

Kilkeel Inner Harbour Best Practicable Environmental Option (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

1.1 Background

Doran Consulting, acting on behalf of the Northern Ireland Fishery Harbour Authority (NIFHA), have appointed EnviroCentre Ltd. to complete a Best Practicable Environmental Option (BPEO) assessment for proposed dredging and disposal works at Kilkeel Harbour on the south coast of County Down. The BPEO will form part of the Marine Licence application to DAERA to permit dredging works. This assessment has been informed using sediment quality results from sampling undertaken in December 2025.

This assessment has been undertaken in line with the *Northern Ireland Guidance on Marine Licensing: Dredging, Disposal and Aggregate Dredging, under Part 4 of the Marine and Coastal Access Act 2009* (DAERA, May 2016).

The maximum volume of material to be dredged at Kilkeel Harbour is 24,999 wet tonnes, over a three-year period. NIFHA owns and operates its own dredger (MS Kilmourne), which works continuously to maintain the depth within the harbour, and at the harbour entrance by removing a relatively small amount of material each day. The dredge depth at any one time is generally between 0.5m and 1.0m, maintaining the harbour to a level no greater than 1.06m below chart datum (bCD). The proposed dredge area is shown on Doran Consulting Drawing No. 251043-DCL-SI-ZZ-D-C-0001, included in the GES Factual Report in Appendix A.

The purpose of the sediment sample analysis is to provide supporting information to the Marine and Fisheries Division of the Department of Agriculture, Environment and Rural Affairs (DAERA) during the licensing process on sediment quality within the proposed dredge area to assess the suitability for sea-based disposal, should that be identified as a viable option. The dredging and disposal activities are regulated by DAERA under the Marine and Coastal Access Act 2009 (MCAA) Part 4. The licensing conditions require representative samples to be collected and the nature (i.e. physical composition), quality and contamination status to be determined.

The results of the 2025 sediment analysis will then be used to determine whether or not sea disposal is acceptable and whether there any suitable alternatives to disposal can be established (i.e. beneficial re-use).

Part of this report has been informed using a previous report prepared by Tetra Tech (Kilkeel Harbour – Marine Dredging Re-Use Feasibility), dated April 2023. This document was provided to EnviroCentre by Doran Consulting. No reliance has been sought from Tetra Tech by EnviroCentre for this report.

This report takes account of comments received from the DAERA coastal geomorphology team regarding the proposed dredged at Kilkeel Outer Harbour, including a Microsoft Teams call held on 16th December 2025 with representatives from Doran Consulting, EnviroCentre, NIFHA and the DAERA coastal geomorphology team.

1.2 Scope of Report

The following report summarises the results of laboratory analysis and provides a summary of the sediment quality present within the proposed dredge areas.

The report will then use the available sediment analysis results to compare the best practicable environmental options (BPEO) for each of the available potential disposal options for the dredged materials. The options which are not considered to be practicable are rejected and the reasons for doing so are explained.

Those options which are practicable are examined in detail and assessed against the following considerations:

- Environmental;
- Strategic; and
- Cost.

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

1.3 Action Levels – AL1 vs AL2

Two action levels are currently used to assess the suitability of sea-based disposal of dredged sediment material in Northern Ireland: Existing Action Level 1 (EAL1) and Existing Action Level 2 (EAL2).

Sediment with contaminant concentrations below EAL1 is generally considered not to have contaminant levels of concern and unlikely to affect the licensing decision.

For samples with concentrations between EAL1 and EAL2, additional consideration and possibly further sampling and testing will be required before a licensing decision is made.

Material with concentrations above EAL2 is generally considered to be unsuitable for disposal to sea, with sediment from the specific area most likely to be subject to an alternative disposal route (e.g. landfill).

1.4 Report Usage

The information and recommendations contained within this report have been prepared in the specific context stated above and should not be utilised in any other context without prior written permission from EnviroCentre Limited.

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2 SAMPLING LOCATIONS AND METHODOLOGY

2.1 Sample Locations & Collection

Sediment sampling was undertaken in December 2025 by Geotechnical Environmental Services Ltd (GES). Five sample stations were progressed within the proposed dredge area within the inner harbour at Kilkeel (P01 to P05). All five sample stations were progressed using a Geoprobe Macro Core sampler to a maximum depth of 0.5m. Each core was supplemented by a surface sediment sample collected using a Van-Veen grab sampler. A total of ten sediment samples were submitted for analysis.

Factual information, including methodology and sediment logs are given in Geotechnical Environmental Services report no. 25184NI, included in Appendix A.

2.2 Analysis Requirements

The laboratory analysis undertaken to inform the marine licence application was as follows:

- Moisture Content;
- Particle Size Analysis (PSA);
- Total Organic Carbon (TOC)
- Metals - Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc;
- Organotins – Tributyltin and Dibutyltin (TBT/DBT);
- Polycyclic Aromatic Hydrocarbons (PAH USEPA 16);
- Total Hydrocarbons (THC) and
- Polychlorinated Biphenyls (PCBs) (ICES 7 congeners).

Samples were dispatched to Socotec's Marine Laboratory for analysis.

3 CHEMICAL ANALYSIS RESULTS

Results of the December 2025 sediment analysis are summarised in the following section.

3.1 Chemical Analysis Assessment Criteria

All chemical analytical results were assessed against Existing Action Levels (EAL) criteria as adopted by the DAERA Marine & Fisheries Division.

3.2 Physical Analysis

3.2.1 Particle Size Analysis (PSA)

Sediment at sample stations P01 to P04 predominantly comprised silt-sized particles (<63 µm), with the proportion of silt generally ranging between 66% and 73%, the proportion of sand generally ranging between 24% and 32% and negligible quantities of gravel. Sample stations P04 and P05 contained a higher proportion of sand-sized particles (63 – 2,000 µm) – generally between 55% and 85%, with most of the remainder comprising silt sized particles. The proportion of sand was greatest at P05 which is located in the outer reaches of the dredge area.

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

3.3 Chemical Analysis Results

A summary of chemical analysis, screened against the EALs, is given Table 3-1.

Laboratory certificates are included in the GES Factual Report in Appendix A.

Table 3-1: Exceedances of Existing Action Levels

Contaminant	No. of Exceedances (of 10 samples)	
	EAL 1	EAL 2
Arsenic	0	0
Cadmium	1	0
Chromium	8	0
Copper	2	0
Mercury	0	0
Nickel	8	0
Lead	0	0
Zinc	2	0
TBT/DBT	1	0
PCBs	0	0
THC	8	0

Several exceedances of EAL1 were recorded for various metals and for total hydrocarbons. One marginal exceedance of EAL1 was recorded for TBT. All concentrations were recorded below EAL2, where a value is available for comparison.

Results, provided in the DAERA Excel template accompany the marine licence application. Note that a formatting error means that some results are incorrectly highlighted as exceedances of EAL2.

4 DISCUSSION OF AVAILABLE DISPOSAL OPTIONS

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

The key stages of a BPEO are:

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

Further details on methodology are provided within each section.

4.1 Identification and Screening of Available Disposal Options

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

Table 4-1: Initial Best Practicable Available Options

Location	Options	Screening Assessment	Carry forward?
Coastline	Leave in situ	Not an option due to the requirements to maintain depth to allow vessels to access the 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 (24,999 tonnes over three years), it is most likely that this would not be a sufficient amount of material to complete any infilling project and would provide only part of the total amount of sediment that would be required, particularly given that only a small quantity of material would be dredged at any one time. Further geotechnical and chemical testing would likely be required before it is permitted for use on any such development. Moreover, previous consultation with DAERA Marine and Fisheries Division notes material should be retained “same sediment cell, to ensure the avoidance of disruption to coastal processes” [...] and not used for land-based purposes” (Tetra Tech, 2023).	No

Beach Nourishment/ Coastal Recharge	Beaches are present between Ballymartin and Kilkeel, which have been described as being at “high risk of erosion” (Tetra Tech, 2023). This area could in theory be used as a receiving site for the dredged material. According to sediment sample logs, the material to be dredged from the outer reaches of the dredge area predominantly comprises sand, which may be considered suitable for beach nourishment. However, sediment across most of the dredge area comprises predominantly silt sized particles which are unlikely to be suitable for beach nourishment in the traditional sense. Re-use of sediment in this way is considered preferable in the context of the waste hierarchy (Re-use > Recycle > Other Recovery > Disposal (last resort)). However, a beach nourishment project will likely require to be supported by additional 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 quality of the material and measures devised from the assessment outcomes to minimise impacts on the environment. Further assessment is also likely to be required to determine if the material is physically compatible. This would ultimately be determined by DAERA. While the scope of any studies required to facilitate this option have not been discussed in any specific detail at this stage, it is recognised that a longer term plan needs to be established to help make best use of dredged material within the local sediment transport cells to help maintain coastal resilience. Further exploration of placement of material will be required to ensure that material is going where it needs to, but there may be merit in placing material locally, updrift of the harbour to enable the material to continue its natural progression along the coast as an alternative/second option in this category. Alternatively, where material is known to be required i.e. areas of localised erosion within the same cell, then there may be an option to place locally to those areas following further study and consultation. Overall, this will require a collaborative approach between the harbour operator and regulators to facilitate it.	Yes
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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. Landfilling is typically regarded as a last resort and given that there are no contaminant concentrations in excess of EAL2, it is likely that other options would be preferable. Moreover, previous consultation with DAERA Marine and Fisheries Division notes material should be retained “same sediment cell, to ensure the avoidance of disruption to coastal processes” [...] and not used for land-based purposes” (Tetra Tech, 2023).	No
	Land Incineration	The dredged material consists of non-combustible material with a low combustible component. Previous consultation with DAERA Marine and Fisheries Division notes material should be retained “same sediment cell, to ensure the avoidance of disruption to coastal processes” [...] and not used for land-based purposes” (Tetra Tech, 2023).	No
	Application to Agricultural Land	The dredged material would need to be treated to reduce salt concentrations to acceptable levels. Would require detailed chemical analysis and assessment and may require a Waste Management authorisation from the Northern Ireland Environment Agency (NIEA). 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. Moreover, previous consultation with DAERA Marine and Fisheries Division notes material should be retained “same sediment cell, to ensure the avoidance of disruption to coastal processes” [...] and not used for land-based purposes” (Tetra Tech, 2023).	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. However, EnviroCentre have not been made aware by the harbour authority of an established disposal and reuse route in County Down at present. In addition, given the relatively small volume of sediment, and the logistics involved, this unlikely to be a cost-effective option compared to the costs associated with establishing a processing plant. Moreover, previous consultation with DAERA Marine and Fisheries Division notes material should be retained “same sediment cell, to ensure the avoidance of disruption to coastal processes” [...] and not used for land-based purposes” (Tetra Tech, 2023).	No
Sea	Aquatic disposal direct to seabed.	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. The results of the chemical analysis suggest that the sediment may be suitable for sea disposal, pending further assessment, as concentrations were either below EAL1 or between EAL1 and EAL2. A receiving disposal site would be identified by DAERA but it is understood that previous licences have permitted disposal at a site 3 miles from the harbour within a 0.5 nautical mile radius of 54° 01.5'N, -05° 55.5'W (Tetra Tech, 2023). All works are undertaken on marine-based plant and may be seen as preferable from a strategic/practical point of view. Disposal of material at sea ensures that sediment is retained within the marine environment and will subsequently be naturally dispersed. It is understood the DAERA have expressed a desire that dredged material is retained within the same sediment cell as the dredge site. The Northern Ireland Coastal Observatory Map Viewer contains details of the First Order Coastal Sediment Cells. The sediment cell in the vicinity of Kilkeel runs from Carlingford Lough to Bloody Bridge, south of Newcastle. The proposed disposal site appears to lie just beyond the coastal sediment cell boundary. Ultimately however, disposal of dredged material at sea ensures that it remains available within the wider sediment system as opposed to being ‘locked up’ on a land-based solution.	Yes

4.2 Summary of Identified BPEO Options

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

- Beach Nourishment; and
- Sea Disposal.

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

4.2.1 Beach Nourishment/Coastal Recharge

Beach nourishment, if progressed in the traditional sense, using the dredging plant currently available to NIFHA, would likely involve the following material handling stages:

- Dredging;
- Temporary stockpiling of material on land;
- Transfer of sediment on to wagon/dumper;
- Placement of sediment on beach; and
- Distribution/profiling of sediment by excavator.

If beach nourishment is to be undertaken in this manner, then it is assumed that dredging would be undertaken using a grab dredger (MS Kilmourne) as per previous campaigns. This vessel is owned and operated by the NIFHA. Rather than the material being emptied through the bottom-door discharge, it is likely that the grab would then be used to transfer the material on to the harbour quayside. The material will then be temporarily stockpiled before being transferred into a suitable wagon for transport to the identified receiving beach site before it is then suitably distributed and profiled. Only a relatively small proportion of the material to be dredged is likely to be suitable for use in a beach nourishment in this manner (i.e. sediments belonging to the outer reaches of the dredge area only), owing to the mixed lithology and higher proportion of silt across most of the dredge area.

Other methods such as direct pumping by pipeline or 'rainbowing' could also be utilised to minimise double handling of material, but it is unclear whether the dredger has capability to undertake this.

A specific receiving beach has not been identified at this stage, but a suitable site could be identified in consultation with DAERA and Newry, Mourne and Down District Council (NMDDC) should it be concluded as a viable option.

An alternative option to the traditional beach placement (as outlined above) which could also be explored, would be to place the material at a strategic location whereby the material is redistributed using natural sediment transport processes close to an area of need (erosion). Alternatively, it could be placed in proximity to the source of material to help combat the effects of sediment transport interruption from the presence of breakwaters at harbours etc. whereby the structure disrupts the natural movement of material and causes an impact up drift. This approach is more likely to be preferable to a 'traditional' beach nourishment, owing to the mixed lithology within the proposed dredge area, but again would require further discussion and assessment.

4.2.2 Sea Disposal

It is assumed that dredging would be undertaken using a bottom-emptying grab dredger (MS Kilmourne) as per previous campaigns. This vessel is owned and operated by the NIFHA. The dredger would store the material on board before travelling to the designated disposal site.

Sea disposal is the traditionally accepted sediment disposal method where no other viable options exist and generally has a low cost and low environmental impact. Disposal to sea directly from the dredging vessel also means that there would be no double handling of material.

It is noted that DAERA have previously noted that *“material should be retained within the “same sediment cell, to ensure the avoidance of disruption to coastal processes”* (Tetra Tech, 2023). Information from the Northern Ireland Coastal Observatory suggests that the previous disposal site lies just beyond the boundary of the first order coastal cell around Kilkeel. Ultimately however, disposal of dredged material at sea ensures that it remains available within the wider sediment system as a whole, when compared against potential options involving land disposal or re-use.

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 <i>e.g.</i> fishing • Amenity/Aesthetic Implications
Costs	• Operating costs <i>e.g.</i> labour, site operations, environmental monitoring • Capital <i>e.g.</i> Transport, equipment hire

5.1.1 BPEO Strategic Assessment

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

Table 5-2: BPEO Strategic Assessment

Criteria	Beach Nourishment/Coastal Recharge	Sea Disposal
Operational Aspects (inc. handling and transport)	This method may involve road transport by HGV or dumper truck to an (as yet) undetermined receiving beach location, as the MS Kilmourne is unsuitable for direct discharge to the receiving beach, however, may be suitable for deposit to nearshore areas of need for coastal recharge. There may be a need for additional environmental assessments would put pressure on the project timescales if they are required. Given the mixed lithology present in the dredge area, this strategy may not be able to accommodate all of the dredge arisings.	There would be no double handling of the dredged material. Transportation to the disposal site would likely be by bottom-emptying dredger. If a new disposal site is to be established, then there will be a need for additional environmental assessments which would put pressure on the project timescales.
Availability of suitable sites/facilities	The coastline in the vicinity of Kilkeel has previously been noted as being at “high risk” of erosion and beach deposits are present nearby. We understand that a specific receiving beach site/location has not yet been identified, but it is considered likely that a suitable site could be identified in consultation with DAERA and NMDDC should this be concluded as a viable option. The chemical analysis of the sediments from the proposed dredge site would indicate that the material may be acceptable for disposal via this route, pending further assessment.	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 site would indicate that the material may be acceptable for disposal via this route, pending further assessment.

Criteria	Beach Nourishment/Coastal Recharge	Sea Disposal
General Public /Local acceptability	Any beach nourishment project is likely to be generally welcomed by the public, as it will be seen as a way of bolstering and protecting the receiving beach from erosion, which is being exacerbated by climate change. However, the vehicle movements required may not be looked upon favourably. Given that a relatively small amount of material will be dredged at any one time, material would be 'drip fed' to any beach nourishment site, meaning that plant and vehicle movements would likely need to occur relatively often. Alternatively, the material could be placed close to shore for natural distribution which would remove the requirement for access on the beach by machinery. In this instance, given the missed lithology, this would likely be the preferred option over a 'traditional' beach nourishment.	Traditionally accepted disposal route for dredged material with limited public impact.
Legislative Implications	This re-use route would require prior agreement with the Marine & Fisheries Division of DAERA. Will also require agreement of all other key stakeholders including the landowner and the relevant department of NMDDC. However, DAERA have a desire to make coastlines more resilient in the context of a changing climate, and beach nourishment/coastal recharge will be looked upon favourably in this context.	This is an accepted disposal route as long as a Marine Licence is obtained.

5.1.2 BPEO Environmental Assessment

Table 5-3 details the environmental assessment for each option taken forward for detailed BPEO assessment.

Table 5-3: BPEO Environmental Assessment

Criteria	Beach Nourishment/Coastal Recharge	Sea Disposal
Safety Implications	Assuming a beach nourishment is undertaken in the 'traditional' sense by placement of sand on a receiving beach, vehicle movements between the harbour and beach nourishment/placement site increase potential for accidents to occur. It is assumed that the working area will be closed to the public during works. Work would be undertaken in accordance with H&S legislation.	Low amount of material handling required as it is directly placed at the disposal site with no land-based works required. Work would be undertaken in accordance with H&S legislation.
Public Health	Assuming a beach nourishment is undertaken in the 'traditional' sense by placement of sand on a receiving beach, there would be limited potential for human contact assuming that the public are excluded from the active work area. Some potential for dust release during beach profiling works (only if the sediment dries out). Contaminant concentrations are noted be between EAL1 and EAL2.	Low potential for human contact during dredging and disposal operations. Once deposited at disposal site pathways for human contact greatly reduced.
Pollution/contamination	Assuming a beach nourishment is undertaken in the 'traditional' sense by placement of sand on a receiving beach, vehicles transporting material to the beach site would have implication on carbon footprint and potential for local impact on air quality. Contaminant levels would be limited to low levels through the licensing process i.e. same screening criteria for sea deposit. Potential also for temporary noise impacts and dust release during profiling works (if sediment dries out).	Pollutant concentrations in dredged material to be disposed are limited to acceptable levels through regulatory licensing processes. Transport by sea to disposal site would likely increase the project carbon footprint. However, there is an opportunity for the carbon footprint to be reduced if a new disposal site is established closer to the dredge site.

Criteria	Beach Nourishment/Coastal Recharge	Sea Disposal
General Ecological Implications	Assuming a beach nourishment is undertaken in the 'traditional' sense by placement of sand on a receiving beach, significant ecological implications are unlikely as a result of deposition of additional sand on the beach. According to the NIEA Natural Environment Web Viewer, there are no designated ecological protected areas below MHWS in the vicinity of the dredge site or nearby beaches. It is noted that the general vicinity is part of the Causeway Coast Area of Outstanding Natural Beauty, which is unlikely to be negatively impacted by the placement of additional sand on the beach.	Only a licensed disposal site would be used for dredged material, as advised by DAERA. Any new disposal site would require to be supported by additional environmental assessments.
Interference with other legitimate activities	Assuming a beach nourishment is undertaken in the 'traditional' sense by placement of sand on a receiving beach, there is potential for some disruption at Kilkeel Harbour if sediment is required to be off-loaded from the dredger on to land. There is potential for disruption to recreational beach users and other interests in the vicinity of the receiving beach as plant movements and grading works would likely occur relatively often due to a relatively small amount of material being dredged at any one time, with material would being 'drip fed' to any beach nourishment site. Recreational beach users would require to be excluded from the beach while works are undertaken. Deposit of this material below MHWS in proximity to an area of need would reduce the amount of terrestrial disruption but would need to be carefully considered to minimise subtidal effects.	Sediment would be disposed at a licenced disposal site, as advised by DAERA. 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. Potential interference with other activities is something that will require consideration if a new sea disposal site is to be established.

Criteria	Beach Nourishment/Coastal Recharge	Sea Disposal
Amenity / Aesthetic Implications	If sediment is required to be off-loaded to the harbour quayside, there are likely to be impacts associated with increased heavy plant and stockpiling of material for onward transport to the receiving beach. Temporary visual impacts during sediment placement and beach profiling works but no long-term impacts. Some potential for odour emissions and noise impact although these impacts will be short term. Amenity of the receiving beach likely to be improved once beach nourishment project is completed.	Some potential for temporary visual / odour / noise effects while marine plant is in the harbour. However, no significant additional visual/ odour/noise effects following disposal as this occurs at sea.

5.1.3 BPEO Cost Assessment

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

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

Table 5-4: BPEO Estimated Cost Analysis

Activity	Beach Nourishment/Coastal Recharge (£)	Sea Disposal to Existing Disposal Site (£)
Dredging	£2 – 4 /m ³	£2 – 4 /m ³
Transport by vessel to disposal site	-	£7 – 9 m ³
Transportation Cost to Beach	£3 - 5 / m ³	-
Beach profiling works	£1.50 – 2.50 / m ³	-
Total	£6.50 – 11.50 / m³	£9 – 13 / m³

Estimated costs are given for sea disposal to the existing sea disposal site, and for a ‘traditional’ beach nourishment programme, utilising the dredging plant owned and operated by NIFHA. It is acknowledged that the establishment of a new strategic deposit site within the same coastal cell as Kilkeel (which is likely to be closer to the harbour) would result in a lower cost when compared to the sea disposal costs as estimated above.

Note that the above cost estimates 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). It is noted that additional environmental assessments may be required for beach nourishment and will be required should a new sea disposal site be established. The costs also do not take account of the influence volumes will have on costs (economies of scale).

The costs also do not account for the potential lost revenue associated with part of the harbour quayside being taken out of normal use to accommodate transfer of dredged material on to land-based transport.

5.1.4 BPEO Assessment Discussion

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

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

Table 5-5: BPEO Summary

Criteria	Beach Nourishment	Sea Disposal
Environment	1	2
Strategic	4	1
Costs	2	3
TOTAL SCORE	7	6

Deposition of the dredged material at a licensed marine disposal site has traditionally been deemed acceptable, and this practice has been undertaken previously at Kilkeel. It is understood that a sea disposal site will be determined by DAERA if this disposal route is to be progressed. Licenced disposal sites are typically designed to allow easy access as well as being capable of accommodating the quantities of material typically generated by dredging activities. Material handling is limited to transportation thereby reducing the risk for pollution incidences occurring. Pollutant concentrations within sediments are also limited to acceptable levels through regulatory requirements. This is option has been deemed likely to be more expensive than the beach nourishment option, though in reality, the costs and lost revenue associated with using part of the harbour as receiving area for dredged sediments for onward road transport (if this is required), is likely to mean that the overall costs of beach nourishment would be greater than sea disposal.

Previous studies (Tetra Tech, 2023) have noted the feasibility for establishing a new sea disposal site closer to the harbour. This has potential to reduce the carbon footprint and cost of the dredge and disposal operation in the long term, though it is noted that further environmental assessments and consultation with DAERA will be required if this is to be progressed, impacting project timescales.

In previous consultation, DAERA have noted a desire to maintain dredged sediments within the same sediment cell (Tetra Tech, 2023). This was reiterated during the recent conference call in December 2025 with representatives from Doran Consulting, EnviroCentre, NIFHA and the DAERA coastal geomorphology team. The establishment of any new disposal site at a strategic location updrift of the harbour would fall within the same first order coastal cell, as per information available on the Northern Ireland Coastal Observatory. It is noted that a specific site requires to be informed by other assessments which have not been undertaken to date.

Otherwise, if a new sea disposal site is not to be progressed at this time, then it is assumed that material will be deposited at the designated disposal site previously used (centred on 54° 01.5'N, -05° 55.5'W), or as determined by DAERA. It is noted that the harbour is required to be dredged throughout the year to maintain safe access and the work required to establish a new disposal site for coastal benefit may not align with the required project timescales.

The coastline around Kilkeel has been noted in previous reports as being at “high risk” of erosion, and the possibility of direct placement of dredged sand as part of a beach nourishment project has been considered. However, a specific receiving beach has not been identified at this stage and would require agreement with relevant stakeholders. It is unclear if the dredger and owned operated by NIFHA is capable of pumping sediment directly on to a receiving beach by pipeline or rainbowing, therefore it is assumed that material would require to be transferred to land-based plant on the harbour quayside. This would have a significant negative impact on harbour operations and extend the project timescales due to double handling of material. In addition, the time required to obtain the necessary agreements and assessments for beach nourishments mean that it is unlikely to align with the required project timescales (i.e. dredging before the late summer/autumn). Moreover, the lithology of the inner harbour means that sediment only from the outer reaches of the dredge area is likely to be deemed suitable for beach nourishment in the traditional sense. It should be noted however, that there is a commitment from NIFHA to consider the longer term strategy of retaining sediment in coastal cells

as discussed with DAERA to help promote coastal resilience for the longer term and help formulate a strategy which meets the requirements of all stakeholders.

5.2 Conclusion

The Best Practicable Environmental Option for disposal of the Kilkeel Harbour dredged material has therefore been assessed as disposal at a designated sea disposal site, as determined by DAERA. Ultimately, the strategic and logistical challenges of beach nourishment using the available marine plant, combined with the varied (and for the most part unsuitable) lithology, mean that sea disposal is considered to be the most practicable option in this instance.

It is noted that there is a case for establishing a new strategic disposal site that is not only closer to the harbour, but in a location that will benefit coastal features downdrift of the deposit site. Although this would require further environmental assessment and consultation with DAERA, it is considered likely to reduce the overall costs and carbon footprint of the dredge operation in the long term. It is noted that due to required project timescales, that this is unlikely to be progressed on this occasion. Therefore, it is assumed that material will be deposited at the designated disposal site previously used (centred on 54° 01.5'N, -05° 55.5'W), or as determined by DAERA.

It is noted also that DAERA have a desire to facilitate dredge and disposal programmes that ultimately make eroding coastlines more resilient in the context of a changing climate. The need to obtain a dredge licence as soon as possible to maintain safe navigation means that the required consultations and assessment work to fully inform a new strategic coastal recharge site within the same coastal cell, is not practicable in this instance. If this is to be progressed in future, the preferred strategy would be able to utilise existing dredging plant (i.e. the MS Kilmourne, which is a bottom emptying dredger). NIFHA acknowledge that sea disposal at the existing disposal site is not a long-term solution and are committed to engaging with DAERA and other project partners to allow an informed assessment of other disposal options as a longer-term strategy. A collaborative approach to the assessment and selection of any strategic beneficial deposit sites with other local dredge licence holders would ideally be adopted, though how this would work and be co-ordinated in practice remains unclear at this stage.

As identified in the sediment chemical quality section, concentrations of some contaminants were recorded between EAL1 and EAL2. As such, 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 Existing 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 includes comparison of existing chemical data with other recognised sediment assessment criteria including those listed below. Summary tables are provided in Appendix B.

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

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

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

6.1 Dredge and Disposal Site

The dredge is to be undertaken within Kilkeel Inner Harbour. The proposed dredge area is shown on Doran Consulting Drawing No. 251043-DCL-SI-ZZ-D-C-0001, included in the GES Factual Report in Appendix A.

A disposal site will ultimately be determined by DAERA, though it is understood that a disposal site 3 miles from the harbour within a 0.5 nautical mile radius of 54° 01.5'N, -05° 55.5'W was previously licenced to receive dredgings from Kilkeel Harbour. It is assumed that the same disposal site will be used again in this instance, though as noted above, this is acknowledged not to be a long-term solution and agreement to the *status quo* will not necessarily be made indefinitely.

6.2 Analytical Data Review

Existing analytical data for the proposed dredge site is provided in Summary Table A in Appendix B. Analytical data has been summarised against EAL 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 EAL1. Data for PAHs is not presented within the Summary Table in Appendix B, as no EAL exists for these parameters.

A summary of the exceedances is detailed below:

6.2.1 Action Level 1

Exceedances of EAL1 can be summarised as follows:

- Cadmium – 1 of 10 samples recorded a cadmium concentration above EAL 1;
- Chromium – 8 of 10 samples recorded chromium concentrations above EAL1;
- Copper – 2 of 10 samples recorded copper concentrations above EAL1;
- Nickel – 8 of 10 samples recorded nickel concentrations above EAL1;
- Zinc – 2 of 10 samples recorded zinc concentrations above EAL1;
- TBT – 1 of 10 samples recorded a TBT concentration above EAL 1; and
- THC – 8 of 10 samples recorded THC concentrations above EAL 1.

6.2.2 BAC Review

Exceedances of the BAC can be summarised as follows, where a value is available for comparison:

- Cadmium – 2 of 10 samples recorded a cadmium concentration above the BAC;
- Copper – 5 of 10 samples recorded copper concentrations above the BAC; and
- Zinc – 2 of 10 samples recorded zinc concentrations above the BAC.

6.2.3 ERL & PEL Review

Exceedances of the ERL can be summarised as follows, where a value is available for comparison:

- Copper – 3 of 10 samples recorded copper concentrations above the ERL; and
- Zinc – 1 of 10 samples recorded zinc concentrations above the ERL.

No exceedances of the PEL were recorded, where a value is available for comparison.

Note that no ERL or PEL values are published for nickel, nor for THC, PCBs or TBT.

6.2.4 Action Level 2

No exceedances of EAL2 were recorded in any of the samples analysed.

6.3 Averages

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

- Averaged data exceeded EAL1 for chromium, nickel and THC only;
- All samples recorded averaged concentrations below the BAC where one is available;
- All samples recorded averaged concentrations below the ERL where one is available;
- All samples recorded averaged concentrations below the PEL where one is available; and
- All samples recorded averaged concentrations for metals below EAL2 where they exist.

Averaged concentrations are provided in Summary Table B in Appendix B.

6.4 Further Assessment Discussion & Conclusions

Several exceedances of EAL1 were recorded for various metals and for total hydrocarbons. One marginal exceedance of EAL1 was recorded for TBT. Averaged concentrations, which account for the dredged material as a single volume for disposal, exceed EAL1 for chromium, nickel and THC only.

Averaged concentrations do not exceed other recognised chemical assessment criteria (including the BAC, ERL and PEL, where they exist).

No individual samples or averaged concentrations were recorded above EAL2.

The ERLs were developed by the USEPA to provide a screening level below which adverse effects in marine organisms are rare. The PELs are used in Canada to screen concentrations above these values whereby adverse effects frequently occur. Given that the averaged concentrations, which account for the dredge as a single volume for disposal do not exceed the ERL or PEL, significant adverse effects on marine organisms are considered to be unlikely.

Exceedances above EAL 1 were recorded for THC in both individual samples and in the dredge average. Neither a BAC, ERL or PEL is available for THC. However, 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 organic chemical contaminants in sediment are considered to be low, with the associated dilution potential providing further mitigation.

Any potential impacts on water quality as a result of the disposal activity are considered to be both localised and temporary, with the potential for dilution in the open waters beyond the disposal site is considerable. It is assumed that the allocated disposal site will be dispersive in nature. The key risk to water quality is considered to be an increase in turbidity/suspended solids during the disposal activity (*i.e.* placement on the seabed at the disposal site). 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.

On the basis of the further assessment of the parameters which exceeded EAL1, significant adverse effects on the marine environment are considered unlikely as a result of the proposed dredging and disposal activity.

REFERENCES

Department of Agriculture, Environment and Rural Affairs (DAERA) *Northern Ireland Guidance on Marine Licensing: Dredging, Disposal and Aggregate Dredging, under Part 4 of the Marine and Coastal Access Act 2009*, May 2016)

Geotechnical Environmental Services Ltd., *Kilkeel Inner Harbour Dredging Programme – Sediment Sampling and Laboratory Analyses – Factual Report*, Report No. 25184NI, January 2026.

Tetra Tech, *Kilkeel Harbour – Marine Dredging Re-Use Feasibility*, Report No. B033276, April 2023

APPENDICES

A SEDIMENT SAMPLING AND LABORATORY ANALYSES FACTUAL REPORT (GES LTD., JANUARY 2026)



GEOTECHNICAL
ENVIRONMENTAL SERVICES
LIMITED

**KILKEEL INNER HARBOUR DREDGING PROGRAMME
KILKEEL
COUNTY DOWN**

SEDIMENT SAMPLING AND LABORATORY ANALYSES

FACTUAL REPORT

REPORT No. 25184NI

JANUARY 2026

CLIENT: NIFHA

ENGINEER: DORAN CONSULTING

DOCUMENT CONTROL SHEET

CLIENT	NIFHA
PROJECT TITLE	KILKEEL INNER HARBOUR DREDGING PROGRAMME KILKEEL, COUNTY DOWN SEDIMENT SAMPLING AND LABORATORY ANALYSES
CONSULTING ENGINEER	DORAN CONSULTING
REPORT No.	25184NI

REV.	STATUS	AUTHOR(S)	REVIEWED & APPROVED BY	ISSUE DATE
0	FINAL	 ROBERT BARRY BSc, MSc, C. Eng, C. Geol, FGS, MIMMM	 ROBERT BARRY BSc, MSc, C. Eng, C. Geol, FGS, MIMMM	31/01/2026

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3.2 Grab and Dual Tube Sampling	2
3.3 Sub-Sampling	2
4.0 LABORATORY TESTING	3
4.1 Chemical and Physical Property Laboratory Testing	3
REFERENCES	4

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APPENDIX 2	PHOTOGRAPHS OF THE VAN VEEN GRAB AND MACRO CORE SEDIMENT SAMPLING PROCEDURE
APPENDIX 3	BOREHOLE LOGS AND SEDIMENT SAMPLE PHOTOGRAPHS
APPENDIX 4	LABORATORY TEST RESULTS

1.0 INTRODUCTION

On the instruction of Doran Consulting (the Engineer), acting on behalf of NIFHA (the Client), Geotechnical Environmental Services Limited (GES) was appointed to undertake sediment sampling and laboratory analyses in association with the Kilkeel Inner Harbour dredging programme, Kilkeel, County Down.

Site and exploratory hole location plans are included in Appendix 1.

The investigation comprised the following.

- 5 No. "grab" samples of the sea bed.
- 5 No. dual tube continuous sediment cores from sea bed level to 0.5m below sea bed level.
- Sub-sampling of the sediment cores at 0.5m intervals.
- Chemical and physical property laboratory testing of sediment samples.
- Factual reporting.

The Specification for the investigation was the UK Specification for Ground Investigation, 3rd Edition (2022).

Soil descriptions were undertaken in accordance with British Standard BS5930 2015+A1: 2020, Code of Practice for Site Investigation which incorporates guidance presented in BS EN ISO 14688-1:2002+A1:2013 and BS EN ISO 14688-2:2004+A1:2013.

The following provides additional clarification of the terminology that has been used:

- Silty CLAY/clayey SILT – used where it is considered that the secondary fraction is important and hence significantly modifies the appearance and/or behaviour of the principal.
- Fine grained (clays/silts) soils plotting on or just below the A-line on a plasticity chart are classified as clays.
- Fine grained soils with less than 35% sand and/or gravel sized particles are classified as slightly sandy and/or slightly gravelly.
- Fine grained soils with between 35% and 65% sand or gravel sized particles are classified as sandy or gravelly.
- Fine grained soils with greater than 65% sand or gravel sized particles are classified as very sandy or very gravelly.
- Coarse soils (sands/gravels) with less than 5% clay or silt and/or less than 5% sand or gravel are classified as slightly clayey or slightly silty and/or slightly sandy or slightly gravelly.
- Coarse soils with between 5% and 20% clay or silt and/or between 5% and 20% sand or gravel are classified as clayey or silty and/or sandy or gravelly.
- Coarse soils with greater than 20% clay or silt or greater than 20% sand or gravel are classified as very clayey or very silty and/or very sandy or very gravelly.

2.0 AIMS AND OBJECTIVES OF THE INVESTIGATION

The investigation was designed by the Engineer with the objective of obtaining the following information:

- The shallow sediment profile at the inner harbour.
- Tier 1 Physical Properties of the sea bed sediment in accordance with the OSPAR Guidelines for the Management of Dredged Material, Reference No. 2014/06, Technical Annex 1.
- Tier 2 Chemical Properties of the sea bed sediment (in accordance with the OSPAR Guidelines for the Management of Dredged Material, Reference No. 2014/06, Technical Annex 1.

This report provides a factual account of the site works undertaken and the laboratory test results obtained.

All comments made in this report are done so on the assumption that the findings of the investigation are representative of the site area as a whole.

3.0 SITE WORKS

3.1 Introduction

The site works were undertaken on 16th December 2025 under the supervision of a geo-environmental engineer from GES.

An exploratory hole location plan is included in Appendix 1.

3.2 Grab and Dual Tube Sampling

5 No. locations were specified, P01-P05.

At each sampling location an initial sample of the sea bed sediment was obtained using a cable operated Van Veen 2 litre capacity sediment sampler.

To obtain samples below sea bed level, a Geoprobe Macro Core sampler was used to recover continuous sediment cores. The cores were recovered in 1.0m long pvc liners of 38mm internal diameter (ID).

The sampling process was as follows:

Sampler tooling of 1.0m length and 54mm outside diameter (OD) was lowered, over the gunwale of the work boat, to sea bed level by means of manually handled light weight drill rods. Upon coming to rest on the sea bed the sampler was driven into the sediment by means of a jack hammer powered off a hydraulic power pack.

Upon driving the sampler to 1.0m below sea bed level, pulley ropes were attached to the drill rods to extract the sampler using a winch located on the work boat.

Photographs of the Van Veen grab and Macro Core sediment sampling procedure are included in Appendix 2.

Exploratory hole logs for each sampling location, plus photographs of the grab and macro core sample recovery are included in Appendix 3.

3.3 Sub-Sampling

Sub-samples of the grab samples and continuous sediment cores were obtained at sea bed level and from sea bed level to 0.4m below sea bed level.

The samples were placed in testing laboratory approved containers comprising the following;

- 500g capacity plastic tubs.
- 125g capacity glass jars.

4.0 LABORATORY TESTING

4.1 Chemical and Physical Property Laboratory Testing

Following completion of the sediment sampling, a set of samples was dispatched to the laboratory of SOCOTEC, Bretby Business Park, Burton upon Trent, England.

The laboratory participates in the Quality Assurance in Marine Environmental Monitoring in Europe (QUASIMEME) scheme.

The samples were tested for Tier 1 Physical Properties and Tier 2 Chemical Properties in accordance with the OSPAR Guidelines for the Management of Dredged Material, Reference No. 2014/06, Technical Annexes 1 and 2.

The results obtained are included in Appendix 4.

REFERENCES

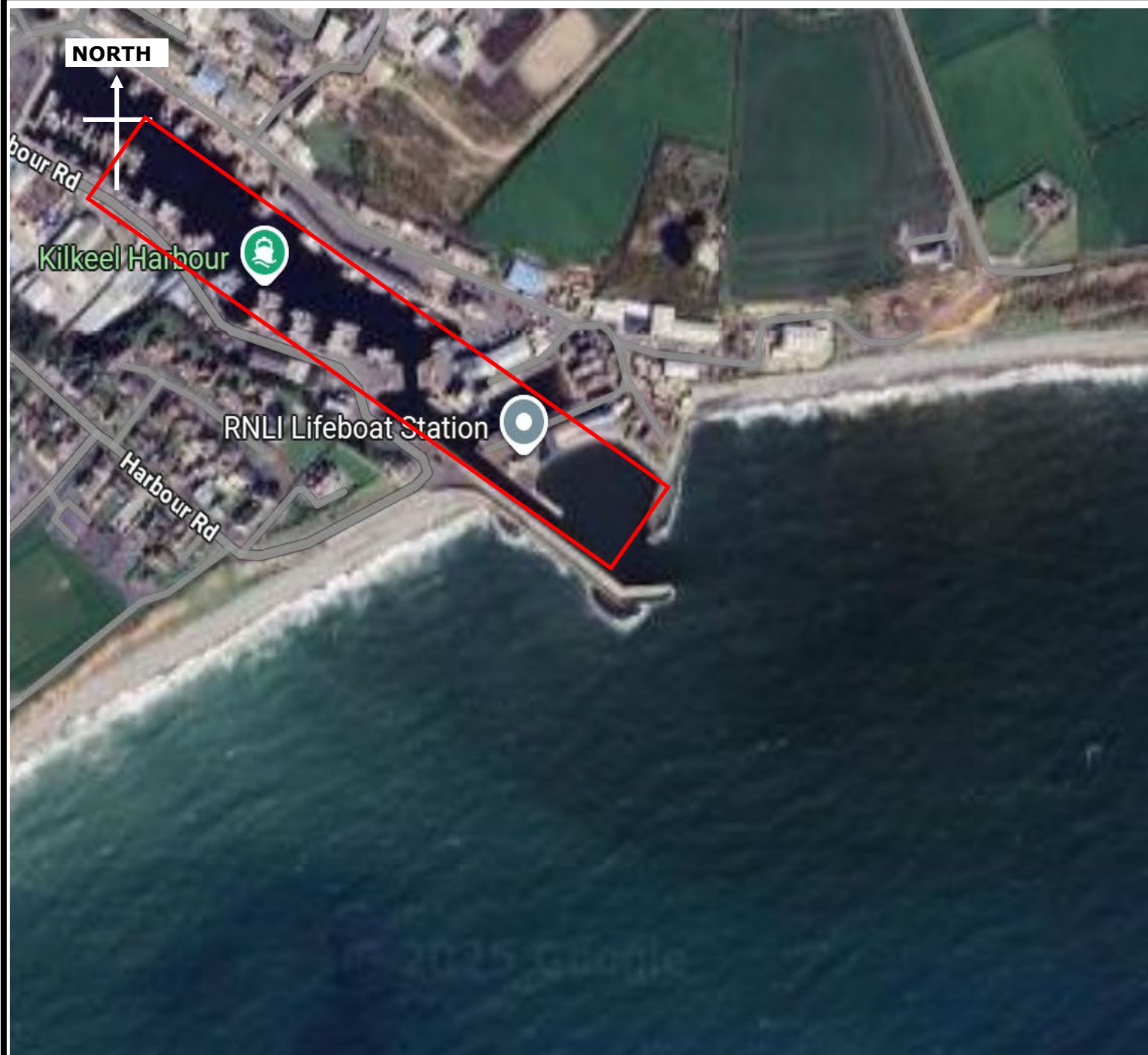
1. Site Investigation Steering Group. 2022. UK Specification for Ground Investigation, 3rd Edition. ICE Publishing Limited.
2. British Standard BS5930:2015+A1:2020, Code of Practice for Site Investigations. British Standards Institution, London.
3. BS EN ISO 14688-1, 2002+A1:2013. Geotechnical Investigation and Testing - Identification and classification of soil. Part 1: Identification and description. British Standards Institution, London.
4. BS EN ISO 14688-2, 2004+A1:2013. Geotechnical Investigation and Testing - Identification and classification of soil. Part 2: Principles for a classification. British Standards Institution, London.
5. OSPAR Guidelines for the Management of Dredged Material at Sea. 2024. Agreement 2014/06. OSPAR Commission.



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APPENDIX 1

SITE AND EXPLORATORY HOLE LOCATION PLANS



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Title: Site Location Plan

Project Name: Kilkeel Inner Harbour
Kilkeel, County Down—Sediment Sampling and Laboratory
Analyses

Figure No.1

Report No. 25081NI

Client: NIFHA

Engineer: Doran Consulting

Drawn by: RB

Date: 03/07/2025

Reviewed by: RB

Date: 03/07/2025

Key/Symbols:



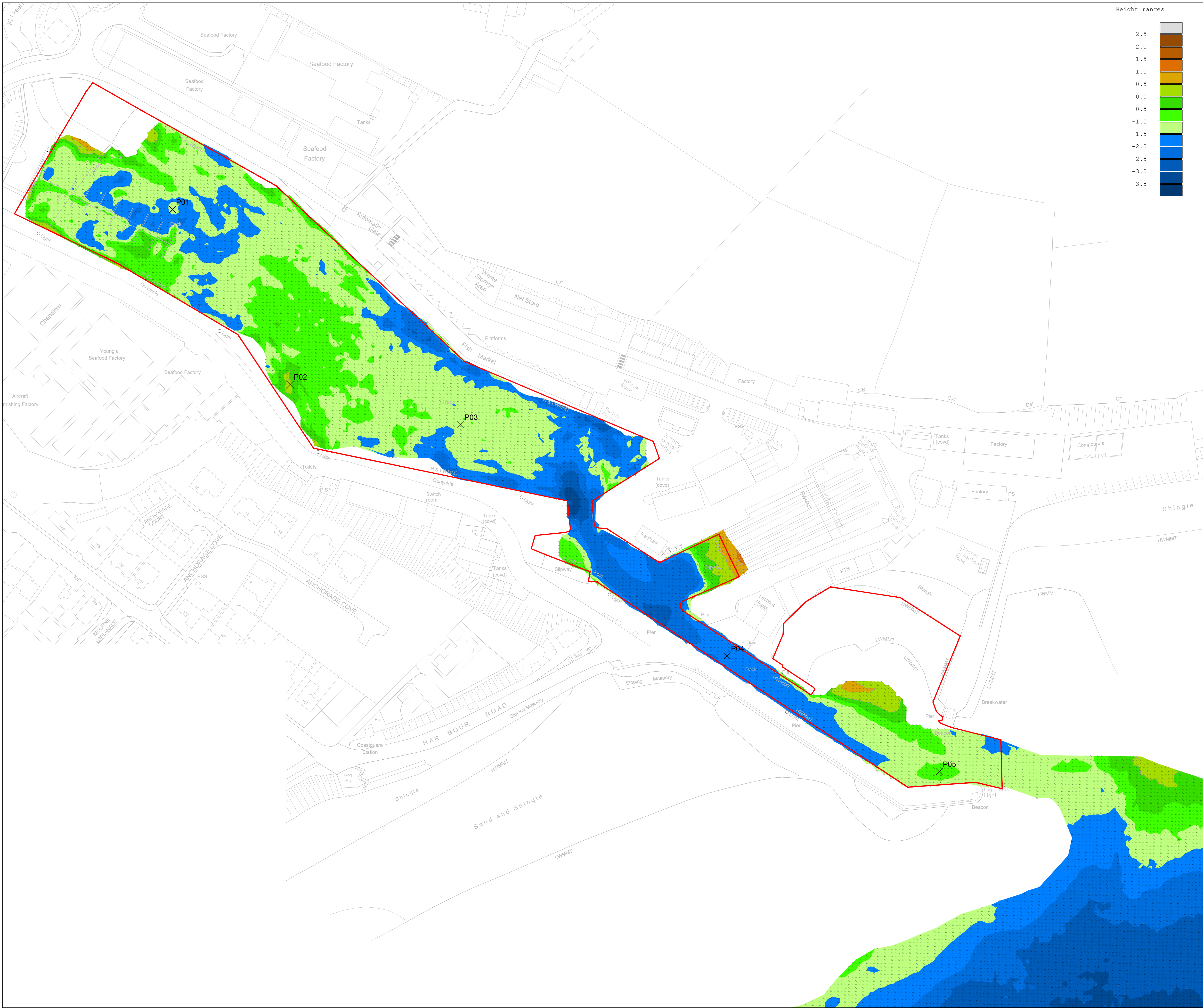
Approximate Site Boundary

Notes:

**Geotechnical Environmental Services
Limited**

The Old Mill,
22A Kilmoyale Road,
Ballybogey,
Co Antrim.
BT53 6NR.

Tel: 0044 (0)28 2074 2066
Fax: 0044 (0)28 2074 2829
Info@geospecialists.co.uk



Rev.	Date	By	Check	Details	Appr.
P01	03/12/25	GP	PMM	First Issue	CD

Inner Harbour

P01 Sample Depths:

Sample Location	CD Depth (m)
Surface	-1.176
-0.4m	-1.576

P04 Sample Depths:

Sample Location	CD Depth (m)
Surface	-1.888
-0.4m	-2.288

P02 Sample Depths:

Sample Location	CD Depth (m)
Surface	0.084
-0.4m	-0.316
-0.8	-0.716
-1.2	-1.116

P05 Sample Depths:

Sample Location	CD Depth (m)
Surface	-0.831
-0.4m	-1.231

P03 Sample Depths:

Sample Location	CD Depth (m)
Surface	-1.079
-0.4m	-1.479

Note:

Chart Datum = 1.06m

Kilkeel Chart Datum = 3.24m below Ordinance Datum

0629 Kilkeel is a Secondary Non-Harmonic port

The tide type is semi-diurnal

HAT	5.2 m
MHWS	4.7 m
MHWN	4.1 m
MSL	2.92 m
MLWN	1.5 m
MLWS	0.8 m
LAT	0.4 m

Point Data		
POINT NUMBER	EASTING	NORTHING
P01	331336.548	314243.948
P02	331402.522	314145.747
P03	331498.355	314123.255
P04	331647.875	313993.387
P05	331766.780	313928.470

Legend

— Dredge Area

PRELIMINARY DRAWING

Project Title:
Kilkeel Dredging

Drawing Title:
Kilkeel Inner Harbour
Sediment Sample Locations

Client: NIFHA	Drawn by: ■	Date: November 2025
Project Number: XXXX	Checked by: ■	Scales: 1:1000
Doran Project Number: 251043	Approved by: ■	Sheet Size: A1
Drawing Number: (Project-Orig-FB-SB-F-DISC-NUMBER) 251043-DCL-SI-ZZ-D-C-0001		Uniclass: PM_40_40
		Revision: P01
		STATUS: S1

Doran CONSULTING
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FLAX HOUSE
83-91 Adelaide Street,
Belfast, BT2 8FE
T 028 90333443
E mail@doran.co.uk
W www.doran.co.uk



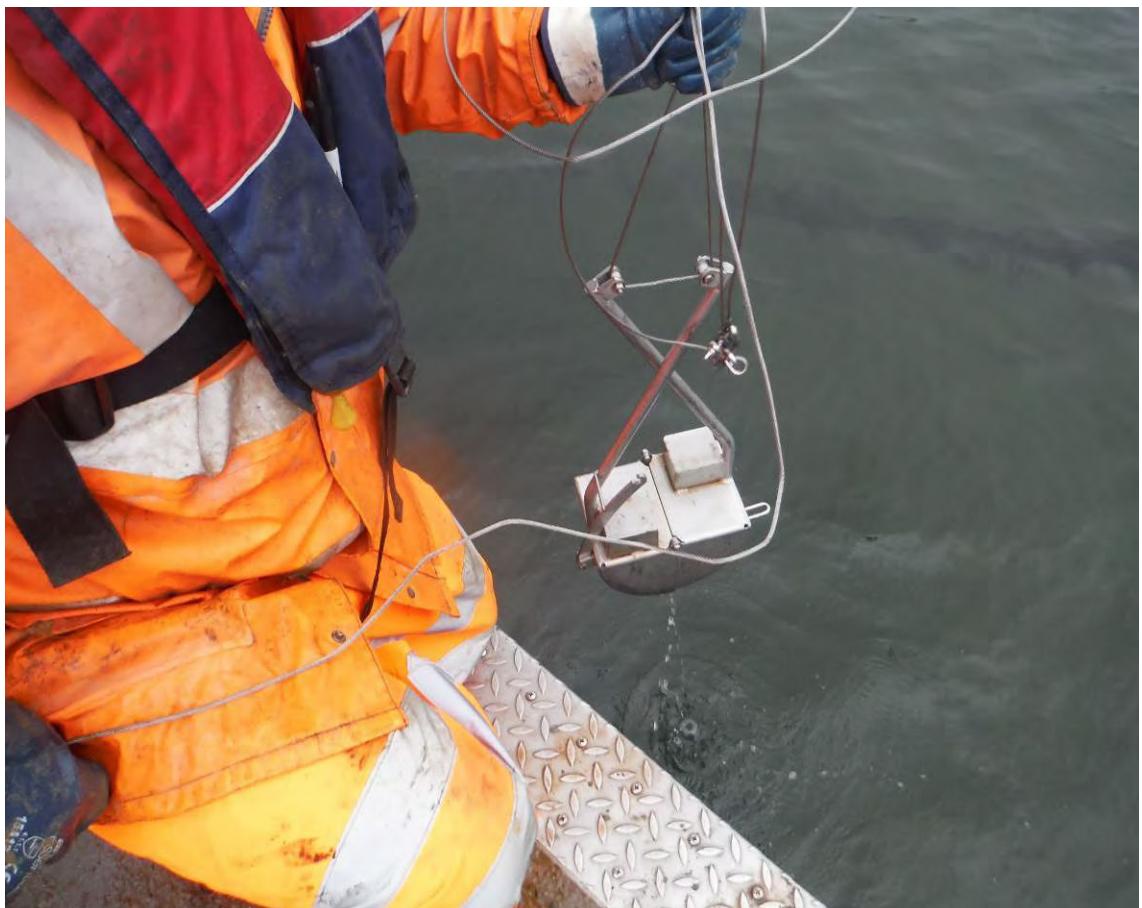
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APPENDIX 2

PHOTOGRAPHS OF THE VAN VEEN GRAB AND MACRO CORE SEDIMENT SAMPLING PROCEDURE



Van Veen Sediment Sampler Ready to be Lowered to Sea Bed



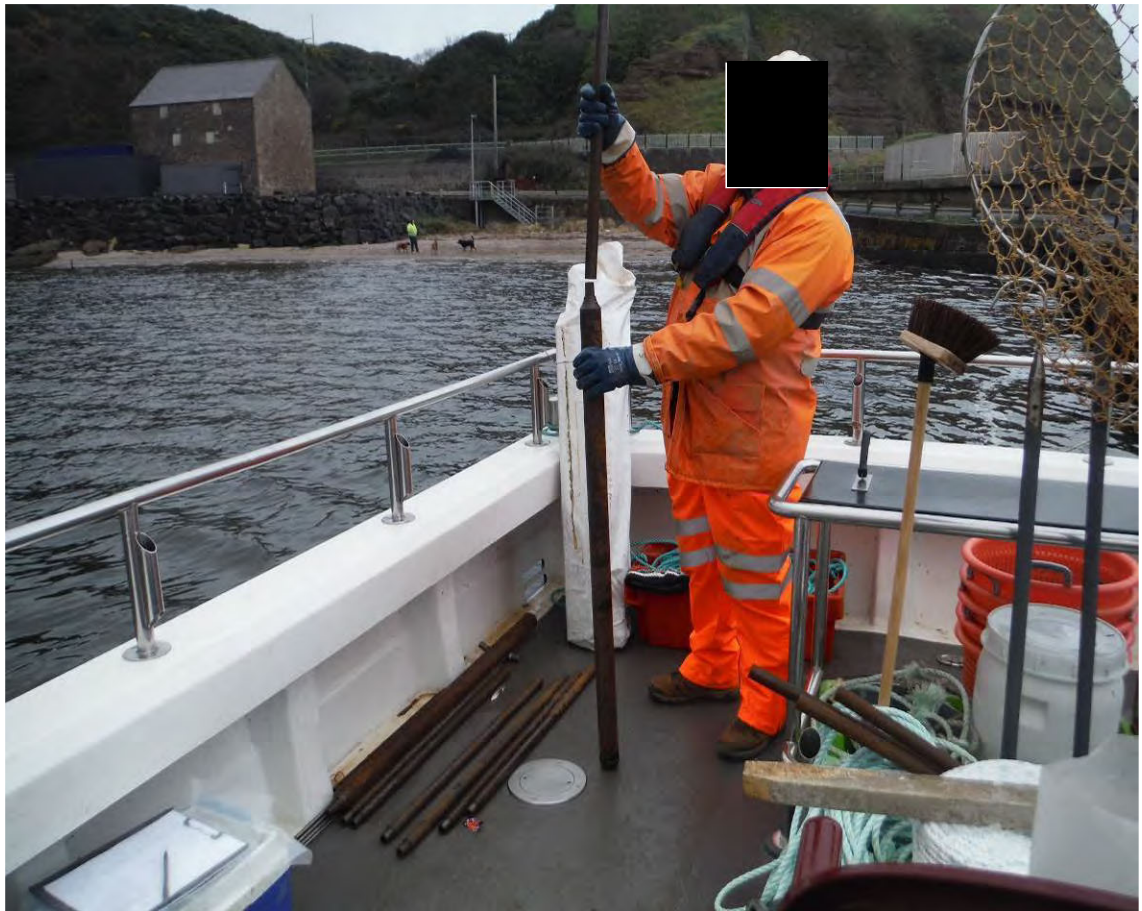
Recovery of Van Veen Sediment Sampler with Sample



Sea Bed Sediment Sample



Insertion of PVC Liner into Dual Tube Sampler



Dual Tube Sampler and Drill Rod



Dual Tube Sampler Lowered to Sea Bed. Additional Drill Rods Added as Required



Dual Tube Sampler Driven into Sea Bed



Recovery of Dual Tube Sampler Using Winch and Pulley System



Dual Tube Sample Recovery

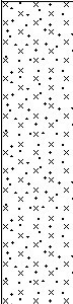


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APPENDIX 3

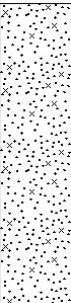
BOREHOLE LOGS AND SEDIMENT SAMPLE PHOTOGRAPHS

 GEOTECHNICAL ENVIRONMENTAL SERVICES LIMITED							Site Kilkeel Inner Harbour Dredging Programme, Kilkeel, County Down - Sediment Sampling and Laboratory Analyses		Borehole Number P01	
Boring Method Van Veen 2kg Capacity Grab Sampler. Macro Core Sampler.		Casing Diameter 54mm cased to 0.40m		Ground Level (mOD)		Client NIFHA		Job Number 25184NI		
		Location		Dates 16/12/2025		Engineer Doran		Sheet 1/1		
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.00 0.00-0.40	ES1 ES2						Greyish brown and grey slightly sandy SILT containing decayed organic matter.			
				16/01/2025:		0.40	Complete at 0.40m			
Remarks ES=Environmental sediment sample comprising 3x0.5kg capacity plastic tubs & 2x125g capacity amber glass jar.							Scale (approx) 1:10	Logged By	Figure No. 25184NI.P01	

 GEOTECHNICAL ENVIRONMENTAL SERVICES LIMITED							Site Kilkeel Inner Harbour Dredging Programme, Kilkeel, County Down - Sediment Sampling and Laboratory Analyses		Borehole Number P02	
Boring Method Van Veen 2kg Capacity Grab Sampler. Macro Core Sampler.		Casing Diameter 54mm cased to 0.50m		Ground Level (mOD)		Client NIFHA		Job Number 25184NI		
		Location		Dates 16/12/2025		Engineer Doran		Sheet 1/1		
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.00 0.00-0.40	ES1 ES2						Greyish brown and grey slightly sandy SILT containing decayed organic matter.			
						(0.40)				
						0.40 (0.10)	Light greyish brown silty fine to medium SAND. Sampler refused at 0.5m depth.			
				16/12/2025:		0.50	Complete at 0.50m			
Remarks ES=Environmental sediment sample comprising 3x0.5kg capacity plastic tubs & 2x125g capacity amber glass jar.							Scale (approx) 1:10	Logged By 	Figure No. 25184NI.P02	

 GEOTECHNICAL ENVIRONMENTAL SERVICES LIMITED							Site Kilkeel Inner Harbour Dredging Programme, Kilkeel, County Down - Sediment Sampling and Laboratory Analyses		Borehole Number P03	
Boring Method Van Veen 2kg Capacity Grab Sampler. Macro Core Sampler.		Casing Diameter 54mm cased to 0.40m		Ground Level (mOD)		Client NIFHA		Job Number 25184NI		
		Location		Dates 16/12/2025		Engineer Doran		Sheet 1/1		
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.00 0.00-0.40	ES1 ES2						Greyish brown and dark grey slightly sandy SILT.			
				16/12/2025:		0.40	Complete at 0.40m			
Remarks ES=Environmental sediment sample comprising 3x0.5kg capacity plastic tubs & 2x125g capacity amber glass jar.							Scale (approx) 1:10	Logged By	Figure No. 25184NI.P03	

 GEOTECHNICAL ENVIRONMENTAL SERVICES LIMITED							Site Kilkeel Inner Harbour Dredging Programme, Kilkeel, County Down - Sediment Sampling and Laboratory Analyses		Borehole Number P04	
Boring Method Van Veen 2kg Capacity Grab Sampler. Macro Core Sampler.		Casing Diameter 54mm cased to 0.40m		Ground Level (mOD)		Client NIFHA		Job Number 25184NI		
		Location		Dates 16/12/2025		Engineer Doran		Sheet 1/1		
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.00 0.00-0.40	ES1 ES2						Greyish brown and grey slightly sandy SILT containing decayed organic matter.			
				16/12/2025:		0.40	Complete at 0.40m			
Remarks ES=Environmental sediment sample comprising 3x0.5kg capacity plastic tubs & 2x125g capacity amber glass jar.							Scale (approx) 1:10	Logged By 		
							Figure No. 25184NI.P04			

 GEOTECHNICAL ENVIRONMENTAL SERVICES LIMITED							Site Kilkeel Inner Harbour Dredging Programme, Kilkeel, County Down - Sediment Sampling and Laboratory Analyses		Borehole Number P05	
Boring Method Van Veen 2kg Capacity Grab Sampler. Macro Core Sampler.		Casing Diameter 54mm cased to 0.40m		Ground Level (mOD)		Client NIFHA		Job Number 25184NI		
		Location		Dates 16/12/2025		Engineer Doran		Sheet 1/1		
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.00 0.00-0.40	ES1 ES2						Greyish brown silty fine SAND containing decayed organic matter.			
				16/12/2025:		0.40	Complete at 0.40m			
Remarks ES=Environmental sediment sample comprising 3x0.5kg capacity plastic tubs & 2x125g capacity amber glass jar.							Scale (approx) 1:10	Logged By 	Figure No. 25184NI.P05	



P01 Van Veen Sediment Sampler Recovery



P01 0m-1.0m Macro Core Sampler Recovery



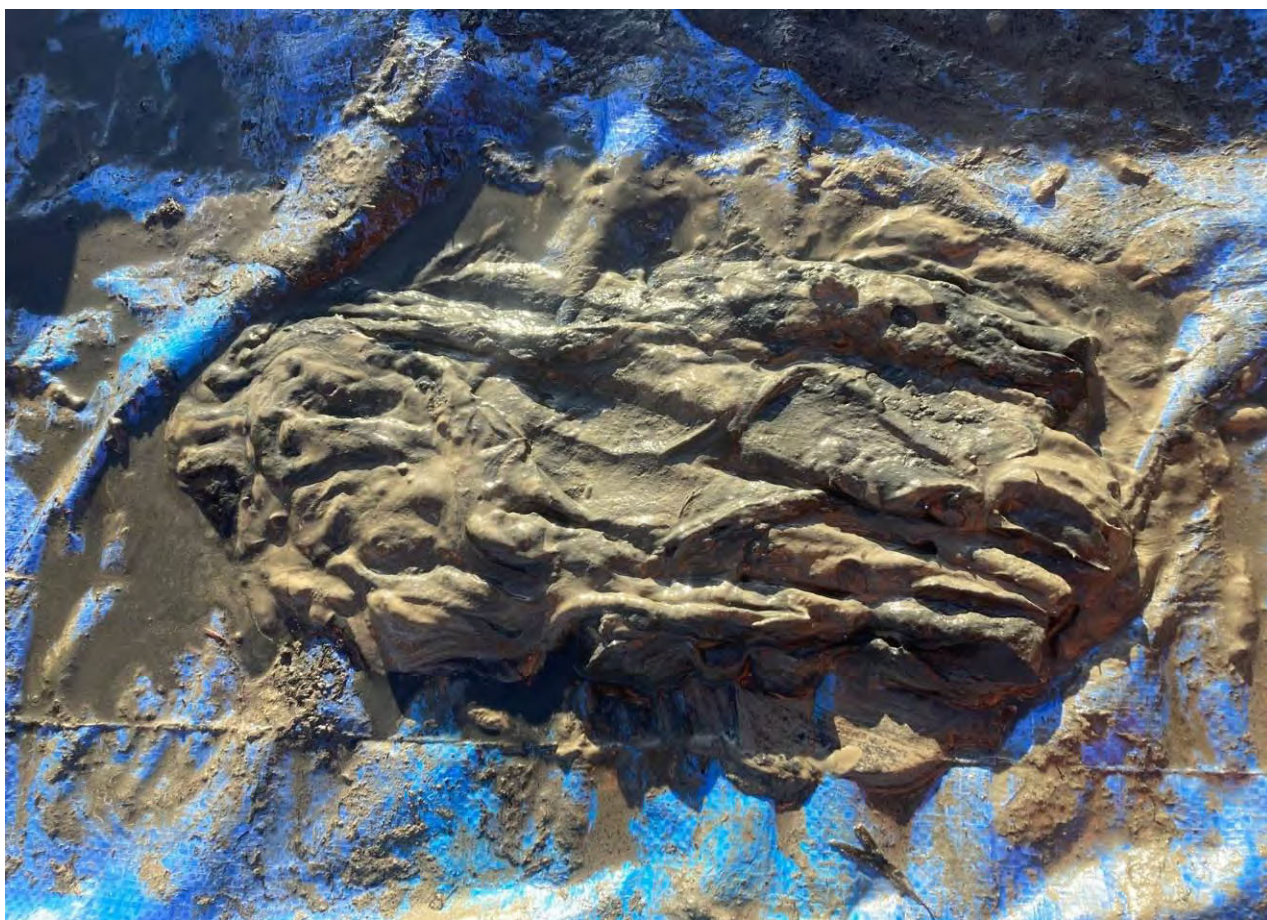
P02 Van Veen Sediment Sampler Recovery



P02 0m-1.0m Macro Core Sampler Recovery



P03 Van Veen Sediment Sampler Recovery



P03 0m-1.0 m Macro Core Sampler Recovery



P04 Van Veen Sediment Sampler Recovery



P04 0m-1.0 m Macro Core Sampler Recovery



P05 Van Veen Sediment Sampler Recovery



P05 0m-1.0 m Macro Core Sampler Recovery



GEOTECHNICAL
ENVIRONMENTAL SERVICES
LIMITED

APPENDIX 4

LABORATORY TEST RESULTS

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 MAR02924

Issue Version: 1

Customer: Geotechnical Environmental Services Limited, The Old Mill, 22A Kilmoyle Road, Ballybogey, County Antrim

Customer Reference: Kilkeel Inner Harbour

Date Sampled: 16-Dec-25

Date Samples Received: 22-Dec-25

Test Report Date: 28-Jan-26

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

Authorised by:



Position:

Customer Service Specialist



1252

MAR02924

This test report shall not be reproduced except in full, without written approval of the laboratory

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Test Report ID MAR02924
Issue Version 1
Customer Reference Kilkeel Inner Harbour

		Units	%	%	%	%	%	Mg/m3
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	N	
Client Reference:	SOCOTEC Ref:	Matrix	Total Moisture @ 120°C	Total Solids	Gravel (>2mm)	Sand (63-2000 µm)	Silt (<63 µm)	Particle Density
P01 - 0.0m (Sea Bed Level)	MAR02924.001	Sediment	52.8	47.2	2.33	24.38	73.29	2.43
P01 - 0.0m - 0.4m	MAR02924.002	Sediment	63.9	36.1	2.46	57.06	40.48	2.51
P02 - 0.0m (Sea Bed Level)	MAR02924.003	Sediment	62.7	37.3	0.64	32.69	66.67	2.22
P02 - 0.0m - 0.4m	MAR02924.004	Sediment	68.5	31.5	1.55	28.94	69.51	2.13
P03 - 0.0m (Sea Bed Level)	MAR02924.005	Sediment	63.4	36.6	0.00	28.44	71.56	2.46
P03 - 0.0m-0.4m	MAR02924.006	Sediment	60.8	39.2	0.67	28.38	70.95	2.50
P04 - 0.0m (Sea Bed Level)	MAR02924.007	Sediment	65.6	34.4	2.81	57.09	40.10	2.06
P04 - 0.0m - 0.4m	MAR02924.008	Sediment	61.1	38.9	1.60	55.61	42.79	1.99
P05 - 0.0m (Sea Bed Level)	MAR02924.009	Sediment	29.2	70.8	0.21	84.49	15.29	2.44
P05 - 0.0m - 0.4m	MAR02924.010	Sediment	28.5	71.5	0.27	85.71	14.02	2.63
Reference Material (% Recovery)			NA	NA	NA	NA	NA	NA
QC Blank			NA	NA	NA	NA	NA	NA

* See Report Notes

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Test Report ID MAR02924
 Issue Version 1
 Customer Reference Kilkeel Inner Harbour

		Units	% m/m
		Method No	WSLM59*
		Limit of Detection	0.02
		Accreditation	UKAS
Client Reference:	SOCOTEC Ref:	Matrix	TOC
P01 - 0.0m (Sea Bed Level)	MAR02924.001	Sediment	2.57
P01 - 0.0m - 0.4m	MAR02924.002	Sediment	2.07
P02 - 0.0m (Sea Bed Level)	MAR02924.003	Sediment	3.50
P02 - 0.0m - 0.4m	MAR02924.004	Sediment	3.49
P03 - 0.0m (Sea Bed Level)	MAR02924.005	Sediment	2.37
P03 - 0.0m-0.4m	MAR02924.006	Sediment	2.41
P04 - 0.0m (Sea Bed Level)	MAR02924.007	Sediment	4.13
P04 - 0.0m - 0.4m	MAR02924.008	Sediment	5.57
P05 - 0.0m (Sea Bed Level)	MAR02924.009	Sediment	0.88
P05 - 0.0m - 0.4m	MAR02924.010	Sediment	0.23
Reference Material (% Recovery)			102
QC Blank			<0.02

* See Report Notes

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Test Report ID MAR02924
Issue Version 1
Customer Reference Kilkeel Inner Harbour

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	ICPMS-MWSED*	ICPMS-MWSED*	ICPMS-MWSED*	ICPMS-MWSED*	ICPMS-MWSED*	ICPMS-MWSED*	ICPMS-MWSED*	ICPMS-MWSED*
		Limit of Detection	0.14	0.03	1	0.7	0.6	0.01	0.4	3.5
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	SOCOTEC Ref:	Matrix	Arsenic as As	Cadmium as Cd	Chromium as Cr	Copper as Cu	Lead as Pb	Mercury as Hg	Nickel as Ni	Zinc as Zn
P01 - 0.0m (Sea Bed Level)	MAR02924.001	Sediment	6.8	0.25	48.0	20.3	31.0	0.02	22.8	91.2
P01 - 0.0m - 0.4m	MAR02924.002	Sediment	6.5	0.26	46.8	21.0	31.2	<0.01	21.9	92.5
P02 - 0.0m (Sea Bed Level)	MAR02924.003	Sediment	7.3	0.32	53.4	40.5	26.5	0.01	23.9	145
P02 - 0.0m - 0.4m	MAR02924.004	Sediment	9.4	0.41	71.1	44.7	34.5	0.02	32.3	172
P03 - 0.0m (Sea Bed Level)	MAR02924.005	Sediment	8.1	0.19	58.2	20.2	24.9	<0.01	24.9	86.7
P03 - 0.0m-0.4m	MAR02924.006	Sediment	10.1	0.27	73.1	28.4	34.4	<0.01	32.7	112
P04 - 0.0m (Sea Bed Level)	MAR02924.007	Sediment	9.6	0.24	58.9	36.2	27.1	0.05	25.8	91.7
P04 - 0.0m - 0.4m	MAR02924.008	Sediment	9.2	0.22	49.8	30.3	23.2	<0.01	23.1	81.6
P05 - 0.0m (Sea Bed Level)	MAR02924.009	Sediment	4.9	0.09	30.9	8.4	17.0	<0.01	16.0	35.8
P05 - 0.0m - 0.4m	MAR02924.010	Sediment	3.4	0.06	21.4	6.2	12.6	<0.01	11.1	32.2
Certified Reference Material 2702 (% Recovery)			82	80	79	81	86	93	92	80
QC Blank			<0.14	<0.03	<1	<0.7	<0.6	<0.01	<0.4	<3.5

* See Report Notes

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Test Report ID MAR02924
 Issue Version 1
 Customer Reference Kilkeel Inner 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)
P01 - 0.0m (Sea Bed Level)	MAR02924.001	Sediment	<5	<5
P01 - 0.0m - 0.4m	MAR02924.002	Sediment	<5	19.2
P02 - 0.0m (Sea Bed Level)	MAR02924.003	Sediment	<5	25.8
P02 - 0.0m - 0.4m	MAR02924.004	Sediment	<5	49.8
P03 - 0.0m (Sea Bed Level)	MAR02924.005	Sediment	<5	19.1
P03 - 0.0m-0.4m	MAR02924.006	Sediment	<5	58.6
P04 - 0.0m (Sea Bed Level)	MAR02924.007	Sediment	25.6	127
P04 - 0.0m - 0.4m	MAR02924.008	Sediment	16.8	13.9
P05 - 0.0m (Sea Bed Level)	MAR02924.009	Sediment	<1	2.44
P05 - 0.0m - 0.4m	MAR02924.010	Sediment	<1	1.58
Certified Reference Material BCR-646 (% Recovery)			65	63
QC Blank			<1	<1

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Test Report ID MAR02924
Issue Version 1
Customer Reference Kilkeel Inner 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	ASC/SOP/303/304
Limit of Detection		1	1	1	1	1	1	1
Accreditation		UKAS	UKAS	N*	UKAS	UKAS	UKAS	UKAS
Client Reference:	SOCOTEC Ref:	Matrix	ACENAPTH	ACENAPHY	ANTHRACN	BAA	BAP	BBF
P01 - 0.0m (Sea Bed Level)	MAR02924.001	Sediment	7.38	7.46	21.2	126	158	146
P01 - 0.0m - 0.4m	MAR02924.002	Sediment	9.40	10.5	15.0	73.1	113	130
P02 - 0.0m (Sea Bed Level)	MAR02924.003	Sediment	13.4	7.68	24.7	93.8	130	149
P02 - 0.0m - 0.4m	MAR02924.004	Sediment	12.9	10.6	29.2	118	168	186
P03 - 0.0m (Sea Bed Level)	MAR02924.005	Sediment	9.83	6.62	17.7	61.0	82.3	101
P03 - 0.0m-0.4m	MAR02924.006	Sediment	8.65	7.68	15.8	69.9	95.7	106
P04 - 0.0m (Sea Bed Level)	MAR02924.007	Sediment	13.0	6.18	19.4	81.2	104	109
P04 - 0.0m - 0.4m	MAR02924.008	Sediment	9.17	5.84	23.7	101	133	134
P05 - 0.0m (Sea Bed Level)	MAR02924.009	Sediment	13.1	2.55	19.4	45.3	50.8	45.9
P05 - 0.0m - 0.4m	MAR02924.010	Sediment	1.60	<1	2.41	6.79	7.97	8.48
Certified Reference Material Quasimeme SED42 (% Recovery)			42	135	88	80	88	97
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 MAR02924
Issue Version 1
Customer Reference Kilkeel Inner Harbour

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	SOCOTEC Ref:	Matrix	BENZGHIP	BKF*	CHRYSENE*	DBENZAH	FLUORANT	FLUORENE
P01 - 0.0m (Sea Bed Level)	MAR02924.001	Sediment	114	139	147	19.5	239	14.5
P01 - 0.0m - 0.4m	MAR02924.002	Sediment	106	108	105	16.2	143	28.4
P02 - 0.0m (Sea Bed Level)	MAR02924.003	Sediment	119	120	120	18.6	188	26.0
P02 - 0.0m - 0.4m	MAR02924.004	Sediment	148	155	157	23.2	230	28.9
P03 - 0.0m (Sea Bed Level)	MAR02924.005	Sediment	83.3	87.3	81.7	15.2	124	18.6
P03 - 0.0m-0.4m	MAR02924.006	Sediment	90.0	94.4	89.6	15.2	140	17.8
P04 - 0.0m (Sea Bed Level)	MAR02924.007	Sediment	85.9	93.8	100	15.3	158	17.8
P04 - 0.0m - 0.4m	MAR02924.008	Sediment	108	117	120	21.3	184	15.1
P05 - 0.0m (Sea Bed Level)	MAR02924.009	Sediment	34.6	42.3	51.8	7.91	102	11.5
P05 - 0.0m - 0.4m	MAR02924.010	Sediment	6.57	7.78	8.19	<1	16.6	1.64
Certified Reference Material Quasimeme SED42 (% Recovery)			105	86	99	90	86	74
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 MAR02924
Issue Version 1
Customer Reference Kilkeel Inner 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/303/304	ASC/SOP/303/306
Limit of Detection		1	1	1	1	1	100
Accreditation		UKAS	UKAS	N*	N*	N	
Client Reference:	SOCOTEC Ref:	Matrix	INDPYR	NAPTH	PHENANT	PYRENE	THC
P01 - 0.0m (Sea Bed Level)	MAR02924.001	Sediment	122	19.0	72.7	219	278000
P01 - 0.0m - 0.4m	MAR02924.002	Sediment	97.9	32.2	73.1	141	644000
P02 - 0.0m (Sea Bed Level)	MAR02924.003	Sediment	119	24.8	88.4	172	562000
P02 - 0.0m - 0.4m	MAR02924.004	Sediment	144	25.6	116	214	673000
P03 - 0.0m (Sea Bed Level)	MAR02924.005	Sediment	86.6	30.2	78.4	109	234000
P03 - 0.0m-0.4m	MAR02924.006	Sediment	96.4	26.5	77.4	128	180000
P04 - 0.0m (Sea Bed Level)	MAR02924.007	Sediment	89.2	31.7	91.0	145	168000
P04 - 0.0m - 0.4m	MAR02924.008	Sediment	111	26.4	88.7	164	142000
P05 - 0.0m (Sea Bed Level)	MAR02924.009	Sediment	36.1	12.3	74.3	84.5	36600
P05 - 0.0m - 0.4m	MAR02924.010	Sediment	6.79	2.94	11.2	13.4	30800
Certified Reference Material Quasimeme SED42 (% Recovery)			91	101	78	90	81~
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 MAR02924
Issue Version 1
Customer Reference Kilkeel Inner 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	ASC/SOP/302
Limit of Detection		0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Accreditation		UKAS	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	SOCOTEC Ref:	Matrix	PCB28	PCB52	PCB101	PCB118	PCB138	PCB153	PCB180
P01 - 0.0m (Sea Bed Level)	MAR02924.001	Sediment	<0.08	0.30	0.82	0.77	0.56	0.58	0.12
P01 - 0.0m - 0.4m	MAR02924.002	Sediment	<0.08	0.16	0.36	0.46	0.53	0.35	<0.08
P02 - 0.0m (Sea Bed Level)	MAR02924.003	Sediment	0.12	0.23	0.56	0.70	0.63	0.51	0.18
P02 - 0.0m - 0.4m	MAR02924.004	Sediment	0.11	0.25	0.58	0.59	0.49	0.48	0.17
P03 - 0.0m (Sea Bed Level)	MAR02924.005	Sediment	0.10	0.10	0.15	0.28	0.16	0.22	<0.08
P03 - 0.0m-0.4m	MAR02924.006	Sediment	0.11	0.11	0.17	0.30	0.10	0.19	<0.08
P04 - 0.0m (Sea Bed Level)	MAR02924.007	Sediment	<0.08	<0.08	<0.08	0.13	0.11	0.11	<0.08
P04 - 0.0m - 0.4m	MAR02924.008	Sediment	<0.08	<0.08	0.08	0.10	0.12	0.14	0.09
P05 - 0.0m (Sea Bed Level)	MAR02924.009	Sediment	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
P05 - 0.0m - 0.4m	MAR02924.010	Sediment	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Certified Reference Material Quasimeme SED28 (% Recovery)			63	88	89	109	85	81	65
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 MAR02924
Issue Version 1
Customer Reference Kilkeel Inner Harbour

REPORT NOTES

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
WSLM59*	MAR02924.001-010	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
ICPMS-MWSED*	MAR02924.001-010	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
ICPOES-MWSED*	MAR02924.001-010	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
SUB_01*	MAR02924.001-010	Analysis was conducted by an approved subcontracted laboratory.
SUB_02*	MAR02924.001-010	Analysis was conducted by an approved subcontracted laboratory.
ASC/SOP/301	MAR02924.001-006	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	MAR02924.001-010	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 (ANTHRACEN, PHENANTH, PYRENE) . These circumstances should be taken into consideration when utilising the data.
ASC/SOP/303/304	MAR02924.001-010	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	MAR02924.001-010	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

MAR02924

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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 MAR02924
Issue Version 1
Customer Reference Kilkeel Inner 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 sieved to <2mm	Carbonate removal and sulphurous acid/combustion at 1600°C/NDIR.
Metals	Air dried and sieved to <2mm	Microwave assisted HF/Boric 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		

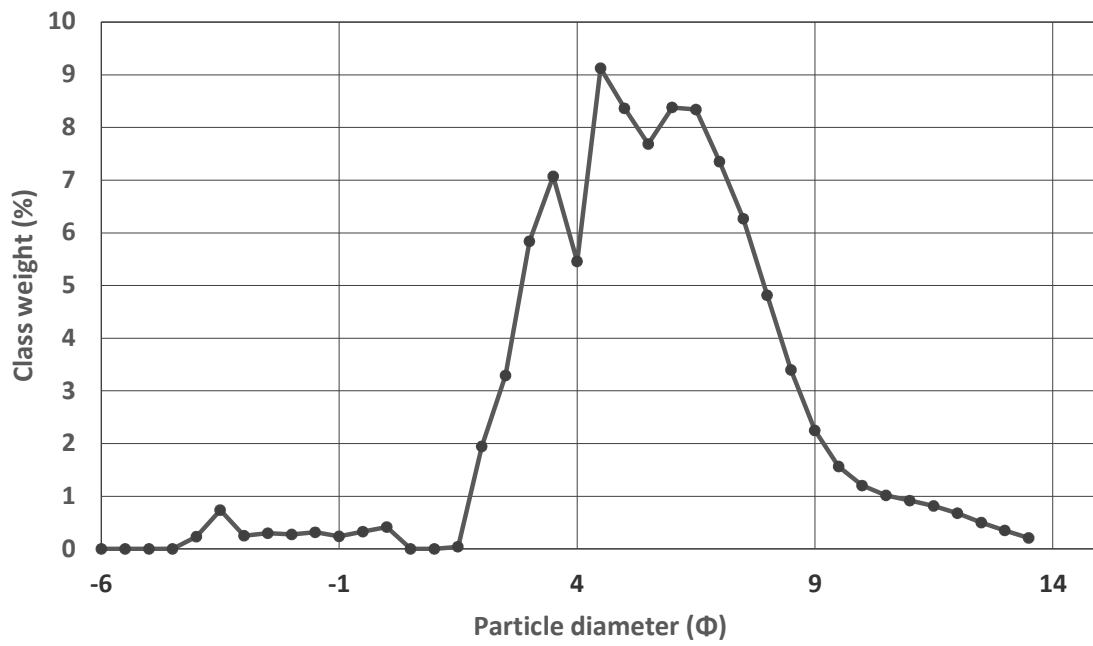
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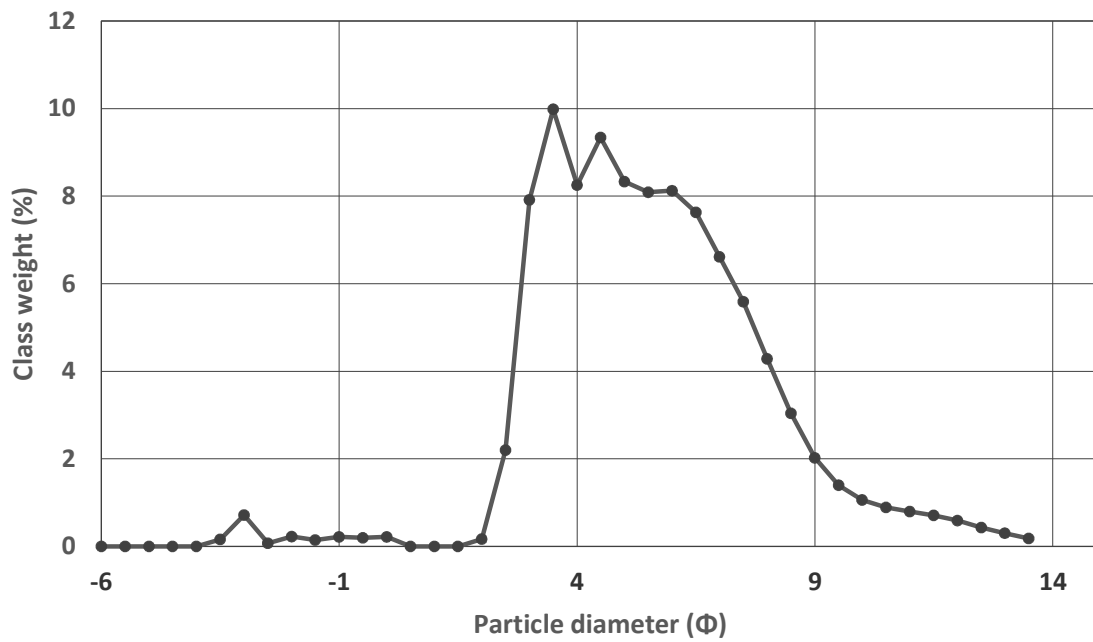
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63000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45000.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
31500.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
22400.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16000.000	0.229	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11200.000	0.735	0.061	0.000	0.158	0.000	0.000	0.000	0.000	0.000	0.000
8000.000	0.245	0.415	0.163	0.721	0.000	0.004	0.149	0.012	0.023	0.000
5600.000	0.298	0.496	0.072	0.075	0.000	0.288	0.436	0.239	0.014	0.000
4000.000	0.274	0.374	0.100	0.229	0.000	0.064	0.673	0.239	0.036	0.070
2800.000	0.315	0.577	0.136	0.146	0.000	0.144	0.734	0.441	0.059	0.062
2000.000	0.233	0.470	0.171	0.221	0.000	0.168	0.822	0.667	0.082	0.136
1400.000	0.327	1.400	0.203	0.197	0.000	0.476	1.135	1.358	0.297	0.283
1000.000	0.413	2.249	0.255	0.217	0.000	0.548	1.648	1.719	0.488	0.422
707.000	0.000	5.920	0.000	0.000	0.000	0.000	7.621	6.629	4.979	3.562
500.000	0.000	9.818	0.000	0.000	0.000	0.000	9.609	8.855	8.592	7.996
353.600	0.040	9.616	0.001	0.000	0.000	0.000	7.218	7.385	13.595	14.277
250.000	1.943	6.279	0.875	0.171	0.309	0.239	5.004	4.084	17.034	18.746
176.800	3.291	5.843	5.188	2.202	3.718	3.635	5.191	4.760	16.658	17.844
125.000	5.840	5.748	8.107	7.918	7.633	7.294	6.147	6.166	11.742	11.731
88.390	7.068	5.568	9.467	9.985	8.868	8.121	6.444	7.266	6.834	6.721
62.500	5.459	4.616	8.590	8.252	7.910	8.067	7.071	7.390	4.272	4.132
44.190	9.121	4.719	8.606	9.338	9.269	9.023	6.179	6.691	2.797	2.482
31.250	8.362	4.604	8.469	8.328	8.155	8.375	4.728	5.415	1.774	1.666
22.097	7.683	4.567	7.949	8.090	7.932	7.622	3.722	4.265	1.375	1.245
15.625	8.382	4.896	8.105	8.126	8.255	7.876	4.044	4.414	1.436	1.237
11.049	8.337	4.773	7.590	7.632	7.953	7.796	4.426	4.601	1.502	1.369
7.813	7.350	4.144	6.413	6.609	7.067	6.936	4.125	4.194	1.394	1.326
5.524	6.267	3.474	5.309	5.590	6.080	5.951	3.584	3.651	1.232	1.188
3.906	4.814	2.613	3.981	4.287	4.678	4.584	2.740	2.826	0.983	0.950
2.762	3.395	1.796	2.749	3.038	3.266	3.231	1.874	1.963	0.729	0.701
1.953	2.249	1.164	1.793	2.022	2.114	2.141	1.174	1.246	0.503	0.477
1.381	1.561	0.802	1.236	1.397	1.429	1.496	0.768	0.816	0.351	0.326
0.977	1.200	0.621	0.948	1.061	1.086	1.171	0.570	0.595	0.266	0.239
0.691	1.017	0.527	0.802	0.892	0.930	1.016	0.481	0.486	0.219	0.192
0.488	0.914	0.469	0.716	0.798	0.853	0.931	0.436	0.428	0.187	0.161
0.345	0.814	0.412	0.633	0.710	0.773	0.844	0.391	0.377	0.159	0.135
0.244	0.678	0.338	0.520	0.591	0.647	0.714	0.324	0.311	0.132	0.111
0.173	0.499	0.245	0.376	0.435	0.472	0.534	0.235	0.225	0.103	0.086
0.122	0.350	0.170	0.258	0.305	0.327	0.381	0.162	0.156	0.078	0.065
0.086	0.208	0.100	0.151	0.181	0.191	0.230	0.095	0.092	0.050	0.042
	0.093	0.044	0.066	0.081	0.083	0.102	0.041	0.040	0.023	0.020

Station	Treatment	Textural Group Classification	Folk and Ward Description	Folk and Ward Sorting	Mean μ m	Mean ϕ i	Sorting Coefficient	Skewness	Kurtosis	Major Sediment Fractions		
										% Gravel	% Sand	% Mud
MAR02924.001	Sediment	(g)sM: Slightly Gravelly Sandy Mud	Coarse Silt	Very Poorly Sorted	23.722275	5.3976138	2.326391035	0.0736030	1.0383365	2.33%	24.38%	73.29%
MAR02924.002	Sediment	(g)mS: Slightly Gravelly Muddy Sand	Very Fine Sand	Very Poorly Sorted	91.033314	3.4574617	2.796866231	0.2221954	0.7935249	2.46%	57.06%	40.48%
MAR02924.003	Sediment	(g)sM: Slightly Gravelly Sandy Mud	Coarse Silt	Very Poorly Sorted	28.836248	5.1159727	2.133541199	0.1649923	0.9371385	0.64%	32.69%	66.67%
MAR02924.004	Sediment	(g)sM: Slightly Gravelly Sandy Mud	Coarse Silt	Very Poorly Sorted	26.075142	5.2611811	2.131674693	0.1830728	0.9355458	1.55%	28.94%	69.51%
MAR02924.005	Sediment	sM: Sandy Mud	Coarse Silt	Very Poorly Sorted	24.256950	5.3654580	2.162849796	0.1564045	0.9480426	0.00%	28.44%	71.56%
MAR02924.006	Sediment	(g)sM: Slightly Gravelly Sandy Mud	Coarse Silt	Very Poorly Sorted	24.369113	5.3588024	2.246058143	0.1659960	0.9782110	0.67%	28.38%	70.95%
MAR02924.007	Sediment	(g)mS: Slightly Gravelly Muddy Sand	Very Fine Sand	Very Poorly Sorted	87.447806	3.5154339	2.795487774	0.1566375	0.7986952	2.81%	57.09%	40.10%
MAR02924.008	Sediment	(g)mS: Slightly Gravelly Muddy Sand	Very Fine Sand	Very Poorly Sorted	79.749954	3.6483726	2.750935276	0.1202682	0.7961256	1.60%	55.61%	42.79%
MAR02924.009	Sediment	(g)mS: Slightly Gravelly Muddy Sand	Fine Sand	Poorly Sorted	193.268016	2.3713253	1.716891823	0.3552404	1.5746020	0.21%	84.49%	15.29%
MAR02924.010	Sediment	(g)mS: Slightly Gravelly Muddy Sand	Fine Sand	Poorly Sorted	198.147056	2.3353566	1.622507113	0.3688272	1.6716498	0.27%	85.71%	14.02%

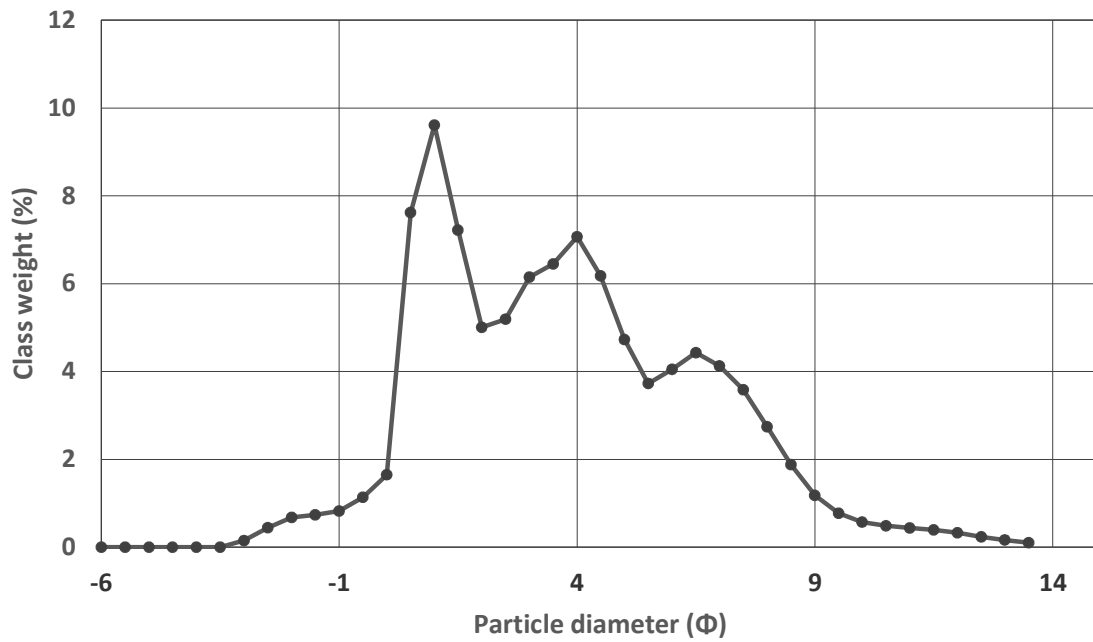
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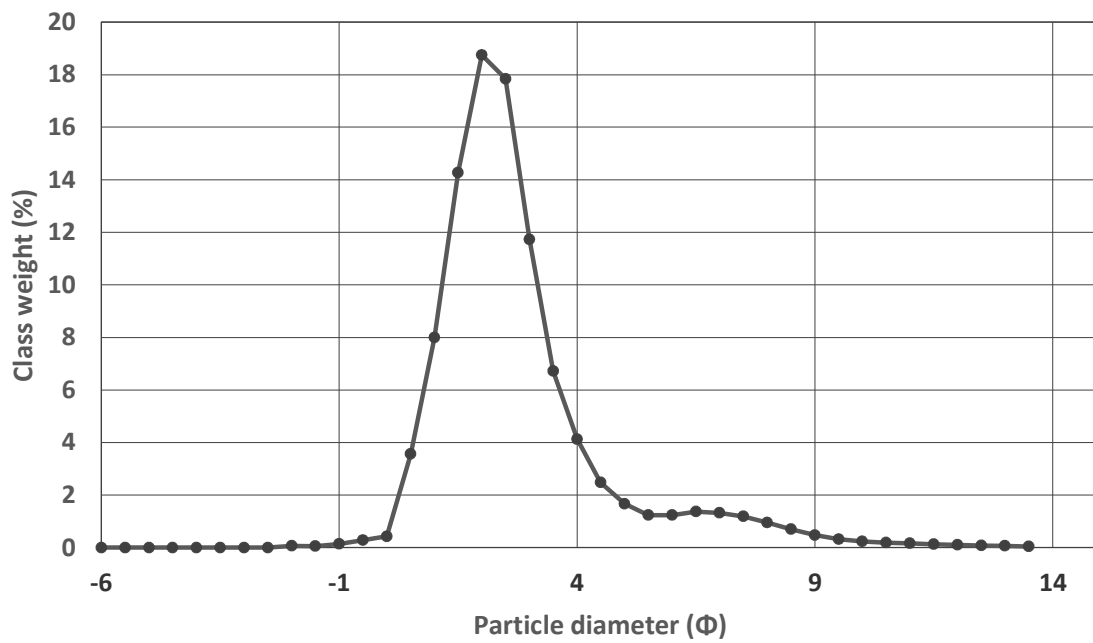
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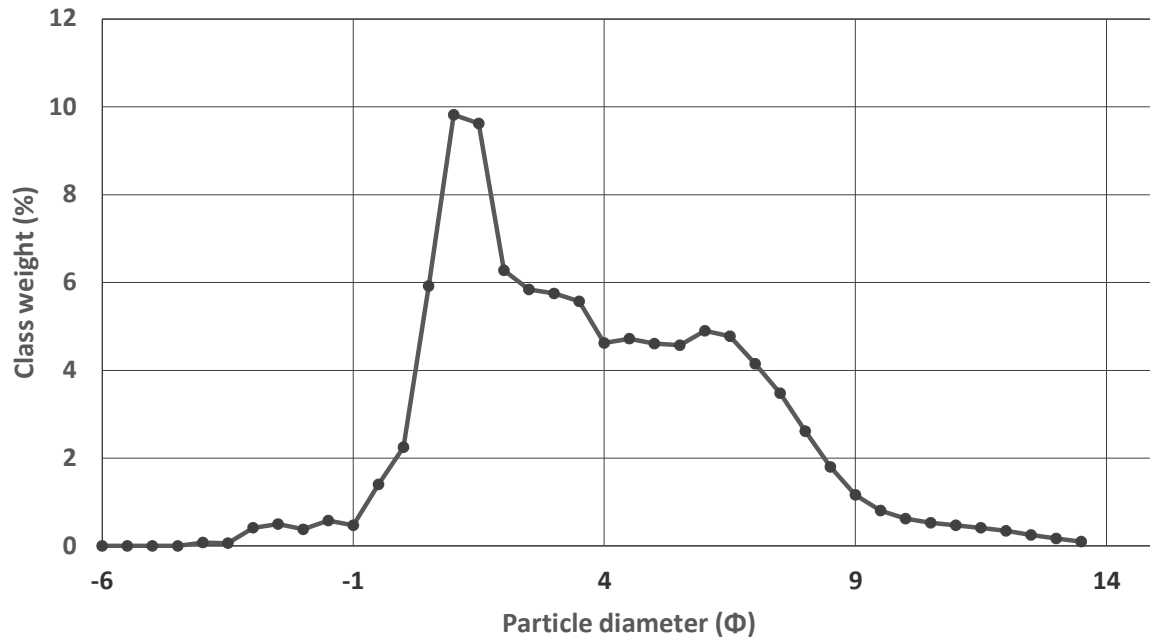
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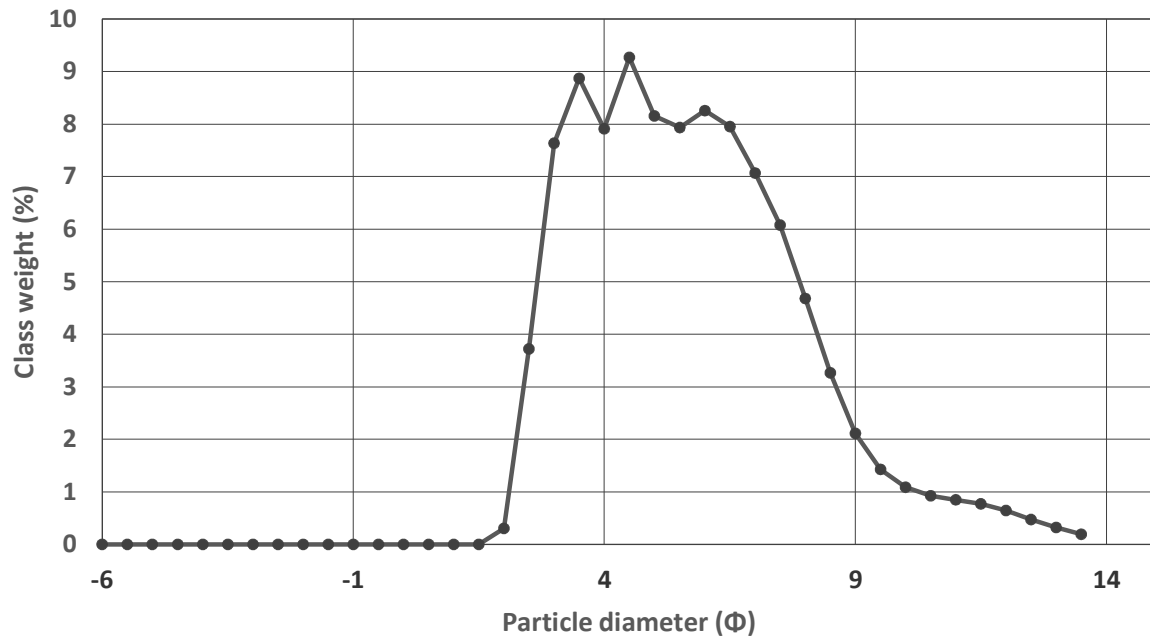
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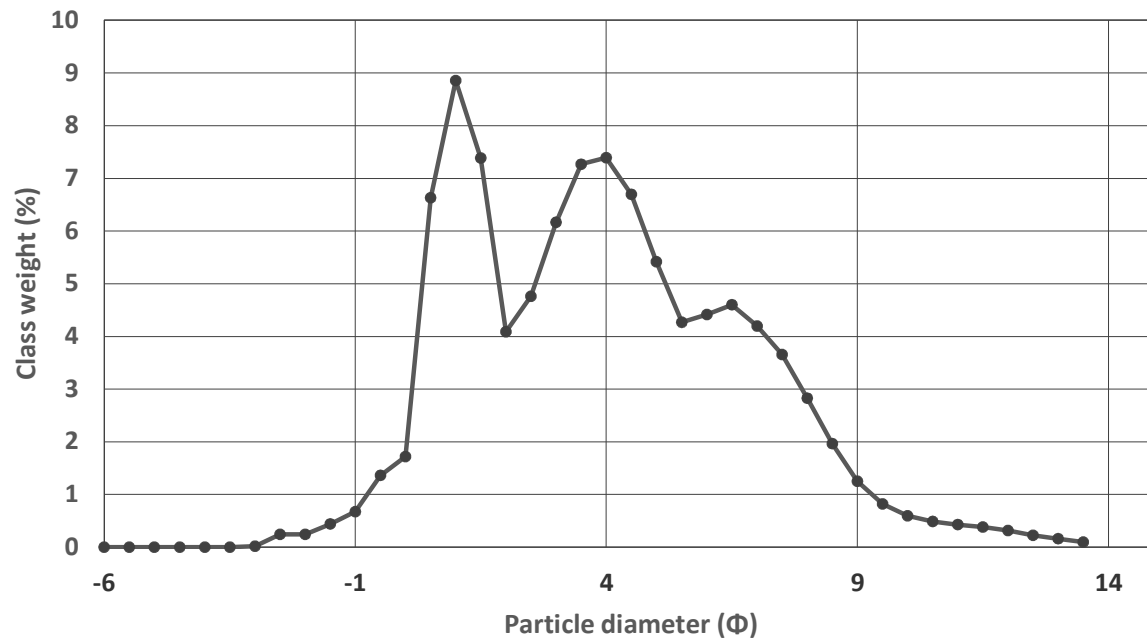
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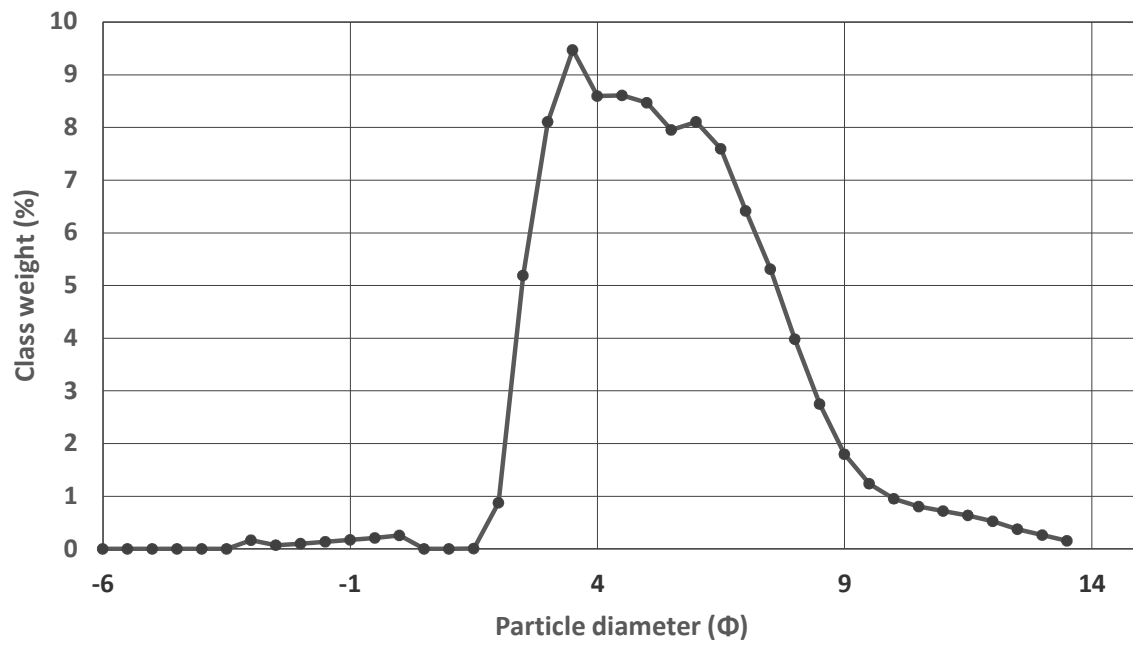
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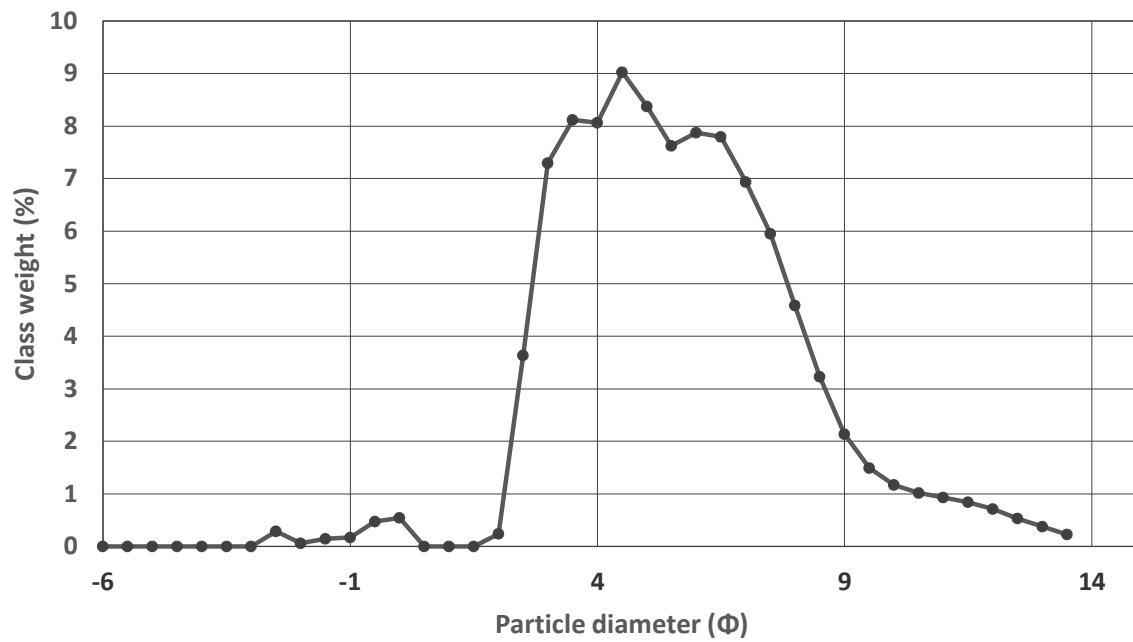
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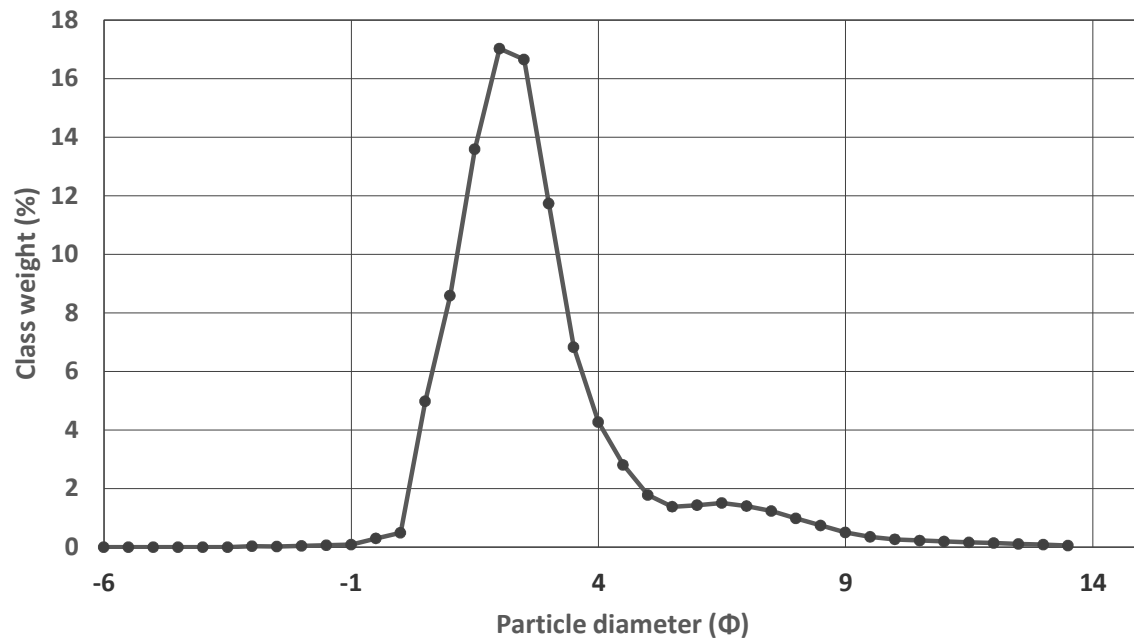
MAR02924.003



MAR02924.006



MAR02924.009



B SUMMARY TABLES

Summary Table A

Sampling Results Incorporated with BPEO Assessment (mg/kg)

						Kilkeel Inner Harbour																
	EAL1	EAL2	BAC	ERL	PEL	P01 - 0.0m (Sea Bed Level)	P01 - 0.0m - 0.4m	P02 - 0.0m (Sea Bed Level)	P02 - 0.0m - 0.4m	P03 - 0.0m (Sea Bed Level)	P03 - 0.0m- 0.4m	P04 - 0.0m (Sea Bed Level)	P04 - 0.0m - 0.4m	P05 - 0.0m (Sea Bed Level)	P05 - 0.0m - 0.4m	Max	AVERAGE	No. Exceed RAL 1	No. Exceed RAL 2	No.Exceed BAC?	No. Exceed ERL	No. Exceed PEL?
Source			CSEMP	CSEMP	Canada																	
Arsenic	20	100	25		41.6	6.8	6.5	7.3	9.4	8.1	10.1	9.6	9.2	4.9	3.4	10.1	7.53	0	0	0	N/A	0
Cadmium	0.4	5	0.31	1.2	4.2	0.25	0.26	0.32	0.41	0.19	0.27	0.24	0.22	0.09	0.06	0.41	0.23	1	0	2	0	0
Chromium	40	400	81	81	160	48	46.8	53.4	71.1	58.2	73.1	58.9	49.8	30.9	21.4	73.1	51.16	8	0	0	0	0
Copper	40	400	27	34	108	20.3	21	40.5	44.7	20.2	28.4	36.2	30.3	8.4	6.2	44.7	25.62	2	0	5	3	0
Mercury	0.3	3	0.07	0.15	0.7	0.02	0.01	0.01	0.02	0.01	0.01	0.05	0.01	0.01	0.01	0.05	0.02	0	0	0	0	0
Nickel	20	200	36	-	-	22.8	21.9	23.9	32.3	24.9	32.7	25.8	23.1	16	11.1	32.7	23.45	8	0	0	N/A	N/A
Lead	50	500	38	47	112	31	31.2	26.5	34.5	24.9	34.4	27.1	23.2	17	12.6	34.5	26.24	0	0	0	0	0
Zinc	130	800	122	150	271	91.2	92.5	145	172	86.7	112	91.7	81.6	35.8	32.2	172	94.07	2	0	2	1	0
THC	100		-	-	-	278	644	562	673	234	180	168	142	36.6	30.8	673	294.8	8	N/A	N/A	N/A	N/A
PCBs ICES7	0.01	-	-	-	0.189	0.00323	0.00202	0.00293	0.00267	0.00109	0.00106	0.00067	0.00069	0.0006	0.0006	0.00323	0.0016	0	0	N/A	N/A	0
DBT	0.1	1	-	-	-	0.005	0.005	0.005	0.005	0.005	0.005	0.026	0.017	0.001	0.001	0.026	0.0075	0	0	N/A	N/A	N/A
TBT	0.1	1	-	-	-	0.005	0.019	0.026	0.05	0.019	0.058	0.127	0.014	0.002	0.002	0.127	0.0322	1	0	N/A	N/A	N/A

Note: Underlined Values are <LOD. Values highlighted red are equal to or greater than EAL1.

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

Summary Table B

Kilkeel Inner Harbour Average Concentrations

All units in mg/kg

	AL1	AL2	BAC	<ERL	PEL	Dredge Average	Exceed AL1?	Exceed AL2?	Exceed BAC?	Exceed ERL ?	Exceed PEL?
Source			CSEMP	CSEMP	Canada						
Arsenic	20	100	25	-	41.6	7.5	No	No	No	N/A	No
Cadmium	0.4	5	0.31	1.2	4.2	0.23	No	No	No	No	No
Chromium	40	400	81	81	160	51.2	Yes	No	No	No	No
Copper	40	400	27	34	108	25.6	No	No	No	No	No
Mercury	0.3	3	0.07	0.15	0.7	0.0	No	No	No	No	No
Nickel	20	200	36	-	-	23.5	Yes	No	No	N/A	N/A
Lead	50	500	38	47	112	26.2	No	No	No	No	No
Zinc	130	800	122	150	271	94.1	No	No	No	No	No
					-						
THC	100	-	-	-	-	294.8	Yes	N/A	N/A	N/A	N/A
PCBs	0.01	-	-	-	0.189	0.002	No	No	N/A	N/A	No
DBT	0.1	1	-	-	-	0.008	No	No	N/A	N/A	N/A
TBT	0.1	1	-	-	-	0.032	No	No	N/A	N/A	N/A