialist marine plant (if available) would likely to be brought in by road and it is unclear whether this could be achieved within the project timescales and budget.

Aberdeenshire Council have identified Portsoy Beach as a possible disposal location for the sediment as part of a beach nourishment project. This practice was undertaken during the previous dredging campaign in 2021. Beach nourishment has been assessed as the most cost-effective option. It is also the strategically preferred option, although it would require approximately 230 return trips by HGV between the harbour and the beach. However, the use of locally dredged materials to supply a beach nourishment is preferable than importing sand from further afield. This disposal route has been assessed as the preferred disposal method.

It is considered that beach nourishment is the preferred option for dredging disposal. The main reason for this is that use of dredged sediment on the beach is considered to be more in keeping with the spirit of ‘beneficial re-use’ of dredgings, as opposed to disposing sediment either at sea or at landfill. The preference of beneficial re-use of dredged materials over disposal where possible is also stated in the OSPAR dredging guidelines.

5.2 Conclusion

The Best Practicable Environmental Option for disposal of the Portsoy Harbour dredged material has therefore been assessed as re-use of sediment to facilitate a beach nourishment project at the nearby Portsoy Beach.

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/water-framework-directive-assessment-estuarine-and-coastal-waters). The conclusions drawn from the available information will provide a recommendation on proposed disposal routes.

6.1 Dredge and Disposal Site

The dredge is to be undertaken within the two Portsoy Harbours – “Old Harbour” and “New Harbour”. Dredged material is proposed to be taken to the nearby Portsoy Beach to facilitate a beach nourishment project. The beach is located approximately 190m to the south-west of the New Harbour.

The dredge and proposed disposal area (i.e. receiving beach) are shown on Drawing No. 374702-QGIS004 in Appendix A.

6.2 Analytical Data Review

Existing 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:

- PAHs – 4 of 6 samples recorded at least one PAH species above RAL1.

6.2.2 Action Level 2

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

6.2.3 BAC Review

Exceedances of the BAC can be summarised as follows:

- PAHs – 4 of 6 samples recorded at least one PAH species above the BAC.

6.2.4 ERL & PEL Review

Exceedances of the ERL & PEL can be summarised as follows:

- PAHs – 1 of 6 samples recorded at least one PAH species above the ERL and PEL.

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 exceeded RAL1 for one or more PAH species;
- Averaged concentrations exceeded the BAC for one or more PAH species;
- All samples recorded averaged concentrations below the ERL where one is available;

6.4 All samples recorded averaged concentrations below the PEL where one is available. Chemical Assessment Conclusions

Four of six samples recorded exceedances of RAL1 for PAHs. The majority of exceedances are noted to be marginal. No samples recorded contaminant levels in exceedance of RAL2. Averaged concentrations which consider the dredge as a single volume for disposal also exceeded RAL1 for one or more PAH species.

A number of exceedances of the BAC were noted for one or more PAH species. Averaged concentrations also exceeded the BAC for one or more PAH species.

One individual sample recorded concentrations for one or more PAH species in exceedance of the ERl and PEL, though no exceedance of averaged concentrations were.

No background chemical data for the proposed disposal site is available for review, therefore a comparison between sediment sample results and disposal site data cannot be made.

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

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 6-1 below, in the context of re-use of dredged material on Portsoy Beach.

Table 6-1: Receptor Risk Assessment

Key Receptor[3]	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	Both harbours at Portsoy have been subject to dredging activity previously (with the most recent dredge undertaken in 2021). The dredging is a requirement for the harbours to remain operational. Despite previous dredging, SEPA do not consider Portsoy (as part of the Findochty to Knock Head coastal body) as a Heavily Modified Water Body (HMWB)[4]. The coastal body has a classification of "High" for morphology. This classification will take into account the presence of the harbour and the impacts of previous dredging and disposal. While there may be temporary, localised effects on the receiving beach, grading of sediment by the excavator and incoming tides are likely to quickly move sediment into a natural morphology. The impacts on local hydromorphology from disposal are considered to be no more significant than sand naturally being transported to and from the coastline by tides/currents. Previous characterisation of beach and harbour sands concluded that particle sizes between the two sites are similar, with a relatively small proportion of silt-sized particles in the harbour sands (~6%). It is likely that silt-sized particles will be transported off the beach following placement by wave action/tidal cycles. It has been assumed that particle sizes in the harbour and beach have not significantly changed since this characterisation was undertaken. Therefore, no further assessment with respect to the water framework directive is considered to be required.

[3] https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters
[4] https://map.environment.gov.scot/sewebmap/

Biology - habitats	Included to assess potential impacts to sensitive/high value habitats.	Yes	The Cullen to Stake Ness Site of Special Scientific Interest (SSSI) is present immediately beyond the harbour walls. The SSSI also encompasses the proposed receiving beach. The SSSI has been designated to take account of the areas geology and coastal habitats (including salt marsh and lowland heath). Further consideration to the SSSI is given in Section 6.6 below. The WFD classification for the Findochty to Knock Head body for macro-invertebrates is "good". Any impact from the disposal of sediment on the receiving beach will be temporary and localised. Therefore, significant impact to habitats is considered unlikely.
Biology – fish	Consideration of fish both within the estuary and also potential effects on migratory fish in transit through the estuary	No	Portsoy and the surrounding area does not have a WFD classification for fish. Dredging works are likely only to be undertaken at low tide when sand is exposed, therefore fish will not be present during dredging works. Sediment disposed in the intertidal zone will be dispersed quickly by rising and falling tides. In addition, there is no estuary in close proximity to the site in which migratory fish would be migrating towards. Immediately out with the harbour lies open sea with no obvious constraints.
Water Quality	Consideration must be given to water quality when contaminants are present in exceedance of CEFAS RAL1.	Yes	The Findochty to Knock Head coastal body is classified as "pass" for specific pollutants. No classification is provided for "priority substances". The overall classification for overall status is "good". Contaminants are noted to exceed CEFAS RAL1 within sediment samples. Potential effects are considered to be both local and temporary. Further consideration of potential effects is discussed in section 6.6 for completeness.

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 disposal site is not located within 2km of an SAC or SPA, marine protected area or Ramsar sites. The closest bathing waters to Portsoy are Inverboyndie (~8 km east) and Cullen (~9 km west). There are no designated shellfish waters along the northern Aberdeenshire and Moray coasts. The Cullen to Stake Ness Site of Special Scientific Interest (SSSI) is present immediately beyond the harbour walls and also encompasses the proposed receiving beach. The SSSI has been designated to take account of the areas geology and coastal habitats (including salt marsh and lowland heath). This is considered further in Section 6.6 below.

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

SEPA classified the coastal water body Findochty to Knock Head as “pass” for specific pollutants. No classification is provided for priority substances.

Although concentrations of PAHs 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 receiving beach is considerable. When the sediment results are reviewed as an average to assess all of the dredged sediment as a single unit for disposal, results for PAHs are in exceedance RAL1 and the BAC. Averaged concentrations do not exceed the ERL or PEL. 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 are generally lower than the Marine Scotland RAL1, therefore it is considered to be a very conservative assessment criterion. In addition, PAHs 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 of sediment on receiving beach and potential subsequent dispersal by tides). Although this is likely to cause localised increase in suspended solids, it is considered that this will be both local and temporary in nature.

The sediment material primarily comprises sand with some silt and negligible quantities of gravel. Table 6-2 summarises the average physical sediment type for all samples from the dredge areas, against an average of four PSA samples collected from the receiving beach on 17th November 2020.

Table 6-2: Averaged PSA data for Dredge Area and Receiving Beach

Sampling Area		Gravel (>2mm) %	Sand (63-2000 µm) %	Silt (<63 µm) %
Old Harbour Dredge	Average	1.8	95.1	3.1
	Std. Dev.	1.5	2.8	1.3
New Harbour Dredge	Average	0.1	97.8	2.2
	Std. Dev.	0.1	0.7	0.6
Whole Dredge	Average	0.9	96.5	2.6
	Std. Dev.	1.4	2.3	1.0
Receiving Beach	Average	0	100	0
	Std. Dev.	0	0	0

Considering the dredge as a whole (i.e. Old and New Harbour samples averaged together), the average sand content is 96.5%, with 2.6% silt and a negligible gravel content. The total dredge volume is a maximum of 3,000m^3. The receiving beach was recorded as having 100% sand sized particles. The average sand and silt content of the dredge as a whole is noted to be within 2 standard deviations of the average particle sizes of the receiving beach. It is considered likely that silt in the dredged

material will be dispersed backshore by wave/tidal action and/or wind, or carried by wave/tidal action in suspension back into the sea.

Sand particles will generally fall out of suspension quickly with minimal lateral spread. Given that over 95% of the sediment to be disposed comprises sand, it is unlikely that there will be a prolonged significant increase in suspended solids/turbidity.

Silt and clay fractions have potential to be suspended for longer within the water column due to their smaller size and density than sand. However, given the relatively small quantity of silt and clay particles in the material to be dredged, any impact to water quality is unlikely to be significant and will be temporary.

Dredged sediment was placed on Portsoy beach during the previous dredging campaign in 2021 and no significant adverse impacts on water quality were reported as a result of this activity.

On this basis, the associated risk with degradation of water quality directly associated with the proposed disposal is considered to be low *i.e.* unlikely to cause a change in status of the waterbodies in question at both the dredge and disposal sites.

6.6.2 Habitats/Protected Areas

Part of the Cullen to Stake Ness SSSI lies immediately beyond the harbour walls (*i.e.* adjacent to the dredge sites). The proposed destination of dredged material is Portsoy Beach and is also part of the designated SSSI.

The SSSI citation[5] states that the area is classified for the features stated in Table 6-3.

Table 6-3: Cullen to Stake Ness SSSI Features

Feature Type	Feature	Latest Assessed Condition
Geological	Structural & metamorphic geology – Dalradian	Favourable maintained
	Quaternary geology and geomorphology – Quaternary of Scotland	Partially destroyed
Biological	Coastlands – Saltmarsh	Favourable maintained
	Coastlands - Shingle	Favourable maintained
	Fens – Springs (including flushes)	Not assessed
	Lowland heathland – Dry Heath	Unfavourable declining

The SSSI extends across a large area of coastline and will encompass a variety of features. Not all of the features listed above will be present at every location. Given that the proposed disposal/re-use site is Portsoy Beach, it is most likely that only the above noted geological features will be present at the disposal location. The above noted biological features are unlikely to be present and are not given any further consideration.

It is proposed that dredged material is placed on Portsoy Beach to be graded by an excavator, with subsequent grading occurring naturally by wave/tidal action. The nature of the beach is such that it is unlikely to contain visible Dalradian or Quaternary (glacial) geological features, although it is noted that such features may be present beneath the beach sand deposits. Given that the beach is already present and is proposed to be bolstered by increasing the quantity of sand, it is unlikely that designated geological features will be affected by the sediment disposal/re-use activity. In addition, given that the dredged material comprises predominantly sand, and is noted to be of a very similar

[5] https://sitelink.nature.scot/site/480

particle size to the receiving beach, the deposition of the dredged material on the beach will likely have no more an adverse effect on the condition of geological features than sand naturally being transported to and from the coast by tides/currents.

Dredged sediment was placed on Portsoy beach during the previous dredging campaign in 2021 and no significant adverse impacts on habitats/protected areas were reported as a result of this activity.

As a result, the risk to designated habitats/protected areas from the proposed disposal of dredged material is considered to be low.

7 BPEO CONCLUSIONS AND RECOMMENDATIONS

Aberdeenshire Council has appointed EnviroCentre Ltd. to complete a Marine Licence application and BPEO assessment for dredging at Portsoy Harbour in Aberdeenshire. This has been informed using sediment quality results from sampling undertaken in February 2020.

The site was previously licenced under MS-00008914, which expired on 3rd May 2022. As such, this project is considered to be a maintenance dredge. Dredging is required to keep the Harbours operational and is of particular importance to the Scottish Traditional Boat Festival held annually in Portsoy.

Dredging is proposed in the Old and New Harbours. The proposed dredge depth will not exceed 1 metre and a maximum volume of 3,000 m^3 will be dredged between both harbour areas.

Results from analysis of sediment samples from across both sites recorded various PAH species in exceedance of RAL 1. 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 recommendation for dredged material to be placed/re-used on Portsoy Beach sediment as part of a beach nourishment project is considered to be the preferred option. This option is considered to have no significant long-term impact on the marine environment and has been assessed as the most cost-effective option. It is acknowledged that many HGV movements will be required to move sediment from harbours to the receiving beach and although local residents may face some disruption, there are longer-term benefits for the community arising from the nourishment of the local beach. The proposed dredge and disposal method is in-keeping with the spirit of beneficial re-use of dredged materials.

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

358900 359000 359100

866500 866400 866300

New Harbour

Sample C

Sample A

Sample B

Old Harbour

Sample F

Sample E

Sample D

Portsoy New Harbour

Shore Street

Schoolhendry Street

Links Road

Ward Street

Main Street

Shorehead

Imagery source: Esri, DigitalGlobe, GeoEye, Earthstar Geographic, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Dredge Area Boundary
- Sediment Sample Location

Do not scale this map

Client
Aberdeenshire Council

Project
Portsoy Harbours Dredging

Title
Dredge Areas and
2023 Sediment Sampling Locations

Status
FINAL

Drawing No.	Revision	Date
374702-QGIS006	-	30 Aug 2023
Drawn	**Checked**	**Approved**
FR	CCAS	CCAS

Scale
1:1,000 @ A3

Rev	Date	Amendment	Initials
-	-	-	-

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358750 359000 359250 359500

866500

866250

New Harbour

Old Harbour

Portsoy Beach

Legend

Dredge Area Boundary

Do not scale this map

Client
Aberdeenshire Council

Project
Portsoy Harbours Dredging

Title
Dredge Areas and Receiving Beach

Status
FINAL

Drawing No.	Revision	Date
374702-QGIS004	-	06 Oct 2022
Drawn	**Checked**	**Approved**
FR	CCAS	CCAS

Scale
1:2,500 @ A3

Rev	Date	Amendment	Initials
-	-	-	-

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B LABORATORY DATA

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 MAR01984

Issue Version: 1

Customer: Envirocentre Ltd, 8 Eagle Street, Glasgow, G4 9XA

Customer Reference: 374702 - Marine Scotland Analysis

Date Sampled: 21-Jul-23

Date Samples Received: 31-Jul-23

Test Report Date: 29-Aug-23

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

<Redacted>

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 MAR01984
Issue Version 1
Customer Reference 374702 - Marine Scotland Analysis

		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**
A	MAR01984.001	Sediment	31.7	68.3	3.08	92.56	4.36	NAIIS
B	MAR01984.002	Sediment	31.8	68.2	0.10	98.06	1.84	NAIIS
C	MAR01984.003	Sediment	35.3	64.7	2.17	94.75	3.09	NAIIS
D	MAR01984.004	Sediment	21.2	78.8	0.00	98.18	1.82	NAIIS
E	MAR01984.005	Sediment	30.8	69.2	0.02	98.20	1.79	NAIIS
F	MAR01984.006	Sediment	29.8	70.2	0.15	97.02	2.84	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

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	MAR01984
Issue Version	1
Customer Reference	374702 - Marine Scotland Analysis

		Units	% M/M
		Method No	WSLM59*
		Limit of Detection	0.02
		Accreditation	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**TOC**
A	MAR01984.001	Sediment	2.93
B	MAR01984.002	Sediment	0.97
C	MAR01984.003	Sediment	3.07
D	MAR01984.004	Sediment	0.23
E	MAR01984.005	Sediment	0.50
F	MAR01984.006	Sediment	0.32
		Reference Material (% Recovery)	103
		QC Blank	<0.02

* See Report Notes

NAIIS - No Asbestos Identified In Sample

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 MAR01984
Issue Version 1
Customer Reference 374702 - Marine Scotland Analysis

		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**
A	MAR01984.001	Sediment	3.2	<0.04	10.3	14.2	0.05	10.0	9.0	25.2
B	MAR01984.002	Sediment	2.5	<0.04	7.4	6.6	0.01	8.0	4.6	18.4
C	MAR01984.003	Sediment	3.4	0.05	10.8	12.3	0.01	10.4	7.7	30.0
D	MAR01984.004	Sediment	2.5	<0.04	7.4	2.2	<0.01	7.1	2.9	9.9
E	MAR01984.005	Sediment	2.7	0.05	8.7	2.6	<0.01	8.4	3.6	11.4
F	MAR01984.006	Sediment	3.0	<0.04	8.2	2.8	<0.01	7.4	3.5	11.1
Certified Reference Material SETOC 768 (% Recovery)			92	108	93	93	104	95	94	94
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	MAR01984
Issue Version	1
Customer Reference	374702 - Marine Scotland Analysis

		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)**
A	MAR01984.001	Sediment	1.15	1.95
B	MAR01984.002	Sediment	<1	2.33
C	MAR01984.003	Sediment	1.83	5.83
D	MAR01984.004	Sediment	<1	<1
E	MAR01984.005	Sediment	<1	<1
F	MAR01984.006	Sediment	1.37	<1
Certified Reference Material BCR-646 (% Recovery)			66	52
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 MAR01984
Issue Version 1
Customer Reference 374702 - Marine Scotland Analysis

		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**
A	MAR01984.001	Sediment	8.29	17.3	52.8	123	134	108
B	MAR01984.002	Sediment	3.62	13.4	21.7	43.3	49.0	32.7
C	MAR01984.003	Sediment	31.0	50.1	200	245	291	194
D	MAR01984.004	Sediment	<1	<1	<1	2.70	3.67	2.89
E	MAR01984.005	Sediment	4.53	21.3	65.2	104	105	73.9
F	MAR01984.006	Sediment	1.56	<1	3.66	5.53	5.79	5.19
Certified Reference Material NIST 1941b(% Recovery)			96	117	71	58	57	81
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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		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	N*	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**BENZGHIP**	**BKF***	**CHRYSENE ***	**DBENZAH**	**FLUORANT**	**FLUORENE**
A	MAR01984.001	Sediment	71.2	106	131	14.7	277	18.1
B	MAR01984.002	Sediment	27.8	37.3	45.3	5.91	94.9	18.0
C	MAR01984.003	Sediment	162	195	238	36.6	484	121
D	MAR01984.004	Sediment	2.35	3.07	3.14	<1	4.47	<1
E	MAR01984.005	Sediment	50.1	84.5	107	11.2	265	32.8
F	MAR01984.006	Sediment	3.72	4.46	6.03	<1	17.1	1.39
Certified Reference Material NIST 1941b(% Recovery)			48	79	84	95	79	49
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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		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**
A	MAR01984.001	Sediment	77.4	19.2	152	240	48400
B	MAR01984.002	Sediment	25.7	36.4	90.4	111	21500
C	MAR01984.003	Sediment	164	528	594	480	53900
D	MAR01984.004	Sediment	2.72	<1	<1	4.20	5630
E	MAR01984.005	Sediment	55.6	10.5	222	229	10400
F	MAR01984.006	Sediment	3.90	2.75	11.5	13.8	5920
Certified Reference Material NIST 1941b(% Recovery)			60	62	75	67	106~
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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		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	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB28**	**PCB52**	**PCB101**	**PCB118**	**PCB138**	**PCB153**	**PCB180**
A	MAR01984.001	Sediment	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
B	MAR01984.002	Sediment	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
C	MAR01984.003	Sediment	<0.08	0.11	<0.08	<0.08	<0.08	<0.08	<0.08
D	MAR01984.004	Sediment	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
E	MAR01984.005	Sediment	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
F	MAR01984.006	Sediment	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Certified Reference Material NIST 1941b(% Recovery)			69	90	99	82	94	101	98
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 MAR01984
Issue Version 1
Customer Reference 374702 - Marine Scotland Analysis

REPORT NOTES

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
WSLM59*	MAR01984.001-006	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
ICPMSS*	MAR01984.001-006	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
SUB_01*	MAR01984.001-006	Analysis was conducted by an approved subcontracted laboratory.
SUB_02*	MAR01984.001-006	Analysis was conducted by an approved subcontracted laboratory.
ASC/SOP/303/304	MAR01984.001-006	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 (BENZGHIP) . These circumstances should be taken into consideration when utilising the data.
ASC/SOP/303/304	MAR01984.001-006	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	MAR01984.001-006	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

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

Test Report ID	MAR01984
Issue Version	1
Customer Reference	374702 - Marine Scotland Analysis

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		

C SUMMARY TABLES

Summary Table A

Sampling Results Incorporated with BPEO Assessment (mg/kg)

						New Harbour			Old Harbour								
	AL1	AL2	BAC	ERL	PEL	Sample A	Sample B	Sample C	Sample D	Sample E	Sample F	AVERAGE	No. Exceed RAL 1	No. Exceed RAL 2	No.Exceed BAC?	No. Exceed ERL	No. Exceed PEL?
Source			CSEMP	CSEMP	Canada												
Arsenic	20	70	25		41.6	3.2	2.5	3.4	2.5	2.7	3	2.88	0	0	0	-	0
Cadmium	0.4	4	0.31	1.2	4.2	0.04	0.04	0.05	0.04	0.05	0.04	0.04	0	0	0	0	0
Chromium	50	370	81	81	160	10.3	7.4	10.8	7.4	8.70	8.2	8.80	0	0	0	0	0
Copper	30	300	27	34	108	14.2	6.6	12.3	2.2	2.6	2.8	6.78	0	0	0	0	0
Mercury	0.25	1.5	0.07	0.15	0.7	0.05	0.01	0.01	0.01	0.01	0.01	0.02	0	0	0	0	0
Nickel	30	150	36	-	-	10.0	8.0	10.4	7.1	8.4	7.4	8.55	0	0	0	N/A	N/A
Lead	50	400	38	47	112	9	4.6	7.7	3	4	3.5	5.22	0	0	0	0	0
Zinc	130	600	122	150	271	25	18	30	10	11	11	17.67	0	0	0	0	0
Naphthalene	0.1		0.08	0.16	0.391	0.019	0.036	0.528	0.001	0.011	0.003	0.10	1	-	1	1	1
Acenaphthylene	0.1				0.128	0.017	0.013	0.050	0.001	0.021	0.001	0.02	0	-	N/A	N/A	0
Acenaphthene	0.1				0.0889	0.008	0.004	0.031	0.001	0.005	0.002	0.01	0	-	N/A	N/A	0
Fluorene	0.1				0.144	0.018	0.018	0.121	0.001	0.033	0.001	0.03	1	-	N/A	N/A	0
Phenanthrene	0.1		0.032	0.24	0.544	0.152	0.090	0.594	0.001	0.222	0.012	0.18	3	-	4	1	1
Anthracene	0.1		0.05	0.085	0.245	0.053	0.022	0.200	0.001	0.065	0.004	0.06	1	-	3	1	0
Fluoranthene	0.1		0.039	0.6	1.494	0.277	0.095	0.484	0.004	0.265	0.017	0.19	3	-	4	0	0
Pyrene	0.1		0.024	0.665	1.398	0.240	0.111	0.480	0.004	0.229	0.014	0.18	4	-	4	0	0
Benzo(a)anthracene	0.1		0.016	0.261	0.693	0.123	0.043	0.245	0.003	0.104	0.006	0.09	3	-	4	0	0
Chrysene	0.1		0.02	0.384	0.846	0.131	0.045	0.238	0.003	0.107	0.006	0.09	3	-	4	0	0
Benzo(b)fluoranthene	0.1		-	-	-	0.108	0.033	0.194	0.003	0.074	0.005	0.07	2	-	N/A	N/A	N/A
Benzo(k)fluoranthene	0.1		-	-	-	0.106	0.037	0.195	0.003	0.085	0.004	0.07	2	-	N/A	N/A	N/A
Benzo(a)pyrene	0.1		0.03	0.384	0.763	0.134	0.049	0.291	0.004	0.105	0.006	0.10	3	-	4	0	0
Indeno(1,2,3cd)pyrene	0.1		0.103	0.24	-	0.077	0.026	0.164	0.003	0.056	0.004	0.05	1	-	1	0	N/A
Benzo(ghi)perylene	0.1		0.08	0.085	-	0.071	0.028	0.162	0.002	0.050	0.004	0.05	1	-	1	1	N/A
Dibenzo(a,h)anthracene	0.01		-	-	0.135	0.015	0.006	0.037	0.001	0.011	0.001	0.01	0	-	N/A	N/A	0
TPH	100		-	-	-	48.40	21.50	53.90	5.63	10.40	5.92	24.29	0	-	N/A	N/A	N/A
PCBs	0.02	0.18	-	-	0.189	0.00056	0.00056	0.00059	0.00056	0.00056	0.00056	0.0006	0	0	N/A	N/A	0
TBT	0.1	0.5	-	-	-	0.00195	0.002	0.006	0.001	0.001	0.001	0.0022	0	0	N/A	N/A	N/A

Note: Underlined Values are < LOD

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

Summary Table B

Portsoy 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	2.9	No	No	No	N/A	No
Cadmium	0.4	4	0.31	1.2	4.2	0.04	No	No	No	No	No
Chromium	50	370	81	81	160	8.8	No	No	No	No	No
Copper	30	300	27	34	108	6.8	No	No	No	No	No
Mercury	0.25	1.5	0.07	0.15	0.7	0.02	No	No	No	No	No
Nickel	30	150	36	-	-	8.6	No	No	No	N/A	N/A
Lead	50	400	38	47	112	5.2	No	No	No	No	No
Zinc	130	600	122	150	271	17.7	No	No	No	No	No
					-						
Naphthalene	0.1	-	0.08	0.16	0.319	0.10	No	N/A	**Yes**	No	No
Acenaphthylene	0.1	-	-	-	0.128	0.02	No	N/A	N/A	N/A	No
Acenaphthene	0.1	-	-	-	0.0889	0.01	No	N/A	N/A	N/A	No
Fluorene	0.1	-	-	-	0.144	0.03	No	N/A	N/A	N/A	No
Phenanthrene	0.1	-	0.032	0.24	0.544	0.18	**Yes**	N/A	**Yes**	No	No
Anthracene	0.1	-	0.05	0.085	0.245	0.06	No	N/A	**Yes**	No	No
Fluoranthene	0.1	-	0.039	0.6	1.494	0.19	**Yes**	N/A	**Yes**	No	No
Pyrene	0.1	-	0.024	0.665	1.398	0.18	**Yes**	N/A	**Yes**	No	No
Benzo(a)anthracene	0.1	-	0.016	0.261	0.693	0.09	No	N/A	**Yes**	No	No
Chrysene	0.1	-	0.02	0.384	0.846	0.09	No	N/A	**Yes**	No	No
Benzo(b)fluoranthene	0.1	-	-	-	-	0.07	No	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	0.1	-	-	-	-	0.07	No	N/A	N/A	N/A	N/A
Benzo(a)pyrene	0.1	-	0.03	0.384	0.763	0.10	No	N/A	**Yes**	No	No
Indeno(1,2,3cd)pyrene	0.1	-	0.103	0.24	-	0.05	No	N/A	No	No	N/A
Benzo(ghi)perylene	0.1	-	0.08	0.085	-	0.05	No	N/A	No	No	N/A
Dibenzo(a,h)anthracene	0.01	-	-	-	0.135	0.01	**Yes**	N/A	N/A	N/A	No
PCBs	0.02	0.18	-	-	0.189	0.001	No	No	N/A	N/A	No
TBT	0.1	0.5	-	-	-	0.0022	No	No	N/A	N/A	N/A