

Cardiff Coastal Defence Scheme

Contaminated Land Review

April 2021

www.jbaconsulting.com



JBA Project Manager

Anne Marie-Moon
Kings Chambers
8 High Street
Newport
NP20 1FQ

+44(0)1937 837900
info@jbaconsulting.com
www.jbaconsulting.com
Follow us:  

Revision history

Revision Ref	Date	Amendments	Issued to
P01	April 2021	Draft Report	

Contract

This report describes work commissioned by David Brain, on behalf of Cardiff City Council. Katherine Prosser of JBA Consulting carried out this work.

Prepared by Katherine Prosser BSc MSc FGS
Senior Geo-Environmental Engineer

Reviewed and Approved by Mike McDonald, BSc MSc PhD, CGeol, FGS
Technical Director

Purpose

This document has been prepared as a Draft Report for Cardiff City Council. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared. JBA Consulting has no liability regarding the use of this report except to Cardiff City Council.

Copyright

© Jeremy Benn Associates Limited 2020.

Carbon footprint

JBA is aiming to reduce its per capita carbon emissions.

Contents

1	Introduction	4
1.1	Scheme Proposal	4
1.2	Aims and Objectives.....	5
1.3	References.....	5
2	Background.....	6
2.1	Site Description	6
2.1.1	Section 1 - West Bank, Railway Bridge to Lamby Way.....	6
2.1.2	Section 2 - Frontage of Parc Tredelerch.....	6
2.1.3	Section 3 - Frontage of the Lamby Way Landfill Site	6
2.1.4	Section 4 – West Bank - Lamby Way and the mouth of the river	7
2.1.5	Section 5 – shore between the river mouth and the eastern side of the 'Frag Tip'.....	7
2.1.6	Section 6 – The Frag Tip	7
2.2	Site History and Land Use	7
2.3	Geology	8
2.3.1	Soils	8
2.3.2	Made Ground	8
2.3.3	Superficial Geology.....	8
2.3.4	Bedrock Geology	10
3	Ground Investigation	11
3.1.1	Field Works	11
4	Ground Conditions	12
4.1	Sections 1 to 5	12
4.1.1	Gas Monitoring Results.....	12
4.2	Section 6 ('Frag Tip')	12
4.2.1	Groundwater Conditions.....	12
4.2.2	Ground gas monitoring	14
4.3	Geo-Environmental Testing Results	14
5	Risk Assessment.....	19
5.1	Introduction	19
5.2	Identified Sources	19
5.3	Pathways and Receptors	19
5.4	Outline Conceptual Site Model	19
5.5	Risk Assessment- Human Health.....	20
5.5.1	Introduction.....	20
5.5.2	Results of Tier 1 Assessment	20
5.5.3	Gas Analysis.....	20
5.6	Risk Assessment- Controlled Waters.....	21
5.6.1	Introduction.....	21
5.7	Refined Conceptual Site Model.....	22
6	Conclusions.....	25
6.1	Summary.....	25

6.2	Recommendations.....	25
6.2.1	Piling Works Risk Assessment	25
6.2.2	Waste/Re-Use of Site Won Material	25
6.2.3	Health and Safety.....	25
6.2.4	Environmental Management	26
A	Laboratory Certificates.....	27
B	Exploratory Hole Plan and Geological Cross Sections	28
C	Risk Assessment Matrix	29

List of Figures

Figure 1-1: Extent of the proposed coastal defence works.	4
Figure 2-1: Subdivisions of the site into six sections	6
Figure 2-2: Historic and existing land use across the site	8
Figure 2-3: BGS superficial geology map	9
Figure 2-4: BGS bedrock geology map	10

List of Tables

Table 3-1: Frag Tip Monitoring Well Installations	11
Table 4-1: Summary of ground gas monitoring results for boreholes B2, B3, B4 and B10 (Section 1 to 5)	12
Table 4-2: Frag Tip Ground Conditions (Section 6)	12
Table 4-3: Summary of Frag Tip Groundwater Monitoring Results (Section 6)	13
Table 4-4: Summary of Frag Tip Ground Gas Monitoring Results (Section 6)	14
Table 5-1: Human Health C4SL Exceedances	20
Table 5-2: Controlled Waters EQS Exceedances	21
Table 5-3: Conceptual Site Model	22

Abbreviations

AGC	Alun Griffiths Contractors
AGS	Association of Geotechnical Specialists
BGS	British Geological Survey
CCC	Cardiff City Council
JBA	JBA Consulting Limited
mAOD	metres Above Ordnance Datum
m bgl	metres below ground level
Quantum	Quantum Geotech Limited
NRW	Natural Resource Wales
DCWW	Dwr Cymru Welsh Water

1 Introduction

1.1 Scheme Proposal

Cardiff City Council (CCC) propose to improve coastal defences around the mouth of the Rhymney River. The proposed coastal defences include the coastline along Rover Way, beginning at the eastern end of the privately owned *Dwr Cymru Welsh Water* (DCWW) defences, extending along the coast and up the west bank of the river as far as the railway line. The defence continues down the east bank of the river and along the coast around Lamby Way Landfill Site to the location of the recently constructed Natural Resources Wales (NRW) defences. Figure 1-1 shows the extent of the proposed coastal defences.

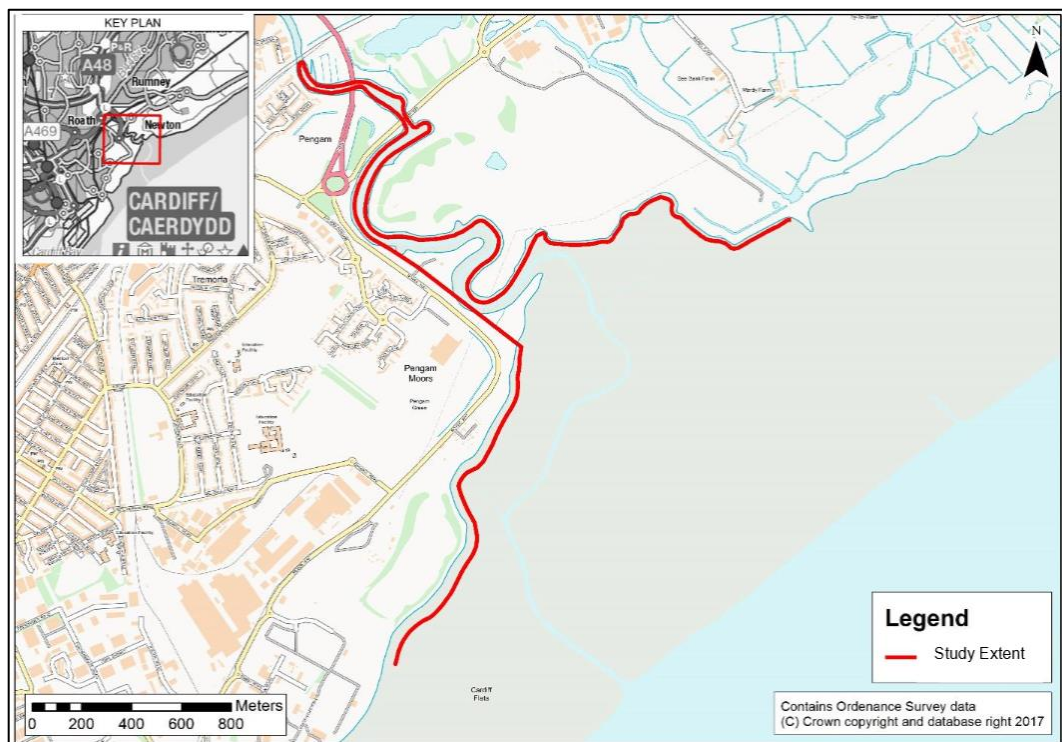


Figure 1-1: Extent of the proposed coastal defence works.

There are six main elements to the scheme:

- Section 1 - Raising existing flood embankments and forming new embankments on the west bank between the Railway Bridge and Lamby Way.
- Section 2 - Raising existing flood embankments along the frontage of Parc Tredelerch.
- Section 3 - Sheet piling and construction of a rock armour revetment along the frontage of the Lamby Way Landfill Site.
- Section 4 - Sheet piling and raising existing flood embankments on the west bank between Lamby Way and the mouth of the river.
- Section 5 - Construction of a rock armour revetment along the shore between the mouth of the river and the eastern end of the 'Frag Tip'.
- Section 6 - Construction of a rock armour revetment along the shore frontage of 'Frag Tip' extending west to the privately owned DCWW defences.

1.2 Aims and Objectives

To inform the design of the permanent works, a ground investigation was scoped by JBA Consulting (JBA) and undertaken by Quantum Geotechnic Limited (Quantum) (subcontracted by Alun Griffith Contractors (AGC)) between 02 March and 20 May 2020. Site works were paused between to 23 March and 11 May 2020 during initial stage of the Coronavirus pandemic.

A Ground Investigation Report was produced by JBA in July 2020 providing a geotechnical assessment. This report forms an addendum to the aforementioned report.

The aim of this report is to assess the potential contamination pathways associated with the whole site with particular focus on Section 6 of the scheme, the 'Frag Tip' which is a historic landfill site with no active tipping currently undertaken.

1.3 References

The following report contains a full desk study and Phase II intrusive report for the site and should be read in conjunction with this report:

- JBA Consulting. 2017. Cardiff - Geo-Environmental and Geotechnical Desk Study Assessment.
- JBA Consulting. 2020. Cardiff Coastal Defence Scheme. Ground Investigation Report.

2 Background

2.1 Site Description

The six sections are as shown in Figure 2-1

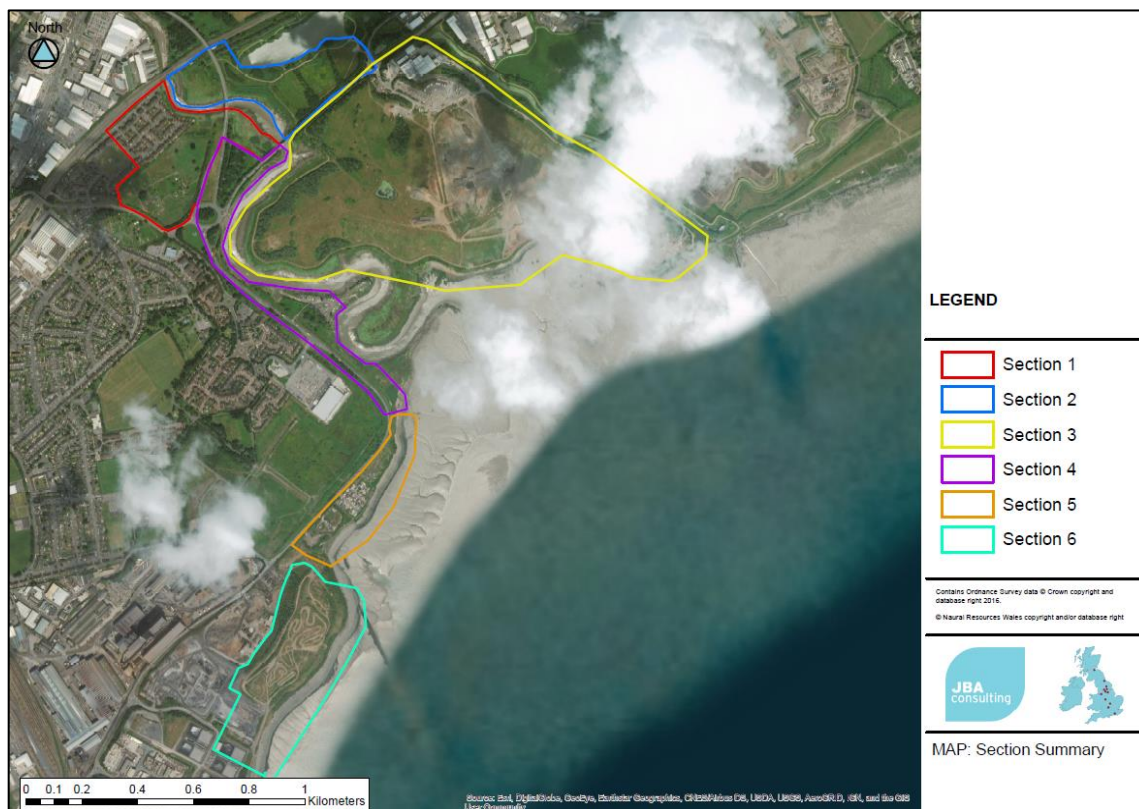


Figure 2-1: Subdivisions of the site into six sections

A description of each of the respective sections is presented below:

2.1.1 Section 1 - West Bank, Railway Bridge to Lamby Way

The land adjacent to the river frontage in Section 1 is occupied to the west by a residential area around Beaufort Square and to the east by allotments. The river frontage, north of the existing flood embankment comprises open grassland and reedbeds and extends east beneath the A4232 road bridge. There is localised slumping along the riverbank, especially along the river frontage of Glan Rhymni.

2.1.2 Section 2 - Frontage of Parc Tredelerch

The land adjacent to the river frontage in Section 2 is occupied by public parkland and a large lake forming Parc Tredelerch. The river frontage comprises a vegetated flood embankment that extends beneath the A4232 road bridge.

2.1.3 Section 3 - Frontage of the Lamby Way Landfill Site

The land adjacent to the river frontage in Section 3 is occupied by the Lamby Way Landfill Site. The river frontage comprises a revetment extending down into open grassland and reedbeds crossed by small channels. Approximately 200m downstream of the Lamby Way bridge erosion of the riverbank prevents vehicle access along the river side of the revetment. Further east, opposite the Rhymney River Motor Boat Sail and Angling Club, erosion associated with a small stream and an area of rough ground will require enabling works for plant access. The coastal

frontage comprises a narrow strip of land occupied by Wales Coast Path adjacent to the existing revetment which drops steeply onto a stony foreshore extending out into mudflats.

2.1.4 Section 4 – West Bank - Lamby Way and the mouth of the river

The land adjacent to the river frontage is occupied Lamby Way and Rover Way. The river frontage comprises wooded areas and grassland adjacent to Lamby Way and a flood embankment carrying the Wales Coast Path adjacent to Rover Way.

2.1.5 Section 5 – shore between the river mouth and the eastern side of the 'Frag Tip'

The land adjacent to the beach is occupied Rover Way and, from east to west, an area of open grassland and bushes, a residential site and a walled compound thought to be operated by Welsh Water. The Wales Coast Path runs across the section.

2.1.6 Section 6 – The Frag Tip

The land adjacent to the foreshore comprises the 'Frag Tip', now used as a motocross track, and the access road leading from the DCWW Treatment Plant to the west. The Wales Coast Path runs across the front section of the tip.

2.2 Site History and Land Use

Historical land use at the site has been determined from a review of historical OS mapping summarised within the Geo-Environmental and Geotechnical Desk Study Assessment (JBA, 2017). The historic and existing land use across the site are shown on Figure 2-2. Notable land uses include an airport on the south side of Rhymney River mouth (1948 map edition), extensive infilling to extent coast line in the southern section, with a large 'works' building just west of it (1965 map edition), expansion of Made Ground and works in the south extent, including new slag reduction works (1973 map edition) and infilling of Lamby Way Landfill which involved realignment of the river to its present day configuration.

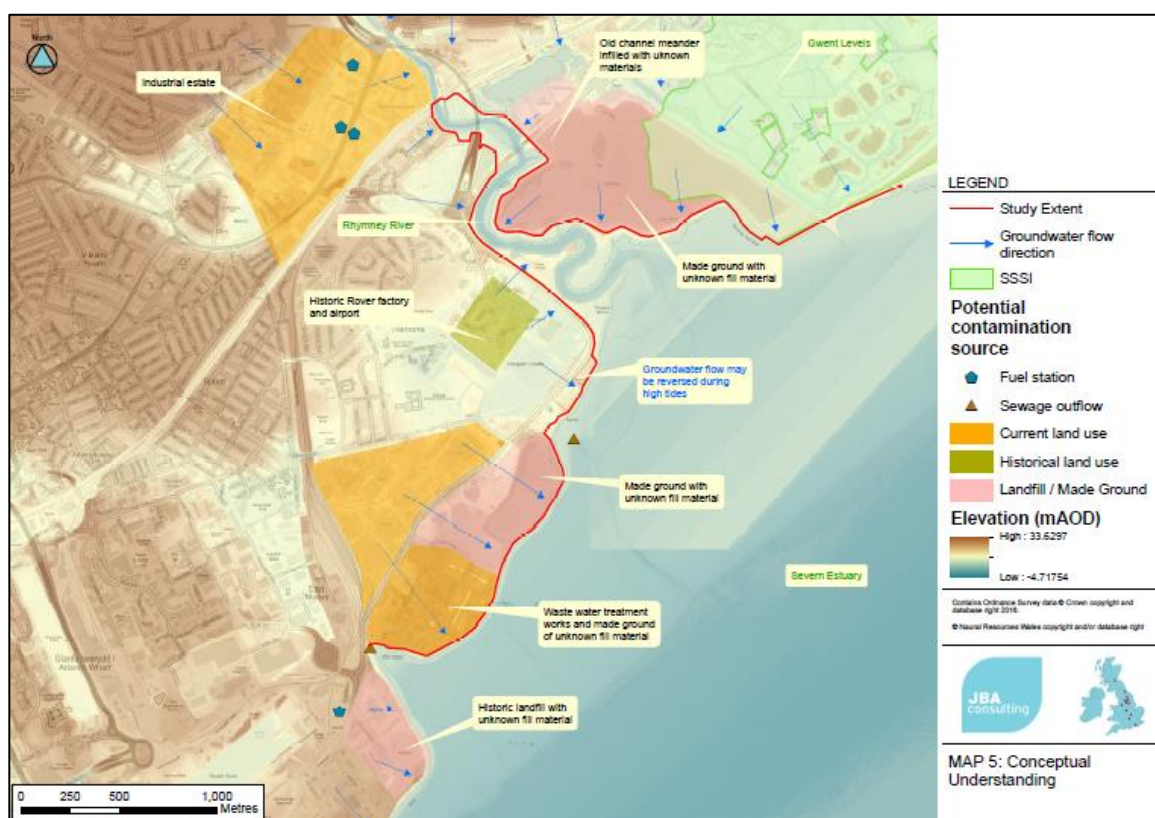


Figure 2-2: Historic and existing land use across the site

2.3 Geology

Information on the soils and geology of the site and surrounding area has been derived from the Soil Survey of England and Wales (1983), 1:50,000 BGS geology mapping (Sheet 263: Cardiff), and the BGS online borehole archive. The geology beneath the site is summarised in subsections below. Extracts of the superficial and bedrock geology maps are presented in Figure 2-3 and Figure 2-4 respectively.

2.3.1 Soils

The Soil Survey of England and Wales (1983) classifies the soils on site as Newchurch 2 association, relating to marine alluvium. This is described as 'deep stoneless mainly calcareous clayey soils'. Groundwater is controlled by ditches and pumps. Flat land. Risk of flooding in places'. The areas adjacent to Rhymney River are classified as 'un-surveyed' which generally applies to urban and industrial areas.

2.3.2 Made Ground

BGS borehole logs in the area of infilling to the north of Rhymney River show that there is approximately 0.7m of fill material, containing sand, clay, ash, brick and gravel, overlaying clay superficial deposits.

Logs for the area of Made Ground to the south show fill to 7.5m consisting of brick, stones, ash, slag, clay and silt over clay superficial deposits.

It is anticipated, based upon the known history of the site (section 2.3) that there are significant thicknesses of Made Ground along the broad line of the proposed flood defences resulting from historic waste disposal and land reclamation.

2.3.3 Superficial Geology

The superficial deposits covering the site are categorised by the BGS as Tidal Flat Deposits, comprising of clay, silt and sand. To the north of the site, within the Rhymney Valley, Alluvium deposits of clay, silt, sand and gravel are recorded.

To the west of the site, south of Roath Brook is an area of Glaciofluvial deposits, containing sands and gravels. Borehole logs show that clays beneath the site contain some organic matter and, locally, layers of peat.

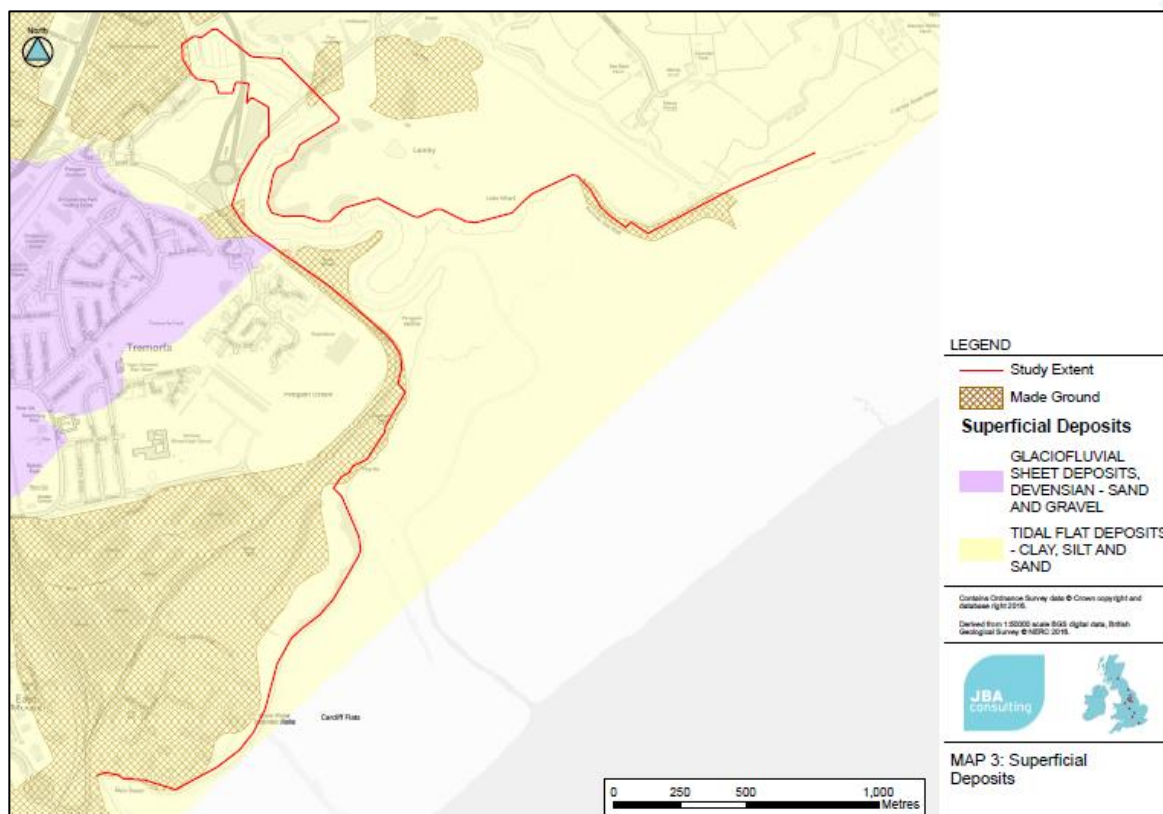


Figure 2-3: BGS superficial geology map

2.3.4 Bedrock Geology

The site is largely underlain by the Mercia Mudstone Group, which is described as 'dominantly red, less commonly green-grey, mudstones and subordinate siltstones with thick halite-bearing units in some basinal areas. Thin beds of gypsum/anhydrite widespread; sandstones are also present.' BGS borehole logs record 'stiff red friable marl with lenses of grey marl and thin bands of hard marl' at approximately 18mbgl to the south of the site. The site extent to the east is underlain by a subcrop of the Cae Castell Formation (sandstone) and the Cardiff Group (mudstone, siltstone and sandstone).

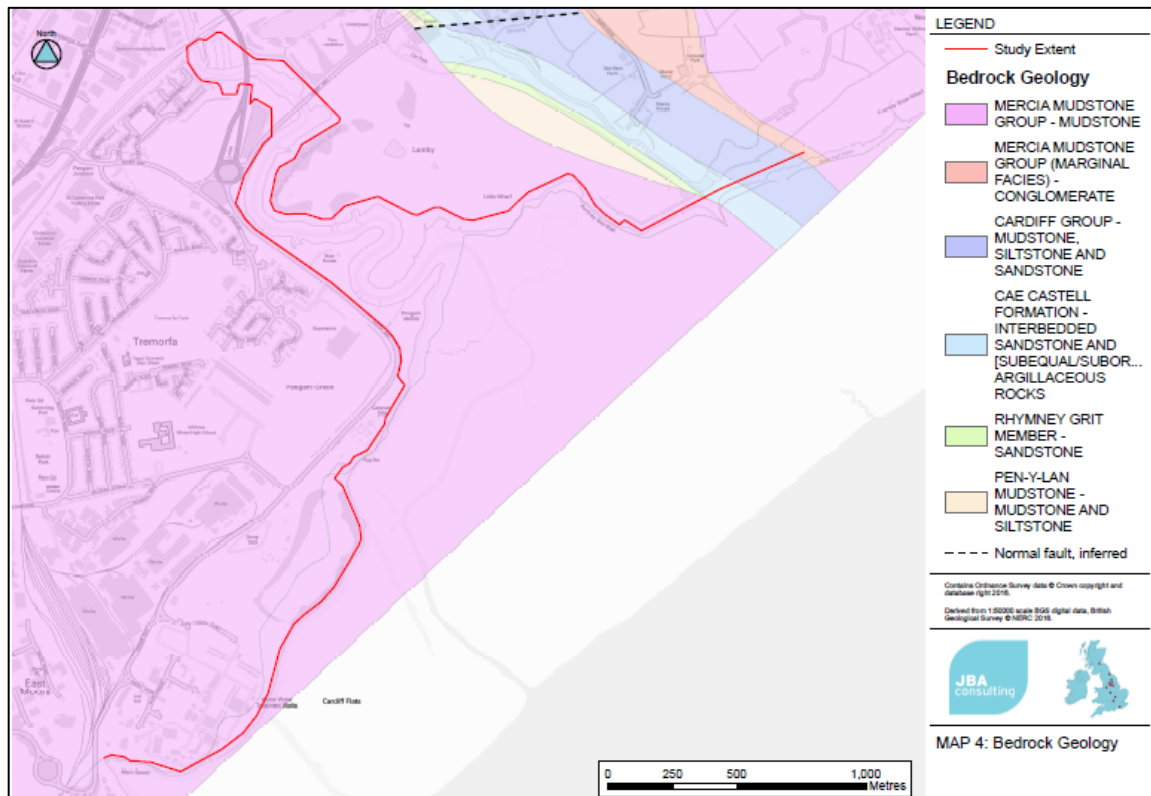


Figure 2-4: BGS bedrock geology map

3 Ground Investigation

A ground investigation scoped by JBA (ref. JBA Consulting. 2019. Cardiff Coastal Defence Scheme. Ground Investigation Specification) was carried out by Quantum Geotechnic Limited (Quantum) who were subcontracted by Alun Griffiths Contractors (AGC) on behalf of Cardiff City Council. AGC were present as the Principal Contractor overseeing the works. JBA engineers were on site to supervise the investigation works. The purpose of the ground investigation was to determine the ground and groundwater conditions at the site to inform engineering design.

3.1.1 Field Works

The ground investigation was undertaken between 02 March and 20 May 2020. Site works were paused between to 23 March and 11 May 2020 during initial stage of the Coronavirus pandemic. The site wide ground investigation comprised:

- 30No. rotary open hole boreholes to a maximum depth of 40.0mbgl (D1 to D5).
- 16No. dynamic windowless sampling boreholes with rotary follow-on using a Multipurpose rig on to a maximum depth of 20.0mbgl (A1 to A14, A3a, A3b, A12a).
- 15No. dynamic windowless sampling boreholes using a Terrier rig to a maximum depth of 8.0mbgl (WS1 to WS12, WS3a, WS6a, WS12a).
- 11No. cable percussive boreholes to a maximum depth of 20.0mbgl (B1 to B11).
- In-situ geotechnical testing.
- Groundwater observation and monitoring records.
- Gas monitoring.
- Geotechnical and contamination testing on soil samples.

The following borehole locations were installed in Section 6 across the Frag Tip:

Table 3-1: Frag Tip Monitoring Well Installations

Borehole	Top depth (m)	Base depth (m)	Drillers description of water bearing strata	Interpretation
D1A.5	5.0	9.0	Black clay Silt	Groundwater perched on underlying alluvial clay deposits
D2A.1	22.5	23.5	Colliery spoil	
D3A.3	19.0	22.0	Crushed slag	
D4A	15.5	20.5	Crushed slag	
D5A	21.0	27.0	Colliery spoil into crushed slag	
D5C	19.0	22.0	Crushed slag into landfill	Granular lenses within made ground containing perched water.
D6A.3	14.0	18.0	Soft no returns	

4 Ground Conditions

4.1 Sections 1 to 5

The ground conditions encountered are described in detailed in the JBA 2020 GIR. In Sections 1 to 5, up to 3m of Made Ground was present, indicative of reworked deposits with industrial and construction content. This was found to be overlying Tidal Flat Deposits of clay and/or Glaciofluvial Deposits of sandy gravel over the Mercia Mudstone Bedrock.

4.1.1 Gas Monitoring Results

Ground gas results recorded during monitoring visits on the 5th of May, the 21st of May and the 2nd of June 2020 within the installed boreholes B2, B3, B4 and B10 are presented in Table 4-1. All ground gas monitoring results recorded a value of zero ppm for CO and H₂S so these have been omitted from the table.

Table 4-1: Summary of ground gas monitoring results for boreholes B2, B3, B4 and B10 (Section 1 to 5)

Date	Hole ID	Flow (L/hr)	CH ₄ (%)	CO ₂ (%)	O ₂ (%)
05.05.20	B2	-1.1	0.0	0.6	20.3
21.05.20		-13.7	0.0	2.6	18.0
02.06.20		-1.9	0.0	1.4	19.7
05.05.20	B3	-0.8	0.1	2.1	19.0
21.05.20		2.5	0.0	2.4	20.2
02.06.20		0.3	0.0	2.3	20.4
05.05.20	B4	0.4	0.0	0.0	20.8
21.05.20		0.0	0.0	0.0	19.7
02.06.20		-0.7	0.0	0.0	20.2
05.05.20	B10	1.3	0.1	1.1	14.6
21.05.20		0.1	0.1	2.3	6.2
02.06.20		0.1	0.1	1.9	9.7

4.2 Section 6 ('Frag Tip')

The ground conditions encountered within boreholes undertaken in Section 6 (the 'Frag Tip') comprising boreholes D1 to D5, A11 and A12 along with A10 located at the margin of Section 5 are summarised in Table 4-2.

Appendix B shows cross sections.

Table 4-2: Frag Tip Ground Conditions (Section 6)

Stratum	Typical Description (drillers log)	Top Level (m AOD) [Thickness (m)]
Made Ground Landfill	Brown clay LANDFILL and crushed slag.	31.0 to 12.0 [0.8 to 21.0]
Made Ground Slag	Steel concrete slag FILL and colliery spoil.	30.2 to 3.5 [1.0 to 11.5]
Tidal flat deposits	Grey Clay.	0.0 to -1.2 [3.3 proven]

4.2.1 Groundwater Conditions

The observation of the groundwater levels are presented in Table 4-3.

Table 4-3: Summary of Frag Tip Groundwater Monitoring Results (Section 6)

Date	Hole ID	Stratum	Response zone mbgl/[mAOD]	Water Level mbgl/[mAOD]
05.05.20	D1a	Made Ground landfill	5.0 to 9.0 [5.0 to 1.0]	7.6 [2.5]
21.05.20				7.7 [2.4]
02.06.20				7.8 [2.3]
05.05.20	D1b	Made Ground slag	6.5 to 8.5 [2.2 to 0.17]	
21.05.20				7.6 [1.0]
02.06.20				7.7 [0.9]
05.05.20	D2a	Made Ground slag	22.5 to 23.5 [-1.3 to -2.3]	
21.05.20				22.2 [0.0]
02.06.20				22.3 [-0.1]
05.05.20	D3a	Made Ground slag	18.0 to 22.0 [-0.5 to -4.5]	
21.05.20				
02.06.20				17.4 [0.1]
05.05.20	D4a	Made Ground slag	15.5 to 20.5 [2.3 to -2.7]	15.6 [2.2]
21.05.20				15.7 [2.1]
02.06.20				15.7 [2.1]
05.05.20	D5a	Made Ground slag	21.0 to 27.0 [3.6 to -2.4]	22.2 [2.4]
21.05.20				22.3 [2.3]
02.06.20				22.3 [2.3]
05.05.20	D5c	Made Ground slag	19.0 to 22.0 [5.7 to 2.7]	21.9 [2.7]
21.05.20				22.0 [2.6]
02.06.20				22.0 [2.6]
05.05.20	D6a	Made Ground slag	14.0 to 18.0 [7.3 to 3.3]	17.7 [3.6]
21.05.20				17.8 [3.5]
02.06.20				17.9 [3.4]

4.2.2 Ground gas monitoring

Ground gas monitoring was undertaken on the 5th of May, the 21st of May and the 2nd of June 2020 within all installed boreholes on the Frag Tip. The ground gas monitoring results are presented Table 4-4. All ground gas monitoring results recorded a value of 0.0ppm for H₂S and are not included in the results table.

Table 4-4: Summary of Frag Tip Ground Gas Monitoring Results (Section 6)

Date	Hole ID	Flow (L/hr)	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	CO (ppm)
05.05.20	D1a	-0.3	0.0	0.0	21.3	0.0
21.05.20		0.0	0.0	0.0	19.7	0.0
02.06.20		-0.1	0.0	0.0	19.6	0.0
05.05.20	D1b					
21.05.20		0.0	0.6	0.0	16.8	9.0
02.06.20		-0.2	0.9	0.0	8.7	1.0
05.05.20	D2a					
21.05.20		0.0	0.3	0.0	18.7	6.0
02.06.20		0.1	0.2	0.1	18.2	4.0
05.05.20	D3a					
21.05.20						
02.06.20		0.3	7.5	0.0	0.8	0.0
05.05.20	D4a	0.7	1.4	0.4	4.8	2.0
21.05.20		0.6	0.1	0.0	7.5	0.0
02.06.20		0.2	0.2	0.0	7.1	0.0
05.05.20	D5a	0.8	0.1	0.0	8.6	0.0
21.05.20		0.3	0.1	0.0	8.8	0.0
02.06.20		0.5	0.1	0.0	7.4	0.0
05.05.20	D5c	0.8	0.1	0.1	12.3	5.0
21.05.20		0.3	0.0	0.0	8.8	1.0
02.06.20		0.3	0.1	0.0	8.5	0.0
05.05.20	D6a	-0.2	0.3	0.4	7.3	0.0
21.05.20		0.2	1.2	0.8	3.2	0.0
02.06.20		0.2	0.2	0.1	13.8	0.0

The ground gas monitoring results recorded maximum levels of:

- Methane (CH₄) within Borehole D3a at 7.5%.
- Carbon dioxide (CO₂) within Borehole D6a at 0.8%.
- Oxygen (O₂) lowest value in Borehole D3a at 0.8%.
- Carbene Monoxide (CO) within Borehole D1b at 9ppm.

4.3 Geo-Environmental Testing Results

Laboratory testing results are provided in Appendix A. Results for Sections 1-5 are summarised in Tables 4-5 and 4-6. Results for Section 6 (the 'Frag Tip') are summarised in Table 4-7.

Table 4-5 Chemical Testing Results (soils) for Sections 1-5

Chemical Determinant	Unit	Locations	Recorded Value Range
Acenaphthene	mg/kg	A3b, WS1, WS4, WS8, WS9	0.26 – 0.92
Acenaphthylene	mg/kg	A7, WS1, WS4, WS8, WS9	0.12 – 0.37
Anthracene	mg/kg	A7, B3, B9, B11, WS1, WS3, WS4, WS8, WS9	0.16 – 0.71
Arsenic	mg/kg	All tested samples	6.70 – 27.0
Benzo (g,h,i) perylene	mg/kg	A7, B9, B11, WS1, WS4, WS8, WS9	0.30 – 2.40
Benzo(a)anthracene	mg/kg	A7, B3, B9, B11, WS1, WS3, WS4, WS8, WS9	0.49 – 2.10
Benzo(a)pyrene	mg/kg	A7, B9, WS1, WS4, WS8, WS9	0.57 – 2.30
Benzo(b)fluoranthene	mg/kg	A7, B9, B11, WS1, WS4, WS8, WS9	0.85 – 2.40
Benzo(k)fluoranthene	mg/kg	A7, B9, B11, WS1, WS4, WS8, WS9	0.39 – 1.30
Boron	mg/kg	All tested samples	1.40 – 58.0
Cadmium	mg/kg	All tested samples	0.13 – 5.10
Chromium	mg/kg	All tested samples	21.0 – 1100
Chrysene	mg/kg	A7, B3, B9, B11, WS1, WS3, WS4, WS8, WS9	0.54 – 2.30
Copper	mg/kg	All tested samples	12.0 – 1400
Cyanide	mg/kg	WS8	0.00 – 1.7
Dibenz[A,H]anthracene	mg/kg	A7, B11, WS1, WS4, WS8, WS9	0.29 – 1.70
Fluoranthene	mg/kg	A3b, A7, B3, B9, B11, WS1, WS3, WS4, WS8, WS9	0.82 – 3.10
Fluorene	mg/kg	A7, WS1, WS4, WS8, WS9	0.28 – 1.30
Indeno(1,2,3-cd)pyrene	mg/kg	A7, B9, B11, WS1, WS4, WS8, WS9	0.29 – 2.30
Lead	mg/kg	All tested samples	25.0 – 210
Mercury	mg/kg	A3b, A7, B3, B11, WS1, WS3, WS4, WS5, WS7, WS8, WS9, WS11	0.11 – 1.20
Naphthalene	mg/kg	A7, WS1, WS4, WS8, WS9	0.32 – 3.10
Nickel	mg/kg	All tested samples	23.0 – 43.0
Organic matter	%	All tested samples	1.30 – 17
Pah,Total	mg/kg	A7, B3, B9, B11, WS1, WS3, WS4, WS8, WS9	3.6 – 26.0
pH	-	All tested samples	7.80 – 11.4
Phenanthrene	mg/kg	A7, B3, B9, B11, WS1, WS3, WS4, WS8, WS9	0.54 – 3.10
Phenols	mg/kg	None	0.00
Pyrene	mg/kg	A3b, A7, B3, B9, B11, WS1, WS3, WS4, WS8, WS9	0.30 – 2.60
Sulphate as SO4	g/l	A3b A7, B2, B9, B11, WS3	0.01 – 0.92
TPH >C6-40	mg/kg	A7, B3, B9, WS1, WS4	34 – 270
Zinc	mg/kg	All tested samples	86 – 550

Table 4-6 Chemical Testing Results (water) for Sections 1-5

Chemical Determinant	Unit	Locations	Min Value	Max Value
Ammoniacal Nitrogen as N	mg/l	B2, B3, B4, B10	380	1400
Ammonium	mg/l	B2, B3, B4, B10	0.12	4.80
Arsenic	ug/l	B2, B3, B4, B10	5.00	32.0
Biochemical oxygen demand	mg O2/l	B2, B3, B4, B10	1.00	1.00
Boron	ug/l	B2, B4, B10	1400	1800
Cadmium	ug/l	B2, B3, B4, B10	0.10	0.52
Calcium	mg/l	B2, B3, B4, B10	99.0	480
Chloride	mg/l	B2, B3, B4, B10	2500	9500
Chromium	ug/l	B2, B3, B4, B10	33.0	91.0
Chromium - Hexavalent	ug/l	B2, B3, B4, B10	1.20	4.90
Conductivity- Electrical 20deg	uS/cm	B2, B3, B4, B10	8600	22000
Copper	ug/l	B2, B3, B4, B10	17.0	83.0
Dissolved Organic Carbon.	mg/l	B2, B3, B4, B10	4.60	14.0
Fluoride	mg/l	B2, B3, B4, B10	0.16	0.51
Hardness, Total as CaCO3	mg/l	B2, B3, B4, B10	660	3500
Iron	ug/l	B2, B3, B4, B10	170	1600
Kjeldahl Nitrogen	mg/l	B2, B3, B4, B10	5.80	10.0
Lead	ug/l	B10	4.50	
Magnesium	mg/l	B2, B3, B4, B10	100	590
Manganese	ug/l	B2, B3, B4, B10	81.0	4000
Mercury	ug/l	B2, B10	2.50	3.40
Nickel	ug/l	B2, B3, B4, B10	1.80	14.0
Nitrate as N	mg/l	B3	0.72	
Nitrate as NO3	mg/l	B2, B3	0.59	3.20
Nitrite as NO2	mg/l	B2, B3, B4	0.92	5.80
Nitrogen	mg/l	B2, B3, B4	5.90	10.0
O-Xylene	ug/l	B10	1.00	
pH	-	B2, B3, B4, B10	8.10	8.50
Phosphates	mg/l	B2, B3, B4, B10	0.21	3.60
Phosphorus as P	mg/l	B2, B3, B4, B10	0.07	1.20
Potassium	mg/l	B2, B3, B4, B10	51.0	170
Selenium	ug/l	B2, B3, B4, B10	33.0	48.0
Sodium	mg/l	B2, B3, B4, B10	1700	4800
Solids, Suspended	mg/l	B2, B3, B4, B10	390	1000
Sulphate as SO4	mg/l	B2, B3, B4, B10	440	1200
Zinc	ug/l	B2, B3, B4, B10	36.0	62.0

Table 4-7 Groundwater testing results for Section 6 (the 'Frag Tip')

Chemical Determinant	Unit	Locations	Min Value	Max Value
2-Methylnaphthalene	ug/l	D5c	22.0	
Acenaphthylene	ug/l	D5c	9.70	
Alkalinity	mg/l	All tested locations	60.0	200
Ammoniacal Nitrogen as N	mg/l	All tested locations	0.93	4.80
Ammonium	mg/l	All tested locations	0.53	5.6
Anthracene	ug/l	D5c	2.40	
Arsenic	ug/l	All tested locations	2.40	9.70
Benzo (g,h,i) perylene	ug/l	D5c	0.91	
Benzo(a)anthracene	ug/l	D5c	4.9	
Benzo(a)pyrene	ug/l	D5c	3.2	
Benzo(b)fluoranthene	ug/l	D5c	5.7	
Benzo(k)fluoranthene	ug/l	D5c	1.6	
Biochemical oxygen demand	mgO ₂ /l	D1a, D1b, D2a, D5c, D6a	1.00	9.00
Boron	ug/l	All tested locations	480	8600
Cadmium	ug/l	All tested locations	0.12	0.39
Calcium	mg/l	All tested locations	100	470
Carbazole	ug/l	D5c	1.80	
Chloride	mg/l	All tested locations	140	1500
Chromium - Hexavalent	ug/l	D1a, D4a, D5a, D5c	0.22	0.58
Chrysene	ug/l	D5c	7.80	
Conductivity- Electrical 20deg	uS/cm	All tested locations	1500	5400
Copper	ug/l	All tested locations	1.10	8.20
Dibenzofuran	ug/l	D5c	6.60	
Dissolved Organic Carbon.	mg/l	All tested locations	5.90	43.0
Fluoranthene	ug/l	D5c	15.0	
Fluorene	ug/l	D5c	4.10	
Fluoride	mg/l	All tested locations	0.11	1.40
Hardness, Total as CaCO ₃	mg/l	All tested locations	340	1200
Indeno(1,2,3-cd)pyrene	ug/l	D5c	1.00	
Iron	ug/l	All tested locations	430	1300
Kjedhal Nitrogen	mg/l	D4A, D5A, D5C, D6AC, D1B, D2A3	5.10	13.0
Lead	ug/l	D1b, D2a, D5c	2.50	5.60
Magnesium	mg/l	D1a, D1b, D2a, D5a, D5c	0.62	38.0
Manganese	ug/l	All tested locations	3.90	210
Mercury	ug/l	All tested locations	3.70	36.0
Naphthalene	ug/l	D5c	22.0	
Nickel	ug/l	All tested locations	1.10	18.0
Nitrate as N	mg/l	D4a, D5a	0.70	1.70
Nitrate as NO ₃	mg/l	D4a, D5a	3.10	7.50
Nitrite as NO ₂	mg/l	D1a, D4a, D6a	0.03	0.04
Nitrogen	mg/l	All tested locations	5.10	13.0
Nitrogen total organic as N	mg/l	D4a, D5a	0.70	1.70
pH	-	All tested locations	8.30	10.1
Phenanthrene	ug/l	D5c	15	
Phosphates	mg/l	All tested locations	0.07	0.36
Phosphorus as P	mg/l	All tested locations	0.10	0.12
Potassium	mg/l	All tested locations	21.0	310
Pyrene	ug/l	D5c	8.30	

Table 4-7 continued

Chemical Determinant	Unit	Locations	Min Value	Max value
Selenium	ug/l	All tested locations	7.00	96.0
Sodium	mg/l	All tested locations	140	530
Solids, Suspended	mg/l	All tested locations	520	25000
Sulphate as SO ₄	mg/l	All tested locations	460	740
Zinc	ug/l	All tested locations	21.0	68.0

5 Risk Assessment

5.1 Introduction

A qualitative contaminated land risk assessment has been undertaken in accordance with current UK guidelines, based on a source-pathway-receptor methodology, which is described in Appendix C. This section summarises the findings for each component of this analysis, which then culminates in the development of a conceptual site model.

This model is then used to develop a risk rating for any given potential contamination source that has been identified.

5.2 Identified Sources

The following potential sources of contamination were identified in the desk study report (2017) and confirmed during the GI:

- Areas of fill materials - including landfills and waste management areas;
- Waste water treatment and sewage works, and associated sewerage network;
- Various historical and current industrial and commercial sites (including associated railway networks, airport and fuel sites).

5.3 Pathways and Receptors

Potential receptors and possible pathways for contaminants to reach these receptors are summarised below:

- Current and future site users, construction workers [direct contact, inhalation, accidental ingestion, migration of fugitive gases onto site];
- Groundwater (Secondary B aquifer) [migration via permeable strata];
- Surface water (Rhymney River, Seven Estuary, Roath Brook) [overland flow, migration via drainage, groundwater baseflow]; and,
- Ecologically sensitive sites (Gwent Levels - Rumney and Peterstone) [overland flow, migration via permeable strata].

5.4 Outline Conceptual Site Model

The main considerations of the conceptual model are as follows:

- The scheme does not change the site usage, remaining public open space/ a motorcross area. Although the site will be assessed in respect to public open space users, the presence of frequent human receptors on site is unlikely and therefore the main human health receptors to consider are construction workers.
- Extensive Made Ground and waste associated with the Frag Tip in Section 6 which may result in leachate release to the estuary. However, the scheme in this area consists of rock armour including installation of a geotextile with limited excavation at the crest which will be replaced with embankment fill/topsoil. Therefore, no pathways are introduced in this area by the proposed scheme, but excavated material will need to be adequately managed, or disposed of off-site.
- Sheet piling at the head and toe of the slope with scour protection is anticipated for the scheme along Rover Way and Lamby Way. Although landfills are not present in these areas, potentially contaminated material associated with the historical industrial works may be present and Made Ground deposits have been

identified during ground investigation works. Therefore, risks associated with piling should be considered. Excess material in these areas may be reused on site, or disposed off site subject to its suitability as a fill material.

5.5 Risk Assessment- Human Health

5.5.1 Introduction

Generic 'Tier 1' risk assessment involves comparison of the concentrations of potential contaminants to Generic Assessment Criteria (GAC) that are risk based and designed to protect the most sensitive receptors. This phase of human health quantitative risk assessment is designed to identify potentially significant pollutant linkages that warrant further detailed investigation.

Generic assessment criteria are largely based on generic assumptions about the characteristics and behaviour of sources, pathways and receptors. They are derived for a set of standard assumptions relating to land-use, receptor behaviour, site, building and soil characteristics and do not take into account the particular circumstances affecting a site. These assumptions are usually conservative for a defined range of conditions.

For the assessment of soils, the Land Quality Management's (LQM) Suitable for Use Levels (S4ULs) have been used for a Public Open Space (parks) scenario (Nathanial et al, 2015). These are screening values developed for various end use types for a suite of potential contaminants.

A 'Tier 1' risk assessment has been undertaken for the site for those contaminants where generic risk assessment criteria exist.

5.5.2 Results of Tier 1 Assessment

Results from the soil chemical analysis from the investigations have been summarised and any exceedances of the relevant assessment criteria are highlighted below in **Error! Reference source not found. 5-1**. The full set of laboratory data is presented in Appendix **Error! Reference source not found.**

Table 5-1: Human Health C4SL Exceedances

Determinand	Min Value (mg/kg)	Max Value (mg/kg)	GAC (mg/kg)	No. of samples exceeding GAC
Chromium	4.6	1,100	220	2 (WS5 at 0.2m and WS9 at 0.2m)

The only exceedance was for Chromium in two samples from Section 1; WS5 and WS9 both from 0.2m bgl. This however is utilising the more conservative GAC for chromium VI of 220 mg/kg whereas it is most likely to be representative of the less toxic chromium III with a GAC of 33,000 mg/kg.

With the exception of chromium, the Tier 1 screening level assessment indicates that there are no exceedances of soil S4ULs for a public open space site end use. At all sampling locations, the concentration of potential contaminants of concern were several orders of magnitude below the screening levels.

No asbestos containing material was noted during the GI or included in soil samples, however due to the landfills on site, the presence of asbestos in Made Ground deposits in these areas can not be ruled out.

5.5.3 Gas Analysis

Generally, low concentrations of gas were noted during the three monitoring rounds with the exception of a single high concentration of methane (7.5%) in D3a and of carbon monoxide (9ppm) in D1b, both in Section 6. Gas flow rates were also very low suggesting limited potential for active gas generation in soils along the proposed line of the coastal defences. However, the likelihood of gas generation on site based on the presence of a landfill and the occasional high concentrations is high and some form of mitigation including monitoring will be required during construction, particularly for any groundworks involving excavation of Made Ground deposits.

5.6 Risk Assessment- Controlled Waters

5.6.1 Introduction

The risk to controlled waters is assessed in accordance with the recommendations within the Environment Agency 'Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination'. This guidance outlines the framework for the evaluation of pollution risk to controlled waters in the UK, advocating a tiered approach with increasing level of complexity.

'Tier 1' comprises comparison of contaminant concentrations in either soil pore water or groundwater against appropriate guideline values. Groundwater chemical analysis has been screened against the Environment Agency's (EA) Environmental Quality Standards (EQS) for marine waters.

Table 5-2: Controlled Waters EQS Exceedances

Determinand	Min Value (µg/l)	Max Value (mg/kg)	EQS (µg/l)	No. of samples exceeding EQS
pH	7.9	10.1	6 – 8.5	5 (D4A, D5A, D5C, D6A.3, D1A.5)
Boron	86	8,600	7,000	1 (D2A.3)
Chromium	<1.0	91	32	4 (B10, B3, B2, B4)
Copper	1.1	83	17.9	3 (B3, B2, B4)
Iron	170	1,600	1,000	3 (D5A, D5C, B2)
Zinc	21	68	10.9	12 (all)
Anthracene	<0.5	2.4	0.1	1 (D5A)
Fluoranthene	<0.5	15	0.12	1 (D5A)
Benzo[b]fluoranthene	<0.5	5.7	0.017	1 (D5A)
Benzo[k]fluoranthene	<0.5	1.6	0.017	1 (D5A)
Benzo[a]pyrene	<0.5	3.2	0.027	1 (D5A)
Benzo[g,h,i]perylene	<0.5	0.91	0.00082	1 (D5A)

Table 5-2 above highlights a number of exceedances of EQS values for marine and coastal waters. In summary, the following observations can be made:

- Alkali pH in samples from the Frag Tip.
- Elevated concentrations of metal and metalloid contaminants in some samples.
- Elevated concentrations of PAHs in D5A only.

The presence of elevated pH, PAHs and metals detected within groundwater samples recovered from the Made Ground in monitoring locations installed on the

Frag Tip is indicative of landfill leachate although elevated concentrations of a range of potential contaminants are not widespread.

Elevated metals were also noted in groundwater samples collected from Sections 4 and 5, likely associated with the industry in this area.

5.7 Refined Conceptual Site Model

A tabulated summary of the risk assessment process can be seen in Table 5-3 based on the current design proposals. This describes the sources, pathways and receptors derived from the baseline desk study and refined by the ground investigation data.

Table 5-3: Conceptual Site Model

Source	Pathway	Receptor	Risk	Comment
Made Ground associated with the Frag Tip	Direct contact, inhalation, accidental ingestion	Human Health: site users	Low	(Severity: Medium, Likelihood: Unlikely) This area of the is utilised as a motocross track which may generate dust, over a topsoil/fill capping over excavated areas reduces the likelihood of this pathway occurring.
		Human Health: construction workers	Low	(Severity: Medium, Likelihood: Unlikely) Although construction workers have the possibility of coming into direct contact with contaminated site soils, the risk is assumed to be managed through appropriate health and safety and environmental controls.
	Ground gas migration to the surface	Human Health: site users	Low	(Severity: Medium, Likelihood: Unlikely) While there were occasional high concentrations of methane and carbon monoxide recorded in the Frag Tip, ground gas will dilute and disperse outdoors and due to the low frequency of visitors the risk is considered to be low.
		Human Health: construction workers	Low	(Severity: Medium, Likelihood: Unlikely) Construction workers should be made aware of the risk associated with the accumulation of ground gas in low lying excavated areas. However as above, the risk is assumed to be managed through appropriate health and safety and environmental controls.
	Migration via permeable strata	Controlled Waters: Groundwater (Secondary B Aquifer)	Low	(Severity: Medium, Likelihood: Unlikely) Groundwater/leachate was noted within the Made Ground, assumed to be in continuity with the underlying Secondary B Aquifers. However, the scheme does not create any potential pathways and the topsoil/fill capping will reduce infiltration
	Overland flow, migration via drainage, baseflow	Surface waters (Rhymney River, Seven Estuary and Roath Brook)	Low	(Severity: Medium, Likelihood: Unlikely) Due to the added presence of the rock armour with geotextile membrane, direct contact of the landfill materials with the surface waters is reduced.
Made Ground associated with current and historic industrial in Sections 1 to 5	Direct contact, inhalation, accidental ingestion	Human Health: site users	Low	(Severity: Medium, Likelihood: Unlikely) The site areas are used as public open space and therefore visitors are not thought to come into direct contact with the site soils.
		Human Health: construction workers	Low	(Severity: Medium, Likelihood: Unlikely) Although construction workers have the possibility of coming into direct contact with contaminated site soils, the risk is assumed to be managed through appropriate health and safety and environmental controls.
	Ground gas migration to the surface	Human Health: site users	Low	(Severity: Medium, Likelihood: Unlikely) Ground gases were not noted at elevated concentrations in these areas. Also, ground gas will dilute and disperse outdoors and due to the low frequency of visitors the risk is considered to be low.
		Human Health: construction workers	Low	(Severity: Medium, Likelihood: Unlikely) As above, the risk is assumed to be managed through appropriate health and safety and environmental controls.

	Migration via permeable strata	Controlled Waters: Groundwater (Secondary B Aquifer)	Moderate	(Severity: Medium, Likelihood: Low likelihood) Elevated metals were noted in shallow groundwater in Section 4 and 5. The proposed sheet piling in this area creates a potential pathway to deeper groundwater in the bedrock aquifer. This should be addressed through a piling works risk assessment.
		Surface waters (Rhymney River, Seven Estuary and Roath Brook)	Moderate	(Severity: Medium, Likelihood: Low likelihood) As above, the groundwater is in continuity with adjacent surface waters.
	Overland flow, migration via drainage, baseflow	Surface waters (Rhymney River, Seven Estuary and Roath Brook)	Low	(Severity: Medium, Likelihood: Unlikely) The creation of the shoring with geotextile prevents the direct pathway to surface waters.

6 Conclusions

6.1 Summary

The general ground model comprises Made Ground, Tidal Flat Deposits, Glaciofluvial deposits and bedrock with little variation other than in the Frag Tip area (Section 6) with a considerable depth of Made Ground associated with historic deposition of mixed waste materials.

Following a Tier 1 generic risk assessment of the site soils and groundwater, the risks to human health associated with the proposed works are considered to be low and the risks to controlled waters are also low assuming appropriate risk controls and mitigation are put into place.

In Section 6, the rock revetment will limit the potential for future physical erosion of material from the base of the Frag Tip. Also, with the exception of excavation of materials at the crest of the tip no works involving re-profiling or re-engineering of the tip are planned and therefore no specific mitigation measures considered necessary. Where sheet piling is proposed along Rover Way and Lamby Way, a piling works risk assessment is recommended.

6.2 Recommendations

6.2.1 Piling Works Risk Assessment

Once sheet piles are designed, a piling works risk assessment should be carried out due to the presence of contaminated groundwater in this area. The assessment should consider the risk of creation of potential migration pathways where Made Ground deposits are present along the route of the defences and identify any necessary mitigation measures.

6.2.2 Waste/Re-Use of Site Won Material

Under current proposals, excavated materials (predominantly Made Ground) may be re-used as backfill under a CL:AIRE CoP Materials Management Plan. This Materials Management Plan will set out the estimated cut and fill volumes and specify details of the re-use criteria based on this Phase II Risk Assessment.

It is recommended that trial pitting and chemical testing is undertaken in advance of the main excavation works to ensure that excavated material is suitable for re-use on site and remains compliant with the re-use criteria set out in the Material Management Plan (Materials which are brought on to site should also be subject to chemical testing to confirm their suitability for use against any defined specifications.).

WAC testing is likely to be required for any materials that do not meet the re-use criteria. These materials will be removed from the site and disposed of at a suitably licenced waste facility. In addition, prior to the disposal of any excavated material, the waste will need to be classified as either hazardous or non-hazardous according to the WM3 waste classification guidelines.

6.2.3 Health and Safety

Suitable precautions are recommended for undertaking site works particularly in relation to minimising production of dust and external exposure. Earthworks should be carried out in such a way to minimise dust generation and contaminated run off water.

Asbestos Containing Materials cannot be ruled out in Made Ground and therefore measures for dealing with any such materials that may be encountered during groundworks should be established ahead of construction works.

6.2.4 Environmental Management

An Environmental Management Plan, or Construction Environmental Action Plan for the works should also be developed including a watching brief during excavation and construction works to deal with contamination that may be encountered on a "live" basis during groundworks. The plan should contain a methodology for dealing with potentially contaminated soils and groundwater that may be encountered during construction and should also include the adoption of suitable health and safety precautions for construction workers and measures to control and prevent the spread of contaminated materials, or impact upon the estuary (e.g. through migration of contaminated silt laden run-off or release of landfill materials). The plan should include arrangements for disposal and / or temporary secure storage material from excavations within dry enclosures and within impermeable bunded stockpiles.

It is recommended that groundwater samples are collected during and following construction works from the existing monitoring network to compare with baseline data. Following the post-construction monitoring round, the monitoring wells should be decommissioned in line with best practise.

Appendices

A Laboratory Certificates



Final Report

Report No.: 20-07089-1

Initial Date of Issue: 12-Mar-2020

Client Quantum Geotechnic Ltd

Client Address: Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contact(s): Lee Simlett

Project Q0188 Cardiff Coastal Defence GI

Quotation No.: Q19-19105 **Date Received:** 05-Mar-2020

Order No.: **Date Instructed:** 05-Mar-2020

No. of Samples: 2

Turnaround (Wkdays): 5 **Results Due:** 11-Mar-2020

Date Approved: 12-Mar-2020

Approved By: 

Details: Darrell Hall, Director

Results - Soil

Client: Quantum Geotechnic Ltd		Chemtest Job No.:		20-07089	20-07089
Quotation No.: Q19-19105		Chemtest Sample ID.:		980848	980857
Order No.:		Client Sample Ref.:		ES2	ES3
		Sample Location:		A7	A3b
		Sample Type:		SOIL	SOIL
		Top Depth (m):		0.50	1.00
		Date Sampled:		02-Mar-2020	03-Mar-2020
		Asbestos Lab:		DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD	
ACM Type	U	2192	%	N/A	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected
ACM Detection Stage	U	2192	%	N/A	-
Moisture	N	2030	%	0.020	9.7
pH	U	2010		4.0	9.5
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.92
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50
Arsenic	U	2450	mg/kg	1.0	17
Boron	N	2450	mg/kg	0.40	28
Cadmium	U	2450	mg/kg	0.10	1.3
Chromium	U	2450	mg/kg	1.0	57
Copper	U	2450	mg/kg	0.50	54
Mercury	U	2450	mg/kg	0.10	0.21
Nickel	U	2450	mg/kg	0.50	23
Lead	U	2450	mg/kg	0.50	110
Zinc	U	2450	mg/kg	0.50	240
Organic Matter	U	2625	%	0.40	8.5
Total TPH >C6-C40	U	2670	mg/kg	10	140
Naphthalene	U	2700	mg/kg	0.10	0.39
Acenaphthylene	U	2700	mg/kg	0.10	0.15
Acenaphthene	U	2700	mg/kg	0.10	0.48
Fluorene	U	2700	mg/kg	0.10	0.44
Phenanthrene	U	2700	mg/kg	0.10	2.2
Anthracene	U	2700	mg/kg	0.10	0.58
Fluoranthene	U	2700	mg/kg	0.10	2.9
Pyrene	U	2700	mg/kg	0.10	2.4
Benzo[a]anthracene	U	2700	mg/kg	0.10	1.6
Chrysene	U	2700	mg/kg	0.10	2.3
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	2.2
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	0.85
Benzo[a]pyrene	U	2700	mg/kg	0.10	1.4
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	0.95
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	0.62
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	1.3
Total Of 16 PAH's	U	2700	mg/kg	2.0	21
Total Phenols	U	2920	mg/kg	0.30	< 0.30

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
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.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and Trimethylphenols. Note: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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"

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 45 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



Final Report

Report No.: 20-07501-1

Initial Date of Issue: 13-Mar-2020

Client Quantum Geotechnic Ltd

Client Address: Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contact(s): Lee Simlett

Project Q0188 Cardiff Coastal Defence GI

Quotation No.: Q19-19105 **Date Received:** 09-Mar-2020

Order No.: **Date Instructed:** 09-Mar-2020

No. of Samples: 1

Turnaround (Wkdays): 5 **Results Due:** 13-Mar-2020

Date Approved: 13-Mar-2020

Approved By: 

Details: Darrell Hall, Director

Results - Soil

Client: Quantum Geotechnic Ltd		Chemtest Job No.:		20-07501
Quotation No.: Q19-19105		Chemtest Sample ID.:		982604
		Client Sample ID.:		ES1
		Sample Location:		BH11
		Sample Type:		SOIL
		Top Depth (m):		0.50
		Date Sampled:		02-Mar-2020
		Asbestos Lab:		COVENTRY
Determinand	Accred.	SOP	Units	LOD
ACM Type	U	2192	%	N/A
Asbestos Identification	U	2192	%	0.001
ACM Detection Stage	U	2192	%	N/A
Moisture	N	2030	%	0.020
pH	U	2010		4.0
Sulphate (2:1 Water Soluble) as SO ₄	U	2120	g/l	0.010
Cyanide (Total)	U	2300	mg/kg	0.50
Arsenic	U	2450	mg/kg	1.0
Boron	N	2450	mg/kg	0.40
Cadmium	U	2450	mg/kg	0.10
Chromium	U	2450	mg/kg	1.0
Copper	U	2450	mg/kg	0.50
Mercury	U	2450	mg/kg	0.10
Nickel	U	2450	mg/kg	0.50
Lead	U	2450	mg/kg	0.50
Zinc	U	2450	mg/kg	0.50
Organic Matter	U	2625	%	0.40
Total TPH >C6-C40	U	2670	mg/kg	10
Naphthalene	U	2700	mg/kg	0.10
Acenaphthylene	U	2700	mg/kg	0.10
Acenaphthene	U	2700	mg/kg	0.10
Fluorene	U	2700	mg/kg	0.10
Phenanthrene	U	2700	mg/kg	0.10
Anthracene	U	2700	mg/kg	0.10
Fluoranthene	U	2700	mg/kg	0.10
Pyrene	U	2700	mg/kg	0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10
Chrysene	U	2700	mg/kg	0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0
Total Phenols	U	2920	mg/kg	0.30

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
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.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and Trimethylphenols. Note: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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"

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 45 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



Final Report

Report No.: 20-08431-1

Initial Date of Issue: 07-Apr-2020

Client Quantum Geotechnic Ltd

Client Address: Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contact(s): Lee Simlett

Project Q0188 Cardiff Coastal Defence

Quotation No.: **Date Received:** 17-Mar-2020

Order No.: **Date Instructed:** 31-Mar-2020

No. of Samples: 2

Turnaround (Wkdays): 5 **Results Due:** 06-Apr-2020

Date Approved: 07-Apr-2020

Approved By:


Details: Glynn Harvey, Technical Manager

Client: Quantum Geotechnic Ltd		Chemtest Job No.:		20-08431	20-08431
Quotation No.:		Chemtest Sample ID.:		987034	987036
Order No.:		Client Sample Ref.:		ES1	ES4
		Sample Location:		B2	A3B
		Sample Type:		SOIL	SOIL
		Top Depth (m):		0.20	3.50
		Date Sampled:		11-Mar-2020	16-Mar-2020
		Asbestos Lab:		COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD	
ACM Type	U	2192	%	N/A	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected
ACM Detection Stage	U	2192	%	N/A	-
Moisture	N	2030	%	0.020	27 30
pH	U	2010		4.0	8.5 8.4
Sulphate (2:1 Water Soluble) as SO ₄	U	2120	g/l	0.010	0.010 0.17
Cyanide (Total)	U	2300	mg/kg	0.50	[B] < 0.50 [B] < 0.50
Arsenic	U	2450	mg/kg	1.0	14 22
Boron	N	2450	mg/kg	0.40	29 32
Cadmium	U	2450	mg/kg	0.10	0.13 < 0.10
Chromium	U	2450	mg/kg	1.0	34 34
Copper	U	2450	mg/kg	0.50	14 12
Mercury	U	2450	mg/kg	0.10	< 0.10 < 0.10
Nickel	U	2450	mg/kg	0.50	40 40
Lead	U	2450	mg/kg	0.50	27 23
Zinc	U	2450	mg/kg	0.50	95 87
Organic Matter	U	2625	%	0.40	1.3 1.3
Total TPH >C6-C40	U	2670	mg/kg	10	[B] < 10 [B] < 10
Naphthalene	U	2700	mg/kg	0.10	< 0.10 < 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10 < 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10 < 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10 < 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10 < 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10 < 0.10
Fluoranthene	U	2700	mg/kg	0.10	< 0.10 < 0.10
Pyrene	U	2700	mg/kg	0.10	< 0.10 < 0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10 < 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10 < 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10 < 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10 < 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10 < 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10 < 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10 < 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10 < 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0 < 2.0
Total Phenols	U	2920	mg/kg	0.30	< 0.30 < 0.30

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request. The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
987034	ES1		B2	11-Mar-2020	B	Amber Glass 250ml
987034	ES1		B2	11-Mar-2020	B	Amber Glass 60ml
987034	ES1		B2	11-Mar-2020	B	Plastic Tub 500g
987036	ES4		A3B	16-Mar-2020	B	Amber Glass 250ml
987036	ES4		A3B	16-Mar-2020	B	Amber Glass 60ml
987036	ES4		A3B	16-Mar-2020	B	Plastic Tub 500g

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
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.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and Trimethylphenols. Note: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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"

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 45 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



Final Report

Report No.: 20-09227-1

Initial Date of Issue: 07-Apr-2020

Client Quantum Geotechnic Ltd

Client Address: Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contact(s): Lee Simlett

Project Q0188 Cardiff Coastal Defence

Quotation No.: Q19-19105

Order No.:

No. of Samples: 2

Turnaround (Wkdays): 5

Date Approved: 07-Apr-2020

Approved By: 

Details: Glynn Harvey, Technical Manager

Date Received: 23-Mar-2020

Date Instructed: 31-Mar-2020

Results Due: 06-Apr-2020

Results - Soil

Client: Quantum Geotechnic Ltd		Chemtest Job No.:			20-09227	20-09227
Quotation No.: Q19-19105		Chemtest Sample ID.:			990880	990882
		Client Sample ID.:			ES2	ES4
		Sample Location:			B9	B9
		Sample Type:			SOIL	SOIL
		Top Depth (m):			0.50	3.00
		Date Sampled:			17-Mar-2020	17-Mar-2020
		Asbestos Lab:			COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD		
ACM Type	U	2192		N/A		
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-
Moisture	N	2030	%	0.020	16	28
pH	U	2010		4.0	8.6	7.8
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	0.14
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	< 0.50
Arsenic	U	2450	mg/kg	1.0	6.7	16
Boron	N	2450	mg/kg	0.40	4.6	27
Cadmium	U	2450	mg/kg	0.10	1.4	0.18
Chromium	U	2450	mg/kg	1.0	21	37
Copper	U	2450	mg/kg	0.50	1400	200
Mercury	U	2450	mg/kg	0.10	< 0.10	< 0.10
Nickel	U	2450	mg/kg	0.50	33	40
Lead	U	2450	mg/kg	0.50	640	72
Zinc	U	2450	mg/kg	0.50	550	120
Organic Matter	U	2625	%	0.40	1.4	2.2
Total TPH >C6-C40	U	2670	mg/kg	10	34	< 10
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	0.90
Anthracene	U	2700	mg/kg	0.10	< 0.10	0.30
Fluoranthene	U	2700	mg/kg	0.10	< 0.10	1.5
Pyrene	U	2700	mg/kg	0.10	< 0.10	1.3
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10	0.68
Chrysene	U	2700	mg/kg	0.10	< 0.10	1.1
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	0.85
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	0.39
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	0.57
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10	0.29
Dibenz[a,h]Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10	0.30
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0	8.2
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
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.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and Trimethylphenols. Note: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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"

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 45 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



Final Report

Report No.: 20-09401-1

Initial Date of Issue: 07-Apr-2020

Client Quantum Geotechnic Ltd

Client Address: Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contact(s): Lee Simlett

Project Q0188 - Cardiff Coastal Defence GI

Quotation No.: Q19-18264

Order No.:

No. of Samples: 2

Turnaround (Wkdays): 5

Date Approved: 07-Apr-2020

Approved By: 

Details: Glynn Harvey, Technical Manager

Date Received: 25-Mar-2020

Date Instructed: 01-Apr-2020

Results Due: 07-Apr-2020

Results - Soil

Client: Quantum Geotechnic Ltd		Chemtest Job No.:		20-09401	20-09401
Quotation No.: Q19-18264		Chemtest Sample ID.:		991864	991866
Order No.:		Client Sample Ref.:		ES1	ES1
		Sample Location:		B3	WS3
		Sample Type:		SOIL	SOIL
		Top Depth (m):		0.5	0.3
		Date Sampled:		21-Mar-2020	23-Mar-2020
		Asbestos Lab:		LIVERPOOL	LIVERPOOL
Determinand	Accred.	SOP	Units	LOD	
ACM Type	U	2192	%	N/A	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected
ACM Detection Stage	U	2192	%	N/A	-
Moisture	N	2030	%	0.020	14
pH	U	2010		4.0	7.9
Sulphate (2:1 Water Soluble) as SO ₄	U	2120	g/l	0.010	< 0.010
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50
Arsenic	U	2450	mg/kg	1.0	13
Boron	N	2450	mg/kg	0.40	1.4
Cadmium	U	2450	mg/kg	0.10	0.50
Chromium	U	2450	mg/kg	1.0	39
Copper	U	2450	mg/kg	0.50	34
Mercury	U	2450	mg/kg	0.10	0.14
Nickel	U	2450	mg/kg	0.50	34
Lead	U	2450	mg/kg	0.50	80
Zinc	U	2450	mg/kg	0.50	130
Organic Matter	U	2625	%	0.40	3.5
Total TPH >C6-C40	U	2670	mg/kg	10	60
Naphthalene	U	2700	mg/kg	0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	0.54
Anthracene	U	2700	mg/kg	0.10	0.16
Fluoranthene	U	2700	mg/kg	0.10	0.82
Pyrene	U	2700	mg/kg	0.10	0.92
Benzo[a]anthracene	U	2700	mg/kg	0.10	0.49
Chrysene	U	2700	mg/kg	0.10	0.66
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	3.6
Total Phenols	U	2920	mg/kg	0.30	< 0.30

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
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.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and Trimethylphenols. Note: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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"

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 45 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



Final Report

Report No.: 20-09720-1

Initial Date of Issue: 08-Apr-2020

Client Quantum Geotechnic Ltd

Client Address: Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contact(s): Lee Simlett

Project Q0188 Cardiff Coastal Defence GI

Quotation No.: Q19-18264 **Date Received:** 30-Mar-2020

Order No.: **Date Instructed:** 01-Apr-2020

No. of Samples: 1

Turnaround (Wkdays): 5 **Results Due:** 07-Apr-2020

Date Approved: 08-Apr-2020

Approved By: 

Details: Glynn Harvey, Technical Manager

Results - Soil

Client: Quantum Geotechnic Ltd	Chemtest Job No.:				20-09720
Quotation No.: Q19-18264	Chemtest Sample ID.:				993699
Order No.:	Client Sample Ref.:				ES
	Client Sample ID.:				ES2
	Sample Location:				A1
	Sample Type:				SOIL
	Top Depth (m):				0.50
	Date Sampled:				26-Mar-2020
	Asbestos Lab:				COVENTRY
Determinand	Accred.	SOP	Units	LOD	
ACM Type	U	2192		N/A	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-
Moisture	N	2030	%	0.020	34
pH	U	2010		4.0	8.2
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.19
Cyanide (Total)	U	2300	mg/kg	0.50	2.4
Arsenic	U	2450	mg/kg	1.0	33
Boron	N	2450	mg/kg	0.40	20
Cadmium	U	2450	mg/kg	0.10	3.4
Chromium	U	2450	mg/kg	1.0	48
Copper	U	2450	mg/kg	0.50	57
Mercury	U	2450	mg/kg	0.10	0.84
Nickel	U	2450	mg/kg	0.50	58
Lead	U	2450	mg/kg	0.50	190
Zinc	U	2450	mg/kg	0.50	510
Organic Matter	U	2625	%	0.40	12
Total TPH >C6-C40	U	2670	mg/kg	10	74
Naphthalene	U	2700	mg/kg	0.10	1.5
Acenaphthylene	U	2700	mg/kg	0.10	0.60
Acenaphthene	U	2700	mg/kg	0.10	1.1
Fluorene	U	2700	mg/kg	0.10	0.97
Phenanthrene	U	2700	mg/kg	0.10	2.7
Anthracene	U	2700	mg/kg	0.10	0.94
Fluoranthene	U	2700	mg/kg	0.10	3.3
Pyrene	U	2700	mg/kg	0.10	2.8
Benz[a]anthracene	U	2700	mg/kg	0.10	1.8
Chrysene	U	2700	mg/kg	0.10	2.0
Benz[b]fluoranthene	U	2700	mg/kg	0.10	2.6
Benz[k]fluoranthene	U	2700	mg/kg	0.10	1.2
Benz[a]pyrene	U	2700	mg/kg	0.10	1.6
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	0.92
Dibenz[a,h]Anthracene	U	2700	mg/kg	0.10	0.49
Benz[ghi]perylene	U	2700	mg/kg	0.10	1.1
Total Of 16 PAH's	U	2700	mg/kg	2.0	26
Total Phenols	U	2920	mg/kg	0.30	0.64

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
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.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and Trimethylphenols. Note: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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"

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 45 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



Final Report

Report No.: 20-13152-1

Initial Date of Issue: 01-Jun-2020

Client Quantum Geotechnic Ltd

Client Address: Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contact(s): Lee Simlett

Project Q0188 Cardiff Coastal Defence GI

Quotation No.: Q19-18264 **Date Received:** 26-May-2020

Order No.: **Date Instructed:** 26-May-2020

No. of Samples: 11

Turnaround (Wkdays): 5 **Results Due:** 01-Jun-2020

Date Approved: 01-Jun-2020

Approved By: 

Details: Glynn Harvey, Technical Manager

Results - Water

Client: Quantum Geotechnic Ltd				Chemtest Job No.:			
Quotation No.: Q19-18264		Chemtest Sample ID.:		20-13152		20-13152	
		Sample Location:		1008401		1008402	
				D4A		D5A	
		Sample Type:		WATER		WATER	
		Top Depth (m):		15.73		22.35	
		Date Sampled:		21-May-2020		21-May-2020	
Determinand		Accred.	SOP	Units	LOD	20-13152	20-13152
pH		U	1010		N/A		
Electrical Conductivity		U	1020	µS/cm	1.0	2600	5100
Suspended Solids At 105C		U	1030	mg/l	5.0	1200	520
Biochemical Oxygen Demand Low Level		N	1090	mg O2/l	1.0	[B] < 1.0	[B] 1.0
Alkalinity (Total)		U	1220	mg/l	10	60	75
Chloride		U	1220	mg/l	1.0	1500	1500
Phosphorus (Total)		N	1220	mg/l	0.020	0.030	0.026
Fluoride		U	1220	mg/l	0.050	0.28	0.11
Ammonium		U	1220	mg/l	0.050	0.53	2.4
Ammoniacal Nitrogen		U	1220	mg/l	0.050	3.0	2.4
Nitrite		U	1220	mg/l	0.020	0.026	< 0.020
Nitrate		U	1220	mg/l	0.50	7.5	3.1
Nitrate as N		U	1220	mg/l	0.50	1.7	0.70
Phosphorus (Total)		N	1220	mg/l	0.020	0.030	0.026
Orthophosphate as PO4		U	1220	mg/l	0.050	0.091	0.078
Sulphate		U	1220	mg/l	1.0	580	600
Total Oxidised Nitrogen		U	1220	mg/l	0.20	1.7	0.70
Cyanide (Total)		U	1300	mg/l	0.050	< 0.050	< 0.050
Cyanide (Free)		U	1300	mg/l	0.050	< 0.050	< 0.050
Nitrogen (Total)		N	1340	mg/l	1.0	6.9	10
Calcium		U	1415	mg/l	5.0	290	470
Potassium		U	1415	mg/l	0.50	450	310
Magnesium		U	1415	mg/l	0.50	< 0.50	1.2
Sodium		U	1415	mg/l	0.50	240	530
Total Hardness as CaCO3		U	1270	mg/l	15	710	1200
Arsenic (Dissolved)		U	1450	µg/l	1.0	4.4	8.8
Boron (Dissolved)		U	1450	µg/l	20	840	580
Cadmium (Dissolved)		U	1450	µg/l	0.080	0.13	0.13
Chromium (Dissolved)		U	1450	µg/l	1.0	< 1.0	< 1.0
Copper (Dissolved)		U	1450	µg/l	1.0	8.2	4.0
Iron (Dissolved)		N	1450	µg/l	20	960	1200
Mercury (Dissolved)		U	1450	µg/l	0.50	16	21
Manganese (Dissolved)		U	1450	µg/l	1.0	4.5	4.0
Nickel (Dissolved)		U	1450	µg/l	1.0	1.1	1.1
Lead (Dissolved)		U	1450	µg/l	1.0	< 1.0	< 1.0
Selenium (Dissolved)		U	1450	µg/l	1.0	20	96
Zinc (Dissolved)		U	1450	µg/l	1.0	31	25
Cadmium (Total)		N	1450	µg/l	0.080	0.17	0.27
Chromium (Hexavalent)		U	1490	µg/l	20	< 20	< 20
Low-Level Chromium (Hexavalent)		U	1495	µg/l	0.10	0.38	0.22

Results - Water

Client: Quantum Geotechnic Ltd				Chemtest Job No.:															
Quotation No.: Q19-18264				Chemtest Sample ID.:															
Sample Location:				Sample Type:															
Top Depth (m):				Date Sampled:															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															
21-May-2020				21-May-2020															

[illegible]

Results - Water

Client: Quantum Geotechnic Ltd				Chemtest Job No.:			
Quotation No.: Q19-18264		Chemtest Sample ID.:		Sample Location:		Sample Type:	
				</			

Results - Water

Client: Quantum Geotechnic Ltd		Chemtest Job No.:		Chemtest Sample ID.:		20-13152		20-13152		20-13152		20-13152		20-13152		20-13152		20-13152		20-13152	
Quotation No.: Q19-18264		Sample Location:		D4A		1008401		20-13152		20-13152		20-13152		20-13152		20-13152		20-13152		20-13152	
		Sample Type:		WATER		15.73		21-May-2020		20-13152		20-13152		20-13152		20-13152		20-13152		20-13152	
		Top Depth (m):		15.73		21-May-2020		20-13152		20-13152		20-13152		20-13152		20-13152		20-13152		20-13152	
		Date Sampled:		21-May-2020		20-13152		20-13152		20-13152		20-13152		20-13152		20-13152		20-13152		20-13152	
Determinand	Accred.	SOP		Units		LOD		20-13152		20-13152		20-13152		20-13152		20-13152		20-13152		20-13152	
		1790	1800	µg/l	µg/l	0.50	0.50	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
Benzof(g,h,i)perylene	N	1790	1800	µg/l	µg/l	0.50	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
4-Nitrophenol	N	1790	1800	µg/l	µg/l	0.50	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Naphthalene	N	1800	1800	µg/l	µg/l	0.010	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Acenaphthylene	N	1800	1800	µg/l	µg/l	0.010	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Acenaphthene	N	1800	1800	µg/l	µg/l	0.010	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Fluorene	N	1800	1800	µg/l	µg/l	0.010	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Phenanthrene	N	1800	1800	µg/l	µg/l	0.010	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Anthracene	N	1800	1800	µg/l	µg/l	0.010	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Fluoranthene	N	1800	1800	µg/l	µg/l	0.010	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Pyrene	N	1800	1800	µg/l	µg/l	0.010	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzof(a)anthracene	N	1800	1800	µg/l	µg/l	0.010	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Chrysene	N	1800	1800	µg/l	µg/l	0.010	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzof(b)fluoranthene	N	1800	1800	µg/l	µg/l	0.010	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzof(k)fluoranthene	N	1800	1800	µg/l	µg/l	0.010	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzof(a)pyrene	N	1800	1800	µg/l	µg/l	0.010	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Indeno(1,2,3-c,d)Pyrene	N	1800	1800	µg/l	µg/l	0.010	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Dibenz(a,h)Anthracene	N	1800	1800	µg/l	µg/l	0.010	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzof(g,h,i)perylene	N	1800	1800	µg/l	µg/l	0.010	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Of 16 PAH's	N	1800	1800	µg/l	µg/l	0.10	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Results - Water

Client: Quantum Geotechnic Ltd		Chemtest Job No.:		20-13152	20-13152	20-13152
Quotation No.: Q19-18264		Chemtest Sample ID.:		1008409	1008410	1008411
		Sample Location:		B3	B2	B4
		Sample Type:		WATER	WATER	WATER
		Top Depth (m):		6.85	5.74	5.58
		Date Sampled:		21-May-2020	21-May-2020	21-May-2020
Determinand	Accred.	SOP	Units	LOD		
pH	U	1010		N/A	8.3	8.5
Electrical Conductivity	U	1020	µS/cm	1.0	12000	8600
Suspended Solids At 105C	U	1030	mg/l	5.0	550	1000
Biochemical Oxygen Demand Low Level	N	1090	mg O ₂ /l	1.0	[B] < 1.0	[B] 1.0
Alkalinity (Total)	U	1220	mg/l	10	770	440
Chloride	U	1220	mg/l	1.0	3500	9500
Phosphorus (Total)	N	1220	mg/l	0.020	0.25	0.070
Fluoride	U	1220	mg/l	0.050	0.51	0.16
Ammonium	U	1220	mg/l	0.050	0.14	1.4
Ammoniacal Nitrogen	U	1220	mg/l	0.050	0.12	1.2
Nitrite	U	1220	mg/l	0.020	5.8	1.2
Nitrate	U	1220	mg/l	0.50	3.2	0.59
Nitrate as N	U	1220	mg/l	0.50	0.72	< 0.50
Phosphorus (Total)	N	1220	mg/l	0.020	0.25	0.070
Orthophosphate as PO ₄	U	1220	mg/l	0.050	0.75	0.21
Sulphate	U	1220	mg/l	1.0	930	1200
Total Oxidised Nitrogen	U	1220	mg/l	0.20	2.5	0.50
Cyanide (Total)	U	1300	mg/l	0.050	< 0.050	< 0.050
Cyanide (Free)	U	1300	mg/l	0.050	< 0.050	< 0.050
Nitrogen (Total)	N	1340	mg/l	1.0	6.5	8.9
Calcium	U	1415	mg/l	5.0	270	420
Potassium	U	1415	mg/l	0.50	91	170
Magnesium	U	1415	mg/l	0.50	270	590
Sodium	U	1415	mg/l	0.50	2400	4800
Total Hardness as CaCO ₃	U	1270	mg/l	15	1800	3500
Arsenic (Dissolved)	U	1450	µg/l	1.0	28	32
Boron (Dissolved)	U	1450	µg/l	20	1400	1800
Cadmium (Dissolved)	U	1450	µg/l	0.080	0.39	0.17
Chromium (Dissolved)	U	1450	µg/l	1.0	33	91
Copper (Dissolved)	U	1450	µg/l	1.0	33	83
Iron (Dissolved)	N	1450	µg/l	20	850	1600
Mercury (Dissolved)	U	1450	µg/l	0.50	< 0.50	2.5
Manganese (Dissolved)	U	1450	µg/l	1.0	4000	1100
Nickel (Dissolved)	U	1450	µg/l	1.0	17	6.8
Lead (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0
Selenium (Dissolved)	U	1450	µg/l	1.0	48	< 1.0
Zinc (Dissolved)	U	1450	µg/l	1.0	44	62
Cadmium (Total)	N	1450	µg/l	0.080	0.52	0.17
Chromium (Hexavalent)	U	1490	µg/l	20	< 20	< 20
Low-Level Chromium (Hexavalent)	U	1495	µg/l	0.10	4.9	1.2

Results - Water

Client: Quantum Geotechnic Ltd		Chemtest Job No.:		20-13152	20-13152	20-13152
Quotation No.: Q19-18264		Chemtest Sample ID.:		1008409	1008410	1008411
		Sample Location:		B3	B2	B4
		Sample Type:		WATER	WATER	WATER
		Top Depth (m):		6.85	5.74	5.58
		Date Sampled:		21-May-2020	21-May-2020	21-May-2020
Determinand	Accred.	SOP	Units	LOD		
Chromium (Trivalent)	U	1450	µg/l	1	28	40
Dissolved Organic Carbon	U	1610	mg/l	2.0	9.7	11
Dichlorodifluoromethane	U	1760	µg/l	1.0	< 1.0	< 1.0
Chloromethane	U	1760	µg/l	1.0	< 1.0	< 1.0
Vinyl Chloride	N	1760	µg/l	1.0	< 1.0	< 1.0
Bromomethane	U	1760	µg/l	5.0	< 5.0	< 5.0
Chloroethane	U	1760	µg/l	2.0	< 2.0	< 2.0
Trichlorofluoromethane	U	1760	µg/l	1.0	< 1.0	< 1.0
1,1-Dichloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0
1,1-Dichloroethane	U	1760	µg/l	1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0
Bromochloromethane	U	1760	µg/l	5.0	< 5.0	< 5.0
Trichloromethane	U	1760	µg/l	1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	U	1760	µg/l	1.0	< 1.0	< 1.0
Tetrachloromethane	U	1760	µg/l	1.0	< 1.0	< 1.0
1,1-Dichloropropene	U	1760	µg/l	1.0	< 1.0	< 1.0
Benzene	U	1760	µg/l	1.0	< 1.0	< 1.0
1,2-Dichloroethane	U	1760	µg/l	2.0	< 2.0	< 2.0
Trichloroethene	N	1760	µg/l	1.0	< 1.0	< 1.0
1,2-Dichloropropane	U	1760	µg/l	1.0	< 1.0	< 1.0
Dibromomethane	U	1760	µg/l	10	< 10	< 10
Bromodichloromethane	U	1760	µg/l	5.0	< 5.0	< 5.0
cis-1,3-Dichloropropene	N	1760	µg/l	10	< 10	< 10
Toluene	U	1760	µg/l	1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene	N	1760	µg/l	10	< 10	< 10
1,1,2-Trichloroethane	U	1760	µg/l	10	< 10	< 10
Tetrachloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0
1,3-Dichloropropane	U	1760	µg/l	2.0	< 2.0	< 2.0
Dibromochloromethane	U	1760	µg/l	10	< 10	< 10
1,2-Dibromoethane	U	1760	µg/l	5.0	< 5.0	< 5.0
Chlorobenzene	N	1760	µg/l	1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	U	1760	µg/l	2.0	< 2.0	< 2.0
Ethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0
m & p-Xylene	U	1760	µg/l	1.0	< 1.0	< 1.0
o-Xylene	U	1760	µg/l	1.0	< 1.0	< 1.0
Styrene	U	1760	µg/l	1.0	< 1.0	< 1.0
Tribromomethane	U	1760	µg/l	1.0	< 1.0	< 1.0
Isopropylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0
Bromobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0

Results - Water

Client: Quantum Geotechnic Ltd		Chemtest Job No.:		20-13152	20-13152	20-13152
Quotation No.: Q19-18264		Chemtest Sample ID.:		1008409	1008410	1008411
		Sample Location:		B3	B2	B4
		Sample Type:		WATER	WATER	WATER
		Top Depth (m):		6.85	5.74	5.58
		Date Sampled:		21-May-2020	21-May-2020	21-May-2020
Determinand	Accred.	SOP	Units	LOD		
1,2,3-Trichloropropane	N	1760	µg/l	50	< 50	< 50
N-Propylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0
2-Chlorotoluene	U	1760	µg/l	1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0
4-Chlorotoluene	U	1760	µg/l	1.0	< 1.0	< 1.0
Tert-Butylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0
Sec-Butylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	N	1760	µg/l	1.0	< 1.0	< 1.0
4-Isopropyltoluene	U	1760	µg/l	1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0
N-Butylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane	U	1760	µg/l	50	< 50	< 50
1,2,4-Trichlorobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0
Hexachlorobutadiene	U	1760	µg/l	1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	U	1760	µg/l	2.0	< 2.0	< 2.0
Methyl Tert-Butyl Ether	N	1760	µg/l	1.0	< 1.0	< 1.0
Total Kjeldahl Nitrogen	N	1340	mg/l	1.0	5.8	8.7
N-Nitrosodimethylamine	N	1790	µg/l	0.50	< 0.50	< 0.50
Phenol	N	1790	µg/l	0.50	< 0.50	< 0.50
2-Chlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50
Bis-(2-Chloroethyl)Ether	N	1790	µg/l	0.50	< 0.50	< 0.50
1,3-Dichlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50
1,4-Dichlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50
1,2-Dichlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50
2-Methylphenol (o-Cresol)	N	1790	µg/l	0.50	< 0.50	< 0.50
Bis(2-Chloroisopropyl)Ether	N	1790	µg/l	0.50	< 0.50	< 0.50
Hexachloroethane	N	1790	µg/l	0.50	< 0.50	< 0.50
N-Nitrosodi-n-propylamine	N	1790	µg/l	0.50	< 0.50	< 0.50
4-Methylphenol	N	1790	µg/l	0.50	< 0.50	< 0.50
Nitrobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50
Isophorone	N	1790	µg/l	0.50	< 0.50	< 0.50
2-Nitrophenol	N	1790	µg/l	0.50	< 0.50	< 0.50
2,4-Dimethylphenol	N	1790	µg/l	0.50	< 0.50	< 0.50
Bis(2-Chloroethoxy)Methane	N	1790	µg/l	0.50	< 0.50	< 0.50
2,4-Dichlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50
1,2,4-Trichlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50
Naphthalene	N	1790	µg/l	0.50	< 0.50	< 0.50
4-Chloroaniline	N	1790	µg/l	0.50	< 0.50	< 0.50

Results - Water

Client: Quantum Geotechnic Ltd		Chemtest Job No.:		20-13152	20-13152	20-13152
Quotation No.: Q19-18264		Chemtest Sample ID.:		1008409	1008410	1008411
		Sample Location:		B3	B2	B4
		Sample Type:		WATER	WATER	WATER
		Top Depth (m):		6.85	5.74	5.58
		Date Sampled:		21-May-2020	21-May-2020	21-May-2020
Determinand	Accred.	SOP	Units	LOD		
Hexachlorobutadiene	N	1790	µg/l	0.50	< 0.50	< 0.50
4-Chloro-3-Methylphenol	N	1790	µg/l	0.50	< 0.50	< 0.50
2-Methylnaphthalene	N	1790	µg/l	0.50	< 0.50	< 0.50
Hexachlorocyclopentadiene	N	1790	µg/l	0.50	< 0.50	< 0.50
2,4,6-Trichlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50
2,4,5-Trichlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50
2-Chloronaphthalene	N	1790	µg/l	0.50	< 0.50	< 0.50
2-Nitroaniline	N	1790	µg/l	0.50	< 0.50	< 0.50
Acenaphthylene	N	1790	µg/l	0.50	< 0.50	< 0.50
Dimethylphthalate	N	1790	µg/l	0.50	< 0.50	< 0.50
2,6-Dinitrotoluene	N	1790	µg/l	0.50	< 0.50	< 0.50
Acenaphthene	N	1790	µg/l	0.50	< 0.50	< 0.50
3-Nitroaniline	N	1790	µg/l	0.50	< 0.50	< 0.50
Dibenzofuran	N	1790	µg/l	0.50	< 0.50	< 0.50
4-Chlorophenylphenylether	N	1790	µg/l	0.50	< 0.50	< 0.50
2,4-Dinitrotoluene	N	1790	µg/l	0.50	< 0.50	< 0.50
Fluorene	N	1790	µg/l	0.50	< 0.50	< 0.50
Diethyl Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50
4-Nitroaniline	N	1790	µg/l	0.50	< 0.50	< 0.50
2-Methyl-4,6-Dinitrophenol	N	1790	µg/l	0.50	< 0.50	< 0.50
Azobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50
4-Bromophenylphenyl Ether	N	1790	µg/l	0.50	< 0.50	< 0.50
Hexachlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50
Pentachlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50
Phenanthrene	N	1790	µg/l	0.50	< 0.50	< 0.50
Anthracene	N	1790	µg/l	0.50	< 0.50	< 0.50
Carbazole	N	1790	µg/l	0.50	< 0.50	< 0.50
Di-N-Butyl Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50
Fluoranthene	N	1790	µg/l	0.50	< 0.50	< 0.50
Pyrene	N	1790	µg/l	0.50	< 0.50	< 0.50
Butylbenzyl Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50
Benzofluoranthene	N	1790	µg/l	0.50	< 0.50	< 0.50
Chrysene	N	1790	µg/l	0.50	< 0.50	< 0.50
Bis(2-Ethylhexyl)Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50
Di-N-Octyl Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50
Benzofluoranthene	N	1790	µg/l	0.50	< 0.50	< 0.50
Benzokjfluoranthene	N	1790	µg/l	0.50	< 0.50	< 0.50
Benzofluoranthene	N	1790	µg/l	0.50	< 0.50	< 0.50
Indeno(1,2,3-c,d)Pyrene	N	1790	µg/l	0.50	< 0.50	< 0.50
Dibenz(a,h)Anthracene	N	1790	µg/l	0.50	< 0.50	< 0.50

Results - Water

Client: Quantum Geotechnic Ltd		Chemtest Job No.:		20-13152	20-13152	20-13152
Quotation No.: Q19-18264		Chemtest Sample ID.:		1008409	1008410	1008411
		Sample Location:		B3	B2	B4
		Sample Type:		WATER	WATER	WATER
		Top Depth (m):		6.85	5.74	5.58
		Date Sampled:		21-May-2020	21-May-2020	21-May-2020
Determinand	Accred.	SOP	Units	LOD		
Benzo[g,h,i]perylene	N	1790	µg/l	0.50	< 0.50	< 0.50
4-Nitrophenol	N	1790	µg/l	0.50	< 0.50	< 0.50
Naphthalene	N	1800	µg/l	0.010	< 0.010	< 0.010
Acenaphthylene	N	1800	µg/l	0.010	< 0.010	< 0.010
Acenaphthene	N	1800	µg/l	0.010	< 0.010	< 0.010
Fluorene	N	1800	µg/l	0.010	< 0.010	< 0.010
Phenanthrene	N	1800	µg/l	0.010	< 0.010	< 0.010
Anthracene	N	1800	µg/l	0.010	< 0.010	< 0.010
Fluoranthene	N	1800	µg/l	0.010	< 0.010	< 0.010
Pyrene	N	1800	µg/l	0.010	< 0.010	< 0.010
Benzo[a]anthracene	N	1800	µg/l	0.010	< 0.010	< 0.010
Chrysene	N	1800	µg/l	0.010	< 0.010	< 0.010
Benzo[b]fluoranthene	N	1800	µg/l	0.010	< 0.010	< 0.010
Benzo[k]fluoranthene	N	1800	µg/l	0.010	< 0.010	< 0.010
Benzo[a]pyrene	N	1800	µg/l	0.010	< 0.010	< 0.010
Indeno(1,2,3-c,d)Pyrene	N	1800	µg/l	0.010	< 0.010	< 0.010
Dibenz[a,h]Anthracene	N	1800	µg/l	0.010	< 0.010	< 0.010
Benzo[g,h,i]perylene	N	1800	µg/l	0.010	< 0.010	< 0.010
Total Of 16 PAH's	N	1800	µg/l	0.10	< 0.10	< 0.10

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request. The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1008401			D4A	21-May-2020	B	Coloured Winchester 1000ml
1008401			D4A	21-May-2020	B	EPA Vial 40ml
1008401			D4A	21-May-2020	B	Plastic Bottle 1000ml
1008402			D5A	21-May-2020	B	Coloured Winchester 1000ml
1008402			D5A	21-May-2020	B	EPA Vial 40ml
1008402			D5A	21-May-2020	B	Plastic Bottle 1000ml
1008403			D5C	21-May-2020	B	Coloured Winchester 1000ml
1008403			D5C	21-May-2020	B	EPA Vial 40ml
1008403			D5C	21-May-2020	B	Plastic Bottle 1000ml
1008404			D6A.3	21-May-2020	B	Coloured Winchester 1000ml
1008404			D6A.3	21-May-2020	B	EPA Vial 40ml
1008404			D6A.3	21-May-2020	B	Plastic Bottle 1000ml
1008405			D1A.5	21-May-2020	B	Coloured Winchester 1000ml
1008405			D1A.5	21-May-2020	B	EPA Vial 40ml
1008405			D1A.5	21-May-2020	B	Plastic Bottle 1000ml
1008406			D1B	21-May-2020	B	Coloured Winchester 1000ml
1008406			D1B	21-May-2020	B	EPA Vial 40ml
1008406			D1B	21-May-2020	B	Plastic Bottle 1000ml
1008407			D2A.3	21-May-2020	B	Coloured Winchester 1000ml
1008407			D2A.3	21-May-2020	B	EPA Vial 40ml
1008407			D2A.3	21-May-2020	B	Plastic Bottle 1000ml

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request. The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1008408			B10	21-May-2020	B	Coloured Winchester 1000ml
1008408			B10	21-May-2020	B	EPA Vial 40ml
1008408			B10	21-May-2020	B	Plastic Bottle 1000ml
1008409			B3	21-May-2020	B	Coloured Winchester 1000ml
1008409			B3	21-May-2020	B	EPA Vial 40ml
1008409			B3	21-May-2020	B	Plastic Bottle 1000ml
1008410			B2	21-May-2020	B	Coloured Winchester 1000ml
1008410			B2	21-May-2020	B	EPA Vial 40ml
1008410			B2	21-May-2020	B	Plastic Bottle 1000ml
1008411			B4	21-May-2020	B	Coloured Winchester 1000ml
1008411			B4	21-May-2020	B	EPA Vial 40ml
1008411			B4	21-May-2020	B	Plastic Bottle 1000ml

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1030	Total Suspended Solids	Total suspended solids	Filtration of a mixed sample through a standard glass fibre filter and determination of the mass of residue retained dried at 105°C.
1090	Biochemical Oxygen Demand	Biochemical Oxygen demand (BOD)	Colorimetric determination of dissolved oxygen in seeded sample after 5 days incubation at 20°C.
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1270	Total Hardness of Waters	Total hardness	Calculation applied to calcium and magnesium results, expressed as mg l-1 CaCO3 equivalent.
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1340	Total Nitrogen in Waters	Total Nitrogen and organic Nitrogen	Persulphate digestion followed by colorimetry.
1415	Cations in Waters by ICP-MS	Sodium; Potassium; Calcium; Magnesium	Direct determination by inductively coupled plasma - mass spectrometry (ICP-MS).
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1490	Hexavalent Chromium in Waters	Chromium [VI]	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
1495	Low Level Hexavalent Chromium in Waters	Chromium [VI]	Colorimetric determination of hexavalent chromium expressed as Cr (VI) µg/l in water, using Ion Chromatography and UV-visible spectrophotometry.
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.
1790	Semi-Volatile Organic Compounds (SVOCs) in Waters by GC-MS	Semi-volatile organic compounds	Solvent extraction / GCMS detection
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection

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"

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 45 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



Final Report

Report No.: 20-13292-1

Initial Date of Issue: 02-Jun-2020

Client Quantum Geotechnic Ltd

Client Address: Plas Newydd
Llanedi
Pontarddulais
Swansea
SA4 0FQ

Contact(s): Lee Simlett

Project Q0188 Cardiff Coastal Defence

Quotation No.: Q19-18264

Order No.:

No. of Samples: 8

Turnaround (Wkdays): 5

Date Approved: 02-Jun-2020

Approved By: 

Details: Glynn Harvey, Technical Manager

Date Received: 27-May-2020

Date Instructed: 27-May-2020

Results Due: 02-Jun-2020

Results - Soil

Client: Quantum Geotechnic Ltd				Chemtest Job No.:		20-13292	20-13292	20-13292	20-13292	20-13292	20-13292	20-13292	20-13292	20-13292	20-13292	20-13292	20-13292																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
Determinand	Accred.	Chemtest Sample ID.:		SOP	Units	LOD	Chemtest Job No.:		20-13292	20-13292	20-13292	20-13292	20-13292	20-13292	20-13292	20-13292	20-13292																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		Client Sample Ref.:	Sample Location:				Sample Type:	Top Depth (m):	Date Sampled:	Asbestos Lab:	ASCM Type	Asbestos Identification	ACM Detection Stage	Moisture	pH	Sulphate (2:1 Water Soluble) as SO4	Cyanide (Total)	Arsenic	Boron	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Zinc	Organic Matter	Total TPH >C6-C40	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo[a]anthracene	Chrysene	Benzo[b]fluoranthene	Benzo[k]fluoranthene	Benzo[a]pyrene	Indeno(1,2,3-c,d)Pyrene	Dibenz[a,h]Anthracene	Benzo[g,h,i]perylene	Total Of 16 PAH's	Total Phenols																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
U	2192	%	0.001	N/A	N	2030	%	0.020	4.0	0.010	g/l	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
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
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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"

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 45 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

DRAFT

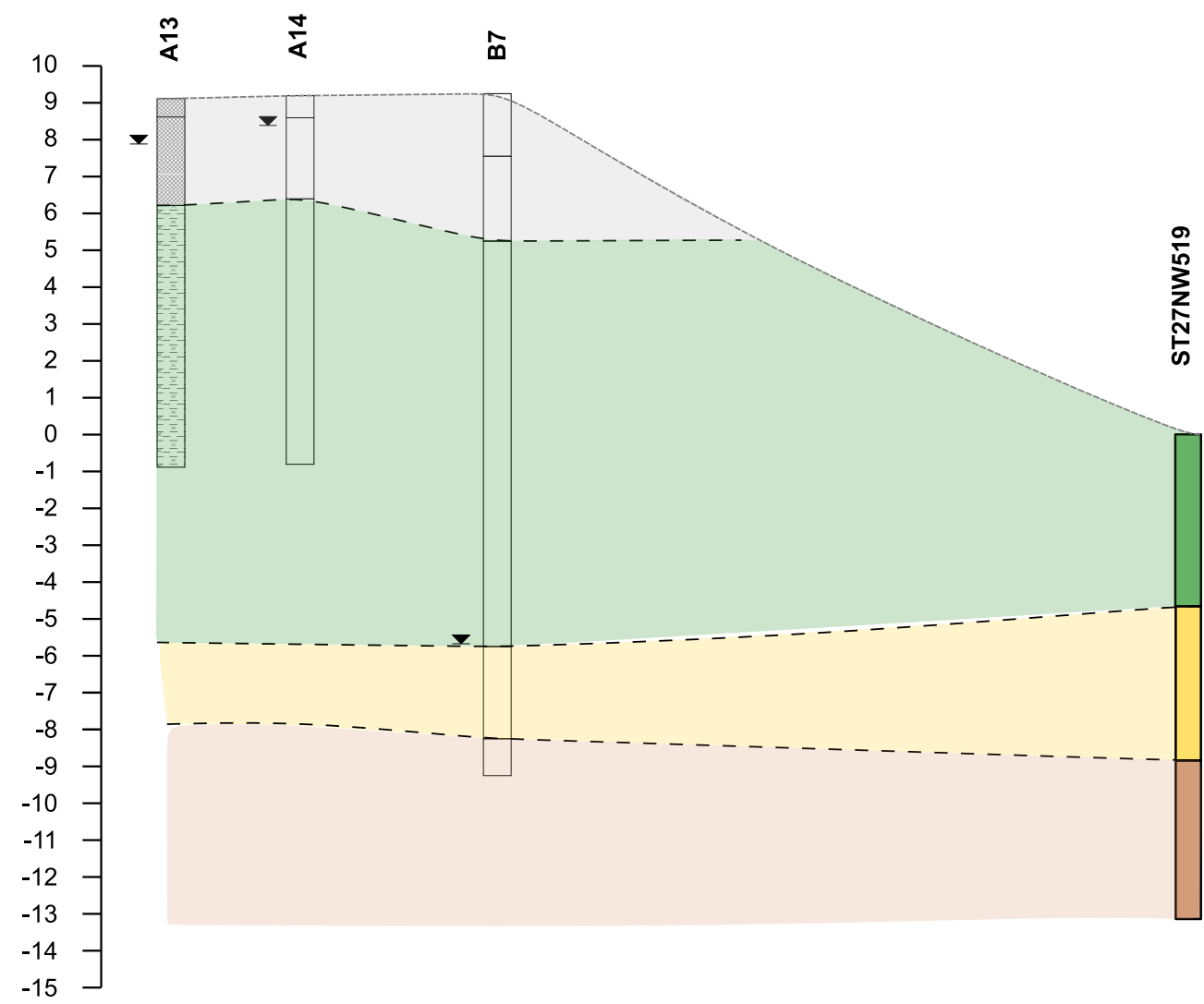


Quantum Geotechnic Ltd
Plas Newydd
Pontardulais
Swansea
SA4 0FQ

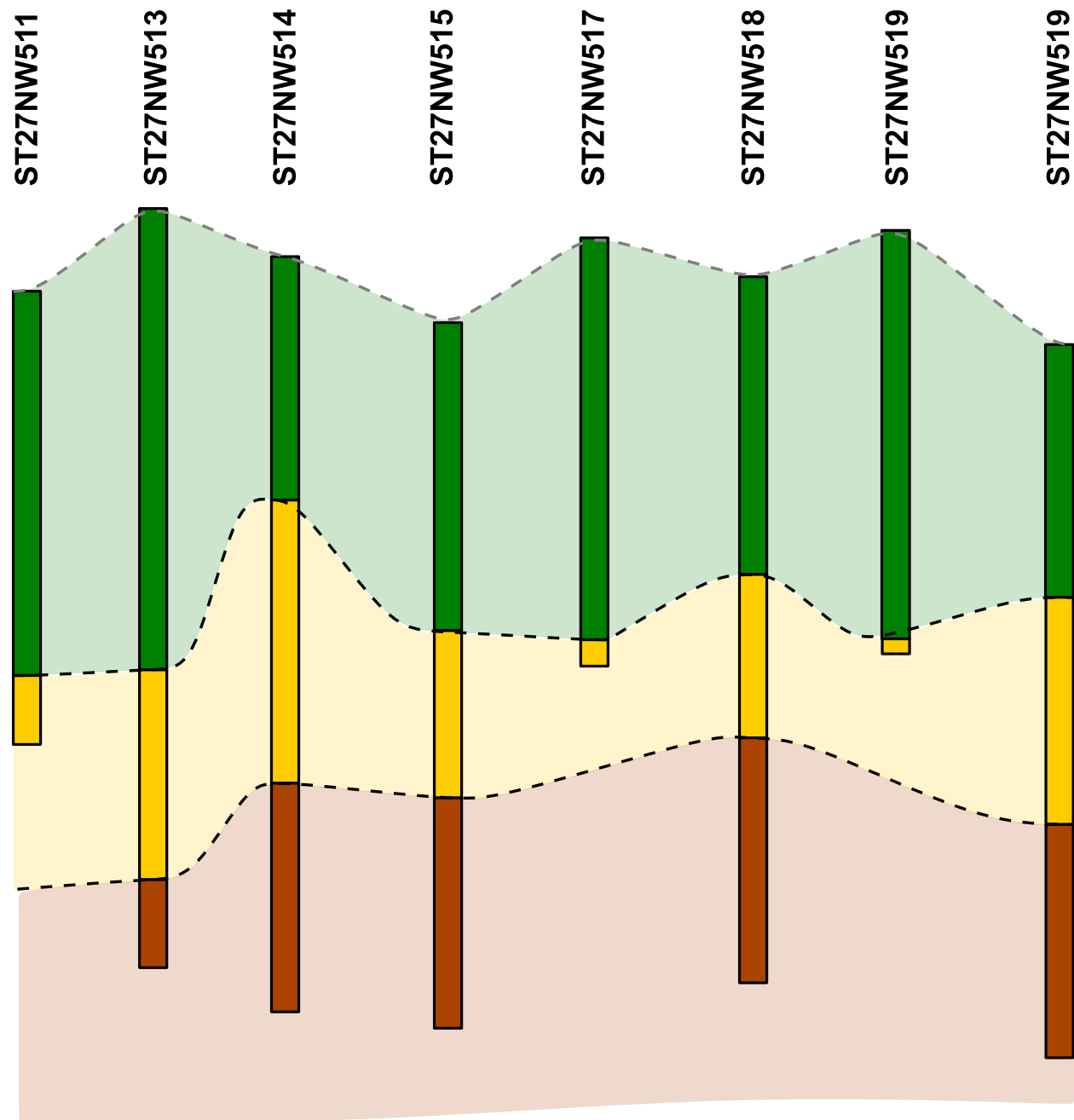
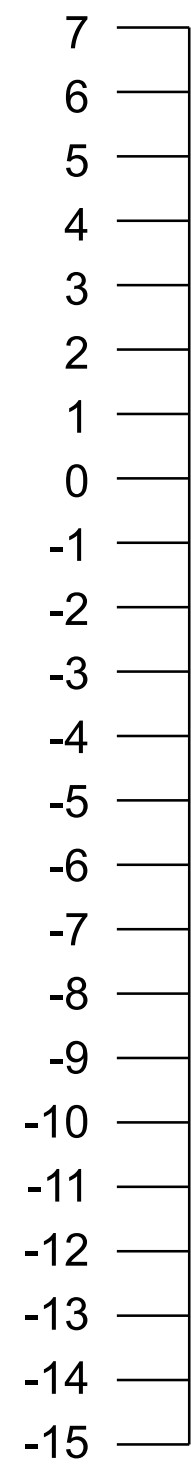
T: 01554 744880
E: enquiries@quantumgeotech.co.uk
W: <http://www.quantumgeotech.co.uk>



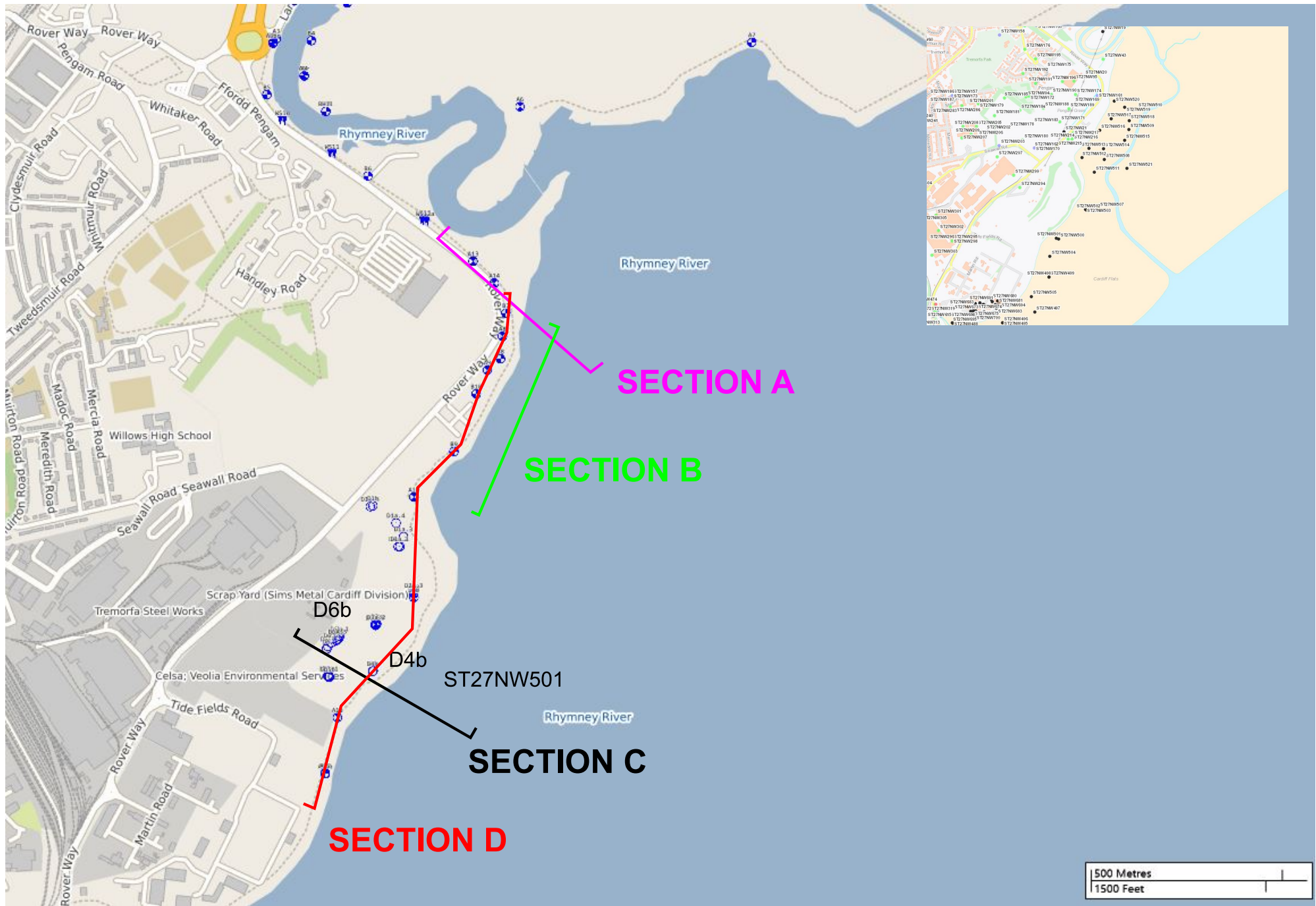
B Exploratory Hole Plan and Geological Cross Sections



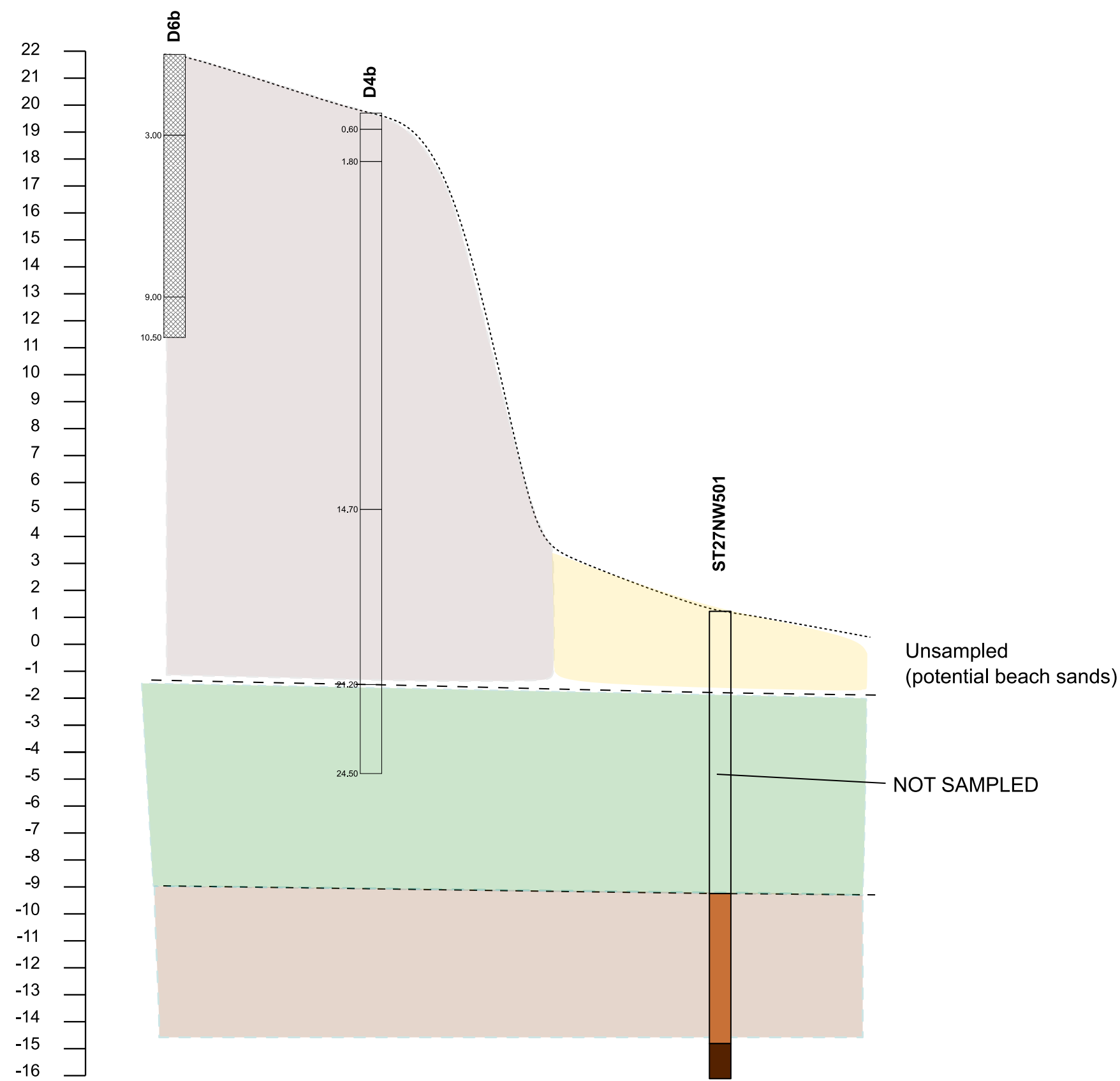
SECTION A
NOT TO HORIZONTAL SCALE



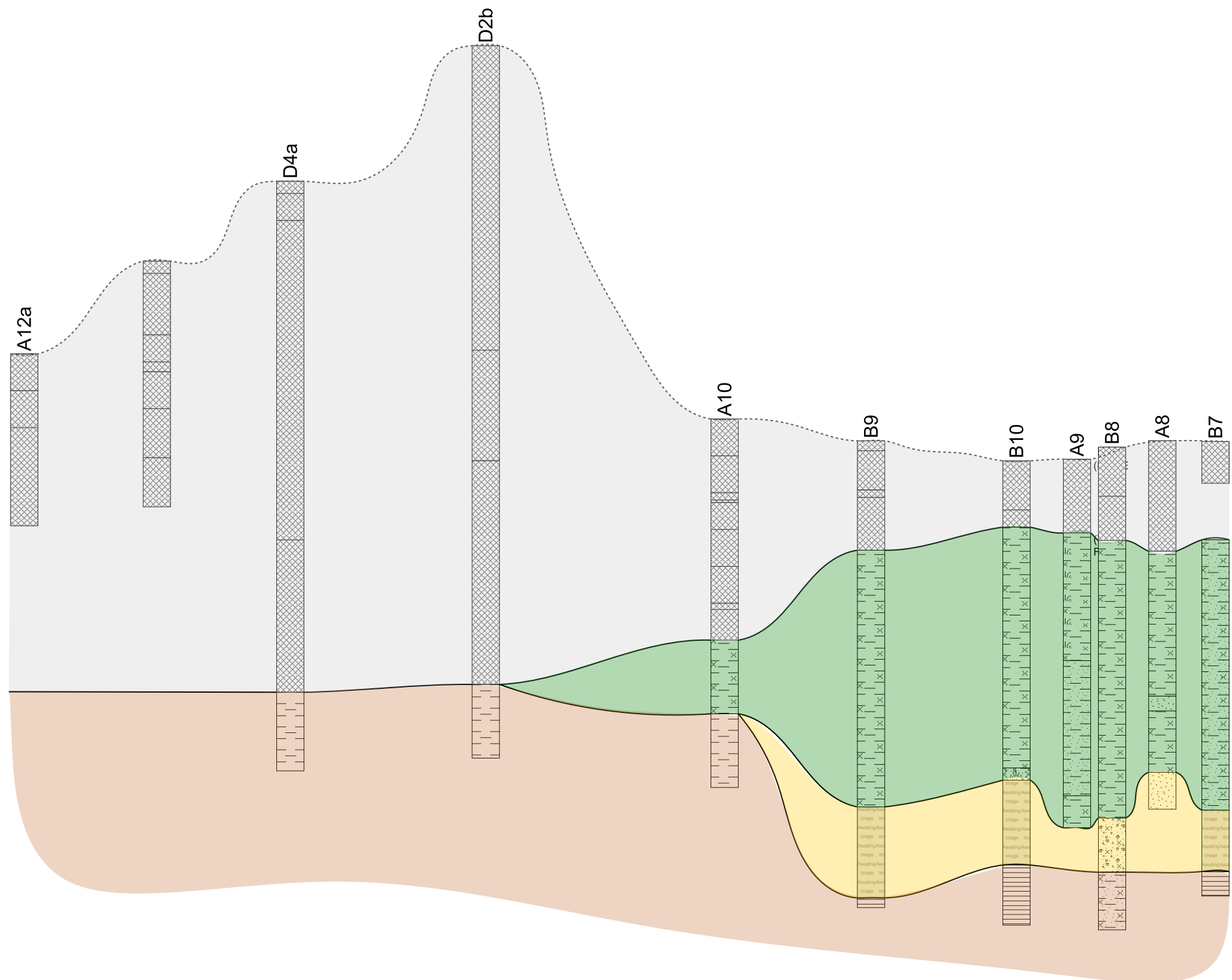
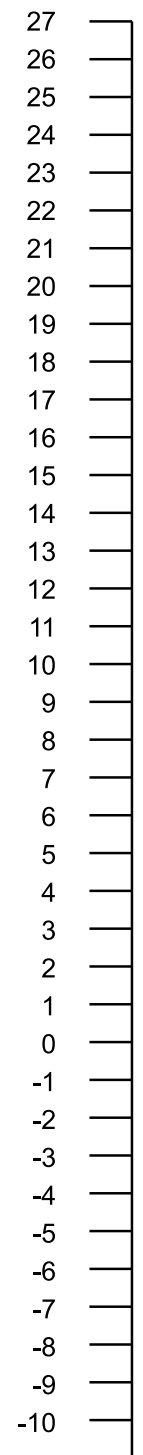
SECTION B
NOT TO HORIZONTAL SCALE



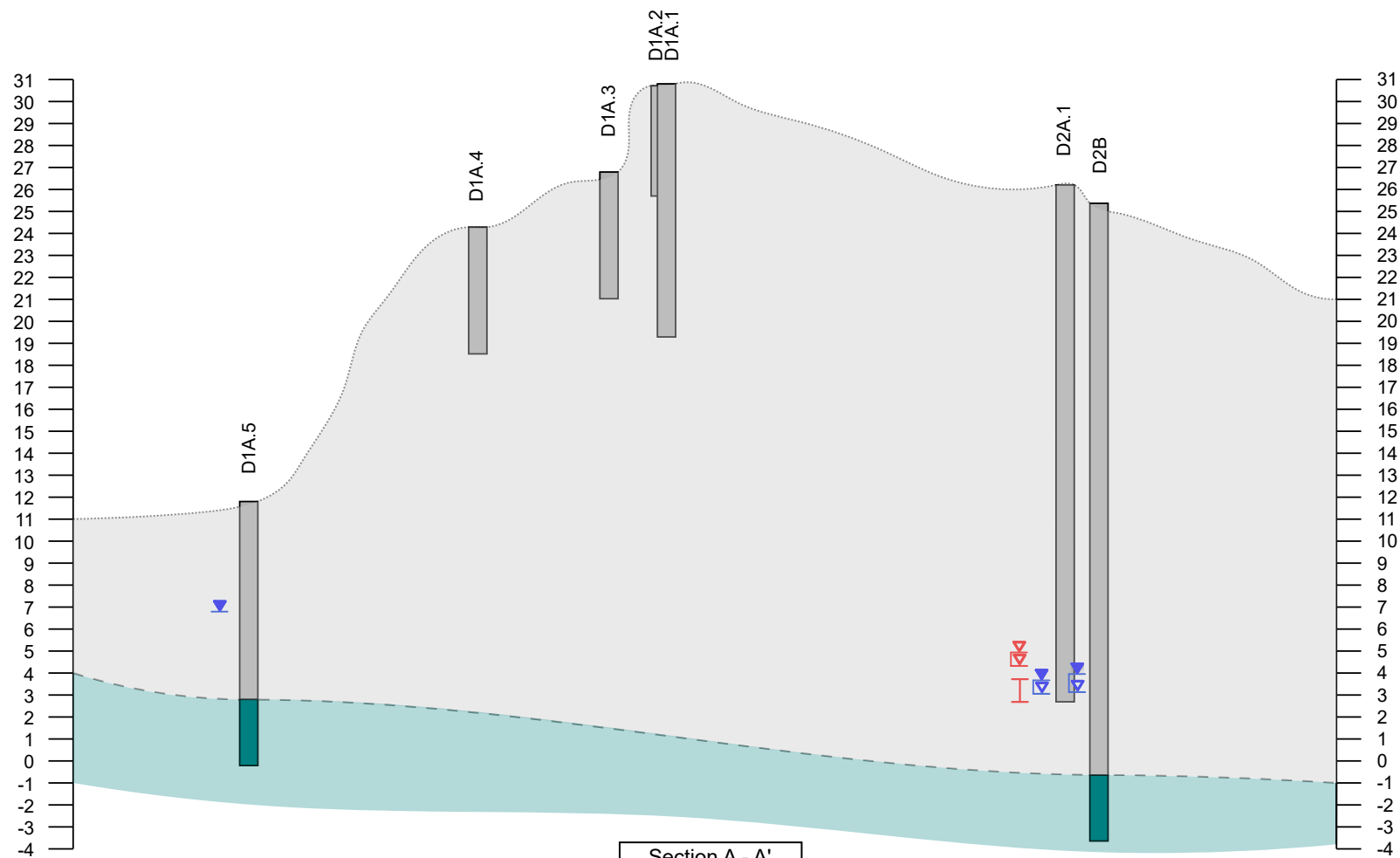
- Made ground:** colliery spoil
- Made ground:** mixed granular and cohesive artifical ground
- Tidal flat deposits:** soft to firm silty CLAY
- Fluvioglacial:** medium dense sandy GRAVEL
- Weathered mudstone:** stiff to very stiff silty CLAY



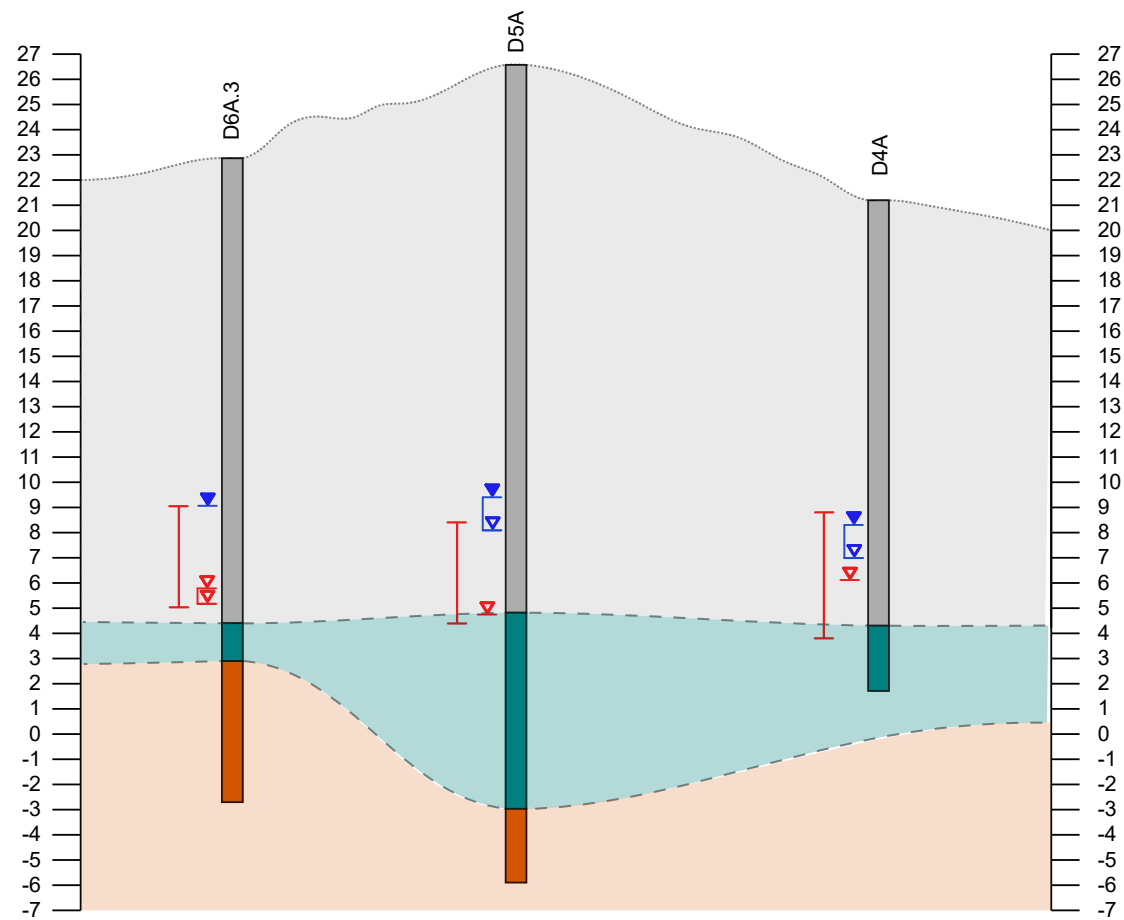
SECTION C
NOT TO HORIZONTAL SCALE



SECTION D



Section A - A'
Scale: Not to scale

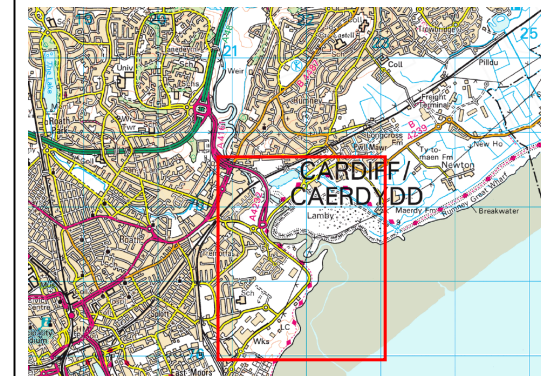


Section B - B'
Scale: Not to scale

General Notes

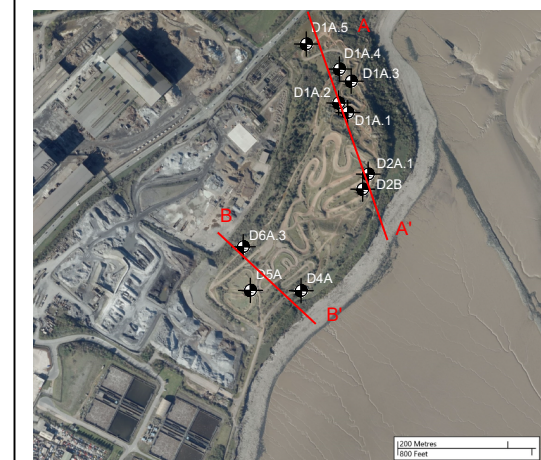
- A. All dimensions shown are in metres unless otherwise stated and levels in metres to Ordnance Datum.
B. Do not scale from this drawing. All dimensions must be checked/verified on site.
C. The electronic version of this drawing is not to be used for setting out.

Site location map



Legend

Geology		Boreholes	
	Made ground		Rotary open hole
	Tidal flat deposits		
	Mercia Mudstone		
Misc			
	Water rise		Groundwater monitoring top and base level
	Water strike		Groundwater monitoring response zones
	Geological boundary (inferred)		
	Geological boundary (estimated)		



P01	Comments
Rev.:	Date Drawn Designed Checked Approved
Client Approval	
A - Approved	
B - Approved with Revisions	
C - Do Not Use	

Floor 4
Maybrook House
31/35 Grainger Street
Newcastle upon Tyne
NE1 5JE
T +44 (0)191 233 0707
E info@jbaconsulting.com
www.jbaconsulting.com
Twitter @JBAConsulting

DRAFT

JBA

Project
Cardiff Coastal Defence Scheme

Title
**Section 6 - Frag Tip
Geological Long Section
Contamination Assessment**

Client
for

The property of this drawing and design vested in Jeremy Benn Associates Ltd. It shall not be reproduced in whole or in part, nor disclosed to a third party, without the prior written consent of Jeremy Benn Associates Ltd.

Drawn:	C Hanson	26/07/2020	Designed:	C Hanson	26/07/2020
Checked:	J Howard	27/07/2020	Approved:	M McDonald	28/07/2020
Project Reference:	2019s0183		Scale:	As Shown @ A3	
Drawing Number:	0001		Status:	S3	
			Revision:	P01	
			Sheet Size:	A3	

C Risk Assessment Matrix

RISK APPRAISAL

The identification of potential “pollutant linkages” is a key aspect of the evaluation of potentially contaminated land. An approach based on the UK CIRIA report C552 (Contaminated Land Risk Assessment: A Guide to Good Practice, 2001) has been adopted within this report. For each of the pollutant linkages, an estimate is made of;

- < The potential severity of the risk; and
- < The likelihood of the risk occurring.

Table C.1 presents the classification of the severity of the risk:

TABLE C.1 SEVERITY OF RISK

Severe	Acute risks to human health; Major pollution of controlled waters (watercourses or groundwater)
Medium	Chronic (long-term) risk to human health; Pollution of sensitive controlled waters (surface waters or aquifers)
Mild	Pollution of non-sensitive water resources.
Minor	Requirement for protective equipment during site works to mitigate health effects; Damage to non-sensitive ecosystems or species

The probability of the risk occurring is classified by criteria given in Table C.2.

TABLE C.2 PROBABILITY OF RISK OCCURRING

High Likelihood	Pollutant linkage may be present, and risk is almost certain to occur in the long term, or there is evidence of harm to the receptor.
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term.
Low Likelihood	Pollutant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
Unlikely	Pollutant linkage may be present but the circumstances under which harm would occur are improbable.

An overall evaluation of the level of risk is gained from a comparison of the severity and probability as presented in Table C.3.

TABLE C.3 COMPARISON OF SEVERITY AND PROBABILITY

		Severity			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very high risk	High risk	Moderate risk	Moderate / low risk
	Likely	High risk	Moderate risk	Moderate/ low risk	Low risk
	Low Likelihood	Moderate risk	Moderate/ low risk	Low risk	Very low risk
	Unlikely	Moderate / low risk	Low risk	Very low risk	Very low risk

Table C.4 then provides a description of the typical consequences and potential actions required following each risk definition.

TABLE C.4 QUALITATIVE RISK ASSESSMENT - CLASSIFICATION OF CONSEQUENCE

Classification	Definition
Very High Risk	Severe harm to a receptor may already be occurring, or a high likelihood severe harm will arise to a receptor, unless immediate remedial works / mitigation measures are undertaken.
High Risk	Harm is likely to arise to a receptor, and is likely to be severe, unless appropriate remedial actions / mitigation measures are undertaken. Remedial works may be required in the short-term, but likely to be required over the long-term.
Moderate Risk	Possible that harm could arise to a receptor, but low likelihood that such harm would be severe. Harm is likely to be mild. Some remedial works may be required in the long-term.
Moderate / Low Risk	Possible that harm could arise to a receptor, but where a combination of likelihood and consequence results in a risk that is above low, but is not of sufficient concern to be classified as mild. Limited further investigation may be required to clarify the risk. If necessary, remediation works are likely to be limited in extent.
Low Risk	Possible that harm could arise to a receptor. Such harm, at worst, would normally be mild.
Very Low Risk	Low likelihood that harm could arise to a receptor. Such harm is unlikely to be any worse than mild.

Offices at

Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Glasgow
Haywards Heath
Isle of Man
Limerick
Newcastle upon Tyne
Newport
Peterborough
Saltaire
Skipton
Tadcaster
Thirsk
Wallingford
Warrington

Registered Office
1 Broughton Park
Old Lane North
SKIPTON
North Yorkshire
BD23 3FD
United Kingdom

+44(0)1756 799919
info@jbaconsulting.com
www.jbaconsulting.com
Follow us:  

Jeremy Benn Associates Limited

Registered in England 3246693

JBA Group Ltd is certified to:
ISO 9001:2015
ISO 14001:2015
OHSAS 18001:2007

