

Our Ref: MW/14647/VR-Plots 88, 91, 118 and 119

Your Ref:

Contact: Michael Watkins

7th December 2022

Persimmon Homes West Wales
Dragon House
Parc y Ddraig
Penllagaer Business Park
Swansea
SA4 9HJ

For the Attention of: Mr Ellis Jones

Dear Ellis,

CAPPING LAYER VALIDATION REPORT: PLOTS 88, 91, 118 AND 119, AFAN LIDO, PORT TALBOT

Section 1 Introduction

Persimmon Homes West Wales (the Client) are developing land at the former Afan Lido site and land to the south of Channel View in Port Talbot for residential purposes. The majority of the dwellings are low-rise dwellings with private gardens. Sixteen apartments (65-72 and 93-100) are to be built within two buildings. The proposed layout is illustrated on **Drawing 01**.

Hyder Consulting (UK) Limited completed a Geo-environmental and Geotechnical Site Investigation in July 2015 (Report No. UA007442-001-R001). Terra Firma (Wales) Limited completed a Supplementary Geotechnical and Geo-environmental Site Investigation Report in November 2018, and a Remediation Strategy report in April 2022.

The Remediation Strategy report (14647/RS dated June 2021) made recommendation for mitigation measures in areas of soft surfacing. The recommendation was to place 600mm of clean inert soils over a no-dig membrane comprising a geo-grid and high-visibility geotextile.

TFW Group Limited have been commissioned by the Client to validate the thickness of the capping soils, presence of the no-dig membrane, and the soils suitability to be used in residential gardens with plant uptake based upon their chemical composition in the gardens of Plots 88, 91, 118 and 119.

Capping soils comprise a top layer of soil comprising of dark brown, organic-rich silty slightly sandy slightly gravelly **CLAY** with occasional fine roots. The subsoil comprised brown mottled sandy slightly gravelly **CLAY**.

Section 2 Soil Chemical Testing of Imported Soils

A TFW Group Limited engineer visited the site on 26th September and 4th October 2022 to collect samples for chemical analysis. Four samples from a 250m³ stockpile of topsoil and four samples from a 250m³ stockpile of subsoil were taken as per the guidance 'Requirements for the Chemical Testing of Imported Materials for Various End Uses and Validation of Cover Systems' prepared by the Welsh Land Contamination Working Group.

Samples were taken and despatched to the laboratories of Eurofins Chemtest for chemical testing of a broad pathfinder suite of metals, inorganics, speciated polycyclic aromatic hydrocarbons and petroleum hydrocarbons. The samples were also screened for asbestos.

Comparison of the analytical results has been made with the 2015 Suitable 4 Use Levels (S4UL) provided by Land Quality Management (LQM) Limited and the Chartered Institute of Environmental Health (CIEH) or provisional Category 4 Screening Levels (pC4SL).

A summary of the chemical test results which include the regulatory soil guideline values used in the Tier 1 assessment are given in **Tables 3.1 to 3.3** and can be found in **Annex A**.

Table 3.1 Summary of Soil Chemical Test Results – Inorganics & Miscellaneous

Substance	Threshold Value (mg/kg)	Source	Measured Concentrations (mg/kg)				Number of Exceedances
			Topsoil		Subsoil		
			Min	Max	Min	Max	
Arsenic	37	LQM/CIEH	5.0	11	5.2	32	0
Cadmium	11	LQM/CIEH	<1.0	0.17	0.48	1.2	0
Chromium III	910	LQM/CIEH	9.7	22	39	76	0
Chromium VI	6	LQM/CIEH	<0.5	<0.5	<0.5	<0.5	0
Copper	2400	LQM/CIEH	8.6	19	14	68	0
Lead	200	pC4SL	22	50	22	42	0
Mercury (inorganic)	40	LQM/CIEH	0.05	0.12	<0.05	0.05	0
Nickel	180	LQM/CIEH	5.3	11	17	25	0
Selenium	250	LQM/CIEH	0.41	0.79	0.58	0.93	0
Zinc	3700	LQM/CIEH	29	53	90	170	0
Cyanide*	-	-	<0.50	<0.50	<0.5	<0.5	0
Phenols	120	LQM/CIEH	<0.1	<0.1	<0.10	<0.10	0
Boron	290	LQM/CIEH	0.74	1.4	0.76	2.6	0
Organic Matter (%)	-	-	4.9	5.2	0.30	1.0	-
pH	-	-	6.7	7.1	7.9	9.0	-
Asbestos	-	-	Not Detected	Not Detected	Not Detected	Not Detected	0

Notes:

- No available guideline

*Free Cyanide for Topsoil

Table 3.2 Summary of Soil Chemical Test Results – Speciated PAH

Substance	Threshold Value (mg/kg)	Source	Measured Concentrations (mg/kg)				Number of Exceedances
			Topsoil		Subsoil		
			Min	Max	Min	Max	
Naphthalene	2.3	LQM/CIEH	< 0.10	< 0.10	< 0.10	< 0.10	0
Acenaphthylene	170	LQM/CIEH	< 0.10	< 0.10	< 0.10	< 0.10	0
Acenaphthene	210	LQM/CIEH	< 0.10	< 0.10	< 0.10	< 0.10	0
Fluorene	170	LQM/CIEH	< 0.10	< 0.10	< 0.10	< 0.10	0
Phenanthrene	95	LQM/CIEH	< 0.10	< 0.10	< 0.10	< 0.10	0
Anthracene	2400	LQM/CIEH	< 0.10	< 0.10	< 0.10	<0.10	0
Fluoranthene	280	LQM/CIEH	< 0.10	0.33	< 0.10	0.35	0
Pyrene	620	LQM/CIEH	< 0.10	0.20	< 0.10	0.32	0
Benzo(a)anthracene	7.2	LQM/CIEH	< 0.10	< 0.10	< 0.10	< 0.10	0
Chrysene	15	LQM/CIEH	< 0.10	< 0.10	< 0.10	< 0.10	0
Benzo(b)fluoranthene	2.6	LQM/CIEH	< 0.10	< 0.10	< 0.10	< 0.10	0
Benzo(k)fluoranthene	77	LQM/CIEH	< 0.10	< 0.10	< 0.10	< 0.10	0
Benzo(a)pyrene	2.2	LQM/CIEH	< 0.10	< 0.10	< 0.10	< 0.10	0
Indeno(123cd)pyrene	27	LQM/CIEH	< 0.10	< 0.10	< 0.10	< 0.10	0
Dibenzo(ah)anthracene	0.24	LQM/CIEH	< 0.10	< 0.10	< 0.10	< 0.10	0
Benzo(ghi)perylene	320	LQM/CIEH	< 0.10	< 0.10	< 0.10	< 0.10	0
Total PAH	-	-	< 2.0	< 2.0	< 2.0	<2.0	-

Notes:

Thresholds based on 1.0% soil organic matter

- No available guidelines

Table 3.3 Summary of Soil Chemical Test Results – Petroleum Hydrocarbons

Substance	Threshold Value (mg/kg)	Source	Measured Concentrations (mg/kg)				Number of Exceedances
			Topsoil		Subsoil		
			Min	Max	Min	Max	
Aliphatic							
PH C5 – C6 Ali	42	LQM/CIEH	< 1.0	< 1.0	< 1.0	< 1.0	0
PH C6 – C8 Ali	100	LQM/CIEH	< 1.0	< 1.0	< 1.0	< 1.0	0
PH C8 – C10 Ali	27	LQM/CIEH	< 1.0	< 1.0	< 1.0	< 1.0	0
PH C10 – C12 Ali	130	LQM/CIEH	< 1.0	< 1.0	< 1.0	< 1.0	0
PH C12 – C16 Ali	1100	LQM/CIEH	< 1.0	< 1.0	< 1.0	15	0
PH C16 – C21 Ali	65000*	LQM/CIEH	< 1.0	< 1.0	< 1.0	22	0
PH C21 – C35 Ali	65000*	LQM/CIEH	< 1.0	< 1.0	< 1.0	180	0
PH C35 – C44 Ali	65000	LQM/CIEH	< 1.0	< 1.0	< 1.0	< 1.0	0
Aromatic							
PH C5 – C7 Arom	70	LQM/CIEH	< 1.0	< 1.0	< 1.0	< 1.0	0
PH C7 – C8 Arom	130	LQM/CIEH	< 1.0	< 1.0	< 1.0	< 1.0	0
PH C8 – C10 Arom	34	LQM/CIEH	< 1.0	< 1.0	< 1.0	< 1.0	0

PH C10 – C12 Arom	74	LQM/CIEH	< 1.0	< 1.0	< 1.0	< 1.0	0
PH C12 – C16 Arom	140	LQM/CIEH	< 1.0	< 1.0	< 1.0	< 1.0	0
PH C16 – C21 Arom	260	LQM/CIEH	< 1.0	< 1.0	< 1.0	< 1.0	0
PH C21 – C35 Arom	1100	LQM/CIEH	< 1.0	< 1.0	< 1.0	34	0
PH C35 – C44 Arom	1100	LQM/CIEH	< 1.0	< 1.0	< 1.0	< 1.0	0

Notes:

PH – Petroleum Hydrocarbon

Ali – Aliphatic

Arom – Aromatic

Thresholds based on 1.0% soil organic matter

* – Ali C16-21 and C21-C35 based on criteria for Ali EC >16-35

Section 3 Verification of Capping Thickness and No Dig Barrier

A TFW Group Limited engineer visited the site on 6th December 2022 to confirm the capping thickness and presence of a no-dig barrier comprising a high-visibility geotextile and geogrid. In accordance with WLGA document 'Requirements for the Chemical Testing of Imported Materials for Various End Uses and Validation of Cover Systems', one in every four plots require validation across the site.

A hand dug inspection pit was excavated, inspected, and photographed in the rear garden of Plot 119 as indicated in **Figure 3.1**. The no-dig barrier was also inspected and photographed prior to the capping soil being laid in Plot 118.

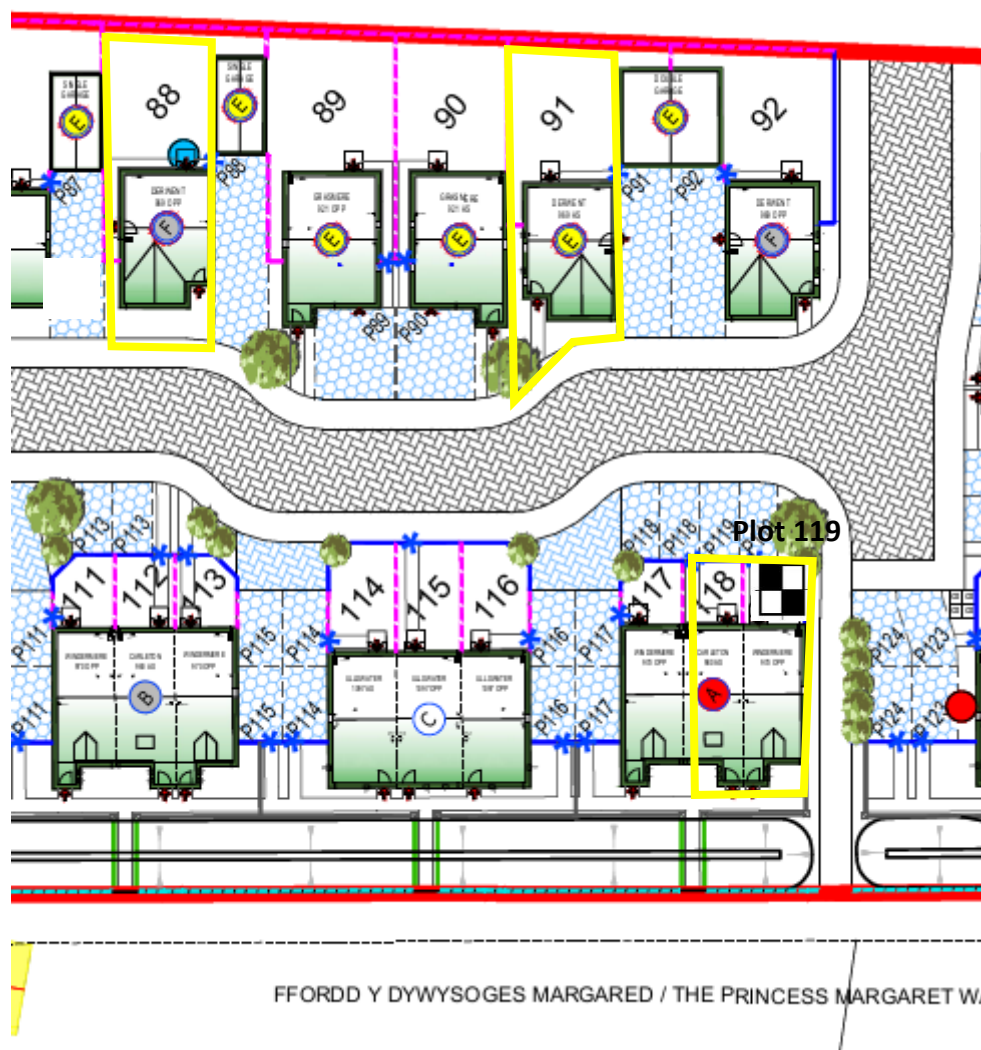


Figure 3.1: Location of Validation Plots and Pit Location

Table 3.1 records the depth of the upper soil layer and lower soil layer, and the depth of samples taken.

Table 3.1 Summary of Capping Soil Thickness and Sample Depth

Plot	Upper Soil Layer Depth (m)	Sample Depth (m)	Lower Soil Layer Depth (m)	Sample Depth (m)	High Visibility Geotextile Membrane Present?
Plot 119	0.15	-	0.60	-	Yes

Photographs of the inspection trial pit and no-dig membrane are presented in **Annex B**.

Section 4 Conclusion

The above sections demonstrate that all substances tested for were below their respective Tier 1 threshold values, and that sufficient depth of capping soil has been placed above a high-visibility geotextile layer.

It is therefore concluded that the hazard to receptor pathway has been successfully interrupted and, in relation to contamination only, and the garden areas, of Plots 88, 91, 118 and 119 have been made suitable for their intended use.

We trust that the above is to your satisfaction, however, if you have any queries or require any further information, please do not hesitate to contact us.

Yours sincerely

for: TFW Group Limited



Michael Watkins

ANNEX A
Soil Laboratory Chemical Test Results



Amended Report

Report No.:	22-37012-2		
Initial Date of Issue:	11-Oct-2022	Date of Re-Issue:	12-Oct-2022
Client	Terra Firma (Wales) Ltd		
Client Address:	5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA		
Contact(s):	michael@terrafirmawales.co.uk		
Project	Afan Lido		
Quotation No.:	Q20-21666	Date Received:	28-Sep-2022
Order No.:	14647-MW	Date Instructed:	28-Sep-2022
No. of Samples:	2		
Turnaround (Wkdays):	15	Results Due:	18-Oct-2022
Date Approved:	12-Oct-2022		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Soil

Project: Afan Lido

Client: Terra Firma (Wales) Ltd	Chemtest Job No.:				22-37012	22-37012
Quotation No.: Q20-21666	Chemtest Sample ID.:				1514355	1514356
	Client Sample ID.:				TS1	TS2
	Sample Type:				SOIL	SOIL
	Date Sampled:				26-Sep-2022	26-Sep-2022
	Time Sampled:				12:00	12:00
	Asbestos Lab:				DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD		
ACM Type	U	2192		N/A	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-
Moisture	N	2030	%	0.020	17	17
Soil Colour	N	2040		N/A	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones
Soil Texture	N	2040		N/A	Sand	Sand
pH	M	2010		4.0	7.1	7.1
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	1.4	1.4
Cyanide (Free)	M	2300	mg/kg	0.50		< 0.50
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	0.60
Sulphate (Acid Soluble)	U	2430	%	0.010	0.066	0.052
Arsenic	M	2455	mg/kg	0.5	11	9.1
Cadmium	M	2455	mg/kg	0.10	0.17	0.13
Chromium	M	2455	mg/kg	0.5	22	17
Mercury Low Level	M	2450	mg/kg	0.05	0.12	0.09
Copper	M	2455	mg/kg	0.50	19	15
Nickel	M	2455	mg/kg	0.50	11	8.4
Lead	M	2455	mg/kg	0.50	50	41
Selenium	M	2455	mg/kg	0.25	0.79	0.41
Zinc	M	2455	mg/kg	0.50	53	44
Chromium (Trivalent)	N	2490	mg/kg	1.0	22	17
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0

Results - Soil

Project: Afan Lido

Client: Terra Firma (Wales) Ltd	Chemtest Job No.:				22-37012	22-37012
Quotation No.: Q20-21666	Chemtest Sample ID.:				1514355	1514356
	Client Sample ID.:				TS1	TS2
	Sample Type:				SOIL	SOIL
	Date Sampled:				26-Sep-2022	26-Sep-2022
	Time Sampled:				12:00	12:00
	Asbestos Lab:				DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD		
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10
Naphthalene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Fluorene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	0.33	< 0.10
Pyrene	M	2700	mg/kg	0.10	0.20	< 0.10
Benzo[a]anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Chrysene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0	< 2.0	< 2.0
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10
Organic Matter BS1377	N	2930	%	0.10	5.2	4.0

Test Methods

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.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
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.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazine.
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
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.
2930	Organic Matter	Organic Matter	Acid Dichromate digestion/Titration

Report Information

Key

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

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

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

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

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

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com



Final Report

Report No.: 22-38079-1
Initial Date of Issue: 17-Oct-2022
Client Terra Firma (Wales) Ltd

Client Address: 5 Deryn Court
Wharfedale Road
Pentwyn
Cardiff
CF23 7HA

Contact(s): Michael Watkins

Project Afan Lido

Quotation No.: **Date Received:** 06-Oct-2022

Order No.: 14647-MW **Date Instructed:** 06-Oct-2022

No. of Samples: 2

Turnaround (Wkdays): 5 **Results Due:** 12-Oct-2022

Date Approved: 17-Oct-2022

Approved By:

Details: Stuart Henderson, Technical
Manager

Results - Soil

Project: Afan Lido

Client: Terra Firma (Wales) Ltd		Chemtest Job No.:			22-38079	22-38079
Quotation No.:		Chemtest Sample ID.:			1519445	1519446
		Sample Location:			TS3	TS4
		Sample Type:			SOIL	SOIL
		Date Sampled:			04-Oct-2022	04-Oct-2022
		Asbestos Lab:			DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD		
ACM Type	U	2192		N/A	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-
Moisture	N	2030	%	0.020	19	17
Soil Colour	N	2040		N/A	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones
Soil Texture	N	2040		N/A	Sand	Sand
pH	M	2010		4.0	6.8	6.7
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	1.1	0.74
Cyanide (Total)	M	2300	mg/kg	0.50	0.50	0.50
Sulphate (Acid Soluble)	U	2430	%	0.010	0.080	0.040
Arsenic	M	2455	mg/kg	0.5	7.8	5.0
Cadmium	M	2455	mg/kg	0.10	0.14	< 0.10
Chromium	M	2455	mg/kg	0.5	15	9.7
Mercury Low Level	M	2450	mg/kg	0.05	0.08	0.05
Copper	M	2455	mg/kg	0.50	13	8.6
Nickel	M	2455	mg/kg	0.50	7.5	5.3
Lead	M	2455	mg/kg	0.50	31	22
Selenium	M	2455	mg/kg	0.25	0.52	0.54
Zinc	M	2455	mg/kg	0.50	37	29
Chromium (Trivalent)	N	2490	mg/kg	1.0	15	9.7
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0

Results - Soil

Project: Afan Lido

Client: Terra Firma (Wales) Ltd	Chemtest Job No.:				22-38079	22-38079
Quotation No.:	Chemtest Sample ID.:				1519445	1519446
	Sample Location:				TS3	TS4
	Sample Type:				SOIL	SOIL
	Date Sampled:				04-Oct-2022	04-Oct-2022
	Asbestos Lab:				DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD		
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10
Naphthalene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Fluorene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Chrysene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0	< 2.0	< 2.0
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10
Organic Matter BS1377	N	2930	%	0.10	5.1	4.9

Test Methods

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.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
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.
2455	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.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
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; Dibenzo[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.
2930	Organic Matter	Organic Matter	Acid Dichromate digestion/Titration

Report Information

Key

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

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

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

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

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

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com



Final Report

Report No.:	22-37871-1		
Initial Date of Issue:	13-Oct-2022		
Client	Terra Firma (Wales) Ltd		
Client Address:	5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA		
Contact(s):	michael@terrafirmawales.co.uk		
Project	Afan Lido		
Quotation No.:	Q20-21666	Date Received:	05-Oct-2022
Order No.:	14647-MW	Date Instructed:	05-Oct-2022
No. of Samples:	4		
Turnaround (Wkdays):	5	Results Due:	11-Oct-2022
Date Approved:	13-Oct-2022		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Soil

Project: Afan Lido

Client: Terra Firma (Wales) Ltd	Chemtest Job No.:				22-37871	22-37871	22-37871	22-37871
Quotation No.: Q20-21666	Chemtest Sample ID.:				1518291	1518292	1518293	1518294
	Client Sample ID.:				SS1	SS2	SS3	SS4
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Date Sampled:				04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
	Time Sampled:				12:00	12:00	12:00	12:00
	Asbestos Lab:				NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	Accred.	SOP	Units	LOD				
ACM Type	U	2192		N/A	-	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-
Moisture	N	2030	%	0.020	7.8	7.1	5.8	5.9
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones	Stones	Stones
Soil Texture	N	2040		N/A	Sand	Sand	Sand	Sand
pH	M	2010		4.0	7.9	9.2	9.0	9.0
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	2.0	1.8	0.76	2.6
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Sulphate (Acid Soluble)	U	2430	%	0.010	0.068	0.063	0.070	0.067
Arsenic	M	2455	mg/kg	0.5	5.9	5.2	32	5.2
Cadmium	M	2455	mg/kg	0.10	1.2	0.48	0.60	0.49
Chromium	M	2455	mg/kg	0.5	76	39	50	60
Mercury Low Level	M	2450	mg/kg	0.05	0.05	< 0.05	< 0.05	< 0.05
Copper	M	2455	mg/kg	0.50	25	14	68	17
Nickel	M	2455	mg/kg	0.50	25	17	23	18
Lead	M	2455	mg/kg	0.50	42	22	32	22
Selenium	M	2455	mg/kg	0.25	0.88	0.69	0.93	0.58
Zinc	M	2455	mg/kg	0.50	170	90	120	130
Chromium (Trivalent)	N	2490	mg/kg	1.0	76	39	50	60
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	15	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	22	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	180	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	220	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	34	< 1.0

Results - Soil

Project: Afan Lido

Client: Terra Firma (Wales) Ltd	Chemtest Job No.:				22-37871	22-37871	22-37871	22-37871
Quotation No.: Q20-21666	Chemtest Sample ID.:				1518291	1518292	1518293	1518294
	Client Sample ID.:				SS1	SS2	SS3	SS4
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Date Sampled:				04-Oct-2022	04-Oct-2022	04-Oct-2022	04-Oct-2022
	Time Sampled:				12:00	12:00	12:00	12:00
	Asbestos Lab:				NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	Accred.	SOP	Units	LOD				
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	34	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	250	< 10
Naphthalene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	< 0.10	0.35	0.13	< 0.10
Pyrene	M	2700	mg/kg	0.10	< 0.10	0.32	0.11	< 0.10
Benzo[a]anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Organic Matter BS1377	N	2930	%	0.10	1.0	0.30	0.60	0.60

Test Methods

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.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
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.
2455	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.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
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; Dibenzo[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.
2930	Organic Matter	Organic Matter	Acid Dichromate digestion/Titration

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ANNEX B
Validation Photographs

SITE PHOTOGRAPHS

Photo No:	01	
Date:	06/12/22	
Description: Photograph showing no-dig barrier before capping soil is laid at plot 119.		
Photo No:	02	
Date:	06/12/22	
Description: Validation thickness of plot 118 following laying of subsoil and topsoil.		