Portsoy Harbours
Sediment Quality and BPEO Report

July 2020

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1 INTRODUCTION

1.1 Background

Aberdeenshire Council appointed EnviroCentre Ltd to undertake a sediment assessment of samples collected within Portsoy Harbours, Aberdeenshire. The samples were collected in both the Old Harbour and New Harbour areas to support the licencing requirements to allow both areas of the harbour to be dredged. As it has been more than eight years since the previous dredge, this is considered to be a capital dredge.

Sample locations are shown on Drawing No. 373569-QGIS-001 in Appendix A.

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

The purpose of these samples 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 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.

EnviroCentre accept no liability for use of the report for purposes other than those for which it was originally provided, or where EnviroCentre have confirmed it is appropriate for the new context.

2 SAMPLING LOCATIONS AND METHODOLOGY

Sediment sampling was undertaken on 11th February 2020. 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°41.16558'	-002°41.36150'
	Sample B	57°41.15034'	-002°41.29782'
	Sample C	57°41.17056'	-002°41.33644'
Old Harbour	Sample D	57°41.09166'	-002°41.47682'
	Sample E	57°41.10900'	-002°41.45904'
	Sample F	57°41.12082'	-002°41.46430'

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 sent to Socotec's Marine Laboratory for analysis, which holds UKAS and MMO accreditations.

3 RESULTS

Results 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. No other inclusions were noted in the samples.

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 3-1.

Table 3-1: 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)	2	0
PCBs	0	0
TBT	1	0
THC	0	0

Two exceedances were noted for one or more PAH species and for TBT in samples, with no exceedances above RAL 2. There were no exceedances of the RALs for metals, PCBs or THC.

Parameters exceeding RAL 1 are given for each sample location in Table 3-2.

Table 3-2: 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	TBT
Old Harbour	Sample D	*None*
	Sample E	
	Sample F	

3.3 Asbestos

Asbestos was not detected in any of the samples analysed.

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 is 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 increase depth to allow vessels to access the harbours, specifically for the forthcoming Portsoy Traditional Boat Festival currently scheduled for June 2021.	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 would require to be supported by Environmental Assessments as a minimum 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.	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. If pumping is deemed unsuitable on cost or practical grounds, then 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. This practice has been undertaken and accepted previously. However, there may be temporary and localised impacts to water quality and local amenity associated with this process.	Yes

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, three options were identified for further detailed BPEO assessment which are as follows:

- Beach Nourishment;
- Pumping or placement on to intertidal zone;
- 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 Pumping or placement on to intertidal zone

This method would involve the following material handling stages:

- Dredging (at low tide);
- Temporary stockpiling of material on land;
- Transfer into mixing hopper with water; and
- Pumping of slurry to intertidal zone.

It is anticipated that dredging will be undertaken using a long-arm excavator located on land. The material would then be temporarily stockpiled before being transferred into a hopper for mixing with water to create a slurry. The slurry would then be pumped from the mixing tank on to the intertidal zone for dispersal by high tides.

In the event that mixing with water and pumping of slurry is not considered to be practical or cost effective as the project progresses, then sediment could be placed on rocks (without water mixing). In this case material will be stockpiled on land before being placed on the intertidal zone by a long arm excavator.

There is potential for some temporary disruption to local residents as a result of these operations.

4.3.3 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. 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.

4.3.4 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.

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

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.

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	Pumping or placement on to Intertidal Zone	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. The need for additional environmental assessment and potential licensing requirements would put pressure on the required project timescales.	This method would involve the least material handling stages of the three methods brought forward for assessment. As all works will be completed within close proximity of the harbour area, the need for any road transport would essentially be eliminated.	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.	Rocky intertidal areas are present immediately to the north of both the old and new harbours where sediment could potentially be pumped to, or deposited upon for natural dispersal.	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.

Criteria	Beach Nourishment	Pumping or placement on to Intertidal Zone	Landfill	Sea Disposal
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.	Varied as pumping of sediment slurry may give impression of being wasteful (whereas other disposal methods are out of public sight). The reduced HGV movements required compared to what would be likely with other methods would be welcomed. There is a possibility of perceived negative temporary impacts to local amenity (e.g. dust, noise) while slurry pumping or sediment placement is being undertaken.	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.
Legislative Implications	This option may have licencing requirements over and above the routine dredge and disposal licencing. This may add additional programme/timescale pressures which make this option less favourable or practical.	This practice is understood to have been used historically but will require prior agreement with Marine Scotland.	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	Pumping or placement on to Intertidal Zone	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.	This involves the least amount of material handling stages and involves the least transport, therefore the potential for accidents to occur is minimised. 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). Further geo-chemical testing of the sediment would be required to ensure it is suitable for use.	Limited potential for human contact assuming that the public are excluded from the active work area. Some potential for release of windblown sediment during pumping/placement but will be mitigated by high water content in the sediment. Impacts could be mitigated further by working only where winds are favourable (i.e. light and blowing sediment away from public receptors). Once pumping/placement is complete, the pathways for human contact are greatly reduced.	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	Pumping or placement on to Intertidal Zone	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).	Energy and water required to create and pump slurry, with subsequent impact on carbon footprint. Carbon footprint likely to be lower where sediment is placed directly on to foreshore. Temporary impact to water quality as sediment slurry is dispersed by tides. Potential also for temporary noise impacts. Potential for air pollution is considered to be minimised by high water content of slurry.	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.

Criteria	Beach Nourishment	Pumping or placement on to Intertidal Zone	Landfill	Sea Disposal
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 Skate 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.	Any impacts would be localised and temporary as particles would likely disperse and settle out quickly in water. The Cullen to Skate Ness SSSI is immediately beyond harbour in proposed disposal area. 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.
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.	Significant interference or disruption with other operations would not be anticipated. Disruption caused to harbour users (mainly leisure craft) is not considered to be significant.	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.

Criteria	Beach Nourishment	Pumping or placement on to Intertidal Zone	Landfill	Sea Disposal
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,	Temporary visual impacts during sediment movement but no long term impacts. Sediment will temporarily cover rocks on the intertidal zone but should disperse at high tide. Some potential for odour emissions and noise impacting properties although these impacts will be short term. The closest residential properties to the rocky foreshore at the New Harbour is 60m south, and 100m south at the Old Harbour.	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 (£)	Pumping or placement to Intertidal Zone (£)	Landfill Disposal (£)	Sea Disposal (£)
Dredging	9,630	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	-	15,000	-	-
Excavator for beach profiling works	2,250	-	-	-
Total Costs	**17,256**	**24,630**	**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	Pumping/ Direct Placement	Landfill Disposal	Sea Disposal
Environment	2	2	4	2
Strategic	2	1	4	3
Costs	1	2	4	3
TOTAL SCORE	**5**	**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 deadline (Portsoy Traditional Boat Festival in June 2020).

Aberdeenshire Council have identified Portsoy Beach as a possible disposal location for the sediment as part of a beach nourishment project. However, this is in the early stages of planning and may not be considered as a final option. Beach nourishment has been assessed as the most cost-effective option. In reality however, the final cost is likely to be considerably higher than estimated above due to the environmental assessments that will need to be undertaken. Also, it would require approximately 230 return trips by HGV between the harbour and the beach meaning that strategically it scores lower than sediment pumping or placement on the foreshore. However, if beach nourishment is deemed a necessity at present or in the near future, then the use of the dredged material would be preferable than importing sand from further afield. This disposal route has been assessed as the jointly preferred method along with sediment pumping or placement on the foreshore (see below).

The use of a sediment slurry pumping method to dispose of sediment over and away from the harbour wall has been assessed as the second most cost-effective and is strategically preferred. However, if the use of a slurry pumping system is eventually ruled out based on cost or practical grounds, then direct placement of sediment on to the intertidal zone by long arm excavator may be considered as an alternative. The land-based plant required for these operations is likely to be more readily available than specialist marine plant and therefore more likely to be compatible with the required project timescales. While there will be some temporary local impacts to water quality, this method would eliminate the need for any significant transport of dredged material, either by road or by sea, thus reducing air pollution and carbon emissions, as well as potential HGV movements in Portsoy. Therefore, pumping or direct placement of sediment over the harbour wall has been jointly deemed as the preferred disposal method. However, this approach would require approval in advance from Marine Scotland.

As the sediment pumping or placement method will not require HGV movements through the town, this is considered to be the preferable option for disposal. Beach nourishment will be kept under consideration as a second potential option, but would also require discussion and agreement with Marine Scotland.

5.2 Conclusions

The Best Practicable Environmental Option for disposal of the Portsoy Harbour dredged material has therefore been assessed as pumping or direct placement of sediment over the harbour wall into the intertidal zone for natural dispersal. Beach nourishment has been identified as a second potential option.

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 finger prints 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 B, but have not been used as part of the further assessment as they typically fall below the RAL1

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) to draw conclusions from available information and provide recommendation for 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”, as shown on Drawing No. 773569-QGIS001 in Appendix A.

On the basis that sediment discharge to the intertidal zone is chosen as the preferred disposal option, it is proposed that the dredged material is pumped over to the locations noted in Table 6-1, either directly into the water or on to rocks on the intertidal zone (depending on tidal state).

Table 6-1: Proposed disposal Locations for Sediment Slurry (by Dredge Area)

Dredge Area	Latitude	Longitude
Old Harbour	57°41.13558'	-002°41.51930'
New Harbour	57°41.17068'	-002°41.25409'

The proposed disposal locations for pumped sediment slurry are shown on Drawing No. 773569-QGIS-002 in Appendix A.

If beach nourishment is required, then it is proposed that Portsoy Beach would be the receiving site. The beach is located approximately 190m to the south west of the New Harbour.

The sections to follow will provide further assessment on the sediment pumping or direct placement to the intertidal zone method. If the beach nourishment project is to be progressed further by Aberdeenshire Council, then the assessment below will be revised.

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 – 2 of 6 samples recorded at least one PAH species above RAL1; and
- TBT – 1 of 6 samples recorded TBT 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 RAL 1.

6.2.4 ERL & PEL Review

No exceedances of the ERL or PEL (where values are available) 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:

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

- All samples recorded averaged concentrations below RAL2 where they exist.

6.4 Chemical Assessment Conclusions

A number of samples recorded exceedances of RAL1 for PAHs and TBT. The exceedances are noted to be marginal. No samples recorded contaminant levels in exceedance of RAL2.

A number of exceedances of the BAC were noted for one or more PAH species. Averaged concentrations which consider the dredge as a single volume for disposal also exceeded the BAC for one or more PAH species.

No individual samples or averaged concentrations were noted to exceed either the ERL or PEL.

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 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 6-2 below, in the context of disposing of sediment by pumping or direct placement on to the intertidal rocks.

Table 6-2: 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	Although the dredging activity is classified as a capital dredge as it has been over 8 years since the previous dredge, both harbours at Portsoy have been subject to dredging activity previously and are a requirement 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 are likely to be temporary, localised effects on the rocky foreshore where it is anticipated that sediment will be deposited, incoming tides are likely to disperse any sediment quickly. 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. 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 Skate Ness Site of Special Scientific Interest (SSSI) is present immediately beyond the harbour walls. 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 in the intertidal zone 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 the dredge and disposal sites are Inverboyndie (8.2 km east) and Cullen (8.7 km west). There are no designated shellfish waters along the northern Aberdeenshire and Moray coasts. The Cullen to Skate Ness Site of Special Scientific Interest (SSSI) is present immediately beyond the harbour walls. 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 there are contaminants of concern marginally 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 harbour wall is considerable. Additionally, when the sediment results are reviewed as an average to assess all of the dredged sediment as a single unit for disposal, then only the BAC for several PAH species are exceeded. Averaged concentrations do not exceed RAL1, 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 criteria. 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. where sediment and/or sediment slurry is pumped to, or placed on the intertidal zone and dispersed 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 6-3 summarises the average physical sediment type for all samples versus the proposed maximum dredge volume.

Table 6-3: Summary of Average PSA Data

Gravel (>2mm)	Sand (0.063mm<Sand<2mm)	Silt & Clay (<0.063mm)	Maximum quantity to be dredged m^3
0.1 %	93.6 %	6.3 %	3,000
2.5 m^3	2,807 m^3	190 m^3	

Sand particles will generally fall out of suspension quickly with minimal lateral spread. Given that over 90% 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.

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 Skate Ness SSSI lies immediately beyond the harbour walls (i.e. adjacent to the dredge sites). The proposed destination of sediment slurry is anticipated to be the rocky foreshore which is included as part of the SSSI.

The SSSI citation[5] states that the area is classified for the features stated in Table 6-4.

Table 6-4: Cullen to Skate 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 area immediately beyond the harbour wall where the sediment slurry is anticipated to be disposed comprises a rocky foreshore, it is most likely that the only above noted feature present at the disposal location is the Dalradian structural & metamorphic geology. All other features are considered unlikely to be present and are not given any further consideration.

It is proposed the sediment is pumped to or placed upon the intertidal zone where it will land either directly on the Dalradian rocks or in the water (likely dependent upon tidal state at the time). Specific attention should be paid during the disposal activity to ensure that sediment is deposited far enough down the foreshore to ensure that it will be dispersed by the tides. Where sediment lands directly on the rocks at low tide, it is considered likely that the next high tide will disperse any significant accumulation of sediment. Given that the dredged material comprises predominantly sand, the deposition of the material will have no more an adverse effect on the condition of geological features than sand naturally being transported towards the coast by tides/currents.

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

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

7 BPEO CONCLUSIONS AND RECOMMENDATIONS

Aberdeenshire Council appointed EnviroCentre Ltd to undertake a sediment assessment of samples collected within the Portsoy Harbours, Aberdeenshire; along with a subsequent BPEO. It is intended that both Old and New Harbours are dredged prior to the Portsoy Traditional Boat Festival in June 2021.

Results from analysis of sediment samples from across both sites recorded a few contaminants including PAH species and TBT marginally 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 pumping or placing sediment into the intertidal zone for natural dispersal is considered to be the preferred option. Use of the dredged material to fulfil a local beach nourishment project may be progressed by Aberdeenshire Council. On that basis, beach nourishment should remain as a second potential option.

Currently the preferred option is to dispose of the sediment into the intertidal zone for dispersal. This option is considered to have no significant long term impact on the marine environment; is strategically preferred mainly as there is no need for road transport or double handling of material; and has been assessed as a relatively cost effective option. In addition, it will also mean that no marine-based plant will be required, which would be required for sea disposal to a licenced disposal site. This is preferable due to the constraints present at the Portsoy Harbours (i.e. low water depth/drying out at low tide, tight bend to access Old Harbour).

REFERENCES

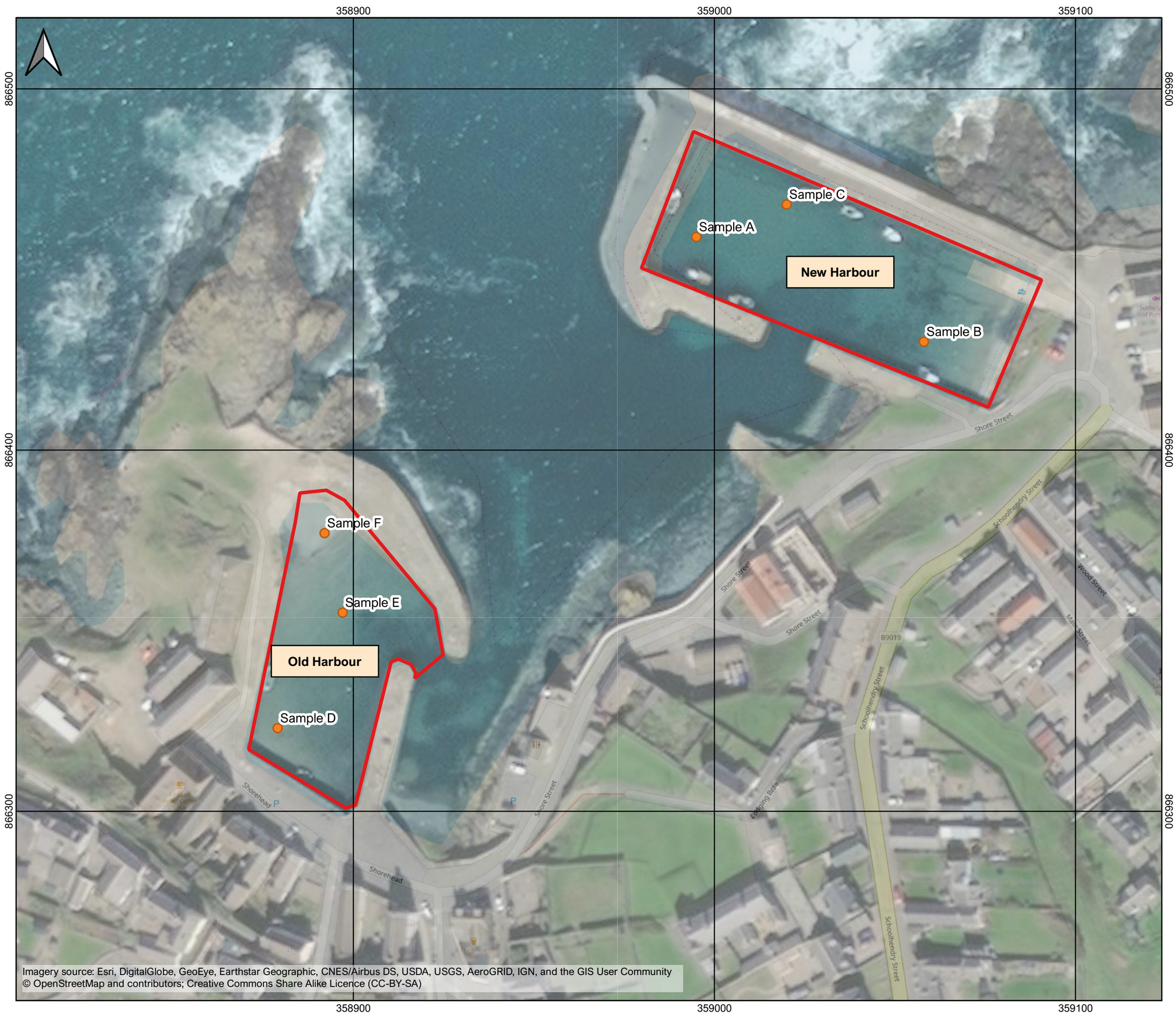
Environment Agency (2017). Water Framework Directive assessment: estuarine and coastal waters. https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters

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



Legend

- Approximate Dredge Areas
- Sample Locations

Do not scale this map

Client
Aberdeenshire Council

Project
Portsoy Harbours Dredging

Title
Sediment Sampling Locations

Status
Final

Drawing No.	Revision	Date
373569-QGIS001	-	20 Feb 2020
Drawn	**Checked**	**Approved**
FR	NC	CCAS

Scale
1:1000 @ A3

Rev	Date	Amendment	Initials
-	-	-	-

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358800 359000 359200 359400

866600 866400 866200 866000

New Harbour

Old Harbour

Portsoy Beach

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

- Proposed Disposal Points (TBC)
- Approximate Dredge Areas
- Harbour Authority Jurisdiction

Do not scale this map

Client
Aberdeenshire Council

Project
Portsoy Harbours Dredging

Title
Proposed Sediment Disposal Locations
& Harbour Jurisdiction Boundary

Status
Final

Drawing No.	Revision	Date
373569-QGIS002	-	20 Mar 2020
Drawn	**Checked**	**Approved**
FR	NC	CCAS

Scale
1:3000 @ A3

Rev	Date	Amendment	Initials
-	-	-	-

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B LABORATORY DATA

Certificate of Analysis

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

Test Report ID	**MAR00578**	
Issue Version	1	
Customer	EnviroCentre Ltd, Craighall Business Park, 8 Eagle Street, Glasgow, G4 9XA	
Customer Reference	Portsoy Harbour	
Date Sampled	11-Feb-20	
Date Received	15-Feb-20	
Date Reported	09-Mar-20	
Condition of samples	Cold	Satisfactory

[redacted]

Authorised by: Marya Hubbard

Position: Laboratory Manager

Any additional opinions or interpretations found in this report, are outside the scope of UKAS accreditation.

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Test Report ID	MAR00578
Issue Version	1
Customer Reference	Portsoy Harbour

		Units	%	%	N/A	%M/M	%	%	%
		Method No	ASC/SOP/303	ASC/SOP/303	SUB_01*	SOCOTEC Env Chem*	SUB_02*	SUB_02*	SUB_02*
		Limit of Detection	0.2	0.2	N/A	0.02	N/A	N/A	N/A
		Accreditation	UKAS	UKAS	UKAS	UKAS	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Total Moisture @ 120°C**	**Total Solids**	**Asbestos**	**Total Organic Carbon**	**Gravel (>2mm)**	**Sand (63-2000 µm)**	**Silt (<63 µm)**
Sample A	MAR00578.001	Sediment	28.1	71.9	NADIS	1.90	0.4	88.9	10.6
Sample B	MAR00578.002	Sediment	27.3	72.7	NADIS	0.46	0.0	95.0	5.0
Sample C	MAR00578.003	Sediment	28.3	71.7	NADIS	1.19	0.0	86.3	13.7
Sample D	MAR00578.004	Sediment	29.9	70.1	NADIS	1.04	0.1	95.7	4.2
Sample E	MAR00578.005	Sediment	19.8	80.2	NADIS	0.43	0.0	97.7	2.3
Sample F	MAR00578.006	Sediment	20.0	80.0	NADIS	0.50	0.0	97.8	2.2
		Reference Material (% Recovery)	N/A	N/A	N/A	99	N/A	N/A	N/A
		QC Blank	N/A	N/A	N/A	<0.02	N/A	N/A	N/A

* See Report Notes

NADIS - No Asbestos Detected In Sample

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Test Report ID	MAR00578
Issue Version	1
Customer Reference	Portsoy Harbour

		Units	mg/Kg (Dry Weight)							
		Method No	SOCOTEC Env Chem*							
		Limit of Detection	0.5	0.04	0.5	0.5	0.01	0.5	0.5	2
		Accreditation	UKAS	UKAS	UKAS	UKAS	No	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Mercury**	**Nickel**	**Lead**	**Zinc**
Sample A	MAR00578.001	Sediment	5.2	0.12	16.6	16.4	0.04	14.4	11.2	28.2
Sample B	MAR00578.002	Sediment	3.8	0.04	16.2	10.8	0.02	14.2	6.3	22.2
Sample C	MAR00578.003	Sediment	4.0	0.08	15.7	13.0	0.02	13.2	6.7	25.8
Sample D	MAR00578.004	Sediment	4.4	0.11	15.3	10.9	0.03	13.6	6.0	20.5
Sample E	MAR00578.005	Sediment	3.5	0.04	15.0	8.5	<0.01	13.2	4.6	15.4
Sample F	MAR00578.006	Sediment	3.5	0.09	16.6	9.3	0.011	14.1	7.0	17.2
Certified Reference Material SETOC 774 (% Recovery)			102	105	98	105	101	100	98	100
QC Blank			<0.5	<0.04	<0.5	<0.5	<0.01	<0.5	<0.5	<2

* See Report Notes

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

Test Report ID	MAR00578
Issue Version	1
Customer Reference	Portsoy Harbour

		Units	µg/Kg (Dry Weight)	
		Method No	ASC/SOP/301	
		Limit of Detection	1	1
		Accreditation	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Dibutyltin (DBT)**	**Tributyltin (TBT)**
Sample A	MAR00578.001	Sediment	<1	<1
Sample B	MAR00578.002	Sediment	<1	1.64
Sample C	MAR00578.003	Sediment	12.1	135
Sample D	MAR00578.004	Sediment	<1	<1
Sample E	MAR00578.005	Sediment	<1	<1
Sample F	MAR00578.006	Sediment	<1	<1
Certified Reference Material BCR-646 (% Recovery)			107	89
QC Blank			<1	<1

* See Report Notes

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

Test Report ID	MAR00578
Issue Version	1
Customer Reference	Portsoy Harbour

		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**
Sample A	MAR00578.001	Sediment	4.66	25.3	60.3	72.7	67.2	52.8
Sample B	MAR00578.002	Sediment	3.81	13.9	34.1	51.3	47.0	32.3
Sample C	MAR00578.003	Sediment	3.06	8.08	15.9	38.5	44.6	35.4
Sample D	MAR00578.004	Sediment	1.81	5.59	13.0	23.1	25.1	18.5
Sample E	MAR00578.005	Sediment	<1	<1	3.74	8.98	11.3	9.27
Sample F	MAR00578.006	Sediment	<1	<1	1.84	4.56	6.47	4.63
Certified Reference Material CRM180013 1941b (% Recovery)			88	100	65	65	60	88
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.

Certificate of Analysis

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

Test Report ID MAR00578
Issue Version 1
Customer Reference Portsoy Harbour

		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**
Sample A	MAR00578.001	Sediment	79.6	61.2	71.0	16.0	148	15.5
Sample B	MAR00578.002	Sediment	23.4	16.6	49.8	5.47	107	25.6
Sample C	MAR00578.003	Sediment	25.9	14.2	45.3	5.67	96.5	9.18
Sample D	MAR00578.004	Sediment	15.4	10.1	22.1	2.84	57.2	7.38
Sample E	MAR00578.005	Sediment	7.85	4.05	10.4	1.65	15.9	1.82
Sample F	MAR00578.006	Sediment	5.34	2.97	5.25	<1	9.73	<1
Certified Reference Material CRM180013 1941b (% Recovery)			66	96	86	100	78	53
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.

Certificate of Analysis

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Test Report ID MAR00578
Issue Version 1
Customer Reference Portsoy Harbour

		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**
Sample A	MAR00578.001	Sediment	86.3	19.8	93.5	127	19500
Sample B	MAR00578.002	Sediment	25.8	3.62	88.4	87.7	13100
Sample C	MAR00578.003	Sediment	27.6	18.5	83.4	83.9	22000
Sample D	MAR00578.004	Sediment	14.7	8.56	44.0	50.8	11900
Sample E	MAR00578.005	Sediment	7.48	6.45	12.3	16.8	7110
Sample F	MAR00578.006	Sediment	4.81	4.75	10.2	9.02	6760
Certified Reference Material CRM180013 1941b (% Recovery)			71	60	78	70	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.

Certificate of Analysis

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

Test Report ID MAR00578
Issue Version 1
Customer Reference Portsoy Harbour

		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	N	N	N	N	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB28**	**PCB52**	**PCB101**	**PCB118**	**PCB138**	**PCB153**	**PCB180**
Sample A	MAR00578.001	Sediment	<0.08	0.09	<0.08	<0.08	<0.08	<0.08	<0.08
Sample B	MAR00578.002	Sediment	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Sample C	MAR00578.003	Sediment	<0.08	0.09	<0.08	<0.08	<0.08	<0.08	<0.08
Sample D	MAR00578.004	Sediment	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Sample E	MAR00578.005	Sediment	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Sample F	MAR00578.006	Sediment	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Certified Reference Material SRM 1941b (% Recovery)			73	103	105	122	129	110	105
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.

Certificate of Analysis

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

Test Report ID MAR00578
Issue Version 1
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REPORT NOTES

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
SOCOTEC Env Chem*	MAR00578.001-006	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
SUB_01*	MAR00578.001-006	Analysis was conducted by an approved subcontracted laboratory.
SUB_02*	MAR00578.001-006	Analysis was conducted by an approved subcontracted laboratory.
ASC/SOP/303/304	MAR00578.001-006	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.
ASC/SOP/303/304	MAR00578.001-006	The Primary process control data associated with this Test has not wholly met the requirements of the Laboratory Quality Management System QMS with Benzo[e]pyrene and Perylene falling below acceptable limits in the CRM. However 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. These circumstances 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	Handling Time Exceeded	N/A	**N/A**
D3	Sample Contaminated through Damaged Packaging	N/A	N/A
D4	Sample Contaminated through Sampling	N/A	N/A
D5	Inappropriate Container/Packaging	N/A	N/A
D6	Damaged in Transit	N/A	N/A
D7	Insufficient Quantity of Sample	N/A	N/A
D8	Inappropriate Headspace	N/A	N/A
D9	Retained at Incorrect Temperature	N/A	N/A
D10	Lack of Date & Time of Sampling	N/A	N/A
D11	Insufficient Sample Details	N/A	N/A
D12	Sample integrity compromised or not suitable for analysis	N/A	N/A

Certificate of Analysis

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

Test Report ID	MAR00578
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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.
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.
Particle Size Analysis	Wet Sediment	Wet and dry sieving followed by laser diffraction analysis.
Total Organic Carbon (TOC)	Wet Sediment	Carbonate removal and sulphurous acid/combustion at 800°C/NDIR.
Polychlorinated Biphenyls (PCBs)	Air dried and seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS analysis.
Asbestos	Air Dried	Qualitative analysis of samples for determination of presence/type of Asbestos

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	Diben[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	DDE	p,p'-Dichorodiphenyldicloroethylene
BENZGHIP	Benzo[ghi]perylene	NAPTH	Naphthalene	DDT	p,p'-Dichorodiphenyltrichloroethane
BKF	Benzo[k]fluoranthene	PERYLENE	Perylene		
C1N	C1-naphthalenes	PHENANT	Phenanthrene		
C1PHEN	C1-phenanthrene	PYRENE	Pyrene		

C SUMMARY TABLES

Applicant Information

Applicant:	
Description of dredging:	
Total amount to be dredged (wet tonnes)	

Sample Details & Physical Properties

Explanatory Notes:
An example of a 'Dredge area' is: 'Dock A, Harbour X'
Provide description of the dredge area and the latitude and longitude co-oridnates (WGS84) for each sample location. Co-ordinates taken from GPS equipment should be set to WGS84.
Note for sample depth that the seabed is 0 metres.
Gravel is defined as >2mm, **Sand** is defined as >63um<2mm, **Silt** is deinfed as <63um).

Sample information:

Sample ID	Dredge area	Latitude										Longitude											Type of sample	Sample depth (m)	Total solids (%)	Gravel (%)	Sand (%)	Silt (%)	TOC (%)	Specific gravity	Asbestos
Sample A	New Harbour	5	7	°	4	1	.	1	6	6	'N	-	0	2	°	4	1	.	3	6	1	'W	Grab	0.0 - 0.15	71.9	0.4	88.9	10.6	1.9		No
Sample B	New Harbour	5	7	°	4	1	.	1	5	0	'N	-	0	2	°	4	1	.	2	9	8	'W	Grab	0.0 - 0.15	72.7	0	95	5	0.46		No
Sample C	New Harbour	5	7	°	4	1	.	1	7	1	'N	-	0	2	°	4	1	.	3	3	6	'W	Grab	0.0 - 0.15	71.7	0	86.3	13.7	1.19		No
Sample D	Old Harbour	5	7	°	4	1	.	0	9	2	'N	-	0	2	°	4	1	.	4	7	7	'W	Grab	0.0 - 0.15	70.1	0.1	95.7	4.2	1.04		No
Sample E	Old Harbour	5	7	°	4	1	.	1	0	9	'N	-	0	2	°	4	1	.	4	5	9	'W	Grab	0.0 - 0.15	80.2	0	97.7	2.3	0.43		No
Sample F	Old Harbour	5	7	°	4	1	.	1	2	1	'N	-	0	2	°	4	1	.	4	6	4	'W	Grab	0.0 - 0.15	80	0	97.8	2.2	0.5		No
				°			.				'N				°			.				'W									
				°			.				'N				°			.				'W									
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Trace Metals & Organotins

Explanatory Notes:
Results above Action Level 1 will be highlighted in blue and above Action Level 2 in red.

Sample information:

Sample ID	Dredge area	Type of sample	Sample depth (m)	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Mercury (Hg)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)	Dibutyltin (DBT)	Tributyltin (TBT)
				mg/kg dry weight									
Sample A	New Harbour	Grab	0.0 - 0.15	5.2	0.12	16.6	16.4	0.04	14.4	11.2	28.2	<0.001	<0.001
Sample B	New Harbour	Grab	0.0 - 0.15	3.8	0.04	16.2	10.8	0.02	14.2	6.3	22.2	<0.001	0.002
Sample C	New Harbour	Grab	0.0 - 0.15	4	0.08	15.7	13	0.02	13.2	6.7	25.8	0.012	0.135
Sample D	Old Harbour	Grab	0.0 - 0.15	4.4	0.11	15.3	10.9	0.03	13.6	6	20.5	<0.001	<0.001
Sample E	Old Harbour	Grab	0.0 - 0.15	3.5	0.04	15	8.5	<0.01	13.2	4.6	15.4	<0.001	<0.001
Sample F	Old Harbour	Grab	0.0 - 0.15	3.5	0.09	16.6	9.3	0.011	14.1	7	17.2	<0.001	<0.001
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Polyaromatic Hydrocarbons (PAH)

Explanatory Notes:
Results above Action Level 1 will be highlighted in blue and above Action Level 2 in red.

Definitions:

ACENAPTH	Acenaphthene
ACENAPHY	Acenaphthylene
ANTHRACN	Anthracene
BAA	Benz(a)anthracene
BAP	Benzo(a)pyrene
BBF	Benzo(b)fluoranthene
BEP	Benzo(e)pyrene
BENZGHIP	Benzo(ghi)perylene
BKF	Benzo(K)fluoranthene
C1N	C1-naphthalenes
C1PHEN	C1-phenanthrene
C2N	C2-naphthalenes
C3N	C3-naphthalenes
CHRYSENE	Chrysene
DBENZAH	Diben(ah)anthracene
FLUORANT	Fluoranthene
FLUORENE	Fluorene
INDPYR	Indeno(1,2,3-cd)pyrene
NAPTH	Naphthalene
PERYLENE	Perylene
PHENANT	Phenanthrene
PYRENE	Pyrene
THC	Total Hydrocarbon Content

Sample information:

		Type of	Sample depth	µg/kg																							
Sample ID	Dredge area	sample	(m)	ACENAPTH	ACENAPHY	ANTHRACN	BAA	BAP	BBF	BEP	BENZGHIP	BKF	C1N	C1PHEN	C2N	C3N	CHRYSENE	DBENZAH	FLUORANT	FLUORENE	INDPYR	NAPTH	PERYLENE	PHENANT	PYRENE	THC
Sample A	New Harbour	Grab	0.0 - 0.15	4.66	25.3	60.3	72.7	67.2	52.8		79.6	61.2					71	16	148	15.5	86.3	19.8		93.5	127	19500
Sample B	New Harbour	Grab	0.0 - 0.15	3.81	13.9	34.1	51.3	47	32.3		23.4	16.6					49.8	5.47	107	25.6	25.8	3.62		88.4	87.7	13100
Sample C	New Harbour	Grab	0.0 - 0.15	3.06	8.08	15.9	38.5	44.6	35.4		25.9	14.2					45.3	5.67	96.5	9.18	27.6	18.5		83.4	83.9	22000
Sample D	Old Harbour	Grab	0.0 - 0.15	1.81	5.59	13	23.1	25.1	18.5		15.4	10.1					22.1	2.84	57.2	7.38	14.7	8.56		44	50.8	11900
Sample E	Old Harbour	Grab	0.0 - 0.15	<1	<1	3.74	8.98	11.3	9.27		7.85	4.05					10.4	1.65	15.9	1.82	7.48	6.45		12.3	16.8	7110
Sample F	Old Harbour	Grab	0.0 - 0.15	<1	<1	1.84	4.56	6.47	4.63		5.34	2.97					5.25	<1	9.73	<1	4.81	4.75		10.2	9.02	6760
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Organohalogens

Explanatory Notes:
Results above Action Level 1 will be highlighted in blue and above Action Level 2 in red.
ICES7 is the sum of PCB 28,52,101,138,153,180 and 118.

Definitions:

AHCH	alpha-Hexachlorcyclohexane
BHCH	beta-Hexachlorcyclohexane
GHCH	gamma-Hexachlorcyclohexane
DIELDRIN	Dieldrin
HCB	Hexachlorobenzene
PPDDE	p,p'-Dichorodiphenyldicloroethylene
PPDDT	p,p'-Dichorodiphenyltrichloroethane
PPTDE	p,p'-Dichorodiphenyldicloroethane

Sample information:

Sample ID	Dredge area	Type of sample	Sample depth (m)	PCB28	PCB52	PCB101	PCB118	PCB138	PCB153	PCB18	PCB105	PCB110	PCB128	PCB141	PCB149	PCB151	PCB156	PCB158	PCB170	PCB180	PCB183	PCB187	PCB194	PCB31	PCB44	PCB47	PCB49	PCB66	ICES7
																											µg/kg		
Sample A	New Harbour	Grab	0.0 - 0.15	<0.08	0.09	<0.08	<0.08	<0.08	<0.08											<0.08									0.57
Sample B	New Harbour	Grab	0.0 - 0.15	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08											<0.08									0.56
Sample C	New Harbour	Grab	0.0 - 0.15	<0.08	0.09	<0.08	<0.08	<0.08	<0.08											<0.08									0.56
Sample D	Old Harbour	Grab	0.0 - 0.15	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08											<0.08									0.56
Sample E	Old Harbour	Grab	0.0 - 0.15	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08											<0.08									0.56
Sample F	Old Harbour	Grab	0.0 - 0.15	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08											<0.08									0.56
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Sample ID	AHCH	BHCH	GHCH	DIELDRIN	HCB	DDE	DDT	TDE	BDE100	BDE138	BDE153	BDE154	BDE17	BDE183	BDE209	BDE28	BDE47	BDE66	BDE85	BDE99
Sample A																				
Sample B																				
Sample C																				
Sample D																				
Sample E																				
Sample F																				
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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		No. Exceed RAL 1	No. Exceed RAL 2			
Source			CSEMP	CSEMP	Canada							AVERAGE			No.Exceed BAC?	No. Exceed ERL	No. Exceed PEL?
Arsenic	20	70	25		41.6	5.2	3.8	4.0	4.4	3.5	3.5	4.07	0	0	0	-	0
Cadmium	0.4	4	0.31	1.2	4.2	0.12	0.04	0.08	0.11	0.04	0.09	0.08	0	0	0	0	0
Chromium	50	370	81	81	160	16.6	16.2	15.7	15.3	15.00	16.6	15.90	0	0	0	0	0
Copper	30	300	27	34	108	16.4	10.8	13	10.9	8.5	9.3	11.48	0	0	0	0	0
Mercury	0.25	1.5	0.07	0.15	0.7	0.04	0.02	0.02	0.03	0.01	0.011	0.02	0	0	0	0	0
Nickel	30	150	36	-	-	14.4	14.2	13.2	13.6	13.2	14.1	13.78	0	0	0	N/A	N/A
Lead	50	400	38	47	112	11.2	6.3	6.7	6	5	7	6.97	0	0	0	0	0
Zinc	130	600	122	150	271	28	22	26	21	15	17	21.55	0	0	0	0	0
Napthalene	0.1		0.08	0.16	0.391	0.020	0.004	0.019	0.009	0.006	0.005	0.01	0	-	0	0	0
Acenaphthylene	0.1				0.128	0.025	0.014	0.008	0.006	0.001	0.001	0.01	0	-	N/A	N/A	0
Acenaphthene	0.1				0.0889	0.005	0.004	0.003	0.002	0.001	0.001	0.00	0	-	N/A	N/A	0
Fluorene	0.1				0.144	0.016	0.026	0.009	0.007	0.002	0.001	0.01	0	-	N/A	N/A	0
Phenanthrene	0.1		0.032	0.24	0.544	0.094	0.088	0.083	0.044	0.012	0.010	0.06	0	-	4	0	0
Anthracene	0.1		0.05	0.085	0.245	0.060	0.034	0.016	0.013	0.004	0.002	0.02	0	-	1	0	0
Fluoranthene	0.1		0.039	0.6	1.494	0.148	0.107	0.097	0.057	0.016	0.010	0.07	2	-	4	0	0
Pyrene	0.1		0.024	0.665	1.398	0.127	0.088	0.084	0.051	0.017	0.009	0.06	1	-	4	0	0
Benzo(a)anthracene	0.1		0.016	0.261	0.693	0.073	0.051	0.039	0.023	0.009	0.005	0.03	0	-	4	0	0
Chrysene	0.1		0.02	0.384	0.846	0.071	0.050	0.045	0.022	0.010	0.005	0.03	0	-	4	0	0
Benzo(b)fluoranthene	0.1		-	-	-	0.053	0.032	0.035	0.019	0.009	0.005	0.03	0	-	N/A	N/A	N/A
Benzo(k)fluoranthene	0.1		-	-	-	0.061	0.017	0.014	0.010	0.004	0.003	0.02	0	-	N/A	N/A	N/A
Benzo(a)pyrene	0.1		0.03	0.384	0.763	0.067	0.047	0.045	0.025	0.011	0.006	0.03	0	-	3	0	0
Indeno(1,2,3cd)pyrene	0.1		0.103	0.24	-	0.086	0.026	0.028	0.015	0.007	0.005	0.03	0	-	0	0	N/A
Benzo(ghi)perylene	0.1		0.08	0.085	-	0.080	0.023	0.026	0.015	0.008	0.005	0.03	0	-	0	0	N/A
Dibenzo(a,h)anthracene	0.01		-	-	0.135	0.016	0.005	0.006	0.003	0.002	0.001	0.01	0	-	N/A	N/A	0
TPH	100		-	-	-	19.50	13.10	22.00	11.90	7.11	6.76	13.40	0	-	N/A	N/A	N/A
PCBs	0.02	0.18	-	-	0.189	0.00057	0.00056	0.00057	0.00056	0.00056	0.00056	0.0006	0	0	N/A	N/A	0
TBT	0.1	0.5	-	-	-	0.001	0.002	0.135	0.001	0.001	0.001	0.0234	1	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	4.1	No	No	No	N/A	No
Cadmium	0.4	4	0.31	1.2	4.2	0.1	No	No	No	No	No
Chromium	50	370	81	81	160	15.9	No	No	No	No	No
Copper	30	300	27	34	108	11.5	No	No	No	No	No
Mercury	0.25	1.5	0.07	0.15	0.7	0.0	No	No	No	No	No
Nickel	30	150	36	-	-	13.8	No	No	No	N/A	N/A
Lead	50	400	38	47	112	7.0	No	No	No	No	No
Zinc	130	600	122	150	271	21.6	No	No	No	No	No
					-						
Napthalene	0.1	-	0.08	0.16	0.319	0.01	No	N/A	No	No	No
Acenaphthylene	0.1	-	-	-	0.128	0.01	No	N/A	N/A	N/A	No
Acenaphthene	0.1	-	-	-	0.0889	0.00	No	N/A	N/A	N/A	No
Fluorene	0.1	-	-	-	0.144	0.01	No	N/A	N/A	N/A	No
Phenanthrene	0.1	-	0.032	0.24	0.544	0.06	No	N/A	**Yes**	No	No
Anthracene	0.1	-	0.05	0.085	0.245	0.02	No	N/A	No	No	No
Fluoranthene	0.1	-	0.039	0.6	1.494	0.07	No	N/A	**Yes**	No	No
Pyrene	0.1	-	0.024	0.665	1.398	0.06	No	N/A	**Yes**	No	No
Benzo(a)anthracene	0.1	-	0.016	0.261	0.693	0.03	No	N/A	**Yes**	No	No
Chrysene	0.1	-	0.02	0.384	0.846	0.03	No	N/A	**Yes**	No	No
Benzo(b)fluoranthene	0.1	-	-	-	-	0.03	No	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	0.1	-	-	-	-	0.02	No	N/A	N/A	N/A	N/A
Benzo(a)pyrene	0.1	-	0.03	0.384	0.763	0.03	No	N/A	**Yes**	No	No
Indeno(1,2,3cd)pyrene	0.1	-	0.103	0.24	-	0.03	No	N/A	No	No	N/A
Benzo(ghi)perylene	0.1	-	0.08	0.085	-	0.03	No	N/A	No	No	N/A
Dibenzo(a,h)anthracene	0.01	-	-	-	0.135	0.01	No	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	-	-	-	0.0234	No	No	N/A	N/A	N/A