Banff Harbour
Best Practicable Environmental Option (BPEO) Report

February 2025

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1 INTRODUCTION

1.1 Background

Aberdeenshire Council has appointed EnviroCentre Ltd to complete a Marine Licence application for dredging at Banff Harbour in Aberdeenshire. As part of the application, a Best Practicable Environmental Option (BPEO) assessment requires to be undertaken. This revised assessment has been informed using sediment quality results from sampling undertaken in January 2025 and has been submitted following a request from the Marine Directorate Licensing Operations Team (MD-LOT) that a new sediment sampling campaign was undertaken. The reasons given for this included the sampling data being close to its three-year expiry upon the date of submission and further information being required as a result of a historic exceedance of a single Revised Action Level 2 sample recorded in the 2019 sampling campaign.

The site was previously licenced under MS-00009311, which expired on 15th December 2023. As such, this project is considered to be a maintenance dredge.

The proposed dredge depth will not exceed 1 metre and a maximum volume of 5,000 m^3 will be dredged across the harbour, as shown in Drawing No. 374655-QGIS001 in Appendix A.

The purpose of these the samples 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 2025 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 Programme of Work

The programme of work involves the removal of up to 5,000m^3 (10,000 tonnes) of material from within the harbour, to a maximum depth of 1 metre below bed level. The maintenance dredging activity is required to ensure that sufficient depth remains to ensure that Banff Harbour continues to be able to accommodate vessels. Sediment primarily consists of sand and silt and it is anticipated that material will be removed by a grab dredger.

Chemical testing of the material has been undertaken to support this assessment. The findings of the sediment sampling exercises are summarised in the sections below.

1.5 Dredging Activities

The method of dredging at the dredge site has not been completely finalised and the specific plant will not be confirmed until a contractor has been appointed. However, the method is most likely to utilise a grab dredger with a split-hull hopper or similar as per previous dredging campaigns.

2 SAMPLING LOCATIONS AND METHODOLOGY

The latest campaign of sampling works were undertaken on 14th January 2025. Although a dredge of this scale would typically only require three grab samples under the requirements of Marine Scotland *Pre-Dredge Sampling Guidance Version 2* (2017), MD-LOT advised a more detailed scope of investigation, as given in an email to EnviroCentre dated 24/05/2024:

> *"Although the volume of material to be dredged only requires 3 samples to be taken under the OSPAR Convention, due to the 2019 results MD-LOT advise that the new samples should reflect the previous sampling in 2021/22 with a total of 8 samples, 5 of these being taken in the inner basin near the historical site of contamination and the other 3 spaced over the remaining extent of the harbour. As the inner basin is known to have historical contamination then core samples must be taken in this area, with sub-samples taken as per the guidance, down to maximum dredge depth. If the depth to be dredged across the remainder of the site is 1m or less then grab samples are sufficient, if the dredge depth is to be more than 1m then core samples are required.*

The following section details the sampling methodology used to retrieve sediment samples.

2.1 Sample Locations

Sediment cores (VC) were collected from five locations, with grab samples (GS) collected from three locations. Sample station locations are outlined in Table 2-1.

Sample Station ID	Latitude	Longitude	Easting	Northing
GS1	57° 40.235	-2° 31.340	368941.03	864645.181
GS2	57° 40.206	-2° 31.380	368900.758	864591.557
GS3	57° 40.201	-2° 31.346	368934.026	864582.803
VC1	57° 40.183	-2° 31.379	368900.648	864549.151
VC2	57° 40.180	-2° 31.359	368921.003	864543.023
VC3	57° 40.178	-2° 31.338	368942.015	864540.068
VC4	57° 40.167	-2° 31.361	368918.924	864518.455
VC5	57° 40.161	-2° 31.338	368941.687	864507.292

Sample locations are shown in Drawing No. 374702-QGIS-012, included in Appendix A.

2.2 Navigation and Sample Location

Pre-determined sample station locations were programmed into a Trimble TDC600 GPS device. The sampling pontoon was then moved on to the predetermined location and fixed in place by tying on to the fixed marina pontoons. Upon successful recovery of sample, the location was logged on the GPS device before moving to the next location.

2.3 Sampling Constraints and Deviation from Sampling Plan

Core samples require a top, middle and bottom sub-sample to be analysed. However, owing to shallow depth of sediment deposits due to recent dredging, and shallow bedrock at mall VC locations with the exception of VC4, a grab sample and a single composite core sub-sample was submitted for analysis. All cores were progressed to refusal, presumed bedrock.

Bedrock is known to be shallow in Banff Harbour and similar constraints were noted during the 2019 core sampling exercise. It is understood that the most recent dredging works took the harbour bed down to rockhead. It is clear from aerial photography that the harbour lies within an area of natural rock outcrops on all sides, which further indicates the presence of shallow bedrock.

No core sample was obtained at proposed location VC3, despite several attempts in the vicinity. The vibrocore recovered only a few dark grey pieces of fine gravel, suggesting that the core barrel was hitting bedrock. A grab sample was however able to be obtained.

As the sediment thickness at all locations was less than 1.0m, a grab sample was collected for analysis. In addition to this, and based on recent experiences with similar situations, the recovered core samples were also tested as these were part of the agreed sample plan, however there was insufficient volume of material to fill all the required sample media. Due to the historic metal contamination recorded within the harbour, sample media for metals analysis (plastic tub) was prioritised. Organic analysis was also undertaken from this media but the resultant results are flagged as deviating as the sample was not from a glass jar. The grab samples at the same locations were submitted for analysis in both glass and plastic containers as required and given that the sediment depth is <1.0m in these locations, a single gran sample is considered appropriate.

2.4 Sample Collection

Core samples were recovered using a vibrocorer with 75mm sample tube. The vibrocorer was deployed and recovered using a mobile, floating pontoon with a central moon-pool as a sampling window.

Once the tube was recovered, the core was detached from the head unit, and the recovery depth and sediment type at the base were noted. Where necessary, additional attempts were made at the same or similar location to obtain a better recovery and/or meet the required sampling depth.

All core samples were supplemented by a surface grab sample, to ensure there was sufficient surface sediment for analysis. Grab samples were obtained using a 0.045m^2 stainless steel Van Veen grab sampler. Grab samples were collected by hand from the pontoons. The exception to this is GS1, which was collected directly from the beach at low tide. Recovered material was emptied into a plastic bucket ready for sub-sampling. Where required, the grab was deployed multiple times to ensure enough sample was recovered for testing.

2.5 Field Information

The following field data was recorded for each sample obtained:

- A unique sample ID;
- Sample location;
- Sample coordinate in latitude and longitude in degrees, minutes and decimals of minutes;
- Date, time and depth of collection;

- Sampler's ID;
- Sediment description;
- Sample photographs; and,
- Details of any deviation from sampling protocol.

2.6 Sample Preparation

Cores were cut into subsections and extruded into a plastic core holder, spilt in half lengthways, photographed and logged prior to sub sampling. Grab samples were also photographed and logged prior to sub-sampling.

The entirety of the three cores were sub-sampled for analysis, with no surplus material left for retention.

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

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

Once samples had been placed within sample containers, they were labelled and placed immediately into cool boxes. Samples were dispatched to the project laboratory (Socotec) on 16th January 2025.

2.7 Analysis Requirements

The laboratory analysis required by the Marine Directorate (MD-LOT), and undertaken as part of this investigation, was as follows (subject to the deviations noted above):

- Metals – Arsenic, Chromium, Cadmium, Copper, Mercury, Nickel, Lead, Zinc;
- Organotins – Tributyl Tin and 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 the Socotec Marine Laboratory for analysis.

3 RESULTS

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

3.1 Sediment Summary

Sediment generally comprised of soft, black/dark grey silt and fine sand. Greyish-brown silty fine sand was noted at locations GS1 and GS3. Leaf litter and vegetation was the primary constituent of several samples and was noted in at least occasional quantities in most samples.

Full descriptions and photographs for each sample station are provided in Appendix B.

3.2 Physical Analysis

3.2.1 Particle Size Analysis (PSA)

Sediment was generally noted to primarily comprise silt and sand sized particles. Sediment from GS1 (located in the outer basin and beach area) and GS3 (in the middle basin) was noted to primarily comprise sand. The Particle Size Analytical data sets for each sample is included within Appendix C.

3.3 Chemical Analysis

3.3.1 Chemical Analysis Assessment Criteria

All chemical analysis results were assessed against Revised Action Levels (RAL) criteria as adopted by Marine Scotland. The results are summarised in sections 3.3 and 3.4. Summary reports detailing exceedances in the Marine Scotland format have been submitted along with the supporting information for the application. The laboratory certificates are provided in Appendix C.

Where contaminants have RALs as adopted by Marine Scotland, exceedances above these criteria are summarised in Table 3-1, along with the maximum concentration recorded for each parameter.

Table 3-1: Exceedances of Revised Action Levels and Maximum Concentrations

Contaminant	No. Exceedances (of 13 samples)		Maximum Concentration (mg/kg) and Location
	RAL1	RAL2	
Arsenic	0	0	9.3 @ VC5 (0.0-0.15m)
Cadmium	9	0	0.96 @ VC5 (0.0-0.15m)
Copper	10	0	79 @ VC5 (0.0-0.15m)
Chromium	1	0	54.3 @ VC1 (0.0-0.25m)
Lead	0	0	30.7 @ VC5 (0.0-0.15m)
Mercury	0	0	0.06 79 @ VC5 (0.0-0.15m)
Nickel	5	0	56.9 @ VC1 (0.0-0.25m)
Zinc	2	0	190 @ VC5 (0.0-0.15m)

Contaminant	No. Exceedances (of 13 samples)		Maximum Concentration (mg/kg) and Location
	RAL1	RAL2	
PAH (All Species)	11	-	0.577 (Pyrene) @ GS2 (0.0-0.15m)
PCBs	0	0	0.00338 @ VC2 (0.15-0.7m)
TBT	0	0	0.0165 @ VC5 (0.0-0.2m)
THC	11	-	505 @ GS2 (0.0-0.15m)

A maximum of 10 (of 13) samples exceeded RAL1 for at least one metal, with most exceedances occurring for cadmium and copper. All but two of the 13 samples analysed recorded exceedances above RAL1 for at least one PAH species and THC.

There were no exceedances above RAL1 for PCBs and TBT, and no exceedances above RAL2 for all contaminants of concern.

3.4 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 Identification and Screening of Available Disposal Options

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

Table 4-1: Initial Best Practicable Available Options

Location	Options	Screening Assessment	Carry forward?
Coastline	Leave in situ	Not an option due to the requirements to maintain depth to allow vessels to access and berth in the harbour.	No
	Infilling of an existing dry dock/harbour facility (re-use)	No current or proposed dock/harbour infilling projects are known within a reasonable distance of the dredge site. In addition, given the relatively small volume of sediment to be dredged (~5,000 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 previously used dredged material from the outer basin for beach nourishment (with the remainder of material from the middle and inner basins being disposed at sea). The dredge material in the outer basin area predominantly comprises sand, which is likely to be considered suitable for beach nourishment. Finer grained material from the middle and inner basins is unlikely to be considered to be suitable for beach nourishment in the traditional sense.	Yes

Location	Options	Screening Assessment	Carry forward?
Land	Landfill Disposal	This is technically 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. There will be significant cost associated with set up of dewatering facility at the quayside or elsewhere plus transportation and additional costs associated with gaining the necessary planning and regulatory consents. Other disposal and/or re-use routes are likely to be preferable which would re-introduce sediment back into the coastal cells for sediment transport.	No
	Land Incineration	The dredged material consists primarily 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. It would require detailed chemical analysis and assessment as well as a Waste Management Licence Exemption. It would require special precautions during spreading in relation to the risk of odour and watercourses / aquifers. Disposal of sediments in this manner would potentially have a detrimental effect on existing terrestrial habitats.	No
	Recycling	Recycling of dredged material is theoretically possible, however, due to the varied lithology there would need to be either segregation during dredging works, or energy and water rich processing on land. EnviroCentre have not been made aware by the harbour authority of an established disposal and reuse route in 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 dredge spoil disposal ground is Macduff (CR050), 3.6km north-east of Banff Harbour. The proposed dredge method is to utilise a grab dredger with a split hull hopper or similar, as per previous dredging campaigns. Overall disposal costs associated with sea disposal are generally lower than land-based disposal, with low environmental risk due to appropriate sediment quality screening measures applied during the licensing process.	Yes

4.2 Summary of Identified BPEO Options

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

- Beach Nourishment; 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.

4.2.1 Beach Nourishment

This method would involve the following material handling stages:

- Dredging;
- 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 grab dredger. The material would then have to be transferred on to land and 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 a beach 150m west of Banff Harbour as a possible site for a small-scale beach nourishment project. There is potential for some temporary disruption to local residents and harbour users as a result of plant movements.

The previous maintenance dredge licence has permitted the use of material from the outer basin of the harbour to be used as part of a beach nourishment exercise.

4.2.2 Sea Disposal

A licenced sea disposal site is located within close proximity of Banff Harbour – Macduff (CR050) is located 3.6km north-east of the harbour to be dredged.

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

This practice has previously been accepted as a disposal route for dredged material from Banff Harbour. This disposal route was used during the most recent dredge campaign during 2023.

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	Sea Disposal
Operational Aspects (inc. handling and transport)	This method would involve double handling of material, with road transport by HGV between the harbour and the beach site required. A small beach 150m west of the harbour has been identified as a potentially suitable site, therefore HGV movements would be over short distances. The potential need for additional environmental assessment and potential licensing requirements may put pressure on the required project timescales.	There would be no double handling of the dredged material. Transportation to the disposal site would be by dredging vessel without the need to bring the material on to land. The proposed disposal site is only 3.4km away by sea.
Availability of suitable sites/facilities	Aberdeenshire Council have identified a potential receiving beach, approximately 150m west of the harbour.	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. That said, any HGV movements will be concentrated within the harbour area and considered to have little impact on the wider town.	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. However, the beneficial re-use of material reduces the amount of material being disposed of.	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	Sea Disposal
Safety Implications	HGV movements between the harbour and disposal site increase 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 geochemical testing/risk assessment of the sediment may be required to ensure it is suitable for use.	Low potential for human contact during dredging and disposal operations. Once deposited at disposal site, pathways for human contact are greatly reduced.
Pollution/ contamination	HGVs transporting material to the beach site would have implication on carbon footprint and potential for localised impact on air quality. Potential also for temporary noise impacts and dust release during profiling works (if sediment dries out).	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 and 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, however this is limited due to the relatively short distance (3.6 km) to the nearest sea disposal site.
General Ecological Implications	Significant ecological implications are unlikely as a result of deposition of additional sand on the beach. The receiving beach is part of the Whitehills to Melrose Coast SSSI. The feature of note in the SSSI is the Dalradian metamorphic rocks, which are unlikely to be adversely impacted by sediment deposition where sand material is already present.	Macduff (CR050) is a licensed disposal site for dredged material.

Criteria	Beach Nourishment	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.	The Macduff disposal site is licensed by Marine Scotland for the disposal of dredging spoil. 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. Residential properties are noted to be within 50 metres of the beach.	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 10,000 tonnes (approximately 5,000m^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 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.* fine 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 £450 per day) operating for 5 days;
- To transport sediment from the harbour to the beach (for beach nourishment), it is anticipated that this would use a 16 tonne wagon and it is estimated that 125 return trips (0.2 mile round trip) would be required to transport a maximum of 2,000 tonnes of material. Minimum hire charges mean that the cost of this work element is estimated to be in the region of £5,000;
- The cost for an excavator to distribute sediment and profile the beach as part of a beach nourishment project 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:

Table 5-4: BPEO Cost Analysis (based on 10,000 tonnes)

Activity	Beach Nourishment (£)	Sea Disposal (£)
Dredging	16,050	16,050
Transport by vessel to disposal site	-	40,000
Transfer of material to lorry	2,250	-
Transportation Cost to Beach	5,000	-
Excavator for beach profiling works	2,250	-
Total Costs	**28,550**	**56,050**

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).

The costs noted above are indicative and given as a general comparison between the different disposal methods (*i.e.* assuming a single volume for disposal of 10,000 tonnes). The totals given above do not account for the splitting of the total dredged material between different disposal routes (*e.g.* sea disposal with a smaller proportion of material destined for beach nourishment).

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	Sea Disposal
Environment	2	2
Strategic	3	2
Costs	1	2
TOTAL SCORE	**6**	**6**

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.

Aberdeenshire Council have identified a receiving beach 150m west of the harbour as a potential disposal location for sand material from the outer basin only as part of a small-scale beach nourishment project. It is understood that this practice has been accepted previously, with the remaining material unsuitable for beach nourishment (*i.e.* from the middle and inner basins) destined for sea disposal. Beach nourishment has been assessed as the most cost-effective option. Further environmental assessments may be required for beach nourishment. Also, it would require plant movements between the harbour and the beach meaning that strategically it scores lower than sea disposal. If beach nourishment at the proposed location 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 joint preferred disposal option along with sea disposal.

5.2 Conclusions

The Best Practicable Environmental Option for disposal of the Banff Harbour dredged material has therefore been assessed as a combination of sea disposal and beach nourishment as per Table 5-5.

Depending upon the confirmed dredging methodology and plant available, it is proposed that material from the middle and inner basins (silt-laden material unsuitable for beach nourishment) is disposed of at sea, with sand material with a considerably lower silt content from the outer basin used as part of a beach nourishment project if required. It is understood that this has been accepted on the most recent dredging licences, with a split of up to 80%/20% of the material destined for sea disposal and beach nourishment permitted respectively.

Similarly, if the final dredging method and available plant mean that it would be logistically more straightforward to dispose of all the material at sea (*i.e*. from the outer, middle and inner basins), then it is proposed that this disposal route is followed as circumstances dictate. If time pressures arise which mean dredging and disposal has to be undertaken quickly, then those circumstances would also mean that it would be proposed that all material is disposed of at sea. The final methodology is to be confirmed.

As identified in the sediment chemical quality section, further assessment is deemed necessary to confirm the suitability of the sediment for disposal within the disposal site and consider potential impacts to the receiving environment. The following section details this assessment.

6 FURTHER ASSESSMENT

As detailed in Section 1.3, 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; and
- Compare existing chemical data with other recognised sediment assessment criteria including those listed below. Summary tables are provided in Appendix D.

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), which are related to the PELs have been not been included in the summary table in Appendix D or 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 Banff Harbour, as shown on Drawing No. 374655-QGIS003 in Appendix A.

It is anticipated that a minimum 80% of the total dredged material (including all of the material from the middle and inner basins) will be destined for sea disposal, with a maximum of 20% of the total dredged material (only to include sand material from the outer basin) will be used as part of a small-scale beach nourishment project.

Material to be disposed of at sea is deposited at the Macduff disposal site (CR050). The proposed receiving beach for the sand material from the outer basin is 150 metres west of the harbour. Proposed disposal locations are shown on Drawing No. 374655-QGIS003 in Appendix A. It should be noted that depending on available marine plant and the finalised dredging method, then it may be proposed that all material is destined for sea disposal.

6.2 Analytical Data Review

Analytical data from the January 2025 sampling campaign for the proposed dredge site is provided in Summary Table A in Appendix D. 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:

- Cadmium – 9 of 13 samples recorded cadmium above RAL1;
- Copper – 10 of 13 samples recorded copper above RAL1;
- Nickel – 5 of 13 samples recorded nickel above RAL1;
- Zinc – 2 of 13 samples recorded zinc above RAL1
- PAHs – 11 of 13 samples recorded at least one PAH species above RAL1; and
- THC – 11 of 13 samples recorded total hydrocarbons above RAL1.

6.2.2 BAC Review

Exceedances of the BAC can be summarised as follows:

- Cadmium – 10 of 13 samples recorded cadmium above the BAC;
- Copper – 10 of 13 samples recorded copper above the BAC;
- Nickel – 2 of 13 samples recorded nickel above the BAC;
- Zinc – 3 of 13 samples recorded zinc above the BAC; and
- PAHs – 12 of 13 samples recorded at least one PAH species above the BAC.

6.2.3 ERL & PEL Review

Exceedances of the ERL can be summarised as follows:

- Copper – 8 of 13 samples recorded copper above the ERL;
- Zinc – 1 of 13 samples recorded zinc above the ERL; and
- PAHs – 9 of 13 samples recorded at least one PAH species above the ERL.

There were no exceedances of the PEL, where one is available for review.

6.2.4 Action Level 2

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

6.3 Additional Commentary on Deviating Samples

As discussed in Section 2.3, organic parameters were noted to be deviating within core samples VC1 (0.0-0.25m) and VC5 (0.0-0.2m). This was due to very limited recovery of sediment and depth of these cores, meaning that only one container could be filled. The plastic tub was prioritised to allow the metals suite to be analysed without deviation. This was considered the most appropriate course of action given the historical elevated concentrations of copper and zinc at Banff Harbour. Analysis of the organic parameters was undertaken regardless to provide as much information as possible.

The core samples noted as deviating are very limited in depth (and associated volume) due to the presence of bedrock (max 0.25m), therefore it is considered that the respective grab samples (to 0.15m depth) provide more robust data for the same locations, and at a similar depth and applicable for dredge depths of <1.0m.

As a way of comparison, the results from the deviating core samples, and the respective grab samples from the same location are displayed in Table 6-1 below. Although there is some variation as would be expected in a heterogenous sediment, the results are considered to be in a similar range to one another and therefore any potential impacts on the integrity of the dataset are not considered to be significant with all of the recorded concentrations below RAL2 and similar to historic levels.

Table 6-1: Comparison of Deviating Results from Cores Against Respective Grabs

Parameter	VC1 0.0-0.15m (grab)	VC1 0.0-0.25m (core – deviating)	VC5 0.0-0.15m (grab)	VC5 0.0-0.2m (core – deviating)
Napthalene	0.049	0.073	0.046	0.062
Acenaphthylene	0.056	0.027	0.031	0.023
Acenaphthene	<0.005	<0.005	0.005	0.005
Fluorene	<0.005	0.028	0.033	0.020
Phenanthrene	0.051	0.173	0.197	0.159
Anthracene	<0.005	0.058	0.135	0.033
Fluoranthene	0.486	0.346	0.576	0.331
Pyrene	0.381	0.330	0.510	0.298
Benzo(a)anthracene	0.208	0.157	0.271	0.128
Chrysene	0.175	0.178	0.301	0.176
Benzo(b)fluoranthene	0.188	0.152	0.228	0.157
Benzo(k)fluoranthene	0.212	0.157	0.230	0.142
Benzo(a)pyrene	0.256	0.181	0.283	0.168
Indeno(1,2,3cd)pyrene	0.160	0.128	0.179	0.117
Benzo(ghi)perylene	0.151	0.128	0.184	0.122
Dibenzo(a,h)anthracene	<0.005	0.027	0.036	0.026
THC	390	314	337	302
PCBs	0.00087	0.00093	0.00159	0.00135
TBT	0.005	0.005	<0.005	0.0165

6.4 Averages

A review of the averaged data for all the samples has been undertaken *i.e.* considering the material as a single volume for disposal. The averaged data is presented in Summary Table B in Appendix D. The review of average data against the available adopted assessment criteria can be summarised as follows:

- Averaged concentrations marginally exceeded RAL1 copper, various PAH species and THC. The averaged concentrations for cadmium also marginally exceeded RAL1;
- Averaged concentrations exceeded the BAC for cadmium, copper and various PAH species;
- Averaged concentrations exceeded the ERL for copper and for benzo(g,h,i)perylene;
- All samples recorded averaged concentrations below the PEL where one is available for comparison; and
- All samples recorded averaged concentrations below RAL2.

6.5 Review of Historic Sample Data from 2019 and 2021/2022

Three grab samples were collected in the harbour and scheduled for analysis during 2019 to support a previous licence application. The results were previously provided to EnviroCentre by Aberdeenshire Council.

Following this, the most recent Marine Licence (ref. MS-00009311) was informed using sediment sampling data from 2021. This was supplemented by additional sampling works during March 2022 following a request from Marine Scotland to obtain additional data to delineate the area of the harbour represented by sample "A7402 C" collected in 2019. This sample recorded an exceedance of RAL2 for copper and zinc.

Marine Scotland subsequently requested additional analysis to be undertaken in the Inner Basin to provide additional data on metals concentrations in the vicinity of the 2019 RAL2 exceedance. The findings of the additional analysis were originally included in EnviroCentre letter ref. 374655/CCAS/003 dated 26/04/2022. During the 2022 additional sampling campaign, one grab sample was collected at the same location as 2019 sample "A7204 C", with four grab samples collected in the harbour surrounding this location. Results of the additional metals analysis were considered to be broadly in line with the main 2021 dataset – *i.e.* several metals in exceedance of RAL1, with no exceedances of RAL2.

It was concluded at the time that the RAL2 exceedance recorded in 2019 was likely to have been as a result of an anomaly which is not representative of the wider harbour area sediment quality and may have arisen from a discrete source of contamination *(i.e.* paint chips, treated wood, metal plating or another similar source). Differences in sample preparation and analytical techniques between the James Hutton Institute (who analysed the 2019 samples) and Socotec (who analysed the 2021 samples) may also have been a factor.

The average concentrations for each analysed parameter for each of the most recent sampling campaigns is given in Table 6-2 below. Generally, averaged concentrations are either comparable, or are in some cases lower than the average concentrations recorded in 2019.

The number of RAL1 exceedances recorded between the 2025 and 2021/22 sampling campaigns is broadly similar. It is noted that the number of RAL exceedances for 2019 appear to be considerably lower than those noted in 2025 and 2021/25. This is due to only three samples being analysed during this sampling campaign, with 13 samples analysed in 2025, and 11 during 2021/22 (16 samples for the metals suite).

There have been no other exceedances of RAL2 since the exceedance recorded in grab sample "A7402 C" collected during 2019.

Table 6-2: Summary of 2025, 2021/22 and 2019 Sample Data

Parameter	Average (mg/kg)			RAL1 Exceedances			RAL2 Exceedances		
	2025	2021/22	2019	2025	2021/22	2019	2025	2021/22	2019
Arsenic	5.65	5.51	9.27	0	0	1	0	0	0
Cadmium	0.41	0.46	0.37	9	11	1	0	0	0
Chromium	31.74	27.94	46.60	1	0	1	0	0	0
Copper	36.26	33.41	152.10	10	10	1	0	0	1
Mercury	0.01	0.06	0.10	0	0	0	0	0	0
Nickel	28.54	25.27	27.70	5	7	1	0	0	0
Lead	19.41	19.27	20.83	0	0	0	0	0	0
Zinc	102.66	85.39	341.03	2	1	1	0	0	1
Naphthalene	0.05	0.05	0.00	1	2	0	-	-	-

Parameter	Average (mg/kg)			RAL1 Exceedances			RAL2 Exceedances		
	2025	2021/22	2019	2025	2021/22	2019	2025	2021/22	2019
Acenaphthylene	0.02	0.02	0.01	0	0	0	-	-	-
Acenaphthene	0.01	0.01	0.03	0	0	0	-	-	-
Fluorene	0.02	0.03	0.06	0	0	1	-	-	-
Phenanthrene	0.15	0.18	0.08	8	7	2	-	-	-
Anthracene	0.05	0.07	0.05	1	3	0	-	-	-
Fluoranthene	0.29	0.35	0.05	11	10	0	-	-	-
Pyrene	0.28	0.34	0.05	11	10	0	-	-	-
Benzo(a)anthracene	0.13	0.17	0.08	9	9	1	-	-	-
Chrysene	0.15	0.18	0.01	9	9	0	-	-	-
Benzo(b)fluoranthene	0.12	0.15	0.15	9	9	2	-	-	-
Benzo(k)fluoranthene	0.12	0.09	0.01	9	4	0	-	-	-
Benzo(a)pyrene	0.15	0.18	0.05	9	9	0	-	-	-
Indeno(1,2,3cd)pyrene	0.10	0.14	0.03	9	9	0	-	-	-
Benzo(ghi)perylene	0.10	0.13	0.08	9	9	1	-	-	-
Dibenzo(a,h)anthracene	0.02	0.03	0.14	0	0	2	-	-	-
THC	295.29	265.28	177.47	11	10	2	-	-	-
PCBs	0.0013	0.0019	0.0006	0	0	0	0	0	0
TBT	0.0062	0.0086	0.0050	0	0	0	0	0	0

Notes: 2025 – 13 samples; 2021/22 – 11 samples (16 samples for metals); 2019 – 3 samples.

6.6 Chemical Assessment Conclusions

A number of samples recorded exceedances of RAL1 for various metals, several PAH species and THC. Averaged concentrations (which consider the dredge as a single volume for disposal) exceeded RAL1 for copper, several PAH species and THC. A marginal exceedance of the averaged concentration of cadmium also exceeded RAL1.

A number of individual samples recorded exceedances above the ERL for copper, zinc and at least one PAH species. Averaged concentrations exceeded the ERL for copper and Benzo(g,h,i)perylene only. No averaged concentrations exceeded the PEL or RAL2.

At the time of writing, no background chemical data for the proposed sea 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.

6.7 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 6-3 below, in the context of disposing of sediment by disposal at sea and for beach nourishment.

Table 6-3: Receptor Risk Assessment

Key Receptor[1]	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	Despite continued maintenance dredging in the harbour, SEPA do not consider Banff (as part of the Banff and Macduff coastal body) as a Heavily Modified Water Body (HMWB)[2]. 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. The sea disposal site is also located in the Banff and Macduff coastal body (*i.e.* classified as "High" for morphology and not considered to be heavily modified). The classification will take into account the presence of the disposal site, so no further assessment is considered to be required. It is noted that the Whitehills to Melrose Coast Site of Special Scientific Interest (SSSI) lies immediately beyond the harbour walls. The SSSI accounts for the rocky foreshore and is designated for its structural and metamorphic geology. The proposed beach nourishment site is located within the SSSI. However, the placement of sand on an area where sand is already present is considered unlikely to cause significant impact on the notified natural features of the SSSI. Dredging works are not anticipated to cause negative impacts on the condition of the SSSI. Similarly, it is noted that sea disposal will take place in a Marine Protection Area (MPA). This is considered separately below.

[1] https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters
[2] https://marinescotland.atkinsgeospatial.com/nmpi/

Key Receptor[1]	Brief Summary of Potential Effects on Receptor	Further Consideration Required?	Comment
Biology - habitats	Included to assess potential impacts to sensitive/high value habitats.	No	The WFD classification for the Banff and Macduff body for macro-invertebrates is "good". The classification will take into account the presence of the disposal site, so no further assessment with regard to sea disposal is considered to be required. Any effects are considered to be both localised and temporary. Similarly, the deposition of sediment as part of a beach nourishment programme is unlikely to cause significant adverse impacts on habitats. It is noted that sea disposal will take place in a Marine Protection Area (MPA). This is considered separately below.
Biology – fish	Consideration of fish both within the estuary and also potential effects on migratory fish in transit through the estuary	No	Banff and the surrounding area does not have a WFD classification for fish. In addition, there is no estuary in close proximity to the site in which migratory fish would be travelling towards. Immediately out with the harbour lies open sea with no obvious constraints. Dredged material will be deposited in the same way as per previous dredging campaigns. Therefore no further assessment is considered necessary.
Water Quality	Consideration must be given to water quality when contaminants are present in exceedance of CEFAS RAL1.	Yes	The Banff and Macduff 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 localised and temporary. Further consideration of potential effects is discussed in section 6.8.1 for completeness.

Key Receptor[1]	Brief Summary of Potential Effects on Receptor	Further Consideration Required?	Comment
Protected Areas	If your activity is within 2km of any WFD protected area, include each identified area in your impact assessment. • special areas of conservation (SAC) • special protection areas (SPA) • shellfish waters • bathing waters • nutrient sensitive areas	Yes	The dredging site is located 1.1km south of the Southern Trench Marine Protected Area (MPA). The sea disposal site is located within the MPA. The MPA was designated in December 2020 with its features are noted to include: burrowed mud, Minke whale, thermal fronts, shelf deeps, submarine mass movements and Quaternary geology. The closest designated bathing water to the dredge site is Inverboyndie (1.4 km west). The proposed disposal site is not located within 2km of any other protected areas (including SAC, SPA or Ramsar sites). There are no designated shellfish waters along the northern Aberdeenshire and Moray coasts. Further assessment with regard to protected areas is given in section 6.8.2 below.

6.8 Potential Risk to Water Quality and 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.

6.8.1 Water Quality

SEPA classified the Banff and Macduff coastal water body as “pass” for specific pollutants. No classification is provided for priority substances.

Although there are contaminants of concern 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 both dilution and natural attenuation in the open waters beyond the harbour wall is considerable.

When the sediment results are reviewed as an average to assess all of the dredged sediment as a single unit for disposal, RAL1 is exceeded for several contaminants of concern as follows. The dredge average for cadmium marginally exceeded RAL1 (average concentration of 0.41 mg/kg vs. RAL1 of 0.4 mg/kg). Similarly, the dredge average for copper also exceeded RAL1 (average concentration of 36.3 mg/kg vs. RAL1 of 30 mg/kg). The maximum average PAH concentration recorded was 0.29 mg/kg (Fluoranthene) vs. RAL1 of 0.1 mg/kg. For THC, the averaged concentration was 295 vs. RAL1 of 100 mg/kg.

Several averaged concentrations exceeded the BAC, however it should be noted that the BAC is intended to be used to determine if concentrations are near to background concentrations, rather than qualify any potential environmental impact. In addition, the BACs for PAHs and metals are generally lower than the Marine Scotland RAL1, therefore it is considered to be a very conservative assessment criteria. The averaged concentration for benzo(g,h,i)perylene exceeded the ERL, but in this instance the ERL is lower than RAL1 and is again considered to be a very conservative assessment criteria. The averaged concentration of copper also exceeded the ERL. Averaged concentrations do not exceed RAL2 or the PEL.

The key contaminants for impacting water quality are considered to be metals as these have the potential to dissolve or desorb from sorption sites within the sediment. However, the overall concentrations of metals are generally low and natural geochemical processes will limit their solubility along with the large dilution potential it is not expected that these would have a long-term impact on water quality.

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

The key risk to water quality is considered to be an increase in turbidity/suspended solids during the sea disposal activity. Although this is likely to cause a localised increase in suspended solids, it is considered that this will be both local and temporary in nature and has been factored into the selection and location of the agreed sea disposal ground.

It is proposed that the dredged material is split into two disposal sites. It is anticipated that between 80% and 100% of the dredged sediment will be disposed of at the Macduff disposal ground (CR050). This will include all silt-containing material from the middle and inner harbour basins. The remaining material (0% to 20% of the total dredge) will be used as part of a beach nourishment project. Any

material destined for beach nourishment will include sand material from the outer basin only (represented by sediment sample GS1). Results from the GS1 sample did not record any exceedances above RAL1.

According to averaged particle size analysis (PSA) data, the sediment material from the inner and middle basins primarily comprises sand and silt with lesser quantities of gravel. Sediment from the outer basin chiefly comprises sand with negligible quantities of gravel and silt sized particles.

Table 6-4 and Table 6-5 summarises the average physical sediment type for all samples from the inner and middle basins; and outer basin respectively. Estimated volumes are given for physical sediment type based upon the average PSA data and assuming an 80%/20% split of the total dredge volume of 5,000m^3 between sea disposal and beach nourishment respectively.

Table 6-6 provides the average PSA data for the dredge as a single unit for disposal.

Table 6-4: Summary of Average PSA Data – Middle & Inner Basins

Gravel (>2mm)	Sand (0.063mm<Sand<2mm)	Silt & Clay (<0.063mm)	80% of total dredge volume m^3
5.4 %	54.44 %	40.16 %	4,000
216 m^3	2,177 m^3	1,607 m^3	

Table 6-5: Summary of PSA Data (Sample GS1 only) – Outer Basin

Gravel (>2mm)	Sand (0.063mm<Sand<2mm)	Silt & Clay (<0.063mm)	20% of total dredge volume m^3
0.13 %	97.94 %	1.93 %	1,000
1.3 m^3	979.4 m^3	19.3 m^3	

Table 6-6: Summary of Average PSA Data – Entire Dredge

Gravel (>2mm)	Sand (0.063mm<Sand<2mm)	Silt & Clay (<0.063mm)	Maximum quantity to be dredged m^3
4.92 %	58.39 %	36.69 %	5,000
246 m^3	2,920 m^3	1,834 m^3	

The dominant sediment types for material destined for sea disposal are sand and silt. Sand particles will generally fall out of suspension quickly with minimal lateral spread. The silt particles, making up approximately 40% of the material to be disposed at sea, can be suspended in the water column for a longer period of time. However, if the finer grained material is cohesive and in clumps, then it will sink much faster than if in a slurry. The Macduff sea disposal site has accepted dredged material from Banff in 2023. The Banff and Macduff coastal water body as a classification of “good”, which will take into account the presence of the disposal site. On this basis, it is considered that any impact on water quality as a result of suspended solids/turbidity will be localised and temporary and unlikely to cause a change in the classification status at both the dredge and disposal sites.

With regard to material destined for beach nourishment, the material to be dredged from the outer basin comprises a much higher proportion of sand sized particles, which are unlikely to be held in suspension in the water column. It is anticipated that the relatively small proportion of silt sized particles in the outer basin (~2%) will be transported to sea relatively quickly by the tidal cycles with little impact on water quality anticipated.

6.8.2 Protected Areas

6.8.2.1 Southern Trench MPA

Banff Harbour is located 1.1km south of the boundary of the recently designated Southern Trench MPA. The Macduff sea disposal site is located within the MPA.

The Conservation and Management Advice document for the MPA[3] has been reviewed as part of this assessment. The document notes the protected features within the MPA, along with the latest assessment condition. This information is summarised in Table 6-7.

Table 6-7: Southern Trench MPA - Protected Features and Conditions (NatureScot, 2024)

Protected Feature	Feature Type	Feature Condition (2019)
Burrowed mud	Inshore sublittoral sediment (Marine)	Favourable
Fronts	Large-scale feature (Marine)	Favourable
Minke whale *(Balaenoptera acutorostrata)*	Mammals (Marine)	Favourable
Shelf deeps	Large-scale feature (Marine)	Favourable
Quaternary of Scotland (subglacial tunnel valleys and moraines)	Quaternary geology and geomorphology	Favourable
Submarine Mass Movement (slide scars)	Geomorphology	Favourable

Each of the protected features noted in Table 6-7 will be considered in turn, with the risk of negative impacts on the feature assessed in the context of sea disposal works. Features of the MPA are not considered to be at risk as a result of dredging or beach nourishment works due to the relative small-scale of the works and distances involved. Therefore, these are not considered any further.

Burrowed Mud

The Conservation and Management Advice for the MPA states that burrowed mud habitats are "highly sensitive to physical disturbance."

Table 2 of the Advice document provides specific management advice for marine deposit sites and burrowed mud:

"Minimise the likely effects of new disposal sites where there would be likely to be an impact upon burrowed mud habitats. Early pre-application discussions are recommended and these should focus on the appropriate siting of new disposal sites and any pre-submission surveys to avoid impacts within areas of burrowed mud habitat."

The specific management advice refers only to the establishment of new disposal sites and therefore it is considered likely that the presence of the Macduff disposal site was taken into account upon the designation of the MPA, and that the existing disposal site would not be situated in an area of burrowed mud habitat. No further assessment is considered necessary.

[3] https://sitelink.nature.scot/site/10477

Minke Whale
The Conservation and Management Advice for the MPA notes that minke whales are "sensitive to entanglement and incidental bycatch." The sea disposal activity is not considered to cause a risk to minke whales in those regards.

Minke whales are also noted to be sensitive to underwater noise, collision and water pollution. There may be some short-lived, temporary effects on underwater noise as a result of the disposal activity may be experienced. Secondly, it is considered that the risk of underwater collision between a minke whale and the dredging vessel is no greater than any other vessel passing through the MPA area. Finally, the effects on water quality as a result of the disposal to sea have been considered above. Effects on water quality are likely to be localised and temporary.

It is considered likely that the presence of the dredge spoil disposal site will have been taken into account when the MPA was designated, and on that basis the potential risks to minke whale are considered to be acceptable.

Table 2 of the MPA document provides specific management advice for marine deposit sites and minke whales:

"Minimise the potential impact of new deposit sites (including disused/closed sites if to be reopened) on the habitat of sandeels. Early pre-application discussions are recommended and these should consider the appropriate siting of new deposit sites and any pre-submission surveys to ensure that the habitat of sandeels is maintained in extent and suitability."

The specific management advice refers only to the establishment of new disposal sites (or re-opening of old ones) and therefore it is considered likely that the presence of the Macduff disposal site was taken into account upon the designation of the MPA, and that the existing disposal site would not be situated in an area of sandeel habitat (which are feeding grounds for minke whale).

If considered necessary through statutory consultation with NatureScot, then a Marine Mammal Observer (MMO) could be deployed to the dredging vessel to monitor minke whale activity at the disposal ground.

Fronts
The Conservation and Management Advice for the MPA states that thermal fronts states that "the MPA could be sensitive to pressures such as changes in tidal flow or physical changes to the seabed." The deposition of sediment at the Macduff disposal ground will cause a change in the seabed topography as deposited material settles.

However, it is known that sediment disposal sites in Scotland are generally dispersive, therefore any changes to seabed topography are likely to be temporary. Moreover, the Advice document also states: *"Currently most pressures associated with human activities in the marine environment are considered unlikely to cause significant risk of impact on the fronts feature within the MPA."* It is also assumed that the dredge spoil disposal site would have been taken into account when the MPA was designated. No further assessment is considered necessary,

Shelf Deeps
The Conservation and Management Advice for the MPA states that: *"Shelf deeps are considered to be robust, entirely natural in origin and are not considered to be at risk of significant damage from human activity."* Therefore the dredging and disposal activity is considered unlikely to have a negative impact on shelf deeps.

Quaternary of Scotland
According to the Conservation and Management Advice for the MPA, subglacial tunnel valleys are "highly resistant" and are "not sensitive or have a low sensitivity" to human activities. Further assessment with regard to subglacial tunnel valleys is not considered necessary.

Moraines are stated to have a *"medium sensitivity to sub-surface abrasion and changes in tidal flow, and a high sensitivity to physical removal."* The deposition of sediment at the Macduff disposal site is not considered likely to have a negative impact on the moraines. It is considered unlikely that a licensed disposal site would have been permitted in an area known to have protected moraine features susceptible to sub-surface abrasion. Further assessment is not considered necessary.

Submarine Mass Movement
The Conservation and Management Advice for the MPA states that slide scars have a "medium sensitivity… to any activities that could cause obscuring". The deposition of dredged sediment at the Macduff disposal site may cause temporary obscuring of slide scars, if present at the disposal site.

However, it is known that sediment disposal sites in Scotland are dispersive, therefore any obscuring by deposited sediment is likely to be temporary. In addition, the licenced disposal site has been present at Macduff since at least 1995[4] (although the exact opening date of the site is not currently known). It is considered unlikely that the disposal site would continue to remain open for sediment deposits if there was likely to be a significant risk of damage to the protected slide scar features. Further assessment is not considered necessary.

6.8.2.2 Inverboyndie Bathing Water

The Inverboyndie Bathing Water is located 1.4km west of Banff Harbour (as the crow flies), and 4.9km south-west of the Macduff sea disposal site. The bathing water was most recently classified as "good" for 2024[5].

It is concluded above that the key risk to water quality as a result of the dredging and disposal activities is a temporary increase in suspended solids at the dredge and disposal sites.

Even if dredging and disposal works are undertaken during the bathing water season (June to September), the temporary and localised impacts on water quality experienced at the dredge and disposal sites (*i.e.* increase in suspended solids/turbidity) are unlikely to impact the status of the bathing water at Inverboyndie.

Furthermore, the monitoring and classification of bathing water quality by SEPA pertains primarily to microbiological parameters (E. Coli and intestinal enterococci). The nature of marine sediments is such that the dredging and disposal activity is not considered likely to have an impact on microbiological results and bathing water quality classification.

[4] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/197331/TR_SEA2_ExistingActivities.pdf (See Table 6)
[5] https://www2.sepa.org.uk/bathingwaters/ViewResults.aspx?id=233607

7 BPEO CONCLUSIONS AND RECOMMENDATIONS

Aberdeenshire Council appointed EnviroCentre Ltd to undertake a BPEO assessment in support of proposed maintenance dredging at Banff Harbour. This revised assessment has been informed using sediment quality results from sampling undertaken in January 2025.

A review of the available information has highlighted that although several contaminants of concern exceed RAL1, 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.

Sediment results recorded exceedances of RAL1 in individual samples for various metals, several PAH species and THC. Averaged concentrations (which consider the dredge as a single volume for disposal) copper, various PAH species and THC. The averaged concentrations for cadmium also marginally exceeded RAL1. No individual results or averaged concentrations were recorded in exceedance of RAL2. The most recent sample results are at similar levels to those previously licensed for sea disposal.

Overall, based on the multiple lines of evidence approach adopted to further assess the exceedances identified in the sediment assessment, the recommendation for a combination of sea disposal and beneficial re-use as part of a small-scale beach nourishment is considered to be the preferred option. It is understood that this method was adopted during the previous maintenance dredging campaign.

The sea disposal option is considered to have no significant long-term impact on the marine environment; the disposal site is readily accessible from the harbour and previously acceptable disposal route. The identified receiving beach for the beach nourishment project is a short distance from the harbour and means that a portion of the dredged material will be subject to a beneficial re-use. The use of beach nourishment as an additional disposal route to sea disposal is dependent on the final confirmed dredging method and plant available.

REFERENCES

EnviroCentre (2021). *Banff Harbour – Sediment Sampling Report.* Document No. 9551.

EnviroCentre (2022). Banff Harbour – Additional Sampling – March 2022. Document No. 374655/CCAS/003.

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.

NatureScot (2024) *Conservation and Management Advice – Southern Trench MPA*: Scottish Government

APPENDICES

A FIGURES

368900 369000

864700 864600 864500 864400

GS1
OUTER BASIN
GS2
GS3
MIDDLE BASIN
VC1
VC2
VC3
INNER BASIN
VC4
VC5

Imagery Source: Bing Maps © 2025 TomTom, © OpenStreetMap, © Vexcel Imaging

Do not scale this map

Legend

- Dredge Area

Banff Sampled Stations

- Grab
- Vibrocore

Client
Aberdeenshire Council

Project
Banff Harbour

Title
Sampled Stations

Scale
1:1,000 @ A3

Status
FINAL

Drawing No.	Revision	Date
374702-GIS012	-	30 Jan 2025
Drawn	**Checked**	**Approved**
MMF	FR	CCAS

Rev	Date	Amendment	Initials
-	-	-	-

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8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA.
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368000 369000 370000 371000 372000

867000 866000 865000 864000

Macduff Spoil Deposit Site (CR050)

Receiving Beach

MACDUFF

Banff Bay

Hill of Doune

Douneside

Dey Hill

Craigneil

Gallow Hill

Legend

- Dredged Material Deposit Sites
- Dredge Area

Do not scale this map

Client
Aberdeenshire Council

Project
Banff Harbour Maintenance Dredging

Title
Proposed Dredged Material Deposit Sites

Status
Final

Drawing No.	Revision	Date
374655-QGIS003	-	28 Apr 2021
Drawn	**Checked**	**Approved**
FR	NC	CCAS

Scale
1:15,000 @ A3

Rev	Date	Amendment	Initials
-	-	-	-

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B SAMPLE LOGS

envirocentre 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	**Project Name**	Banff Harbour, Aberdeenshire	**Location ID**
	Project No.	374702	**GS1**
	Client	Aberdeenshire Council	

SEDIMENT CORE LOG

Date:	14/01/2025	**Latitude/Longitude:**	57° 40.235083, -2° 31.339866
Dredge Area:	Outer Basin	**Sampled/logged by:**	FR/AJK
Method:	0.045m^2 Van Veen Grab Sampler		

Remarks: **0.0 – 0.15m (Grab)** Light grey/greyish-brown silty fine SAND with rare kelp.

Biota: None noted.

Odours: None noted.

Anthropogenic Inputs: None noted.

Notes: Collected from the beach, below the water line.

envirocentre 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	**Project Name**	Banff Harbour, Aberdeenshire	**Location ID**
	Project No.	374702	**GS2**
	Client	Aberdeenshire Council	

SEDIMENT CORE LOG

Date:	14/01/2025	**Latitude/Longitude:**	57° 40.201437, -2° 31.346427
Dredge Area:	Middle Basin	**Sampled/logged by:**	FR/AJK
Method:	0.045m^2 Van Veen Grab Sampler		

Remarks: **0.0 – 0.15m (Grab)** Almost exclusively decomposing vegetation, leaf litter and kelp.

Biota: None noted.

Odours: Very strong H_2S odour.

Anthropogenic Inputs: None noted.

Notes: Several attempts made from the south pontoon in the middle basin. Very little sediment obtained.

envirocentre 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	**Project Name**	Banff Harbour, Aberdeenshire	**Location ID**
	Project No.	374702	**GS3**
	Client	Aberdeenshire Council	

SEDIMENT CORE LOG

Date:	14/01/2025	**Latitude/Longitude:**	57° 40.206017, -2° 31.379954
Dredge Area:	Middle Basin	**Sampled/logged by:**	FR/AJK
Method:	0.045m^2 Van Veen Grab Sampler		

Remarks: **0.0 – 0.15m (Grab)** Light grey/greyish-brown silty fine sand with rare pockets of soft black silt.

Biota: None noted.

Odours: Faint H_2S odour.

Anthropogenic Inputs: Singular small fragment of hard plastic.

Notes: -

envirocentre 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	**Project Name**	Banff Harbour, Aberdeenshire	**Location ID**
	Project No.	374702	**VC1**
	Client	Aberdeenshire Council	

SEDIMENT CORE LOG

Date:	14/01/2025	**Latitude/Longitude:**	57° 40.183163, -2° 31.379735
Dredge Area:	Inner Basin	**Sampled/logged by:**	FR/AJK
Method:	0.045m^2 Van Veen Grab Sampler / Vibrocore	**Core Length (m):**	0.25

Remarks: **0.0 – 0.15m (Grab)** Almost exclusively decomposing vegetation, leaf litter and kelp with rare black silt.

0.0 – 0.25m (Vibrocore) Very soft dark grey/black silt with frequent vegetation and leaf litter.

Biota: None noted.

Odours: Very strong H_2S odour from grab sample.

Anthropogenic Inputs: None noted.

Notes: Maximum depth achieved with vibrocore was 0.25m, with two attempts and micro-siting undertaken. Probable bedrock obstructing further sampling depth.

envirocentre 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	**Project Name**	Banff Harbour, Aberdeenshire	**Location ID**
	Project No.	374702	**VC2**
	Client	Aberdeenshire Council	

SEDIMENT CORE LOG

Date:	14/01/2025	**Latitude/Longitude:**	57° 40.179945, -2° 31.359216
Dredge Area:	Inner Basin	**Sampled/logged by:**	FR/AJK
Method:	0.045m^2 Van Veen Grab Sampler / Vibrocore	**Core Length (m):**	0.7

Remarks: **0.0 – 0.15m (Grab)** Soft black silt with frequent vegetation, leaf litter and kelp.

0.0 – 0.7m (Vibrocore) Soft dark grey/black silt (very soft at surface) with occasional vegetation and leaf litter. Mussel shell noted at 0.2m.

Biota: One crab noted within grab sample.

Odours: Very strong H_2S odour from grab and vibrocore samples.

Anthropogenic Inputs: None noted.

Notes: -

envirocentre 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	**Project Name**	Banff Harbour, Aberdeenshire	**Location ID**
	Project No.	374702	**VC3**
	Client	Aberdeenshire Council	

SEDIMENT CORE LOG

Date:	14/01/2025	**Latitude/Longitude:**	57° 40.17844, -2° 31.33806
Dredge Area:	Inner Basin	**Sampled/logged by:**	FR/AJK
Method:	0.045m^2 Van Veen Grab Sampler / Vibrocore	**Core Length (m):**	-

Remarks: **0.0 – 0.15m (Grab)** Almost exclusively vegetation, leaf litter and kelp.

Biota: None noted.

Odours: Very strong H_2S odour from grab sample.

Anthropogenic Inputs: None noted.

Notes: Vibrocore sampling provided no recovery of sampleable material other than a few dark grey pieces of fine gravel.

envirocentre 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	**Project Name**	Banff Harbour, Aberdeenshire	**Location ID**
	Project No.	374702	**VC4**
	Client	Aberdeenshire Council	

SEDIMENT CORE LOG

Date:	14/01/2025	**Latitude/Longitude:**	57° 40.166696, -2° 31.361116
Dredge Area:	Inner Basin	**Sampled/logged by:**	FR/AJK
Method:	0.045m^2 Van Veen Grab Sampler / Vibrocore	**Core Length (m):**	0.85

Remarks: **0.0 – 0.15m (Grab)** Very soft dark grey/black and light brown silt.

0.0 – 0.8m (Vibrocore) Soft dark grey/black silt (very soft at surface) with occasional vegetation and leaf litter.

Biota: None noted.

Odours: Very strong H_2S odour from grab and vibrocore samples.

Anthropogenic Inputs: None noted.

Notes: Maximum depth achieved with vibrocore was 0.85m. Probable bedrock obstructing further sampling depth.

envirocentre 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	**Project Name**	Banff Harbour, Aberdeenshire	**Location ID**
	Project No.	374702	**VC5**
	Client	Aberdeenshire Council	

SEDIMENT CORE LOG

Date:	14/01/2025	**Latitude/Longitude:**	57° 40.160775, -2° 31.338136
Dredge Area:	Inner Basin	**Sampled/logged by:**	FR/AJK
Method:	0.045m^2 Van Veen Grab Sampler / Vibrocore	**Core Length (m):**	0.2

Remarks: **0.0 – 0.15m (Grab)** Very soft dark grey/black and light brown silt.

0.0 – 0.2m (Vibrocore) Very soft dark grey/black and light brown silt.

Biota: None noted.

Odours: Very strong H_2S odour from grab and vibrocore samples.

Anthropogenic Inputs: None noted.

Notes: Maximum depth achieved with vibrocore was 0.2m. Probable bedrock obstructing further sampling depth.

C LABORATORY CERTIFICATES

Certificate of Analysis

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

Test Report ID MAR02564

Issue Version: 1

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

Customer Reference: 374702 - Banff Harbour

Date Sampled: 14-Jan-25

Date Samples Received: 21-Jan-25

Test Report Date: 18-Feb-25

Condition of samples: Ambient Deviating

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

Please see Individual pages and Report Notes & Deviating Sample page for details of Deviating samples.

[Redacted]

Authorised by: Jane Colbourne

Position: Customer Service Specialist

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	MAR02564
Issue Version	1
Customer Reference	374702 - Banff Harbour

		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**
GS1 - 0.0-0.15m	MAR02564.001	Sediment	29.0	71.0	0.13	97.94	1.93	NAIIS
GS2 - 0.0-0.15m	MAR02564.002	Sediment	86.2	13.8	30.51	40.49	28.99	NAIIS
GS3 - 0.0-0.15m**	MAR02564.003	Sediment	30.7	69.3	0.04	96.18	3.78	NAIIS
VC1 - 0.0-0.15m	MAR02564.004	Sediment	86.0	14.0	17.34	46.89	35.77	NAIIS
VC1 - 0.0-0.25m	MAR02564.005	Sediment	66.6	33.4	Insufficient	Insufficient	Insufficient	NAIIS
VC2 - 0.0-0.15m**	MAR02564.006	Sediment	73.6	26.4	1.00	64.19	34.81	NAIIS
VC2 - 0.15-0.7m	MAR02564.007	Sediment	64.7	35.3	0.30	61.72	37.98	NAIIS
VC3 - 0.0-0.15m**	MAR02564.008	Sediment	81.8	18.2	2.51	56.57	40.92	NAIIS
VC4 - 0.0-0.15m**	MAR02564.009	Sediment	73.6	26.4	0.03	40.35	59.63	NAIIS
VC4 - 0.15-0.55m	MAR02564.010	Sediment	66.1	33.9	1.54	47.49	50.97	NAIIS
VC4 - 0.55-0.85m	MAR02564.011	Sediment	60.8	39.2	0.62	46.10	53.29	NAIIS
VC5 - 0.0-0.15m**	MAR02564.012	Sediment	73.3	26.7	0.10	44.40	55.50	NAIIS
VC5 - 0.0-0.20m	MAR02564.013	Sediment	67.5	32.5	Insufficient	Insufficient	Insufficient	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

**D5 - Container damaged in transit

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Test Report ID	MAR02564
Issue Version	1
Customer Reference	374702 - Banff Harbour

		Units	% M/M
		Method No	WSLM59*
		Limit of Detection	0.02
		Accreditation	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**TOC**
GS1 - 0.0-0.15m	MAR02564.001	Sediment	0.04
GS2 - 0.0-0.15m	MAR02564.002	Sediment	19.2
GS3 - 0.0-0.15m**	MAR02564.003	Sediment	0.16
VC1 - 0.0-0.15m	MAR02564.004	Sediment	20.2
VC1 - 0.0-0.25m	MAR02564.005	Sediment	3.21
VC2 - 0.0-0.15m**	MAR02564.006	Sediment	5.11
VC2 - 0.15-0.7m	MAR02564.007	Sediment	5.71
VC3 - 0.0-0.15m**	MAR02564.008	Sediment	15.9
VC4 - 0.0-0.15m**	MAR02564.009	Sediment	5.20
VC4 - 0.15-0.55m	MAR02564.010	Sediment	5.02
VC4 - 0.55-0.85m	MAR02564.011	Sediment	5.47
VC5 - 0.0-0.15m**	MAR02564.012	Sediment	5.00
VC5 - 0.0-0.20m	MAR02564.013	Sediment	5.01
		Reference Material (% Recovery)	112
		QC Blank	<0.02

* See Report Notes

NAIIS - No Asbestos Identified In Sample

**D5 - Container damaged in transit

Certificate of Analysis

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Test Report ID	MAR02564
Issue Version	1
Customer Reference	374702 - Banff Harbour

		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**
GS1 - 0.0-0.15m	MAR02564.001	Sediment	2.0	<0.04	7.10	3.3	0.02	5.0	2.9	17.6
GS2 - 0.0-0.15m	MAR02564.002	Sediment	6.7	0.43	27.9	33.1	<0.01	27.0	21.7	106
GS3 - 0.0-0.15m	MAR02564.003	Sediment	1.8	<0.04	7.00	2.4	<0.01	5.2	3.0	17.4
VC1 - 0.0-0.15m	MAR02564.004	Sediment	7.4	0.68	29.1	37.1	<0.01	25.3	20.4	118
VC1 - 0.0-0.25m	MAR02564.005	Sediment	3.2	0.33	54.3	43.8	<0.01	56.9	14.5	147
VC2 - 0.0-0.15m	MAR02564.006	Sediment	5.5	0.30	28.6	26.6	<0.01	25.3	18.8	81.9
VC2 - 0.15-0.7m	MAR02564.007	Sediment	4.4	0.41	30.2	30.9	<0.01	27.1	20.3	91.7
VC3 - 0.0-0.15m	MAR02564.008	Sediment	7.1	0.44	29.8	44.5	<0.01	25.8	19.6	106
VC4 - 0.0-0.15m	MAR02564.009	Sediment	8.0	0.45	38.2	40.0	<0.01	32.8	26.0	115
VC4 - 0.15-0.55m	MAR02564.010	Sediment	6.4	0.44	38.7	49.8	<0.01	34.6	27.4	129
VC4 - 0.55-0.85m	MAR02564.011	Sediment	5.1	0.44	33.8	38.2	<0.01	29.5	24.1	103
VC5 - 0.0-0.15m	MAR02564.012	Sediment	9.3	0.96	48.5	79.0	0.06	42.8	30.7	190
VC5 - 0.0-0.20m	MAR02564.013	Sediment	6.5	0.42	39.4	42.7	<0.01	33.7	22.9	112
Certified Reference Material SETOC 768 (% Recovery)			94	105	93	98	86	97	97	98
QC Blank			<0.5	<0.04	<0.5	<0.5	<0.01	<0.5	<0.5	<2

* See Report Notes

Certificate of Analysis

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

Test Report ID	MAR02564
Issue Version	1
Customer Reference	374702 - Banff Harbour

		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)**
GS1 - 0.0-0.15m	MAR02564.001	Sediment	<1	<1
GS2 - 0.0-0.15m	MAR02564.002	Sediment	<5	<5
GS3 - 0.0-0.15m	MAR02564.003	Sediment	<5	<5
VC1 - 0.0-0.15m	MAR02564.004	Sediment	<5	<5
VC1 - 0.0-0.25m*	MAR02564.005	Sediment	<5	<5
VC2 - 0.0-0.15m	MAR02564.006	Sediment	<5	<5
VC2 - 0.15-0.7m	MAR02564.007	Sediment	19.3	<5
Certified Reference Material BCR-646 (% Recovery)			84	103
QC Blank			<1	<1

* See Report Notes

*D4 - No Amber jar available. Analysis taken from plastic tub.

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	MAR02564
Issue Version	1
Customer Reference	374702 - Banff Harbour

		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)**
VC3 - 0.0-0.15m	MAR02564.008	Sediment	<5	<5
VC4 - 0.0-0.15m	MAR02564.009	Sediment	<5	<5
VC4 - 0.15-0.55m	MAR02564.010	Sediment	<5	<5
VC4 - 0.55-0.85m	MAR02564.011	Sediment	<5	13.6
VC5 - 0.0-0.15m	MAR02564.012	Sediment	<5	<5
VC5 - 0.0-0.20m*	MAR02564.013	Sediment	<5	16.5
Certified Reference Material BCR-646 (% Recovery)			111	108
QC Blank			<1	<1

* See Report Notes

*D4 - No Amber jar available. Analysis taken from plastic tub.

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	MAR02564
Issue Version	1
Customer Reference	374702 - Banff 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**
GS1 - 0.0-0.15m	MAR02564.001	Sediment	<1	<1	<1	5.16	9.06	6.65
GS2 - 0.0-0.15m	MAR02564.002	Sediment	<5	52.1	94.5	199	216	122
GS3 - 0.0-0.15m	MAR02564.003	Sediment	<1	4.48	13.2	23.3	22.8	16.2
VC1 - 0.0-0.15m	MAR02564.004	Sediment	<5	55.8	<5	208	256	188
VC1 - 0.0-0.25m*	MAR02564.005	Sediment	<5	27.1	57.5	157	181	152
VC2 - 0.0-0.15m	MAR02564.006	Sediment	<5	<5	23.9	67.8	80.4	69.4
VC2 - 0.15-0.7m	MAR02564.007	Sediment	<5	27.4	42.3	135	168	141
VC3 - 0.0-0.15m	MAR02564.008	Sediment	<5	<5	34.9	83.1	89.1	73.2
VC4 - 0.0-0.15m	MAR02564.009	Sediment	<5	19.4	33.1	115	141	129
VC4 - 0.15-0.55m	MAR02564.010	Sediment	<5	47.9	61.7	158	193	167
VC4 - 0.55-0.85m	MAR02564.011	Sediment	13.5	20.2	49.7	150	181	155
VC5 - 0.0-0.15m	MAR02564.012	Sediment	<5	31.2	135	271	283	228
VC5 - 0.0-0.20m*	MAR02564.013	Sediment	<5	23.0	33.3	128	168	157
Certified Reference Material NIST 1941b (% Recovery)			62	105	65	65	62	87
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

*D4 - No Amber jar available. Analysis taken from plastic tub.

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 MAR02564
Issue Version 1
Customer Reference 374702 - Banff 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**
GS1 - 0.0-0.15m	MAR02564.001	Sediment	6.33	6.54	5.81	<1	7.90	<1
GS2 - 0.0-0.15m	MAR02564.002	Sediment	134	142	228	<5	436	92.2
GS3 - 0.0-0.15m	MAR02564.003	Sediment	12.6	17.6	22.9	2.96	51.5	3.94
VC1 - 0.0-0.15m	MAR02564.004	Sediment	151	212	175	<5	486	<5
VC1 - 0.0-0.25m*	MAR02564.005	Sediment	128	157	178	27.1	346	28.2
VC2 - 0.0-0.15m	MAR02564.006	Sediment	59.9	65.6	79.5	<5	144	<5
VC2 - 0.15-0.7m	MAR02564.007	Sediment	119	133	150	23.4	274	21.0
VC3 - 0.0-0.15m	MAR02564.008	Sediment	62.7	75.4	95.9	<5	156	<5
VC4 - 0.0-0.15m	MAR02564.009	Sediment	112	114	139	21.0	249	21.0
VC4 - 0.15-0.55m	MAR02564.010	Sediment	138	163	185	26.5	404	44.9
VC4 - 0.55-0.85m	MAR02564.011	Sediment	124	153	186	25.0	290	20.4
VC5 - 0.0-0.15m	MAR02564.012	Sediment	184	230	301	36.0	576	32.7
VC5 - 0.0-0.20m*	MAR02564.013	Sediment	122	142	176	26.1	331	19.9
Certified Reference Material NIST 1941b (% Recovery)			80	74	89	127	79	46
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
*D4 - No Amber jar available. Analysis taken from plastic tub.

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Test Report ID MAR02564
Issue Version 1
Customer Reference 374702 - Banff 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**
GS1 - 0.0-0.15m	MAR02564.001	Sediment	6.34	<1	3.81	8.25	2010
GS2 - 0.0-0.15m	MAR02564.002	Sediment	119	56.5	491	577	505000
GS3 - 0.0-0.15m	MAR02564.003	Sediment	13.6	4.06	29.9	44.4	5720
VC1 - 0.0-0.15m	MAR02564.004	Sediment	160	49.2	50.7	381	390000
VC1 - 0.0-0.25m*	MAR02564.005	Sediment	128	73.4	173	330	314000
VC2 - 0.0-0.15m	MAR02564.006	Sediment	58.7	40.9	71.4	146	213000
VC2 - 0.15-0.7m	MAR02564.007	Sediment	111	37.6	111	269	320000
VC3 - 0.0-0.15m	MAR02564.008	Sediment	62.0	32.0	114	170	452000
VC4 - 0.0-0.15m	MAR02564.009	Sediment	100	110	95.1	240	370000
VC4 - 0.15-0.55m	MAR02564.010	Sediment	129	37.1	265	381	331000
VC4 - 0.55-0.85m	MAR02564.011	Sediment	119	48.1	134	296	297000
VC5 - 0.0-0.15m	MAR02564.012	Sediment	179	45.7	197	510	337000
VC5 - 0.0-0.20m*	MAR02564.013	Sediment	117	62.4	159	298	302000
Certified Reference Material NIST 1941b (% Recovery)			85	58	77	69	85
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
*D4 - No Amber jar available. Analysis taken from plastic tub.

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Test Report ID MAR02564
Issue Version 1
Customer Reference 374702 - Banff 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	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB28**	**PCB52**	**PCB101**	**PCB118**	**PCB138**	**PCB153**	**PCB180**
GS1 - 0.0-0.15m	MAR02564.001	Sediment	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
GS2 - 0.0-0.15m	MAR02564.002	Sediment	0.11	<0.08	0.12	0.15	0.10	0.12	<0.08
GS3 - 0.0-0.15m	MAR02564.003	Sediment	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
VC1 - 0.0-0.15m	MAR02564.004	Sediment	<0.08	<0.08	0.11	0.17	0.18	0.17	<0.08
VC1 - 0.0-0.25m*	MAR02564.005	Sediment	<0.08	<0.08	0.11	0.23	0.16	0.19	<0.08
VC2 - 0.0-0.15m	MAR02564.006	Sediment	<0.08	<0.08	0.16	0.14	0.18	0.22	0.13
VC2 - 0.15-0.7m	MAR02564.007	Sediment	0.09	0.18	0.57	0.29	0.60	1.01	0.64
VC3 - 0.0-0.15m	MAR02564.008	Sediment	<0.08	<0.08	0.15	0.23	0.13	0.16	<0.08
VC4 - 0.0-0.15m	MAR02564.009	Sediment	<0.08	0.09	0.22	0.31	0.22	0.26	0.10
VC4 - 0.15-0.55m	MAR02564.010	Sediment	<0.08	0.11	0.24	0.33	0.29	0.41	0.14
VC4 - 0.55-0.85m	MAR02564.011	Sediment	<0.08	0.19	0.42	0.55	0.48	0.50	0.14
VC5 - 0.0-0.15m	MAR02564.012	Sediment	<0.08	0.12	0.30	0.35	0.37	0.27	0.10
VC5 - 0.0-0.20m*	MAR02564.013	Sediment	<0.08	0.09	0.20	0.31	0.24	0.34	0.09
Certified Reference Material NIST 1941b (% Recovery)			77	99	95	115	92	97	103
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.

*D4 - No Amber jar available. Analysis taken from plastic tub.

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 MAR02564
Issue Version 1
Customer Reference 374702 - Banff Harbour

REPORT NOTES

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
WSLM59*	MAR02564.001-013	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
ICPMSS*	MAR02564.001-013	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
SUB_01*	MAR02564.001-013	Analysis was conducted by an approved subcontracted laboratory.
SUB_02*	MAR02564.001-013	Analysis was conducted by an approved subcontracted laboratory.
ASC/SOP/301	MAR02564.002-013	The matrix of this sample has been found to interfere with the result for this test. The sample has therefore been diluted, but in doing so, the detection limit for this test has been elevated.
ASC/SOP/303/304	MAR02564.002, .004-010, .012-013	The matrix of this sample has been found to interfere with the result for this test. The sample has therefore been diluted, but in doing so, the detection limit for this test has been elevated.
ASC/SOP/303/304	MAR02564.001-013	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	MAR02564.001-013	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	MAR02564.005, 013	1Ltr plastic tub received only for these samples. Organics analysis subsampled from plastic tub.
D5	Damaged in Transit	MAR02564.003, 006, 008, 009, 012	1 ltr plastic tubs damaged in transit.
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	MAR02564
Issue Version	1
Customer Reference	374702 - Banff Harbour

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		

D DATA SUMMARY TABLES

Summary Table A

Sampling Results Incorporated with BPEO Assessment (mg/kg)

						2025 Samples																	
	AL1	AL2	BAC	ERL	PEL	GS1 - 0.0-0.15m	GS2 - 0.0-0.15m	GS3 - 0.0-0.15m	VC1 - 0.0-0.15m	VC1 - 0.0-0.25m*	VC2 - 0.0-0.15m	VC2 - 0.15-0.7m	VC3 - 0.0-0.15m	VC4 - 0.0-0.15m	VC4 - 0.15-0.55m	VC4 - 0.55-0.85m	VC5 - 0.0-0.15m	VC5 - 0.0-0.20m*	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	2.0	6.7	1.8	7.4	3.2	5.5	4.4	7.1	8	6.4	5.1	9.3	6.5	5.65	0	0	0	-	0
Cadmium	0.4	4	0.31	1.2	4.2	0.04	0.43	0.04	0.68	0.33	0.3	0.41	0.44	0.45	0.44	0.44	0.96	0.42	0.41	9	0	10	0	0
Chromium	50	370	81	81	160	7.1	27.9	7	29.1	54.3	28.6	30.2	29.8	38.2	38.7	33.8	48.5	39.4	31.74	1	0	0	0	0
Copper	30	300	27	34	108	3.3	33.1	2.4	37.1	43.8	26.6	30.9	44.5	40	49.8	38.2	79	42.7	36.26	10	0	10	8	0
Mercury	0.25	1.5	0.07	0.15	0.7	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.06	0.01	0.01	0	0	0	0	0
Nickel	30	150	36	-	-	5.0	27.0	5.2	25.3	56.9	25.3	27.1	25.8	32.8	34.6	29.5	42.8	33.7	28.54	5	0	2	N/A	N/A
Lead	50	400	38	47	112	2.9	21.7	3	20.4	14.5	18.8	20.3	19.6	26	27.4	24.1	30.7	22.9	19.41	0	0	0	0	0
Zinc	130	600	122	150	271	17.6	106.0	17.4	118.0	147.0	81.9	91.7	106.0	115.0	129.0	103.0	190.0	112.0	102.66	2	0	3	1	0
Napthalene	0.1		0.08	0.16	0.391	0.001	0.057	0.004	0.049	0.073	0.041	0.038	0.032	0.110	0.037	0.048	0.046	0.062	0.05	1	-	1	0	0
Acenaphthylene	0.1				0.128	0.001	0.052	0.004	0.056	0.027	0.005	0.027	0.005	0.019	0.048	0.020	0.031	0.023	0.02	0	-	N/A	N/A	0
Acenaphthene	0.1				0.0889	0.001	0.005	0.001	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.014	0.005	0.005	0.01	0	-	N/A	N/A	0
Fluorene	0.1				0.144	0.001	0.092	0.004	0.005	0.028	0.005	0.021	0.005	0.021	0.045	0.020	0.033	0.020	0.02	0	-	N/A	N/A	0
Phenanthrene	0.1		0.032	0.24	0.544	0.004	0.491	0.030	0.051	0.173	0.071	0.111	0.114	0.095	0.265	0.134	0.197	0.159	0.15	8	-	11	2	0
Anthracene	0.1		0.05	0.085	0.245	0.001	0.095	0.013	0.005	0.058	0.024	0.042	0.035	0.033	0.062	0.050	0.135	0.033	0.05	1	-	4	2	0
Fluoranthene	0.1		0.039	0.6	1.494	0.008	0.436	0.052	0.486	0.346	0.144	0.274	0.156	0.249	0.404	0.290	0.576	0.331	0.29	11	-	12	0	0
Pyrene	0.1		0.024	0.665	1.398	0.008	0.577	0.044	0.381	0.330	0.146	0.269	0.170	0.240	0.381	0.296	0.510	0.298	0.28	11	-	12	0	0
Benzo(a)anthracene	0.1		0.016	0.261	0.693	0.005	0.199	0.023	0.208	0.157	0.068	0.135	0.083	0.115	0.158	0.150	0.271	0.128	0.13	9	-	12	1	0
Chrysene	0.1		0.02	0.384	0.846	0.006	0.228	0.023	0.175	0.178	0.080	0.150	0.096	0.139	0.185	0.186	0.301	0.176	0.15	9	-	12	0	0
Benzo(b)fluoranthene	0.1		-	-	-	0.007	0.122	0.016	0.188	0.152	0.069	0.141	0.073	0.129	0.167	0.155	0.228	0.157	0.12	9	-	N/A	N/A	N/A
Benzo(k)fluoranthene	0.1		-	-	-	0.007	0.142	0.018	0.212	0.157	0.066	0.133	0.075	0.114	0.163	0.153	0.230	0.142	0.12	9	-	N/A	N/A	N/A
Benzo(a)pyrene	0.1		0.03	0.384	0.763	0.009	0.216	0.023	0.256	0.181	0.080	0.168	0.089	0.141	0.193	0.181	0.283	0.168	0.15	9	-	11	0	0
Indeno(1,2,3cd)pyrene	0.1		0.103	0.24	-	0.006	0.119	0.014	0.160	0.128	0.059	0.111	0.062	0.100	0.129	0.119	0.179	0.117	0.10	9	-	8	0	N/A
Benzo(ghi)perylene	0.1		0.08	0.085	-	0.006	0.134	0.013	0.151	0.128	0.060	0.119	0.063	0.112	0.138	0.124	0.184	0.122	0.10	9	-	9	9	N/A
Dibenzo(a,h)anthracene	0.01		-	-	0.135	0.001	0.005	0.003	0.005	0.027	0.005	0.023	0.005	0.021	0.027	0.025	0.036	0.026	0.02	0	-	N/A	N/A	0
THC	100		-	-	-	2.01	505	5.72	390	314	213	320	452	370	331	297	337	302	295.29	11	-	N/A	N/A	N/A
PCBs	0.02	0.18	-	-	0.189	0.00056	0.00076	0.00056	0.00087	0.00093	0.00099	0.00338	0.00091	0.00128	0.00160	0.00236	0.00159	0.00135	0.0013	0	0	N/A	N/A	0
TBT	0.1	0.5	-	-	-	0.001	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.0136	0.005	0.0165	0.0062	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

Banff Harbour 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	5.6	No	No	No	N/A	No
Cadmium	0.4	4	0.31	1.2	4.2	0.4	**Yes**	No	**Yes**	No	No
Chromium	50	370	81	81	160	31.7	No	No	No	No	No
Copper	30	300	27	34	108	36.3	**Yes**	No	**Yes**	**Yes**	No
Mercury	0.25	1.5	0.07	0.15	0.7	0.0	No	No	No	No	No
Nickel	30	150	36	-	-	28.5	No	No	No	N/A	N/A
Lead	50	400	38	47	112	19.4	No	No	No	No	No
Zinc	130	600	122	150	271	102.7	No	No	No	No	No
					-						
Napthalene	0.1	-	0.08	0.16	0.319	0.05	No	N/A	No	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	0.02	No	N/A	N/A	N/A	No
Phenanthrene	0.1	-	0.032	0.24	0.544	0.15	**Yes**	N/A	**Yes**	No	No
Anthracene	0.1	-	0.05	0.085	0.245	0.05	No	N/A	No	No	No
Fluoranthene	0.1	-	0.039	0.6	1.494	0.29	**Yes**	N/A	**Yes**	No	No
Pyrene	0.1	-	0.024	0.665	1.398	0.28	**Yes**	N/A	**Yes**	No	No
Benzo(a)anthracene	0.1	-	0.016	0.261	0.693	0.13	**Yes**	N/A	**Yes**	No	No
Chrysene	0.1	-	0.02	0.384	0.846	0.15	**Yes**	N/A	**Yes**	No	No
Benzo(b)fluoranthene	0.1	-	-	-	-	0.12	**Yes**	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	0.1	-	-	-	-	0.12	**Yes**	N/A	N/A	N/A	N/A
Benzo(a)pyrene	0.1	-	0.03	0.384	0.763	0.15	**Yes**	N/A	**Yes**	No	No
Indeno(1,2,3cd)pyrene	0.1	-	0.103	0.24	-	0.10	**Yes**	N/A	No	No	N/A
Benzo(ghi)perylene	0.1	-	0.08	0.085	-	0.10	**Yes**	N/A	**Yes**	**Yes**	N/A
Dibenzo(a,h)anthracene	0.01	-	-	-	0.135	0.02	**Yes**	N/A	N/A	N/A	No
Total Hydrocarbons (THC)	100	-	-	-	-	295.29	**Yes**	N/A	N/A	N/A	N/A
PCBs	0.02	0.18	-	-	0.189	0.001	No	No	N/A	N/A	No
TBT	0.1	0.5	-	-	-	0.0062	No	No	N/A	N/A	N/A