



Pittenweem Harbour Best Practicable Environmental Options (BPEO) Report



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1 INTRODUCTION

1.1 Background

Fife Council appointed EnviroCentre Ltd to complete a Best Practicable Environmental Option (BPEO) assessment to inform proposed capital dredging at Pittenweem Harbour. The assessment has been informed using sediment quality results from sampling undertaken in February 2024.

The previous licence (reference: 06650/1/0/0) expired on 21st June 2019. Fife Council is seeking to renew the licence for capital dredging works proposed in August 2026.

The proposed dredge volumes are summarised in Table 1-1:

Table 1-1: Proposed (Estimated) Dredge Volumes

Dredge Areas	Dredge Depth (mCD)	Proposed Dredge Quantity (m ³)	Estimated Dredge Wet Tonnage
Pittenweem Dredge Areas (A, B, & C)	<1.0m	7,000	12,600

An estimated quantity of 12,600 tonnes (~7,000 m³)¹ is proposed to be dredged across the three areas shown in Drawing No. 783694-GIS001, in Appendix A.

The purpose of these the samples analysis is to provide supporting information to the Marine Directorate during the licensing process on sediment quality within the proposed dredge areas to assess the suitability for sea deposit. The dredging and disposal activities are regulated by the Marine Directorate 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 February 2024 sediment analysis will then be used to compare the 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 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.

¹ Assumed 1m³ = 1.8 tonnes.

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 the Marine Directorate.

1.4 Report Usage

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2 SAMPLING LOCATIONS AND METHODOLOGY

Sampling works (comprising collection of grab samples from five locations) were undertaken on the 7th February 2024, as per the Sampling Plan agreed with the Marine Directorate Licensing Operations Team (MD-LOT). The following section details the sampling methodology used to retrieve sediment samples.

2.1 Sample Locations

Grab sediment samples were collected from 5 locations across the dredge areas. Sample station locations are outlined in Table 2-1. The sample station locations are broadly the same as the previous sediment sampling campaign.

Table 2-1: Sample Locations Pittenweem Harbour – February 2024

Sample Station ID	Easting	Northing	Latitude	Longitude
Grab A	354886	702276	56°12.6547'	-2°43.73392'
Grab B	354945	702362	56°12.70138'	-2°43.67799'
Grab C	354955	702457	56°12.75247'	-2°43.66949'
Grab D	354866	702388	56°12.71493'	-2°43.75479'
Grab E	354936	702406	56°12.72489	-2°43.68648'

Sample station locations are shown in Drawing No. 783694-GIS002, in Appendix A.

2.2 Survey Vessel

Sampling was undertaken from a Pioner Multi (safety boat), owned and operated by Coastworks.

2.3 Navigation and Sample Location

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

2.4 Sample Collection

Grab samples were collected at all locations to obtain sediment surface material. All grab samples were collected by a 0.045m² stainless steel Van Veen grab sampler. Recovered material was emptied into a plastic bucket prior to sub-sampling. Where required, the grab was deployed multiple times to ensure sufficient material was recovered for testing where required.

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

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

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

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

Once samples had been placed within appropriate containers, they were labelled and placed immediately into cool boxes. Samples were frozen as soon as practicable prior to being dispatched to the project laboratory (Socotec Marine) on 8th February 2024.

2.7 Analysis Requirements

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

- Metals – Arsenic (As), Chromium (Cr), Cadmium (Cd), Copper (Cu), Mercury (Hg), Nickel (Ni), Lead (Pb), and Zinc (Zn);
- Tributyl Tin (TBT);
- Polycyclic Aromatic Hydrocarbons (PAHs) – USEPA 16;
- Polychlorinated Biphenyl (PCBs) – ICES 7;
- Total Hydrocarbons (THC);
- Asbestos Screen; and
- Particle Size Distribution.

Samples were sent to the Socotec Marine Laboratory for analysis, which holds UKAS accreditation.

3 RESULTS

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

3.1 Physical Analysis

3.1.1 Particle Size Analysis (PSA)

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

Table 3-1: Particle Size Analysis Data

Sample ID	Gravel % (>2 mm)	Sand % (>63 µm<2 mm)	Silt % (<63 µm)
Grab A	0.00	85.06	14.94
Grab B	3.48	50.88	45.64
Grab C	4.79	34.21	61.01
Grab D	1.01	24.53	74.47
Grab E	4.59	37.80	57.61
Average PSA	2.77	46.50	50.73

Note: PSA value with greatest % content per sample is highlighted in bold.

Particle size across Grab A and Grab B samples were primarily noted to comprise sand sized particles. Across all five samples, the proportion of sand ranged from 24.53% to 85.06%.

Particle size across Grab C, Grab D, and Grab E samples were primarily noted to comprise silt sized particles. Across all five samples, the proportion of silt ranged from 14.94% to 74.47%.

Negligible gravel content was recorded in Grab B to Grab E, and no gravel sized particles were recorded within Grab A.

Average gravel, sand and silt particle percentages sizes are provided to represent the dredge area as a whole.

3.2 Chemical Analysis

3.2.1 Chemical Analysis Assessment Criteria

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

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

Table 3-2: Exceedances of Revised Action Levels

Contaminant	No. of Exceedances (of 5 samples)		Maximum Concentration (mg/kg) and Location
	RAL 1	RAL 2	
Arsenic	0	0	11.9 (Grab D)
Cadmium	1	0	0.42 (Grab D)
Chromium	0	0	39.6 (Grab D)
Copper	2	0	55.6 (Grab D)
Mercury	0	0	0.11 (Grab D)
Nickel	0	0	25.2 (Grab D)
Lead	0	0	28.7 (Grab D)
Zinc	2	0	242 (Grab D)
PAH (All Species)	4	N/A	0.294 (Pyrene - Grab C)
PCBs	0	0	N/A
TBT	0	0	N/A
THC	3	N/A	732 (Grab D)

3.3 Asbestos

No asbestos was identified within any of the samples obtained.

3.4 Historic Sampling Results

Sampling was previously undertaken in 2017 for dredge licensing purposes at Pittenweem comprising of 5 grab samples. The results of analysis can be summarised as follows:

- 4 of 5 samples exceed AL1 for Cadmium
- 5 of 5 samples exceed AL1 for Copper
- 5 of 5 samples exceed AL1 for Zinc
- 5 of 5 samples exceed AL1 for 1 or more PAH Species
- No Samples Exceeded Action Level 2

3.5 Chemical Results Summary

All five grab samples recorded exceedances above RAL1 for at least one metal, for various PAHs and THC.

Comparing the results to the previous sampling, the same key contaminants were recorded in the 2024 date set with cadmium, copper, zinc and PAHs being recorded at levels below AL1, although in the 2024 data set, only 1 of 5 samples recorded metals over Action Level 1.

There was no recording of contaminants of concern in either sample set above RAL2 where one is available for comparison.

4 DISCUSSION OF AVAILIABLE DISPOSAL OPTIONS

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

The key stages of a 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 of Available Disposal Options

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

Table 4-1: Initial Best Practicable Available Options

Location	Options	Screening Assessment	Carry forward?
Coastline	Leave in Situ	Not an option due to the requirements to maintain depth to allow vessels to access and berth in the harbour.	No
	Infilling of an existing dry dock/harbour facility (Re-use)	No current or proposed dock/harbour infilling projects are known within a reasonable distance of the dredge site. In addition, given the relatively small volume of sediment to be dredged (~7,000 m ³), it is most likely that this would not be a sufficient amount of material to complete any infilling project and would provide only a small part of the total amount of sediment that would be required. Once material is brought on to land it falls under the jurisdiction of SEPA. Further geotechnical and chemical testing would likely be required before it is permitted for use on any such development.	No
	Beach Nourishment	While sediments with high sand content are suitable for beach replenishment, material with a high silt content are not generally considered suitable. Material sampled and analysed from the site are noted to consist predominantly of silt with smaller fractions of sand and gravel. Typically, the material used in replenishment projects needs to be of a similar nature i.e. grain size proportions similar to that of the receiving beach. Much of the Forth coastline are designated sites (SSSI, SPA etc.) and hold both national and international importance to nature conservation. Specific beach nourishment projects would need to be supported by Environmental Assessments to inform how the project could affect the environment as a result of disturbance to the intertidal area, changes to the sediment levels, the variable composition and quality of the material and measures devised from the assessment outcomes to minimise impacts on the environment.	No
Land	Landfill Disposal	This is possible but it is unlikely that this option will offer a long-term solution due to lack of space at landfills, with other waste types likely to be prioritised. Landfill space is currently at a premium and does not offer a sustainable solution either financially or environmentally for the disposal of dredged arisings. Dredged material is likely to require treatment first in a dewatering facility. Significant cost associated with set up of dewatering facility at the quayside plus transportation and additional costs associated with gaining the necessary planning and regulatory consents.	No
	Land Incineration	The dredged material consists of non-combustible material (silts, sands, gravels, shells) with a low combustible component.	No

Location	Options	Screening Assessment	Carry forward?
	Application to Agricultural Land	The dredged material would need to be treated to reduce salt concentrations to acceptable levels. Would require detailed chemical analysis and assessment as well as an Environmental Authorisation from SEPA. Would require special precautions during spreading in relation to the risk of odour and watercourses / aquifers. Disposal of sediments in this manner would potentially have a detrimental effect on existing terrestrial habitats.	No
	Recycling	Recycling of dredged material is theoretically possible, however, due to the varied lithology there would need to be either segregation during dredging works, or energy and water rich processing on land. EnviroCentre have not been made aware by the harbour authority of an established disposal and reuse route in the Forth at present. In addition, given the relatively small volume of sediment, and the logistics involved, this unlikely to be a cost-effective option.	No
Sea	Water Injection Dredging (WID)	<p>WID offers several sediment-disposal advantages over traditional dredging followed by sea disposal, as primarily the technique relies on natural hydrodynamic forces rather than mechanical excavation and transport. Unlike conventional dredging, which requires sediments to be removed, loaded into barges or pipelines, and transported to designated sea-disposal sites, WID fluidises the seabed sediment into a near-bottom density current that remains close to the bed and is carried away by gravity, tides, and natural water flows, thereby eliminating the need for a dedicated disposal area. The WID approach significantly reduces the operational footprint by avoiding the handling, movement, and double-handling of dredged materials, which are major contributors to fuel consumption, project cost, and environmental disturbance in traditional dredging campaigns. By keeping the sediment within the existing marine system, WID supports more sustainable sediment management practices and avoids the ecological impacts associated with sea disposal, such as increased turbidity and benthic habitat disturbance. Furthermore, its reduced vessel movements and lower fuel requirements contribute to decreased project emissions and overall environmental impact.</p> <p>WID is being utilised more in Scotland and is likely to be a good option for dredging works at Pittenweem Harbour.</p>	Yes

Location	Options	Screening Assessment	Carry forward?
	Aquatic disposal direct to seabed.	<p>The closest spoil ground is the Pittenweem (FO051) sea disposal site, which is located within the Firth of Forth at approx. 5.3 km to the east.</p> <p>The proposed dredge method is to utilise a backhoe upon a bottom-emptying barge. Overall disposal costs associated with sea disposal are generally lower than land-based disposal, with low environmental risk due to appropriate sediment quality screening measures applied during the licensing process.</p>	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:

- WID; and
- Disposal at designated disposal site.

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 Water Injection Dredging

WID provides several advantages because it does not require sediment to be excavated, transported, or disposed of at sea. Instead, it keeps sediment within the existing system, using natural hydrodynamic forces. There are environmental and cost saving benefits to using the WID method. NatureScot have previously stated in discussion that their preference is to retain sediment within local sediment transport cells where possible, which this would help facilitate.

4.2.2 Sea Disposal

Failing the proposed WID methodology, a licenced sea disposal site is located within proximity of the Pittenweem Harbour (Pittenweem (FO051)), within the Firth of Forth at approx. 5.3 km to the east of the dredging area.

It is anticipated that dredging could be undertaken using backhoe upon a barge, or a similar configuration. This would mean that dredging and disposal can take place without the need for double handling of material or bringing the dredged material ashore.

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

5 FURTHER CONSIDERATION OF REMAINING DISPOSAL OPTIONS

5.1 Detailed BPEO Assessment

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

Table 5-1: BPEO Detailed Assessment Criteria

Primary Criteria	Description and Attributes
Strategic	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Safety Implications Public Health Implications Pollution/ Contamination Implications General Ecological Implications Interference with other legitimate activities e.g. fishing Amenity/Aesthetic Implications
Costs	<ul style="list-style-type: none"> Operating costs e.g. labour, site operations, environmental monitoring Capital e.g. Transport, equipment hire

5.1.1 BPEO Strategic Assessment

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

Table 5-2: BPEO Strategic Assessment

Criteria	Water Injection Dredging	Sea Disposal
Operational Aspects (inc. handling and transport)	WID avoids the need for mechanical excavation, lifting, and vessel-based transport of material because the sediment is fluidised in situ and transported horizontally by gravity, tides, and natural currents. This means no double-handling, no barge transport, and no requirement for disposal-site transfers, significantly reducing operational effort and equipment movements. WID therefore eliminates the major cost and workload associated with transporting dredged material to placement locations, which	There would be no double handling of the dredged material. Transportation to the disposal site would be by dredger or barge(s) depending on methodology.

Criteria	Water Injection Dredging	Sea Disposal
	is a dominant component of conventional dredging operations.	
Availability of suitable sites/ facilities	WID does not require designated marine disposal sites, as the technique keeps sediment within the existing water system by enabling it to settle in deeper or naturally depositional areas. Sediment is mobilised only within the local hydrodynamic regime, avoiding dependence on licensed disposal grounds or confined disposal facilities. This makes WID particularly suitable where traditional sea disposal capacity is limited or where regulatory constraints restrict open-water disposal practices.	Marine disposal sites nearby have been designed to accommodate the quantities of material typically generated by dredging operations. The total dredge volume for this project is considered to be relatively low. The chemical analysis of the sediments from the proposed dredge sites would indicate that the material is likely to be acceptable for disposal via this route pending further risk assessment for contaminants present at levels between Action Level 1 and Action Level 2.
General Public / Local Acceptability	WID is generally regarded as an environmentally favourable and low-impact method, producing less turbidity and ecosystem disturbance than traditional excavation and sea disposal operations. Because the technique uses natural processes, avoids sea disposal, and requires fewer vessel movements, the overall visibility and disturbance to local communities is reduced. This often leads to improved public and stakeholder acceptability, especially in environmentally sensitive or high-traffic port areas.	Traditionally accepted disposal route for dredged material with limited public impact.
Legislative Implications	Would need to be agreed with MD-LOT.	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 the options taken forward for the detailed BPEO assessment.

Table 5-3: BPEO Environmental Assessment

Criteria	Water Injection Dredging	Sea Disposal
Safety Implications	WID involves minimal material handling, as sediment is fluidised in-situ and transported horizontally by natural hydrodynamic forces rather than excavated, lifted, or relocated using barges. This reduces manual handling, lifting risks, and vessel-to-	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.

Criteria	Water Injection Dredging	Sea Disposal
	<p>vessel transfer operations compared with traditional dredging, where the majority of safety risk arises during transport and placement activities. WID operations are undertaken using standard marine plant procedures and remain compliant with standard health and safety legislation.</p>	
Public Health	<p>Public exposure pathways are limited as WID does not involve transporting or offloading dredged material at sea or on land, thereby significantly reducing opportunities for human contact with sediments or its operations. The fluidised sediment layer remains close to the seabed and disperses naturally within the water column before settling in deeper areas, which further limits the potential for exposure.</p>	<p>Low potential for human contact during dredging and disposal operations. Once deposited at disposal site pathways for human contact greatly reduced.</p>
Pollution/contamination	<p>As WID retains sediment within the existing system rather than exporting it to a sea disposal site, it reduces pollution risks associated with handling, transport, and sea disposal. WID creates a near-bed density current that minimises turbidity and restricts sediment dispersion to predictable pathways, lowering the risk of contaminant mobilisation into the wider water column. Importantly, WID also avoids emissions from transporting dredged material to sea disposal sites, thereby lowering the project's carbon footprint.</p>	<p>Pollutant concentrations in dredged material to be disposed are limited to acceptable levels through regulatory licensing processes. Information with regards to the type of disposal site with regards to its effects on sediments has not been provided. Correspondence with Marine Directorate has previously concluded that disposal sites in Scotland are Dispersive.</p> <p>Transport by sea to disposal site would increase the project carbon footprint.</p>
General Ecological Implications	<p>WID is considered an environmentally favourable method, as it limits disturbance to benthic habitats compared with traditional dredging and sea disposal. Turbidity generation is lower than with excavation-based methods, and sediment is retained within the local system, supporting natural sediment transport processes rather than creating artificial deposition at licensed sea disposal grounds. This reduces ecological pressure on protected sites where traditional disposal operations might otherwise occur.</p>	<p>Pittenweem (FO051) is a licensed disposal site for dredged material. This disposal site is within the <i>Outer Firth of Forth and St Andrews Bay Complex</i> Special Protection Areas (SPA).</p>
Interference with other legitimate activities	<p>WID generates a smaller operational footprint than conventional dredging and disposal campaigns. With no</p>	<p>The Pittenweem (FO051) is a licenced disposal site. It is likely that interference with other</p>

Criteria	Water Injection Dredging	Sea Disposal
	barge transport or offshore placement runs required, there is significantly less interaction with shipping lanes, fishing activity, or navigational routes. The technique relies on a single, highly manoeuvrable dredging vessel, reducing congestion and the likelihood of interference. Standard navigational controls (such as Notices to Mariners) remain sufficient to manage any residual risks.	activities (such as commercial vessels or fishing) will have been considered as part of the disposal site licencing process. Therefore, the likelihood of significant disruption is considered to be low. Associated risks would likely be managed through the standard Notice to Mariners system via Forth Ports which notifies of activities within the local area.
Amenity / Aesthetic Implications	WID typically results in fewer visible and audible impacts for harbour users and nearby communities. As no barges or disposal vessel convoys are required, noise, visual intrusion, and odour are significantly reduced compared with traditional dredging followed by offshore disposal. Any temporary effects are confined to the presence and operation of the WID vessel within the harbour, with no subsequent disposal phase impacts occurring offshore or nearshore.	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 (where applicable) and methods employed to protect the environment for each of the identified options.

For the purposes of comparing costs associated with each option a benchmark of 12,600 tonnes (~7,000m³)¹ of dredged material has been set.

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	Water Injection Dredging	Sea Disposal at Identified Site
Dredging	£ 30,100	£ 145,000

The costs above have been obtained from recent tendering processes by the Council. The cost for placement in intertidal area is based on previous costs for this method so may be more expensive taking inflation into account.

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	Water Injection Dredging	Sea Disposal at Identified Site
Environment	1	2
Strategic	1	2
Costs	2	3
TOTAL SCORE	4	7

Use of WID to dredge the harbour is an environmentally and cost-efficient means of dredging. The sediments are within the realm of being suitable for sea-based disposal, pending further risk assessment.

In the event that WID is unsuccessful due to the local hydrodynamics in the harbour, a back-up plan for sea deposit is required.

5.2 Conclusion

The Best Practicable Environmental Option for disposal of the Pittenweem Harbour dredged material has been assessed as using the WID method. As a backup option, the Pittenweem (FO051) sea disposal at site approx. 5.3 km to the east is also being considered.

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

6 FURTHER ASSESSMENT

As detailed in Section 5.2, on the basis of the exceedances of Action Level 1, further assessment to determine the suitability of the material for sea disposal (through WID or deposited at a licenced offshore site) is deemed a requirement.

The approach for this further assessment is outlined as follows:

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

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

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

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

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

6.1 Water Injection Dredging

WID fluidises the seabed sediment into a near-bottom density current that remains close to the bed and is carried away by gravity, tides, and natural water flows out of the dredge area and into the marine waterbody, keeping it within the marine ecosystem, reducing turbidity and benthic habitat disturbance. Once sediment is carried out of the dredge area, usually on an ebb tide gravity and hydrodynamics guide the dredged sediment away from the harbour where sediment will naturally settle out on the seabed as velocities decrease.

6.2 Dredge and Disposal Site

The dredge is to be undertaken within three areas of Pittenweem Harbour, within the areas shown on Drawing No. 783694-GIS001, in Appendix A.

If sea disposal is pursued, then dredged material could be taken to the Pittenweem (FO051) disposal site, approximately 5.3 km east of the harbour, should the WID method not be utilised. The Pittenweem sea disposal site is shown on Drawing No. 783694-GIS003, in Appendix A.

Marine Directorate have noted in the past that in Scotland the preference for disposal site selection is those which are dispersive, and as such it is assumed that the Pittenweem (FO051) disposal site is dispersive.

If WID is pursued, then material will be mobilised from the harbour and into the open waters of the Firth of Forth.

6.3 Analytical Data Review

Existing analytical data for the proposed dredge site is provided in Summary Table A in Appendix C. This data has been summarised against RAL 1 & 2, the BAC, ERL and PEL. As detailed previously, the data has not been reviewed against the Canadian TEL as these numbers are typically lower than RAL1. A summary of the exceedances is detailed below.

6.3.1 Action Level 1

Exceedances of RAL1 can be summarised as follows:

- Cadmium – 1 of 5 samples recorded cadmium concentrations above RAL1;
- Copper – 2 of 5 samples recorded copper concentrations above RAL1;
- Zinc – 2 of 5 samples recorded zinc concentrations above RAL1;
- PAHs – 4 of 5 samples recorded concentrations of one or more PAH species above RAL1; and
- THC – 3 of 5 samples recorded THC concentrations above RAL1.

6.3.2 BAC Review

Exceedances of the BAC can be summarised as follows:

- Cadmium – 2 of 5 samples recorded cadmium concentrations above the BAC;
- Copper – 3 of 5 samples recorded copper concentrations above the BAC;
- Mercury – 4 of 5 samples recorded mercury concentrations above the BAC;
- Zinc – 2 of 5 samples recorded zinc concentrations above the BAC; and
- PAHs – 4 of 5 samples recorded concentrations of one or more PAH species above the BAC.

6.3.3 ERL & PEL Review

Exceedances of the ERL can be summarised as follows:

- Copper – 1 of 5 samples recorded copper concentrations above the ERL;
- Zinc – 2 of 5 samples recorded zinc concentrations above the ERL; and
- PAH – 3 of 5 samples recorded concentrations of one or more PAH species above the ERL.

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

6.3.4 Action Level 2

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

6.4 Averages

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

- Averaged concentrations of copper, zinc, several PAH species, and THC's exceeded RAL1;
- All other parameters recorded averaged concentrations below RAL1 where they exist;
- Averaged concentrations exceeded the BAC for copper, mercury, zinc, and several PAH species;
- Averaged concentrations exceeded the ERL for benzo(ghi)perylene only;
- Averaged concentrations were recorded below the PEL where one is available; and
- Averaged concentrations were recorded below RAL2 where they exist.

6.5 Chemical Assessment Conclusions

Four of the five samples analysed recorded exceedances above RAL1 for a least one metal, several PAH species, and THC. Grab A did not record any concentration above RAL1. No samples recorded contaminant levels in exceedance of RAL2. Averaged concentrations, which account for the dredged material as a single volume for disposal, also exceeded RAL1 for copper, zinc, several PAH species, and THC's.

Exceedances of the ERL were recorded in individual samples for copper, zinc, phenanthrene and benzo(ghi)perylene. No exceedances of PEL were recorded in any of the samples analysed.

6.6 Water Framework Directive Assessment

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

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

Each of these points are considered in Table 6-1 below, in the context of sediment dispersal from WID and/or disposal of dredged material at the Pittenweem (FO051) disposal site.

Table 6-1: Receptor Risk Assessment

Key Receptor ²	Brief Summary of Potential Effects on Receptor	Further Consideration Required?	Comment
Hydromorphology (Source Area and Disposal Site)	Morphological conditions, for example depth variation, the seabed and intertidal zone structure tidal patterns, for example dominant currents, freshwater flow and wave exposure	No	<p>The dredge area, WID dispersal zone, and disposal site are located within the Fife Ness to Elie coastal water body (ID: 200054), which is classified as have a “Good” overall status and classification as “High” for hydromorphology (2024)³.</p> <p>The dredging activities are within an area where dredging has been a historic activity, as well as the deposition of sediment in the disposal site. Given that proposed activities are relatively small, not new and at scale, there is unlikely to be a change in status of the water body.</p> <p>In theory, the WID process may result in minor, localised alterations to the seabed profile; however, the volume of dredged material involved is insufficient to produce changes of a magnitude that would affect the water body’s WFD status. Moreover, the harbour has been subject to maintenance dredging in the past and this has not resulted in a change in classification.</p> <p>Disposal at Offshore Site The disposal site is located within the Outer Firth of Forth and St Andrews Bay Complex SPA, within the Fife Ness to Elie coastal water body (ID: 200054), which is classified as have a “Good” overall status and classification as “High” for hydromorphology (2024)³. The classification of this water body takes into account the presence of the disposal site, so no further assessment is considered to be required.</p>
Biology - habitats	Included to assess potential impacts to sensitive/high value habitats.	Yes	The dredge area, WID dispersal zone and disposal site are noted to have a classification for overall ecology of “Good” ³ .

² <https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters>

³ https://informatics.sepa.org.uk/WaterClassificationHub/?page=Information_Sheet&WB=200054

Key Receptor ²	Brief Summary of Potential Effects on Receptor	Further Consideration Required?	Comment
			<p>The Fife Ness to Elie (covering areas of the proposed works) coastal waterbody has a classification of “Good” for invertebrates and benthic invertebrates (IQI)³.</p> <p>The WID dispersal zone, and disposal site are located within designated protected areas for their bird populations.</p> <p>Further consideration is given to these below in Section 6.7.2.</p>
Biology – fish	Consideration of fish both within the estuary and also potential effects on migratory fish in transit through the estuary	No	<p>The Fife Ness to Elie (covering areas of the proposed works) coastal waterbody does not have a classification for fish³ and is located in the wider Forth estuary with no obvious constraints.</p> <p>The small scale of the works proposed within an active harbour, so activities are ongoing on a daily basis.</p> <p>The works will not likely affect the migration of fish within the wider coastal waterbody as the width of the estuary at the point of dredge and deposit site will allow fish will have plenty of scope to avoid the works and continue their migration unhindered.</p> <p>No further assessment is considered necessary.</p>
Water Quality	Consideration must be given to water quality when contaminants are present in exceedance of CEFAS RAL1.	Yes	<p>The Fife Ness to Elie (covering areas of the proposed works) coastal waterbody has a water quality classification status of “Good” and a classification of “Pass” for Specific Pollutants.</p> <p>A number of sediment samples recorded results in exceedance of CEFAS RAL1. Potential effects are considered to be both localised and temporary. Further consideration of potential effects is discussed in Section 6.7.1 for completeness.</p>

Key Receptor ²	Brief Summary of Potential Effects on Receptor	Further Consideration Required?	Comment
Protected Areas	<p>If your activity is within 2km of any WFD protected area, include each identified area in your impact assessment.</p> <ul style="list-style-type: none"> • Special Areas of Conservation (SAC); • Special Protection Areas (SPA); • Shellfish Waters; • Bathing Waters; and • Nutrient Sensitive Areas. 	Yes	<p>The dredge areas are not located within the Outer Firth of Forth and St Andrews Bay Complex SPA; however the WID dispersal zone and the offshore disposal site are both located within the SPA.</p> <p>The SPA is classified for: breeding & non-breeding birds⁴.</p> <p>Anstruther (Billow Ness) designated bathing waters is located approx. 1.3 km northeast of the proposed dredge areas.</p> <p>There are no shellfish harvesting waters within 2 km of either the dredge area, WID dispersal zone, or disposal site⁵.</p> <p>Further discussion with regard to protected areas is given in Section 6.7.2.</p>

⁴ <https://sitelink.nature.scot/site/10478>

⁵ <https://marinescotland.atkinsgeospatial.com/nmpi/default.aspx?layers=1587>

6.7 Potential Risk to Receptors

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

6.7.1 Water Quality

The dredge area, WID dispersal zone, and disposal site are located within the Fife Ness to Elie coastal water body (ID: 200054), which holds a water quality classification status of “Good” and a classification of “Pass” for Specific Pollutants.

Although concentrations of some contaminants of concern were recorded above the RAL1 within the sediment for dredging, it is considered that these levels will not contribute to an overall degradation of water quality coastal waterbody (both within the WID dispersal zone and the disposal site). While any effects which may occur are considered to be both localised and temporary, the potential for both dilution and natural attenuation in the open waters beyond the dredge sites is considerable.

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. Given the large dilution potential, it is not expected that there would be a long-term impact on water quality. Additionally, when the sediment results are reviewed as an average to assess all of the dredged sediment as a single unit for disposal, then RAL1 is exceeded only for total hydrocarbons and marginally for copper, zinc, and most PAHs. Averaged concentrations exceeded the BAC for copper, mercury, zinc, and PAHs. The BAC is intended to be used to determine if concentrations are near to background concentrations, rather than qualify any potential environmental impact. It should also be noted that the BACs for PAH and some metals are generally lower than the Marine Directorate RAL1, therefore it is considered to be a very conservative assessment criterion. No sediment results were recorded in exceedance of RAL2. Averaged concentrations did not record any exceedances of the PEL, which is primarily protective of marine life.

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

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

The sediment material primarily comprises sand and silt and negligible quantities of gravel. Table 6-2 summarises the average physical sediment type from all three samples from the dredge area.

Table 6-2: Averaged PSA Data for Dredge Area

Gravel % (>2 mm)	Sand % (>63 µm<2 mm)	Silt % (<63 µm)
2.77	46.50	50.73

The dominant grain size in the material to be dredged is silt, with a lesser quantity of sand. Sands and gravel will fall from suspension quickly, along with any clumps of cohesive material. Silts and clays,

being finer grained will suspend and have the potential for dispersal due to longer times in suspension, however it is expected that the majority will quickly fall quickly to the seabed.

It is assumed that the identified disposal site will have been utilised to dispose of similar fine-grained sediments from other dredging projects undertaken previously in the Firth of Forth and the SEPA water quality classification remains as “good” since 2014. As a result, it is considered unlikely that this dredging campaign will result in a change in the classification status of coastal water bodies at the dredge, WID dispersal zone, and disposal site.

6.7.2 Habitats/Protected Areas

Marine Special Protection Area (SPA)

The following section gives further discussion on the designated protected areas that have been identified within 2 km of the dredge area, WID dispersal zone, and disposal site.

The dredge areas are not located within the Outer Firth of Forth and St Andrews Bay Complex SPA, however the WID dispersal zone is likely to be within the designated SPA and the identified disposal site is located within the SPA.

Identified designated areas for inclusion within the assessment are shown in Drawing No. 778694-GIS004 in Appendix A).

The Outer Firth of Forth and St Andrews Bay Complex SPA is classified for breeding and non-breeding birds⁴.

The Conservation and Management Advice document for the Outer Firth of Forth and St Andrews Bay Complex SPA³ (NatureScot, June 2022) gives specific advice for capital and maintenance dredging, and is reproduced below:

“No additional management for existing maintenance dredging (ports and harbours).

Reduce or limit pressures (disturbance, damage of supporting habitat) associated with new capital dredging projects and associated maintenance dredging through appropriate mitigation such as:

- spatial limitations to avoid damaging supporting habitat within foraging dive ranges of protected features and/or;*
- seasonal restrictions.”*

Given that marine activities are already undertaken in Pittenweem Harbour, it is considered that that the dredging works will not result in significant disturbance for protected species and habitats, beyond what is already experienced during normal harbour operations.

Bathing Waters

Anstruther (Billow Ness) Bathing Water is located approx. 1.3 km northeast of the dredge area. The bathing water was most recently classified as “Excellent” for 2025⁶.

⁶ <https://bathingwaters.sepa.org.uk/locations-and-results/results/?location=4552>

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 area, WID dispersal zone, and disposal site.

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 site (*i.e.* increase in suspended solids/turbidity) are unlikely to impact the status of the bathing water at Anstruther.

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.

7 CONCLUSIONS AND RECOMMENDATIONS

Fife Council appointed EnviroCentre Ltd to complete a Best Practicable Environmental Option (BPEO) assessment to inform proposed capital dredging at Pittenweem Harbour. The assessment has been informed using sediment quality results from sampling undertaken in February 2024.

The proposed dredge depth will not exceed 1.0m and is intended to improve the navigability in the berth and approaches. A maximum quantity of 7,000 m³ is proposed to be dredged across the areas shown in Drawing No. 783694-GIS001 in Appendix A. It is understood that the previous licence (reference: 04981/13/0) expired on 31st October 2016. Fife Council is seeking to renew the licence for capital dredging works proposed in August 2026.

Review of available information has highlighted that although several contaminants of concern exceed RAL1 in sediment samples, 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 hydromorphological, ecological or chemical status.

The WID method is low impact and should be achievable given the access restrictions of the harbour. In the event that WID is unsuccessful due to the local hydrodynamics in the harbour, a back-up plan for sea deposit is required.

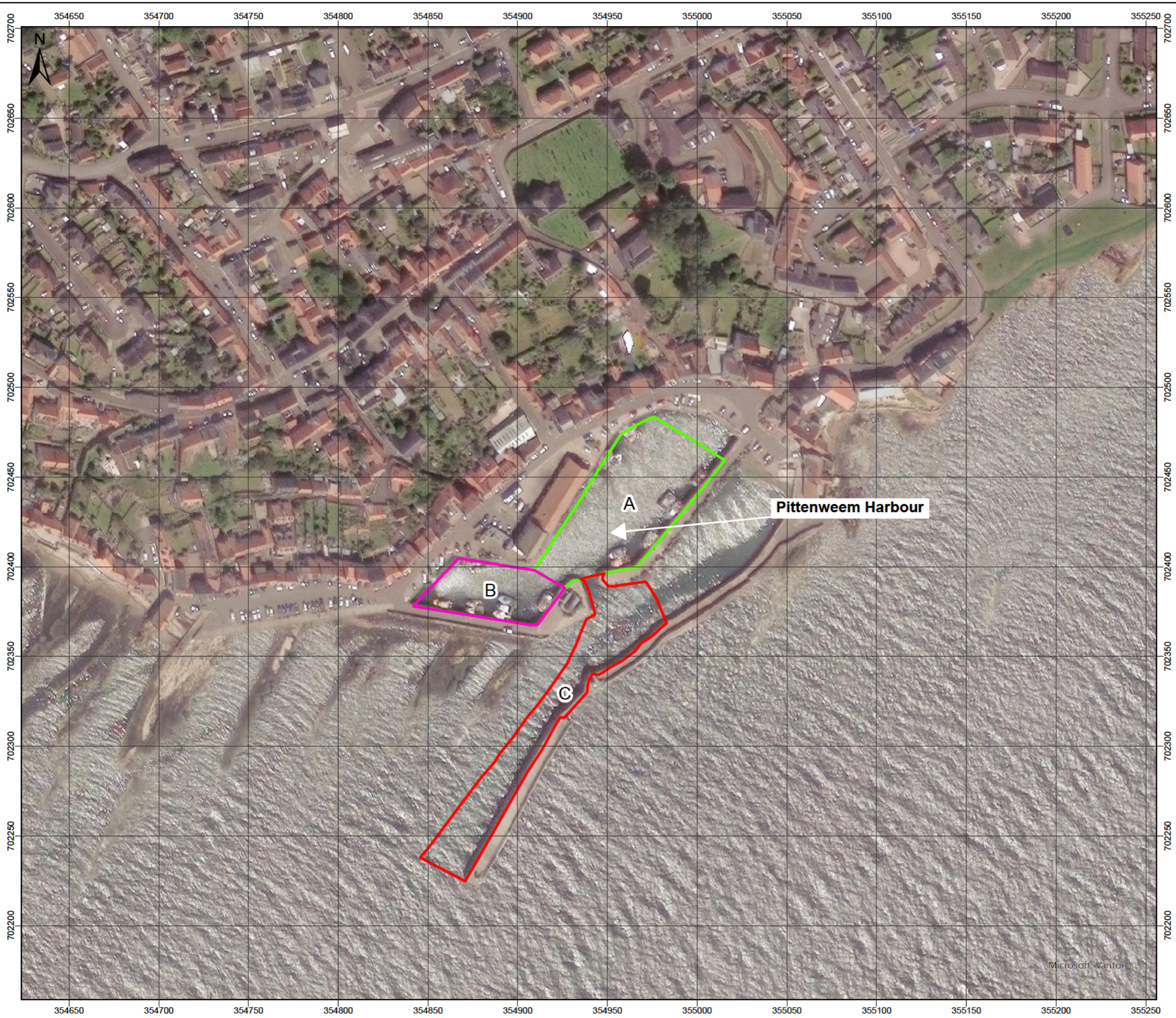
REFERENCES

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

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

APPENDICES

A DRAWINGS



Legend

Pittenweem Dredge Areas

- A
- B
- C

Do not scale this map

Client
Fife Council

Project
Fife Council Harbours

Title
Dredge Area Plan
Pittenweem Harbour

Status
FINAL

Drawing No. 783694-GIS001	Revision A	Date 23 Mar 2026
Drawn MMF	Checked FR	Approved CCAS

Scale
1:2,000 @A3

0 15 30 60 Metres

Rev	Date	Amendment	Initials
A	03/07/26	Update to dredge boundary C	JAS

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Legend

Pittenweem Dredge Areas

- A
- B
- C
- Sediment Sample Locations

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Client
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Fife Council Harbours

Title
2024 Sediment Sample Locations Plan
Pittenweem Harbour

Status
FINAL

Drawing No. 783694-GIS002	Revision A	Date 23 Mar 2026
Drawn MMF	Checked FR	Approved CCAS

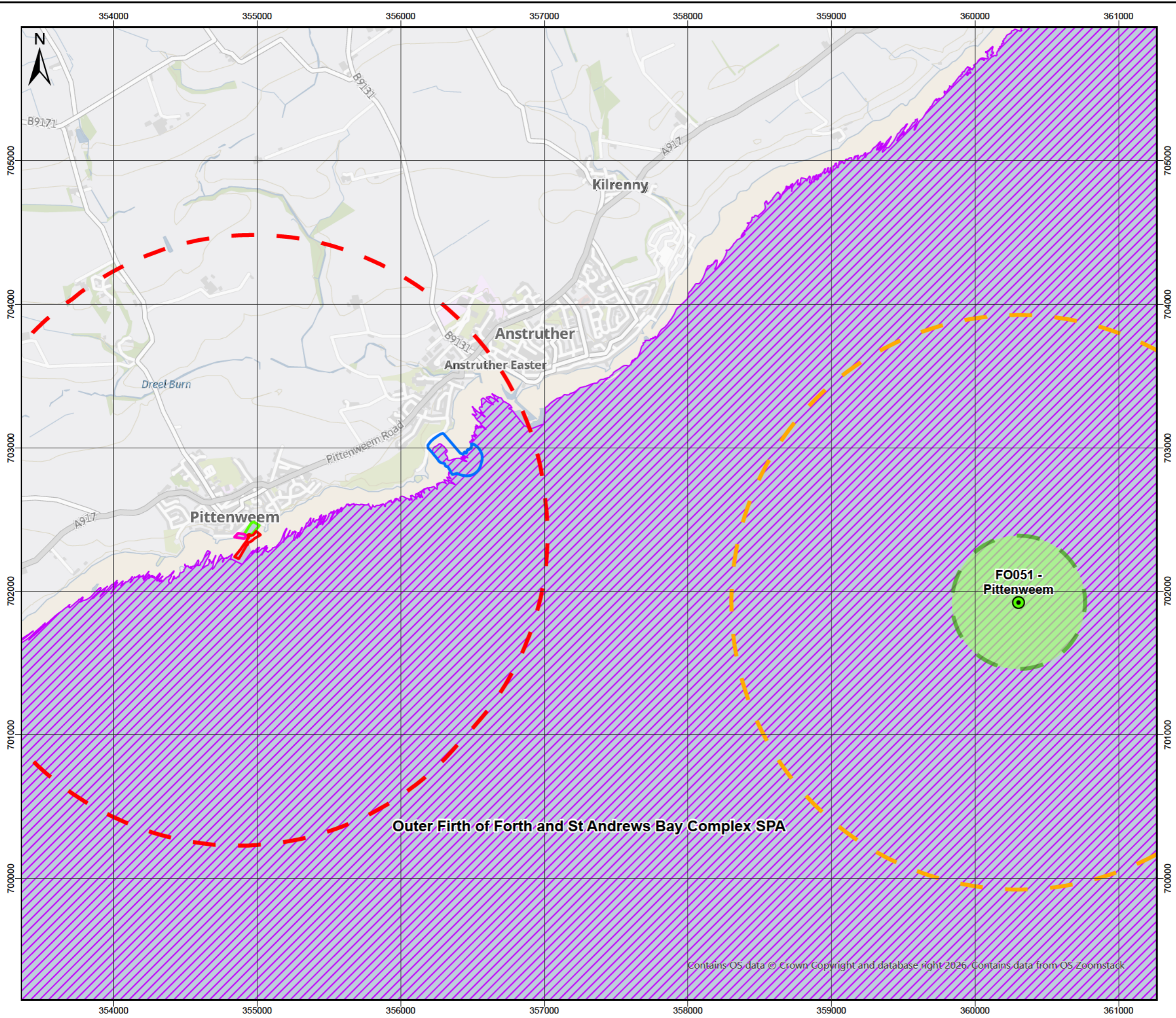
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Rev	Date	Amendment	Initials
A	08/07/26	Revise Boundary C	FR

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Legend

- Pittenweem Disposal Site
- 0.25 Nautical Mile Buffer Zone
- Dredge Areas' 2km Buffer
- Disposal Sites' 2km Buffer
- Anstruther (Billow Ness) Bathing Waters
- Special Protection Areas (SPA)

Pittenweem Dredge Areas

- A
- B
- C

Do not scale this map
Client
 Fife Council

Project
 Fife Council Harbours

Title
 Protected Areas Plan
 Pittenweem Harbour Page 1 of 2

Status
 FINAL

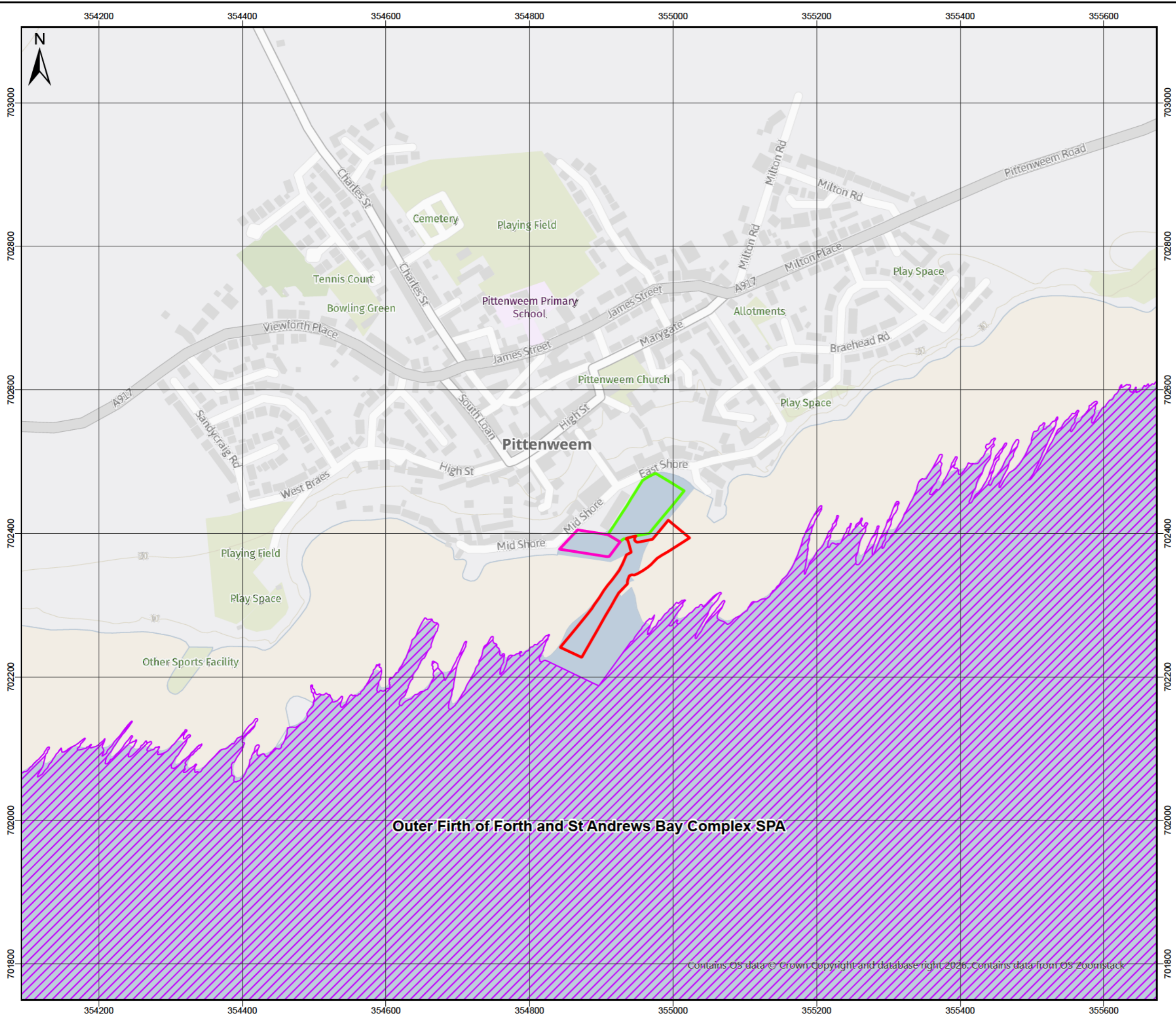
Drawing No. 783694-GIS005	Revision -	Date 24 Mar 2026
Drawn MMF	Checked FR	Approved CCAS

Scale
 1:25,000 @A3 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Legend

Special Protection Areas (SPA)

Pittenweem Dredge Areas

A

B

C

Do not scale this map

Client
Fife Council

Project
Fife Council Harbours

Title
Protected Areas Plan
Pittenweem Harbour Page 2 of 2

Status
FINAL

Drawing No. 783694-GIS005	Revision -	Date 24 Mar 2026
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Scale
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Rev	Date	Amendment	Initials
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B SEDIMENT SAMPLE LOGS

GRAB SAMPLE LOG

Date	07/02/24	Latitude	56° 12.6547'
Dredge Area	Pittenweem Harbour	Longitude	-2° 43.73392'
Method	0.045m ² Van Veen Grab Sampler	Sampled/logged by	FR/MK

Remarks: Greyish brown fine/medium sand

Biota: None

Odours: None

Anthropogenic Inputs: None

Notes: -



Project Name	Fife Harbours Crail and Pittenweem	Location ID
Project No.	778896	
Client	Fife Council	

Grab B

GRAB SAMPLE LOG

Date	07/02/24	Latitude	56° 12.70138'
Dredge Area	Pittenweem Harbour	Longitude	-2° 43.67799'
Method	0.045m ² Van Veen Grab Sampler	Sampled/logged by	FR/MK

Remarks: Soft dark grey/black silt with rare shell derived gravel

Biota: None

Odours: None

Anthropogenic Inputs: None

Notes: -



GRAB SAMPLE LOG

Date	07/02/24	Latitude	56° 12.75247'
Dredge Area	Pittenweem Harbour	Longitude	-2° 43.66949'
Method	0.045m ² Van Veen Grab Sampler	Sampled/logged by	FR/MK

Remarks: Soft dark grey/black silt

Biota: Occasional vegetation/seaweed

Odours: Slight H₂S odour

Anthropogenic None

Inputs:

Notes: -



GRAB SAMPLE LOG

Date	07/02/24	Latitude	56° 12.71493'
Dredge Area	Pittenweem Harbour	Longitude	-2° 43.75479'
Method	0.045m ² Van Veen Grab Sampler	Sampled/logged by	FR/MK

Remarks: Very soft dark grey/black silt

Biota: Occasional vegetation/seaweed

Odours: Strong H₂S odour

Anthropogenic Inputs: None

Notes: -



GRAB SAMPLE LOG

Date	07/02/24	Latitude	56° 12.72489'
Dredge Area	Pittenweem Harbour	Longitude	-2° 43.68648'
Method	0.045m ² Van Veen Grab Sampler	Sampled/logged by	FR/MK

Remarks: Very soft dark grey/black silt

Biota: High vegetation/seaweed content

Odours: Very strong H₂S odour

Anthropogenic Inputs: Piece of rubber belt

Notes: -



C SUMMARY TABLES

Summary Table A

Sampling Results Incorporated with BPEO Assessment (mg/kg)

Source	Pittenweem Harbour																
	AL1	AL2	BAC	ERL	PEL	GRAB A	GRAB B	GRAB C	GRAB D	GRAB E	Max	AVERAGE	No. Exceed RAL 1	No. Exceed RAL 2	No.Exceed BAC?	No. Exceed ERL	No. Exceed PEL?
			CSEMP	CSEMP	Canada												
Arsenic	20	70	25		41.6	6.7	7.3	9.4	11.9	9	11.9	8.86	0	0	0	N/A	0
Cadmium	0.4	4	0.31	1.2	4.2	0.11	0.24	0.34	0.42	0.28	0.42	0.28	1	0	2	0	0
Chromium	50	370	81	81	160	19.9	25.7	32.5	39.6	29	39.6	29.34	0	0	0	0	0
Copper	30	300	27	34	108	19.7	16.6	29.4	55.6	33.8	55.6	31.02	2	0	3	1	0
Mercury	0.25	1.5	0.07	0.15	0.7	0.05	0.07	0.09	0.11	0.08	0.11	0.08	0	0	4	0	0
Nickel	30	150	36	-	-	16.4	18.5	21.9	25.2	20.2	25.2	20.44	0	0	0	N/A	N/A
Lead	50	400	38	47	112	18.9	17.5	24.2	28.7	20.4	28.7	21.94	0	0	0	0	0
Zinc	130	600	122	150	271	48.2	94.7	167	242	116	242	133.58	2	0	2	2	0
Napthalene	0.1		0.08	0.16	0.391	0.00684	0.0623	0.0659	0.0771	0.0426	0.0771	0.05	0	N/A	0	0	0
Acenaphthylene	0.1		-	-	0.128	0.00268	0.0212	0.0408	0.0156	0.005	0.0408	0.02	0	N/A	N/A	N/A	0
Acenaphthene	0.1		-	-	0.0889	0.00142	0.0318	0.0174	0.005	0.005	0.0318	0.01	0	N/A	N/A	N/A	0
Fluorene	0.1		-	-	0.144	0.00402	0.0553	0.0461	0.0413	0.0279	0.0553	0.03	0	N/A	N/A	N/A	0
Phenanthrene	0.1		0.032	0.24	0.544	0.023	0.284	0.2	0.168	0.107	0.284	0.16	4	N/A	4	1	0
Anthracene	0.1		0.05	0.085	0.245	0.00634	0.0707	0.0595	0.0474	0.026	0.0707	0.04	0	N/A	2	0	0
Fluoranthene	0.1		0.039	0.6	1.494	0.0475	0.285	0.29	0.235	0.0944	0.29	0.19	3	N/A	5	0	0
Pyrene	0.1		0.024	0.665	1.398	0.0426	0.284	0.294	0.242	0.102	0.294	0.19	4	N/A	5	0	0
Benzo(a)anthracene	0.1		0.016	0.261	0.693	0.0223	0.121	0.149	0.116	0.0502	0.149	0.09	3	N/A	5	0	0
THC	0.1		0.02	0.384	0.846	0.0225	0.141	0.154	0.142	0.0563	0.154	0.10	3	N/A	5	0	0
Benzo(b)fluoranthene	0.1		-	-	-	0.022	0.13	0.155	0.145	0.0684	0.155	0.10	3	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	0.1		-	-	-	0.02	0.125	0.189	0.139	0.068	0.189	0.11	3	N/A	N/A	N/A	N/A
Benzo(a)pyrene	0.1		0.03	0.384	0.763	0.0227	0.146	0.185	0.144	0.0595	0.185	0.11	3	N/A	4	0	0
Indeno(1,2,3cd)pyrene	0.1		0.103	0.24	-	0.015	0.104	0.126	0.124	0.0569	0.126	0.09	3	N/A	3	0	N/A
Benzo(ghi)perylene	0.1		0.08	0.085	-	0.0161	0.125	0.145	0.138	0.0703	0.145	0.10	3	N/A	3	3	N/A
Dibenzo(a,h)anthracene	0.01		-	-	0.135	0.00283	0.0201	0.0266	0.0167	0.005	0.0266	0.01	3	N/A	N/A	N/A	0
THC	100		-	-	-	12	95.2	230	732	116	732	237.0	3	N/A	N/A	N/A	N/A
PCBs	0.02	0.18	-	-	0.189	0.00056	0.00109	0.00128	0.00202	0.00092	0.00202	0.0012	0	0	N/A	N/A	0
TBT	0.1	0.5	-	-	-	0.005	0.005	0.005	0.005	0.005	0.005	0.0050	0	0	N/A	N/A	N/A

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

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

Summary Table B

Pittenweem Harbour Average Concentrations

All units in mg/kg

Source	AL1	AL2	BAC	<ERL	PEL	Dredge Average	Exceed AL1?	Exceed AL2?	Exceed BAC?	Exceed ERL ?	Exceed PEL?
			CSEMP	CSEMP	Canada						
Arsenic	20	70	25	-	41.6	8.9	No	No	No	N/A	No
Cadmium	0.4	4	0.31	1.2	4.2	0.3	No	No	No	No	No
Chromium	50	370	81	81	160	29.3	No	No	No	No	No
Copper	30	300	27	34	108	31.0	Yes	No	Yes	No	No
Mercury	0.25	1.5	0.07	0.15	0.7	0.1	No	No	Yes	No	No
Nickel	30	150	36	-	-	20.4	No	No	No	N/A	N/A
	50	400	38	47	112	21.9	No	No	No	No	No
Zinc	130	600	122	150	271	133.6	Yes	No	Yes	No	No
Napthalene	0.1	-	0.08	0.16	0.319	0.1	No	N/A	No	No	No
Acenaphthylene	0.1	-	-	-	0.128	0.0	No	N/A	N/A	N/A	No
Acenaphthene	0.1	-	-	-	0.0889	0.0	No	N/A	N/A	N/A	No
Fluorene	0.1	-	-	-	0.144	0.0	No	N/A	N/A	N/A	No
Phenanthrene	0.1	-	0.032	0.24	0.544	0.2	Yes	N/A	Yes	No	No
Anthracene	0.1	-	0.05	0.085	0.245	0.0	No	N/A	No	No	No
Fluoranthene	0.1	-	0.039	0.6	1.494	0.2	Yes	N/A	Yes	No	No
Pyrene	0.1	-	0.024	0.665	1.398	0.2	Yes	N/A	Yes	No	No
Benzo(a)anthracene	0.1	-	0.016	0.261	0.693	0.1	No	N/A	Yes	No	No
Chrysene	0.1	-	0.02	0.384	0.846	0.1	Yes	N/A	Yes	No	No
Benzo(b)fluoranthene	0.1	-	-	-	-	0.1	Yes	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	0.1	-	-	-	-	0.1	Yes	N/A	N/A	N/A	N/A
Benzo(a)pyrene	0.1	-	0.03	0.384	0.763	0.1	Yes	N/A	Yes	No	No
Indeno(1,2,3cd)pyrene	0.1	-	0.103	0.24	-	0.1	No	N/A	No	No	N/A
Benzo(ghi)perylene	0.1	-	0.08	0.085	-	0.1	No	N/A	Yes	Yes	N/A
Dibenzo(a,h)anthracene	0.01	-	-	-	0.135	0.0	Yes	N/A	N/A	N/A	No
THC	100	-	-	-	-	237.0	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	-	-	-	0.005	No	No	N/A	N/A	N/A

D LABORATORY CERTIFICATES

Certificate of Analysis

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



Test Report ID MAR02209

Issue Version: 1

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

Customer Reference: 778896 Pittenweem Harbour

Date Sampled: 07-Feb-24

Date Samples Received: 09-Feb-24

Test Report Date: 14-Mar-24

Condition of samples: Ambient Satisfactory

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

[Redacted]

Authorised by: Jane Colbourne

Position: Customer Service Specialist



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Certificate of Analysis



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Test Report ID MAR02209
 Issue Version 1
 Customer Reference 778896 Pittenweem 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
Grab A	MAR02209 001	Sediment	30.1	69.9	0.00	85.06	14.94	NAIIS
Grab B	MAR02209 002	Sediment	47.6	52.4	3.48	50.88	45.64	NAIIS
Grab C	MAR02209 003	Sediment	65.3	34.7	4.79	34.21	61.01	NAIIS
Grab D	MAR02209 004	Sediment	67.9	32.1	1.01	24.53	74.47	NAIIS
Grab E	MAR02209 005	Sediment	67.1	32.9	4.59	37.80	57.61	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

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Units	% M/M
Method No	WSLM59*
Limit of Detection	0.02
Accreditation	UKAS

Client Reference	SOCOTEC Ref	Matrix	TOC
Grab A	MAR02209 001	Sediment	0.45
Grab B	MAR02209 002	Sediment	6.47
Grab C	MAR02209 003	Sediment	4.30
Grab D	MAR02209 004	Sediment	3.79
Grab E	MAR02209 005	Sediment	4.36
Reference Material (% Recovery)			111
QC Blank			<0.02

* See Report Notes

NAIS - No Asbestos Identified In Sample

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		Units	mg/Kg (Dry Weight)							
		Method No	ICPMSS*							
		Limit of Detection	0.5	0.04	0.5	0.5	0.01	0.5	0.5	2
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference	SOCOTEC Ref	Matrix	Arsenic	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Zinc
Grab A	MAR02209 001	Sediment	6.7	0.11	19.9	19.7	0.05	16.4	18.9	48.2
Grab B	MAR02209 002	Sediment	7.3	0.24	25.7	16.6	0.07	18.5	17.5	94.7
Grab C	MAR02209 003	Sediment	9.4	0.34	32.5	29.4	0.09	21.9	24.2	167
Grab D	MAR02209 004	Sediment	11.9	0.42	39.6	55.6	0.11	25.2	28.7	242
Grab E	MAR02209 005	Sediment	9.0	0.28	29.0	33.8	0.08	20.2	20.4	116
Certified Reference Material SETOC 768 (% Recovery)			95	98	101	102	111	99	98	99
QC Blank			<0.5	<0.04	<0.5	<0.5	<0.01	<0.5	<0.5	<2

* See Report Notes

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 Customer Reference 778896 Pittenweem 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)
Grab A	MAR02209 001	Sediment	<5	<5
Grab B	MAR02209 002	Sediment	<5	<5
Grab C	MAR02209 003	Sediment	<5	<5
Grab D	MAR02209 004	Sediment	<5	<5
Grab E	MAR02209 005	Sediment	<5	<5
Certified Reference Material BCR-646 (% Recovery)			79	69
QC Blank			<1	<1

* See Report Notes

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 Issue Version 1
 Customer Reference 778896 Pittenweem 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
Grab A	MAR02209 001	Sediment	1.42	2.68	6.34	22.3	22.7	22.0
Grab B	MAR02209 002	Sediment	31.8	21.2	70.7	121	146	130
Grab C	MAR02209 003	Sediment	17.4	40.8	59.5	149	185	155
Grab D	MAR02209 004	Sediment	<5	15.6	47.4	116	144	145
Grab E	MAR02209 005	Sediment	<5	<5	26.0	50.2	59.5	68.4
Certified Reference Material Quasimeme QPH118MS (% Recovery)			86	116	92	73	82	86
QC Blank			<1	<1	<1	<1	<1	<1

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

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Test Report ID MAR02209
 Issue Version 1
 Customer Reference 778896 Pittenweem 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	N*	UKAS
Client Reference	SOCOTEC Ref	Matrix	BENZGHIP	BKF*	CHRYSENE *	DBENZAH	FLUORANT	FLUORENE
Grab A	MAR02209 001	Sediment	16.1	20.0	22.5	2.83	47.5	4.02
Grab B	MAR02209 002	Sediment	125	125	141	20.1	285	55.3
Grab C	MAR02209 003	Sediment	145	189	154	26.6	290	46.1
Grab D	MAR02209 004	Sediment	138	139	142	16.7	235	41.3
Grab E	MAR02209 005	Sediment	70.3	68.0	56.3	<5	94.4	27.9
Certified Reference Material Quasimeme QPH118MS (% Recovery)			85	50	98	106	91	81
QC Blank			<1	<1	<1	<1	<1	<1

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

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Test Report ID MAR02209
 Issue Version 1
 Customer Reference 778896 Pittenweem 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
Grab A	MAR02209 001	Sediment	15 0	6.84	23.0	42.6	12000
Grab B	MAR02209 002	Sediment	104	62.3	284	284	95200
Grab C	MAR02209 003	Sediment	126	65.9	200	294	230000
Grab D	MAR02209 004	Sediment	124	77.1	168	242	732000
Grab E	MAR02209 005	Sediment	56 9	43	107	102	116000
Certified Reference Material Quasimeme QPH118MS (% Recovery)			84	61	88	83	103~
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 available.
 As the method uses surrogate standards to correct for losses, the RM results are reported as percentage trueness, not recovery.
 *See report notes

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Test Report ID MAR02209
 Issue Version 1
 Customer Reference 778896 Pittenweem 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
Grab A	MAR02209 001	Sediment	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Grab B	MAR02209 002	Sediment	0.10	0.10	0.15	0.13	0.28	0.22	0.11
Grab C	MAR02209 003	Sediment	0.10	<0.08	0.10	0.18	0.35	0.33	0.14
Grab D	MAR02209 004	Sediment	0.32	0.18	0.22	0.39	0.29	0.40	0.22
Grab E	MAR02209 005	Sediment	0.14	0.08	0.11	0.20	0.18	0.13	<0.08
Certified Reference Material Quasimeme QOR155MS (% Recovery)			101	101	89	98	94	100	101
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 available.

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Test Report ID MAR02209

Issue Version 1

Customer Reference 778896 Pittenweem Harbour

REPORT NOTES

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
WSLM59*	MAR02209.001-005	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
ICPMSS*	MAR02209.001-005	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
SUB_01*	MAR02209.001-005	Analysis was conducted by an approved subcontracted laboratory.
SUB_02*	MAR02209.001-005	Analysis was conducted by an approved subcontracted laboratory.
ASC/SOP/301	MAR02209.001-005	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	MAR02209.004-005	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	MAR02209.001-005	The Primary process control data associated with this Test has not wholly met the requirements of the Laboratory Quality Management System QMS with one or more target analytes falling outside acceptable limits. The remaining data gives the Laboratory confidence that the test has performed satisfactorily and that the validity of the data may not have been significantly affected However in line with our QMS policy we have removed accreditation, where applicable, from the affected analytes (FLUORENE) . These circumstances should be taken into consideration when utilising the data.
ASC/SOP/303/304	MAR02209.001-005	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	MAR02209.001-005	Chrysene is known to coelute with Triphenylene and these peaks can not be resolved. It is believed Triphenylene is present in these samples therefore it is suggested that the Chrysene results should be taken as a Chrysene (inc. Triphenylene). This should be taken into consideration when utilising the data.

DEVIATING SAMPLE STATEMENT

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

MAR02209

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Certificate of Analysis



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Test Report ID MAR02209
 Issue Version 1
 Customer Reference 778896 Pittenweem 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/ND R.
Metals	Air dried and sieved 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-F D analysis.
Polychlorinated Biphenyls (PCBs)	Air dried and sieved 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-Hexachlorocyclohexane
ANTHRACN	Anthracene	CHRYSENE	Chrysene	BHCH	beta-Hexachlorocyclohexane
BAA	Benzo[a]anthracene	DBENZA	Dibenzo[ah]anthracene	GHCH	gamma-Hexachlorocyclohexane
BAP	Benzo[a]pyrene	FLUORANT	Fluoranthene	DIELDR N	Dieldrin
BBF	Benzo[b]fluoranthene	FLUORENE	Fluorene	HCB	Hexachlorobenzene
BEP	Benzo[e]pyrene	NDPYR	Indeno[1,2,3-cd]pyrene	DDD	p,p'-Dichlorodiphenyldichloroethane
BENZGH P	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		

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