Assessments of Impacts of the Maritime Usage (AIMU)

Haulbowline Dredging

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Haulbowline Dredging

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[1] Introduction

To facilitate the assessment of the potential impacts associated with the proposed maritime activities, all applicants must submit an AIMU (Assessment of Impact on Maritime Usage) report as part of their application for a maritime usage license. The extent and intricacy of the AIMU should align with the scale and complexity of the project at hand.

This report specifically focuses on analysing the anticipated positive and negative effects related to the maintenance dredging of the Haulbowline Basin. The project encompasses the maintenance dredging of the Haulbowline Basin, entrance channel and Graving Dock, with the non-contaminated dredge material being transported to a designated dump site south of Roches Point for disposal at sea. The contaminated material dredged from the site will be stored on-site to allow controlled dewatering and desalination before being loaded and transported to a licensed facility.

Following a pre-application meeting with the Maritime Area Regulatory Authority (MARA), it was clarified that only areas below the High-Water Mark (HWM) established by the Chief Boundary Surveyor (CBS) fall within MARA's official Maritime Areas authority.

The blue line represents the HWM boundary in Figure 2-2, indicating that only the entrance channel (Area A of 0.46 ha) and a specified section (Area B of 0.02 ha) of the Graving Dock are officially recognised as Maritime Areas.

Notably, the maintenance dredging activities within the harbour outside these designated areas are not within the scope of consideration for this application.

[2] Project Description

[2.1] Project Background

Haulbowline was originally used as a naval supply and dockyard by the Royal Navy in the 18th and 19th centuries. Extensive land reclamation occurred during the development of the naval docks. Haulbowline comprised two islands linked by a bridge until 1902 when the two islands were linked by infilling activity.

On review of previous Archaeological Reports undertaken for the proposed dredging works of the Naval base in Haulbowline, it is believed that the floor of the Basin was tiled during construction. However, the presence of the tiled Basin floor is unverified at this stage. If the tiled Basin floor is present, it is located below the proposed dredge depth and will not pose a risk to the proposed dredging activities. Table 2-1 below outlines the previous dredge levels within the Basin.

Table 2-1: Previous Dredge Levels Within the Basin (Source: Archaeological Report [1])

Year	Basin Depth (m CD)
1925	- 9.90
1950	-6.20 to -7.31
1979	-5.79 to -6.4
1980	-5.9 to -6.3
1988	-5.6 to -6.1
1991	-4.8 to -5.8
1992	-5.8 to -6.1
1994	-5.5 to -5.9
2003	-5.6 to -5.8
2011	-5.5 to -5.8
2017	-5.5 to -5.8

[2.2] Setting

Haulbowline is situated in an industrial and urbanised harbour setting in the lower part of Cork Harbour, with many industries, including commercial fishing activity, commercial shipping and leisure amenities occurring in the harbour. Haulbowline is overlooked by residential towns such as Cobh to the north and Ringaskiddy to the south. A site location map is presented in Figure 2-1.

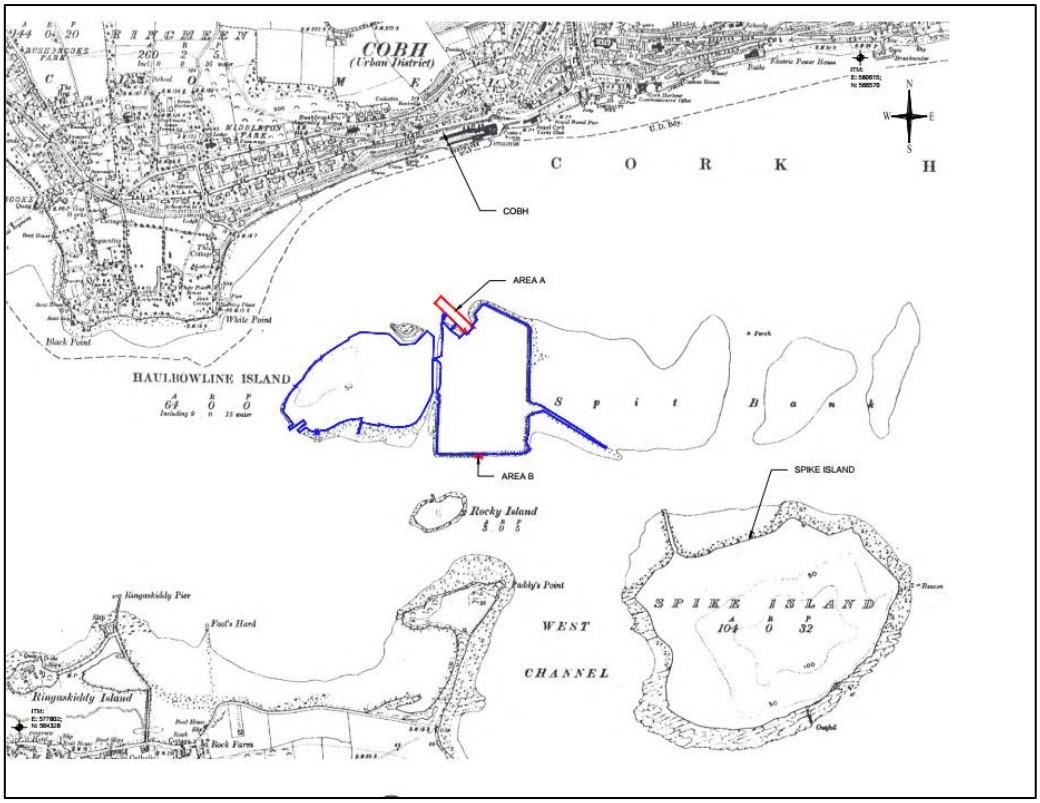

Figure 2-1: Haulbowline Site Location Map

[2.3] Proposed Work

The proposed maintenance dredge sites within the Maritime Area include the entrance channel (Area A) and the southern part of the Graving Dock (Area B), as identified in Figure 2-2 below.

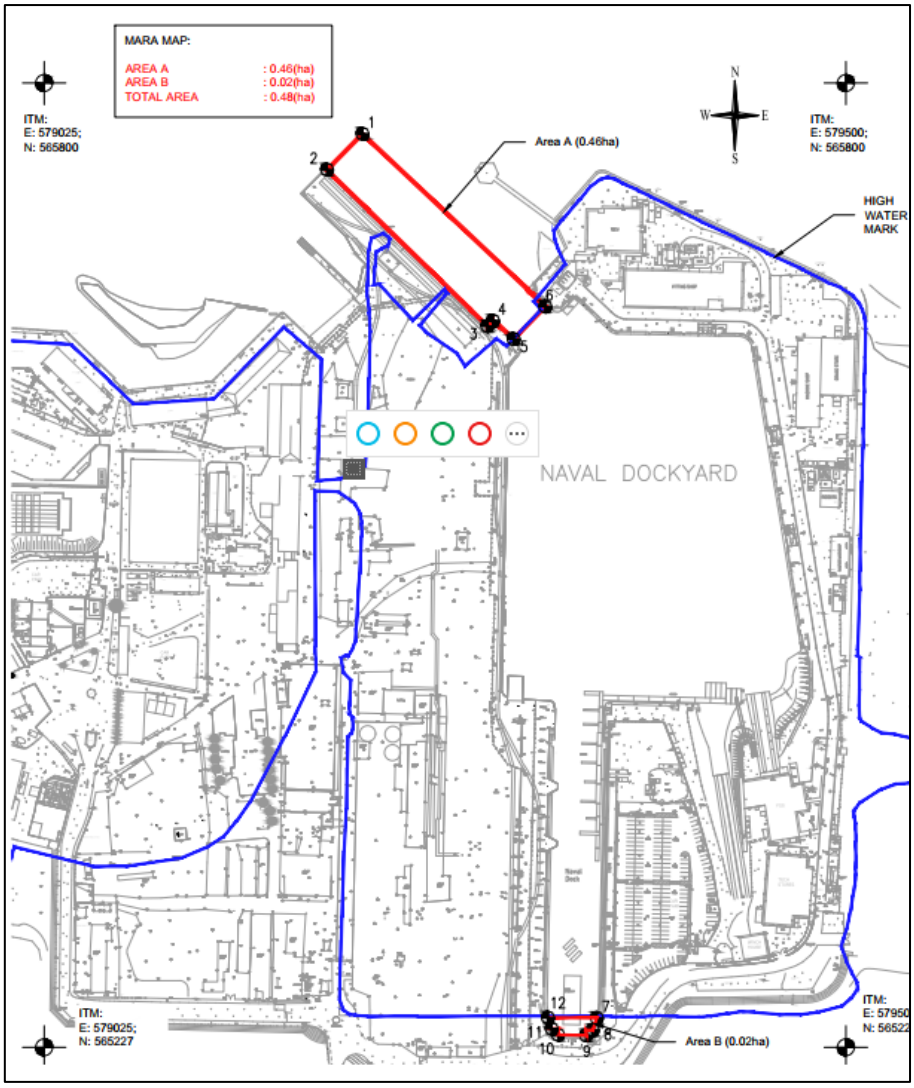

Figure 2-2: Haulbowline License Map

As indicated in Table 2-1, recent maintenance dredging campaigns of the Basin and entrance channel take place approximately every 5 to 8 years to ensure the safe navigation of the naval fleet in the Haulbowline Naval Base. Also, Dumping at Sea (DaS) applications for Haulbowline were submitted in 2009 (No. S050005-01) and 2016 (No. S0005-02), with corresponding permits granted in 2010 and 2017. A 2017 bathymetric survey (provided in the supplementary documents) demonstrates that the proposed work constitutes maintenance dredging to restore previous depths.

While the Graving Dock was flooded many years ago, it now hosts a small craft marina and the dismounted Graving Dock gate. Figure 2-3 shows the Graving Dock as a considerable structure that underwent extension in 1912. As part of the dredging initiative, the proposal is to dredge the Graving Dock to a depth of -5.5 m CD or the original Graving Dock floor, as depicted in Figure 2-3, selecting the lesser of the two depths. Given that the dredging operations aim to, at maximum, restore the Graving Dock to its designed depth, it is categorically classified as maintenance dredging.

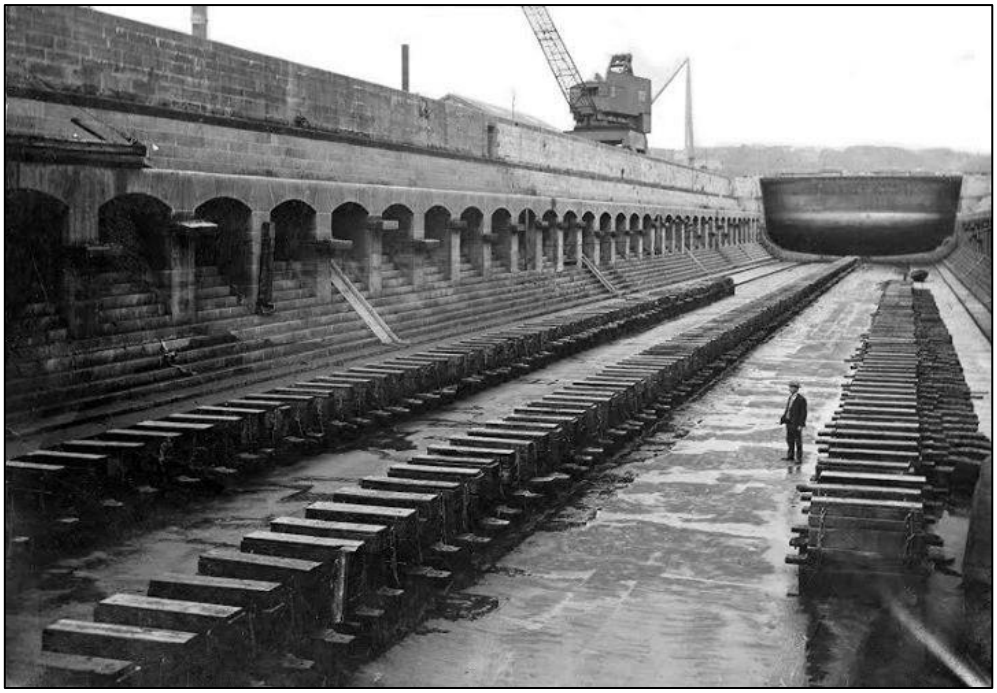

Figure 2-3: Image of Graving Dock in 1912 After It Was Extended

This re-establishment of the Graving Dock depth and removal of the marina currently operating in the Graving Dock will provide the harbour with two additional serviced berths for P60 Class vessels currently operating within the harbour.

Ayesa has been appointed as the engineering and environmental consulting specialist responsible for the Preliminary and Detailed Design stages of the proposed dredging activities as follows:

- Dredging is envisaged to be conducted using a backhoe dredger with an accompanying hopper barge.
- Entrance channel and Harbour Basin are to be dredged to -5.5 m CD.
- Dredging the Graving Dock to -5.5 m CD or the floor of the historical Graving Dock, whichever is first, as illustrated in Figure 2-3.
- Suitable dredge material (i.e. non-contaminated) will be loaded onto a hopper barge and taken to the dump site South of Power Head (Roche's Point). See Section [3.1] for more details.
- Disposal of contaminated dredged material to a licensed landfill facility.

[2.3.1] Dredging Methodology: Non-Contaminated Material

Mechanical dredging will be the primary method used for this project, selected based on the characteristics of the material and tidal accessibility. Two types of dredging equipment are being considered: a DOP dredge pump and a long-reach backhoe excavator (also known as a backhoe dredger). The final choice will depend on site-specific conditions, particularly the type of material to be dredged and ease of access.

These dredgers operate either by lowering a bucket or grab to the seabed to excavate material, or by using a DOP dredge pump to lift sediment to the surface. However, neither method includes the capability to transport the dredged material.

As such, hopper barges with a capacity of approximately 1,000 m³ will be used to collect and transport the dredged material to the licensed offshore disposal site.

[2.3.2] Dredging Methodology: Removal of Contaminated Material

This initial dredging campaign (No. 1) aims to restore the Graving Dock to its designed depth by removing all sedimentation material that has accumulated since its flooding many years ago, along with removing other contaminated material from the mouth of the harbour.

The preferred method for dredging the Graving Dock is the DOP dredge, which will allow contaminated material to be pumped directly into land-based geotubes for onward disposal at a landfill. For the DOP dredge pump option, a Sorensen Kobelco BM 800 crawler crane would lower the DOP 200 dredge pump, equipped with a water jet cutter, from the dockside into the water. The DOP would then pump material from the dock at a rate of 700 m³/hour at the anticipated working head (20 m).

[2.4] Project Programme

The DOD is seeking a Dumping at Sea Permit (DaS) and a Maritime Area Usage License (MUL) to be in effect from August 1, 2025, to December 31, 2032.

The Port of Cork's dredging program started in the second quarter of 2024 and is scheduled to end in the middle of the third quarter of 2024, with the anticipate maintenance campaigns roughly every three years. Additional capital dredging campaigns are being considered.

The Project Programme of the works that have commenced to date and key project timeframes are outlined in Table 2-2 below.

Table 2-2: Programme Estimate

Event	Timeframe
DaS Application Submission	June 2023
DAFM Foreshore Application Submission	June 2023
MARA MUL Pre-Application Meeting	November 2023
DAFM Foreshore Withdrawn/ MUL license Submission	May 2024
DaS Application Amendment Submission	May 2024
Receipt of the MUL license	Q3 2025
Dredging Campaign 1: Removal of Contaminated Material (pending date of MUL receipt)	Q3/Q4 2025
Receipt of Dumping at Sea License (18-24 months)	Q4 2025
Dredging Campaign 1: Removal of Non-Contaminated Material (pending date of DaS receipt)	Q1 2026
Dredging Campaign 2	Q4 2027
Dredging Campaign 3	Q3/Q4 2029
Dredging Campaign 4	Q3/Q4 2032
***To avoid the impact of cumulative effects, it is agreed with the Port of Cork that no dredging or supplementary dumping activities will occur from the Haulbowline site while maintenance or capital dredging is underway for the Port of Cork.**	

[2.5] Estimated Volumes to be Dredged

The total volume of material dredged across the **entire site** over the licence timeframe from the 1st August 2025 to 31st December 2032 inclusive of approximately **105,6300m³**.

This total dredge volume is categorised into two material types:

- Non-contaminated material: 90,000 m³, which will be disposed of at the designated offshore dump site.
- Contaminated material: 15,630 m³, which will be disposed of on land in accordance with applicable regulations.

As outlined in Table 2-2 maintenance dredging is planned to take place over four separate campaigns, with the initial campaign (No.1) accounting for the largest volume and is divided into two distinct phases:

- Dredging of contaminated material (see Section [2.3.1])
- Dredging of non-contaminated material (see Section [2.3.2])

Table 2-3 below indicates the total volume of dredge material per campaign within each of the officially designated Maritime Areas (A and B) and therefore comes under the jurisdiction of MARA.

Table 2-3: Quantity of Dredge Material

Description	Dredge Volume (m³)			
	Non-Contaminated Material		Contaminated Material	Total
	Area A	Area B	Area B	Area A + Area B
Dredging Campaign 1	1,280	-	1,560	2,840
Dredging Campaign 2	920	150	-	1,070
Dredging Campaign 3	920	150	-	1,070
Dredging Campaign 4	920	150	-	1,070
Total	**4,040**	**450**	**1,580**	**6,050**

[2.6] Drawings

The following drawings illustrate the nature and extent of the works and are enclosed in Appendix A;

Table 2-4: Application Drawings

Drawing No.	Drawing Title
CM1265-BLA-XX-DR-C-05000	Site Location Map
CM1265-BLA-XX-DR-C-05001	License Map
CM1265-BLA-XX-DR-C-05002	Admiralty Chart – License Area
CM1265-BLA-XX-DR-C-05003	Admiralty Chart – Dump Site

CM1265-BLA-XX-DR-C-05004	Existing Bathymetry
CM1265-BLA-XX-DR-C-05005	Post Dredging Arrangement
CM1265-BLA-XX-DR-C-05005	Disposal Site Location

[3] Need and Alternatives

Based on the comprehensive analysis of historic bathymetric survey data conducted within the Haulbowline Naval Base approach channel and Basin between 2019 and 2024, it has been observed a consistent increase in the seabed level at an approximate sedimentation rate of approximately 200 mm per year. Extrapolating this sedimentation trend, we have projected the following seabed levels over the coming years:

Table 3-1: Projected Basin Bed Levels

Date	Seabed Level*
January 2024	c. -4.60 m CD to -4.90 m CD
January 2025	c. -4.40 m CD to -4.70 m CD
January 2026	c. -4.20m CD to -4.50 m CD

*Based on selected points in the Haulbowline Naval Basin and Approach Channel

It's important to emphasise that should the seabed level rise to -4.5 meters CD or above, specific naval vessels within the Basin would encounter inadequate under-keel clearance during the Lowest Astronomical Tide (LAT). This insufficient clearance presents a notable risk of damage and accessibility issues while navigating within the harbour, potentially restricting entry into the Basin for these vessels. Such restrained manoeuvring conditions would compromise the operational effectiveness of the Naval base, which is of paramount importance given the national strategic significance of the Basin.

As indicated in Table 2-1, maintenance dredging of the Basin and entrance channel takes place approximately every 5 to 6 years to ensure the safe navigation of the naval fleet in the Haulbowline Naval Base.

An 8-year DaS permit aligned with a MUL for the same period for a maintenance dredge would eliminate repeated licensing procedures, reduce administrative overhead, and ensure long-term maintenance planning without disruptions.

[3.1] Material Analysis

The physical characteristics of the dredged material are important indicators of its engineering properties and potential environmental impacts. The Marine Institute (MI) was consulted about the environmental sampling and provided Ayesa with a Sampling and Analysis Plan (SAP).

[3.1.1] Marine Institute Requirements

The Marine Institute recommended that 18 No. samples be obtained, some at depth below the existing seabed, to cover and outline any problem areas adequately. The SAP specified the location and appropriate parameters which should be tested.

[3.1.2] Laboratory Results

Sediment sampling was conducted by Priority Geotechnical Limited (PGL) on the 19th of January 2022. Laboratory tests were completed by the 28th of February, 2022. The site investigation included the following:

- Soil Profile – SPT Testing and core extraction,
- Contamination Sampling – according to the SAP provided by the MI,
- Radiological sampling – according to guidelines provided by EPA.

The sediment analysis results are enclosed in Appendix C.

[3.1.3] Marine Institute Guidelines

The Marine Institute provides guidelines to assess the ecological risks associated with dredging and disposal at sea [2]. The guideline provides threshold levels for lower and upper levels of sediment contaminations, according to which the sediments are categorised:

- Class 1: Contamination concentration below the lower guidance limit is considered uncontaminated;
- Class 2: Concentration between the lower and upper limits are considered marginally contaminated, and additional sampling and testing may be required and
- Class 3: Contamination values above the upper guidance level are considered heavily contaminated and likely to cause biological effects/toxicity to marine organisms. Alternative management options should be considered.

The chemicals that are the most detrimental to the aquatic environment are those that are persistent, toxic and bio-accumulate in the food chain and include [3]:

1. Heavy metals (e.g., mercury, lead, arsenic, zinc, cadmium)
2. Organotin compounds (e.g., Tri-Butyl Tin [TBT], Di-Butyl Tin [DBT])
3. Polychlorinated Biphenyls – PCBs (e.g., paints, plastics, adhesives)
4. Polycyclic Aromatic Hydrocarbons – PAHs (e.g., Oils, diesel, hydraulic fluid)

The chemical characteristics of the sediments were assessed according to the 'Guidelines for the Assessment of Dredge Material for Disposal in Irish Water' [2]. A summary of the sediment chemistry analysis is provided in Table 3-2.

The assessment reveals that all samples are classified as Class 2 contamination, except 2 samples classified as Class 3 contamination. The location of the samples and contamination Class is illustrated in Figure 3-1.

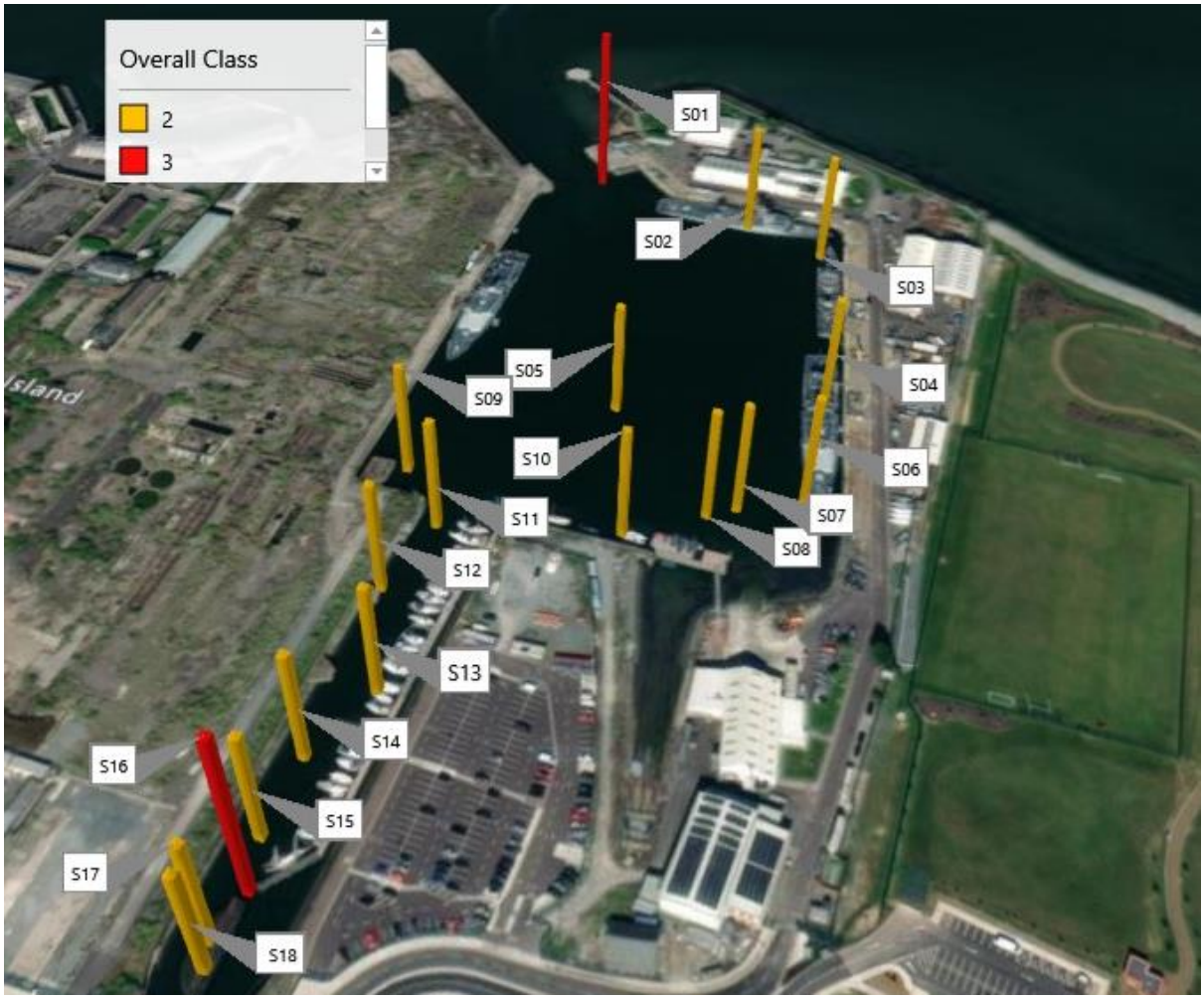

Figure 3-1: Sample Location and Contamination Class (2021 Sampling and Testing Campaign)

Table 3-2: Summary of Sediment Chemistry Analysis (2021 Sampling and Testing Campaign)

Parameter	Units (Dry wt)	Low Level	Upper Level[b]	Results																	
Customer Sample No				S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18
Depth				Surface						1 m	2 m	Surface				2 m	Surface	1.5 m	3 m	1 m	Surface
Arsenic	mg kg^{-1}	9[c]	70*	14.8	14.5	2.6	13.7	14.3	12.6	14.7	13.3	13.4	11.9	13.9	13.4	14	17.3	15.6	36	15.8	13.2
Cadmium	mgkg^{-1}	0.7	4.2	0.7	0.3	0.2	0.2	0.4	0.16	0.3	0.4	0.18	0.2	0.3	0.17	0.9	0.6	0.4	0.6	0.2	0.2
Chromium	mgkg^{-1}	120	370	81.9	81.4	47.7	76.6	82.6	76.9	92.3	97.1	77	73.6	82	83.5	82.5	94.5	96.9	83.9	81.8	83.8
Copper	mgkg^{-1}	40	110[d]	42.9	41.5	28.9	34.6	41.1	28.7	34	58.3	28.9	31.7	37.4	28.7	61	52.6	53.5	103	40.8	37.7
Lead	mgkg^{-1}	60	218	122	45.9	34	44.6	66.2	38.8	72.4	97	37.2	38.8	54	38.1	87.6	93.4	78.5	418	61.3	41.6
Mercury	mgkg^{-1}	0.2	0.7	0.29	0.09	0.08	0.08	0.12	0.08	0.16	0.16	0.08	0.09	0.13	0.08	0.16	0.18	0.23	1.91	0.12	0.08
Nickel	mgkg^{-1}	21	60	31.4	31.8	26.2	32.2	33.9	30.9	34.2	36.3	30.5	29.9	32	33.9	31.8	37.1	34.9	52.9	33.3	32.9
Zinc	mg kg^{-1}	160	410	290	148	132	166	208	78.2	200	330	129	145	192	136	220	299	251	364	174	150
Σ TBT & DBT	mg kg^{-1}	0.1	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0487	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0571	<0.01	<0.01	<0.01
γ - HCH (Lindane)	µg kg^{-1}	0.3	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.11	<0.1	<0.1	<0.1
HCB	µg kg^{-1}	0.3	1	0.61	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
PCB 028	µg kg^{-1}	1	180b	1.56	0.22	0.24	0.21	1.49	0.23	1.03	3.44	0.24	0.51	1.32	0.21	4.18	1.81	4.11	0.69	0.31	0.26
PCB 052	µg kg^{-1}	1	180b	3.93	0.27	0.25	0.21	1.92	0.21	2.94	4.25	0.22	0.47	1.54	0.23	4.49	3.51	5.15	1.16	0.34	0.27
PCB 101	µg kg^{-1}	1	180b	3.13	0.36	0.44	0.32	1.74	0.19	1.69	3.72	0.24	0.5	1.42	0.31	3.06	3.29	5.3	1.23	0.36	0.36
PCB 138	µg kg^{-1}	1	180b	2.57	0.2	0.36	0.27	1.42	0.26	0.7	3.16	0.24	0.45	1.09	0.31	1.67	2.49	3.94	1.11	0.28	0.41
PCB 153	µg kg^{-1}	1	180b	3.42	0.34	0.42	0.36	1.2	0.3	1.41	2.55	0.28	0.45	1.32	0.26	2.41	3.79	4.05	1.48	0.38	0.62
PCB 180	µg kg^{-1}	1	180b	1.03	0.13	0.05	0.12	0.4	0.04	0.33	0.93	0.12	0.13	0.25	0.02	0.79	1.04	1.29	0.48	0.11	0.12
PCB 118	µg kg^{-1}	1	180b	3.04	0.29	0.03	0.29	1.92	0.28	1.56	4.77	0.3	0.71	1.73	0.68	3.77	3.47	5.35	1.52	0.46	0.44
PCB (Σ ICES 7)	µg kg^{-1}	7	1260	18.7	1.8	1.8	1.8	10.1	1.5	9.6	22.8	1.6	3.2	8.6	2.0	20.3	19.4	29.1	7.6	2.2	2.4
PAH (Σ 16)	µg kg^{-1}	4000		4745	426	511	533	1091	989	2713	1204	534	759	680	1955	820	2173	1399	2513	529	551
Total Extract Hydrocarbons	g kg^{-1}	1		0.50	0.22	0.12	0.15	0.20	0.14	0.37	0.62	0.21	0.18	0.25	0.21	0.22	0.82	0.58	0.67	0.24	0.19
Waste Classification (Class)				3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2

[a] total sediment <2mm

[b] ERM (rounded up)

[c] ERL (rounded up) - No background Irish data available

[d] PEL as ERM considered high

* In some locations, natural levels of arsenic will exceed this value, and in such instances, this guidance value will not be appropriate

Class 1: Green < Lower Level

Class 2: Lower level < Orange < Upper Level

Class 3: Red = > Upper Level

[3.1.4] WAC and Rilta Suite Tests

Additional sampling and waste characterisation are essential to determine the precise classification of contaminated materials using Waste Acceptance Criteria (WAC) and RILTA suites within the Graving Dock and at the harbour entrance. This characterisation will dictate the appropriate disposal protocols to ensure full compliance with environmental regulations. Samples will be taken from the Graving Dock and outside of Area B to characterise the entirety of the Graving Dock, including Area B.

A qualified Site Investigation Contractor will execute the sampling and analysis processes. The resulting data will inform the selection of a suitable licensed landfill facility, guaranteeing safe and responsible disposal.

Early engagement with potential waste disposal facilities will ensure capacity alignment and streamline the disposal process once all necessary consents are obtained and a Contractor is appointed. This proactive approach will also mitigate any potential delays stemming from facility-specific limitations.

[3.2] Disposal of Non-Contaminated Materials

The disposal of uncontaminated dredged material at sea in Ireland is regulated by the Environmental Protection Agency (EPA) under the Dumping at Sea Acts 1996 to 2010. These Acts recognise the potential beneficial uses of dredged material. Permission to dump at sea is only granted if the EPA and the Oslo and Paris Conventions (OSPAR) requirements for reuse of materials are satisfied. There are no suitable alternative means of land-based disposal, treatment, or reuse of the material.

If concentrations of contaminants exceed the upper limit levels, the dredged material will likely require some degree of treatment before it can be beneficially used [3]. Sediments classified as Class 2 contamination will require further consideration to determine their suitability for beneficial reuse. Class 1 sediments, having no contaminates with a concentration exceeding the lower limit, can be considered acceptable for beneficial reuse.

While it is important to consider potential reuses, these should be limited within a reasonable distance from the dredge site due to the high cost of material transportation.

The Roches Point dumpsite, located south of the Power Head, is proposed to be used for this dredge campaign. This well-established dump site has been in use since 1978 and serves as the primary disposal site for dredging spoil near Cork Harbour. The dump site lies at least 3.7 km outside of the jurisdiction of the Port of Cork Authority, see Figure 3-2. The seabed is between 25 m and 50 m below the chart datum.

The Port of Cork has permitted Cork County Council to use several surveys carried out on the dump site over the recent years. The most up-to-date of these reports indicates that the site's condition has not undergone any significant changes in terms of siltation since 1999.

Figure 3-2: Location Map of Proposed Dump Site (Roches Point)

[3.2.1] Alternatives to Dumping as Sea

Table 3-3 summarises all the alternatives and their suitability for the project. The following alternatives were identified for further assessment:

- Engineering use:
  1. Land reclamation
  2. Landfill cover
- Environmental Enhancements
  3. Fill for abandoned mines/quarries.
- Agricultural / Product uses.
  4. Concrete Manufacturing
  5. Manufactured topsoil
  6. Production of ceramics/bricks

Table 3-3 below outlines the potential beneficial reuse of the dredged material.

Table 3-3: Review of Beneficial Reuse of Dredged Material

Category of Beneficial Use	Type of Beneficial Use	Dredge Material Characteristics: Contaminated Material	Saltwater	Silt – Soft Clay	Comments
Engineering Uses	Beach Nourishment	US	S	US	Not suitable – due to low structural strength and contamination - will not be considered further.
	Land Reclamation	PS	S	PS	Partially suitable – Most of the soil dredged from Haulbowline will be soft, organic, sandy silt. This material typically exhibits low-strength properties and will take a long time to consolidate. Although this material can be used for land reclamation, it is not ideal. The use of the reclaimed land constructed with this material will be limited to low-stress activities, such as recreational areas (e.g. parks). No land reclamation project (known to Ayesa) is planned within a feasible distance from the dredging operation that will benefit from this alternative. Although this alternative is technically viable, it is limited by the factors above. Therefore, this alternative is dismissed as not feasible.
	Landfill Cover	PS	S	S	Partially suitable – Dredge material can be used as a daily, intermediate, or final capping layer for a landfill. The final capping layer typically needs to support vegetation or the closure plan of the landfill. As the name suggests, a daily capping layer is applied daily to encapsulate the new waste that has been dumped. The purpose of this layer is to control nuisances (e.g. flies, birds, rodents), minimise the emission of gasses and odours and prevent waste from being blown away by the wind. The material required for a daily capping layer is less stringent than a final capping layer. It is envisioned that the dredged material from this project will not be adequate for use as an intermediate or final capping layer. However, it may be suitable as a daily capping layer. Dredged material will need to be dewatered and possibly desalinated before being used. The dredged material will then be transported via trucks to the landfill site, but due to the volume of material is considered unfeasible and not recommended. Furthermore, the Landfill Directive advises reducing reliance on landfills; disposal is one of its key priorities. Considering this and the complexity of transportation, this is not an attractive option. This alternative may be viable for material not dumped at sea due to contamination restraints and must be disposed of in a landfill.
	Offshore Berm Creation	US	S	S	Not suitable without pre-treatment – will not be considered further

Environmental Enhancement	Coastal Protection	S	S	US	Not suitable – due to low structural strength - will not be considered further.
	Wetland Habitat Creation	US	S	PS	Not suitable without pre-treatment – will not be considered further
	Sediment Cell Maintenance	US	S	US	Not suitable – due to low structural strength - will not be considered further.
	Fill for Abandoned Mines	S	S	PS	Partially suitable – Backfilling abandoned mines/ quarries can be a viable alternative with a suitable site near the proposed works. Although there is an abandoned quarry near the dredging site, the material will most probably need desalination treatment before disposal. This approach will also require extensive planning, permission and approval from the landowner and relevant regulatory bodies. The dredged material will then be transported via trucks to the dump site, but due to the volume of material is considered unfeasible and not recommended.
Agricultural / Product use	Upland Habitat Restoration	US	U S	S	Not suitable without pre-treatment – will not be considered further
	Concrete Manufacture	PS	P S	S	Partially suitable – Dredged material can be supplied to concrete manufacturers as an alternate aggregate raw material. Pilot studies have shown that fine-grained dredge material can be used as a raw material in manufacturing ordinary concrete, lightweight concrete, and self-consolidating concrete. Coarse-grained dredged material is the most suitable as a direct replacement for aggregates. It should be clean, hard, durable, and derived from a proven quality and consistency source. Fined-grained dredged material must undergo extensive physical and chemical characterisation before it can be deemed suitable for manufacturing concrete. This alternative is not recommended since there is no concrete batch plant near the side.
	Road Sub-Base Construction	S	U S	PS	Not suitable without desalination treatment – will not be considered further.
	Landfill Liner	PS	S	US	Not suitable – due to low structural strength - will not be considered further.
	Manufactured Topsoil	PS	S	S	Not suitable without desalination treatment – will not be considered further.
	Production of Ceramic / Bricks	S	S	US	Partially suitable – will be considered further

*S – Suitable US – Unsuitable PS – Partially suitable

After considering the environmental, technical, and practical aspects, no viable alternatives to sea dumping were found to dispose of uncontaminated dredge material. Therefore, it is proposed that sea dumping is the most practical and financially viable disposal method.

[3.3] Disposal of Contaminated Materials

Highly contaminated material will be excluded from the DaS application. The entire Graving Dock and a portion of the northern end of the Basin form part of the exclusion zone. Contaminated material will be disposed of in a licensed landfill facility.

As shown in Table 2-2, dredging the Graving Dock will be managed as an early works contract. Works will include dredging with the Dock sealed to prevent basin contamination, negating the need for external mitigation.

[3.3.1] Alternatives to Disposal of Contaminated Materials

The potential approaches for managing the highly contaminated material within the exclusion zone are as follows:

- Leave all contaminated material in the exclusion zone within the Graving Dock: This option is not advisable, as it fails to address the ongoing issue of contaminated dredge material at Haulbowline, which the EPA has urged to be resolved.
- Dispose of the material in a suitable landfill facility within Ireland: This option is recommended as it presents a practical solution. However, further testing is required due to the level of contamination.
- Dispose of the material in a suitable landfill facility abroad: This option is not recommended due to its high cost, complexity, and potential environmental impacts.
- Over-dredge Basin and Disposal of the contaminated material in the Basin: This option is also not recommended due to its complexity. Uncertainties exist regarding the bed material, structural implications, potential impacts on naval fleet operations, and associated costs.

Considering the outlined options, the most viable solution for disposing of the contaminated material appears to be Option 2: Disposal to a landfill within Ireland.

[4] Planning & Development

[4.1] Historical Foreshore Licenses

Previous dredge licences at the Haulbowline Naval Base were undertaken under Section 10 of the Foreshore Act, which suggests that the Department of Defence owns the foreshore. The following are the known relevant foreshore licences at the site:

- Foreshore licence application for maintenance dredging and the disposal of dredge spoil at sea (FS006564).

[4.2] Historical Dumping at Sea Permits

Previous DaS applications for Haulbowline were done in 2009 and 2016, and a DaS permit was granted in 2010 and 2017.

- In 2009: DaS Application (No. S050005-01)
- In 2016: DaS Application (No. S0005-02)

[4.3] Maritime Area Planning Act 2021 Schedule 7

After engaging in correspondence with MARA following the pre-application meeting, it was clarified that only the areas presented in red in Figure 4-1 are officially designated as Maritime Areas and fall under the jurisdiction of MARA. The remaining portions of the harbour are situated above the High Water Mark (HWM) established by the Chief Boundary Surveyor (CBS) and, as such, are not subject to consideration in the scope of this application. Correspondence information is provided in the supporting documents.

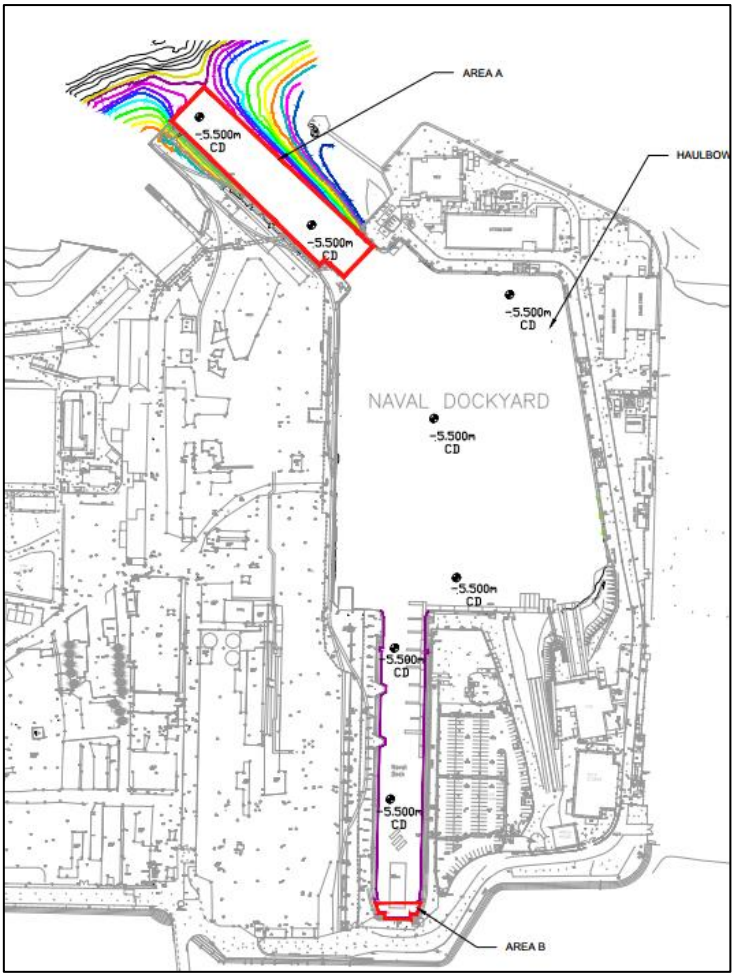

Figure 4-1: Schedule 7 Maintenance Dredging Area

[4.4] Dumping at Sea (DaS) Licence

A DaS permit application was submitted and acknowledged on the 7th of July, 2023 and is currently under review with the EPA for offshore disposal/dumping of non-contaminated dredged material (refer to license application no. S0005-03.)

[4.5] Planning Exemption

Concerning the Planning and Development Legislation concerning Defence Forces' facilities, planning permission is not Required.

Concerning the Planning and Development Legislation with respect to Defence Forces' facilities, please see the following planning regulation extracts identifying exemption from planning permission:

1. Section 181 of the Planning and Development Act, 2000. This section provides the authority to the Minister for the Environment and Local Government (as the office was

titled at the time) to make Regulations exempting or certain types of developments from the general requirements of the Act or adapting the requirements for them.

2. Part 9, Regulation 86 of the Planning and Development Regulations of 2001, provides the details of the Planning Act exemptions applicable to DF facilities.

    a. 86(1)(a)(iv) provides the exemption from the Act's provisions for:

Barracks or other buildings, or other premises or installations (including airfields and naval yards), or other structures or facilities used for the purposes of or in connection with the operations of the Defence Forces

    b. 86(1)(b)(i) and (ii) provide for the application of the exemption to extensions to both buildings and facilities covered in 86(1)(a)(iv):

(b) (i) development consisting of the provision of an extension of any building referred to in paragraph (a), where such extension will be situated, in whole or in part, outside the curtilage of the existing building or where the building is situated within a premises or other installation referred to in the said paragraph, outside the curtilage of the premises or other installation,

(ii) development consisting of the provision of an extension of a premises or other installation, other than a building, referred to in paragraph (a) which will extend the premises or other installation beyond the curtilage of the existing premises or other installation;

    c. 86(1)(d) allows an exemption for developments adjoining a Defence Forces facility where the development is incidental to the use of the facility

development consisting of the carrying out of any works within, or bounding, the curtilage of a building, premises or other installation referred to in paragraph (a), insofar as the works are incidental to the use of such building, premises, or installation;

The relevant exemption from planning permission is outlined within the planning regulation extract. This extract can be found in the supplementary documentation.

[4.6] National Marine Planning Framework (NMPF)

The proposed dredging works are essential to allow the Haulbowline Naval Base to remain operational and provide additional berthing capacity for P60 vessels operating within the harbour. These works align with the key objectives of the Ports, Harbours, and Shipping Chapter 18 of the NMPF as follows:

- Safeguard the operation of ports as key actors in the economic well-being of the State through the provision of safe and sustainable maritime transport;
- Facilitate a competitive and effective market for maritime transport services;

- Sustainable development of the ports sector and full realisation of the National Ports Policy to provide adequate capacity to meet present and future demand and to adapt to the consequences of climate change;

A detailed breakdown of alignment with Chapter 18 policies is enclosed in Appendix B.

This maintenance dredging will allow the Naval Service to maintain more vessels in the harbour, which will enable the Department of Defence to fulfil its functions assigned by the Government and better contribute to national and international peace and security, which is the main objective of Chapter 10 “Defence and Security” of the NMPF.

The alignment of the proposed work in combination with the mitigation factors detailed in [5.17], the environmental assessments and considerations outlined in [5.18] confirmed that there are no potentially significant impacts, and the proposed work is fully compliant with the overall objectives of the NMPF and contributes to its policies and objectives.

[5] Assessment of Impacts

[5.1] Overview

The following documents, also submitted in support of this Licence Application, provide a description of the known receiving environment for the Application Area, identify the potential environmental impacts of the proposed site investigation activities, and assess the possible effects of these impacts on the receiving environment:

- Supporting Information for Screening of Appropriate Assessment (SISAA)
- Risk Assessment for Annex IV Species (RAAIVS)

[5.2] Land & Soils

There is no potential impact on land and soil due to the proposed maintenance dredging.

[5.3] Water

All vessels involved in these activities carry fuel, along with lubricants, while any other potentially harmful substances are kept in limited quantities and securely stored in purpose-made containers or facilities. It is important to note that there will be no intentional release of harmful substances from the vessels. Adherence to strict maritime regulations, standard vessel operating procedures, and compliance with International Maritime Law and National Maritime Legislation will minimise the risk of any release, ensuring a low potential for significant environmental effects.

Furthermore, all vessels utilised in the dredging operation are MARPOL compliant and fully certified by the Maritime Safety Office, following the MARPOL 73/78 Convention, which mandates the requirement of a Shipboard Marine Pollution Emergency Plan.

As part of the works requirements, the appointed Contractor shall collaborate with the Port of Cork Harbour master to develop a Pollution Response Plan, ensuring coordinated procedures in the event of a pollution incident.

Considering these measures and compliance standards, the likelihood of a pollution event, accidental or otherwise, that could impact the environment is deemed low. Additionally, the dredging activities align with the Water Framework Directive (WFD) objectives, and there is no anticipation of long-term deterioration in the designated water body.

[5.4] Biodiversity

Past dredging and ongoing vessel operations have heavily modified the benthic environment within the dredging area of the Basin. The Basin is not a natural structure, constructed using land reclamation in the late 1800s. The benthic material within the Basin is a mixture of soft, slightly sandy silt and slightly sandy, slightly gravelly clay. A localised gravel deposit can be found at the entrance to the Graving Dock [4]. Existing information from the INFOMAR seabed

and sediment classification data portal[1] indicates that the substrata of the dumpsite are predominantly rock, with areas of mud to muddy sand, sand and coarse sediment. The area is an existing dumpsite which has been used on several occasions in the past, both by the Port of Cork and by the applicant for this project.

The Basin is not regularly visited by marine mammals. More than 25 species of cetaceans have been recorded in Irish waters [5], with seven of these commonly sighted within the Cork Harbour area and at the proposed dumpsite located south of Roches Point (harbour porpoise *Phocena phocoena*, common dolphin *Delphinus delphis*, bottlenose dolphin *Tursiops truncatus*, Risso's dolphin *Grampus griseus*, minke whale *Balaenoptera acutorostrata*, fin whale *Balaenoptera physalus*, and humpback whale *Megaptera novaeangliae*) [6]. A number of other cetacean species are infrequently recorded in the area (further details are provided in the Annex IV assessment submitted with this AIMU).

Grey seal *Halichoerus grypus* is the most frequently observed marine mammal species at the dredging site and harbour porpoise and common dolphin are the most frequently observed at the disposal site. No breeding or moulting sites for grey or harbour seals occur in Cork Harbour. A Marine Mammal Risk Assessment for dredging at the Haulbowline site [7] listed three common grey seal haul-outs around the Licence Application Area, these are situated on the south of Haulbowline island itself, and on Rocky Island but no haul-out sites for harbour seal *Phoca vitulina* have been recorded within Cork Harbour (see Annex IV assessment submitted with this AIMU for more information relating to pinnipeds).

Leatherback turtle *Dermochelys coriacea* has been frequently recorded off Cork Harbour, with records throughout the year but mainly between July and September. Loggerhead turtle *Caretta caretta* has also been recorded in the area but these occurrences are very rare [8]. No marine turtles were sighted off the south coast of Ireland during the ObSERVE surveys [9] and there are no leatherback turtle records for the last twelve months (between April 2023 and April 2024) according to the IWDG sightings portal [10] . Two sightings were made near Rocky Bay, Co. Cork in 2000 and off Ballybrannigan Strand in 2015 [5] Marine turtles are considered in the Annex IV assessment submitted with this AIMU.

No site-specific surveys of Eurasian otter *Lutra lutra* have been conducted but otters are known to be widespread around Cork Harbour, although in lower densities than other parts of Ireland. The east side of Cork Harbour has been surveyed extensively and shown to be good habitat for otters [11]. Otters are also common in nearby Cork city [12] .It is therefore likely that otters occur adjacent to the site. Otters are considered in the Annex IV assessment submitted with this AIMU.

Cork Harbour is a designated site for bird species. There are 23 species of birds listed as designated features of the Cork Harbour SPA. A full assessment of the potential impacts of the dredging activity on bird features of the SPA has been carried out in the SISAA submitted with this AIMU.

The harbour includes two designated Natura 2000 sites covering large areas within the harbour; Great Island Channel Special Area of Conservation (SAC) and Cork Harbour Special Protection Area (SPA). Potential effects on features of these sites have been assessed in the SISAA submitted with this AIMU.

[1] https://www.infomar.ie/maps/interactive-maps/seabed-and-sediment (Last accessed 10/07/2023)

Overall, the proposed maintenance dredging works are anticipated to be small scale, have temporary effects and the dredging campaigns are infrequent. Concentrations of sediment released to the water column will reduce rapidly with increased distance from the dredge location and mobile species would be able to evade areas of increased suspended sediment concentration if required. Sediments to be dredged will generally be marginally contaminated as indicated in Section 3.1.3 and some chemicals will be released to the water column, however, they will be rapidly diluted in the water column and effects on marine ecology are considered likely to be minimal.

Overall, it is considered that there will be no significant impact on biodiversity due to the maintenance dredging activities.

[5.5] Fisheries and Aquaculture

The Basin is an enclosed and highly modified habitat which has undergone regular dredging over a long period and constant use by the Irish naval fleet as an industrial port. Given its use, it is not known as an important site for any fish species, however, data are not available for the specific site due to security restrictions within the Basin.

A search was carried out using Ireland's Marine Atlas[2], that indicated the spoil grounds site is in the known range for a number of commercial fish species including: Blue whiting *Micromesistius poutassou*, Atlantic cod *Gadus morhua*, haddock *Melanogrammus aeglefinus*, herring *Clupea harengus*, horse mackerel *Trachurus trachurus*, mackerel *Scomber scombrus*, megrim *Lepidorhombus whiffiagonis*, monkfish *Lophius piscatorius*, whiting *Merlangius merlangus,* and Atlantic salmon *Salmo salar*.

While there are some areas of aquaculture within the wider Cork harbour area, no active aquaculture sites are within the zone of influence (ZoI) of the proposed maintenance dredging or disposal site.

Neither of the two Natura 2000 sites in the area have any fish species as a designated feature. Atlantic salmon are listed as an Annex II species under the Habitats Directive. The protected areas for salmon do not lie within the ZoI of the proposed works and the dredging would not provide a barrier to salmon migrating to and from these protected areas.

The area of the proposed project works contains some fish species of local and international important, both commercially and ecologically. This is particularly true of the spoil grounds. However, the proposed work is temporary in nature and the spoil grounds are in a large expanse of open marine habitat. Given this context, the proposed maintenance dredging project is unlikely to lead to any significant impacts on fish species.

Overall, it is considered that there will be no significant impact on fisheries and aquaculture due to the maintenance dredging activities.

[5.6] Air Quality

The emissions stemming from the additional vessels engaged in the project will be inevitable. However, it is important to note that these emissions constitute a minimal increase within the

[2] https://atlas.marine.ie/ (last accessed 10/07/2023)

overall industrial setting of the harbour, existing shipping lanes, and the project's location within an operational naval service base. Consequently, these activities' anticipated impact on air quality is not expected to be significant.

[5.7] Noise & Vibration

The dredging operations, encompassing both contaminated and non-contaminated overburden materials, are strategically planned to optimise production rates within tidal constraints, operating 24/7. The project will utilise various equipment, such as a dredge barge, backhoe excavator, hopper barge, lifting equipment, dumper trucks, compressors, and generators. The appointed Contractor will finalise the specific equipment list, taking necessary precautions to minimise noise and vibration hazards for site operatives and the public.

To meet standards outlined in BS 5228-1-1 [13] and BS 5228-2 [14] for Noise and Vibration Control on Construction and Open Sites, the Contractor shall implement measures to mitigate potential impacts. While the exact base level of the Graving Dock is unknown, it is believed to be concrete. Dredging will occur up to the lesser of the Graving Dock concrete base or -5.5 m CD, eliminating the need for rock dredging in the Basin and ultimately minimising associated vibration and noise of the works.

Despite the introduction of additional vessels, any increased noise levels in the air and water will be limited in exposure due to the vessels' size, operations, and the project's timeline. The project's location within a large and bustling port ensures that any rise in noise levels will be minimal compared to other industrial operations in the area.

A Marine Mammal Risk Assessment (MMRA) conducted by APEM reveals a low risk of adverse effects on marine mammals during dredging works. The known spatial and temporal activity patterns of species and the high vessel traffic contribute to the overall minimal impact on marine mammals in key functional areas during the project.

[5.8] Landscape/Seascape

Throughout the project, the visual impact of the proposed site dredging activities will be confined to one or two vessels within a privately owned naval base. The Supporting Information for Screening for Appropriate Assessment Report (SISAA), included in this application, establishes that the proposed dredging works do not negatively affect any Natura 2000 sites. Consequently, the works are expected to have no significant effects on landscape and seascape receptors.

[5.9] Traffic & Transport

To safeguard the smooth flow of both land and marine traffic during the dredging works, the following measures and resources are in place:

- Before embarking, vessel operators are strongly advised to consult the online resources provided by the Port of Cork. This resource includes a real-time vessel locator map and a comprehensive shipping schedule, allowing for advanced journey planning and awareness of nearby vessels. The website can be found at

https://www.portofcork.ie/shipping-schedule/. The harbour master will also maintain clear communication channels to facilitate safe movements.

- The Naval Basin will remain fully operational throughout the dredging, ensuring the continuity of its services.
- Given the existing high volume of traffic within the harbour, the dredging works are not expected to introduce significant disruptions to the surrounding infrastructure.
- Fishing vessels operating in the area and vessels transporting dredge material will be carefully coordinated. Safety protocols and clear navigation guidelines will be enforced to optimise traffic flow and minimise potential conflicts.
- Mitigation measures will include formal notices to mariners, appropriate navigation lights, and close liaison with Port authorities for timing and communication protocols. Compliance with the International Regulations for Preventing Collisions at Sea is mandatory.

A traffic management plan will be developed to ensure that the dredging project has minimal impact on both land and sea traffic within the harbour. Communication, planning resources, and adherence to navigational guidelines will be paramount to maintaining safety and efficiency throughout the project.

Thus, there will be no significant impact on the traffic and transport in the area due to maintenance dredging activities.

[5.10] Cultural Heritage

Databases and data portals such as the INFOMAR Data and Sub-Bottom Profiler Viewer[3] and the National Monuments Service Wreck Viewer[4] were reviewed for any shipwrecks or cultural heritage sites which may be in the vicinity of the maintenance dredging and disposal sites.

One shipwreck is listed on the database outside of the dredge area at the entrance to the Basin approach channel. The SS Alison (wreck number W05372) was a steamship that settled on the bottom after a collision with another vessel in 1928. She was, however, towed away by tug from the site and later raised and repaired, so no wreckage is left on the site of the record.

There are several shipwrecks in the area surrounding the spoil grounds. None of these are, however, located within the spoil grounds area. The two closest wrecks (wreck numbers W10422 and W09127) are both unknown. The source records for these wrecks are not known or not available for further investigation and are not considered culturally significant at this time.

Consequently, there will be no significant impact on cultural heritage in the area due to maintenance dredging activities.

[3] https://www.infomar.ie/maps/interactive-maps/data-and-sub-bottom-profiler-viewer (Last accessed 10/04/2024)

[4] https://dahg.maps.arcgis.com/apps/webappviewer/index.html?id=89e50518e5f4437abfa6284ff39fd640 (Last accessed 10/04/2024)

[5.11] Population & Human Health

Cork harbour is a busy commercial and recreational port. Commercial operations of several industries run from Crosshaven up to the city quay. At least six public and private marina facilities lie along the harbour, also from Crosshaven to the city centre. As a result, the harbour contains a lot of vessel traffic from small recreational dinghies to large bulk cargo carriers. The Basin is limited in its use by both the public and commercial operators as it is primarily used by the Irish Defence Forces as their national base of operations. The Basin houses the Naval Services fleet and base of operations.

The dumpsite is located approximately 3.7 km outside the limits of Cork harbour and approximately 4.8 km from the closest point of land. The area sits within the approaches to the harbour in approximately 25 m to 50 m water depth.

Given the locations of both the dredging area and the spoil grounds, along with the type of works to be carried out, there will be no significant impact on population and human health in the area due to maintenance dredging activities.

[5.12] Major Accidents & Disasters

The potential for major accidents or disasters associated with maintenance dredging activities is considered to be very low. Several safeguards and preventative measures will be in place to minimise risks, including:

- Competent Contractor: The project will be undertaken by a suitably qualified and experienced Contractor with a demonstrated safety and environmental compliance track record.
- Risk Assessment and Mitigation (RAMS): Prior to the commencement of works, the Contractor will develop detailed Risk Assessment and Mitigation Strategies (RAMS) addressing potential hazards. These RAMS will be subject to review and approval by the Client's Representative. Potential risks that will be considered include collisions, equipment failure, or accidental release of pollutants.
- Pollution Response Plan: A site-specific Pollution Response Plan will be in place, outlining procedures for rapid response and containment in the unlikely event of a fuel or oil spill. The plan will include emergency contact information and identify available resources for spill cleanup.
- Regulatory Compliance: Dredging will be conducted per applicable environmental and safety regulations.

Given the implementation of these robust preventative measures, the careful selection of a competent Contractor, and the oversight of relevant authorities, the risk of major accidents and disasters due to maintenance dredging activities is deemed negligible. Therefore, there will be no risk of major accidents and disasters due to maintenance dredging activities.

[5.13] Climate

The urgently needed dredging will be carried out within a relatively short timeframe, and activities contributing to climate change are not expected to arise. As a result, there is no anticipated significant impact on the environment.

[5.14] Waste

The total amount of material dredged from the entrance channel and southern part of the Graving Dock is approximately 3,000 m^3. Non-contaminated material from the site will be disposed of at sea per the specifications provided in Section [4.4] of this report. The disposal of contaminated dredged material will be directed to a licensed landfill facility, which the appointed Contractor will determine per the landfill facility requirements.

[5.15] Material Assets

Under the guidance issued by the EPA in 2022, material assets can now be taken to mean built services and infrastructure. As the Basin itself is a piece of critical built infrastructure, the effects of dredging on the Basin must be taken into account. The aim of the project is to remove excess silt and material which has built up within the Basin due to natural processes and return it to its original operating depth of 5.5 m. This will allow the Basin to continue to fulfil its role as a base of operations for the Irish Naval Service and its fleet.

The removal of material from the Basin will have a positive impact on the material assets of the port.

Consequently, there will be no adverse significant impact on material assets in the area due to maintenance dredging activities.

[5.16] Interactions

The proposed dredging activity will interact with existing marine traffic in the Port of Cork. A traffic management plan, developed in consultation with the relevant port authorities, will ensure project vessels' safe and efficient integration with regular port operations.

Any potentially contaminated material will be transported exclusively by Heavy Goods Vehicles (HGVs). Appropriate containment, safety protocols, and designated routes will minimise the risk of interaction with the public.

[5.17] Summary of Mitigations

The previously mentioned potential effects on the receiving environment resulting from the urgently needed dredging activities have been identified. A synopsis of the proposed mitigation measures to counteract these potential impacts is presented in Table 5-1.

Table 5-1:Summary of The Proposed Mitigation Measures

Section	Mitigation Measure
Land & Soils	Priority Geotechnical Limited sampled sediment to classify the contamination material in the dredging area. Ongoing sediment sampling will be implemented during the dredging works to establish the precise contamination volume, ensuring that none of this material is discharged into the sea.

	No mitigation needed - no potential impact on land and soils.
Water	All vessels involved are MARPOL-compliant. A Pollution Response Plan will be in place for immediate action in case of a spill. All necessary permits and licenses have been obtained. Contaminated material will be treated on-site and disposed of following regulations.
Biodiversity	The main mitigation measure for marine mammals, due to the generation of underwater noise and vibration, is that a qualified and experienced Marine Mammal Observer will monitor the works when underwater noise is generated. Other considerations for mitigation for marine mammals are outlined in the Annex IV assessment submitted with this AIMU. No likely significant effects are anticipated for benthic ecology, turtles and birds and no mitigation is proposed for these receptor groups.
Fisheries and Aquaculture	No likely significant effects are anticipated, and no mitigation is proposed.
Air Quality	The anticipated impact on air quality from these activities is not expected to be significant no mitigation measures are proposed.
Noise & Vibration	As specified by MMRA, it is improbable for sound to extend significantly beyond the narrow passage. Consequently, the necessary mitigation measures involve the deployment of a qualified and experienced Marine Mammal Observer (MMO) to oversee operations during periods of potential underwater noise generation. Given its enclosed nature, the monitored zone will be confined to the Basin, which minimises sound propagation.
Landscape/Seascape	No likely significant effects are expected to any landscape or seascape resulting from the proposed dredging activities, so no mitigation measures are proposed.
Traffic & Transport	A traffic management plan that includes clear communication with vessel operators, utilisation of the Port of Cork's vessel locator/schedule, and strict enforcement of collision avoidance protocols will be implemented.
Cultural Heritage	No likely significant effects are anticipated, and no mitigation is proposed.
Population & Human Health	No likely significant effects are anticipated, and no mitigation is proposed.
Major Accidents & Disasters	Safety of shipping and navigation mitigation will include publication of a formal Marine Notice, lights, shapes and other internationally recognised identification or warning signals displayed on working vessels, communication protocol with the relevant Harbour Master and compliance with all requirements of the International Regulations for Preventing Collisions at Sea.
Climate	No likely significant effects are expected on the climate due to the proposed dredging activities, so no mitigation measures are proposed.

Waste	Non-contaminated material disposed of at sea. Contaminated material disposed of in a licensed landfill.
Material Assets	No likely significant effects are anticipated, and no mitigation is proposed.
Interactions	Traffic management plan to be implemented, contaminated material transport to use containment, safety protocols, and designated routes.

[5.18] Consideration and Reasoned Conclusions

[5.18.1] EIA Directive

According to the EU's Environmental Impact Assessment (EIA) Directive (2011/92/EU as amended by 2014/52/EU), major building or development projects within the EU must undergo an assessment for their potential impact on the environment.

The directive outlines in Article 4 (1) 21 Annex 1 projects that require mandatory EIA. Article 4 (2) outlines Annex 2 projects that require consideration for EIA further to a case-by-case examination or through thresholds and criteria established by Member States. Projects requiring mandatory EIA are listed in Schedule 5 of the Planning and Development Regulations 2001, as amended. Where developments are under the relevant EIA threshold, planning authorities are required under Article 103 of the 2001 Regulations, as amended, to request an EIS where it considers the proposed development is likely to have a significant effect on the environment.

Given the scale and nature of the proposed maintenance dredging and taking account of all available information, the overall probability of impacts on the receiving environment arising from the maintenance dredging is considered to be low. No significant environmental impacts will occur (as outlined in Sections 5.2 to 5.17) with regards to the EIA Directive.

[5.18.2] Water Framework Directive

The Water Framework Directive (WFD) primarily focuses on ensuring the qualitative and quantitative health of water resources. It emphasises reducing and eliminating pollution and ensuring an adequate water supply to support wildlife and human requirements. The WFD serves as a fundamental regulation for water protection in Europe, encompassing inland, transitional, and coastal surface waters and groundwaters.

The dredge location is within the Cork Harbour coastal water body, and the disposal area is in the Outer Cork Harbour coastal water body (overall WFD status for 2016-2021 indicated to be Moderate for both water bodies)[5].

We have considered the biological, hydromorphological and physico-chemical quality designated elements of the WFD in respect to the planned activities (Table 5-2).

[5] https://www.catchments.ie/wfd-data-dashboards/

Table 5-2 WFD supporting elements for coastal waters

Biological Quality Elements	Hydromorphological Quality Elements	Physico-chemical and Chemical Quality Elements
Phytoplankton status	Depth variation	Transparency
Invertebrate status	Structure and substrate of the coastal bed	Thermal conditions
	Structure of the intertidal zone	Oxygenation conditions
	Direction of dominant currents	Salinity
	Wave exposure	Nutrient condition
		Specific Pollutants
		Priority Substances and Hazardous Priority Substances

WFD assessment of proposed maintenance dredging.

WFD Biological Quality Elements:

- Phytoplankton: Although there would be localised increases in suspended sediment levels they would be temporary and would not be expected to have any notable effect on phytoplankton assemblages present. Phytoplankton are transported with tidal currents and would only be expected to be subject to elevated levels of suspended sediments for relatively short periods. Any effects of the maintenance dredging on phytoplankton are anticipated to be negligible/minor and would not affect WFD status.
- Invertebrates: As indicated in Section 5.4 and effects of the maintenance dredging on benthic species and habitats is anticipated to be negligible/minor and would not affect WFD status.
- Fish: Does not require consideration as the works are in a coastal water body (no WFD status available for fish for either water body).

WFD Hydromorphological Quality Elements:

- Depth Variation: The maintenance dredging would have localised effects on depth but would not affect depth at the scale of the WFD water body.
- Structure and Substrate of the Coastal Bed: The maintenance dredging would have localised effects on benthic substrates but would not affect depth at the scale of the WFD water body.

- Structure of the Intertidal Zone: The structure of the intertidal zone's structure will be unaffected by the maintenance dredging.
- Direction of Dominant Currents: Current flow patterns and the direction of dominant currents will not be affected by the maintenance dredging.
- Wave Exposure: The maintenance dredging will not change the characteristic wave exposure of the area.

WFD Physico-chemical and Chemical Quality Elements:

- Transparency: The maintenance dredging would have localised and short term effects on transparency but it would not affect transparency at the scale of the WFD water body.
- Thermal Conditions: The maintenance dredging would not have any effects on thermal conditions.
- Oxygenation Conditions: The maintenance dredging could have localised and short term effects on oxygen levels in the water column but it would not affect oxygen levels at the scale of the WFD water body.
- Salinity: The proposed maintenance dredging will not cause fluctuations in the salinity levels of the water.
- Nutrient Condition: The maintenance dredging could have localised and short term effects on nutrient levels in the water column but it would not affect nutrient levels at the scale of the WFD water body.
- Specific Pollutants (ecological status): The maintenance dredging could have localised and short term effects on concentrations of specific pollutants in the water column. Sediments to be dredged are generally marginally contaminated as indicated is Section 3.1.3 and some chemicals will be release to the water column, however, they will be rapidly diluted in the water column. Material with high concentrations of pollutants will be disposed of on land. Overall, the maintenance dredging is not anticipated to affect concentrations of specific pollutants at the scale of the WFD water body.
- Priority substances and Priority hazardous substances (chemical status): The maintenance dredging could have localised and short term effects on concentrations of priority substances and priority hazardous substances in the water column. Sediments to be dredged are generally marginally contaminated as indicated is Section 3.1.3 and some chemicals will be release to the water column, however, they will be rapidly diluted in the water column. Material with high concentrations of pollutants will be disposed of on land. Overall, the maintenance dredging is not anticipated to affect concentrations of priority substances and priority hazardous substances at the scale of the WFD water body.

Given the scale and nature of the proposed maintenance dredging and taking account of all available information, there are not expected to be any non-temporary effects on any WFD quality elements of the Cork Harbour and Outer Cork Harbour coastal water bodies, and the proposed maintenance dredging would not prevent these water bodies from meeting their WFD objectives.

[5.18.3] Marine Strategy Framework Directive

The EU's Marine Strategy Framework Directive (MSFD) was established to safeguard the marine ecosystem and biodiversity, which are crucial for human health and marine-related economic and social activities. The directive underscores the importance of preserving and, where possible, restoring the marine environment to maintain biodiversity and ensure clean, healthy, and productive oceans and seas.

The MSFD identifies negative impacts such as pollution, biodiversity loss, seabed damage, overexploitation, the spread of non-indigenous species, marine litter, underwater noise, ocean warming, and acidification. The MSFD descriptors are indicated in Table 5-3.

Taking account of the relatively small scale of the proposed works, the temporary nature of any effects and the relatively infrequent nature of the maintenance dredge campaigns, it is considered that the MSFD objectives will not be adversely affected.

Table 5-3: Descriptors under the MSFD.

Descriptor	Description
D1 Biodiversity	Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions
D2 Non-indigenous species	Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems
D3 Commercial Fish and Shellfish	Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock
D4 Food Webs	All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity
D5 Eutrophication	Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters
D6 Seabed Integrity	Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected

Descriptor	Description
D7 Hydrographical Conditions	Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems
D8 Contaminants	Concentrations of contaminants are at levels not giving rise to pollution effects
D9 Contaminants in Seafood	Contaminants in fish and other seafood for human consumption do not exceed levels established by Union legislation or other relevant standards
D10 Marine Litter	Properties and quantities of marine litter do not cause harm to the coastal and marine environment
D11 Energy, including underwater noise	Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment

MSFD assessment of the proposed maintenance dredging work:

- **D1 Biodiversity:** Negligible/minor impacts on species, habitats, or ecosystem functionality.
- **D2 Non-indigenous Species:** It is anticipated that dredgers to be used will be mobilised from within Ireland which will minimise risk of introduction or spread of invasive species form other regions.
- **D3 Commercial Fish and Shellfish:** Negligible impact on the population and health of commercial species.
- **D4 Food Webs:** Negligible anticipated disruption to trophic relationships or food chain dynamics.
- **D5 Eutrophication:** Negligible anticipated contribution to nutrient enrichment.
- **D6 Seabed Integrity:** Negligible anticipated detrimental effects on the physical and biological structure of the seabed.
- **D7 Hydrographical Conditions:** Negligible anticipated alteration of hydrological characteristics, including water flow, temperature, and salinity.
- **D8 Contaminants:** Negligible anticipated release or increase in levels of harmful substances.
- **D9 Contaminants in Seafood:** No anticipated accumulation of hazardous substances in the marine food chain.
- **D10 Marine Litter:** No anticipated contribution to marine debris or pollution.
- **D11 Energy, including underwater noise:** Negligible/minor short term anticipated increase in energy inputs or underwater noise levels.

The findings indicate that the proposed maintenance dredging project is anticipated to have no significant impacts on the various MSFD biological, hydromorphological and physico-chemical descriptors within the marine environment.

[6] Conclusion

For the reasons set out in detail in this AIMU report, in the light of the best scientific knowledge, all aspects of the proposed maintenance dredging works which may affect the environment have been considered. Furthermore, the proposed survey work has been considered with regard to EU directives EIA, WFD and MSFD.

Based on the information set out in this report as well as the accompanying documents, we submit that the competent authority has sufficient information to allow them to determine, with reasonable scientific certainty, that the proposed maintenance dredging works, individually or in combination with other plans or projects, will have no adverse effect on the environment, Annex IV species, Annex II species or the integrity of any Natura 2000 site.

[7] References

[1] Hydrographic Surveys, “Archaeological Report and Assessment for Proposed Dredging Works at the Naval Base Haulbowline,” 2004.

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[9] E. Rogan and B. P. M. M. C. A. S. M. , “Aerial surveys of cetaceans and seabirds in Irish waters: Occurrence, distribution and abundance in 2015-2017,” Vols. Department of Communications, Climate Action and Environment and National Parks and Wildlife Service (NPWS),, no. 297, 2018.

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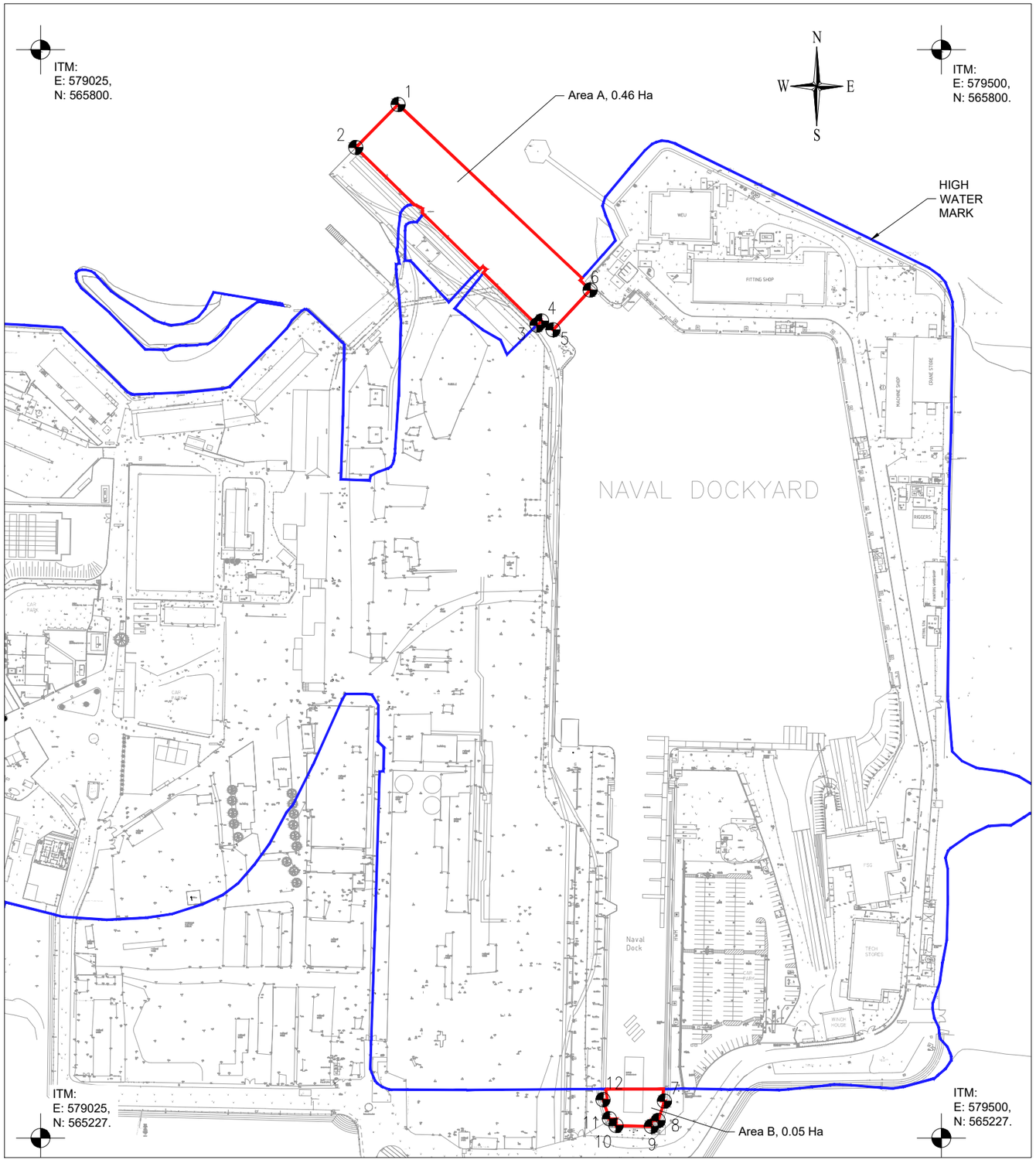
[14] BSI Standards, “BS 5228-2: Code Of Practice for Noise and Vibration Control on Construction and Open Sites,” 2009.

Appendix A Drawings

A3



LICENCE MAP
Scale 1:2,500

AREA A BOUNDARY				
Point	ITM Eastings (m)	ITM Northing (m)	Latitude	Longitude
1	579214	565772	51°50'37.610" N	-8°18'5.992" W
2	579191	565749	51°50'36.867" N	-8°18'7.189" W
3	579287	565656	51°50'33.865" N	-8°18'2.153" W
4	579289	565658	51°50'33.930" N	-8°18'2.049" W
5	579295	565653	51°50'33.769" N	-8°18'1.735" W
6	579315	565674	51°50'34.452" N	-8°18'0.694" W

AREA B BOUNDARY				
Point	ITM Eastings (m)	ITM Northing (m)	Latitude	Longitude
7	579354	565247	51°50'20.639" N	-8°17'58.565" W
8	579351	565236	51°50'20.282" N	-8°17'58.719" W
9	579347	565233	51°50'20.185" N	-8°17'58.928" W
10	579328	565234	51°50'20.215" N	-8°17'59.920" W
11	579325	565237	51°50'20.311" N	-8°18'0.078" W
12	579322	565247	51°50'20.635" N	-8°18'0.237" W

GENERAL NOTES

NOTES:

1. THIS DRAWING IS TO BE READ WITH ALL OTHER AYESA DRAWINGS, SPECIFICATIONS AND ANY OTHER RELEVANT INFORMATION.
2. NO DIMENSIONS SHALL TO BE SCALED FROM THE DRAWING.
3. UNLESS NOTED OTHERWISE, ALL DIMENSIONS ARE IN MILLIMETERS AND ALL LEVELS ARE IN METERS FROM THE NOTED CHART DATUM.
4. ALL DRAWINGS ARE PROPERTY OF AYESA.
5. CHART DATUM IS 2.57m ABOVE ORDNANCE DATUM MALIN.

LEGEND:

- MARITIME USAGE LICENCE Area A, 0.46 ha
- MARITIME USAGE LICENCE Area B, 0.05 ha
- HIGH WATER MARK

Rev	Date	Description	By	Chk	App
P02	06/25	MARA APPLICATION	ALC	DOB	SG
P01	04/24	MARA APPLICATION	TJOC	DOB	SG

ayesa

CLIENT
DEPARTMENT OF DEFENCE

PROJECT
HAULBOWLINE DREDGING

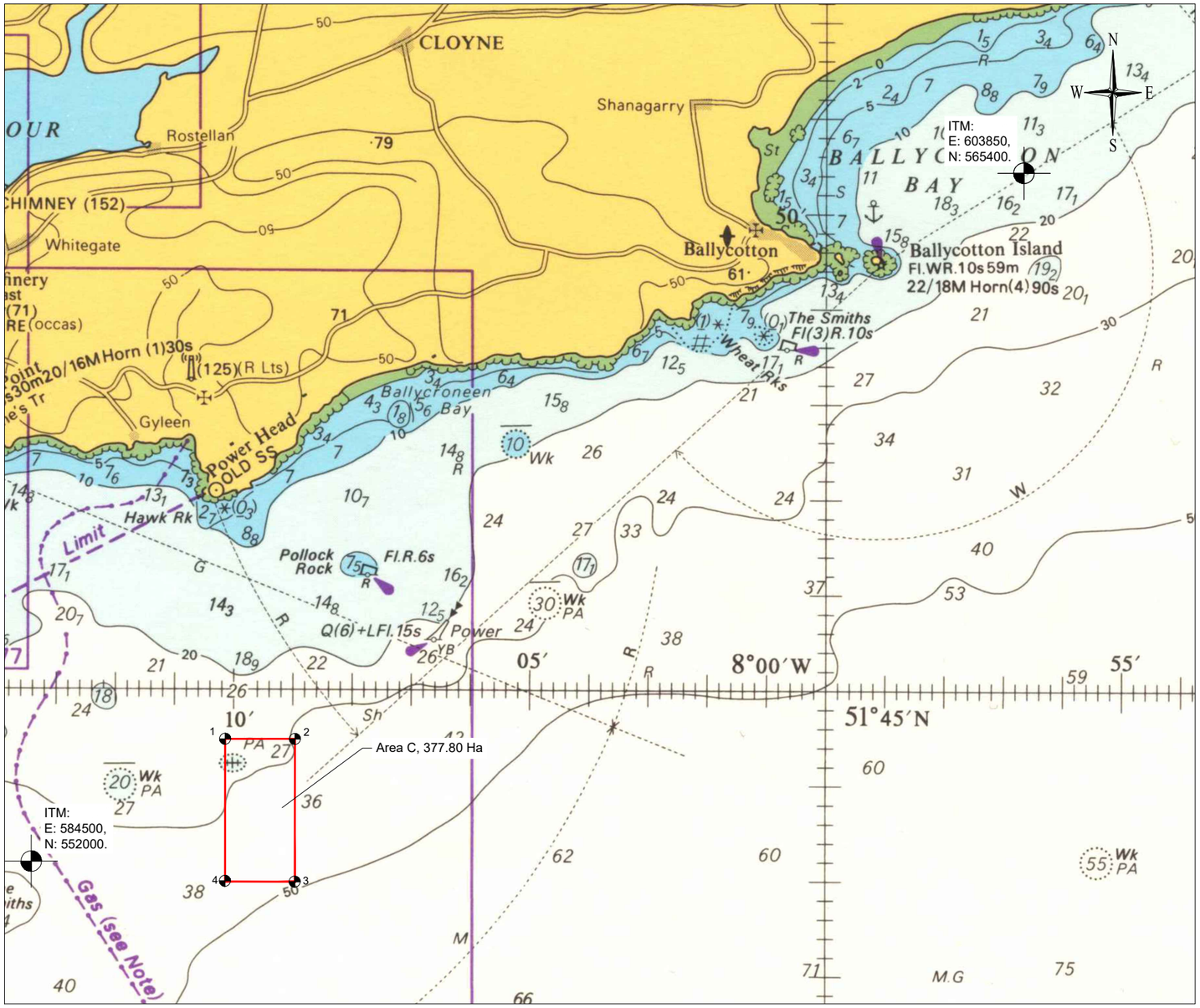
DRAWING TITLE
LICENCE MAP

STATUS	SUITABILITY
MARA APPLICATION	–

Date: 03.04.24	Scale: 1:2,500	Drawn: TJOC	Chk: DOB	App: SG

Project No:	Drg. No:	Rev:
CM1265	CM1265–MA–DWG–05001	P02

A3



FORESHORE BOUNDARY COORDINATES				
Point	ITM Eastings (m)	ITM Northing (m)	Latitude	Longitude
1	588282	554383	51°44'29.996" N	-8°10'10.841" W
2	589640	554380	51°44'29.996" N	-8°9'0.051" W
3	589635	551599	51°42'59.998" N	-8°9'0.013" W
4	588276	551602	51°42'59.998" N	-8°10'10.817" W

ADMIRALTY CHART DUMPSITE
Scale 1:100,000

GENERAL NOTES

NOTES:

1. THIS DRAWING IS TO BE READ WITH ALL OTHER AYESA DRAWINGS, SPECIFICATIONS AND ANY OTHER RELEVANT INFORMATION.
2. NO DIMENSIONS SHALL TO BE SCALED FROM THE DRAWING.
3. UNLESS NOTED OTHERWISE, ALL DIMENSIONS ARE IN MILLIMETERS AND ALL LEVELS ARE IN METERS FROM THE NOTED CHART DATUM.
4. ALL DRAWINGS ARE PROPERTY OF AYESA.
5. CHART DATUM IS 2.57m ABOVE ORDNANCE DATUM MALIN.

LEGEND:

Area C, 377.80 ha

Rev	Date	Description	By	Chk	App
P02	06/25	MARA APPLICATION	ALC	DOB	SG
P01	04/24	MARA APPLICATION	TJOC	DOB	SG

CLIENT
DEPARTMENT OF DEFENCE

PROJECT
HAULBOWLINE DREDGING

DRAWING TITLE
ADMIRALTY CHART DUMPSITE

STATUS
MARA APPLICATION

SUITABILITY
–

Date: 03.04.24 | Scale: 1:100,000 | Drawn: TJOC | Chk: DOB | App: SG

Project No: CM1265

Drg. No: CM1265–MA–DWG–05003

Rev: P02

Appendix B NMPF Policies Relevant

The table below presents a response to policy statements applicable to the proposed activity, as in Chapter 18 of NMPF. Several planning policies directly relate to the proposed Haulbowline Dredging Project.

Policies	Response
Ports, Harbours and Shipping Policy 1 *To provide for shipping activity and freedom of navigation, the following factors will be taken into account when reaching decisions regarding development and use:* *The extent to which the locational decision interferes with existing or planned routes used by shipping, access to ports and harbours and navigational safety. This includes commercial anchorages and approaches to ports as well as key littoral and offshore routes;* *A mandatory Navigation Risk Assessment;* *Where interference is likely: whether reasonable alternatives can be identified; and* *Where there are no reasonable alternatives: whether mitigation through measures adopted following the principles and procedures established by the International Maritime Organisation can be achieved at no significant cost to the shipping or ports sector.*	Marine activity related to the naval base will remain operational during dredging. The dredging works will ensure the continued operation of the harbour and safe navigation within it. There are no navigational safety implications arising from the proposed work. The Contractor and Haulbowline's Harbour Master will coordinate the scheduling of the Works accordingly. The Contractor will abide by the Harbour Master's instructions.
Ports, Harbours and Shipping Policy 2 *Proposals that may have a significant impact on current activity and future opportunities for expansion of port and harbour activities should demonstrate that they will, in order of preference:* *a) avoid,* *b) minimise, or* *c) mitigate* *significant adverse impacts and* *d) if it is impossible to mitigate significant adverse impacts on current activity and future opportunities for expansion of port and harbour activities, proposals should set out the reasons for proceeding.*	The proposed work will not significantly impact current activity and future opportunities to expand the Haulbowline activities. The proposed work will create additional berthing capacity and safe navigation within the Haulbowline Naval facility.
Ports, Harbours and Shipping Policy 3 *Proposals that may have a significant impact upon current activity and future opportunities for expansion of port and harbour activities must demonstrate consideration of the National Ports Policy, the National Planning Framework, and relevant provisions related to the TEN-T network.*	The proposed activities will not significantly impact current and future opportunities to expand Naval operations as the outline for the facility is defined.
Ports, Harbours and Shipping Policy 4 *Proposals within ports limits, beside or in the vicinity of ports, and/or that impact upon the main routes of significance to a port, must demonstrate within applications that they have:* *been informed by consultation at a pre-application stage or earlier with the relevant port authority;*	The proposed maintenance dredging is within the Port of Cork limits. Pre-application consultations were held with the Foreshore Section of the Department of Housing, Local Government & Heritage on 16/12/2021. There are no navigational safety implications arising from the proposed works. Therefore, no navigational risk assessment is required.

have carried out a navigational risk assessment, including an analysis of maritime traffic in the area; and *have consulted the Department of Transport, MSO and Commissioners of Irish Lights.* *Applicants must continue to engage parties identified in pre-application processes as appropriate during the decision-making process.*	The Port of Cork Harbour Authority has been informed of the proposed dredging activities.
Ports, Harbours and Shipping Policy 5 *Proposals for capital dredging will be supported where it is necessary to safeguard national port capacity and Ireland's international connectivity and where required compliance assessments associated with authorisations have been carried out and incorporated into subsequent competent authority decision(s).*	No capital dredging is involved in this project.
Ports, Harbours and Shipping Policy 6 *In areas of authorised dredging activity, including those subjects to navigational dredging, proposals for other activities will not be supported unless they are compatible with the dredging activity.*	Not applicable. There are no proposals for other activities in the area of authorised dredging activity.
Ports, Harbours and Shipping Policy 7 *Proposals for maintenance dredging activity will be supported where:* *Relevant decisions by competent authorities incorporate the outcome of statutory environmental assessment processes, as well as necessary compliance assessments associated with authorisations, including in relation to the planning process;* *There will be no significant adverse impact on marine activities or uses or the maritime area. Any potential adverse impact will be, in order of preference, avoided, minimised or mitigated;* *dredged waste is managed in accordance with an internationally agreed hierarchy of waste management options for sea disposal;* *if disposing of dredged material at sea, existing registered disposal sites are used, in preference to new disposal sites; and* *where they contribute to the policies and objectives of this NMPF.*	A DaS Permit Application was submitted to the EPA on the 13th of June, 2023 and is currently under review. Refer to Application No. S0005-03. An AAS Report and UAIA support the Foreshore Application. There are no other authorisations or planning permissions required. There will be no significant impact on marine activities or uses in the maritime area from this maintenance dredging Foreshore Licence Application. The contaminated waste is to be dredged, dewatered on land adjacent to the dry Dock and transported abroad to a licensed facility in the EU or UK for treatment, recovery, and reuse.
Ports, Harbours and Shipping Policy 8 *Proposals that cause significant adverse impacts on licensed disposal areas should not be supported. Proposals that cannot avoid such impact must, in order of preference,"* *a) minimise,* *b) mitigate, or* *c) if it is not possible to mitigate the significant adverse impacts, proposals must set out the reasons for proceeding.*	Not applicable. This is an application for maintenance dredging. There will be no significant impacts on licensed disposal areas from these activities.
Ports, Harbours and Shipping Policy 9 *Proposals for the management of dredged material must demonstrate that they have been assessed against the waste hierarchy.*	Dredged waste is to be managed per the internationally agreed waste management hierarchy.

	For the removal of the contaminated waste from the site following options have been considered in order of preference; Export the excessively contaminated material to a suitably licensed facility abroad to a licensed EU or UK facility for treatment and reuse. Export the excessively contaminated material to a suitably licensed facility in Ireland.
Ports, Harbours and Shipping Policy 10 *Proposals identifying new dredge disposal sites which are subject to best practice and guidance from previous studies should be supported where:* *competent authority decisions incorporate necessary compliance assessments associated with authorisations and* *they contribute to the policies and objectives of this NMPF.* *Proposals must include an adequate characterisation study, be assessed against the waste hierarchy and must be informed by consultation with all relevant stakeholders.*	There are no new dredge disposal sites proposed.

Appendix C Sediment Analysis Results

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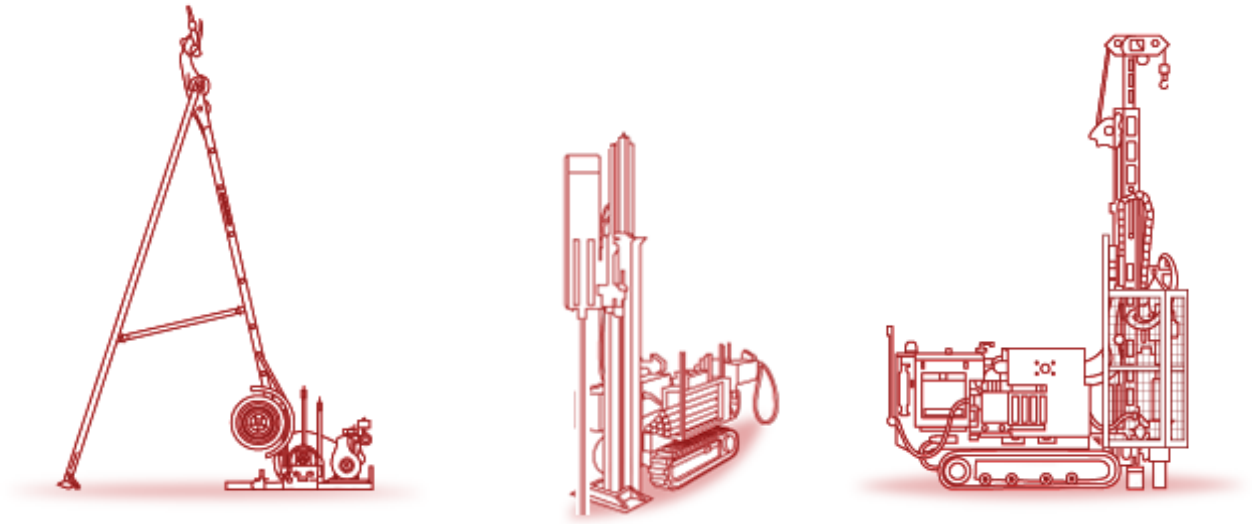
HAULBOWLINE NAVAL BASE

SITE INVESTIGATION CONTRACT

INTERPRETATIVE REPORT

NO. P21250



20/07/2022

REPORT CONTROL SHEET

Employer	Cork County Council					
Employer's Representative	Byrne Looby					
Project Name	Haulboline Naval Base– Site Investigation Contract					
Report Name	Haulboline Naval Base – Site Investigation Contract – Interpretative Report					
Project Number	P21250					
This Report Comprises of	RCS	TOC	Text	No. of Appendices	Drawings	Electronic data
	1	1	17	2	3	*.pdf, *.ags & *.dwg

Revision	Status	Author(s)	Approved By	Issue Date
D01	Draft	J.McS	G.H	14.06.2022
F01	Final	[redacted]	[redacted]	20.07.2022

TABLE OF CONTENTS

APPENDICES

1 INTRODUCTION

1.1 SCOPE OF WORKS

In November 2021, Byrne Looby, Consulting Engineers acting as the Employer's Representative on behalf of the Client, Minister for Defence commissioned Priority Geotechnical (PGL), to carry out a ground investigation contract for the proposed Haulbowline Naval Base Site Investigation Project. The main works proposed is the dredging and disposal at sea of overburden material from the Naval Basin, the Basin Approach and the Graving Dock.

The ground investigation in so far as the scope allows shall provide detailed ground investigation information to inform and assess the geotechnical and environmental characteristics of the soils, sediments at the site.

The scope of the ground investigation, which was specified by Byrne Looby, as Tendered (initially) comprised of the following:

- 7Nr. Cable percussion boreholes;
- Geophysical surveying;
- Environmental sampling;
- Laboratory testing of soil samples;
- Associated reporting.

A geophysical survey consisting of marine magnetometer, marine side scan sonar and marine seismic profiling and land based seismic refraction was also required and is reported separately.

The fieldworks, as completed are detailed in Section 3.2 of this factual report, these works being in accordance with the contract specification: Specification and Related Documents for Ground Investigation in Ireland (Engineers Ireland, October 2016), Eurocode 7- Geotechnical Design Part 2, ground investigation and testing (BS EN 1997-2: 2007) and the relevant British Standards (BS 5930 (2015) Code of Practice for Site Investigation and BS 1377, Method of Tests for Soil for Civil Engineering Purposes, *in situ* Tests Parts 1 to 9) under the supervision of PGL Geologist(s). The marine, direct investigation fieldworks were carried out between 17th and 19th January, 2022. The indirect, non-intrusive marine geophysical survey works were carried out on the 16th November, 2021.

1.2 REPORTING

This geotechnical interpretative report (ref: P21250_Rp_F01) presents a summary of the factual records for the fieldwork with respect to the site investigation works contract for the proposed dredging at Ballycotton Harbour and the geotechnical assessment of this data set. This report was compiled in accordance with the contract specification: Eurocode 7-Geotechnical Design Part 2, ground investigation and testing (BS EN 1997-2: 2007 Section 6) and should be read with its appendixes.

The non-intrusive geophysical and hydrographic survey was reported separately.

No responsibility can be held by PGL for ground conditions between exploratory locations. The exploratory logs provide for ground profiles and configuration of strata relevant to the investigation depths achieved during the fieldworks. Caution shall be taken when extrapolating between such exploratory locations. No liability is accepted for ground conditions extraneous to the exploratory locations.

No account has been taken of potential subsidence or ground movement due to mineral extraction, mining works or karstification below or in proximity to the site, unless specifically addressed.

This report has been prepared for the Employer and their Representative as outline, herein. The information should not be used without their prior written permission. PGL accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

1.3 SITE LOCATION & DESCRIPTION

The site is located in the Haulbowline Naval Base, Co. Cork, in tidal waters. This is an active Naval Base with several large naval vessels and ancillary vessels present within the Base.

The Highest Astronomical Tide (HAT) at the site is +4.4m (CD) and Lowest Astronomical Tide (LAT) of -0.1 CD. Bed levels vary between -6.0m CD and -1.0m CD. The site is relatively sheltered within the basin and graving dock, with limited wave and current exposure. Access through the graving dock is very restricted due to the presence of a marina and old graving dock gate.

2 FIELDWORK

2.1 GENERAL

The fieldwork was carried out in general accordance with British Standards (BS 5930 (2015) Code of Practice for Site Investigation +A2:2010 and BS 1377, Method of Tests for Soil for Civil Engineering Purposes, *in situ* Tests Parts 1 to 9). Details of the equipment and plant used are presented below.

Operation	Equipment	Nominal diameter, mm	Flush	Comments
Cable Percussion Boring	Dando 2000	200mm	N/A	Visual observations of ground and groundwater conditions. Standard penetration test, N values obtained, bulk disturbed sampling.

The exploratory locations were selected by PGL in consultation with Byrne Looby and set out subject to work space restrictions and available access. The 'as constructed' exploratory locations were subsequently surveyed using Trimble V8 GPS equipment to the Ordinance Survey, Irish Transverse Mercator (ITM) system of co-ordinates and elevations to Malin Head datum. Chart datum was taken as mOD Malin +2.57m. These locations are shown on the exploration location layout and plan (dwg. Nr. P21250-SI-01) presented in **APPENDIX A** of this report.

SUMMARY OF SURVEY DATA

Location	Easting	Northing	Seabed Level (mOD)	Seabed Level (mCD)	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
S01	579330.9	565654.4	-7.85	-5.28	3.20	19/01/2022
S03	579455.0	565557.4	-7.39	-4.82	3.70	17/01/2022
S05	579379.3	565502.9	-7.26	-4.69	2.00	19/01/2022
S07	579437.7	565461.9	-3.42	-0.85	5.50	18/01/2022
S08	579434.7	565459.8	-6.72	-4.15	2.00	17/01/2022
S09	579317.7	565447.8	-6.48	-3.91	3.30	18/01/2022
S11	579340.2	565423.9	-6.26	-3.69	2.50	18/01/2022
S13	579341.1	565347.0	-6.13	-3.56	2.00	18/01/2022
S15	579338.2	565295.9	-5.22	-2.65	1.50	18/01/2022
S16	579336.3	565281.3	-4.12	-1.55	4.20	18/01/2022

2.2 EXPLORATORY HOLES

The exploratory holes as completed during the Haulbowline Naval Base Site Investigation project are listed/ detailed in the following table.

SUMMARY OF EXPLORATORY HOLES

Type	Quantity, Nr.	Depth Range, m bgl	Comments
Cable Percussion Boreholes	10	1.50 – 5.50	S01, S03, S05, S07, S08, S09, S11, S13, S15 & S16.

2.3 SAMPLING

Fourteen (14) bulk disturbed samples (B) were recovered from the exploratory holes in accordance with Geotechnical Investigation and Sampling – Sampling Methods and Groundwater Measurements (EN ISO 22475-1:2006).

Eleven (11) environmental samples were taken from exploratory locations; being placed immediately in air-tight containers and filled to the top; in accordance with the preparation for and methods of taking environmental samples, preservation and handling; British Standard BS 5930: 1981- Code of Practice for Site investigation and the Association of Geotechnical and Geo-environmental Specialists (AGS) guide to environmental sampling, September 2010. The sample suite consisted of: 2Nr. small disturbed samples (D) not less than 1.0kg, 2Nr. 250g amber glass sample containers and 2Nr. 60g amber glass sample containers.

2.4 IN SITU TESTING

Standard Penetration Tests, N values, were carried out in the boreholes using the 60^{o} solid cone (CPT) in place of the standard split barrel sampler. The Standard Penetration Test was carried out in accordance with Geotechnical Investigation and Testing, Part 3 Standard penetration test, BS EN ISO 22476-3:2005+A1:2011. The data was presented on the relevant exploratory hole records in APPENDIX A of the factual report and are discussed herein.

SUMMARY OF IN-SITU TESTING

Type	Quantity, Nr.	Remarks
Standard penetration test, N_{SPT} value	14	Uncorrected Nspt 0 – 33 (including refusals N>50) see BH logs APPENDIX A of the factual report

3 LABORATORY TESTING

All samples were transported to Priority Geotechnical's laboratory in Midleton, Co. Cork examined, logged and prepared for scheduled testing. Laboratory testing was proposed by PGL, being approved by Byrne Looby. Testing was carried out by PGL, in accordance with BS1377 (1990), Methods of test for soils for civil engineering purposes and ISRM suggested methods for rock characterisation, testing and monitoring. Specialist chemical testing was undertaken by Chemtest Ltd. (UK) on behalf of PGL. The laboratory test results were presented in **APPENDIX B** of this report and discussed herein. A summary of tests undertaken were detailed below.

SUMMARY OF LABORATORY TESTING UNDERTAKEN

Type	Nr.	Remarks
Natural Moisture Content	13	15% to 117%
Atterberg Limit	08	Liquid limit, LL 41% to 88% Plastic limit, PL 25% to 53% Plasticity index, PI 14 to 40
Particle Size Distribution (grading)	13	See **APPENDIX B**
Grading by hydrometer on fines	11	
Organic matter	13	0.86% to 3.8%
Particle Density by gas jar	18	Particle Density: 2.39Mg/m^3 to 2.97Mg/m^3 See **APPENDIX B**
Dry Density/ Moisture Content Relationship	04	S03 0.00m, S03 1.50m, S05 1.60m, S13 2.00m. **Optimum moisture content**: 12.4% to 37.7% **Maximum dry density**: 1.20Mg/m^3 to 1.80Mg/m^3
Marine suite environmental testing	18	See **APPENDIX B**

Please note that all samples shall be retained for a period no longer than 28 days from the date of this report. Thereafter all remaining samples shall be appropriately disposed of unless a written instruction to the contrary is received by PGL prior to the date of this reporting and within the 28 day period outlined above. Laboratory testing will result in a reduction of sample quantity and in some cased the use of the full sample mass. Samples already tested may not be suitable or available for further testing.

4 GROUND AND GROUNDWATER CONDITIONS

The full details of the ground conditions encountered are provided for on the exploratory records accompanying the factual report. The records provide descriptions, in accordance with BS 5930 (2015) and Eurocode 7, Geotechnical Investigation and Testing, Identification and classification of soils, Part 1, Identification and description (EN ISO 14688-1: 2002),– Identification and Classification of Soil, Part 2: Classification Principles (EN ISO 14688-2:2004) and Identification and Classification of Rock, Part 1: Identification & Description (EN ISO 14689-1:2004) of the materials encountered, in situ testing and details of the samples taken, together with any observations made during the site investigation.

The ground conditions at the site was characterised by; marine sediment; slightly sandy slightly gravelly SILT and slightly sandy slightly gravelly CLAY. Bedrock was not proven by direct investigation.

5 GEOTECHNICAL REVIEW

The following geotechnical review provides an overview of the ground conditions identified within the site along with the general characterisation of the deposits encountered. The following sections should be read in conjunction with the exploratory records and the proposed construction details/ plans, where available.

5.1 DESK STUDY

According to the Geological Survey of Ireland 1:100k Geology Map the survey area is underlain by Waulsortian Limestones with bedrock outcrop apparent on the western and southern end of Haulbowline Island. Marine sediments are expected.

5.2 GROUND MODEL

Shallow very soft (N_{SPT} 0 - 1) slightly sandy SILT (marine sediment) were encountered at exploratory hole locations, 1.5m to 5.4m thick; overlying a layer of stiff, slightly sandy slightly gravelly CLAY 0.1m to 0.7m thick. Localised GRAVEL deposits were encountered at location S09 at a depth 1.5m to 3.30m bgl.

Bedrock was not proven.

Location	Ground level, mOD Malin	Thickness of upper soft sediment, m	Thickness of lower soft sediment, m	Thickness of granular sediment, m
S01	-5.28	2.5	0.7	-
S03	-4.82	3.0	0.7	-
S05	-4.69	1.6	0.4	-
S07	-0.85	5.4	0.1	-
S08	-4.15	2.0	0.2	-
S09	-3.91	1.5	-	1.8
S11	-3.69	2.5	-	-
S13	-3.56	2.0	-	-
S15	-2.65	1.5	-	-
S16	-1.55	4.2	-	-

5.3 GEOTECHNICAL RISK REGISTER

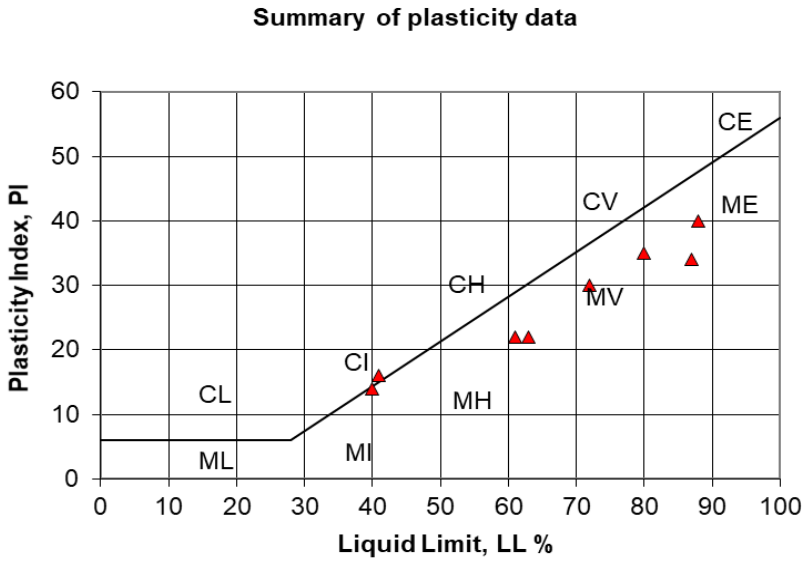
The following non-exhaustive particular geotechnical risks were identified:

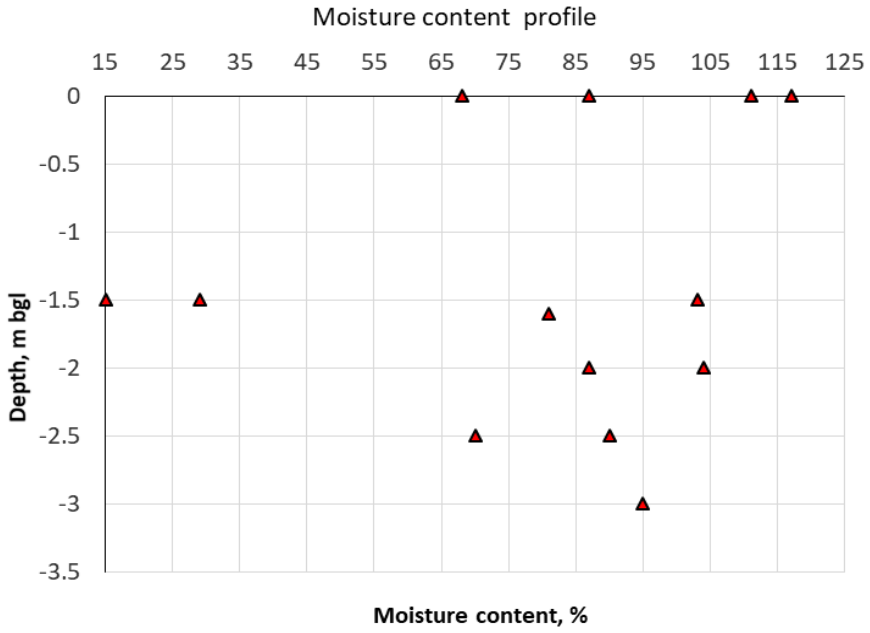
- Variable thickness of soft marine sediment and;
- Shallow (nearshore) bedrock.

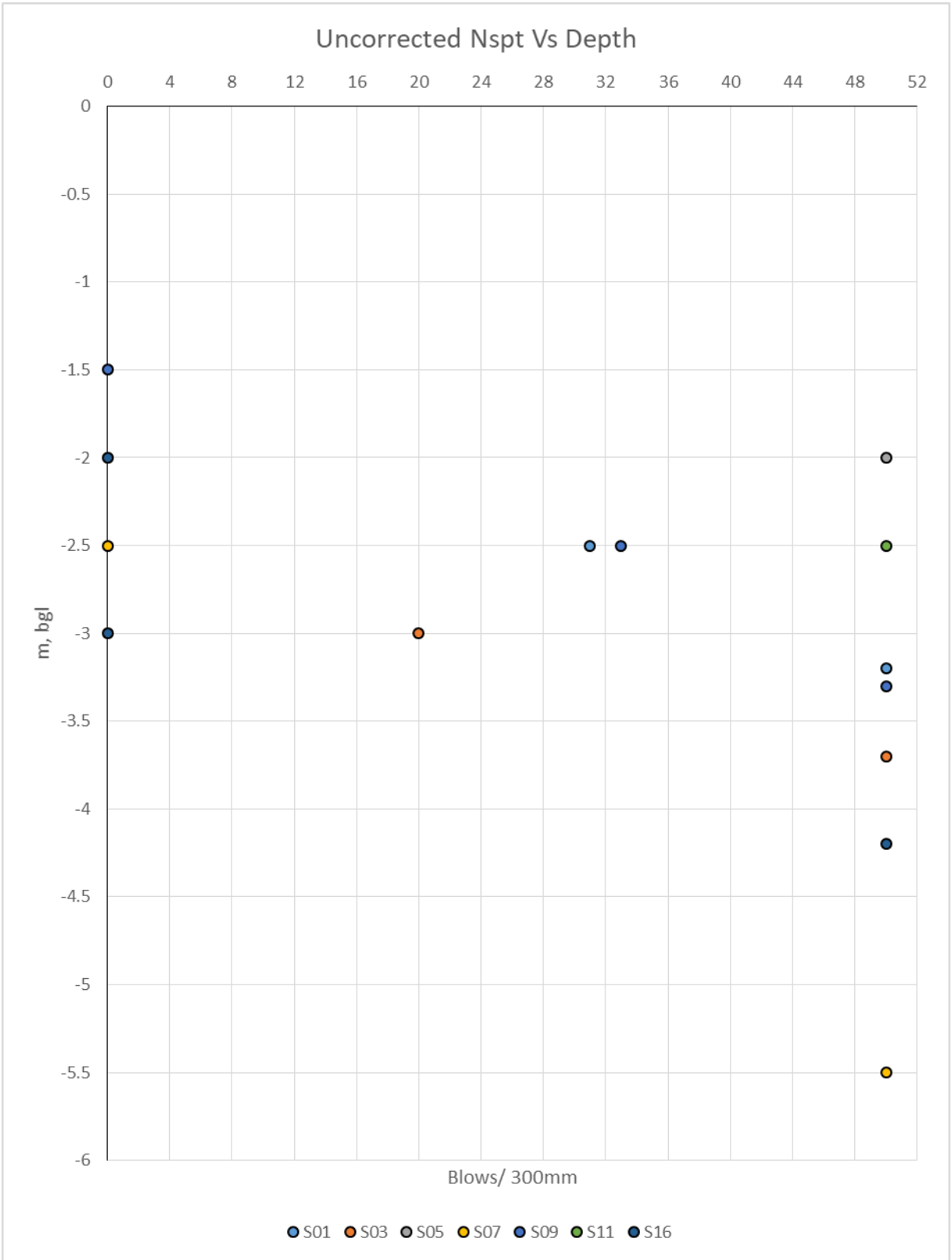
5.4 CHARACTERISTIC PROPERTIES

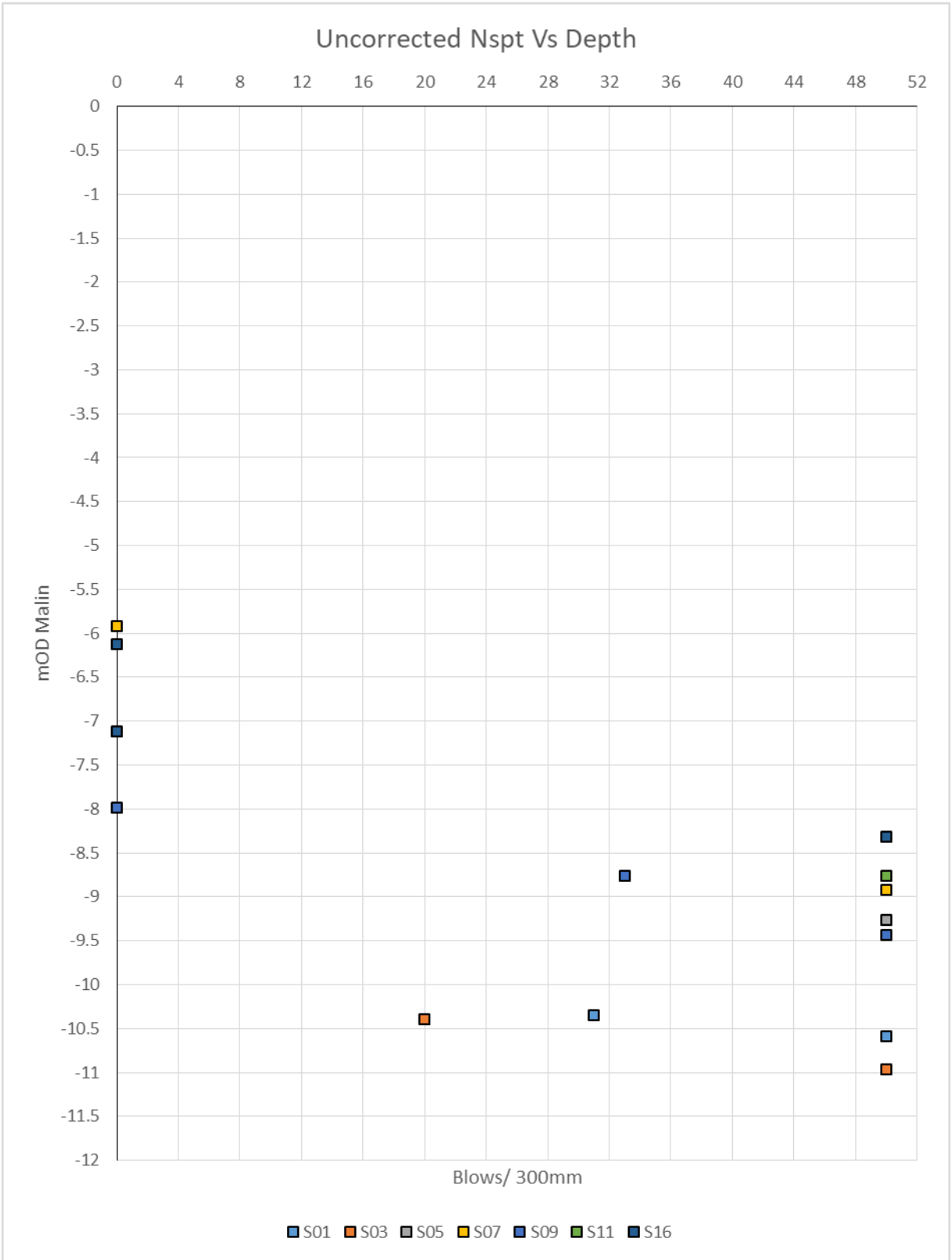
The marine sediment deposits; slightly sandy slightly gravelly SILT were characterised by natural moisture content 68% to 117% and intermediate to high plasticity (MI/ MV) and low organic content. A moisture content of 29% at S03 was associated with a slightly sandy gravelly SILT deposit. A moisture content of 15% at S09 was associated with a slightly sandy slightly silty GRAVEL deposit. Grading indicated Gravel fraction(s) 0% to 49%; Sand fraction(s) 1% to 23% and Silt fraction(s) 6% to 99%.

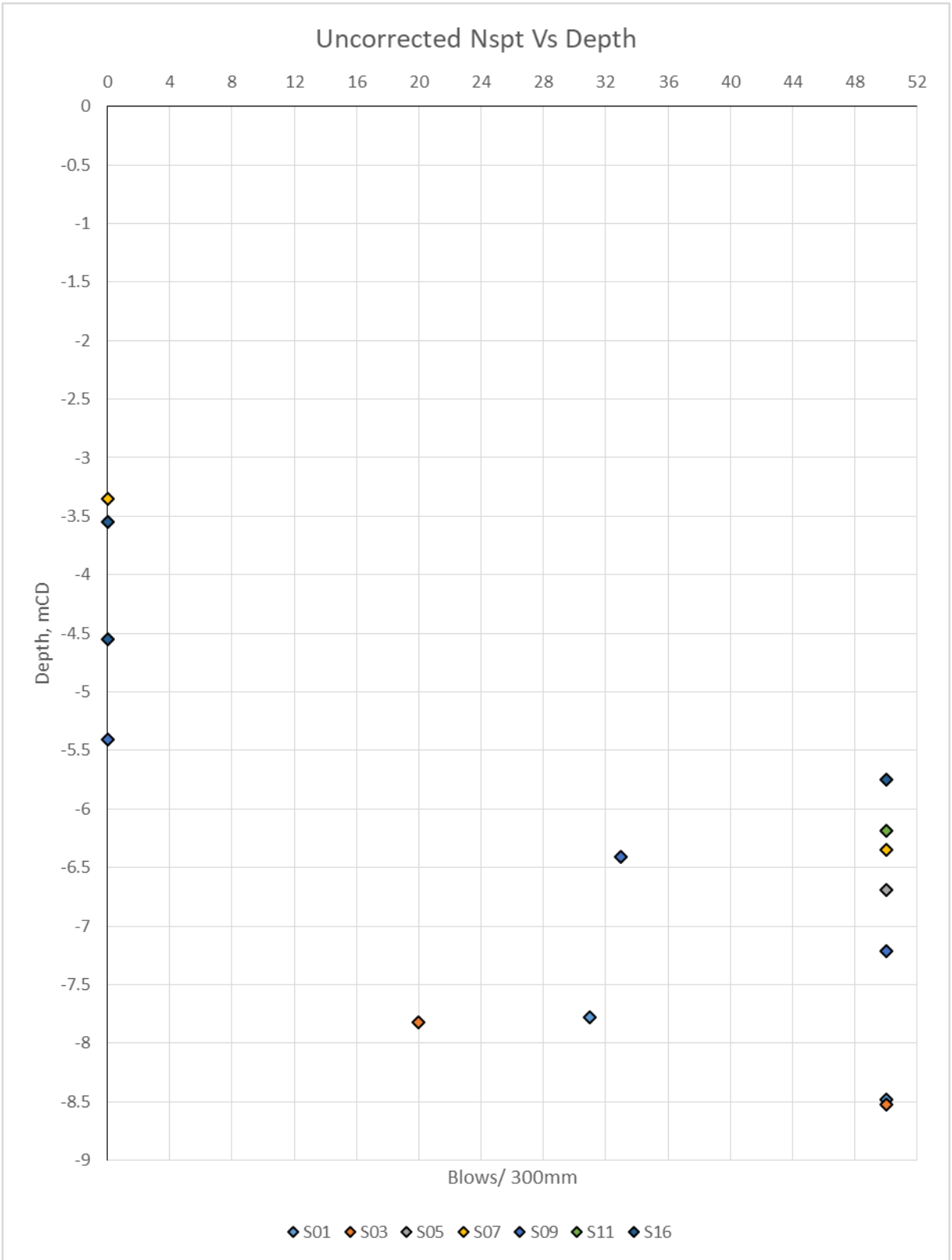
Standard penetration test, refusals were identified; where the complete set of 4 number 75mm increments were not achieved, these refusals were plotted as the numerical value 50.




Moisture content profile
15
25
35
45
55
65
75
85
95
105
115
125
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
Depth, m bgl
Moisture content, %


Uncorrected Nspt Vs Depth
0
4
8
12
16
20
24
28
32
36
40
44
48
52
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5
-5.5
-6
m, bgl
Blows/ 300mm
S01
S03
S05
S07
S09
S11
S16


Uncorrected Nspt Vs Depth
0
4
8
12
16
20
24
28
32
36
40
44
48
52
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5
-5.5
-6
-6.5
-7
-7.5
-8
-8.5
-9
-9.5
-10
-10.5
-11
-11.5
-12
mOD Malin
Blows/ 300mm
S01
S03
S05
S07
S09
S11
S16


Uncorrected Nspt Vs Depth
0
4
8
12
16
20
24
28
32
36
40
44
48
52
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5
-5.5
-6
-6.5
-7
-7.5
-8
-8.5
-9
Depth, mCD
Blows/ 300mm
S01
S03
S05
S07
S09
S11
S16

For a factor f_1= 4.5 (MH) such that undrained shear strength is given by,

Cu (kPa) = Nspt x f_1 (Stroud, 1975) where f_1 being function of plasticity, PI= 14 – 40.

Taking a characteristic value of N_{SPT}= 0 (0 – 1), an undrained shear strength within the range 5kPa to 15kPa is expected for upper very soft marine sediments. For the lower stiff deposits with a characteristic Nspt =31 an undrained shear strength of 140kPa is expected.

Particle density was measured at 2.39Mg/m^3 to 2.97mg/m^3. Soil unit weight(s) were assessed as follows:

Cohesive: γ_{sat} = 16.8 + 0.15N (kPa, kN/m^3)

Unit weight of 16.8kPa is expected of the marine SILT deposits (N_{SPT} 0-1).

Depth (m bgl)	Nspt	Strata	Unit weight, kNm^{-3}	Moisture content, %	Bulk density, Mgm^{-3}	Dry density, Mgm^{-3}
0.00 - 1.50	0	SILT	16.8	70	1.71	1.01
1.50 -2.50	31	SILT	21.45	70	2.19	1.29
2.50 - 3.00	20	SILT	19.8	95	2.02	1.04
3.00 -3.30	50	SILT	24.3	90	2.48	1.30

5.5 EXCAVATIONS

It is intended to provide a single dredging programme as follows:

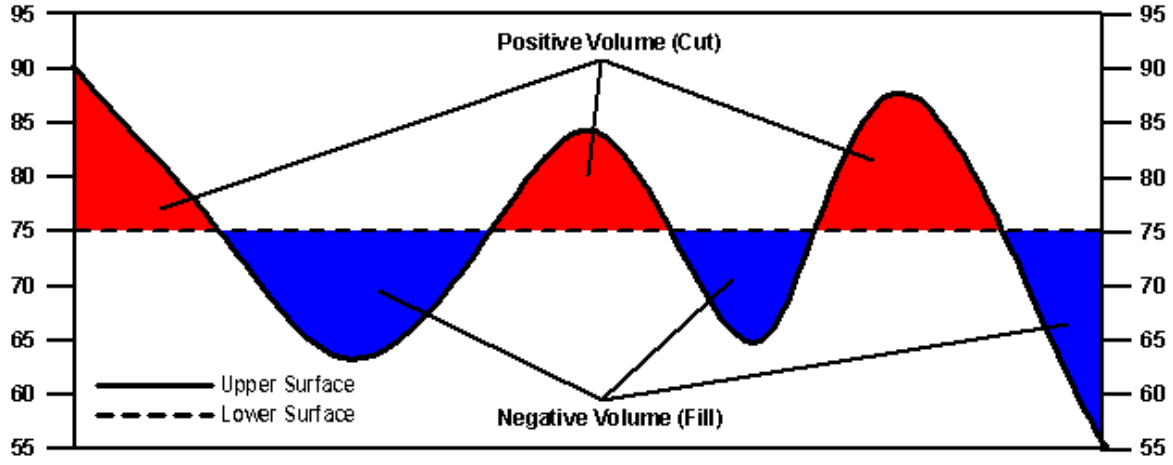
Dredge to bedrock or -5.5m Chart Datum.

Cut & Fill Volumes

Positive Volume [Cut]: 37303 m^3

Negative Volume [Fill]: 198 m^3

Net Volume [Cut-Fill]: 37105 m^3



The soft marine sediment to be dredged, will be excavated (dredged) by hydraulic or mechanical excavator or similar.

Excavation (dredging) within the rockmass is not expected. If required, will be by hard (hydraulic) digging and ripping. The energy required to rip has not been defined.

6 SUMMARY

1. Ten (10) locations were drilled and sampled using PGL's Dando 2000 rig and 200mm diameter casing. The exploratory logs are presented in **APPENDIX A** of this report.

2. Shallow very soft (N_{SPT} 0 - 1) slightly sandy SILT (marine sediment) were encountered at exploratory hole locations, 1.5m to 5.4m thick; overlying a layer of slightly sandy slightly gravelly CLAY 0.1m to 0.7m thick. GRAVEL deposits were encountered at location S09 at a depth 1.5m to 3.30m bgl.

3. *In situ* standard penetration tests were carried out to assess the strength of the deposits encountered. Details are presented on the relevant borehole logs in **APPENDIX A** of this report.

4. Detailed records of the ground and groundwater conditions can be found on the exploratory logs and photographic records presented within **APPENDIX A** of this factual report.

5. Laboratory testing was undertaken to determine the classification, engineering properties and geo-chemistry of the soil and rock encountered during the ground investigation. The data is presented in **APPENDIX B** of this report and discussed herein.

6. A geophysical survey consisting of marine side scan sonar, magnetometer and seismic reflection was undertaken by PGL. The results are presented in a separate report.

7. The exploratory locations are presented on the location plans presented within **APPENDIX A** of this report.

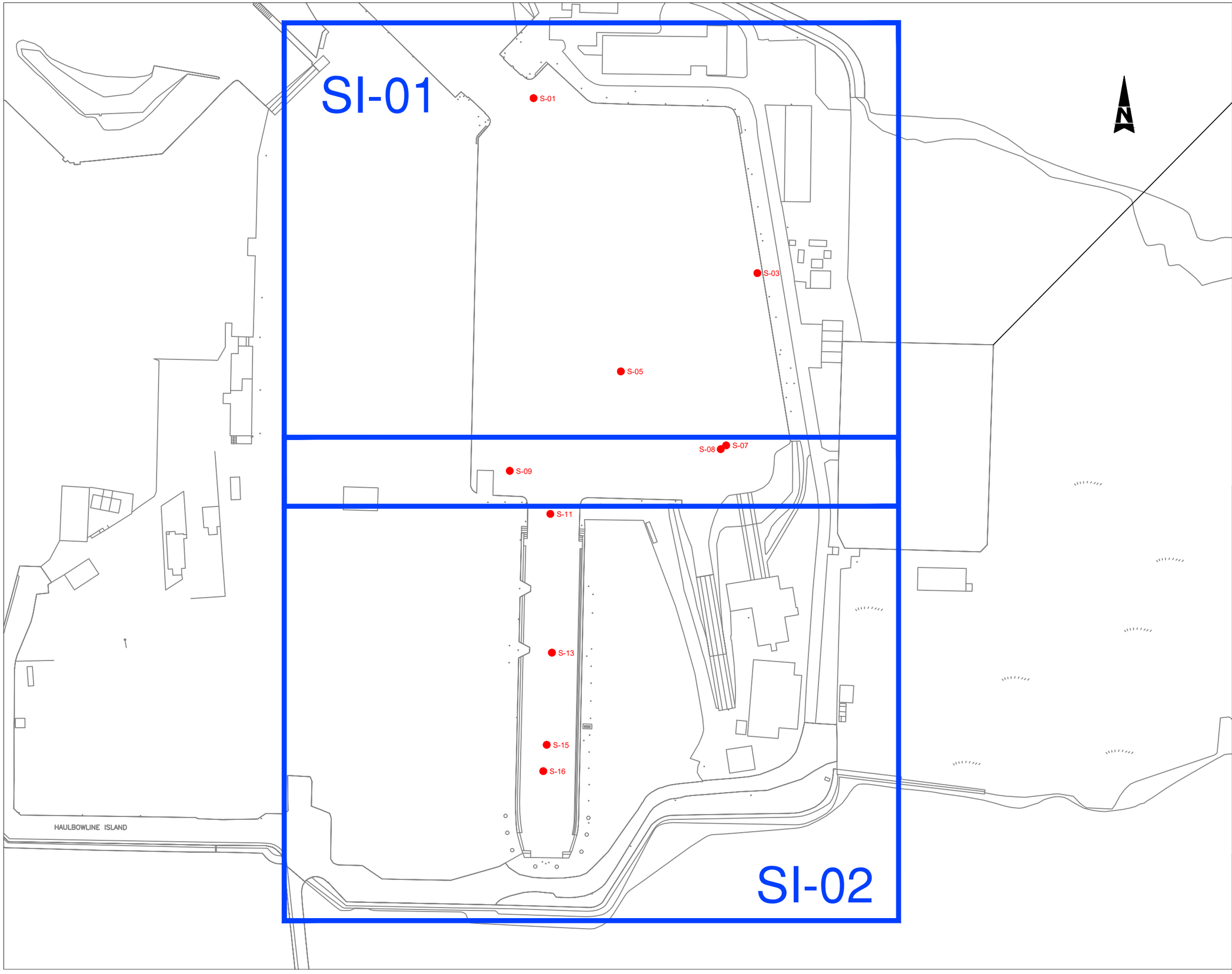
APPENDIX A

EXPLORATORY LOGS

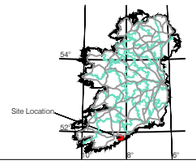
Type	Comments
Cable Percussion Boreholes	S01, S03, S05, S07, S08, S09, S11, S13, S15 & S16.

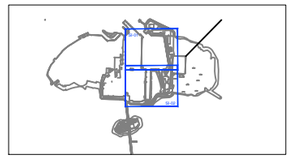
EXPLORATORY LOCATION PLAN

Location Plans	P21250_SI_01



Priority Geotechnical Site





JOB NAME:

Haulbowline,
Naval Base,
Co. Cork.

Sheet Title:

EXPLORATORY LOCATION LAYOUT

JOB NUMBER:

P21250

DRAWING NUMBER:

P21250-SI-A

DRAWN BY:

[redacted]

DATE:

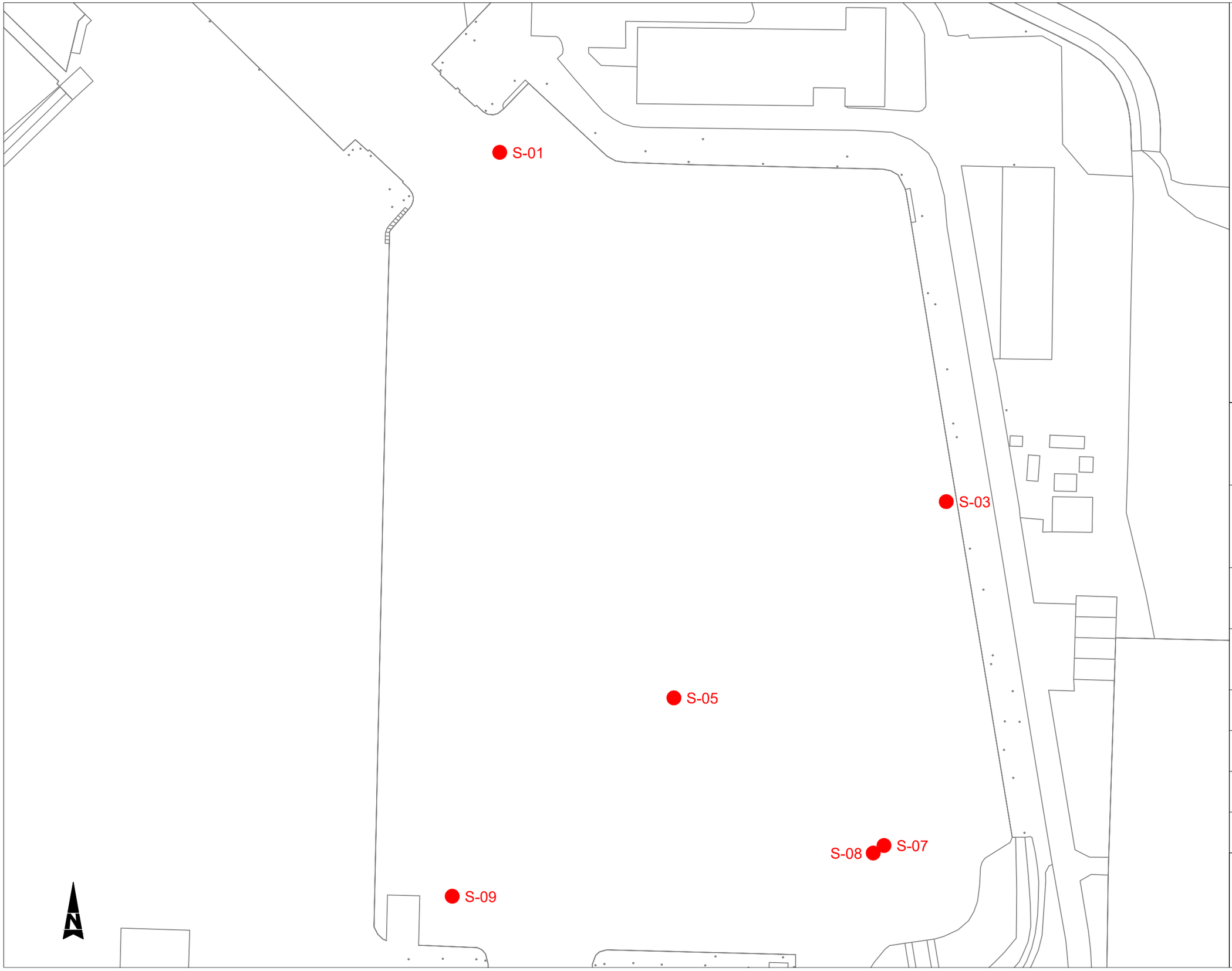
19/01/2022

SCALE:	APPROVED:
1:2000 ON A3	GH

REVISION:

D01

pgl priority geotechnical



KEY:

S-00 Denotes Borehole Sample location

JOB NAME:

Haulbowline,
Naval Base,
Co. Cork.

Sheet Title:

EXPLORATION LOCATION PLAN

JOB NUMBER:

P21250

DRAWING NUMBER:

P21250-SI-01

DRAWN BY:

[redacted]

DATE:

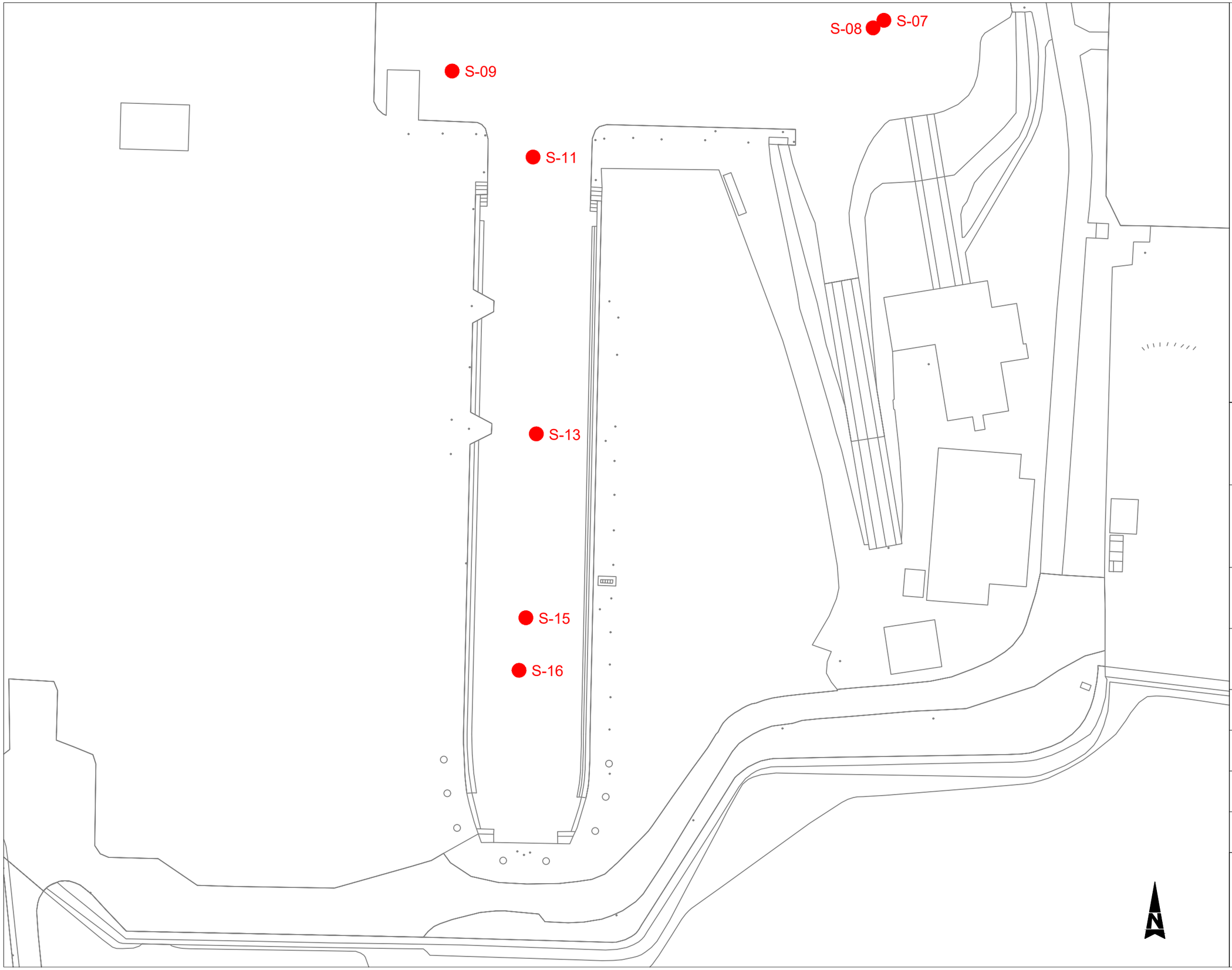
19/01/2022

SCALE:	APPROVED:
1:1000 ON A3	GH

REVISION:

D01

pgl priority geotechnical



KEY:

S-00 Denotes Borehole Sample location

JOB NAME:

Haulbowline,
Naval Base,
Co. Cork.

Sheet Title:

EXPLORATION LOCATION PLAN

JOB NUMBER:

P21250

DRAWING NUMBER:

P21250-SI-02

DRAWN BY:

[redacted]

DATE:

19/01/2022

SCALE:	APPROVED:
1:1000 ON A3	GH

REVISION:

D01

pgl priority geotechnical

KEY TO SYMBOLS ON EXPLORATORY HOLE RECORDS

All linear dimensions are in metres or millimetres

DESCRIPTIONS

**	Drillers Description
Friable	Easily crumbled

SAMPLES

U( )	Undisturbed 102mm diameter sample, ( ) denotes number of blows to drive sampler
U( )F, U( )P	F- not recovered, P-partially recovered
U38	Undisturbed 38mm diameter sample
P(F), (P)	Piston sample - disturbed
B	Bulk sample - disturbed
D	Jar Sample - disturbed
W	Water Sample
CBR	California Bearing Ratio mould sample
ES	Chemical Sample for Contamination Analysis
SPTLS	Standard Penetration Test S lump sample from split sampler

CORE RECOVERY AND ROCK QUALITY

TCR	Total Core Recovery (% of Core Run)
SCR	Solid Core Recovery (length of core having at least one full diameter as % of core run)
RQD	Rock Quality Designation (length of solid core greater than 100mm as % of core run)

Where there is insufficient space for the TCR, SCR and RQD, the results may be found in the remarks column

If	Fracture Spacing in mm (Minimum/Average/Maximum) NI - non intact, NR - no recovery
AZCL	Assumed Zone of Core Loss
NI	Non intact

GROUNDWATER

▽	Groundwater strike
▼	Groundwater level after standing period
Date/Water	Date of shift (day/month)/Depth to water at end of previous shift shown above the date and depth to water at beginning of shift given below the date

INSITU TESTING

S	Standard Penetration Test - split barrel sampler
C	Standard Penetration Test - solid 60^o cone
SW	Self Weight Penetration
Ivp, HVp (R)	In Situ Vane Test, Hand Vane Test (R) demonstrates remoulded strength
K(F), (C), (R), (P)	Permeability Test
HP	Hand Penetrometer Test

MEASURED PROPERTIES

N	Standard Penetration Test - blows required to drive 300mm after seating drive
x/y	Denotes x blows for y mm within the Standard Penetration Test
x*/y	Denotes x blows for y mm within the seating drive
c_u	Undrained Shear Strength (kN/m^2)
CBR	California Bearing Ratio

ROTARY DRILLING SIZES

Index Letter	Nominal Diameter (mm)	
	Borehole	Core
N	75	54
H	99	76
P	120	92
S	146	113

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Drilled By	Borehole No.
KC	**S01**
Logged By	Sheet 1 of 1
OD	

Project Name:	Haulbowline Naval Base Site Investigation	**Project No.** P21250	**Co-ords:**	579331E - 565654N	**Hole Type** CP
Location:	Ringaskiddy, Co. Cork		**Level:**	-5.28 m CD	**Scale** 1:50
Client:	Department of Defence		**Date:**	19/01/2022 - 19/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mCD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		0.00	ES					Very soft, dark grey, organic, slightly sandy SILT. Sand is fine.
		2.50 - 3.20 2.50	B SPT (C)	N=31 (7,8/8,9,9,5)	2.50	-7.78		Stiff, grey, slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded.
		3.20	SPT (C)	50 (25 for 0mm/50 for 0mm)	3.20	-8.48		End of Borehole at 3.200m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				Drilled over water.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
3.20	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks:

Borehole terminated at 3.20m, refusal.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	19/01/2022 08:00	0.00	Start of shift.
	19/01/2022 18:00	3.20	End of borehole.

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	**Drilled By** KC **Logged By** AO	Borehole No. **S03** Sheet 1 of 1

Project Name:	Haulbowline Naval Base Site Investigation	**Project No.** P21250	**Co-ords:** 579455E - 565557N	**Hole Type** CP
Location:	Ringaskiddy, Co. Cork		**Level:** -4.82 m CD	**Scale** 1:50
Client:	Department of Defence		**Date:** 17/01/2022 - 17/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mCD)	Legend	Stratum Description
		0.00 0.00 - 1.50	ES B					Dark grey, organic, slightly gravelly slightly sandy SILT with a bone fragment. Sand is fine. Gravel is fine to coarse.
		1.50 - 3.00	B		1.50	-6.32		Dark grey, organic slightly sandy gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, varied lithology.
		3.00 - 3.70 3.00	B SPT (C)	N=20 (3,4/4,5,5,6)	3.00	-7.82		Stiff, brown, slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded, varied lithology. Cobbles are angular to sub-angular, varied lithology.
		3.70	SPT (C)	50 (25 for 0mm/50 for 0mm)	3.70	-8.52		End of Borehole at 3.700m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				Drilled over water.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
3.70	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks:

Borehole terminated at 3.70m bgl, refusal.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	17/01/2022 08:00	0.00	Start of shift.
	17/01/2022 18:00	3.70	End of borehole.

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	**Drilled By** KC **Logged By** OD	Borehole No. **S05** Sheet 1 of 1

Project Name:	Haulbowline Naval Base Site Investigation	**Project No.** P21250	**Co-ords:**	579379E - 565503N	**Hole Type** CP
Location:	Ringaskiddy, Co. Cork		**Level:**	-4.69 m CD	**Scale** 1:50
Client:	Department of Defence		**Date:**	19/01/2022 - 19/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mCD)	Legend	Stratum Description
		0.00	ES					Grey, organic slightly gravelly slightly sandy SILT. Sand is fine. Gravel is fine to coarse.
		1.60 - 2.00	B		1.60	-6.29		Stiff, grey brown, slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to rounded, varied lithology.
		2.00	SPT (C)	50 (25 for 0mm/50 for 0mm)	2.00	-6.69		End of Borehole at 2.000m

Groundwater:				
Struck (m bgl)	**Rose to (m bgl)**	**After (mins)**	**Sealed (m bgl)**	**Comment**
				Drilled over water.

Hole Information:		
Depth (m bgl)	**Hole Dia (mm)**	**Casing Dia (mm)**
2.00	200	200
Equipment:	Dando 2000	

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks:

Borehole terminated at 2.00m, refusal.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	19/01/2022 08:00	0.00	Start of shift.
	19/01/2022 18:00	2.00	End of borehole.

pgl priority geotechnical	**Priority Geotechnical Ltd.** **Tel: 021 4631600** **Fax: 021 4638690** **www.prioritygeotechnical.ie**	**Drilled By** KC **Logged By** AO	Borehole No. **S07** Sheet 1 of 1

Project Name:	Haulbowline Naval Base Site Investigation	**Project No.** P21250	**Co-ords:**	579438E - 565462N	**Hole Type** CP
Location:	Ringaskiddy, Co. Cork		**Level:**	-0.85 m CD	**Scale** 1:50
Client:	Department of Defence		**Date:**	18/01/2022 - 18/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (mCD)	Legend	Stratum Description
		0.00 - 2.50	B					Dark grey, organic, slightly sandy SILT. Sand is fine.
		1.00	ES					
		2.50 - 5.40	B		2.50	-3.35		
		2.50	SPT (C)	N=0 (0,0/0,0,0,0)				Soft, dark grey, organic slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, varied lithology.
		5.40 - 5.50	D		5.40	-6.25		
		5.50	SPT (C)	50 (25 for 0mm/50 for 0mm)	5.50	-6.35		Very stiff, brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded, varied lithology.
								End of Borehole at 5.500m

1 2 3 4 5 6 7 8 9

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				Drilled over water.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
5.50	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks:

Borehole terminated at 5.50m bgl, refusal.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	18/01/2022 08:00	0.00	Start of shift.
	18/01/2022 18:00	5.50	End of borehole.

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Drilled By	Borehole No.
KC	**S08**
Logged By	Sheet 1 of 1
AO	

Project Name:	Haulbowline Naval Base Site Investigation	**Project No.** P21250	**Co-ords:**	579435E - 565460N	**Hole Type** CP
Location:	Ringaskiddy, Co. Cork		**Level:**	-4.15 m CD	**Scale** 1:50
Client:	Department of Defence		**Date:**	17/01/2022 - 17/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mCD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
								Very soft, dark grey, organic slightly sandy SILT. Sand is fine.
		2.00 2.00	B ES		2.00	-6.15		End of Borehole at 2.000m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				Drilled over water.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
2.00	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks:

Borehole terminated at 2.00m bgl, refusal.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	17/01/2022 08:00	0.00	Start of shift.
	17/01/2022 18:00	2.00	End of borehole.

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Drilled By	Borehole No.
KC	**S09**
Logged By	Sheet 1 of 1
AO	

Project Name:	Haulbowline Naval Base Site Investigation	**Project No.** P21250	**Co-ords:**	579318E - 565448N	**Hole Type** CP
Location:	Ringaskiddy, Co. Cork		**Level:**	-3.91 m CD	**Scale** 1:50
Client:	Department of Defence		**Date:**	18/01/2022 - 18/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mCD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		0.00 0.00 - 1.50	ES B					Very soft, dark grey, organic, slightly sandy SILT. Sand is fine.
		1.50 - 3.30 1.50	B SPT (C)	N=0 (0,0/0,0,0,0)	1.50	-5.41		Loose to dense, grey, slightly sandy slightly silty GRAVEL with high cobble content and dark grey organic SILT infill. Gravel is fine to coarse, angular, Limestone. Cobbles are angular, Limestone.
		2.50	SPT (C)	N=33 (6,6/7,8,9,9)				
		3.30	SPT (C)	50 (25 for 0mm/50 for 0mm)	3.30	-7.21		End of Borehole at 3.300m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				Drilled over water.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
3.30	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks:

Borehole terminated at 3.30m bgl, refusal.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	18/01/2022 08:00	0.00	Start of shift.
	18/01/2022 18:00	3.30	End of borehole.

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Drilled By	Borehole No.
KC	**S11**
Logged By	Sheet 1 of 1
AO	

Project Name:	Haulbowline Naval Base Site Investigation	**Project No.** P21250	**Co-ords:**	579340E - 565424N	**Hole Type** CP
Location:	Ringaskiddy, Co. Cork		**Level:**	-3.69 m CD	**Scale** 1:50
Client:	Department of Defence		**Date:**	18/01/2022 - 18/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mCD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		0.00 0.00 - 2.50	ES B					Very soft, dark grey, organic slightly gravelly slightly sandy SILT. Sand is fine. Gravel is fine to coarse.
		2.50	SPT (C)	50 (25 for 0mm/50 for 0mm)	2.50	-6.19		End of Borehole at 2.500m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				Drilled over water.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
2.50	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks:

Borehole terminated at 2.50m bgl, refusal.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	18/01/2022 08:00	0.00	Start of shift
	18/01/2022 18:00	2.50	End of borehole

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Drilled By	Borehole No.
KC	**S13**
Logged By	Sheet 1 of 1
AO	

Project Name:	Haulbowline Naval Base Site Investigation	**Project No.** P21250	**Co-ords:**	579341E - 565347N	**Hole Type** CP
Location:	Ringaskiddy, Co. Cork		**Level:**	-3.56 m CD	**Scale** 1:50
Client:	Department of Defence		**Date:**	18/01/2022 - 18/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mCD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
								Very soft, dark grey, organic slightly sandy SILT. Sand is fine.
		2.00 2.00	B ES		2.00	-5.56		End of Borehole at 2.000m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				Drilled over water.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
2.00	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks:

Borehole terminated at 2.00m bgl, refusal.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	18/01/2022 08:00	0.00	Start of shift
	18/01/2022 18:00	2.00	End of borehole

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Drilled By	Borehole No.
KC	**S15**
Logged By	Sheet 1 of 1
AO	

Project Name:	Haulbowline Naval Base Site Investigation	**Project No.** P21250	**Co-ords:**	579338E - 565296N	**Hole Type** CP
Location:	Ringaskiddy, Co. Cork		**Level:**	-2.65 m CD	**Scale** 1:50
Client:	Department of Defence		**Date:**	18/01/2022 - 18/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mCD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		1.50 1.50 1.50	B ES ES		1.50	-4.15		Very soft, dark grey, slightly sandy organic SILT. Sand is fine. End of Borehole at 1.500m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				Drilled over water.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
1.50	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks:

Borehole terminated at 1.50m bgl, refusal.

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	18/01/2022 08:00	0.00	Start of shift.
	18/01/2022 18:00	1.50	End of borehole.

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Drilled By	Borehole No.
KC	**S16**
Logged By	Sheet 1 of 1
AO	

Project Name:	Haulbowline Naval Base Site Investigation	**Project No.** P21250	**Co-ords:**	579336E - 565281N	**Hole Type** CP
Location:	Ringaskiddy, Co. Cork		**Level:**	-1.55 m CD	**Scale** 1:50
Client:	Department of Defence		**Date:**	18/01/2022 - 18/01/2022	

Well Backfill	Water Strike (m bgl)	Sample and In Situ Testing			Depth (m bgl)	Level (mCD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		0.00 - 4.20	B					Very soft, dark grey, organic SILT.
		2.00	SPT (C)	N=0 (0,0/0,0,0,0)				
		3.00	ES					
		3.00	SPT (C)	N=0 (0,0/0,0,0,0)				
		4.20	SPT (C)	50 (25 for 0mm/50 for 0mm)	4.20	-5.75		End of Borehole at 4.200m

Groundwater:

Struck (m bgl)	Rose to (m bgl)	After (mins)	Sealed (m bgl)	Comment
				Drilled over water.

Hole Information:

Depth (m bgl)	Hole Dia (mm)	Casing Dia (mm)
4.20	200	200

Equipment: Dando 2000

Chiselling Details:

Top (m)	Base (m)	Duration (hh:mm)	Tool

Remarks:

Borehole terminated at 4.20m bgl, refusal

Shift Data:

GW (m bgl)	Shift	Depth (m bgl)	Remarks
	18/01/2022 08:00	0.00	Start of shift
	18/01/2022 18:00	4.20	End of borehole

APPENDIX B

LABORATORY RESULTS

KEY TO SYMBOLS - LABORATORY TEST RESULT

U	Undisturbed Sample	
P	Piston Sample	
TWS	Thin Wall Sample	
B	Bulk Sample - Disturbed	
D	Jar Sample - Disturbed	
W	Water Sample	
pH	Acidity/Alkalinity Index	
SO_3	% - Total Sulphate Content (acid soluble)	
SO_3	g/ltr - Water Soluble Sulphate (Water or 2:1 Aqueous Soil Extract)	
+	Calcareous Reaction	
Cl	Chloride Content	
PI	Plasticity Index	
<425	% of material in sample passing 425 micron sieve	
LL	Liquid Limit	
PL	Plastic Limit	
MC	Water Content	
NP	Non Plastic	
Yb	Bulk Density	
Yd	Dry Density	
Ps	Particle Density	
U/D	Undrained/Drained Triaxial	
U/C	Unconsolidated/Consolidated Triaxial	
T/M	Single Stage/Multistage Triaxial	
100/38	Sample Diameter (mm)	
REM	Remoulded Triaxial Test Specimen	
TST	Triaxial Suction Test	
V	Vane Test	
DSB	Drained Shear Box	
RSB	Residual Shear Box	
RS	Ring Shear	
σ_3	Cell Pressure	
σ_1-σ_3	Deviator Stress	
c	Cohesion	
c_	Effective Cohesion Intercept	
ϕ	Angle of Shearing Resistance - Degrees	
ϕ_	Effective Angle of Shearing Resistance	
εf	Strain at Failure	
*	Failed under 1st Load	
**	Failed under 2nd Load	
#	Untestable	
##	Excessive Strain	
p_o	Effective Overburden Pressure	
m_v	Coefficient of Volume Decrease	
c_v	Coefficient of Consolidation	
Opt	Optimum	
Nat	Natural	
Std	Standard Compaction - 2.5kg Rammer	(¶ CBR)
Hvy	Heavy Compaction - 4.5kg Rammer	(§ CBR)
Vib	Vibratory Compaction	
CBR	California Bearing Ratio	
Sat m.c.	Saturation Moisture Content	
MCV	Moisture Condition Value	

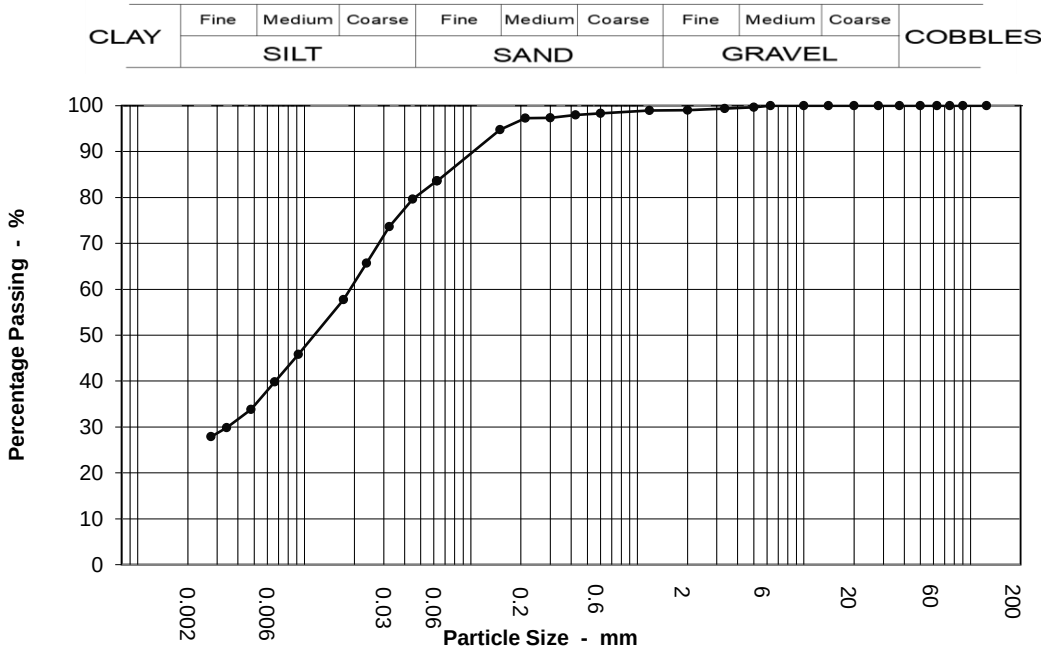
pgl priority geotechnical	**Natural Moisture Content/Atterberg Limits Summary** **BS 1377 : Part 2 : 1990 : Clause 3**	**Job Ref**
Location	**Haulbowline**	**P21250**

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pass 425
S01	1	2.5	B	Slightly gravelly slightly sandy SILT	70	72	42	30	100
S03	1	0	B	Slightly gravely slightly sandy SILT	68	80	45	35	100
S03	2	1.5	B	Slightly sandy gravelly SILT	29	40	26	14	65.7
S03	3	3	B	Slightly sandy slightly gravelly CLAY with medium cobble content	95	41	25	16	68.9
S05	1	1.6	B	Slightly gravelly slightly sandy SILT	81	63	41	22	99.3
S07	1	0	B	Slightly sandy SILT	87	87	53	34	100
S07	2	2.5	B	Slightly sandy slightly gravelly CLAY	90	61	39	22	97.3
S08	1	2	B	Slightly sandy SILT	87	88	48	40	100
S09	2	0	B	Slightly sandy SILT	117				
S09	3	1.5	B	Slightly sandy slightly silty GRAVEL with high cobble content	15				
S11	2	0	B	Slightly sandy SILT	111				
S13	2	2	B	Slightly gravelly slightly sandy SILT	104				
S15	3	1.5	B	Slightly sandy SILT	103				

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P21250**
		Borehole / Pit No	S01
Location	**Haulbowline**	Sample No	1
		Depth	2.50 m
Soil Description	Slightly gravelly slightly sandy SILT	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.062	84
90	100	0.045	80
75	100	0.032	74
63	100	0.024	66
50	100	0.017	58
37.5	100	0.009	46
28	100	0.007	40
20	100	0.005	34
14	100	0.003	30
10	100	0.003	28
6.3	100	0.001	22
5	100		
3.35	99		
2	99		
1.18	99		
0.6	98		
0.425	98		
0.3	97		
0.212	97		
0.15	95		
0.063	84		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

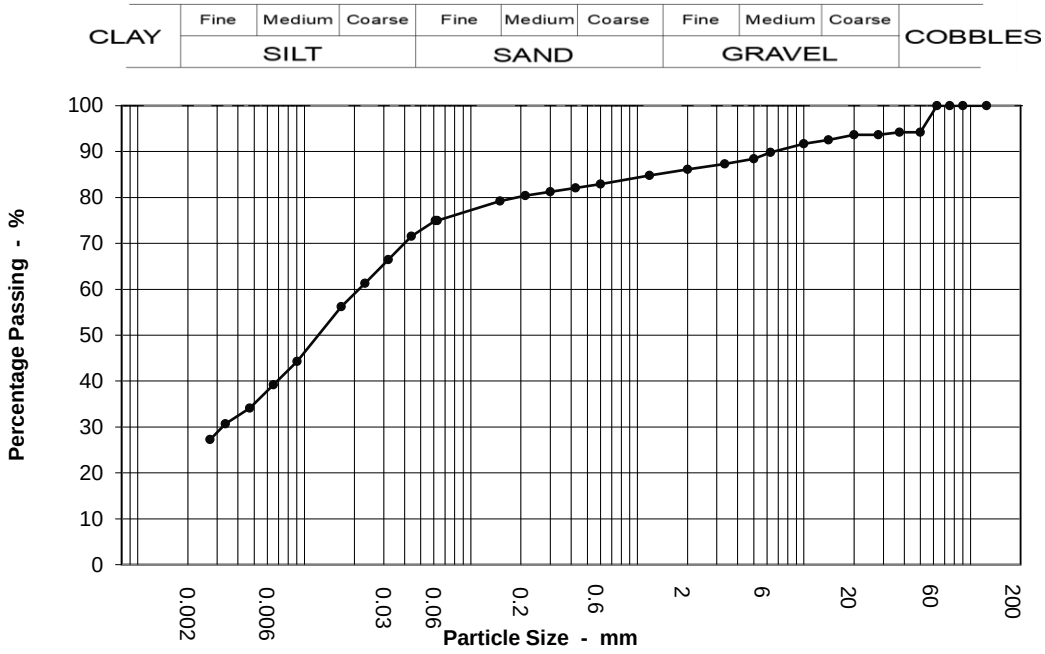
Sample Proportions	
Cobbles	0.0
Gravel	1.0
Sand	15.0
Silt	59.0
Clay	25.0

Grading Analysis	
D100	6.30
D60	0.02
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P21250**
		Borehole / Pit No	S03
Location	**Haulbowline**	Sample No	1
		Depth	0.00 m
Soil Description	Slightly gravely slightly sandy SILT	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.061	75
90	100	0.044	72
75	100	0.032	66
63	100	0.023	61
50	94	0.017	56
37.5	94	0.009	44
28	94	0.007	39
20	94	0.005	34
14	93	0.003	31
10	92	0.003	27
6.3	90	0.001	20
5	88		
3.35	87		
2	86		
1.18	85		
0.6	83		
0.425	82		
0.3	81		
0.212	80		
0.15	79		
0.063	75		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

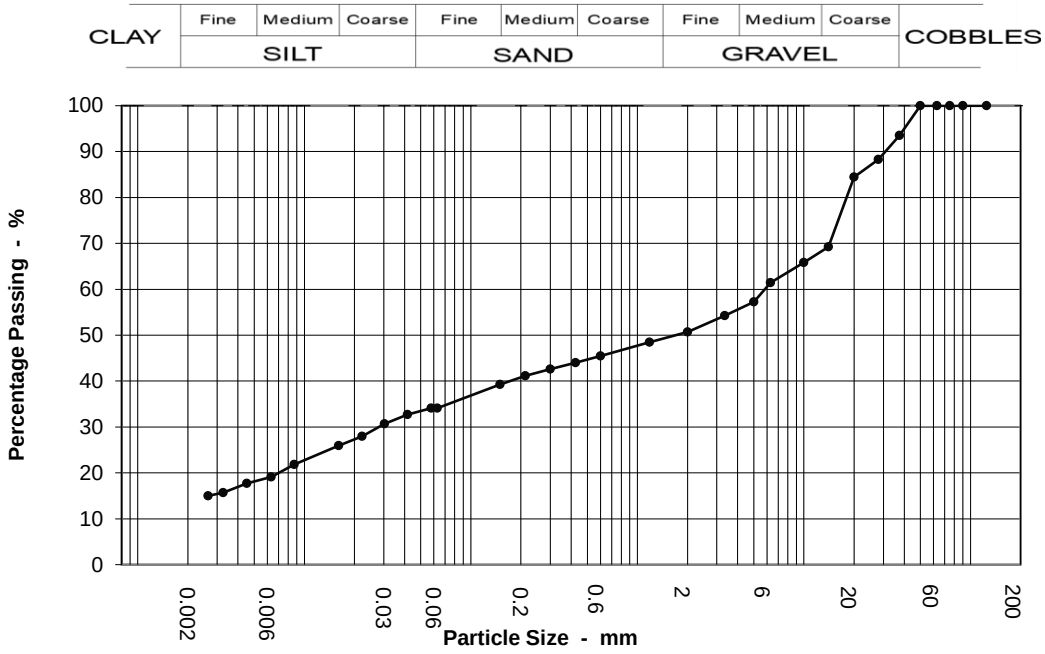
Sample Proportions	
Cobbles	0.0
Gravel	14.0
Sand	11.0
Silt	51.0
Clay	24.0

Grading Analysis	
D100	63.00
D60	0.02
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P21250**
		Borehole / Pit No	S03
Location	**Haulbowline**	Sample No	2
		Depth	1.50 m
Soil Description	Slightly sandy gravelly SILT	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.058	34
90	100	0.042	33
75	100	0.030	31
63	100	0.022	28
50	100	0.016	26
37.5	94	0.009	22
28	88	0.006	19
20	84	0.005	18
14	69	0.003	16
10	66	0.003	15
6.3	61	0.001	12
5	57		
3.35	54		
2	51		
1.18	48		
0.6	45		
0.425	44		
0.3	43		
0.212	41		
0.15	39		
0.063	34		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

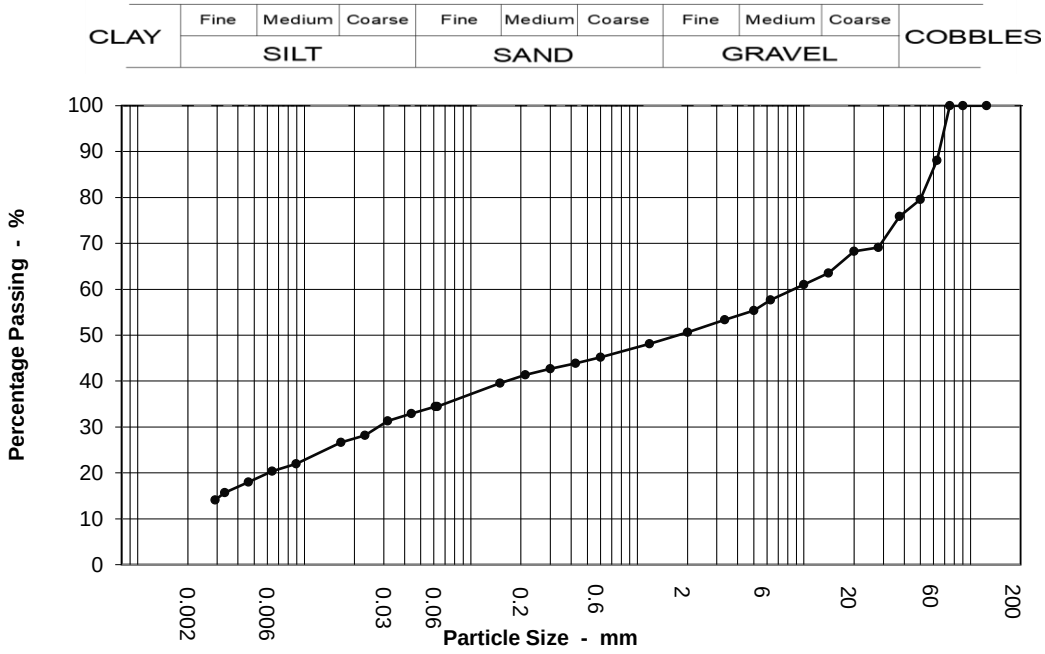
Sample Proportions	
Cobbles	0.0
Gravel	49.0
Sand	17.0
Silt	20.0
Clay	14.0

Grading Analysis	
D100	50.00
D60	5.83
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P21250**
		Borehole / Pit No	S03
Location	**Haulbowline**	Sample No	3
		Depth	3.00 m
Soil Description	Slightly sandy slightly gravelly CLAY with medium cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.061	34
90	100	0.044	33
75	100	0.032	31
63	88	0.023	28
50	80	0.017	27
37.5	76	0.009	22
28	69	0.006	20
20	68	0.005	18
14	63	0.003	16
10	61	0.003	14
6.3	58	0.001	9
5	55		
3.35	53		
2	51		
1.18	48		
0.6	45		
0.425	44		
0.3	43		
0.212	41		
0.15	40		
0.063	34		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

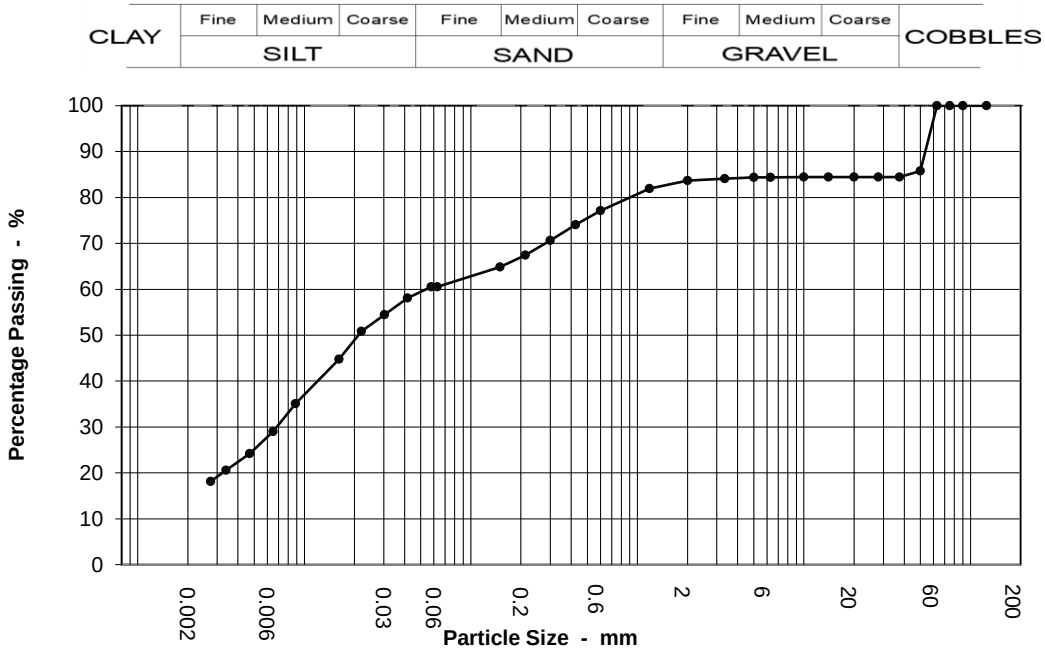
Sample Proportions	
Cobbles	12.0
Gravel	37.0
Sand	16.0
Silt	22.0
Clay	13.0

Grading Analysis	
D100	75.00
D60	8.71
D10	0.00
Uniformity Coefficient	8800.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P21250**
		Borehole / Pit No	S05
Location	**Haulbowline**	Sample No	1
		Depth	1.60 m
Soil Description	Slightly gravelly slightly sandy SILT	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.058	60
90	100	0.042	58
75	100	0.030	54
63	100	0.022	51
50	86	0.016	45
37.5	84	0.009	35
28	84	0.006	29
20	84	0.005	24
14	84	0.003	21
10	84	0.003	18
6.3	84	0.001	13
5	84		
3.35	84		
2	84		
1.18	82		
0.6	77		
0.425	74		
0.3	71		
0.212	67		
0.15	65		
0.063	60		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

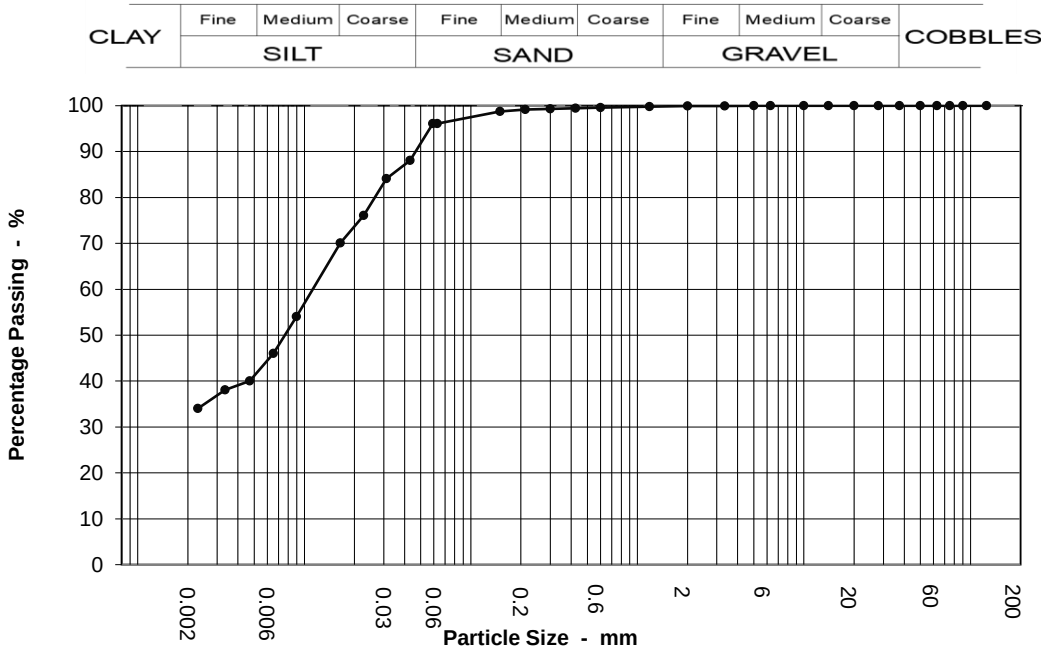
Sample Proportions	
Cobbles	0.0
Gravel	16.0
Sand	23.0
Silt	45.0
Clay	16.0

Grading Analysis	
D100	63.00
D60	0.05
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P21250**
		Borehole / Pit No	S07
Location	**Haulbowline**	Sample No	1
		Depth	0.00 m
Soil Description	Slightly sandy SILT	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.059	96
90	100	0.043	88
75	100	0.031	84
63	100	0.023	76
50	100	0.016	70
37.5	100	0.009	54
28	100	0.007	46
20	100	0.005	40
14	100	0.003	38
10	100	0.002	34
6.3	100	0.001	18
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	99		
0.3	99		
0.212	99		
0.15	99		
0.063	96		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

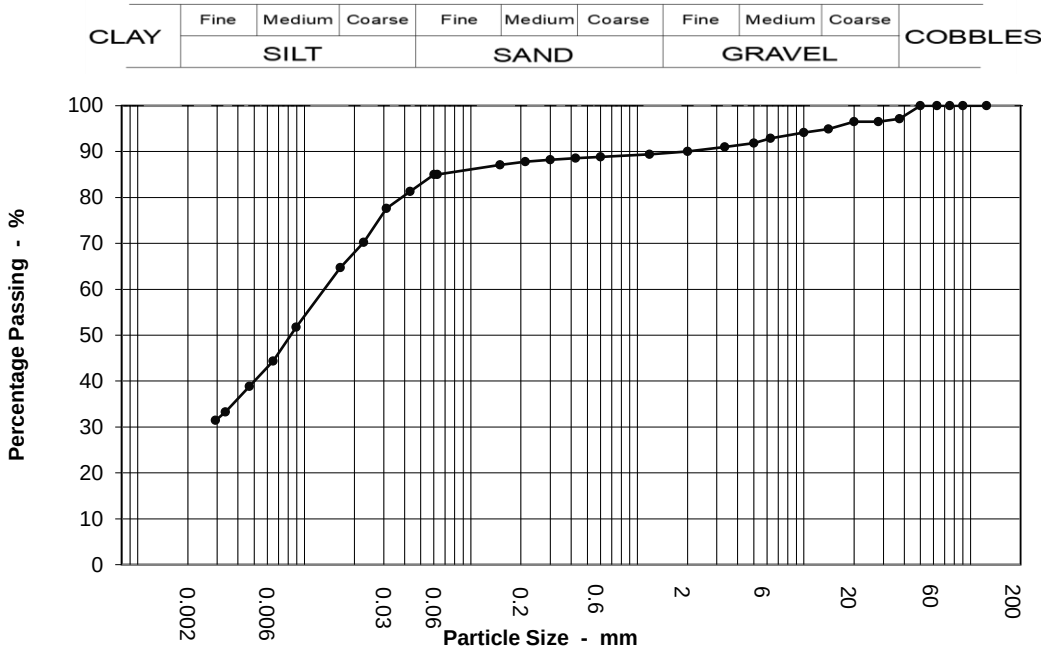
Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	4.0
Silt	64.0
Clay	32.0

Grading Analysis	
D100	6.30
D60	0.01
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P21250**
		Borehole / Pit No	S07
Location	**Haulbowline**	Sample No	2
		Depth	2.50 m
Soil Description	Slightly sandy slightly gravelly CLAY	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.060	85
90	100	0.043	81
75	100	0.031	78
63	100	0.023	70
50	100	0.016	65
37.5	97	0.009	52
28	97	0.006	44
20	97	0.005	39
14	95	0.003	33
10	94	0.003	31
6.3	93	0.001	18
5	92		
3.35	91		
2	90		
1.18	89		
0.6	89		
0.425	89		
0.3	88		
0.212	88		
0.15	87		
0.063	85		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

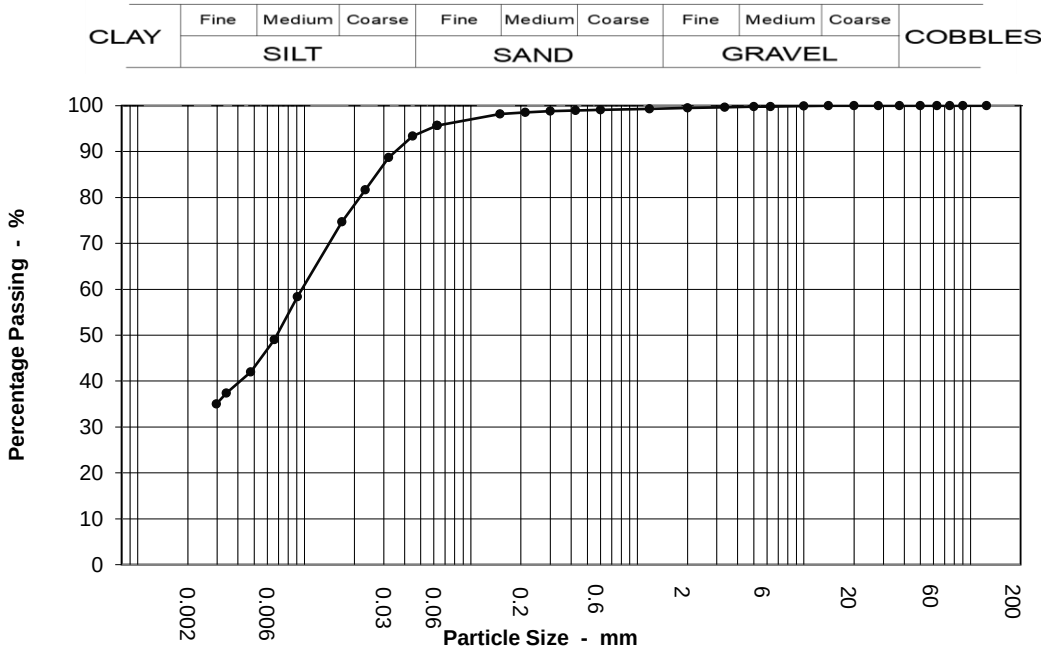
Sample Proportions	
Cobbles	0.0
Gravel	10.0
Sand	5.0
Silt	58.0
Clay	27.0

Grading Analysis	
D100	50.00
D60	0.01
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P21250**
		Borehole / Pit No	S08
Location	**Haulbowline**	Sample No	1
		Depth	2.00 m
Soil Description	Slightly sandy SILT	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.063	96
90	100	0.045	93
75	100	0.032	89
63	100	0.023	82
50	100	0.017	75
37.5	100	0.009	58
28	100	0.007	49
20	100	0.005	42
14	100	0.003	37
10	100	0.003	35
6.3	100	0.001	19
5	100		
3.35	100		
2	100		
1.18	99		
0.6	99		
0.425	99		
0.3	99		
0.212	99		
0.15	98		
0.063	96		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

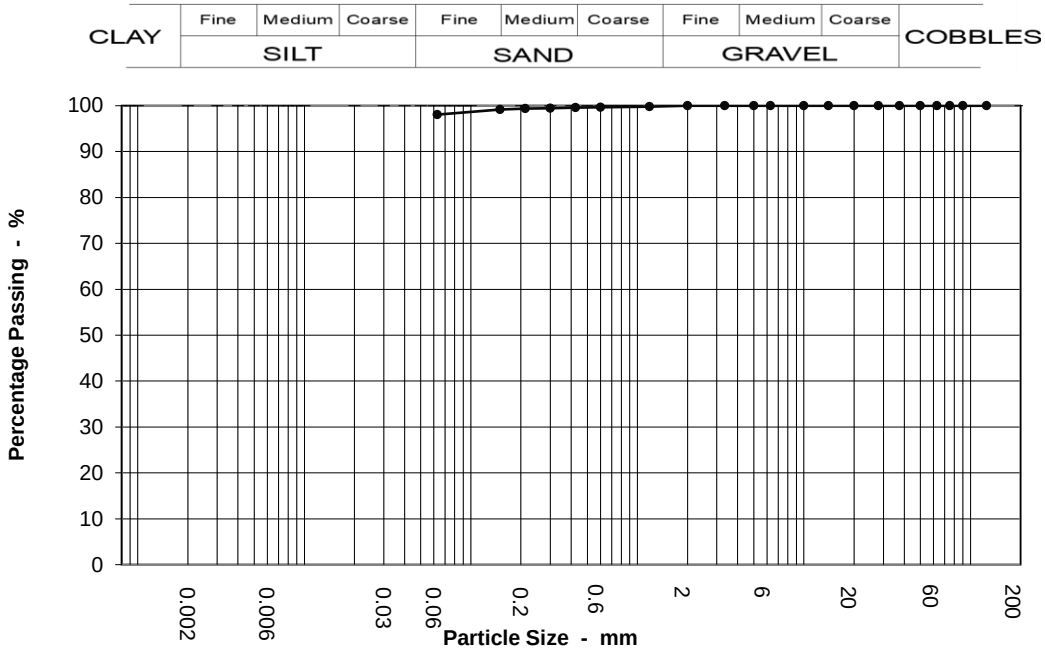
Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	4.0
Silt	66.0
Clay	30.0

Grading Analysis	
D100	14.00
D60	0.01
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P21250**
		Borehole / Pit No	S09
Location	**Haulbowline**	Sample No	2
		Depth	0.00 m
Soil Description	Slightly sandy SILT	Sample type	B



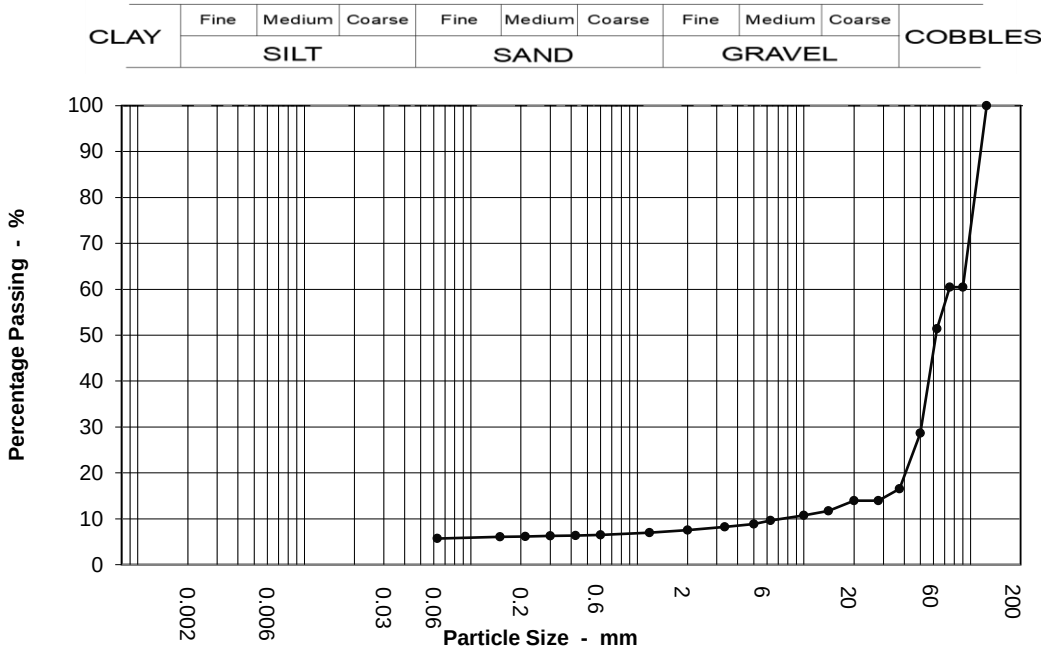
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	99		
0.212	99		
0.15	99		
0.063	98		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	2.0
Silt & Clay	98.0

Grading Analysis	
D100	3.35
D60	
D10	
Uniformity Coefficient	

pgl priority geotechnical	**PARTICLE SIZE DISTRIBUTION** **BS 1377 : Part 2 : 1990 : Clause 9**	**Job Ref**	**P21250**
		Borehole / Pit No	S09
Location	**Haulbowline**	Sample No	3
		Depth	1.50 m
Soil Description	Slightly sandy slightly silty GRAVEL with high cobble content	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	60		
75	60		
63	51		
50	29		
37.5	16		
28	14		
20	14		
14	12		
10	11		
6.3	10		
5	9		
3.35	8		
2	8		
1.18	7		
0.6	7		
0.425	6		
0.3	6		
0.212	6		
0.15	6		
0.063	6		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.3
Sedimentation	N/A

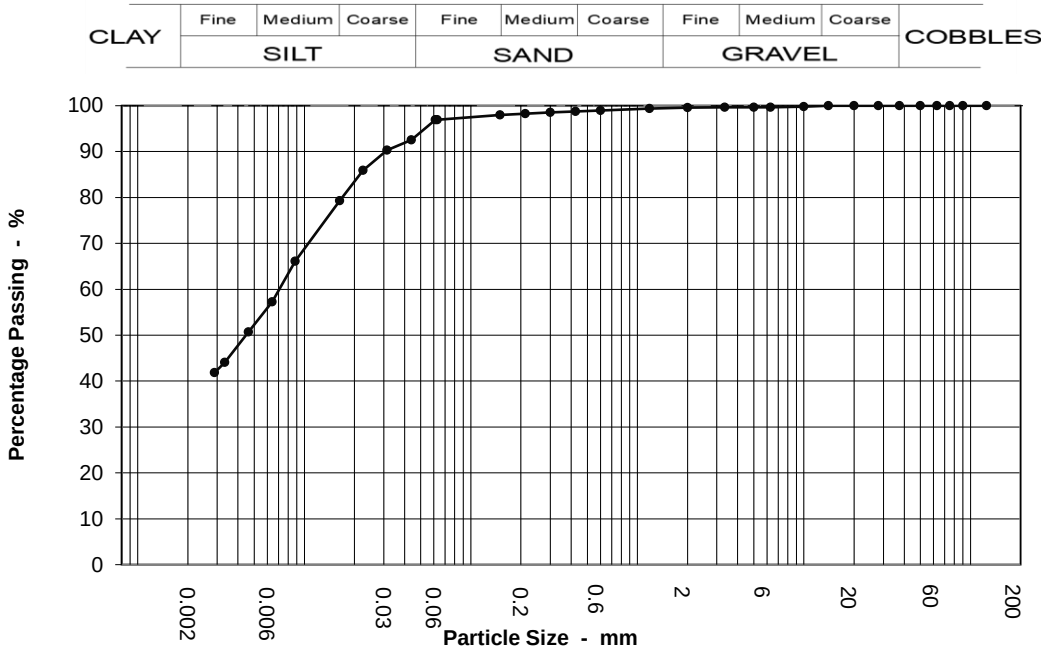
Sample Proportions	
Cobbles	49.0
Gravel	44.0
Sand	2.0
Silt & Clay	6.0

Grading Analysis	
D100	125.00
D60	74.30
D10	7.31
Uniformity Coefficient	10.00

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P21250**
		Borehole / Pit No	S11
Location	**Haulbowline**	Sample No	2
		Depth	0.00 m
Soil Description	Slightly sandy SILT	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.061	97
90	100	0.044	93
75	100	0.031	90
63	100	0.023	86
50	100	0.016	79
37.5	100	0.009	66
28	100	0.006	57
20	100	0.005	51
14	100	0.003	44
10	100	0.003	42
6.3	100	0.001	22
5	100		
3.35	100		
2	100		
1.18	99		
0.6	99		
0.425	99		
0.3	99		
0.212	98		
0.15	98		
0.063	97		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

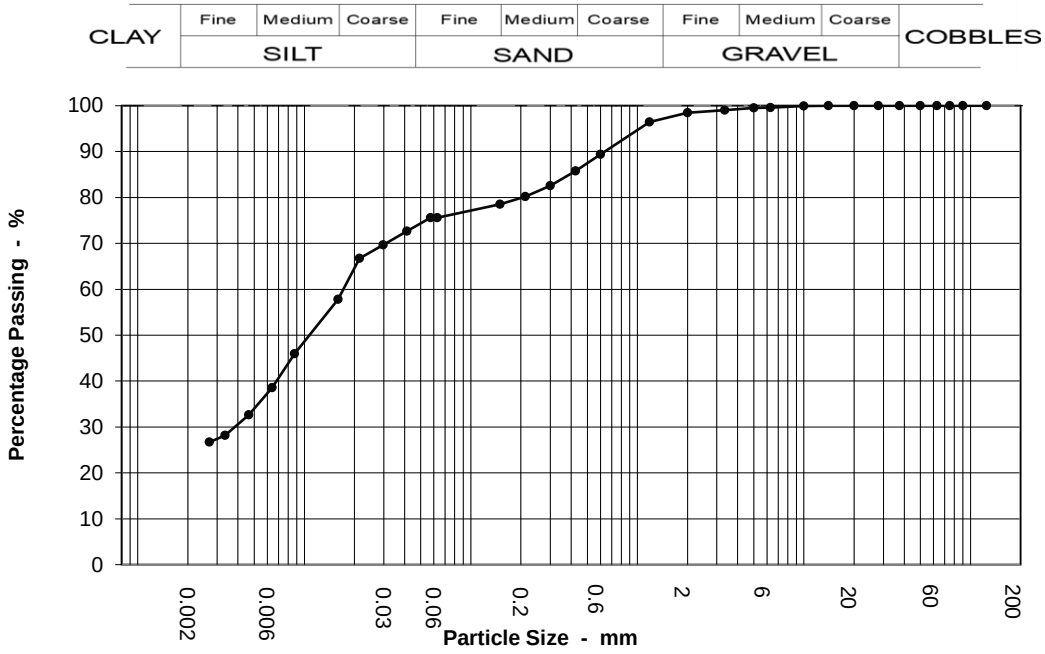
Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	3.0
Silt	61.0
Clay	36.0

Grading Analysis	
D100	14.00
D60	0.01
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P21250**
		Borehole / Pit No	S13
Location	**Haulbowline**	Sample No	2
		Depth	2.00 m
Soil Description	Slightly gravelly slightly sandy SILT	Sample type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.057	76
90	100	0.041	73
75	100	0.030	70
63	100	0.021	67
50	100	0.016	58
37.5	100	0.009	46
28	100	0.006	39
20	100	0.005	33
14	100	0.003	28
10	100	0.003	27
6.3	100	0.001	19
5	100		
3.35	99		
2	98		
1.18	96		
0.6	89		
0.425	86		
0.3	83		
0.212	80		
0.15	79		
0.063	76		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

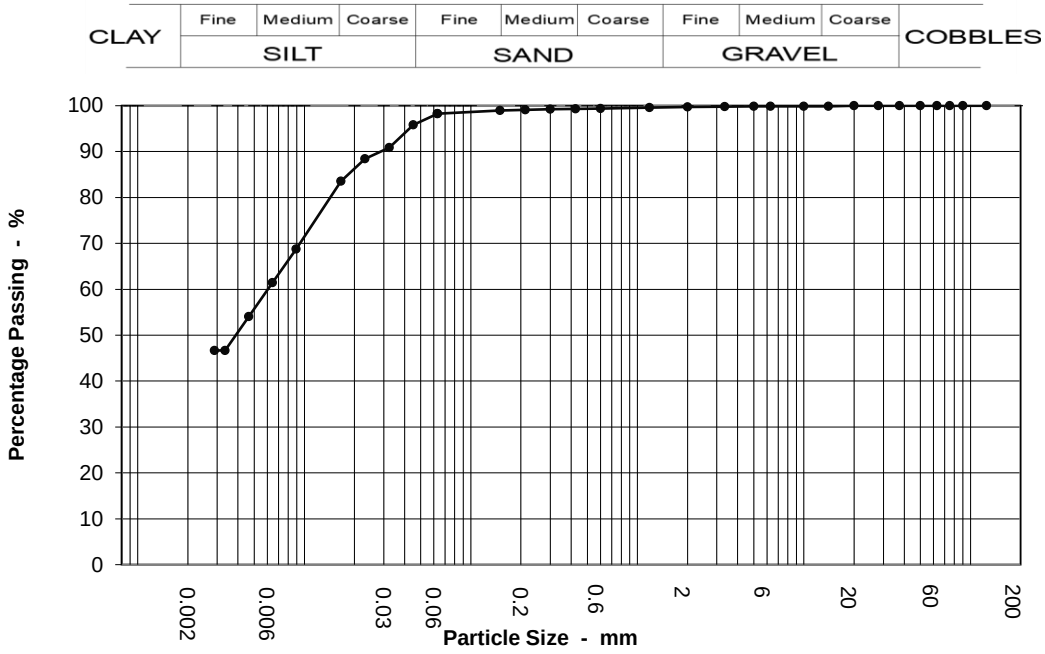
Sample Proportions	
Cobbles	0.0
Gravel	2.0
Sand	23.0
Silt	53.0
Clay	23.0

Grading Analysis	
D100	14.00
D60	0.02
D10	
Uniformity Coefficient	

PARTICLE SIZE DISTRIBUTION

BS 1377 : Part 2 : 1990 : Clause 9

		Job Ref	**P21250**
		Borehole / Pit No	S15
Location	**Haulbowline**	Sample No	3
		Depth	1.50 m
Soil Description	Slightly sandy SILT	Sample type	B



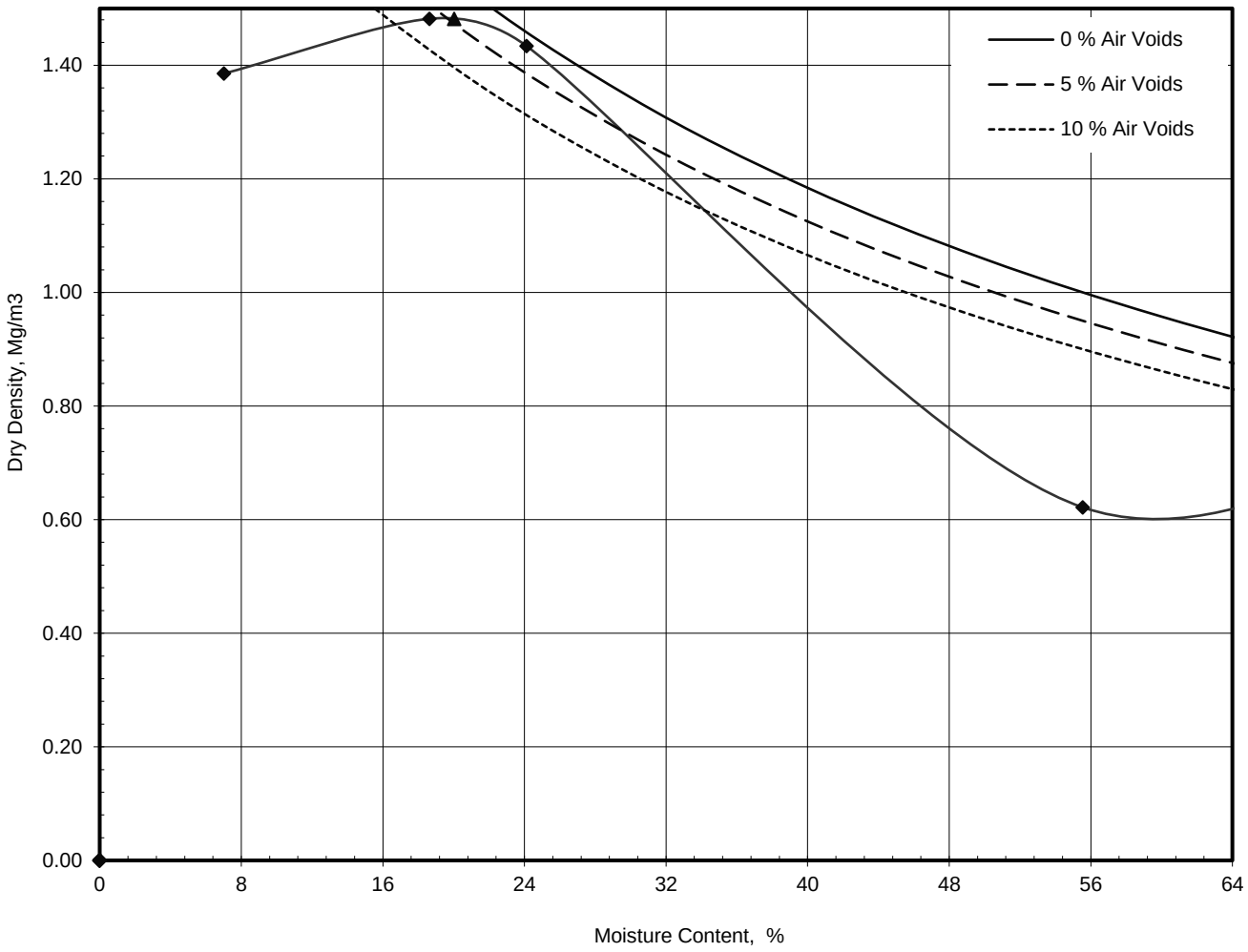
Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.063	98
90	100	0.045	96
75	100	0.032	91
63	100	0.023	88
50	100	0.017	84
37.5	100	0.009	69
28	100	0.006	61
20	100	0.005	54
14	100	0.003	47
10	100	0.003	47
6.3	100	0.001	25
5	100		
3.35	100		
2	100		
1.18	100		
0.6	99		
0.425	99		
0.3	99		
0.212	99		
0.15	99		
0.063	98		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.5
Sedimentation	Clause 9.5

Sample Proportions	
Cobbles	0.0
Gravel	0.0
Sand	1.0
Silt	58.0
Clay	40.0

Grading Analysis	
D100	20.00
D60	0.01
D10	
Uniformity Coefficient	

	Dry Density / Moisture Content Relationship Light Compaction	Job Ref	
		Borehole / Pit No	S03
Location	**Haulbowline**	Sample No	1
Soil Description	Slightly gravely slightly sandy SILT	Depth	0.00 m
		Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.3, 2.5kg rammer	Keylab ID	PGL120220413165
		Compaction Test Reference/No.	



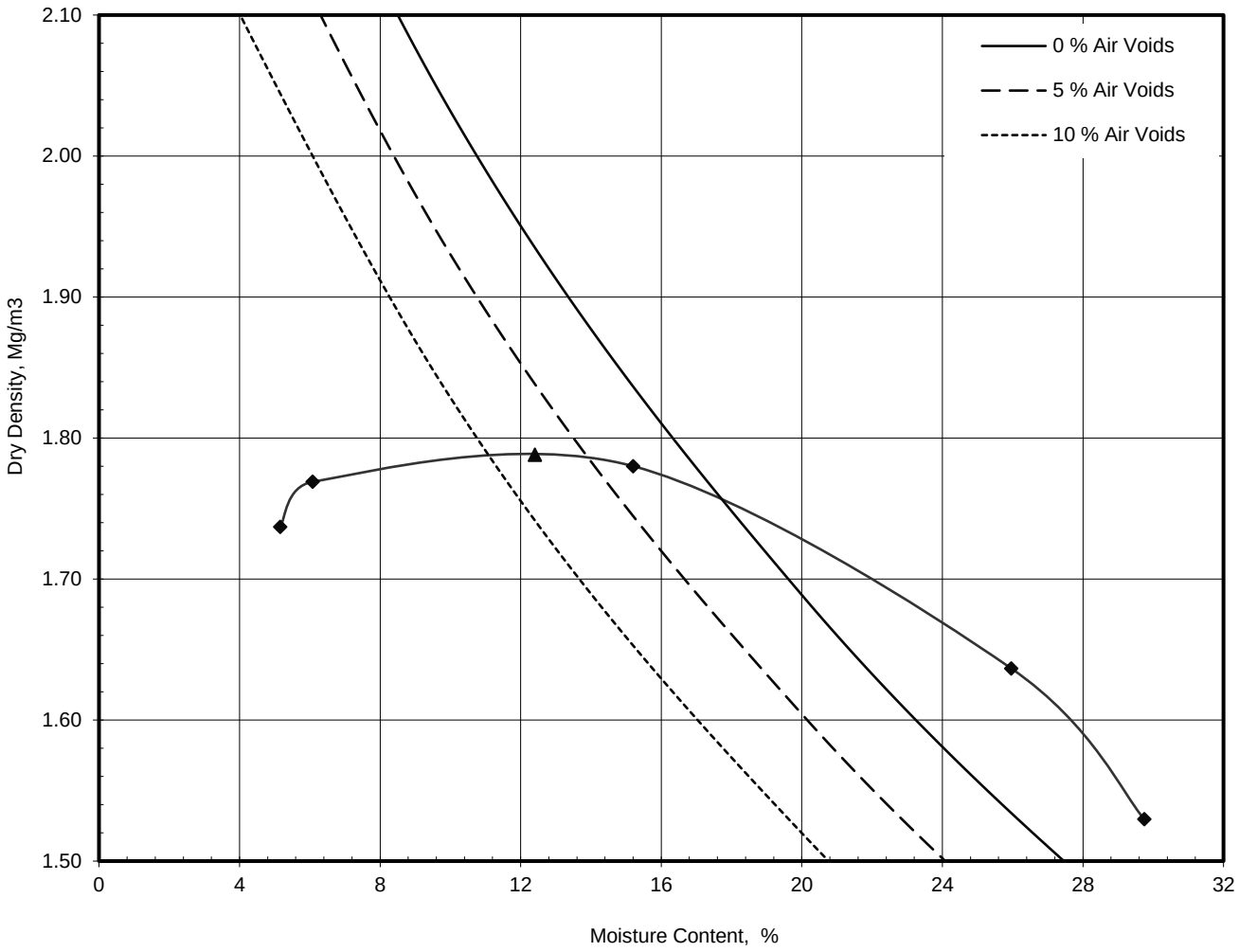
Preparation		Material used was natural
Mould Type		One Litre
Samples Used		Single sample tested
Material Retained on 37.5 mm Sieve	%	3
Material Retained on 20.0 mm Sieve	%	4
Particle Density - Assumed	Mg/m³	2.25

Maximum Dry Density	Mg/m³	**1.50**

Optimum Moisture Content	%	**20**
Natural Mositure Content	**%**	**79.47**

Operator	Checked	Approved	Remarks	Fig
				Sheet 1 of 1

	Dry Density / Moisture Content Relationship **Light Compaction**	Job Ref	
		Borehole / Pit No	S03
Location	**Haulbowline**	Sample No	2
Soil Description	Slightly sandy gravelly SILT	Depth	1.50 m
		Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.4, 2.5kg rammer	Keylab ID	PGL120220413166
		Compaction Test Reference/No.	



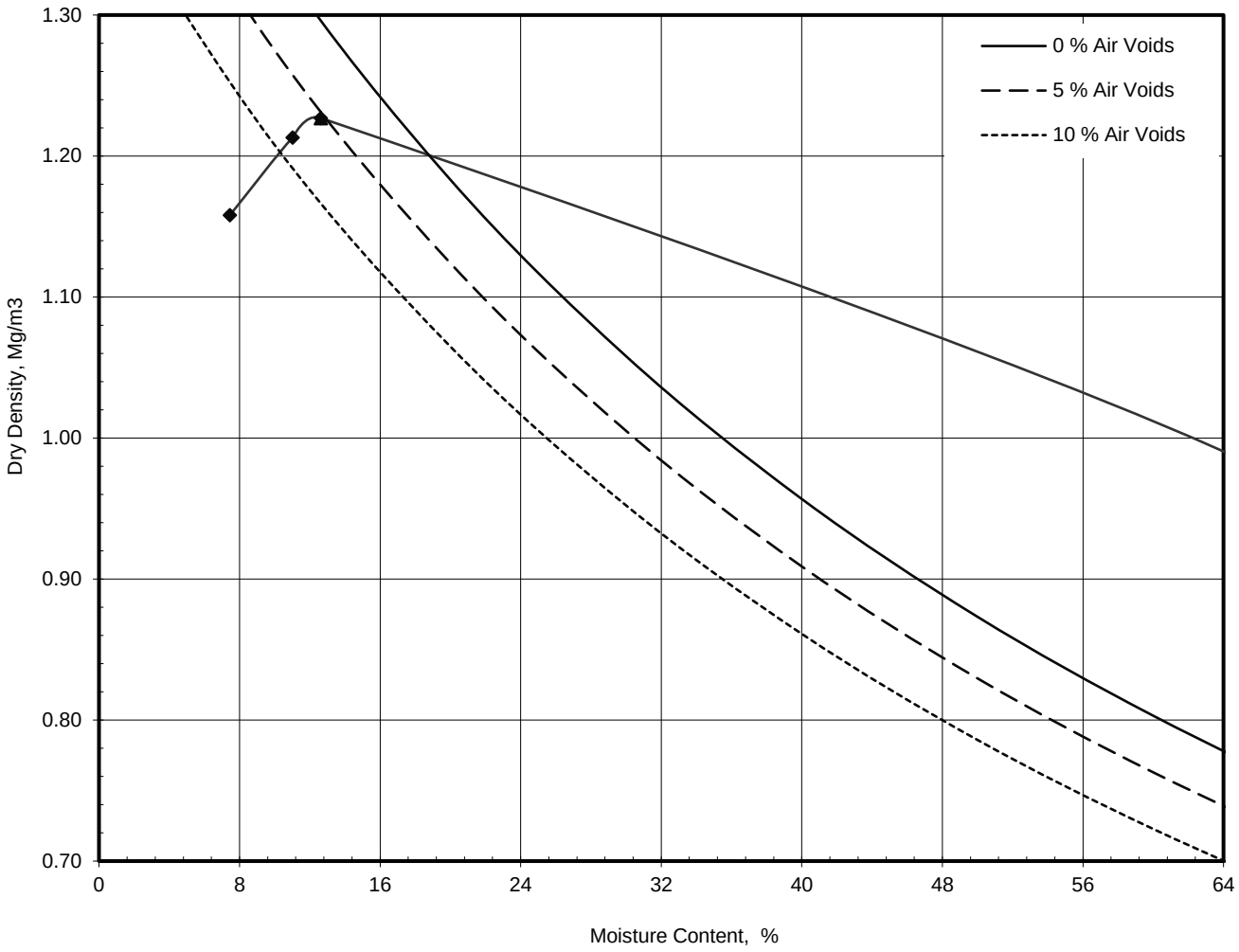
Preparation		Material used was natural
Mould Type		CBR
Samples Used		Single sample tested
Material Retained on 37.5 mm Sieve	%	6
Material Retained on 20.0 mm Sieve	%	15
Particle Density - Assumed	Mg/m³	2.55

Maximum Dry Density	Mg/m³	**1.80**

Optimum Moisture Content	%	**12.4**
Natural Mositure Content	**%**	**29.74**

Operator	Checked	Approved	Remarks	
				Fig
				Sheet 1 of 1

	Dry Density / Moisture Content Relationship Light Compaction	Job Ref	
		Borehole / Pit No	S05
Location	**Haulbowline**	Sample No	1
Soil Description	Slightly gravelly slightly sandy SILT	Depth	1.60 m
		Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.3, 2.5kg rammer	Keylab ID	PGL120220413169
		Compaction Test Reference/No.	



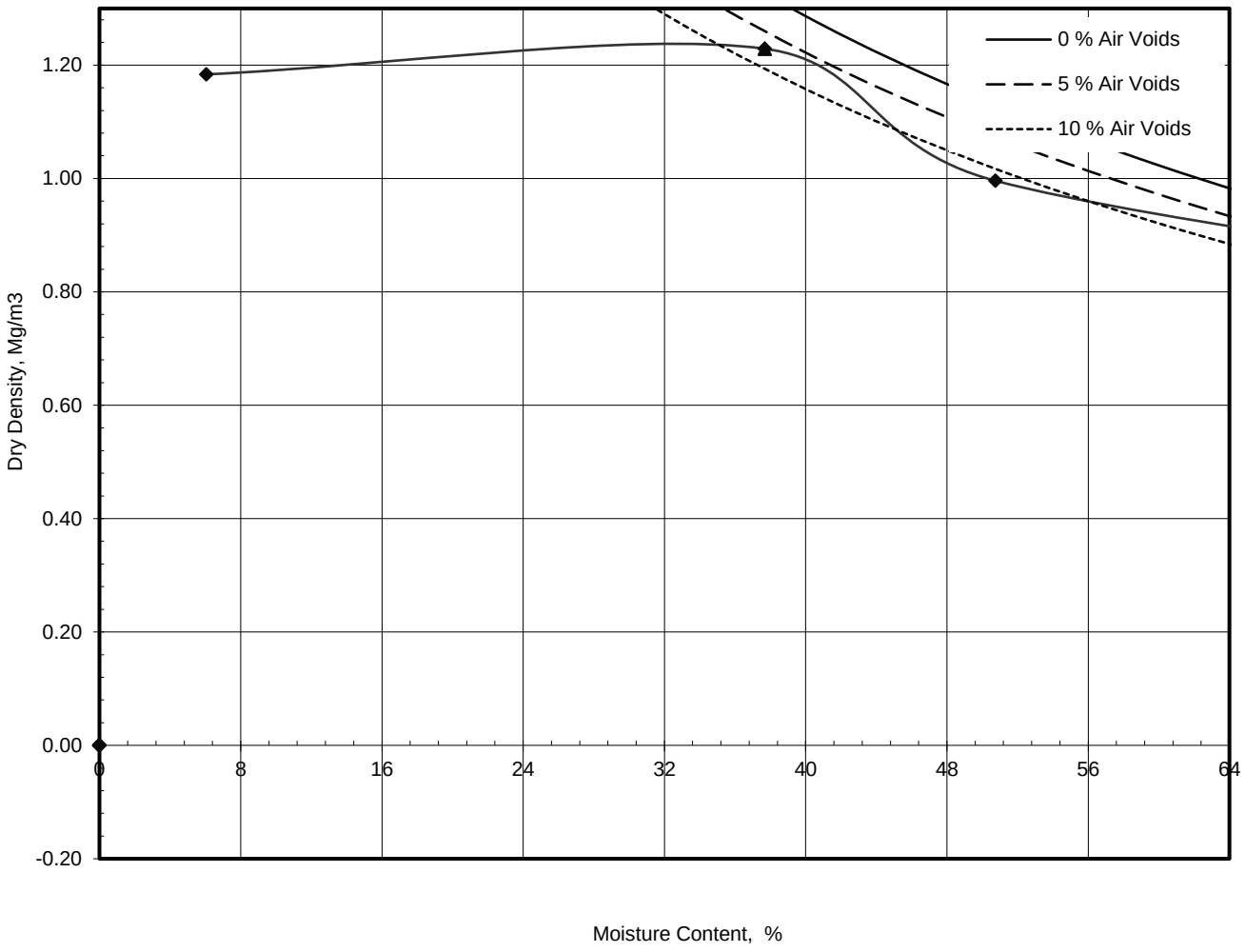
Preparation		Material used was natural
Mould Type		One Litre
Samples Used		Single sample tested
Material Retained on 37.5 mm Sieve	%	14
Material Retained on 20.0 mm Sieve	%	15
Particle Density - Assumed	Mg/m³	1.55

Maximum Dry Density	Mg/m³	**1.20**

Optimum Moisture Content	%	**12.6**
Natural Mositure Content	**%**	**86.61**

Operator	Checked	Approved	Remarks	
				Fig
				Sheet 1 of 1

	Dry Density / Moisture Content Relationship Light Compaction	Job Ref	
		Borehole / Pit No	S13
Location	**Haulbowline**	Sample No	2
Soil Description	Slightly gravelly slightly sandy SILT	Depth	2.00 m
		Sample Type	B
Test Method	BS1377:Part 4:1990, clause 3.3, 2.5kg rammer	Keylab ID	PGL120220413182
		Compaction Test Reference/No.	



Preparation		Material used was natural
Mould Type		One Litre
Samples Used		Single sample tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m³	2.65

Maximum Dry Density	Mg/m³	**1.20**

Optimum Moisture Content	%	**37.7**
Natural Mositure Content	**%**	**105.9**

Operator	Checked	Approved	Remarks	**Fig**
				Sheet 1 of 1

Particle Density by Gas Jar Tests - Summary of Results

Project No.	Project Name
P21250	Haulbowline

Hole No.	Sample				Soil Description at test horizon	Particle Density Mg/m^3	Remarks
	Ref	Top	Base	Type			
Sample 1	Seabe	0.00		B		2.53	
Sample 10	Seabe	0.00		B		2.54	
Sample 11	Seabe	0.00		B		2.39	
Sample 12	Seabe	0.00		B		2.47	
Sample 13		2.00		B		2.56	
Sample 14	Seabe	0.00		B		2.62	
Sample 15		1.50		B		2.51	
Sample 16		3.00		B		2.45	
Sample 17	Seabe	0.00		B		2.47	
Sample 18	Seabe	0.00		B		2.50	
Sample 2	Seabe	0.00		B		2.50	
Sample 3	Seabe	0.00		B		2.47	
Sample 4	Seabe	0.00		B		2.51	
Sample 5	Seabe	0.00		B		2.47	
Sample 6	Seabe	0.00		B		2.97	
Sample 7		1.00		B		2.55	
Sample 8		2.00		B		2.53	
Sample 9	Seabe	0.00		B		2.54	

Notes	Date Printed	Table
Tests performed in accordance with BS 1377 unless annotated otherwise Gas Jar tests to BS1377: Part 2 : 1990, clause 8.2	25/02/2022	sheet

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	**MAR01284**
Issue Version	1
Customer	Priority Geotechnical, Unit 12, Owenacurra Business Park, Midleton, Co. Cork
Customer Reference	Haulbowline Basin Marine Institute Sediment Analysis
Date Sampled	19-Jan-22
Date Received	25-Jan-22
Date Reported	28-Feb-22
Condition of samples	Cold Satisfactory

[redacted]

Authorised by: [redacted]

Position: Laboratory Manager

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

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 MAR01284
Issue Version 1
Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

		Units	%	%	%	%	%	% M/M
		Method No	ASC/SOP/303	ASC/SOP/303	SUB_01*	SUB_01*	SUB_01*	SOCOTEC Env Chem*
		Limit of Detection	0.2	0.2	N/A	N/A	N/A	0.02
		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)**	**TOC**
S01	MAR01284.001	Sediment	40.0	60.0	0.0	8.1	91.9	1.83
S02	MAR01284.002	Sediment	67.2	32.8	0.4	6.0	93.6	2.60
S03	MAR01284.003	Sediment	65.6	34.4	0.0	3.4	96.6	2.43
S04	MAR01284.004	Sediment	68.5	31.5	0.0	4.0	96.0	2.48
S05	MAR01284.005	Sediment	48.4	51.6	0.0	0.5	99.5	2.13
S06	MAR01284.006	Sediment	63.2	36.8	0.0	4.0	96.0	2.28
S07	MAR01284.007	Sediment	48.6	51.4	0.0	1.8	98.2	2.14
S08	MAR01284.008	Sediment	44.8	55.2	0.0	1.1	98.9	2.00
S09	MAR01284.009	Sediment	64.8	35.2	0.0	2.0	98.0	2.42
S10	MAR01284.010	Sediment	60.0	40.0	0.6	4.5	94.9	2.14
S11	MAR01284.011	Sediment	63.3	36.7	0.0	0.7	99.3	2.16
S12	MAR01284.012	Sediment	69.4	30.6	0.0	5.6	94.4	2.42
S13	MAR01284.013	Sediment	51.0	49.0	0.0	2.0	98.0	2.18
S14	MAR01284.014	Sediment	51.2	48.8	0.0	1.2	98.8	2.36
S15	MAR01284.015	Sediment	50.1	49.9	0.0	0.6	99.4	2.11
S16	MAR01284.016	Sediment	53.3	46.7	1.3	1.6	97.1	2.48
S17	MAR01284.017	Sediment	65.7	34.3	0.0	5.7	94.3	2.50
S18	MAR01284.018	Sediment	62.9	37.1	0.0	6.6	93.4	2.54
		Reference Material (% Recovery)	NA	NA	NA	NA	NA	108
		QC Blank	NA	NA	NA	NA	NA	<0.02

* See Report Notes

Certificate of Analysis

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

Test Report ID MAR01284
Issue Version 1
Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

		Units	% M/M
		Method No	SOCOTEC Env Chem*
		Limit of Detection	0.12
		Accreditation	No
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Carbonate Equivalent (%CO3)**
S01	MAR01284.001	Sediment	9.60
S02	MAR01284.002	Sediment	10.6
S03	MAR01284.003	Sediment	9.84
S04	MAR01284.004	Sediment	10.1
S05	MAR01284.005	Sediment	10.1
S06	MAR01284.006	Sediment	9.36
S07	MAR01284.007	Sediment	9.84
S08	MAR01284.008	Sediment	9.48
S09	MAR01284.009	Sediment	9.60
S10	MAR01284.010	Sediment	9.48
S11	MAR01284.011	Sediment	9.60
S12	MAR01284.012	Sediment	10.1
S13	MAR01284.013	Sediment	6.24
S14	MAR01284.014	Sediment	4.56
S15	MAR01284.015	Sediment	9.84
S16	MAR01284.016	Sediment	10.1
S17	MAR01284.017	Sediment	8.64
S18	MAR01284.018	Sediment	8.88
		Reference Material (% Recovery)	99
		QC Blank	<0.12

* See Report Notes

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upo

DE15 0YZ

Test Report ID MAR01284
Issue Version 1
Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*
		Limit of Detection	0.5	0.2	2	2	1.2
		Accreditation	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**
S01	MAR01284.001	Sediment	14.8	0.7	81.9	42.9	122
S02	MAR01284.002	Sediment	14.5	0.3	81.4	41.5	45.9
S03	MAR01284.003	Sediment	2.6	0.2	47.7	28.9	34.0
S04	MAR01284.004	Sediment	13.7	0.2	76.6	34.6	44.6
S05	MAR01284.005	Sediment	14.3	0.4	82.6	41.1	66.2
S06	MAR01284.006	Sediment	12.6	0.16*	76.9	28.7	38.8
S07	MAR01284.007	Sediment	14.7	0.3	92.3	34.0	72.4
S08	MAR01284.008	Sediment	13.3	0.4	97.1	58.3	97.0
S09	MAR01284.009	Sediment	13.4	0.18*	77.0	28.9	37.2
S10	MAR01284.010	Sediment	11.9	0.2	73.6	31.7	38.8
S11	MAR01284.011	Sediment	13.9	0.3	82.0	37.4	54.0
S12	MAR01284.012	Sediment	13.4	0.17*	83.5	28.7	38.1
S13	MAR01284.013	Sediment	14.0	0.9	82.5	61.0	87.6
S14	MAR01284.014	Sediment	17.3	0.6	94.5	52.6	93.4
S15	MAR01284.015	Sediment	15.6	0.4	96.9	53.5	78.5
S16	MAR01284.016	Sediment	36.0	0.6	83.9	103	418
S17	MAR01284.017	Sediment	15.8	0.2	81.8	40.8	61.3
S18	MAR01284.018	Sediment	13.2	0.2	83.8	37.7	41.6
Certified Reference Material 2702 (Measured Value)			45.4	0.61	321	111	130
Certified Reference Material 2702 (Certified Value)			45.3	0.817	352	117.7	132.8
Certified Reference Material 2702 (% Recovery)			102	90	106	107	104
QC Blank			<0.5	<0.2	<2	<2	<1.2

* See Report Notes
~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upo

DE15 0YZ

Test Report ID MAR01284
Issue Version 1
Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*
		Limit of Detection	2	3	0.01	10	2
		Accreditation	UKAS	UKAS	N	UKAS	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Nickel as Ni**	**Zinc as Zn**	**Mercury as Hg**	**Aluminium as Al**	**Lithium as Li**
S01	MAR01284.001	Sediment	31.4	290	0.29	50800	55.2
S02	MAR01284.002	Sediment	31.8	148	0.09	53700	61.0
S03	MAR01284.003	Sediment	26.2	132	0.08	51100	62.3
S04	MAR01284.004	Sediment	32.2	166	0.08	52500	59.7
S05	MAR01284.005	Sediment	33.9	208	0.12	55700	62.7
S06	MAR01284.006	Sediment	30.9	78.2	0.08	55000	61.3
S07	MAR01284.007	Sediment	34.2	200	0.16	55900	60.9
S08	MAR01284.008	Sediment	36.3	330	0.16	56900	62.8
S09	MAR01284.009	Sediment	30.5	129	0.08	57700	63.3
S10	MAR01284.010	Sediment	29.9	145	0.09	56400	61.8
S11	MAR01284.011	Sediment	32.0	192	0.13	52600	60.0
S12	MAR01284.012	Sediment	33.9	136	0.08	55700	62.5
S13	MAR01284.013	Sediment	31.8	220	0.16	55000	62.8
S14	MAR01284.014	Sediment	37.1	299	0.18	56700	66.7
S15	MAR01284.015	Sediment	34.9	251	0.23	59200	65.1
S16	MAR01284.016	Sediment	52.9	364	1.91	48900	55.1
S17	MAR01284.017	Sediment	33.3	174	0.12	53500	62.6
S18	MAR01284.018	Sediment	32.9	150	0.08	52800	62.7
Certified Reference Material 2702 (Measured Value)			69.6	439.0	<0.01	80500	85.5
Certified Reference Material 2702 (Certified Value)			75.4	485.3	0.04	84000	78.2
Certified Reference Material 2702 (% Recovery)			107	103	101~	105	116
QC Blank			<2	<3	<0.01	<10	<2

* See Report Notes

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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 MAR01284
Issue Version 1
Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

		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)**
S01	MAR01284.001	Sediment	<5	<5
S02	MAR01284.002	Sediment	<5	<5
S03	MAR01284.003	Sediment	<5	<5
S04	MAR01284.004	Sediment	<5	<5
S05	MAR01284.005	Sediment	<5	<5
S06	MAR01284.006	Sediment	<5	<5
S07	MAR01284.007	Sediment	<5	<5
S08	MAR01284.008	Sediment	12.7	18.0
S09	MAR01284.009	Sediment	<5	<5
S10	MAR01284.010	Sediment	<5	<5
S11	MAR01284.011	Sediment	<5	<5
S12	MAR01284.012	Sediment	<5	<5
S13	MAR01284.013	Sediment	<5	<5
S14	MAR01284.014	Sediment	<5	<5
S15	MAR01284.015	Sediment	17.9	19.6
S16	MAR01284.016	Sediment	<5	<5
S17	MAR01284.017	Sediment	<5	<5
S18	MAR01284.018	Sediment	<5	<5
Certified Reference Material BCR-646 (Measured Value)			554	269
Certified Reference Material BCR-646 (Certified Value)			770	480
Certified Reference Material BCR-646 (% Recovery)			72	56
QC Blank			<1	<1

See Report Notes

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

Test Report ID MAR01284
Issue Version 1
Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

		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	N*	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**ACENAPTH**	**ACENAPHY**	**ANTHRACN**	**BAA**	**BAP**	**BBF**
S01	MAR01284.001	Sediment	43.8	24.9	130	334	389	389
S02	MAR01284.002	Sediment	5.24	3.05	9.05	23.4	30.4	49.8
S03	MAR01284.003	Sediment	3.170	2.79	8.96	29.0	33.5	64.3
Certified Reference Material QPH097MS (Measured Value)			30.4	35.9	97.4	289	279	316
Certified Reference Material QPH097MS (Certified Value)			35.3	37.3	121	359	350	418
Certified Reference Material QPH097MS (% Recovery)			86	96	81	80	80	76
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries
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As the method uses surrogate standards to correct for losses, the RM results are reported as percentage trueness, not recovery.

Certificate of Analysis

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Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

		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	N*
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**BENZGHIP**	**BKF**	**CHRYSENE**	**DBENZAH**	**FLUORANT**	**FLUORENE**
S01	MAR01284.001	Sediment	304	238	405	60.8	764	65.1
S02	MAR01284.002	Sediment	40.0	29.9	33.0	8.11	51.1	8.60
S03	MAR01284.003	Sediment	49.8	41.2	37.1	8.40	60.1	8.72
Certified Reference Material QPH097MS (Measured Value)			244	185	380	40.1	690	46.6
Certified Reference Material QPH097MS (Certified Value)			267	193	447	54.4	933	71.7
Certified Reference Material QPH097MS (% Recovery)			91	96	85	74	74	65
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries
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Test Report ID MAR01284
Issue Version 1
Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

		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	N*	UKAS	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**INDPYR**	**NAPTH**	**PHENANT**	**PYRENE**	**THC**
S01	MAR01284.001	Sediment	316	81.0	438	763	502000
S02	MAR01284.002	Sediment	44.1	15.8	29.0	46.0	228000
S03	MAR01284.003	Sediment	57.0	19.0	34.0	54.4	127000
Certified Reference Material QPH097MS (Measured Value)			212	113	379	619	NA
Certified Reference Material QPH097MS (Certified Value)			274	115	510	794	NA
Certified Reference Material QPH097MS (% Recovery)			77	98	74	78	100~
QC Blank			<1	<1	<1	<1	<1

For full analyte name see method summaries
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Test Report ID MAR01284
Issue Version 1
Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

		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**
S04	MAR01284.004	Sediment	4.03	2.73	9.37	32.2	38.6	60.1
S05	MAR01284.005	Sediment	5.93	5.72	23.4	81.0	83.7	118
S06	MAR01284.006	Sediment	6.82	3.83	21.4	71.0	79.7	99.6
S07	MAR01284.007	Sediment	17.4	18.0	56.0	196	229	287
S08	MAR01284.008	Sediment	10.5	6.47	22.9	78.6	96.9	139
S09	MAR01284.009	Sediment	4.32	2.81	8.84	34.2	31.2	51.8
S10	MAR01284.010	Sediment	4.75	4.83	12.8	43.0	66.3	94.0
S11	MAR01284.011	Sediment	5.69	7.46	14.4	42.0	50.7	73.4
S12	MAR01284.012	Sediment	8.17	16.4	34.8	179	170	171
S13	MAR01284.013	Sediment	5.24	5.31	15.7	46.9	62.0	102
S14	MAR01284.014	Sediment	12.9	15.0	48.6	149	182	235
S15	MAR01284.015	Sediment	12.8	8.40	29.3	92.4	111	152
S16	MAR01284.016	Sediment	14.7	18.0	48.0	161	200	256
S17	MAR01284.017	Sediment	3.74	3.62	8.55	32.7	38.1	58.8
S18	MAR01284.018	Sediment	4.36	3.58	9.27	33.0	39.4	63.0
Certified Reference Material QPH097MS (Measured Value)			25.6	33.4	101	295	280	313
Certified Reference Material QPH097MS (Certified Value)			35.3	37.3	121	359	350	418
Certified Reference Material QPH097MS (% Recovery)			72	90	83	82	80	75
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries
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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 MAR01284
Issue Version 1
Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

		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	N*
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**BENZGHIP**	**BKF**	**CHRYSENE**	**DBENZAH**	**FLUORANT**	**FLUORENE**
S04	MAR01284.004	Sediment	48.9	34.1	45.7	10.5	65.2	8.16
S05	MAR01284.005	Sediment	82.8	63.1	97.8	13.5	166	12.8
S06	MAR01284.006	Sediment	71.8	46.9	86.0	15.7	160	9.76
S07	MAR01284.007	Sediment	211	155	240	34.2	409	26.5
S08	MAR01284.008	Sediment	97.9	71.7	104	20.0	166	12.8
S09	MAR01284.009	Sediment	48.9	36.7	46.8	9.66	76.0	8.81
S10	MAR01284.010	Sediment	84.5	46.2	49.6	13.6	88.6	10.2
S11	MAR01284.011	Sediment	61.6	41.8	55.0	11.9	87.4	11.1
S12	MAR01284.012	Sediment	113	92.0	156	26.2	421	12.4
S13	MAR01284.013	Sediment	72.5	45.5	69.7	12.1	106	10.7
S14	MAR01284.014	Sediment	181	105	193	36.7	307	23.8
S15	MAR01284.015	Sediment	118	89.2	121	23.5	192	16.1
S16	MAR01284.016	Sediment	200	161	216	34.6	372	26.2
S17	MAR01284.017	Sediment	52.2	33.2	44.6	10.3	63.5	7.88
S18	MAR01284.018	Sediment	51.9	25.6	47.5	9.45	72.3	8.43
Certified Reference Material QPH097MS (Measured Value)			218	168	376	41.8	704	52.5
Certified Reference Material QPH097MS (Certified Value)			267	193	447	54.4	933	71.7
Certified Reference Material QPH097MS (% Recovery)			82	87	84	77	75	73
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries
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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 MAR01284
Issue Version 1
Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

		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	N*	UKAS	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**INDPYR**	**NAPTH**	**PHENANT**	**PYRENE**	**THC**
S04	MAR01284.004	Sediment	60.8	19.6	35.5	57.8	157000
S05	MAR01284.005	Sediment	97.2	23.3	66.6	151	203000
S06	MAR01284.006	Sediment	81.2	21.9	76.6	137	146000
S07	MAR01284.007	Sediment	225	49.6	164	396	375000
S08	MAR01284.008	Sediment	118	26.0	68.2	166	626000
S09	MAR01284.009	Sediment	53.9	18.1	35.9	66.5	217000
S10	MAR01284.010	Sediment	89.5	21.9	43.9	85.8	188000
S11	MAR01284.011	Sediment	69.2	19.9	41.0	88.0	256000
S12	MAR01284.012	Sediment	138	23.3	70.9	323	219000
S13	MAR01284.013	Sediment	87.4	23.8	59.1	97.0	225000
S14	MAR01284.014	Sediment	200	48.7	131	305	822000
S15	MAR01284.015	Sediment	138	30.3	72.1	193	582000
S16	MAR01284.016	Sediment	224	55.4	158	369	671000
S17	MAR01284.017	Sediment	63.2	16.7	33.4	59.0	244000
S18	MAR01284.018	Sediment	58.6	17.5	41.7	65.5	194000
		Certified Reference Material QPH097MS (Measured Value)	227	117	393	627	NA
		Certified Reference Material QPH097MS (Certified Value)	274	115	510	794	NA
		Certified Reference Material QPH097MS (% Recovery)	83	102	77	79	103~
		QC Blank	<1	<1	<1	<1	<1

For full analyte name see method summaries
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Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

		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	N*	UKAS	UKAS	N*
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB28**	**PCB52**	**PCB101**	**PCB118**	**PCB138**	**PCB153**	**PCB180**
S01	MAR01284.001	Sediment	1.56	3.93	3.13	3.04	2.57	3.42	1.03
S02	MAR01284.002	Sediment	0.22	0.27	0.36	0.29	0.20	0.34	0.13
S03	MAR01284.003	Sediment	0.24	0.25	0.44	0.03	0.36	0.42	0.05
S04	MAR01284.004	Sediment	0.21	0.21	0.32	0.29	0.27	0.36	0.12
S05	MAR01284.005	Sediment	1.49	1.92	1.74	1.92	1.42	1.20	0.40
S06	MAR01284.006	Sediment	0.23	0.21	0.19	0.28	0.26	0.30	0.04
S07	MAR01284.007	Sediment	1.03	2.94	1.69	1.56	0.70	1.41	0.33
S08	MAR01284.008	Sediment	3.44	4.25	3.72	4.77	3.16	2.55	0.93
S09	MAR01284.009	Sediment	0.24	0.22	0.24	0.30	0.24	0.28	0.12
S10	MAR01284.010	Sediment	0.51	0.47	0.50	0.71	0.45	0.45	0.13
S11	MAR01284.011	Sediment	1.32	1.54	1.42	1.73	1.09	1.32	0.25
S12	MAR01284.012	Sediment	0.21	0.23	0.31	0.68	0.31	0.26	0.02
S13	MAR01284.013	Sediment	4.18	4.49	3.06	3.77	1.67	2.41	0.79
S14	MAR01284.014	Sediment	1.81	3.51	3.29	3.47	2.49	3.79	1.04
S15	MAR01284.015	Sediment	4.11	5.15	5.30	5.35	3.94	4.05	1.29
S16	MAR01284.016	Sediment	0.69	1.16	1.23	1.52	1.11	1.48	0.48
S17	MAR01284.017	Sediment	0.31	0.34	0.36	0.46	0.28	0.38	0.11
S18	MAR01284.018	Sediment	0.26	0.27	0.36	0.44	0.41	0.62	0.12
Certified Reference Material QOR146 MS (Measured Value)			0.16	0.69	0.58	0.17	0.55	0.70	0.22
Certified Reference Material QOR146 MS (Certified Value)			0.21	0.62	0.59	0.32	0.55	0.67	0.41
Certified Reference Material QOR146 MS (% Recovery)			75	110	98	52	100	104	53
QC Blank			<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08

For full analyte name see method summaries
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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 MAR01284
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Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

		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)	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	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Accreditation	UKAS	UKAS	UKAS	UKAS	N*	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**AHCH**	**BHCH**	**GHCH**	**DIELDRIN**	**HCB**	**DDE**	**DDT**	**DDD**
S01	MAR01284.001	Sediment	<0.1	<0.1	<0.1	0.26	0.61	0.98	<0.1	1.02
S02	MAR01284.002	Sediment	<0.1	<0.1	<0.1	<0.1	<0.1	0.12	<0.1	0.18
S03	MAR01284.003	Sediment	<0.1	<0.1	<0.1	<0.1	<0.1	0.12	<0.1	0.10
S04	MAR01284.004	Sediment	<0.1	<0.1	<0.1	0.19	<0.1	0.23	<0.1	<0.1
S05	MAR01284.005	Sediment	<0.1	<0.1	<0.1	0.12	<0.1	0.26	<0.1	0.31
S06	MAR01284.006	Sediment	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.15
S07	MAR01284.007	Sediment	<0.1	<0.1	<0.1	0.22	<0.1	1.12	0.19	1.33
S08	MAR01284.008	Sediment	<0.1	<0.1	<0.1	0.27	<0.1	0.37	<0.1	0.48
S09	MAR01284.009	Sediment	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.25	0.10
S10	MAR01284.010	Sediment	<0.1	<0.1	<0.1	0.11	<0.1	0.23	<0.1	0.11
S11	MAR01284.011	Sediment	<0.1	<0.1	<0.1	<0.1	<0.1	0.32	<0.1	0.20
S12	MAR01284.012	Sediment	<0.1	<0.1	<0.1	<0.1	<0.1	0.14	<0.1	<0.1
S13	MAR01284.013	Sediment	<0.1	<0.1	<0.1	<0.1	<0.1	0.51	<0.1	0.44
S14	MAR01284.014	Sediment	<0.1	<0.1	<0.1	0.34	<0.1	1.35	0.15	1.01
S15	MAR01284.015	Sediment	<0.1	<0.1	0.11	0.35	<0.1	0.59	0.18	0.83
S16	MAR01284.016	Sediment	<0.1	<0.1	<0.1	0.54	<0.1	0.56	0.61	0.64
S17	MAR01284.017	Sediment	<0.1	<0.1	<0.1	<0.1	<0.1	0.27	0.14	0.15
S18	MAR01284.018	Sediment	<0.1	<0.1	<0.1	<0.1	<0.1	0.20	<0.1	<0.1
Certified Reference Material QOR146 MS (Measured Value)			0.00	0.02	0.01	0.03	0.01	0.12	0.00	0.13
Certified Reference Material QOR146 MS (Certified Value)			NA	NA	NA	NA	NA	0.21	NA	0.32
Certified Reference Material QOR146 MS (% Recovery)			120~	104~	122~	118~	120~	56	105~	41
QC Blank			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

For full analyte name see method summaries
~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.
*See report notes

Certificate of Analysis

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

Test Report ID MAR01284
Issue Version 1
Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

REPORT NOTES

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
SOCOTEC Env Chem*	MAR01284.001-018	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
SUB_01*	MAR01284.001-018	Analysis was conducted by an approved subcontracted laboratory.
Cadmium	MAR01284.006, 009, 012	Values marked with * are reported lower than the accredited LoD of 0.2 mg/kg. Therefore we have removed accreditation removed these results only.
ASC/SOP/301	MAR01284.001.007, .009-0014, .0016-018	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/302	MAR01284.001-018	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 ma y not have been significantly affected.However in line with our QMS policy we have removed accreditation, where applicable, from the affected analytes (PCB118, PCB180, HCB) . These circumstances should be taken into consideration when utilising the data.
ASC/SOP/303/304	MAR01284.001-018	Chrysene is known to coelute with Triphenylene and these peaks can not be resolved. It is believed Triphenylene is present in these samples therefore it is suggested that the Chrysene results should be taken as a Chrysene (inc. Triphenylene).This should be taken into consideration when utilising the data.
ASC/SOP/303/304	MAR01284.001-003	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 (ANTHRACN, FLUORENE, PHENANT) . These circumstances should be taken into consideration when utilising the data.
ASC/SOP/303/304	MAR01284.004-018	The Primary process control data associated with this Test has not wholly met the requirements of the Laboratory Quality Management System QMS with one or more target analytes falling outside acceptable limits. The remaining data gives the Laboratory confidence that the test has performed satisfactorily and that the validity of the data may not have been significantly affected.However in line with our QMS policy we have removed accreditation, where applicable, from the affected analytes (FLUORENE, PHENANT) . These circumstances should be taken into consideration when utilising the data.

DEVIATING SAMPLE STATEMENT

Deviation Code	Deviation Definition	Sample ID	Deviation Details. The following information should be taken into consideration when using the data contained within this report
D1	Holding Time Exceeded	N/A	N/A
D2	Handling Time Exceeded	N/A	N/A
D3	Sample Contaminated through Damaged Packaging	N/A	N/A
D4	Sample Contaminated through Sampling	N/A	N/A
D5	Inappropriate Container/Packaging	N/A	N/A
D6	Damaged in Transit	N/A	N/A
D7	Insufficient Quantity of Sample	N/A	N/A
D8	Inappropriate Headspace	N/A	N/A
D9	Retained at Incorrect Temperature	N/A	N/A
D10	Lack of Date & Time of Sampling	N/A	N/A
D11	Insufficient Sample Details	N/A	N/A

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	MAR01284
Issue Version	1
Customer Reference	Haulbowline Basin Marine Institute Sediment Analysis

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 seived to <2mm	Carbonate removal and sulphurous acid/combustion at 1600°C/NDIR.
Carbonate	Air dried and seived to <2mm	Quantitative digestion with Hydrochloric Acid back titration with 1M Sodium Hydroxide to pH 7
Metals	Air dried and seived to <2mm	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 seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS analysis.
Organochlorine Pesticides (OCPs)	Air dried and seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS analysis.

Analyte Definitions					
Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name
ACENAPTH	Acenaphthene	C2N	C2-naphthalenes	THC	Total Hydrocarbon Content
ACENAPHY	Acenaphthylene	C3N	C3-naphthalenes	AHCH	alpha-Hexachlorcyclohexane
ANTHRACN	Anthracene	CHRYSENE	Chrysene	BHCH	beta-Hexachlorcyclohexane
BAA	Benzo[a]anthracene	DBENZAH	Dibenzo[ah]anthracene	GHCH	gamma-Hexachlorcyclohexane
BAP	Benzo[a]pyrene	FLUORANT	Fluoranthene	DIELDRIN	Dieldrin
BBF	Benzo[b]fluoranthene	FLUORENE	Fluorene	HCB	Hexachlorobenzene
BEP	Benzo[e]pyrene	INDPYR	Indeno[1,2,3-cd]pyrene	DDD	p,p'-Dichlorodiphenyldichloroethane
BENZGHIP	Benzo[ghi]perylene	NAPTH	Naphthalene	DDE	p,p'-Dichlorodiphenyldichloroethylene
BKF	Benzo[k]fluoranthene	PERYLENE	Perylene	DDT	p,p'-Dichlorodiphenyltrichloroethane
C1N	C1-naphthalenes	PHENANT	Phenanthrene		
C1PHEN	C1-phenanthrene	PYRENE	Pyrene		

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	22-20992-1
Initial Date of Issue:	09-Jun-2022
Client	Priority Geotechnical Ltd
Client Address:	Unit 12 Owenacurra Business Park Midleton County Cork Ireland
Contact(s):	[redacted]
Project	P21250 Haulbowline

Quotation No.:		**Date Received:**	06-Jun-2022
Order No.:	14584	**Date Instructed:**	07-Jun-2022
No. of Samples:	1		
Turnaround (Wkdays):	5	**Results Due:**	13-Jun-2022
Date Approved:	09-Jun-2022		

Approved By:

[redacted]

Details: [redacted] Technical Manager

Results - Soil

Project: P21250 Haulbowline

Client: Priority Geotechnical Ltd			**Chemtest Job No.:**		22-20992
Quotation No.:			**Chemtest Sample ID.:**		1442757
			Sample Location:		S01
			Sample Type:		SOIL
			Top Depth (m):		2.5
			Date Sampled:		31-May-2022
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Moisture	N	2030	%	0.020	40
Organic Matter	U	2625	%	0.40	3.8

Test Methods

SOP	Title	Parameters included	Method summary
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	22-17009-1
Initial Date of Issue:	12-May-2022
Client	Priority Geotechnical Ltd
Client Address:	Unit 12 Owenacurra Business Park Midleton County Cork Ireland
Contact(s):	[redacted]
Project	P21250 Haulbowline

Quotation No.:		**Date Received:**	09-May-2022
Order No.:	14584	**Date Instructed:**	09-May-2022
No. of Samples:	12		
Turnaround (Wkdays):	5	**Results Due:**	13-May-2022
Date Approved:	12-May-2022		

Approved By:

[redacted]

Details: [redacted] Technical Manager

Results - Soil

Project: P21250 Haulbowline

Client: Priority Geotechnical Ltd				**Chemtest Job No.:**	22-17009	22-17009	22-17009	22-17009	22-17009	22-17009	22-17009	22-17009	22-17009
Quotation No.:				**Chemtest Sample ID.:**	1424505	1424506	1424507	1424508	1424509	1424510	1424511	1424512	1424513
				Sample Location:	508	515	507	511	509	513	503	505	503
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	2.0	1.5	0.0	0.0	0.0	2.0	0.0	1.6	1.5
				Date Sampled:	05-May-2022	05-May-2022	05-May-2022	05-May-2022	05-May-2022	05-May-2022	05-May-2022	05-May-2022	05-May-2022
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Moisture	N	2030	%	0.020	43	45	43	51	40	48	43	40	20
Organic Matter	U	2625	%	0.40	2.8	2.8	2.6	3.1	2.6	2.9	2.6	2.9	1.3

Results - Soil

Project: P21250 Haulbowline

Client: Priority Geotechnical Ltd			**Chemtest Job No.:**		22-17009	22-17009	22-17009
Quotation No.:			**Chemtest Sample ID.:**		1424514	1424515	1424516
			Sample Location:		503	507	509
			Sample Type:		SOIL	SOIL	SOIL
			Top Depth (m):		3.0	2.5	1.5
			Date Sampled:		05-May-2022	05-May-2022	05-May-2022
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Moisture	N	2030	%	0.020	17	37	11
Organic Matter	U	2625	%	0.40	0.86	2.8	2.9

Test Methods

SOP	Title	Parameters included	Method summary
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.

Report Information

Key

U	UKAS accredited
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S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
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<	"less than"
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D - Broken Container
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All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Rinville
Oranmore
Co Galway
Tel: 091 387200

[redacted]
Byrne Looby
3 Westbourne Place
Cobh
Co. Cork

09 April, 2021

Dear [redacted]

Sampling and Analysis Plan – Haulbowline Basin

The revised sampling and analysis plan for Haulbowline basin is detailed below.

In light of the dredging of the graving dock, eighteen samples are recommended, some at depth, in order to adequately cover the area and delineate any potentially problem areas. You should give your sampling contractor a copy of this plan. They will need to draw the testing laboratory's attention especially to Section 3 and Section 4 and confirm that the selected lab is capable of meeting the quality assurance standards required.

Please select a laboratory well experienced in testing of marine sediment and participating in relevant marine sediment inter laboratory proficiency testing schemes such as QUASIMEME, and please ensure that they can meet the limits of detection required.

Please also submit results using the EPA material analysis spreadsheet, which can be found at this link - https://www.epa.ie/pubs/forms/lic/das/materialanalysisreportingform.html

If you need clarification on anything, please let me know.

Best regards,

[redacted]
_____
[redacted]
Marine Environment Chemist

1.0 Sample location and analyses required:

Eighteen samples, as listed in Table 1 below, should be taken. Sample locations are also shown in Figure 1.

Table 1. Locations and details of proposed samples

Station/Sample No.	Longitude (° W) *	Latitude (° N) *	Depth	Parameters for analysis
1	-8.29998	51.84274	Surface	1, 2, 3, 4a, 4b, 4c, 4d, 4e, 4f, 4g
2	-8.29892	51.84261	Surface	1, 2, 3, 4a, 4b, 4c, 4d, 4e, 4f, 4g
3	-8.29841	51.84249	Surface	1, 2, 3, 4a, 4b, 4c, 4d, 4e, 4f, 4g
4	-8.29813	51.84163	Surface	1, 2, 3, 4a, 4b, 4c, 4d, 4e, 4f, 4g
5	-8.29923	51.84137	Surface	1, 2, 3, 4a, 4b, 4c, 4d, 4e, 4f, 4g
6	-8.29809	51.84112	Surface	1, 2, 3, 4a, 4b, 4c, 4d, 4e, 4f, 4g
7	-8.29841	51.84102	1 m	1, 2, 3, 4a, 4b, 4c, 4d, 4e, 4f, 4g
8	-8.29855	51.84096	2 m	1, 2, 3, 4a, 4b, 4c, 4d, 4e, 4f, 4g
9	-8.30015	51.84086	Surface	1, 2, 3, 4a, 4b, 4c, 4d, 4e, 4f, 4g
10	-8.29893	51.84080	Surface	1, 2, 3, 4a, 4b, 4c, 4d, 4e, 4f, 4g
11	-8.29985	51.84065	Surface	1, 2, 3, 4a, 4b, 4c, 4d, 4e, 4f, 4g
12	-8.29995	51.84035	Surface	1, 2, 3, 4a, 4b, 4c, 4d, 4e, 4f, 4g
13	-8.29972	51.83999	2 m	1, 2, 3, 4a, 4b, 4c, 4d, 4e, 4f, 4g
14	-8.29988	51.83972	Surface	1, 2, 3, 4a, 4b, 4c, 4d, 4e, 4f, 4g
15	-8.29988	51.83946	1.5 m	1, 2, 3, 4a, 4b, 4c, 4d, 4e, 4f, 4g
16	-8.29981	51.83931	3 m	1, 2, 3, 4a, 4b, 4c, 4d, 4e, 4f, 4g
17	-8.29986	51.83916	1 m	1, 2, 3, 4a, 4b, 4c, 4d, 4e, 4f, 4g
18	-8.29982	51.83909	Surface	1, 2, 3, 4a, 4b, 4c, 4d, 4e, 4f, 4g

* Positions in decimal degrees, WGS84

2.0 Parameter Code:

1. Visual inspection, to include colour, texture, odour, presence of animals etc
2. Water content, density (taking into account sample collection and handling)
3. Granulometry including % gravel (> 2mm fraction), % sand (< 2mm fraction) and % mud (< 63μm fraction).
4. The following determinants in the sand-mud (< 2mm) fraction * :
   a) total organic carbon
   b) carbonate
   c) mercury, arsenic, cadmium, copper, lead, zinc, chromium, nickel, lithium, aluminium.

d) organochlorines HCH and γ-HCH, PCBs (to be reported as the ICEΣ7 CB congeners: 28, 52, 101, 118, 138, 153, 180) and DDT metabolites (pp'DDT, pp'DDE, pp'DDD).

e) total extractable hydrocarbons.

f) tributyltin (TBT) and dibutyltin (DBT)

g) Polycyclic aromatic hydrocarbons (PAH) - Acenaphthene, Acenaphthylene, Anthracene, Benzo (a) anthracene, Benzo (a) pyrene, Benzo (b) fluoranthene, Benzo (ghi) perylene, Benzo (k) fluoranthene, Chrysene, Dibenz (a,h) anthracene, Flourene, Fluoranthene, Indeno 1,2,3 – cd pyrene, Naphthalene, Phenanthrene, Pyrene.

h) Toxicity tests (Microtox or whole sediment bioassay) using appropriate representative aquatic species. (This requirement will depend on the results of the chemical analyses.)

Note: ***where the gravel fraction (> 2mm) constitutes a significant part of the total sediment, this should be taken into account in the calculation of the concentrations.***

3.0 Important notes:

3.1 The required detection limits for the various determinants are given in Table 2. below.

3.2 Details of the methodologies used must be furnished with the results. This should include sampling, sub sampling and analytical methods used for each determinant**.**

3.3 Appropriate marine CRM are to be analysed during each batch of analyses and the results to be reported along with sample results.

3.4 Blanks & in-house references to be run with each sample batch, and reported with sample results.

Table 2. Maximum limits of detection required

Contaminant	**Concentration**	**Units (dry wt)**
Mercury	0.05	mg kg^{-1}
Arsenic	1.0	mg kg^{-1}
Cadmium	0.1	mg kg^{-1}
Copper	5.0	mg kg^{-1}
Lead	5.0	mg kg^{-1}
Zinc	10	mg kg^{-1}
Chromium	5.0	mg kg^{-1}
Nickel	5	mg kg^{-1}
Total extractable hydrocarbons	10.0	mg kg^{-1}
TBT and DBT (not organotin)	10	μg kg^{-1}
PCB – individual congener	0.1	μg kg^{-1}

Contaminant	Concentration	Units (dry wt)
OCP – individual compound	0.1	$\mu g\ kg^{-1}$
DDT metabolite	0.1	$\mu g\ kg^{-1}$
PAH – individual compound	10	$\mu g\ kg^{-1}$

4.0 Reporting requirements

Reports should include the following information

4.1 Results of testing should be reported in EPA spreadsheet format, which can be found here.

4.2 Spreadsheet results to include:

- Tabulated geophysical/chemical test results
- Clear expression of units
- Indication of wet weight or dry weight basis
- Location of samples in decimal degrees WGS84 (latitude/longitude).
- Date of sampling
- Treatment of samples and indication of sub sampling, compositing etc.
- Summary method details
- CRM results
- QA /QC
- Other quality assurance information (e.g. accreditation status)
- Project details.

4.3 If determinant is not detected, report less than values, and indicate LoD/ LoQ used.

4.4 Testing laboratories may be asked to provide additional details of method performance including limit of detection, precision, bias.

Figure 1. Sample locations, Haulbowline Basin.

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	**MAR01284**	
Issue Version	1	
Customer	Priority Geotechnical, Unit 12, Owenacurra Business Park, Midleton, Co. Cork	
Customer Reference	Haulbowline Basin Marine Institute Sediment Analysis	
Date Sampled	19-Jan-22	
Date Received	25-Jan-22	
Date Reported	28-Feb-22	
Condition of samples	Cold	Satisfactory

[redacted]

Authorised by: [redacted]

Position: Laboratory Manager

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

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 MAR01284
Issue Version 1
Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

		Units	%	%	%	%	%	% M/M
		Method No	ASC/SOP/303	ASC/SOP/303	SUB_01*	SUB_01*	SUB_01*	SOCOTEC Env Chem*
		Limit of Detection	0.2	0.2	N/A	N/A	N/A	0.02
		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)**	**TOC**
S01	MAR01284.001	Sediment	40.0	60.0	0.0	8.1	91.9	1.83
S02	MAR01284.002	Sediment	67.2	32.8	0.4	6.0	93.6	2.60
S03	MAR01284.003	Sediment	65.6	34.4	0.0	3.4	96.6	2.43
S04	MAR01284.004	Sediment	68.5	31.5	0.0	4.0	96.0	2.48
S05	MAR01284.005	Sediment	48.4	51.6	0.0	0.5	99.5	2.13
S06	MAR01284.006	Sediment	63.2	36.8	0.0	4.0	96.0	2.28
S07	MAR01284.007	Sediment	48.6	51.4	0.0	1.8	98.2	2.14
S08	MAR01284.008	Sediment	44.8	55.2	0.0	1.1	98.9	2.00
S09	MAR01284.009	Sediment	64.8	35.2	0.0	2.0	98.0	2.42
S10	MAR01284.010	Sediment	60.0	40.0	0.6	4.5	94.9	2.14
S11	MAR01284.011	Sediment	63.3	36.7	0.0	0.7	99.3	2.16
S12	MAR01284.012	Sediment	69.4	30.6	0.0	5.6	94.4	2.42
S13	MAR01284.013	Sediment	51.0	49.0	0.0	2.0	98.0	2.18
S14	MAR01284.014	Sediment	51.2	48.8	0.0	1.2	98.8	2.36
S15	MAR01284.015	Sediment	50.1	49.9	0.0	0.6	99.4	2.11
S16	MAR01284.016	Sediment	53.3	46.7	1.3	1.6	97.1	2.48
S17	MAR01284.017	Sediment	65.7	34.3	0.0	5.7	94.3	2.50
S18	MAR01284.018	Sediment	62.9	37.1	0.0	6.6	93.4	2.54
		Reference Material (% Recovery)	NA	NA	NA	NA	NA	108
		QC Blank	NA	NA	NA	NA	NA	<0.02

* See Report Notes

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

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		Units	% M/M
		Method No	SOCOTEC Env Chem*
		Limit of Detection	0.12
		Accreditation	No
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Carbonate Equivalent (%CO3)**
S01	MAR01284.001	Sediment	9.60
S02	MAR01284.002	Sediment	10.6
S03	MAR01284.003	Sediment	9.84
S04	MAR01284.004	Sediment	10.1
S05	MAR01284.005	Sediment	10.1
S06	MAR01284.006	Sediment	9.36
S07	MAR01284.007	Sediment	9.84
S08	MAR01284.008	Sediment	9.48
S09	MAR01284.009	Sediment	9.60
S10	MAR01284.010	Sediment	9.48
S11	MAR01284.011	Sediment	9.60
S12	MAR01284.012	Sediment	10.1
S13	MAR01284.013	Sediment	6.24
S14	MAR01284.014	Sediment	4.56
S15	MAR01284.015	Sediment	9.84
S16	MAR01284.016	Sediment	10.1
S17	MAR01284.017	Sediment	8.64
S18	MAR01284.018	Sediment	8.88
		Reference Material (% Recovery)	99
		QC Blank	<0.12

* See Report Notes

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DE15 0YZ

Test Report ID MAR01284
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		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*
		Limit of Detection	0.5	0.2	2	2	1.2
		Accreditation	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**
S01	MAR01284.001	Sediment	14.8	0.7	81.9	42.9	122
S02	MAR01284.002	Sediment	14.5	0.3	81.4	41.5	45.9
S03	MAR01284.003	Sediment	2.6	0.2	47.7	28.9	34.0
S04	MAR01284.004	Sediment	13.7	0.2	76.6	34.6	44.6
S05	MAR01284.005	Sediment	14.3	0.4	82.6	41.1	66.2
S06	MAR01284.006	Sediment	12.6	0.16*	76.9	28.7	38.8
S07	MAR01284.007	Sediment	14.7	0.3	92.3	34.0	72.4
S08	MAR01284.008	Sediment	13.3	0.4	97.1	58.3	97.0
S09	MAR01284.009	Sediment	13.4	0.18*	77.0	28.9	37.2
S10	MAR01284.010	Sediment	11.9	0.2	73.6	31.7	38.8
S11	MAR01284.011	Sediment	13.9	0.3	82.0	37.4	54.0
S12	MAR01284.012	Sediment	13.4	0.17*	83.5	28.7	38.1
S13	MAR01284.013	Sediment	14.0	0.9	82.5	61.0	87.6
S14	MAR01284.014	Sediment	17.3	0.6	94.5	52.6	93.4
S15	MAR01284.015	Sediment	15.6	0.4	96.9	53.5	78.5
S16	MAR01284.016	Sediment	36.0	0.6	83.9	103	418
S17	MAR01284.017	Sediment	15.8	0.2	81.8	40.8	61.3
S18	MAR01284.018	Sediment	13.2	0.2	83.8	37.7	41.6
Certified Reference Material 2702 (Measured Value)			45.4	0.61	321	111	130
Certified Reference Material 2702 (Certified Value)			45.3	0.817	352	117.7	132.8
Certified Reference Material 2702 (% Recovery)			102	90	106	107	104
QC Blank			<0.5	<0.2	<2	<2	<1.2

* See Report Notes
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DE15 0YZ

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Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

		Units	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)	mg/Kg (Dry Weight)
		Method No	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*	SOCOTEC Env Chem*
		Limit of Detection	2	3	0.01	10	2
		Accreditation	UKAS	UKAS	N	UKAS	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Nickel as Ni**	**Zinc as Zn**	**Mercury as Hg**	**Aluminium as Al**	**Lithium as Li**
S01	MAR01284.001	Sediment	31.4	290	0.29	50800	55.2
S02	MAR01284.002	Sediment	31.8	148	0.09	53700	61.0
S03	MAR01284.003	Sediment	26.2	132	0.08	51100	62.3
S04	MAR01284.004	Sediment	32.2	166	0.08	52500	59.7
S05	MAR01284.005	Sediment	33.9	208	0.12	55700	62.7
S06	MAR01284.006	Sediment	30.9	78.2	0.08	55000	61.3
S07	MAR01284.007	Sediment	34.2	200	0.16	55900	60.9
S08	MAR01284.008	Sediment	36.3	330	0.16	56900	62.8
S09	MAR01284.009	Sediment	30.5	129	0.08	57700	63.3
S10	MAR01284.010	Sediment	29.9	145	0.09	56400	61.8
S11	MAR01284.011	Sediment	32.0	192	0.13	52600	60.0
S12	MAR01284.012	Sediment	33.9	136	0.08	55700	62.5
S13	MAR01284.013	Sediment	31.8	220	0.16	55000	62.8
S14	MAR01284.014	Sediment	37.1	299	0.18	56700	66.7
S15	MAR01284.015	Sediment	34.9	251	0.23	59200	65.1
S16	MAR01284.016	Sediment	52.9	364	1.91	48900	55.1
S17	MAR01284.017	Sediment	33.3	174	0.12	53500	62.6
S18	MAR01284.018	Sediment	32.9	150	0.08	52800	62.7
Certified Reference Material 2702 (Measured Value)			69.6	439.0	<0.01	80500	85.5
Certified Reference Material 2702 (Certified Value)			75.4	485.3	0.04	84000	78.2
Certified Reference Material 2702 (% Recovery)			107	103	101~	105	116
QC Blank			<2	<3	<0.01	<10	<2

* See Report Notes

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

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		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)**
S01	MAR01284.001	Sediment	<5	<5
S02	MAR01284.002	Sediment	<5	<5
S03	MAR01284.003	Sediment	<5	<5
S04	MAR01284.004	Sediment	<5	<5
S05	MAR01284.005	Sediment	<5	<5
S06	MAR01284.006	Sediment	<5	<5
S07	MAR01284.007	Sediment	<5	<5
S08	MAR01284.008	Sediment	12.7	18.0
S09	MAR01284.009	Sediment	<5	<5
S10	MAR01284.010	Sediment	<5	<5
S11	MAR01284.011	Sediment	<5	<5
S12	MAR01284.012	Sediment	<5	<5
S13	MAR01284.013	Sediment	<5	<5
S14	MAR01284.014	Sediment	<5	<5
S15	MAR01284.015	Sediment	17.9	19.6
S16	MAR01284.016	Sediment	<5	<5
S17	MAR01284.017	Sediment	<5	<5
S18	MAR01284.018	Sediment	<5	<5
Certified Reference Material BCR-646 (Measured Value)			554	269
Certified Reference Material BCR-646 (Certified Value)			770	480
Certified Reference Material BCR-646 (% Recovery)			72	56
QC Blank			<1	<1

See Report Notes

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		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	N*	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**ACENAPTH**	**ACENAPHY**	**ANTHRACN**	**BAA**	**BAP**	**BBF**
S01	MAR01284.001	Sediment	43.8	24.9	130	334	389	389
S02	MAR01284.002	Sediment	5.24	3.05	9.05	23.4	30.4	49.8
S03	MAR01284.003	Sediment	3.170	2.79	8.96	29.0	33.5	64.3
Certified Reference Material QPH097MS (Measured Value)			30.4	35.9	97.4	289	279	316
Certified Reference Material QPH097MS (Certified Value)			35.3	37.3	121	359	350	418
Certified Reference Material QPH097MS (% Recovery)			86	96	81	80	80	76
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries
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		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	N*
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**BENZGHIP**	**BKF**	**CHRYSENE**	**DBENZAH**	**FLUORANT**	**FLUORENE**
S01	MAR01284.001	Sediment	304	238	405	60.8	764	65.1
S02	MAR01284.002	Sediment	40.0	29.9	33.0	8.11	51.1	8.60
S03	MAR01284.003	Sediment	49.8	41.2	37.1	8.40	60.1	8.72
Certified Reference Material QPH097MS (Measured Value)			244	185	380	40.1	690	46.6
Certified Reference Material QPH097MS (Certified Value)			267	193	447	54.4	933	71.7
Certified Reference Material QPH097MS (% Recovery)			91	96	85	74	74	65
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries
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		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	N*	UKAS	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**INDPYR**	**NAPTH**	**PHENANT**	**PYRENE**	**THC**
S01	MAR01284.001	Sediment	316	81.0	438	763	502000
S02	MAR01284.002	Sediment	44.1	15.8	29.0	46.0	228000
S03	MAR01284.003	Sediment	57.0	19.0	34.0	54.4	127000
Certified Reference Material QPH097MS (Measured Value)			212	113	379	619	NA
Certified Reference Material QPH097MS (Certified Value)			274	115	510	794	NA
Certified Reference Material QPH097MS (% Recovery)			77	98	74	78	100~
QC Blank			<1	<1	<1	<1	<1

For full analyte name see method summaries
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		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**
S04	MAR01284.004	Sediment	4.03	2.73	9.37	32.2	38.6	60.1
S05	MAR01284.005	Sediment	5.93	5.72	23.4	81.0	83.7	118
S06	MAR01284.006	Sediment	6.82	3.83	21.4	71.0	79.7	99.6
S07	MAR01284.007	Sediment	17.4	18.0	56.0	196	229	287
S08	MAR01284.008	Sediment	10.5	6.47	22.9	78.6	96.9	139
S09	MAR01284.009	Sediment	4.32	2.81	8.84	34.2	31.2	51.8
S10	MAR01284.010	Sediment	4.75	4.83	12.8	43.0	66.3	94.0
S11	MAR01284.011	Sediment	5.69	7.46	14.4	42.0	50.7	73.4
S12	MAR01284.012	Sediment	8.17	16.4	34.8	179	170	171
S13	MAR01284.013	Sediment	5.24	5.31	15.7	46.9	62.0	102
S14	MAR01284.014	Sediment	12.9	15.0	48.6	149	182	235
S15	MAR01284.015	Sediment	12.8	8.40	29.3	92.4	111	152
S16	MAR01284.016	Sediment	14.7	18.0	48.0	161	200	256
S17	MAR01284.017	Sediment	3.74	3.62	8.55	32.7	38.1	58.8
S18	MAR01284.018	Sediment	4.36	3.58	9.27	33.0	39.4	63.0
Certified Reference Material QPH097MS (Measured Value)			25.6	33.4	101	295	280	313
Certified Reference Material QPH097MS (Certified Value)			35.3	37.3	121	359	350	418
Certified Reference Material QPH097MS (% Recovery)			72	90	83	82	80	75
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries
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Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

		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	N*
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**BENZGHIP**	**BKF**	**CHRYSENE**	**DBENZAH**	**FLUORANT**	**FLUORENE**
S04	MAR01284.004	Sediment	48.9	34.1	45.7	10.5	65.2	8.16
S05	MAR01284.005	Sediment	82.8	63.1	97.8	13.5	166	12.8
S06	MAR01284.006	Sediment	71.8	46.9	86.0	15.7	160	9.76
S07	MAR01284.007	Sediment	211	155	240	34.2	409	26.5
S08	MAR01284.008	Sediment	97.9	71.7	104	20.0	166	12.8
S09	MAR01284.009	Sediment	48.9	36.7	46.8	9.66	76.0	8.81
S10	MAR01284.010	Sediment	84.5	46.2	49.6	13.6	88.6	10.2
S11	MAR01284.011	Sediment	61.6	41.8	55.0	11.9	87.4	11.1
S12	MAR01284.012	Sediment	113	92.0	156	26.2	421	12.4
S13	MAR01284.013	Sediment	72.5	45.5	69.7	12.1	106	10.7
S14	MAR01284.014	Sediment	181	105	193	36.7	307	23.8
S15	MAR01284.015	Sediment	118	89.2	121	23.5	192	16.1
S16	MAR01284.016	Sediment	200	161	216	34.6	372	26.2
S17	MAR01284.017	Sediment	52.2	33.2	44.6	10.3	63.5	7.88
S18	MAR01284.018	Sediment	51.9	25.6	47.5	9.45	72.3	8.43
Certified Reference Material QPH097MS (Measured Value)			218	168	376	41.8	704	52.5
Certified Reference Material QPH097MS (Certified Value)			267	193	447	54.4	933	71.7
Certified Reference Material QPH097MS (% Recovery)			82	87	84	77	75	73
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries
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		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	N*	UKAS	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**INDPYR**	**NAPTH**	**PHENANT**	**PYRENE**	**THC**
S04	MAR01284.004	Sediment	60.8	19.6	35.5	57.8	157000
S05	MAR01284.005	Sediment	97.2	23.3	66.6	151	203000
S06	MAR01284.006	Sediment	81.2	21.9	76.6	137	146000
S07	MAR01284.007	Sediment	225	49.6	164	396	375000
S08	MAR01284.008	Sediment	118	26.0	68.2	166	626000
S09	MAR01284.009	Sediment	53.9	18.1	35.9	66.5	217000
S10	MAR01284.010	Sediment	89.5	21.9	43.9	85.8	188000
S11	MAR01284.011	Sediment	69.2	19.9	41.0	88.0	256000
S12	MAR01284.012	Sediment	138	23.3	70.9	323	219000
S13	MAR01284.013	Sediment	87.4	23.8	59.1	97.0	225000
S14	MAR01284.014	Sediment	200	48.7	131	305	822000
S15	MAR01284.015	Sediment	138	30.3	72.1	193	582000
S16	MAR01284.016	Sediment	224	55.4	158	369	671000
S17	MAR01284.017	Sediment	63.2	16.7	33.4	59.0	244000
S18	MAR01284.018	Sediment	58.6	17.5	41.7	65.5	194000
		Certified Reference Material QPH097MS (Measured Value)	227	117	393	627	NA
		Certified Reference Material QPH097MS (Certified Value)	274	115	510	794	NA
		Certified Reference Material QPH097MS (% Recovery)	83	102	77	79	103~
		QC Blank	<1	<1	<1	<1	<1

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

Certificate of Analysis

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

Test Report ID MAR01284
Issue Version 1
Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

		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	N*	UKAS	UKAS	N*
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB28**	**PCB52**	**PCB101**	**PCB118**	**PCB138**	**PCB153**	**PCB180**
S01	MAR01284.001	Sediment	1.56	3.93	3.13	3.04	2.57	3.42	1.03
S02	MAR01284.002	Sediment	0.22	0.27	0.36	0.29	0.20	0.34	0.13
S03	MAR01284.003	Sediment	0.24	0.25	0.44	0.03	0.36	0.42	0.05
S04	MAR01284.004	Sediment	0.21	0.21	0.32	0.29	0.27	0.36	0.12
S05	MAR01284.005	Sediment	1.49	1.92	1.74	1.92	1.42	1.20	0.40
S06	MAR01284.006	Sediment	0.23	0.21	0.19	0.28	0.26	0.30	0.04
S07	MAR01284.007	Sediment	1.03	2.94	1.69	1.56	0.70	1.41	0.33
S08	MAR01284.008	Sediment	3.44	4.25	3.72	4.77	3.16	2.55	0.93
S09	MAR01284.009	Sediment	0.24	0.22	0.24	0.30	0.24	0.28	0.12
S10	MAR01284.010	Sediment	0.51	0.47	0.50	0.71	0.45	0.45	0.13
S11	MAR01284.011	Sediment	1.32	1.54	1.42	1.73	1.09	1.32	0.25
S12	MAR01284.012	Sediment	0.21	0.23	0.31	0.68	0.31	0.26	0.02
S13	MAR01284.013	Sediment	4.18	4.49	3.06	3.77	1.67	2.41	0.79
S14	MAR01284.014	Sediment	1.81	3.51	3.29	3.47	2.49	3.79	1.04
S15	MAR01284.015	Sediment	4.11	5.15	5.30	5.35	3.94	4.05	1.29
S16	MAR01284.016	Sediment	0.69	1.16	1.23	1.52	1.11	1.48	0.48
S17	MAR01284.017	Sediment	0.31	0.34	0.36	0.46	0.28	0.38	0.11
S18	MAR01284.018	Sediment	0.26	0.27	0.36	0.44	0.41	0.62	0.12
Certified Reference Material QOR146 MS (Measured Value)			0.16	0.69	0.58	0.17	0.55	0.70	0.22
Certified Reference Material QOR146 MS (Certified Value)			0.21	0.62	0.59	0.32	0.55	0.67	0.41
Certified Reference Material QOR146 MS (% Recovery)			75	110	98	52	100	104	53
QC Blank			<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08

For full analyte name see method summaries
~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.

Certificate of Analysis

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Test Report ID MAR01284
Issue Version 1
Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

		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)	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	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Accreditation	UKAS	UKAS	UKAS	UKAS	N*	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**AHCH**	**BHCH**	**GHCH**	**DIELDRIN**	**HCB**	**DDE**	**DDT**	**DDD**
S01	MAR01284.001	Sediment	<0.1	<0.1	<0.1	0.26	0.61	0.98	<0.1	1.02
S02	MAR01284.002	Sediment	<0.1	<0.1	<0.1	<0.1	<0.1	0.12	<0.1	0.18
S03	MAR01284.003	Sediment	<0.1	<0.1	<0.1	<0.1	<0.1	0.12	<0.1	0.10
S04	MAR01284.004	Sediment	<0.1	<0.1	<0.1	0.19	<0.1	0.23	<0.1	<0.1
S05	MAR01284.005	Sediment	<0.1	<0.1	<0.1	0.12	<0.1	0.26	<0.1	0.31
S06	MAR01284.006	Sediment	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.15
S07	MAR01284.007	Sediment	<0.1	<0.1	<0.1	0.22	<0.1	1.12	0.19	1.33
S08	MAR01284.008	Sediment	<0.1	<0.1	<0.1	0.27	<0.1	0.37	<0.1	0.48
S09	MAR01284.009	Sediment	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.25	0.10
S10	MAR01284.010	Sediment	<0.1	<0.1	<0.1	0.11	<0.1	0.23	<0.1	0.11
S11	MAR01284.011	Sediment	<0.1	<0.1	<0.1	<0.1	<0.1	0.32	<0.1	0.20
S12	MAR01284.012	Sediment	<0.1	<0.1	<0.1	<0.1	<0.1	0.14	<0.1	<0.1
S13	MAR01284.013	Sediment	<0.1	<0.1	<0.1	<0.1	<0.1	0.51	<0.1	0.44
S14	MAR01284.014	Sediment	<0.1	<0.1	<0.1	0.34	<0.1	1.35	0.15	1.01
S15	MAR01284.015	Sediment	<0.1	<0.1	0.11	0.35	<0.1	0.59	0.18	0.83
S16	MAR01284.016	Sediment	<0.1	<0.1	<0.1	0.54	<0.1	0.56	0.61	0.64
S17	MAR01284.017	Sediment	<0.1	<0.1	<0.1	<0.1	<0.1	0.27	0.14	0.15
S18	MAR01284.018	Sediment	<0.1	<0.1	<0.1	<0.1	<0.1	0.20	<0.1	<0.1
Certified Reference Material QOR146 MS (Measured Value)			0.00	0.02	0.01	0.03	0.01	0.12	0.00	0.13
Certified Reference Material QOR146 MS (Certified Value)			NA	NA	NA	NA	NA	0.21	NA	0.32
Certified Reference Material QOR146 MS (% Recovery)			120~	104~	122~	118~	120~	56	105~	41
QC Blank			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

For full analyte name see method summaries
~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.
*See report notes

Certificate of Analysis

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

Test Report ID MAR01284
Issue Version 1
Customer Reference Haulbowline Basin Marine Institute Sediment Analysis

REPORT NOTES

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
SOCOTEC Env Chem*	MAR01284.001-018	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
SUB_01*	MAR01284.001-018	Analysis was conducted by an approved subcontracted laboratory.
Cadmium	MAR01284.006, 009, 012	Values marked with * are reported lower than the accredited LoD of 0.2 mg/kg. Therefore we have removed accreditation removed these results only.
ASC/SOP/301	MAR01284.001.007, .009-0014, .0016-018	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/302	MAR01284.001-018	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 ma y not have been significantly affected.However in line with our QMS policy we have removed accreditation, where applicable, from the affected analytes (PCB118, PCB180, HCB) . These circumstances should be taken into consideration when utilising the data.
ASC/SOP/303/304	MAR01284.001-018	Chrysene is known to coelute with Triphenylene and these peaks can not be resolved. It is believed Triphenylene is present in these samples therefore it is suggested that the Chrysene results should be taken as a Chrysene (inc. Triphenylene).This should be taken into consideration when utilising the data.
ASC/SOP/303/304	MAR01284.001-003	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 (ANTHRACN, FLUORENE, PHENANT) . These circumstances should be taken into consideration when utilising the data.
ASC/SOP/303/304	MAR01284.004-018	The Primary process control data associated with this Test has not wholly met the requirements of the Laboratory Quality Management System QMS with one or more target analytes falling outside acceptable limits. The remaining data gives the Laboratory confidence that the test has performed satisfactorily and that the validity of the data may not have been significantly affected.However in line with our QMS policy we have removed accreditation, where applicable, from the affected analytes (FLUORENE, PHENANT) . These circumstances should be taken into consideration when utilising the data.

DEVIATING SAMPLE STATEMENT

Deviation Code	Deviation Definition	Sample ID	Deviation Details. The following information should be taken into consideration when using the data contained within this report
D1	Holding Time Exceeded	N/A	N/A
D2	Handling Time Exceeded	N/A	N/A
D3	Sample Contaminated through Damaged Packaging	N/A	N/A
D4	Sample Contaminated through Sampling	N/A	N/A
D5	Inappropriate Container/Packaging	N/A	N/A
D6	Damaged in Transit	N/A	N/A
D7	Insufficient Quantity of Sample	N/A	N/A
D8	Inappropriate Headspace	N/A	N/A
D9	Retained at Incorrect Temperature	N/A	N/A
D10	Lack of Date & Time of Sampling	N/A	N/A
D11	Insufficient Sample Details	N/A	N/A

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	MAR01284
Issue Version	1
Customer Reference	Haulbowline Basin Marine Institute Sediment Analysis

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 seived to <2mm	Carbonate removal and sulphurous acid/combustion at 1600°C/NDIR.
Carbonate	Air dried and seived to <2mm	Quantitative digestion with Hydrochloric Acid back titration with 1M Sodium Hydroxide to pH 7
Metals	Air dried and seived to <2mm	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 seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS analysis.
Organochlorine Pesticides (OCPs)	Air dried and seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS analysis.

Analyte Definitions					
Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name
ACENAPTH	Acenaphthene	C2N	C2-naphthalenes	THC	Total Hydrocarbon Content
ACENAPHY	Acenaphthylene	C3N	C3-naphthalenes	AHCH	alpha-Hexachlorcyclohexane
ANTHRACN	Anthracene	CHRYSENE	Chrysene	BHCH	beta-Hexachlorcyclohexane
BAA	Benzo[a]anthracene	DBENZAH	Dibenzo[ah]anthracene	GHCH	gamma-Hexachlorcyclohexane
BAP	Benzo[a]pyrene	FLUORANT	Fluoranthene	DIELDRIN	Dieldrin
BBF	Benzo[b]fluoranthene	FLUORENE	Fluorene	HCB	Hexachlorobenzene
BEP	Benzo[e]pyrene	INDPYR	Indeno[1,2,3-cd]pyrene	DDD	p,p'-Dichlorodiphenyldichloroethane
BENZGHIP	Benzo[ghi]perylene	NAPTH	Naphthalene	DDE	p,p'-Dichlorodiphenyldichloroethylene
BKF	Benzo[k]fluoranthene	PERYLENE	Perylene	DDT	p,p'-Dichlorodiphenyltrichloroethane
C1N	C1-naphthalenes	PHENANT	Phenanthrene		
C1PHEN	C1-phenanthrene	PYRENE	Pyrene		

Laboratory Test Report

Report Date: 16th -June 2022

Samples Tested on Behalf of: Priority Geotechnical

Laboratory Analysis: High Resolution Gamma Spectrometry with appropriate density correction

Sample Type: Marine Sediment

Date of Receipt: 27th January 2022

Date of Analysis 29th April 2022

Results:

ORM Reference	Client Reference	Coordinates	Nuclide	Activity Concentration (Bq/kg, dry)[1]
ES22200015	S01	Easting (m) 579329.599 Northing (m) 565655.765	K-40 I-131 Cs-134 Cs-137 Am-241 Ra-226 Ra-228 U-235	464.4 ± 6.7 Nd Nd 5.43 ± 0.08 0.7 ± 0.1 19.76 ± 0.73 29.57 ± 1.21 1.2 ± 0.094
ES22200016	S04	Easting (m) 579456.569 Northing (m) 565531.761	K-40 I-131 Cs-134 Cs-137 Am-241 Ra-226 Ra-228 U-235	521.1 ± 8.3 Nd Nd 3.46 ± 0.13 Nd 17.21 ± 1.10 21.43 ± 1.21 Nd

Note:
(1) Quoted uncertainties are ±1 SD counting statistics
(2) Nd = not detected

ES22200017	S10	Easting (m) 579401.065 Northing (m) 565439.655	K-40 I-131 Cs-134 Cs-137 Am-241 Ra-226 Ra-228 U-235	481.0 ± 9.5 Nd Nd 3.47 ± 0.08 Nd 18.51 ± 1.73 24.75 ± 1.52 1.4 ± 0.11
ES22200018	S15	Easting (m) 579334.988 Northing (m) 565290.857	K-40 I-131 Cs-134 Cs-137 Am-241 Ra-226 Ra-228 U-235	506.4 ± 61.0 Nd Nd 7.67 ± 0.92 1.1 ± 0.2 19.35 ± 3.76 30.86 ± 4.43 1.2 ± 0.21

The Office of Radiation Protection and Environmental Monitoring received four grab sediment sample from Hawlbowline Naval Base, Ringaskiddy, Co Cork. These samples were taken in support of application for a Capital/Maintenance Dredging Permit.

The samples were prepared by placing an aliquot in a well-defined counting geometry and then measured on a high-resolution gamma spectrometer. Appropriate density corrections were applied to the resultant spectra to take account of the differences in sample density. Dry to wet weight ratio was determined for the sample. Results are quoted on a dry weight basis.

The results indicate that dumping of these materials at sea will not result in a radiological hazard.

[redacted]

Laboratory Manager

Notes:

- This report relates only to the samples tested.
- This report shall not be reproduced except in full, without the approval of the Agency
- The following scientific officers may sign test reports on behalf of the lab manager [redacted].
- Where applicable, the number following the symbol ± is the combined standard uncertainty and not a confidence interval.