



Anstruther Harbour Best Practicable Environmental Options (BPEO) Report



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EnviroCentre Limited Office Locations:

Glasgow

Edinburgh

Inverness

Banchory

Registered Office: Craighall Business Park 8 Eagle Street Glasgow G4 9XA
Tel 0141 341 5040 info@envirocentre.co.uk www.envirocentre.co.uk

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1 INTRODUCTION

Fife Council appointed EnviroCentre Ltd to complete a Best Practicable Environmental Option (BPEO) assessment to inform proposed maintenance dredging at Anstruther Harbour. The assessment has been informed using sediment quality results from sampling undertaken on 11th June 2026.

Fife Council is seeking to renew the licence for maintenance dredging works, which are proposed to be undertaken in autumn of 2026. The dredge areas span across areas A (17,684m²) and B (6,976m²).

The proposed dredge volumes are summarised in Table 1-1 below.

Table 1-1: Proposed (Estimated) Dredge Volumes

Dredge Area	Dredge Depth (mCD)	Proposed Dredge Quantity (m ³)	Estimated Dredge Wet Tonnage ¹
Anstruther Dredge Areas	-1.0	10,193	18,347

An estimated quantity of 18,347 wet tonnes (~10,193m³) is proposed to be dredged across the area shown in Drawing No. 784222-GIS001, in Appendix A.

The purpose of the sample analysis is to provide supporting information to the Marine Directorate during the licensing process on sediment quality within the proposed dredge area to assess the suitability for sediment for sea-based disposal. 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 June 2026 sediment analysis will then be used to compare the BPEO for each of the available potential disposal options for the dredged materials.

1.1 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 area.

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.

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

¹ Assumed Bulk Density 1.0 m³ = 1.8 tonnes.

1.2 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.

1.3 Report Usage

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2 SAMPLING LOCATIONS AND METHODOLOGY

Sampling works were undertaken on the 11th of June 2026, 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 three locations across the dredge areas. Sample station locations are outlined in Table 2-1.

Table 2-1: Sample Locations Anstruther Harbour – June 2024

Sample Station ID	Easting	Northing	Latitude	Longitude
Sample 1	356718	703502	56°22.2100'	-2°69.95571'
Sample 2	356745	703381	56°22.1016'	-2°69.91055'
Sample 3	356818	703320	56°22.0479'	-2°69.79130'

Sample station locations are shown in Drawing No. 784222-GIS001, in Appendix A.

2.2 Survey Vessel

Sampling was undertaken from a Pioneer 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 coolboxes. Samples were frozen as on return to the office prior to being dispatched to the project laboratory (Socotec Marine) on 15th June 2026.

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;
- Asbestos Screen; and
- Particle Size Distribution.

Samples were sent to the Socotec Marine laboratory for analysis, which holds UKAS accreditation for analysis of marine sediment samples.

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 below.

Table 3-1: Particle Size Analysis Data

Sample ID	Gravel % (>2 mm)	Sand % (>63 µm<2 mm)	Silt % (<63 µm)
Sample 1	0.00	2.05	97.95
Sample 2	0.00	54.88	45.12
Sample 3	0.00	55.61	44.39
Average PSA	0.00	37.51	62.49

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

Particle size within Sample 1 was primarily noted comprise silt and clay sized particles. Particle size within Sample 2 and Sample 3 was noted to have slightly higher quantities of sand than silt. No gravel was noted in any sample.

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 3 samples)		Maximum Concentration (mg/kg) and Location
	RAL 1	RAL 2	
Copper	1	0	40.9 (Sample 1)
PAH (All Species)	3	N/A	0.226 (Pyrene – Sample 1)
THC	3	N/A	344 (Sample 1)

3.3 Asbestos

No asbestos was identified within any of the samples obtained.

3.4 Historic Sampling Results

Sampling was previously undertaken in 2015 for dredge licensing purposes at Anstruther Harbour comprising of three grab samples. The results of analysis can be summarised as follows:

- 1 of 3 samples exceeded RAL1 for Cadmium;
- 3 of 3 samples exceeded RAL1 for Chromium;
- 2 of 3 samples exceeded RAL1 for Copper;
- 2 of 3 samples exceeded RAL1 for Nickel;
- 3 of 3 samples exceeded RAL1 for Tributyltin (TBT); and
- No samples exceeded RAL2.

Note that no THC results were included in the 2015 data provided.

Dredge averages for 2020 is also available on the Marine Directorate website, which outline the sediment average exceeded RAL1 for THC only. PCB concentrations were recorded below the laboratory limit of detection (LOD). Concentrations from the 2020 results are similar to current average results.

3.5 Chemical Results Summary

All three samples recorded THC and at least one PAH species above RAL1. Sample 1 recorded copper concentrations above RAL1.

No exceedances above RAL1 were recorded for PCBs or TBT in any sample.

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

Compared with the historical data, the current analytical results indicate lower levels of heavy metal contamination and no exceedances of the RAL1 criterion for TBT. THC concentrations were detected in both the current investigation and the 2020 round, with concentrations in the current dataset less than those recorded in 2020. No THC data were available from the 2015 round for comparison. The 2020 dataset retrieved from the Marine Directorate website outlines PCB analysis undertaken, however the high laboratory LOD means comparison against the current results is not possible.

4 DISCUSSION OF AVAILABLE 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, material with a high silt content are not generally considered geotechnically suitable for such projects. 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 mostly consists of silt. Typically, the material used in replenishment projects needs to be of a similar nature i.e. grain size proportions similar to that of the receiving beach. Much of the Forth coastline are designated sites (SSSI, SPA) and hold both national and international importance to nature conservation. Specific beach nourishment projects may 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)	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. WID is being utilised more in Scotland and is likely to be a good option for dredging works at Anstruther Harbour.	Yes

Location	Options	Screening Assessment	Carry forward?
	Aquatic disposal direct to seabed	MD-LOT were consulted in relation to the potentially suitable sea disposal sites for the Anstruther Harbour dredge material. It was advised by a casework officer that MD-LOT were still reviewing with Centre for Environment, Fisheries and Aquaculture Science (CEFAS) the possible closure of their disposal sites around Scotland. Whilst the Anstruther (FO101) disposal site is currently under review, MD-LOT advised that it is still possible to apply to request to use this site in the meantime. The Anstruther (FO101) disposal site, which is the closest to Anstruther Harbour, is located within the Firth of Forth at approx. 3.6 km to the southeast. The location of this sea disposal site is outlined within Drawing No. 784222-GIS002, in Appendix A. The proposed dredge method would be to utilise a backhoe marine dredger 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. Dredged material would be retained within the wider marine system.	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:

- Water Injection Dredging; and
- Sea Disposal.

A brief summary of the necessary works or methodology for the identified 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 method would help facilitate.

4.2.2 Sea Disposal

MD-LOT were consulted on the 7th August 2026 in relation to the potentially suitable sea disposal sites for the Anstruther Harbour dredge material. Whilst the Anstruther (FO101) disposal site is currently under review, MD-LOT advised that it is still possible to apply to request to use this site until such a date that is officially marked as closed. The Anstruther (FO101) disposal site, which is the closest to Anstruther Harbour, is located within the Firth of Forth at approx. 3.6 km to the southeast. The location of this sea disposal site is outlined within Drawing No. 784222-GIS002, in Appendix A.

It is anticipated that dredging could be undertaken using backhoe marine dredger 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. Dredged material would be retained within the wider marine system.

5 FURTHER CONSIDERATION OF REMAINING DISPOSAL OPTIONS

5.1 Detailed BPEO Assessment

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

Table 5-1: BPEO Detailed Assessment Criteria

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

5.1.1 BPEO Strategic Assessment

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

Table 5-2: BPEO Strategic Assessment

Criteria	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 there is no requirement for double-handling, barge transport or disposal-site transfers, significantly reducing operational effort and equipment movements.	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 3.6 km away by sea. This method has successfully been undertaken in the past at Anstruther Harbour.
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	Marine disposal sites nearby have been designed to accommodate the quantities of material typically generated by dredging operations. A

Criteria	Water Injection Dredging	Sea Disposal
	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.	licensed disposal site is available in the vicinity of the Harbour. 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.	Traditionally accepted disposal route for dredged material with limited public impact.
Legislative Implications	Can be licensed through normal licensing process subject to meeting key criteria.	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 option 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-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.	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	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	Low potential for human contact during dredging and disposal operations. Once deposited at disposal site pathways for human contact greatly reduced.

Criteria	Water Injection Dredging	Sea Disposal
	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.	
Pollution/contamination	Pollutant concentrations are limited to acceptable levels through regulatory licensing processes. Information with regards to the type of WID dispersal zone and its effects on sediments has not been provided. WID avoids emissions from transporting dredged material to sea disposal sites, thereby lowering the project's carbon footprint.	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 Directorate 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	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.	Anstruther (FO101) is a licensed disposal site for dredged material. This disposal site is within the Outer Firth of Forth and St Andrews Bay Complex Special Protection Areas (SPA).
Interference with other legitimate activities	WID generates a smaller operational footprint than conventional dredging and disposal campaigns. With no 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.	The Anstruther (FO101) disposal site is licensed by Marine Directorate 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. 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	Some potential for temporary visual / odour / noise effects while marine plant is in the harbour. However, no

Criteria	Water Injection Dredging	Sea Disposal
	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.	significant additional visual/ odour/noise effects following disposal at the proposed site.

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. 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 18,347 tonnes (~10,193 m³)¹ of dredged material has been set.

Table 5-4 below provide a breakdown the cost of sea disposal at each key stage.

Table 5-4: Sea Disposal Cost Breakdown

Activity	Sea Disposal at Identified Site
Dredging	£ 2 – 4 / m ³
Transport by vessel to disposal site	£ 6 – 8 / m ³
Total	£ 8 – 12 / m ³

Table 5-5 provides details on the total Cost assessment for each option taken forward for detailed BPEO assessment. The below sea disposal estimate is based upon cost rates provided above in Table 5-4 against the proposed dredge volume.

Table 5-5: BPEO Cost Analysis (based on 18,347 tonnes)

Activity	Water Injection Dredging	Sea Disposal at Identified Site
Estimated Total Cost	£ 44,100	£ 81,544 – 122,316

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

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) or minimum hire charges.

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 5-6 provides a summary of the BPEO assessment.

Table 5-6: 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 disposal is required.

5.2 Conclusion

The Best Practicable Environmental Option for disposal of the Anstruther Harbour dredged material has been assessed as using the WID method. As a backup option, the Anstruther (FO101) sea disposal at site approx. 3.6 km to the south-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 marine environment. The following section details this assessment.

6 FURTHER ASSESSMENT

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

The approach for this further assessment is outlined as follows:

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

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

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

Probable Effects Level (PEL) – PELs (Marine) have been adopted from the Canadian Environmental Quality Guidelines (http://www.ccme.ca/en/resources/canadian_environmental_quality_guidelines/). If a concentration is recorded above the PEL this is the probable effect range within which adverse effects frequently occur. The Threshold Effect levels (TELs) have 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 Dredge and Disposal Site

The dredge is to be undertaken within Anstruther Harbour, within the area shown on Drawing No. 784222-GIS001, in Appendix A.

6.1.1 Sea Disposal

If sea disposal is pursued, then dredged material could be taken to the Anstruther (FO101) disposal site, approximately 3.6 km southeast of the harbour, should the WID method not be utilised. The Anstruther (FO101) sea disposal site is shown on Drawing No. 784222-GIS002, 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 Anstruther (FO101) disposal site is dispersive.

6.1.2 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 into the open waters of the Firth of Forth as velocities decrease.

6.2 Analytical Data Review

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

6.2.1 Action Level 1

Exceedances of RAL1 can be summarised as follows:

- Copper – 1 of 3 samples recorded copper concentrations above RAL1;
- PAHs – all 3 samples recorded concentrations of one or more PAH species above RAL1; and
- THC – all 3 samples recorded THC concentrations above RAL1.

6.2.2 BAC Review

Exceedances of the BAC can be summarised as follows:

- Copper – 1 of 3 samples recorded copper concentrations above the BAC;
- Mercury – all 3 samples recorded mercury concentrations above the BAC; and
- PAHs – all 3 samples recorded concentrations of one or more PAH species above the BAC.

6.2.3 ERL & PEL Review

Exceedances of the ERL can be summarised as follows:

- Copper – 1 of 3 samples recorded copper concentrations above the ERL;
- Mercury – 1 of 3 samples recorded mercury concentrations above the ERL;
- PAH – 2 of 3 samples recorded PAH (specifically benzo(ghi)perylene) concentrations above the ERL.

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

6.2.4 Action Level 2

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

6.3 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 review of average data against the available adopted assessment criteria can be summarised as follows:

- Averaged concentrations of 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 mercury and several PAH species;
- Averaged concentrations exceeded the ERL for PAH (specifically 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.

6.4 Chemical Assessment Conclusions

The RAL1 for copper was exceeded at Sample 1 only, and all samples recorded exceedances of RAL1 of at least one PAH species and THC. 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 several PAH species and THC. The ERL for PAH (specifically for benzo(ghi)perylene) was also exceeded. Averaged concentrations did not exceed the PEL or RAL2.

6.5 Water Framework Directive Assessment

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

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

Each of these points are considered in Table 6-1 below, in the context of sediment dispersal from WID and/or disposal of dredged material at the Anstruther (FO101) 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	The dredge area, WID dispersal zone, and disposal site are located within the Fife Ness to Elie coastal waterbody (ID: 200054), which is classified as having a “Good” overall status and classification as “High” for hydromorphology (2024)³. The water body incorporates various harbours where dredging activities have been undertaken historically, as well as the deposition of sediment at the licensed disposal site. Given that proposed activities are relatively small, not new and at a similar scale to previous works, there is unlikely to be a change in status of the water body. 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. The classification of the Fife Ness to Elie water body takes into account the presence of the disposal site, so no further assessment is considered to be required.
Biology - habitats	Included to assess potential impacts to sensitive/high value habitats.	Yes	The dredge area, WID dispersal zone and disposal site are noted to have a classification for overall ecology of “Good”³. The Fife Ness to Elie coastal waterbody (covering areas of the proposed dredging and disposal works) has a classification of “Good” for invertebrates and benthic invertebrates (IQI)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
			The WID dispersal zone, and disposal site are located within designated protected areas for their bird populations. Further consideration is given to these below in Section 6.6.2.
Biology – fish	Consideration of fish both within the estuary and also potential effects on migratory fish in transit through the estuary	No	The Fife Ness to Elie coastal waterbody (covering areas of the proposed works) does not have a classification for fish and is located in the wider Forth estuary with no obvious constraints. The small scale of the works proposed are within an active harbour, so activities are ongoing on a daily basis. The works are not located within an estuary. No further assessment is considered necessary.
Water Quality	Consideration must be given to water quality when contaminants are present in exceedance of CEFAS RAL1.	Yes	The Fife Ness to Elie coastal waterbody (covering areas of the proposed dredging works) has a water quality classification status of “Good” and a classification of “Pass” for Specific Pollutants³. All 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 6.6.1 for completeness.
Protected Areas	If your activity is within 2 km of any WFD protected area, include each identified area in your impact assessment. • Special Areas of Conservation (SAC); • Special Protection Areas (SPA);	Yes	The dredge area is not located the Outer Firth of Forth and St Andrews Bay Complex SPA; however, the WID dispersal zone and the sea disposal site are located within this SPA. This SPAs are classified for: breeding & non-breeding birds⁴.

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

Key Receptor ²	Brief Summary of Potential Effects on Receptor	Further Consideration Required?	Comment
	• Shellfish Waters; • Bathing Waters; and • Nutrient Sensitive Areas.		The Anstruther (Billow Ness) designated bathing water is located approx. 400m southwest of the proposed dredge area. There are no shellfish harvesting waters within 2 km of either the dredge area, WID dispersal zone, or sea disposal area. Further discussion with regard to protected areas is given in Section 6.6.2.

6.6 Potential Risk to Receptors

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

6.6.1 Water Quality

The dredge area and WID dispersal zone 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 Pollutants³.

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 within the 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 most PAHs. Averaged concentrations exceeded the BAC for mercury 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 sea 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)
0.00	37.51	62.49

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 has remained 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.

6.6.2 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 this 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. 784222-GIS003 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 SPA⁵ (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 Anstruther 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. 400m southwest of the dredge area, as outlined within the Drawing 784222-GIS003 in Appendix A. The bathing water was most recently classified as “Excellent” for 2025⁶.

⁵ <https://www.nature.scot/sites/default/files/special-protection-area/10478/conservation-and-management-advice.pdf>

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.

The presence of sewage outfalls is unknown. *E. coli* in sediments acts as a long-term reservoir for the bacteria in lakes, rivers, and coastal areas. Sediments trap organic matter and nutrients, allowing *E. coli* to survive for months instead of quickly dying off in the open water column. When sediment is disturbed by waves, currents, or human activity, the bacteria can resuspend into the water and degrade bathing water quality.

Based upon the previous licence conditions, it is assumed that dredging and disposal works will not be authorised by the marine licence during the bathing season (1st June to 15th September) in any case.

7 CONCLUSIONS AND RECOMMENDATIONS

Fife Council appointed EnviroCentre Ltd to complete a Best Practicable Environmental Option (BPEO) assessment to inform proposed maintenance dredging at Anstruther Harbour. The assessment has been informed using sediment quality results from sampling undertaken on 11th June 2026.

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 10,193 m³ is proposed to be dredged across the areas shown in Drawing No. 784222-GIS001 in Appendix A. It is understood that the previous licence (reference: 06784/19/0) has expired and subsequently Fife Council is seeking to renew the licence for maintenance dredging works proposed in autumn of 2026.

Review of available information has highlighted that although some 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 hydro-morphological, 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 disposal is required.

REFERENCES

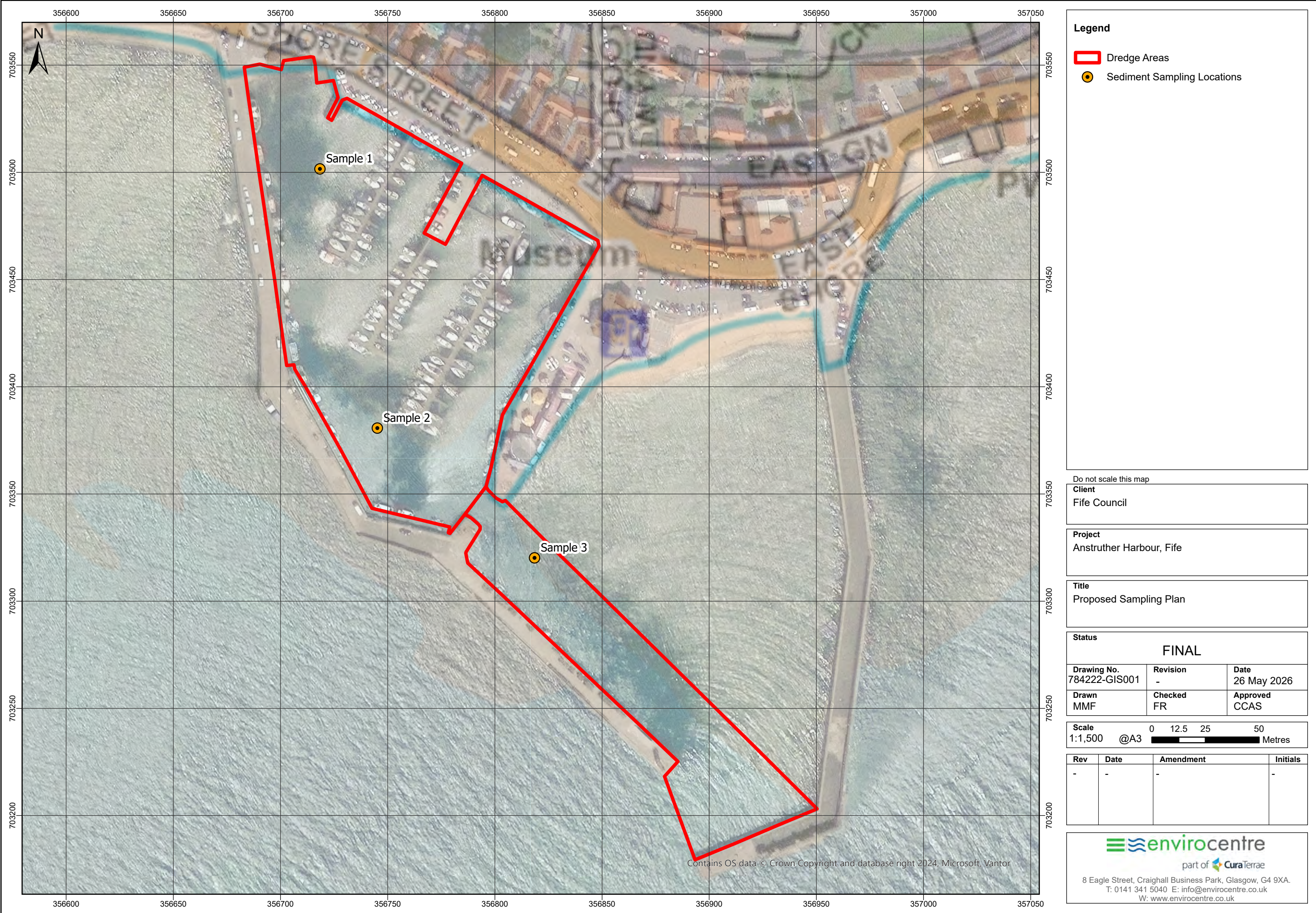
Environment Agency (2017). Water Framework Directive assessment: estuarine and coastal waters.
<https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters>

Marine 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**
- Dredge Areas
 - Sediment Sampling Locations

Do not scale this map

Client
Fife Council

Project
Anstruther Harbour, Fife

Title
Proposed Sampling Plan

Status FINAL		
Drawing No. 784222-GIS001	Revision -	Date 26 May 2026
Drawn MMF	Checked FR	Approved CCAS

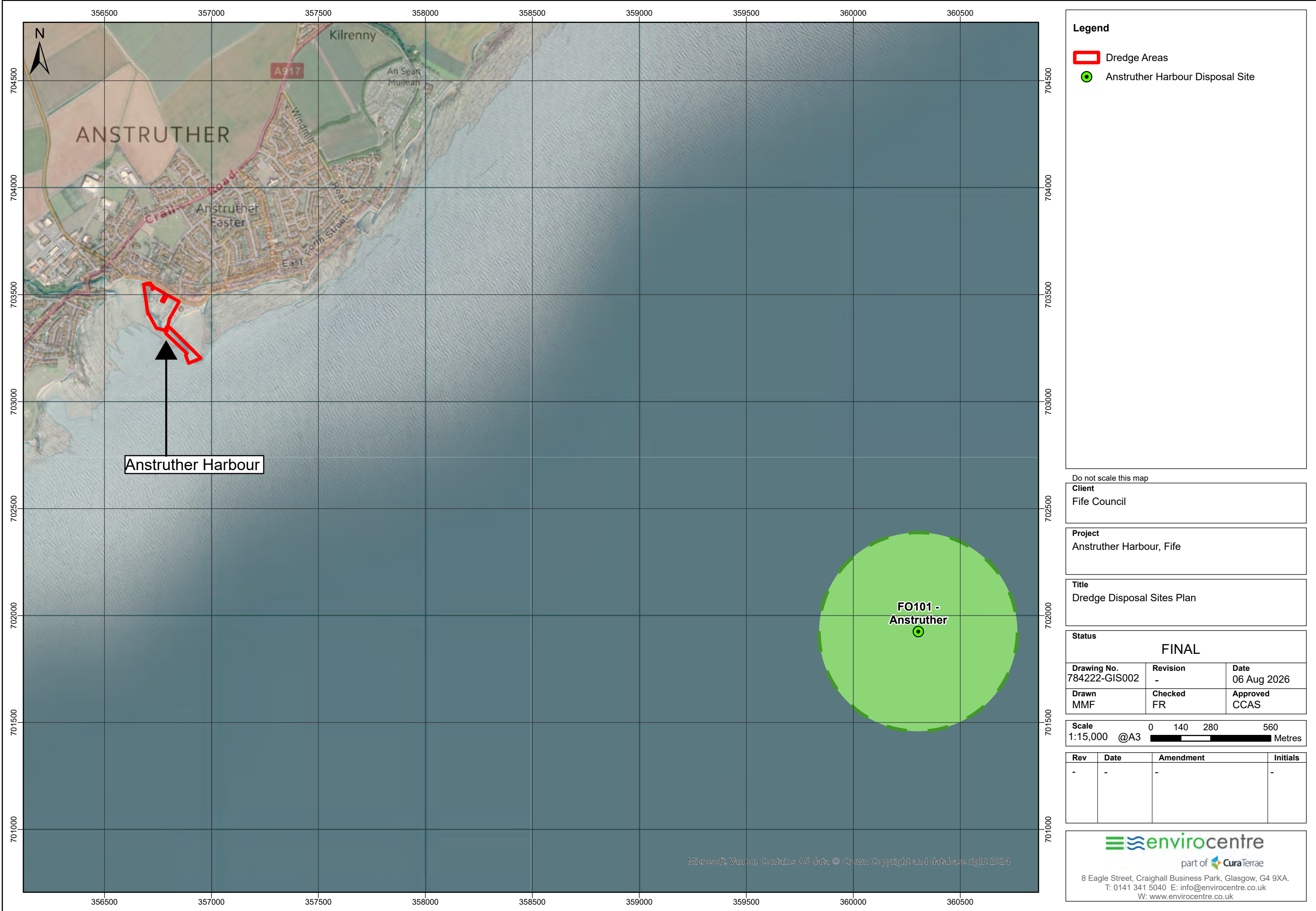
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Rev	Date	Amendment	Initials
-	-	-	-


part of 

8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA.
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Legend

Dredge Areas

Anstruther Harbour Disposal Site

Do not scale this map

Client
Fife Council

Project
Anstruther Harbour, Fife

Title
Dredge Disposal Sites Plan

Status FINAL		
Drawing No. 784222-GIS002	Revision -	Date 06 Aug 2026
Drawn MMF	Checked FR	Approved CCAS

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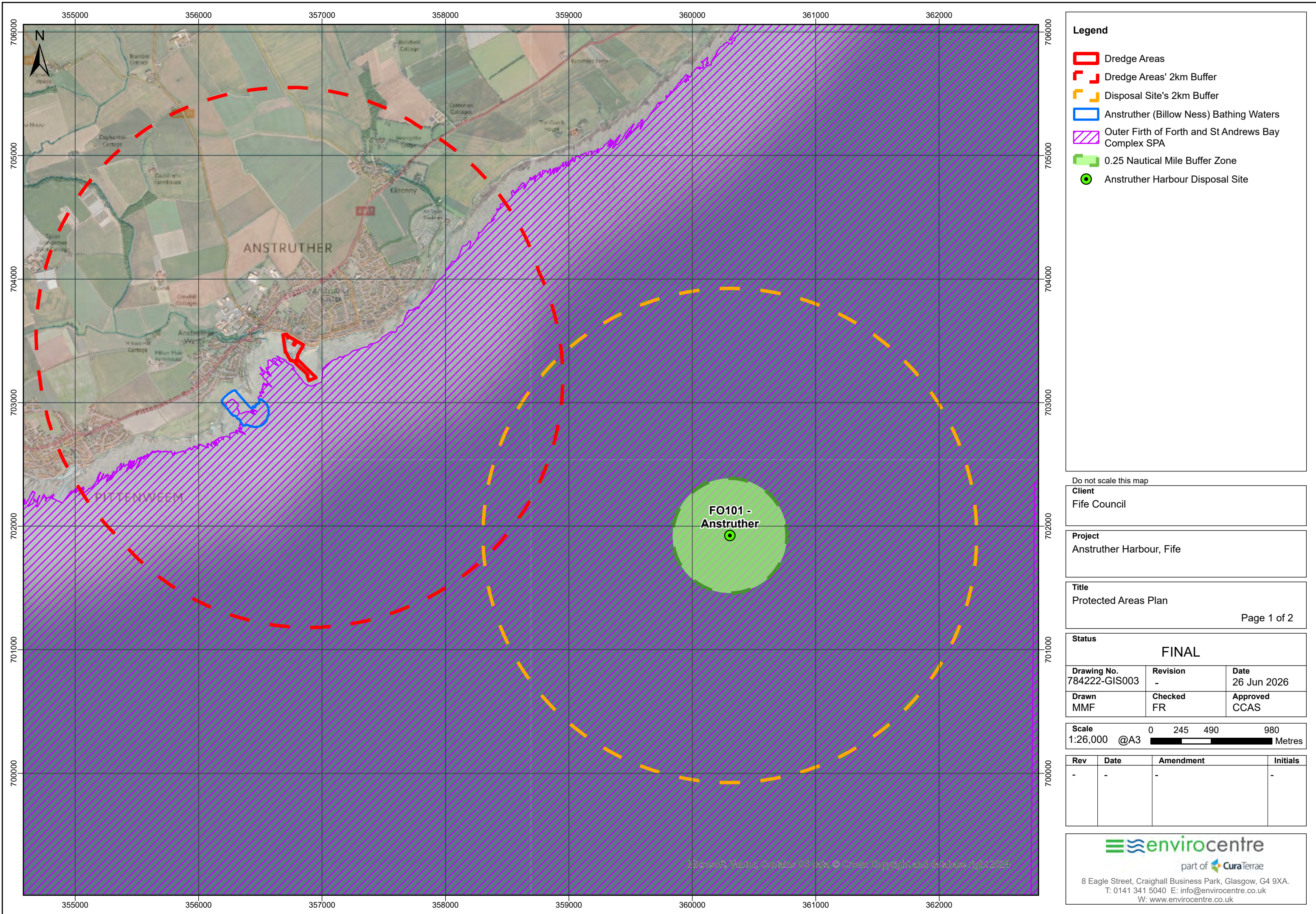
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Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Legend

- Dredge Areas
- Dredge Areas' 2km Buffer
- Disposal Site's 2km Buffer
- Anstruther (Billow Ness) Bathing Waters
- Outer Firth of Forth and St Andrews Bay Complex SPA
- 0.25 Nautical Mile Buffer Zone
- Anstruther Harbour Disposal Site

Do not scale this map

Client
Fife Council

Project
Anstruther Harbour, Fife

Title
Protected Areas Plan

Page 1 of 2

Status		
FINAL		
Drawing No. 784222-GIS003	Revision -	Date 26 Jun 2026
Drawn MMF	Checked FR	Approved CCAS

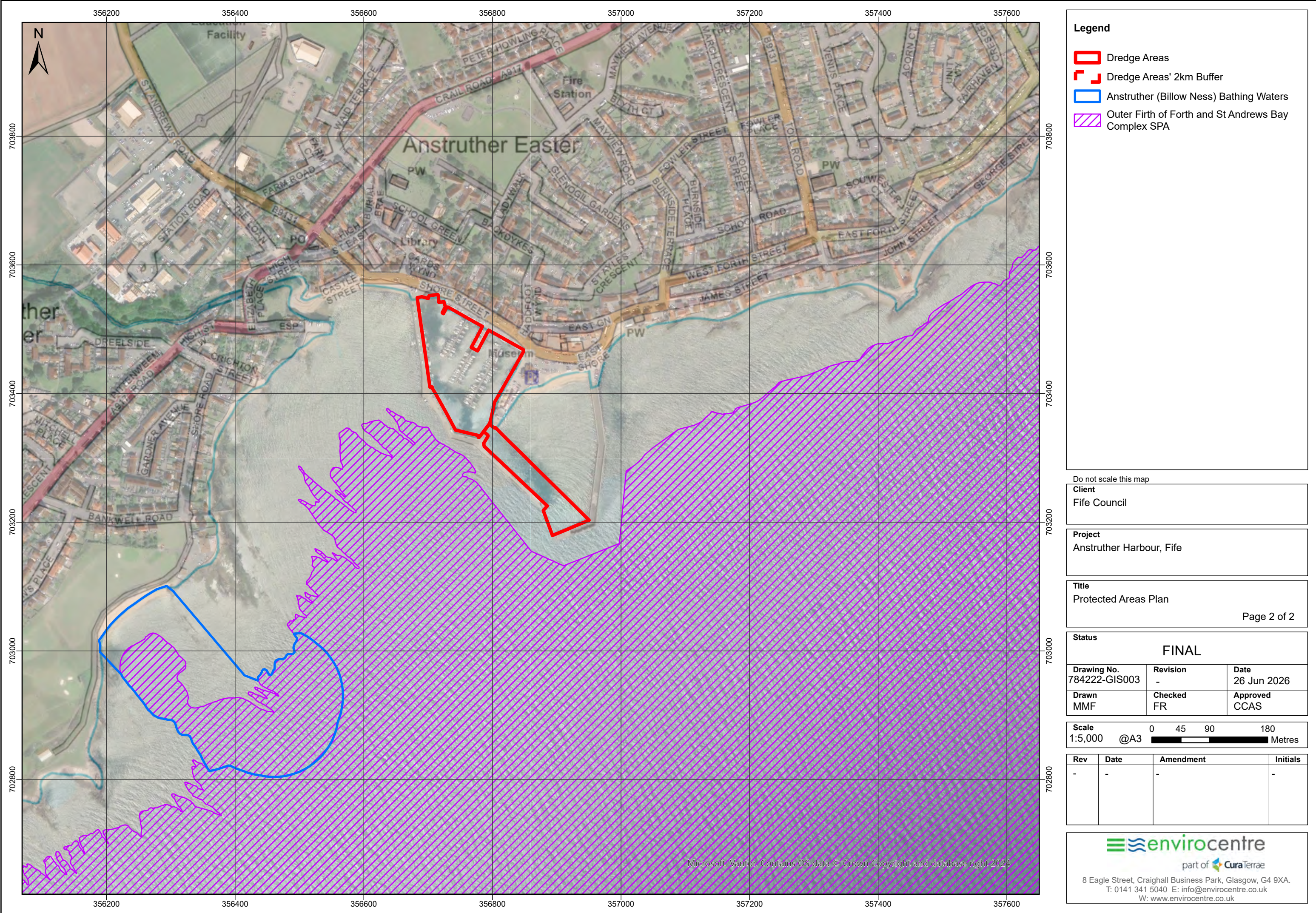
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Rev	Date	Amendment	Initials
-	-	-	-

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Legend

Dredge Areas

Dredge Areas' 2km Buffer

Anstruther (Billow Ness) Bathing Waters

Outer Firth of Forth and St Andrews Bay Complex SPA

Do not scale this map

Client

Fife Council

Project

Anstruther Harbour, Fife

Title

Protected Areas Plan

Page 2 of 2

Status

FINAL

Drawing No.

784222-GIS003

Revision

-

Date

26 Jun 2026

Drawn

MMF

Checked

FR

Approved

CCAS

Scale

1:5,000

@A3

0

45

90

180

Metres

Rev	Date	Amendment	Initials
-	-	-	-

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W: www.envirocentre.co.uk

B SEDIMENT SAMPLE LOGS

Project Name	Anstruther Harbour 2026	Location ID Sample 1
Project No.	784222	
Client	Fife Council	

GRAB SAMPLE LOG

Date/Time	11/06/2026, 09:55	Latitude	56° 13.325530727'
Dredge Area	-	Longitude	-2° 41.973772855'
Method	0.045m² Van Veen Grab Sampler	Sampled/logged by	MMF

Remarks: **0.00 – 0.15m** Very soft dark grey-brown silt containing two pieces of seaweed, a single shell fragment, and several rootlets.

Biota: None noted.

Odours: None noted.

Anthropogenic None noted.

Inputs:

Notes: _____



 part of  CuraTerra 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	Project Name	Anstruther Harbour 2026	Location ID Sample 2
	Project No.	784222	
	Client	Fife Council	

GRAB SAMPLE LOG			
Date/Time	11/06/2026, 10:05	Latitude	56° 13.260515924'
Dredge Area	-	Longitude	-2° 41.946678101'
Method	0.045m ² Van Veen Grab Sampler	Sampled/logged by	MMF

Remarks:
0.00 – 0.15m Very soft brown sandy silt with frequent rootlets. Sand is fine.

Biota:
None noted.

Odours:
None noted.

Anthropogenic Inputs:
None noted.

Notes:
-



 part of  CuraTerra 8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA	Project Name	Anstruther Harbour 2026	Location ID Sample 3
	Project No.	784222	
	Client	Fife Council	

GRAB SAMPLE LOG			
Date/Time	11/06/2026, 10:15	Latitude	56° 13.228289795'
Dredge Area	-	Longitude	-2° 41.875134117'
Method	0.045m ² Van Veen Grab Sampler	Sampled/logged by	MMF

- Remarks:

0.00 – 0.15m Very soft brown sandy silt with lenses of dark grey to black silt. Sand is fine. Contains large fragments of flattened seaweed, frequent rootlets, and abundant fine metallic shiny fragments throughout.
- Biota:

Single live ragworm.
- Odours:

Moderate to strong sulphuric odour.
- Anthropogenic Inputs:

None noted.
- Notes:

-



C SUMMARY TABLES

Summary Table A

Sampling Results Incorporated with BPEO Assessment (mg/kg)

All units in mg/kg						Anstruther Harbour									
Source	AL1	AL2	BAC	ERL	PEL	Sample 1	Sample 2	Sample 3	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	12.2	8.1	7.6	12.2	9.3000	0	0	0	N/A	0
Cadmium	0.4	4	0.31	1.2	4.2	0.17	0.1	0.1	0.17	0.1233	0	0	0	0	0
Chromium	50	370	81	81	160	43.4	23.7	26.9	43.4	31.3333	0	0	0	0	0
Copper	30	300	27	34	108	40.9	20.9	17.9	40.9	26.5667	1	0	1	1	0
Mercury	0.25	1.5	0.07	0.15	0.7	0.17	0.09	0.07	0.17	0.1100	0	0	3	1	0
Nickel	30	150	36	-	-	29.7	17.4	19.2	29.7	22.1000	0	0	0	N/A	N/A
Lead	50	400	38	47	112	37.2	18	17.8	37.2	24.3333	0	0	0	0	0
Zinc	130	600	122	150	271	109	62.4	60.6	109	77.3333	0	0	0	0	0
Napthalene	0.1		0.08	0.16	0.391	0.0706	0.0486	0.0302	0.0706	0.0498	0	N/A	0	0	0
Acenaphthylene	0.1		-	-	0.128	0.019	0.005	0.005	0.019	0.0097	0	N/A	N/A	N/A	0
Acenaphthene	0.1		-	-	0.0889	0.0121	0.0128	0.005	0.0128	0.0100	0	N/A	N/A	N/A	0
Fluorene	0.1		-	-	0.144	0.0365	0.0266	0.0216	0.0365	0.0282	0	N/A	N/A	N/A	0
Phenanthrene	0.1		0.032	0.24	0.544	0.151	0.116	0.0899	0.151	0.1190	2	N/A	3	0	0
Anthracene	0.1		0.05	0.085	0.245	0.0444	0.0333	0.0252	0.0444	0.0343	0	N/A	0	0	0
Fluoranthene	0.1		0.039	0.6	1.494	0.219	0.14	0.114	0.219	0.1577	3	N/A	3	0	0
Pyrene	0.1		0.024	0.665	1.398	0.226	0.159	0.115	0.226	0.1667	3	N/A	3	0	0
Benzo(a)anthracene	0.1		0.016	0.261	0.693	0.108	0.0677	0.058	0.108	0.0779	1	N/A	3	0	0
Chrysene	0.1		0.02	0.384	0.846	0.127	0.0814	0.0706	0.127	0.0930	1	N/A	3	0	0
Benzo(b)fluoranthene	0.1		-	-	-	0.156	0.1	0.0726	0.156	0.1095	2	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	0.1		-	-	-	0.141	0.0951	0.0757	0.141	0.1039	1	N/A	N/A	N/A	N/A
Benzo(a)pyrene	0.1		0.03	0.384	0.763	0.146	0.0883	0.0738	0.146	0.1027	1	N/A	3	0	0
Indeno(1,2,3cd)pyrene	0.1		0.103	0.24	-	0.15	0.0995	0.0726	0.15	0.1074	1	N/A	1	0	N/A
Benzo(ghi)perylene	0.1		0.08	0.085	-	0.164	0.11	0.0737	0.164	0.1159	2	N/A	2	2	N/A
Dibenzo(a,h)anthracene	0.01		-	-	0.135	0.0239	0.0156	0.0111	0.0239	0.0169	3	N/A	N/A	N/A	0
THC	100		-	-	-	344	167	102	344	204.3333	3	N/A	N/A	N/A	N/A
PCBs	0.02	0.18	-	-	0.189	0.00273	0.00116	0.0011	0.00273	0.0017	0	0	N/A	N/A	0
TBT	0.1	0.5	-	-	-	0.02	0.005	0.005	0.02	0.0100	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.ccm.ca/en/index.html#void>

Summary Table B

Anstruther Harbour Average Concentrations

All units in mg/kg

Source	AL1	AL2	BAC CSEMP	<ERL CSEMP	PEL Canada	Dredge Average	Exceed AL1?	Exceed AL2?	Exceed BAC?	Exceed ERL ?	Exceed PEL?
Arsenic	20	70	25	-	41.6	9.3	No	No	No	N/A	No
Cadmium	0.4	4	0.31	1.2	4.2	0.1	No	No	No	No	No
Chromium	50	370	81	81	160	31.3	No	No	No	No	No
Copper	30	300	27	34	108	26.6	No	No	No	No	No
Mercury	0.25	1.5	0.07	0.15	0.7	0.1	No	No	Yes	No	No
Nickel	30	150	36	-	-	22.1	No	No	No	N/A	N/A
Lead	50	400	38	47	112	24.3	No	No	No	No	No
Zinc	130	600	122	150	271	77.3	No	No	No	No	No
Napthalene	0.1	-	0.08	0.16	0.391	0.050	No	N/A	No	No	No
Acenaphthylene	0.1	-	-	-	0.128	0.010	No	N/A	N/A	N/A	No
Acenaphthene	0.1	-	-	-	0.0889	0.010	No	N/A	N/A	N/A	No
Fluorene	0.1	-	-	-	0.144	0.028	No	N/A	N/A	N/A	No
Phenanthrene	0.1	-	0.032	0.24	0.544	0.119	Yes	N/A	Yes	No	No
Anthracene	0.1	-	0.05	0.085	0.245	0.034	No	N/A	No	No	No
Fluoranthene	0.1	-	0.039	0.6	1.494	0.158	Yes	N/A	Yes	No	No
Pyrene	0.1	-	0.024	0.665	1.398	0.167	Yes	N/A	Yes	No	No
Benzo(a)anthracene	0.1	-	0.016	0.261	0.693	0.078	No	N/A	Yes	No	No
Chrysene	0.1	-	0.02	0.384	0.846	0.093	No	N/A	Yes	No	No
Benzo(b)fluoranthene	0.1	-	-	-	-	0.110	Yes	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	0.1	-	-	-	-	0.104	Yes	N/A	N/A	N/A	N/A
Benzo(a)pyrene	0.1	-	0.03	0.384	0.763	0.103	Yes	N/A	Yes	No	No
Indeno(1,2,3cd)pyrene	0.1	-	0.103	0.24	-	0.107	Yes	N/A	Yes	No	N/A
Benzo(ghi)perylene	0.1	-	0.08	0.085	-	0.116	Yes	N/A	Yes	Yes	N/A
Dibenzo(a,h)anthracene	0.01	-	-	-	0.135	0.017	Yes	N/A	N/A	N/A	No
THC	100	-	-	-	-	204.3	Yes	N/A	N/A	N/A	N/A
PCBs	0.02	0.18	-	-	0.189	0.002	No	No	N/A	N/A	No
TBT	0.1	0.5	-	-	-	0.010	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 MAR03108

Issue Version: 1

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

Customer Reference: 784222 - Anstruther Grab Sampling

Date Sampled: 11-Jun-26

Date Samples Received: 16-Jun-26

Test Report Date: 06-Aug-26

Condition of samples: Cold 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



MAR03108

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Test Report ID MAR03108
 Issue Version 1
 Customer Reference 784222 - Anstruther Grab Sampling

		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
Sample 1 (0.0-0.15m)	MAR03108.001	Sediment	57.4	42.6	0.00	2.05	97.95	NAIIS
Sample 2 (0.0-0.15m)	MAR03108.002	Sediment	56.5	43.5	0.00	54.88	45.12	NAIIS
Sample 3 (0.0-0.15m)	MAR03108.003	Sediment	49.2	50.8	0.00	55.61	44.39	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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Test Report ID MAR03108
Issue Version 1
Customer Reference 784222 - Anstruther Grab Sampling

		Units	% M/M
		Method No	WSLM59*
		Limit of Detection	0.02
		Accreditation	UKAS
Client Reference:	SOCOTEC Ref:	Matrix	TOC
Sample 1 (0.0-0.15m)	MAR03108.001	Sediment	2.91
Sample 2 (0.0-0.15m)	MAR03108.002	Sediment	1.75
Sample 3 (0.0-0.15m)	MAR03108.003	Sediment	2.11
Reference Material (% Recovery)			103
QC Blank			<0.02

* See Report Notes

NAIIS - No Asbestos Identified In Sample

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Test Report ID MAR03108
 Issue Version 1
 Customer Reference 784222 - Anstruther Grab Sampling

		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
Sample 1 (0.0-0.15m)	MAR03108.001	Sediment	12.2	0.17	43.4	40.9	0.17	29.7	37.2	109
Sample 2 (0.0-0.15m)	MAR03108.002	Sediment	8.1	0.10	23.7	20.9	0.09	17.4	18.0	62.4
Sample 3 (0.0-0.15m)	MAR03108.003	Sediment	7.6	0.10	26.9	17.9	0.07	19.2	17.8	60.6
Certified Reference Material SETOC 768 (% Recovery)			103	97	105	100	92	105	88	97
QC Blank			<0.5	<0.04	<0.5	<0.5	<0.01	<0.5	<0.5	<2

* See Report Notes

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Test Report ID MAR03108
 Issue Version 1
 Customer Reference 784222 - Anstruther Grab Sampling

		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)
Sample 1 (0.0-0.15m)	MAR03108.001	Sediment	<5	20.0
Sample 2 (0.0-0.15m)	MAR03108.002	Sediment	<5	<5
Sample 3 (0.0-0.15m)	MAR03108.003	Sediment	<5	<5
Certified Reference Material BCR-646 (% Recovery)			66	83
QC Blank			<1	<1

* See Report Notes

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Test Report ID MAR03108
 Issue Version 1
 Customer Reference 784222 - Anstruther Grab Sampling

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	SOCOTEC Ref:	Matrix	ACENAPTH	ACENAPHY	ANTHRACN	BAA	BAP	BBF
Sample 1 (0.0-0.15m)	MAR03108.001	Sediment	12.1	19.0	44.4	108	146	156
Sample 2 (0.0-0.15m)	MAR03108.002	Sediment	12.8	<5	33.3	67.7	88.3	100
Sample 3 (0.0-0.15m)	MAR03108.003	Sediment	<5	<5	25.2	58.0	73.8	72.6
Certified Reference Material Quasimeme SED42 (% Recovery)			38	94	87	75	87	78
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 MAR03108
Issue Version 1
Customer Reference 784222 - Anstruther Grab Sampling

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	SOCOTEC Ref:	Matrix	BENZGHIP	BKF*	CHRYSENE *	DBENZAH	FLUORANT	FLUORENE
Sample 1 (0.0-0.15m)	MAR03108.001	Sediment	164	141	127	23.9	219	36.5
Sample 2 (0.0-0.15m)	MAR03108.002	Sediment	110	95.1	81.4	15.6	140	26.6
Sample 3 (0.0-0.15m)	MAR03108.003	Sediment	73.7	75.7	70.6	11.1	114	21.6
Certified Reference Material Quasimeme SED42 (% Recovery)			97	85	91	110	84	60
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 MAR03108
 Issue Version 1
 Customer Reference 784222 - Anstruther Grab Sampling

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/306
		Limit of Detection	1	1	1	1	100
		Accreditation	UKAS	UKAS	UKAS	UKAS	N
Client Reference:	SOCOTEC Ref:	Matrix	INDPYR	NAPTH	PHENANT	PYRENE	THC
Sample 1 (0.0-0.15m)	MAR03108.001	Sediment	150	70.6	151	226	344000
Sample 2 (0.0-0.15m)	MAR03108.002	Sediment	100	48.6	116	159	167000
Sample 3 (0.0-0.15m)	MAR03108.003	Sediment	72.6	30.2	89.9	115	102000
Certified Reference Material Quasimeme SED42 (% Recovery)			111	93	71	89	79~
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 MAR03108
 Issue Version 1
 Customer Reference 784222 - Anstruther Grab Sampling

		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
Sample 1 (0.0-0.15m)	MAR03108.001	Sediment	0.32	0.28	0.45	0.53	0.43	0.54	0.18
Sample 2 (0.0-0.15m)	MAR03108.002	Sediment	0.13	0.11	0.13	0.19	0.22	0.29	0.09
Sample 3 (0.0-0.15m)	MAR03108.003	Sediment	0.16	0.11	0.13	0.18	0.20	0.24	0.08
Certified Reference Material Quasimeme SED28 (% Recovery)			70	97	92	106	82	87	76
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 MAR03108
Issue Version 1
Customer Reference 784222 - Anstruther Grab Sampling

REPORT NOTES

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
WSLM59*	MAR03108.001-003	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
ICPMSS*	MAR03108.001-003	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
SUB_01*	MAR03108.001-003	Analysis was conducted by an approved subcontracted laboratory.
ASC/SOP/301	MAR03108.001-003	The matrix of this sample has been found to interfere with the result for this test. The sample has therefore been diluted, but in doing so, the detection limit for this test has been elevated.
ASC/SOP/303/304	MAR03108.002-003	The matrix of this sample has been found to interfere with the result for this test. The sample has therefore been diluted, but in doing so, the detection limit for this test has been elevated.
ASC/SOP/303/304	MAR03108.001-003	Benzo[k]fluoranthene is known to coelute with Benzo[j]fluoranthene and these peaks can not be resolved. It is believed Benzo[j]fluoranthene is present in these samples therefore it is suggested that the Benzo[k]fluoranthene results should be taken as a Benzo[k]fluoranthene (inc. Benzo[j]fluoranthene). Benzo[j]fluoranthene is not UKAS accredited. This should be taken into consideration when utilising the data.
ASC/SOP/303/304	MAR03108.001-003	Chrysene is known to coelute with Triphenylene and these peaks can not be resolved. Triphenylene may be 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

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Test Report ID MAR03108
 Issue Version 1
 Customer Reference 784222 - Anstruther Grab Sampling

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 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-FID 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	DBENZAH	Dibenzo[ah]anthracene	GHCH	gamma-Hexachlorocyclohexane
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		

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