james&nicholas

DRAINAGE STRATEGY REPORT

DRAINAGE TO PROCESSING AREA
SHREDDER PROJECT
SCRAP HANDLING FACILITY
MINERAL SITE
TREMORFA

CLIENT

Celsa Manufacturing (UK) Ltd
Building 58 Castle Works
East Moors Road
Cardiff
CF24 5NN

JOB REF	ISSUE	PREPARED BY	CHECKED BY	APPROVED BY	DATE
23.105	1	KJ	KJT	KJT	11.12.2023

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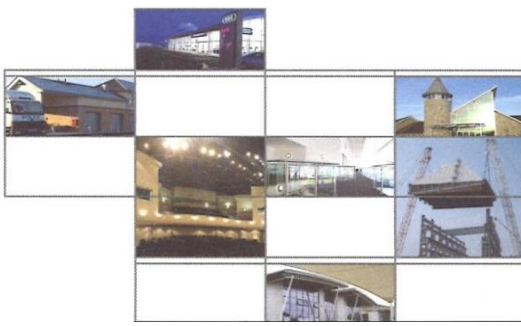

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1.0 INTRODUCTION

1.1 BACKGROUND

Celsa Manufacturing (UK) Ltd ('Celsa') are the largest manufacturer of steel reinforcement in the United Kingdom and one of the largest producers of other long-steel products.

Celsa's Cardiff facility produces circa 1.2 million tonnes of recycled steel per annum, all from recycled scrap metal.

The proposed development comprises the following: -

- Installation of two new cylindrical steel tanks and associated pumping equipment
- Installation of a new infiltrating drainage system

1.2 REFERENCES

Our proposed drainage strategy has been developed in accordance with and with reference to the following:-

- CIRIA SuDS Manual C753 published in 2015
- Sewers for Adoption 7th Edition by WRc plc
- Geotechnical Site Investigation Report by Terra Firma (Wales) Ltd ref. DE/17250/New Road and dated 8th June 2022 (copy included at Appendix A)
- Flood Consequences Assessment Report ref. JBAU-XX-XX-RP-Z-0001-S3-P01 by JBA Consulting dated June 2022.
- Guidance Note 16 Fire Prevention & Mitigation Plan Guidance – Waste Management dated August 2017 by Natural Resources Wales

1.4 DESIGNERS

Designed by:	-	Karl Jones BSc Civil Engineering (Hons) MSc
Checked by:	-	Kevin Tobin MSc DIC CEng MICE
Approved by:	-	Kevin Tobin MSc DIC CEng MICE

2.0 EXISTING SITE

2.1 SITE LOCATION

The proposed development site is located to the south of Rover Way, adjacent to Celsa's existing steelmaking facility in Tremorfa, Cardiff.

The existing site comprises approximately 15 hectares of previously-developed (brownfield) land; the site is split into two separate operations, i.e. slag processing and scrap handling.

Figure 1 – Site Location Plan (site denoted by red line)

2.2 SITE GEOLOGY

2.2.1 In the past, various site investigation works have been undertaken across the Celsa site and in connection with a variety of different construction projects; additional site investigation works were undertaken by Terra Firma (Wales) Ltd to establish infiltration rates of the existing subsoils.

The various previous site investigations carried out across the site have indicated the ground profile to comprise the following: -

- Dense to very dense made ground (0.0 m – 8.0 m)
- Very soft silty clay with bands of peat (8.0 m – 22.0 m)
- Extremely soft mudstone (22.0 m - 23.5 m)

The testing carried out by Terra Firma (Wales) Ltd as part of their site investigation confirmed infiltration rates within the made ground of between 1.17×10^{-4} m/s to 3.96×10^{-5} m/s i.e. the proposed development site appears to have a very good soakaway potential rate. A copy of Geotechnical Report ref. 17250 dated 8th June 2022 by Terra Firma (Wales) Ltd is appended (ref. Appendix A).

2.3 SITE FLOOD RISK

2.3.1 JBA Consulting were commissioned by Celsa to prepare a Flood Consequence Assessment (FCA) in accordance with Welsh Government ('WG') guidance on development and flood risk, as set out in Welsh Assembly Government Technical Advice Note 15 dated 2004.

2.3.2 The FCA (i.e. Flood Consequence Assessment report ref. JBAU-XX-XX-RP-Z-0001-S3-C01 dated May 2022 by JBA Consulting) concludes that the vast majority of the proposed development site is located in Flood Zone B with only a very limited portion falling within Flood Zone C2.

The FCA recommends that in order to manage the risk of tidal flooding, ground levels should be raised above the 2097 0.5% AEP flood level of 8.64 m AOD.

The FCA also concludes that due to the implementation of the Cardiff coastal defence, the proposed development site is expected to be flood-free for the 0.5% and 0.1% AEP events with climate change allowances for the 75-year lifetime of the development, irrespective of the proposed flood mitigation.

2.4 EXISTING DRAINAGE INFRASTRUCTURE

2.4.1 FOUL DRAINAGE

There is currently an existing consent in place for the site allowing effluent to be discharged to Dwr Cymru/Welsh Water (DCWW) mains drainage at a rate of 3.3 litres/second.

The mains drainage connection is located in the north-east corner of the site and crosses Rover Way northwards into a combined sewer located within Celsa's Tremorfa Steelworks site. This in turn discharges into the DCWW pumping station situated to the south of Rover Way and to the east of the development site.

From here it is pumped into a large (2400 mm diameter) pipe which drains under gravity to DCWW's sewerage treatment plant located adjacent to the west of Celsa's Mineral Site on Tide Fields Road. The 2400 mm diameter pipe (connecting the pumping station to the sewage treatment plant) runs across the development site parallel with and adjacent to its southern boundary (Ref. DCWW Plan ref. 321525,176305 dated 10th March 2022 – copy appended, ref. Appendix B).

2.4.2 SURFACE WATER DRAINAGE

The proposed development site is not currently served by dedicated surface water mains drainage.

The vast majority of the site is unsurfaced and therefore surface water infiltrates into the ground

The nearest surface water mains drainage comprises 2 no. DCWW sewers located to the north-east of Celsa's site entrance in Rover Way. These ultimately drain into the combined drainage system as per the foul drainage noted above.

3.0 PROPOSED SITE DRAINAGE

3.1 INTRODUCTION

Due to the nature of the site operations (i.e. storage and processing of scrap metals) an Environmental Permit is required from Natural Resources Wales (NRW). It is conditional within the Environmental Permit that areas where the processing of metals takes place must be impermeable/hard surfaced and that surface water run-off from these areas must be collected and classified as trade effluent. It is proposed therefore to provide drainage as follows:-

3.1.1 PROCESSING AREA

Any surface water falling within the processing areas will be classed as trade effluent

This area is proposed to comprise circa 22127 m^2 (2.213 ha) of concrete hardstanding which will accommodate all of the operational plant, the scrap storage areas and a small section of internal access road. It is proposed that the hardstanding will be laid to fall, draining in two directions to proprietary sealed filter strips running along the northern and southern perimeters of the hardstanding.

The proposed filter strip is a proprietary product (SDS Aqua Exchange) which is an engineered pollution-control system that uses ionic exchange and filtration to remove solid and soluble pollutants and which is particularly beneficial in areas at high risk of metals pollution. It comprises the following layers: -

Layer 1 - 500 mm wide by 500 mm thick of 20/40 mm clean stone

Layer 2 – 500 mm wide by 250 mm thick of SDS Aqua-Xchange filter media

Layer 3 – 500 mm wide by 250 mm thick of 20/40 mm clean stone

Layer 4 – 500 mm wide by 250 mm thick of SDS Aqua-Xchange filter media

Layer 5 – 500 mm wide by 545 mm thick of 20/40 mm clean stone with a 375mm perforated pipe to drain the water into a pumping chamber.

It is proposed that each layer will be separated with a layer of Terram 1000 geotextile membrane and that the entire system will be enclosed within an impermeable membrane to prevent infiltration into the surrounding ground.

It is proposed that water will be collected from the filter strips, and pumped into 2 no. 12.5 m diameter by 10.87 m high cylindrical above-ground steel storage tanks and that from the tanks it will be discharged via a sampling point into the DCWW mains drainage system utilising the existing or a modified consent at an agreed rate and attenuated (utilising the tanks to provide the required storage capacity) as required.

3.1.2 NON-PROCESSING AREA

It is proposed that any surface water that falls onto areas where metals are not processed or stored (i.e. any surface water falling onto the access roads located to the north of the processing area) to be classified as non-processed water. NRW has confirmed that surface water from these areas can be infiltrated into the ground via approved SuDS techniques

It is proposed that it will be of overall length 190 m, width of 0.5 m and depth of 1.545 m, draining into a 1.0 m wide by 0.8 m deep cellular soakaway which will sit underneath the filter strip.

The steepest gradient of 1:100 will be achieved, to ensure interception will occur.

The total amount of hardstanding to be drained is 3,900m^2.

It is proposed that the filter strip will be a complex structure made up with the following layers:

Layer 1 – 500 mm wide by 500 mm thick of 20/40 mm clean stone

Layer 2 – 500 mm wide by 250 mm thick of SDS Aqua-Xchange filter media

Layer 3 – 500 mm wide by 250 mm thick of 20/40 mm clean stone

Layer 4 – 500 mm wide by 250 mm thick of SDS Aqua-Xchange filter media

Layer 5 – 1000mm wide by 800mm deep SDS Cellular Soakaway

APPENDIX A

INFILTRATION RATES (GEOTECHNICAL REPORT BY TERRA FIRMA (WALES) LTD)

terra firma
Geotechnical & Geoenvironmental Specialists
www.terrafirmawales.co.uk

Our Ref: DE/17250/NEW ROAD

Your Ref:

Contact: David Emanuel

8th June 2022

James and Nicholas LLP

For the attn. of Mr Karl Jones (karl.jones@jamesandnicholas.com)

Dear Mr Jones

NEW ROAD, CELSA, ROVER WAY

TFW Group Limited has been retained by James and Nicholas LLP to assist with a proposed new road at CELSA, south of Rover Way, Cardiff.

In April and May 2022 TFW Group Limited attend site to perform trial pits, undertake soakage testing, undertake chemical analysis and perform Plate Load Tests.

Trial pits were performed by a 30 Tonne excavator with a toothed bucket. Despite the size of the machine excavations were often difficult on account of the ground's density. The locations of the excavations are presented in **Figure 01**.

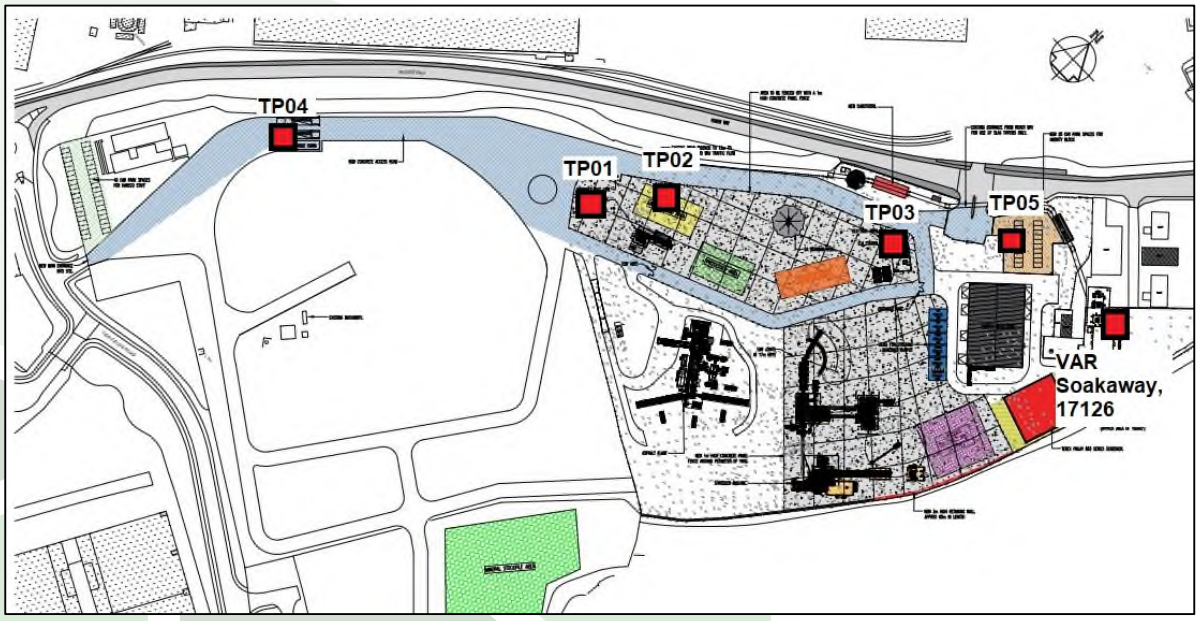


Figure 01. Trial Pit Locations (not to scale)

Ground Conditions
The ground conditions encountered are summarised in **Table 01**.

Table 01. Summary of Ground Conditions	
TP01	**GL – 0.6:** Dense to very dense, grey, slightly silty sandy GRAVEL to COBBLE including brick, metal and slag. **0.6 – 1.2:** Dense to very dense, brown, silty sandy GRAVEL to COBBLE including metal, brick and slag. Trial Pit Dry.
TP02	**GL – 0.4:** Dense to very dense, grey, silty, very sandy GRAVEL of slag **0.4 – 0.9:** Dense to very dense, dark-grey, silty sandy GRAVEL of slag. Trial Pit Dry
TP03	**GL – 0.9:** Dark-brown, silty sandy GARVEL including slag, brick, metal and plastic. Marker tape encountered at 0.9m Trial Pit Dry
TP04	**GL – 1.0:** Very dense, grey to brown, silty sandy GRAVEL to COBBLE Trial Pit Dry
TP05	**GL – 0.5:** Very dense, grey to brown, clayey/silty sandy GRAVEL to COBBLE Trial Pit Dry

In 2019 Terra Firma Wales Ltd performed three shallow and three deep boreholes at the Aggregate and Asphalt Plant (Terra Firma Wales Ltd Job Reference 15264). The approximate location of these boreholes is contained within the area marked on **Figure 02**.

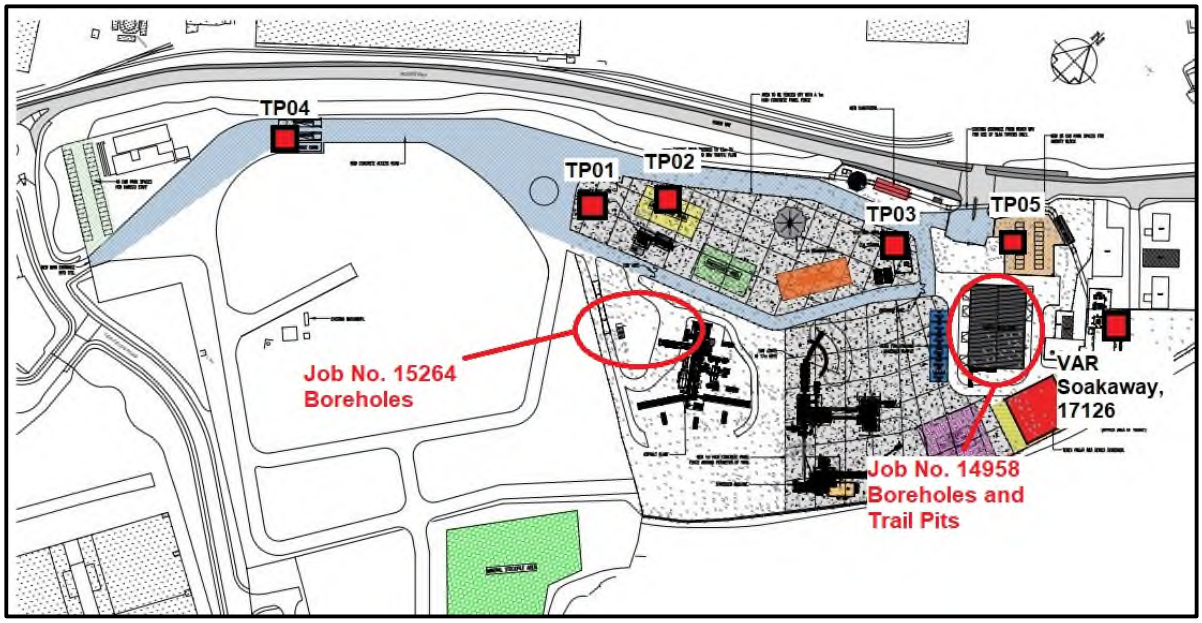


Figure 02. Approximate location of 2019 investigations (not to scale)

The Job No. 15264 boreholes encountered between 7.3m and 7.7m of made ground, recovered as grey to black, granular material including brick and concrete fragments, with traces of clay. The made ground was slow to drill on account of its density and in-situ testing recorded SPT-C Values of >50. Below the made ground, soft clay was encountered, extending to a depth of between 15.0m and 16.4m below ground level, where weathered marl was encountered.

In 2018, near the north-eastern end of the proposed road, Terra Firma Wales Ltd observed the excavation of three trial pits and six rotary boreholes (Job No. 14958). Between 4.7m and 6.5m of made ground were encountered, comprising generally dense to very dense, sandy GRAVEL to BOULDER including slag, concrete and brick. Beneath the made ground grey clay was noted with some gravels and possible channel deposits in two location (silty SAND with gravel). Basal GRAVEL was encountered at one location between 18.3m and 19.0m bgl. Weathered Marl was encountered between 17.6m and 22.3m bgl.

Soakage Tests
Recorded soakage rates are presented in **Table 02**.

Table 02. Summary of Soakage Test Results			
	TP01	**TP02**	**TP04**
Test 1	5.66×10^{-5} ms^{-1}	6.56×10^{-5} ms^{-1}	1.17×10^{-4} ms^{-1}
Test 2	4.21×10^{-5} ms^{-1}	7.39×10^{-5} ms^{-1}	1.11×10^{-4} ms^{-1}
Test 3	3.96×10^{-5} ms^{-1}	4.19×10^{-5} ms^{-1}	1.11×10^{-4} ms^{-1}

A soakaway was attempted in TP05 at 0.5m although the water level did not change over the observation period.

However, soakaways have been successfully performed at greater depth near the eastern end of the new road, at the proposed VAR Static Compensator (Terra Firma Report 17126, February 2022) where soakage rates of soakage rates of between 2.27×10^{-5} ms^{-1} and 1.76×10^{-5} ms^{-1} were recorded within the made ground in a 2.4m deep pit.

Soakaway Test Results are presented in **Annex A**.

CHEMICAL ANALYSIS

During the Investigation 6 samples were submitted for chemical analysis for a broad suite of common industrial determinants and asbestos. Four samples were also subject to volatile/semi volatile organic compounds (VOC/SVOC) analysis. Chemical test results are presented in **Annex B**.

The results of the chemical analysis are summarised in **Tables 03**, along with the published Generic Assessment Criteria for Human Health in a Commercial/Industrial setting.

Project: 17250 Celsa												
Client: Terra Firma (Wales) Ltd	Chemtest Job No.:						22-15458	22-15458	22-15458	22-15458	22-18521	22-18521
Quotation No.: Q21-24021	Chemtest Sample ID.:				Commercial/ Industrial Guidelines	Source	1418011	1418012	1418013	1418014	1431404	1431405
	Sample Location:						TP01	TP02	TP02	TP03	TP04	TP05
	Sample Type:						SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):						0.1	0	0.4	0	0.0	0.0
	Bottom Depth (m):							0.4	0.9	0.9	1.0	0.5
	Asbestos Lab:						NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	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	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A			-	-	-	-	-	-
Moisture	N	2030	%	0.020			5.1	7.6	9.4	11	7.1	7.2
Soil Colour	N	2040		N/A			Brown	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A			Stones	Stones	Stones	Stones	Stones	Stones
Soil Texture	N	2040		N/A			Sand	Sand	Sand	Sand	Gravel	Gravel
pH	M	2010		4.0			11.4	10.8	10	9.7	11.0	10.7
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	240,000		8.4	13	3.4	3	3.0	4.7
Cyanide (Total)	M	2300	mg/kg	0.50	480	CLEA (WITHDRAWN)	< 0.50	< 0.50	0.7	0.8	< 0.50	< 0.50
Sulphate (Acid Soluble)	U	2430	%	0.010			0.14	0.14	0.041	0.061	0.22	0.17
Arsenic	M	2455	mg/kg	0.5	640	S4UL	4.8	3.8	13	17	7.5	11
Cadmium	M	2455	mg/kg	0.10	190	S4UL	2.9	2.3	2.9	4.0	4.0	2.8
Chromium	M	2455	mg/kg	0.5			1200	1100	210	220	970	1000
Mercury Low Level	M	2450	mg/kg	0.05	1,100	S4UL	0.13	0.10	1.2	1.3	0.09	0.31
Copper	M	2455	mg/kg	0.50	68,000	S4UL	270	300	66	76	240	470
Nickel	M	2455	mg/kg	0.50	980	S4UL	70	61	58	66	140	230
Lead	M	2455	mg/kg	0.50	2,330	C4SL	170	83	270	350	180	370
Selenium	M	2455	mg/kg	0.25	12,000	S4UL	0.71	0.53	0.70	0.72	1.1	1.2
Zinc	M	2455	mg/kg	0.50	730,000	S4UL	1300	1100	520	720	1100	1100
Chromium (Trivalent)	N	2490	mg/kg	1.0	8600	S4UL	1200	1100	210	220	970	1000
Chromium (Hexavalent)	N	2490	mg/kg	0.50	33	S4UL	< 0.50	0.53	< 0.50	< 0.50	< 0.50	< 0.50
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	3,200	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	7,800	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	2,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	9,700	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	17	46
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	59,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	57	580
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	1,600,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	150	800
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	1,600,000	S4UL	< 1.0	< 1.0	< 1.0	66	4300	1600
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	1,600,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0			< 5.0	< 5.0	< 5.0	66	4500	3000
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	26,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	56,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	3,500	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	16,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	36,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	65
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	28,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	52	88
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	28,000	S4UL	< 1.0	< 1.0	< 1.0	180	170	380
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	28,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	17	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0			< 5.0	< 5.0	< 5.0	180	240	530
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0			< 10	< 10	< 10	240	4700	3600
Naphthalene	M	2700	mg/kg	0.10	190	S4UL	< 0.10	< 0.10	4	5.2	< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	83,000	S4UL	< 0.10	< 0.10	0.67	0.88	< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10	84,000	S4UL	< 0.10	< 0.10	0.75	0.67	< 0.10	< 0.10
Fluorene	M	2700	mg/kg	0.10	63,000	S4UL	< 0.10	< 0.10	0.71	0.41	< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	22,000	S4UL	< 0.10	< 0.10	3	1.5	< 0.10	< 0.10
Anthracene	M	2700	mg/kg	0.10	520,000	S4UL	< 0.10	< 0.10	0.65	0.31	< 0.10	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	23,000	S4UL	0.78	< 0.10	4.2	2.1	0.58	0.38
Pyrene	M	2700	mg/kg	0.10	54,000	S4UL	0.89	< 0.10	4.5	2.5	0.72	3.5
Benzo[a]anthracene	M	2700	mg/kg	0.10	170	S4UL	< 0.10	< 0.10	2.9	1.3	< 0.10	2.8
Chrysene	M	2700	mg/kg	0.10	350	S4UL	< 0.10	< 0.10	4.1	2.5	< 0.10	6.2
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	44	S4UL	< 0.10	< 0.10	4.3	2.3	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	1,200	S4UL	< 0.10	< 0.10	1.8	1.1	< 0.10	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10	35	S4UL	< 0.10	< 0.10	3.2	1.9	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	500	S4UL	< 0.10	< 0.10	2.2	1.3	< 0.10	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	3.5	S4UL	< 0.10	< 0.10	0.59	0.4	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	3,900	S4UL	< 0.10	< 0.10	2.3	1.5	< 0.10	< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0			< 2.0	< 2.0	40	26	< 2.0	13

Table 03. Summary of Soil Chemical Testing and Commercial GACs

During VOC/SVOC testing only benzene, toluene, ethyl-benzene, xylene and selected PAH species were detected and these were at concentration significantly below the corresponding GACs. All other determinants tested were either not detected or at concentrations below their corresponding Generic Assessment Criteria for an industrial setting.

Asbestos was not detected during screening.

GEOTECHNICAL TESTING

Two samples of slag were submitted to GSTL to assess swelling potential via their in-house method. Volume changes of between 0.05% and 0.07% were recorded, which would be considered insignificant. The results of the geotechnical testing are presented in **Annex C**.

On 27th April 2022, 5 No. Plate Load Tests were performed along the route of the proposed road using a 600mm plate. The applied load was taken to 300 kN/m^2 and the process included an off-load/reload cycle. The location of the Plate Load Tests are presented in **Figure 03** and the results of the tests are summarised in **Table 06**.

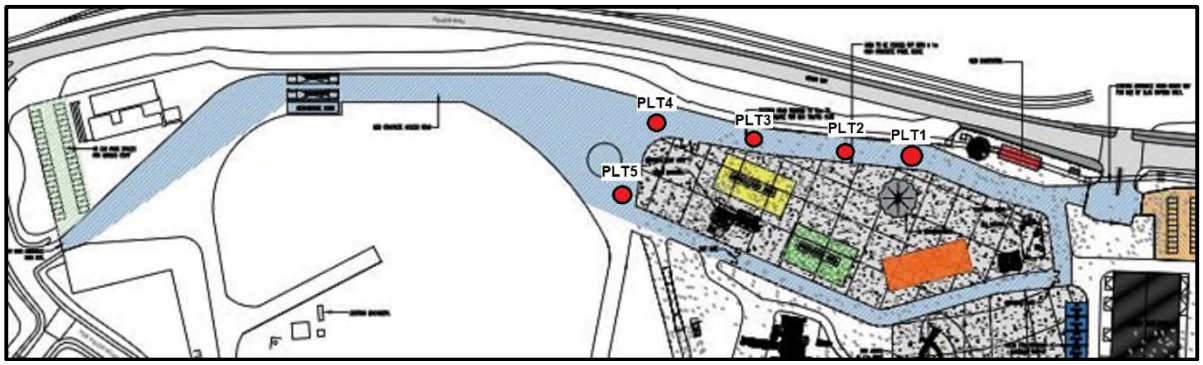


Figure 03. Location of Plate Load Tests

Table 06. Results of Plate Load Tests	
Location	**Average Plate Settlement after 2nd Load Cycle at 300kN/m^2 (mm)**
PLT 1	0.90
PLT 2	0.30
PLT 3	0.46
PLT 4	1.36
PLT 5	0.83

Plate Load Test Results are presented in **Annex C**.

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: Terra Firma (Wales) Ltd

Mr D Emanuel

Annex A
Soakage Test Results

Terra Firma (Wales) Ltd. 5 Deryn Court, Wharfedale Road, Pentwyn, Cardiff CF23 7HA
Tel: 029 2073 5354 **Fax:** 029 2073 5433 **Email:** info@terrafirmawales.co.uk **www.terrafirmawales.co.uk**
Registered in Wales No. 4013230. VAT No: 753 2566 25. Registered Office: 5 Deryn Court, Wharfedale Road, Pentwyn, Cardiff CF23 7HA

SOAKAWAY TEST

terra firma
Geotechnical & Geoenvironmental Specialists

Site Name: CELSA New Road
Project Number: 17250
Date: 26/04/2022
Engineer: DE

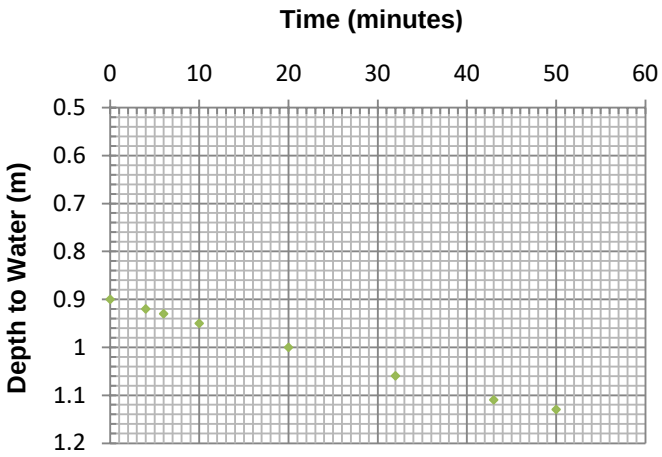
Trial Pit: **TP01**

TEST 1

Length	2.00	m
Bredth	2.00	m
Depth	1.20	m
Fill Level	0.90	m

V_{p75-25}	0.6	m^3
a_{p50}	5.2	m^2
t_{p75-25}	34	minutes

Soil Infiltration Rate, f **5.66E-05** **ms^{-1}**

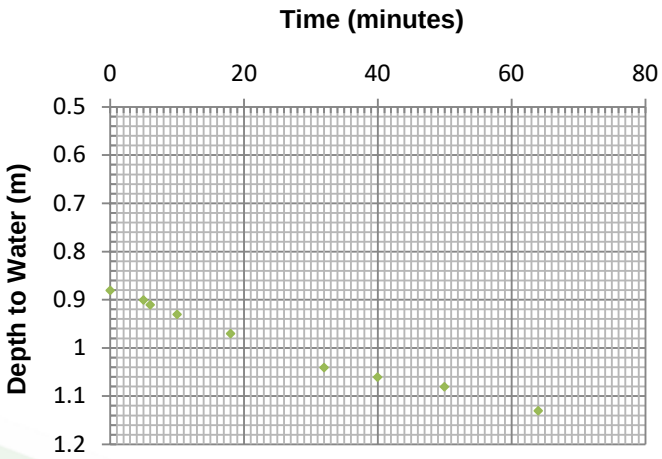


TEST 2

Length	2.00	m
Bredth	2.00	m
Depth	1.20	m
Fill Level	0.88	m

V_{p75-25}	0.64	m^3
a_{p50}	5.28	m^2
t_{p75-25}	48	minutes

Soil Infiltration Rate, f **4.21E-05** **ms^{-1}**

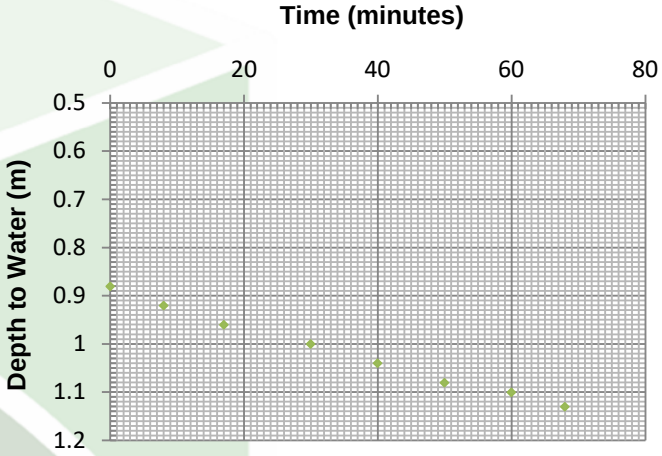


TEST 3

Length	2.00	m
Bredth	2.00	m
Depth	1.20	m
Fill Level	0.88	m

V_{p75-25}	0.64	m^3
a_{p50}	5.28	m^2
t_{p75-25}	51	minutes

Soil Infiltration Rate, f **3.96E-05** **ms^{-1}**



REMARKS:
Test carried out in accordance with BRE Digest 365 (2016)

SOAKAWAY TEST

terra firma
Geotechnical & Geoenvironmental Specialists

Site Name: CELSA New Road
Project Number: 17250
Date: 26/04/2022
Engineer: DE

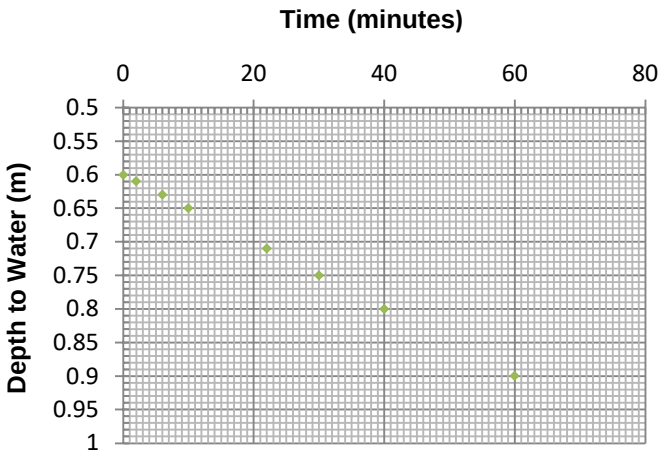
Trial Pit: **TP02**

TEST 1

Length	2.00	m
Bredth	2.50	m
Depth	0.90	m
Fill Level	0.60	m

V_{p75-25}	0.75	m^3
a_{p50}	6.35	m^2
t_{p75-25}	30	minutes

Soil Infiltration Rate, f **6.56E-05** **ms^{-1}**

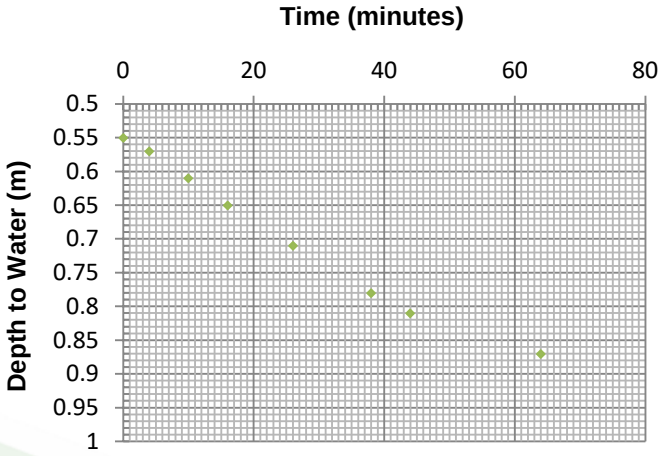


TEST 2

Length	2.00	m
Bredth	2.50	m
Depth	0.90	m
Fill Level	0.55	m

V_{p75-25}	0.875	m^3
a_{p50}	6.575	m^2
t_{p75-25}	30	minutes

Soil Infiltration Rate, f **7.39E-05** **ms^{-1}**

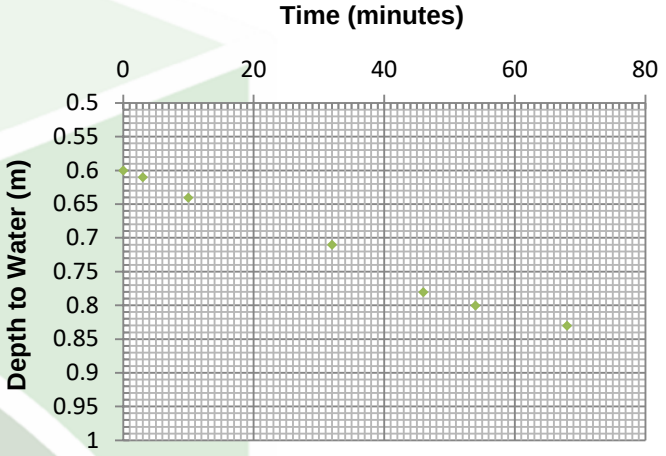


TEST 3

Length	2.00	m
Bredth	2.50	m
Depth	0.90	m
Fill Level	0.60	m

V_{p75-25}	0.75	m^3
a_{p50}	6.35	m^2
t_{p75-25}	47	minutes

Soil Infiltration Rate, f **4.19E-05** **ms^{-1}**



REMARKS:
Test carried out in accordance with BRE Digest 365 (2016)

SOAKAWAY TEST

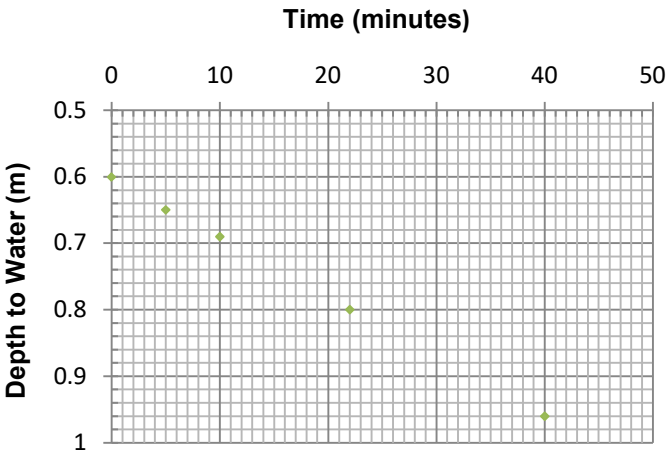
terra firma
Geotechnical & Geoenvironmental Specialists

Site Name: CELSA New Road
Project Number: 17250
Date: 17/05/2022
Engineer: DE

Trial Pit: **TP04**

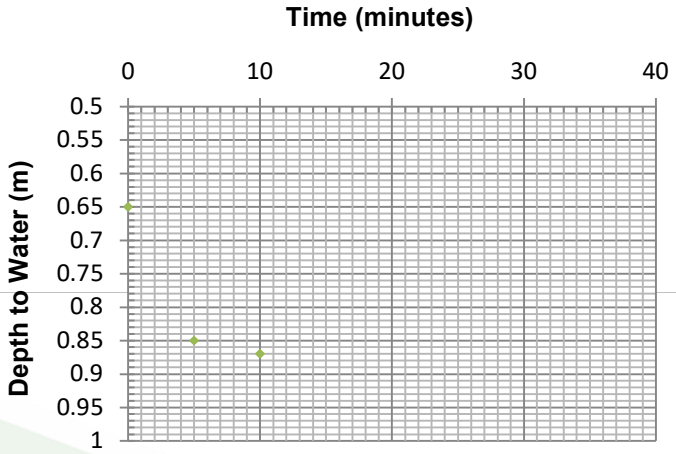
TEST 1

Length	2.00	m
Bredth	2.50	m
Depth	1.00	m
Fill Level	0.60	m
V_{p75-25}	1	m^3
a_{p50}	6.8	m^2
t_{p75-25}	21	minutes
Soil Infiltration Rate, f	**1.17E-04**	**ms^{-1}**



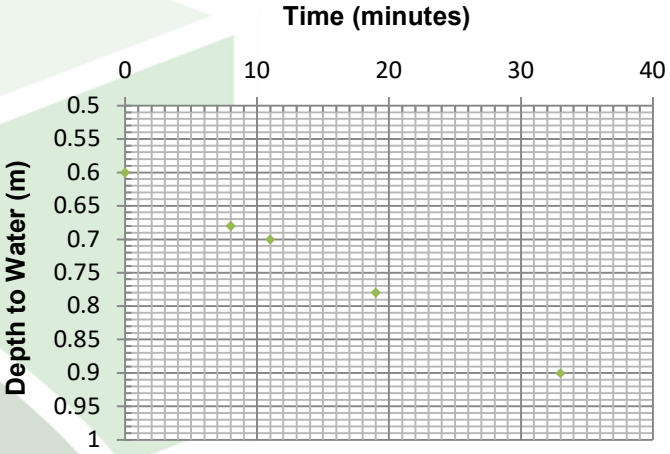
TEST 2

Length	2.00	m
Bredth	2.50	m
Depth	1.00	m
Fill Level	0.65	m
V_{p75-25}	0.875	m^3
a_{p50}	6.575	m^2
t_{p75-25}	20	minutes
Soil Infiltration Rate, f	**1.11E-04**	**ms^{-1}**



TEST 3

Length	2.00	m
Bredth	2.50	m
Depth	1.00	m
Fill Level	0.60	m
V_{p75-25}	1	m^3
a_{p50}	6.8	m^2
t_{p75-25}	22	minutes
Soil Infiltration Rate, f	**1.11E-04**	**ms^{-1}**



REMARKS:
Test carried out in accordance with BRE Digest 365 (2016)

Annex B
Chemical Test Results

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

Final Report

Report No.:	22-15458-1		
Initial Date of Issue:	03-May-2022		
Client	Terra Firma (Wales) Ltd		
Client Address:	5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA		
Contact(s):	Dave Emanuel		
Project	17250 Celsa		
Quotation No.:	Q21-24021	**Date Received:**	27-Apr-2022
Order No.:		**Date Instructed:**	27-Apr-2022
No. of Samples:	4		
Turnaround (Wkdays):	5	**Results Due:**	04-May-2022
Date Approved:	03-May-2022		

Approved By:

Details: Stuart Henderson, Technical Manager

Results - Soil

Project: 17250 Celsa

Client: Terra Firma (Wales) Ltd		**Chemtest Job No.:**			22-15458	22-15458	22-15458	22-15458
Quotation No.: Q21-24021		**Chemtest Sample ID.:**			1418011	1418012	1418013	1418014
		Sample Location:			TP01	TP02	TP02	TP03
		Sample Type:			SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			0.1	0	0.4	0
		Bottom Depth (m):				0.4	0.9	0.9
		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	5.1	7.6	9.4	11
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	[A] 11.4	[A] 10.8	[A] 10.0	[A] 9.7
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	[A] 8.4	[A] 13	[A] 3.4	[A] 3.0
Cyanide (Total)	M	2300	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] 0.70	[A] 0.80
Sulphate (Acid Soluble)	U	2430	%	0.010	[A] 0.14	[A] 0.14	[A] 0.041	[A] 0.061
Arsenic	M	2455	mg/kg	0.5	4.8	3.8	13	17
Cadmium	M	2455	mg/kg	0.10	2.9	2.3	2.9	4.0
Chromium	M	2455	mg/kg	0.5	1200	1100	210	220
Mercury Low Level	M	2450	mg/kg	0.05	0.13	0.10	1.2	1.3
Copper	M	2455	mg/kg	0.50	270	300	66	76
Nickel	M	2455	mg/kg	0.50	70	61	58	66
Lead	M	2455	mg/kg	0.50	170	83	270	350
Selenium	M	2455	mg/kg	0.25	0.71	0.53	0.70	0.72
Zinc	M	2455	mg/kg	0.50	1300	1100	520	720
Chromium (Trivalent)	N	2490	mg/kg	1.0	1200	1100	210	220
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	0.53	< 0.50	< 0.50
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] 66
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] 66
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] 180

Results - Soil

Project: 17250 Celsa

Client: Terra Firma (Wales) Ltd		**Chemtest Job No.:**			22-15458	22-15458	22-15458	22-15458
Quotation No.: Q21-24021		**Chemtest Sample ID.:**			1418011	1418012	1418013	1418014
		Sample Location:			TP01	TP02	TP02	TP03
		Sample Type:			SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			0.1	0	0.4	0
		Bottom Depth (m):				0.4	0.9	0.9
		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	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] 180
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	[A] < 10	[A] < 10	[A] < 10	[A] 240
Naphthalene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 4.0	[A] 5.2
Acenaphthylene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 0.67	[A] 0.88
Acenaphthene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 0.75	[A] 0.67
Fluorene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 0.71	[A] 0.41
Phenanthrene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 3.0	[A] 1.5
Anthracene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 0.65	[A] 0.31
Fluoranthene	M	2700	mg/kg	0.10	[A] 0.78	[A] < 0.10	[A] 4.2	[A] 2.1
Pyrene	M	2700	mg/kg	0.10	[A] 0.89	[A] < 0.10	[A] 4.5	[A] 2.5
Benzo[a]anthracene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 2.9	[A] 1.3
Chrysene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 4.1	[A] 2.5
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 4.3	[A] 2.3
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 1.8	[A] 1.1
Benzo[a]pyrene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 3.2	[A] 1.9
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 2.2	[A] 1.3
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 0.59	[A] 0.40
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 2.3	[A] 1.5
Total Of 16 PAH's	M	2700	mg/kg	2.0	[A] < 2.0	[A] < 2.0	[A] 40	[A] 26
Dichlorodifluoromethane	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Chloromethane	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Vinyl Chloride	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Bromomethane	M	2760	µg/kg	20	[A] < 20	[A] < 20	[A] < 20	[A] < 20
Chloroethane	U	2760	µg/kg	2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0
Trichlorofluoromethane	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,1-Dichloroethene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Trans 1,2-Dichloroethene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,1-Dichloroethane	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
cis 1,2-Dichloroethene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Bromochloromethane	U	2760	µg/kg	5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0
Trichloromethane	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,1,1-Trichloroethane	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Tetrachloromethane	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,1-Dichloropropene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Benzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] 7.1
1,2-Dichloroethane	M	2760	µg/kg	2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0
Trichloroethene	N	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,2-Dichloropropane	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0

Results - Soil

Project: 17250 Celsa

Client: Terra Firma (Wales) Ltd		**Chemtest Job No.:**			22-15458	22-15458	22-15458	22-15458
Quotation No.: Q21-24021		**Chemtest Sample ID.:**			1418011	1418012	1418013	1418014
			Sample Location:		TP01	TP02	TP02	TP03
			Sample Type:		SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.1	0	0.4	0
			Bottom Depth (m):			0.4	0.9	0.9
			Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Dibromomethane	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Bromodichloromethane	M	2760	µg/kg	5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0
cis-1,3-Dichloropropene	N	2760	µg/kg	10	[A] < 10	[A] < 10	[A] < 10	[A] < 10
Toluene	M	2760	µg/kg	1.0	[A] 1.7	[A] < 1.0	[A] < 1.0	[A] 5.5
Trans-1,3-Dichloropropene	N	2760	µg/kg	10	[A] < 10	[A] < 10	[A] < 10	[A] < 10
1,1,2-Trichloroethane	M	2760	µg/kg	10	[A] < 10	[A] < 10	[A] < 10	[A] < 10
Tetrachloroethene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,3-Dichloropropane	U	2760	µg/kg	2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0
Dibromochloromethane	U	2760	µg/kg	10	[A] < 10	[A] < 10	[A] < 10	[A] < 10
1,2-Dibromoethane	M	2760	µg/kg	5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0
Chlorobenzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,1,1,2-Tetrachloroethane	M	2760	µg/kg	2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0
Ethylbenzene	M	2760	µg/kg	1.0	[A] 1.3	[A] < 1.0	[A] < 1.0	[A] 1.4
m & p-Xylene	M	2760	µg/kg	1.0	[A] 2.9	[A] < 1.0	[A] < 1.0	[A] 6.4
o-Xylene	M	2760	µg/kg	1.0	[A] 1.3	[A] < 1.0	[A] < 1.0	[A] 1.8
Styrene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Tribromomethane	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Isopropylbenzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Bromobenzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,2,3-Trichloropropane	N	2760	µg/kg	50	[A] < 50	[A] < 50	[A] < 50	[A] < 50
N-Propylbenzene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
2-Chlorotoluene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,3,5-Trimethylbenzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
4-Chlorotoluene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Tert-Butylbenzene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,2,4-Trimethylbenzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Sec-Butylbenzene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,3-Dichlorobenzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
4-Isopropyltoluene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,4-Dichlorobenzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
N-Butylbenzene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,2-Dichlorobenzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,2-Dibromo-3-Chloropropane	U	2760	µg/kg	50	[A] < 50	[A] < 50	[A] < 50	[A] < 50
1,2,4-Trichlorobenzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Hexachlorobutadiene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,2,3-Trichlorobenzene	U	2760	µg/kg	2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
N-Nitrosodimethylamine	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Phenol	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50

Results - Soil

Project: 17250 Celsa

Client: Terra Firma (Wales) Ltd			**Chemtest Job No.:**		22-15458	22-15458	22-15458	22-15458
Quotation No.: Q21-24021			**Chemtest Sample ID.:**		1418011	1418012	1418013	1418014
			Sample Location:		TP01	TP02	TP02	TP03
			Sample Type:		SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.1	0	0.4	0
			Bottom Depth (m):			0.4	0.9	0.9
			Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
2-Chlorophenol	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Bis-(2-Chloroethyl)Ether	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
1,3-Dichlorobenzene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
1,4-Dichlorobenzene	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
1,2-Dichlorobenzene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2-Methylphenol	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Bis(2-Chloroisopropyl)Ether	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Hexachloroethane	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
N-Nitrosodi-n-propylamine	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
4-Methylphenol	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Nitrobenzene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Isophorone	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2-Nitrophenol	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2,4-Dimethylphenol	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Bis(2-Chloroethoxy)Methane	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2,4-Dichlorophenol	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
1,2,4-Trichlorobenzene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Naphthalene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
4-Chloroaniline	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Hexachlorobutadiene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
4-Chloro-3-Methylphenol	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2-Methylnaphthalene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
4-Nitrophenol	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Hexachlorocyclopentadiene	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2,4,6-Trichlorophenol	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2,4,5-Trichlorophenol	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2-Chloronaphthalene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2-Nitroaniline	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Acenaphthylene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Dimethylphthalate	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2,6-Dinitrotoluene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Acenaphthene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
3-Nitroaniline	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Dibenzofuran	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
4-Chlorophenylphenylether	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2,4-Dinitrotoluene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Fluorene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Diethyl Phthalate	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
4-Nitroaniline	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50

Results - Soil

Project: 17250 Celsa

Client: Terra Firma (Wales) Ltd		**Chemtest Job No.:**			22-15458	22-15458	22-15458	22-15458
Quotation No.: Q21-24021		**Chemtest Sample ID.:**			1418011	1418012	1418013	1418014
			Sample Location:		TP01	TP02	TP02	TP03
			Sample Type:		SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.1	0	0.4	0
			Bottom Depth (m):			0.4	0.9	0.9
			Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
2-Methyl-4,6-Dinitrophenol	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Azobenzene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
4-Bromophenylphenyl Ether	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Hexachlorobenzene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Pentachlorophenol	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Phenanthrene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 1.1
Anthracene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Carbazole	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Di-N-Butyl Phthalate	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Fluoranthene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 1.9
Pyrene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 1.6
Butylbenzyl Phthalate	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Benzo[a]anthracene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 1.3
Chrysene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 1.3
Bis(2-Ethylhexyl)Phthalate	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Di-N-Octyl Phthalate	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Benzo[b]fluoranthene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 1.7
Benzo[k]fluoranthene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 0.56
Benzo[a]pyrene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 1.3
Indeno(1,2,3-c,d)Pyrene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 0.99
Dibenz(a,h)Anthracene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Benzo[g,h,i]perylene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 1.1
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Organic Matter BS1377	N	2930	%	0.10	[A] 0.90	[A] 1.6	[A] 0.30	[A] 3.3

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:
1418011			TP01		A	Amber Glass 250ml
1418011			TP01		A	Plastic Tub 500g
1418012			TP02		A	Amber Glass 250ml
1418012			TP02		A	Plastic Tub 500g
1418013			TP02		A	Amber Glass 250ml
1418013			TP02		A	Plastic Tub 500g
1418014			TP03		A	Amber Glass 250ml
1418014			TP03		A	Plastic Tub 500g

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	Allkaline 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-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; 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)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2790	Semi-Volatile Organic Compounds (SVOCs) in Soils by GC-MS	Semi-volatile organic compounds(cf. USEPA Method 8270)	Acetone/Hexane extraction / GC-MS
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

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

Final Report

Report No.:	22-15463-1		
Initial Date of Issue:	06-May-2022		
Client	Terra Firma (Wales) Ltd		
Client Address:	5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA		
Contact(s):	Jamie Alderman		
Project	17250 Celsa		
Quotation No.:	Q21-24021	**Date Received:**	27-Apr-2022
Order No.:		**Date Instructed:**	27-Apr-2022
No. of Samples:	3		
Turnaround (Wkdays):	7	**Results Due:**	06-May-2022
Date Approved:	06-May-2022		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - 2 Stage WAC

Project: 17250 Celsa

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	22-15463								
Chemtest Sample ID:	1418022								
Sample Ref:									
Sample ID:									
Sample Location:	TP01								
Top Depth(m):	0.1								
Bottom Depth(m):									
Sampling Date:									
Determinand	**SOP**	**Accred.**	**Units**				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%			[A] 0.72	3	5	6
Loss On Ignition	2610	M	%			2.6	--	--	10
Total BTEX	2760	M	mg/kg			[A] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg			0.16	1	--	--
TPH Total WAC (Mineral Oil)							500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			< 2.0	100	--	--
pH	2010	M				12.0	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.56	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0003	0.0002	0.0007	0.0023	0.5	2	25
Barium	1455	U	5.9	2.4	12	27	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	0.030	0.027	0.060	0.27	0.5	10	70
Copper	1455	U	0.030	0.013	0.061	0.021	2	50	100
Mercury	1455	U	0.00009	0.00016	0.00018	0.0015	0.01	0.2	2
Molybdenum	1455	U	0.11	0.071	0.22	0.73	0.5	10	30
Nickel	1455	U	0.0012	0.0007	0.0025	0.0076	0.4	10	40
Lead	1455	U	0.0070	0.0064	0.014	0.064	0.5	10	50
Antimony	1455	U	0.0012	0.0020	0.0024	0.020	0.06	0.7	5
Selenium	1455	U	0.0037	0.0028	0.0074	0.029	0.1	0.5	7
Zinc	1455	U	0.038	0.019	0.076	0.20	4	50	200
Chloride	1220	U	64	29	130	310	800	15000	25000
Fluoride	1220	U	2.2	2.2	4.4	22	10	150	500
Sulphate	1220	U	< 1.0	10	< 10	94	1000	20000	50000
Total Dissolved Solids	1020	N	1900	1500	3900	15000	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	10	3.5	< 50	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	6.8

Leachate Test Information	
Leachant volume 1st extract/l	0.337
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.112

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - 2 Stage WAC

Project: 17250 Celsa

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	22-15463								
Chemtest Sample ID:	1418023								
Sample Ref:									
Sample ID:									
Sample Location:	TP02								
Top Depth(m):	0								
Bottom Depth(m):	0.4								
Sampling Date:									
Determinand	**SOP**	**Accred.**	**Units**				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%			[A] < 0.20	3	5	6
Loss On Ignition	2610	M	%			0.85	--	--	10
Total BTEX	2760	M	mg/kg			[A] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg			< 0.10	1	--	--
TPH Total WAC (Mineral Oil)							500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			< 2.0	100	--	--
pH	2010	M				10.8	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.23	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0003	0.0002	0.0006	0.0024	0.5	2	25
Barium	1455	U	1.1	0.74	2.1	8.0	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	0.046	0.017	0.092	0.22	0.5	10	70
Copper	1455	U	0.026	0.010	0.053	0.049	2	50	100
Mercury	1455	U	0.00092	0.00039	0.0018	0.0048	0.01	0.2	2
Molybdenum	1455	U	0.17	0.048	0.34	0.70	0.5	10	30
Nickel	1455	U	0.0007	< 0.0005	0.0013	0.0012	0.4	10	40
Lead	1455	U	0.0020	0.0010	0.0040	0.011	0.5	10	50
Antimony	1455	U	0.0015	0.0022	0.0030	0.021	0.06	0.7	5
Selenium	1455	U	0.0055	0.0026	0.011	0.031	0.1	0.5	7
Zinc	1455	U	0.006	0.003	0.012	0.036	4	50	200
Chloride	1220	U	8.1	1.7	16	28	800	15000	25000
Fluoride	1220	U	2.0	1.5	4.0	16	10	150	500
Sulphate	1220	U	28	25	56	260	1000	20000	50000
Total Dissolved Solids	1020	N	12000	490	24000	25000	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	4.5	2.6	< 50	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	8.0

Leachate Test Information	
Leachant volume 1st extract/l	0.335
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.303

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - 2 Stage WAC

Project: 17250 Celsa

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	22-15463								
Chemtest Sample ID:	1418024								
Sample Ref:									
Sample ID:									
Sample Location:	TP03								
Top Depth(m):	0								
Bottom Depth(m):	0.9								
Sampling Date:									
Determinand	**SOP**	**Accred.**	**Units**				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%			[A] 36	3	5	6
Loss On Ignition	2610	M	%			10	--	--	10
Total BTEX	2760	M	mg/kg			[A] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg			0.25	1	--	--
TPH Total WAC (Mineral Oil)							500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			24	100	--	--
pH	2010	M				9.1	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.015	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0085	0.0077	0.017	0.079	0.5	2	25
Barium	1455	U	0.067	0.038	0.13	0.43	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	0.0048	0.023	0.0095	0.20	0.5	10	70
Copper	1455	U	0.0042	0.0040	0.0084	0.0080	2	50	100
Mercury	1455	U	0.00015	0.00010	0.00030	0.0011	0.01	0.2	2
Molybdenum	1455	U	0.077	0.017	0.15	0.27	0.5	10	30
Nickel	1455	U	0.0024	0.0029	0.0048	0.028	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.5	10	50
Antimony	1455	U	0.0083	0.0046	0.017	0.052	0.06	0.7	5
Selenium	1455	U	0.0031	0.0026	0.0061	0.027	0.1	0.5	7
Zinc	1455	U	< 0.003	0.079	< 0.003	0.66	4	50	200
Chloride	1220	U	6.1	20	12	180	800	15000	25000
Fluoride	1220	U	0.57	0.34	1.1	3.8	10	150	500
Sulphate	1220	U	71	19	140	280	1000	20000	50000
Total Dissolved Solids	1020	N	260	130	520	1500	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	12	5.7	< 50	67	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	8.1

Leachate Test Information	
Leachant volume 1st extract/l	0.335
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.296

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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:
1418022			TP01		A	Amber Glass 250ml
1418022			TP01		A	Plastic Tub 500g
1418023			TP02		A	Amber Glass 250ml
1418023			TP02		A	Plastic Tub 500g
1418024			TP03		A	Amber Glass 250ml
1418024			TP03		A	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
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.
1455	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).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
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
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
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)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge
650	Characterisation of Waste (Leaching WAC)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

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

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

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

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

Sample Deviation Codes

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

Sample Retention and Disposal

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

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

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

Final Report

Report No.:	22-18521-1
Initial Date of Issue:	25-May-2022
Client	Terra Firma (Wales) Ltd
Client Address:	5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA
Contact(s):	Dave Emanuel
Project	17250 CELSA

Quotation No.:		**Date Received:**	19-May-2022
Order No.:		**Date Instructed:**	19-May-2022
No. of Samples:	2		
Turnaround (Wkdays):	5	**Results Due:**	25-May-2022
Date Approved:	25-May-2022		

Approved By:

Details: Stuart Henderson, Technical Manager

Results - Soil

Project: 17250 CELSA

Client: Terra Firma (Wales) Ltd			**Chemtest Job No.:**		22-18521	22-18521
Quotation No.:			**Chemtest Sample ID.:**		1431404	1431405
			Sample Location:		TP04	TP05
			Sample Type:		SOIL	SOIL
			Top Depth (m):		0.0	0.0
			Bottom Depth (m):		1.0	0.5
			Date Sampled:		17-May-2022	17-May-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	7.1	7.2
Soil Colour	N	2040		N/A	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones
Soil Texture	N	2040		N/A	Gravel	Gravel
pH	M	2010		4.0	11.0	10.7
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	3.0	4.7
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50
Sulphate (Acid Soluble)	U	2430	%	0.010	0.22	0.17
Arsenic	M	2455	mg/kg	0.5	7.5	11
Cadmium	M	2455	mg/kg	0.10	4.0	2.8
Chromium	M	2455	mg/kg	0.5	970	1000
Mercury Low Level	M	2450	mg/kg	0.05	0.09	0.31
Copper	M	2455	mg/kg	0.50	240	470
Nickel	M	2455	mg/kg	0.50	140	230
Lead	M	2455	mg/kg	0.50	180	370
Selenium	M	2455	mg/kg	0.25	1.1	1.2
Zinc	M	2455	mg/kg	0.50	1100	1100
Chromium (Trivalent)	N	2490	mg/kg	1.0	970	1000
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	17	46
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	57	580
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	150	800
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	4300	1600
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	4500	3000
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	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	65
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	52	88

Results - Soil

Project: 17250 CELSA

Client: Terra Firma (Wales) Ltd		**Chemtest Job No.:**			22-18521	22-18521
Quotation No.:		**Chemtest Sample ID.:**			1431404	1431405
		Sample Location:			TP04	TP05
		Sample Type:			SOIL	SOIL
		Top Depth (m):			0.0	0.0
		Bottom Depth (m):			1.0	0.5
		Date Sampled:			17-May-2022	17-May-2022
		Asbestos Lab:			DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	170	380
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	17	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	240	530
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	4700	3600
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	0.58	0.38
Pyrene	M	2700	mg/kg	0.10	0.72	3.5
Benzo[a]anthracene	M	2700	mg/kg	0.10	< 0.10	2.8
Chrysene	M	2700	mg/kg	0.10	< 0.10	6.2
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	13
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10
Organic Matter BS1377	N	2930	%	0.10	2.0	3.4

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	Allkaline 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-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; 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

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SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
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I/S	Insufficient Sample
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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

Annex C
Geotechnical Test Results

Laboratory Report

2788

GEO Site & Testing Services Ltd

Contract Number: 59304

Client Ref:
Client PO:

Report Date: **22-05-2022**

Client **Terrafirma Wales Ltd**
5 Deryn Court
Wharfedale Road
Pentwyn
Cardiff
CF23 7HB

Contract Title: **CELSA**
For the attention of: **David Emanuel**

Date Received: **28-04-2022**
Date Completed: **22-05-2022**

Test Description	Qty
Determination of the Swelling Potential of Fill Material (Rapid Slag Expansion Test) In House Test Method DIHM 003 - @ Non Accredited Test	2
Disposal of samples for job	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

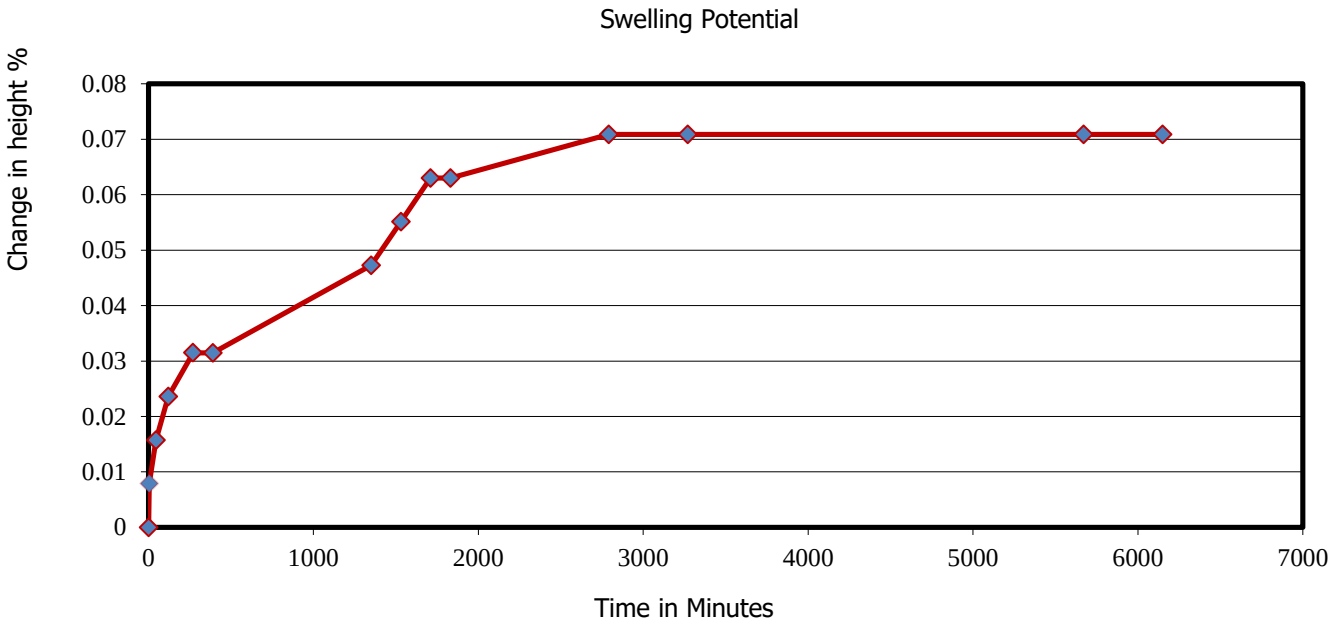
Approved Signatories:
Emma Sharp (Business Support Manager) - Paul Evans (Director) - Richard John (Quality/Technical Manager)
Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager) - Wayne Honey (Quality Assistant / Administrator / Health and Safety Coordinator)

GEO Site & Testing Services Ltd
Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk

Test Report: **Determination of the Swelling Potential of Fill Material. Rapid Assessment, In house Method**

Client:	Terra Firma Wales
Client ref:	Unknown
Location:	CELSA
Contract Number:	59304
Date Test Started:	09/05/22
Sample Number:	TP01
Depth (m) :	0.40-0.90m
Tested By:	Conal Aliffe
Description:	Black gravelly silty ASHFILL/SLAG

INITIAL CONDITIONS.		**FINAL CONDITIONS.**	
Initial Height - mm:	127.00	Final Height - mm:	127.09
Moisture Content - %:	8.5	Moisture Content - %:	9
Bulk Density - Mg/m3:	1.89	Bulk Density - Mg/m3:	1.91
Dry Density - Mg/m3:	1.74	Dry Density - Mg/m3:	1.74
Test Temperature C°:	90		



Swelling after 96 Hours -%
0.07

For and behalf of GEO Site & Testing Services Ltd

Remarks:

Authorised By:
Richard John (Quality/Technical Manager)

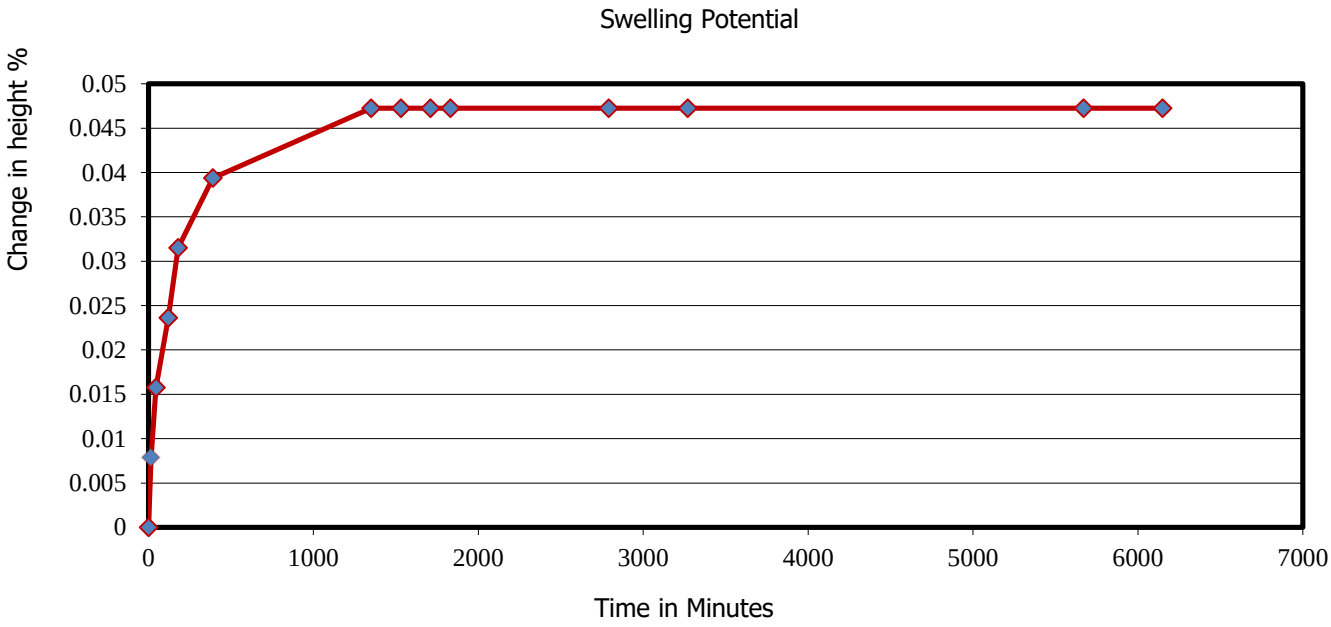
GSTL
GEO SITE & TESTING SERVICES LTD

Date: 22.5.22

Test Report: **Determination of the Swelling Potential of Fill Material. Rapid Assessment, In house Method**

Client:	Terra Firma Wales
Client ref:	Unknown
Location:	CELSA
Contract Number:	59304
Date Test Started:	09/05/22
Sample Number:	TP02
Depth (m) :	0.60-1.20m
Tested By:	Conal Aliffe
Description:	Black gravelly silty ASHFILL/SLAG

INITIAL CONDITIONS.		**FINAL CONDITIONS.**	
Initial Height - mm:	127.00	Final Height - mm:	127.06
Moisture Content - %:	11.9	Moisture Content - %:	13
Bulk Density - Mg/m3:	1.88	Bulk Density - Mg/m3:	1.91
Dry Density - Mg/m3:	1.68	Dry Density - Mg/m3:	1.68
Test Temperature C°:	90		



Swelling after 96 Hours -%
0.05

For and behalf of GEO Site & Testing Services Ltd

Remarks:

Authorised By:
Richard John (Quality/Technical Manager)

GSTL
GEO SITE & TESTING SERVICES LTD

Date: 22.5.22

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Data

Contract: Celsa, Rover Way, Cardiff | Date: 27.04.22

Test Reference: Test 1 | Test Depth: Surface | Plate Diameter: 600mm | Seating Load: 7.5kN/m^2

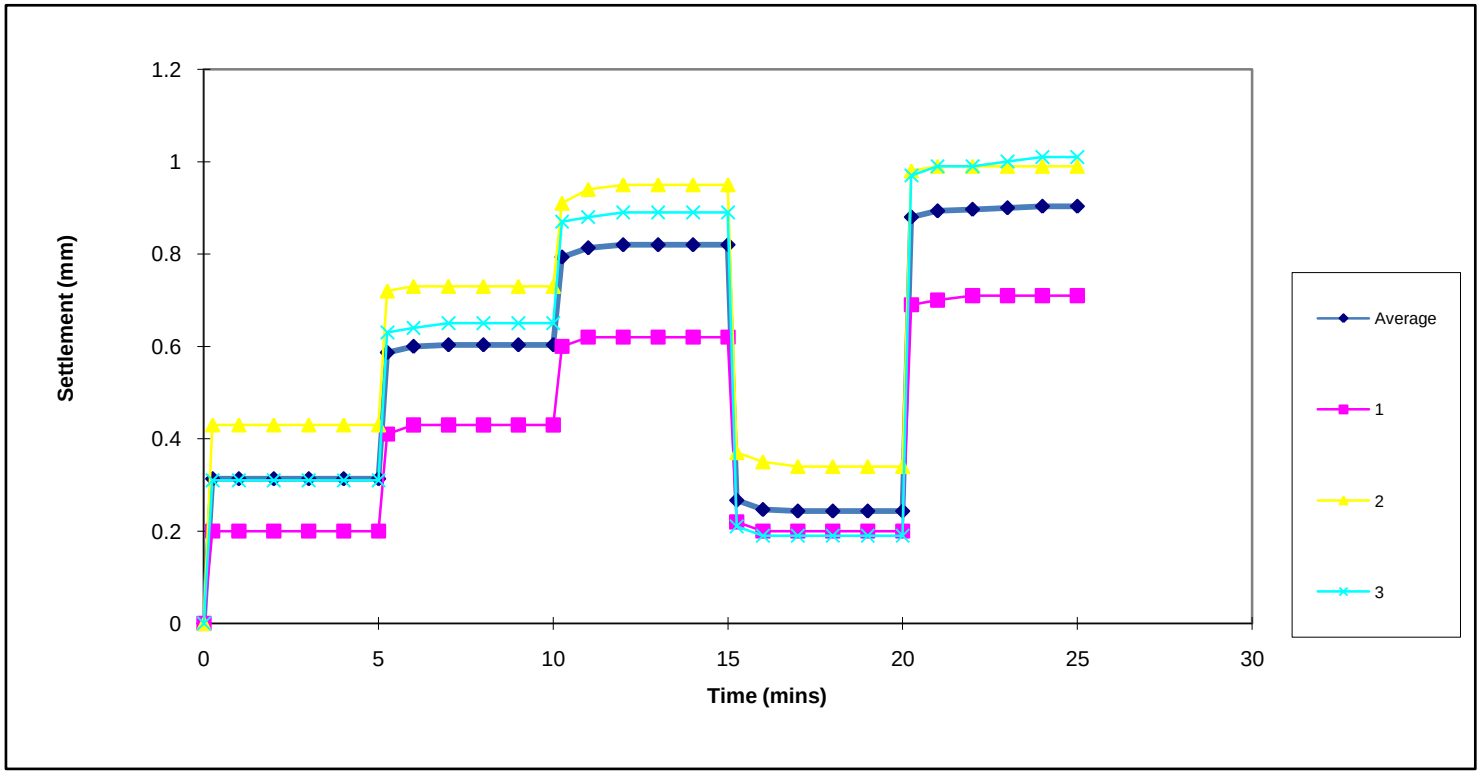
		Travel Gauges set on plate			
	Time (mins)	Gauge 1	Gauge 2	Gauge 3	Average Plate Settlement mm
100kN/m^2 Load	0	0	0	0	0
	0.25	0.20	0.43	0.31	0.31
	1	0.20	0.43	0.31	0.31
	2	0.20	0.43	0.31	0.31
	3	0.20	0.43	0.31	0.31
	4	0.20	0.43	0.31	0.31
	5	0.20	0.43	0.31	0.31
200kN/m^2 Load	5.25	0.41	0.72	0.63	0.59
	6	0.43	0.73	0.64	0.60
	7	0.43	0.73	0.65	0.60
	8	0.43	0.73	0.65	0.60
	9	0.43	0.73	0.65	0.60
	10	0.43	0.73	0.65	0.60
300kN/m^2 Load	10.25	0.60	0.91	0.87	0.79
	11	0.62	0.94	0.88	0.81
	12	0.62	0.95	0.89	0.82
	13	0.62	0.95	0.89	0.82
	14	0.62	0.95	0.89	0.82
	15	0.62	0.95	0.89	0.82
0kN/m^2 Unload	15.25	0.22	0.37	0.21	0.27
	16	0.20	0.35	0.19	0.25
	17	0.20	0.34	0.19	0.24
	18	0.20	0.34	0.19	0.24
	19	0.20	0.34	0.19	0.24
	20	0.20	0.34	0.19	0.24
300kN/m^2 Load	20.25	0.69	0.98	0.97	0.88
	21	0.70	0.99	0.99	0.89
	22	0.71	0.99	0.99	0.90
	23	0.71	0.99	1.00	0.90
	24	0.71	0.99	1.01	0.90
	25	0.71	0.99	1.01	0.90

SOUTH WALES GROUND TESTING

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Plot

Test Reference: Test 1



Contract:

Celsa, Rover Way, Cardiff

Date:

27.04.22

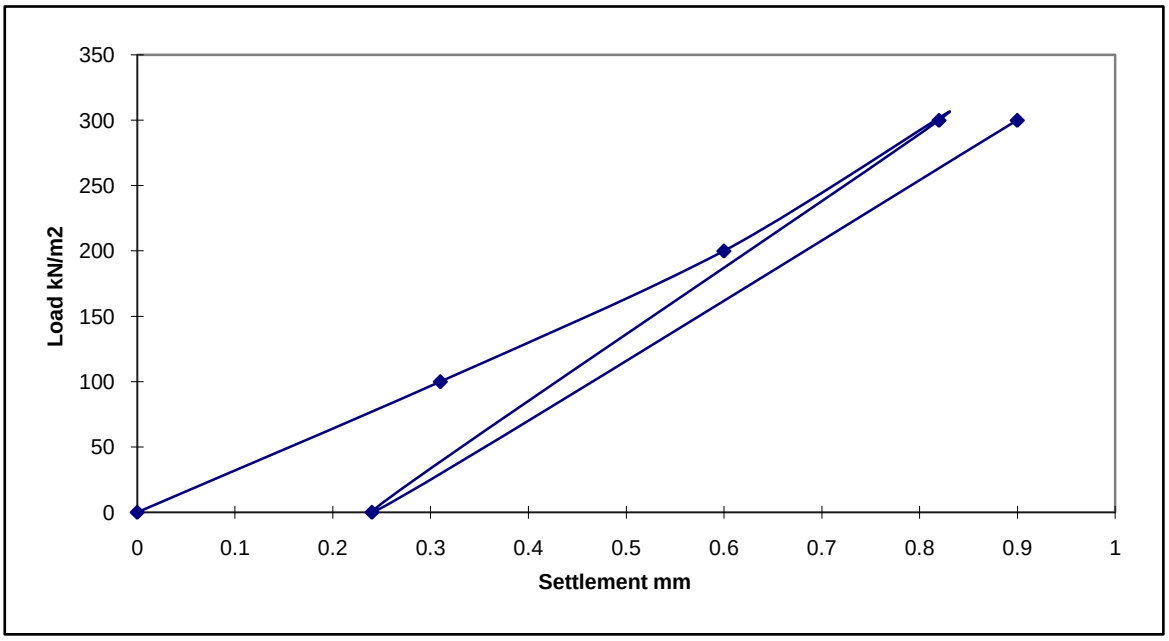
SOUTH WALES GROUND TESTING

PLATE LOAD TEST SUMMARY

Test Reference: Test 1	Test Depth: GL	Plate Diameter: 600mm	Soil Description: Compacted slag

Average Plate Settlement (mm)	Load (kN/m^2)	Time (mins)
0	0	0
0.31	100	5
0.60	200	10
0.82	300	15
0.24	0	20
0.90	300	25

Deformation Modulus (Ev1)	157.3	MN/m2
Elastic Modulus (Ev2)	195.5	MN/m2
Compaction Ratio (Ev2/Ev1)	1.2	
Degree of Rebound	70.7	%
Modulus of subgrade reaction (k762)	379.6	MPa/m
Approximate CBR value	**284.6**	%



Notes:

1: Circular steel plate bedded on uniform coarse sand.
2: Tracked excavator used as counter weight.
3: Load applied to plate via hydraulic jack and loading columns.
4: Each load increment applied until plate settlement less than 0.01mm per minute.
5: Plate settlement measured by three travel gauges fixed to datum beams.
6: Load measured using UKAS calibrated electric load cell.

SOUTH WALES GROUND TESTING

Approved by : D. McArthur

David McArthur BSc MSc ARSM

REMARKS: Test carried out in accordance with BS1377.1990, Part 9.
k752 for 600mm circular plate = pressure requied to achieve 1.25mm penetration x 0.83

CONTRACT: Celsa,m Rover Way, Cardiff	Date: 27.04.22 Sheet 1 of 1

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Data

Contract: Celsa, Rover Way, Cardiff | Date: 27.04.22

Test Reference: Test 2 | Test Depth: Surface | Plate Diameter: 600mm | Seating Load: 7.5kN/m^2

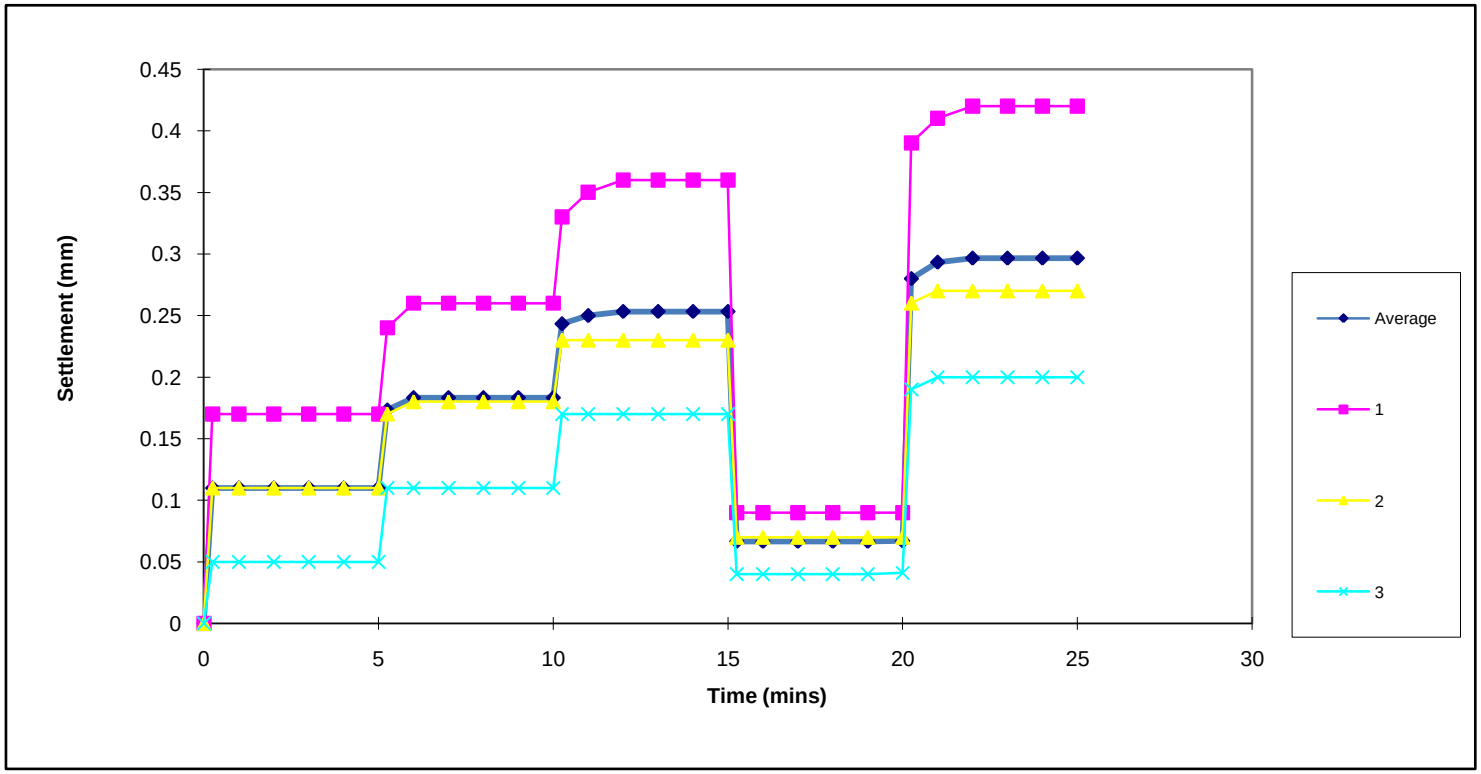
		Travel Gauges set on plate			
	Time (mins)	Gauge 1	Gauge 2	Gauge 3	Average Plate Settlement mm
100kN/m^2 Load	0	0	0	0	0
	0.25	0.17	0.11	0.05	0.11
	1	0.17	0.11	0.05	0.11
	2	0.17	0.11	0.05	0.11
	3	0.17	0.11	0.05	0.11
	4	0.17	0.11	0.05	0.11
	5	0.17	0.11	0.05	0.11
200kN/m^2 Load	5.25	0.24	0.17	0.11	0.17
	6	0.26	0.18	0.11	0.18
	7	0.26	0.18	0.11	0.18
	8	0.26	0.18	0.11	0.18
	9	0.26	0.18	0.11	0.18
	10	0.26	0.18	0.11	0.18
300kN/m^2 Load	10.25	0.33	0.23	0.17	0.24
	11	0.35	0.23	0.17	0.25
	12	0.36	0.23	0.17	0.25
	13	0.36	0.23	0.17	0.25
	14	0.36	0.23	0.17	0.25
	15	0.36	0.23	0.17	0.25
0kN/m^2 Unload	15.25	0.09	0.07	0.04	0.07
	16	0.09	0.07	0.04	0.07
	17	0.09	0.07	0.04	0.07
	18	0.09	0.07	0.04	0.07
	19	0.09	0.07	0.04	0.07
	20	0.09	0.07	0.04	0.07
300kN/m^2 Load	20.25	0.39	0.26	0.19	0.28
	21	0.41	0.27	0.20	0.29
	22	0.42	0.27	0.20	0.30
	23	0.42	0.27	0.20	0.30
	24	0.42	0.27	0.20	0.30
	25	0.42	0.27	0.20	0.30

SOUTH WALES GROUND TESTING

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Plot

Test Reference: Test 2



Contract:

Celsa, Rover Way, Cardiff

Date:

27.04.22

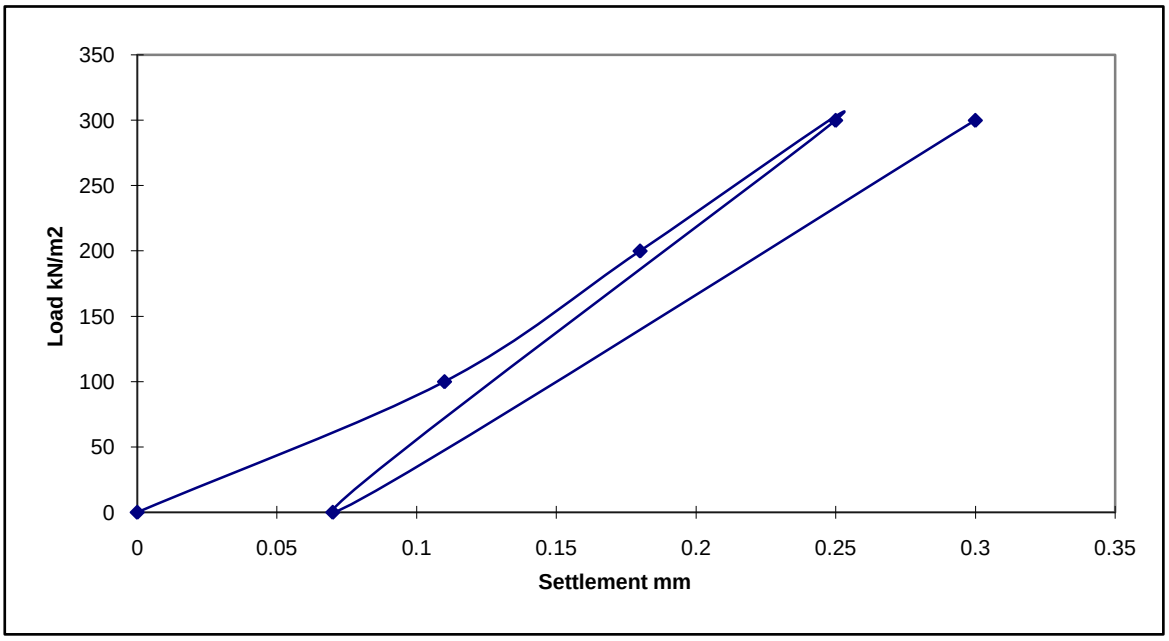
SOUTH WALES GROUND TESTING

PLATE LOAD TEST SUMMARY

Test Reference: Test 2	Test Depth: GL	Plate Diameter: 600mm	Soil Description: Compacted slag

Average Plate Settlement (mm)	Load (kN/m^2)	Time (mins)
0	0	0
0.11	100	5
0.18	200	10
0.25	300	15
0.07	0	20
0.30	300	25

Deformation Modulus (Ev1)	516.0	MN/m2
Elastic Modulus (Ev2)	560.9	MN/m2
Compaction Ratio (Ev2/Ev1)	1.1	
Degree of Rebound	72.0	%
Modulus of subgrade reaction (k762)	1245	MPa/m
Approximate CBR value	**2229.8**	%



Notes:

1: Circular steel plate bedded on uniform coarse sand.
2: Tracked excavator used as counter weight.
3: Load applied to plate via hydraulic jack and loading columns.
4: Each load increment applied until plate settlement less than 0.01mm per minute.
5: Plate settlement measured by three travel gauges fixed to datum beams.
6: Load measured using UKAS calibrated electric load cell.

SOUTH WALES GROUND TESTING

Approved by : D. McArthur

David McArthur BSc MSc ARSM

REMARKS: Test carried out in accordance with BS1377.1990, Part 9.
k752 for 600mm circular plate = pressure requied to achieve 1.25mm penetration x 0.83

CONTRACT:	Date: 27.04.22
Celsa,m Rover Way, Cardiff	Sheet 1 of 1

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Data

Contract: Celsa, Rover Way, Cardiff | Date: 27.04.22

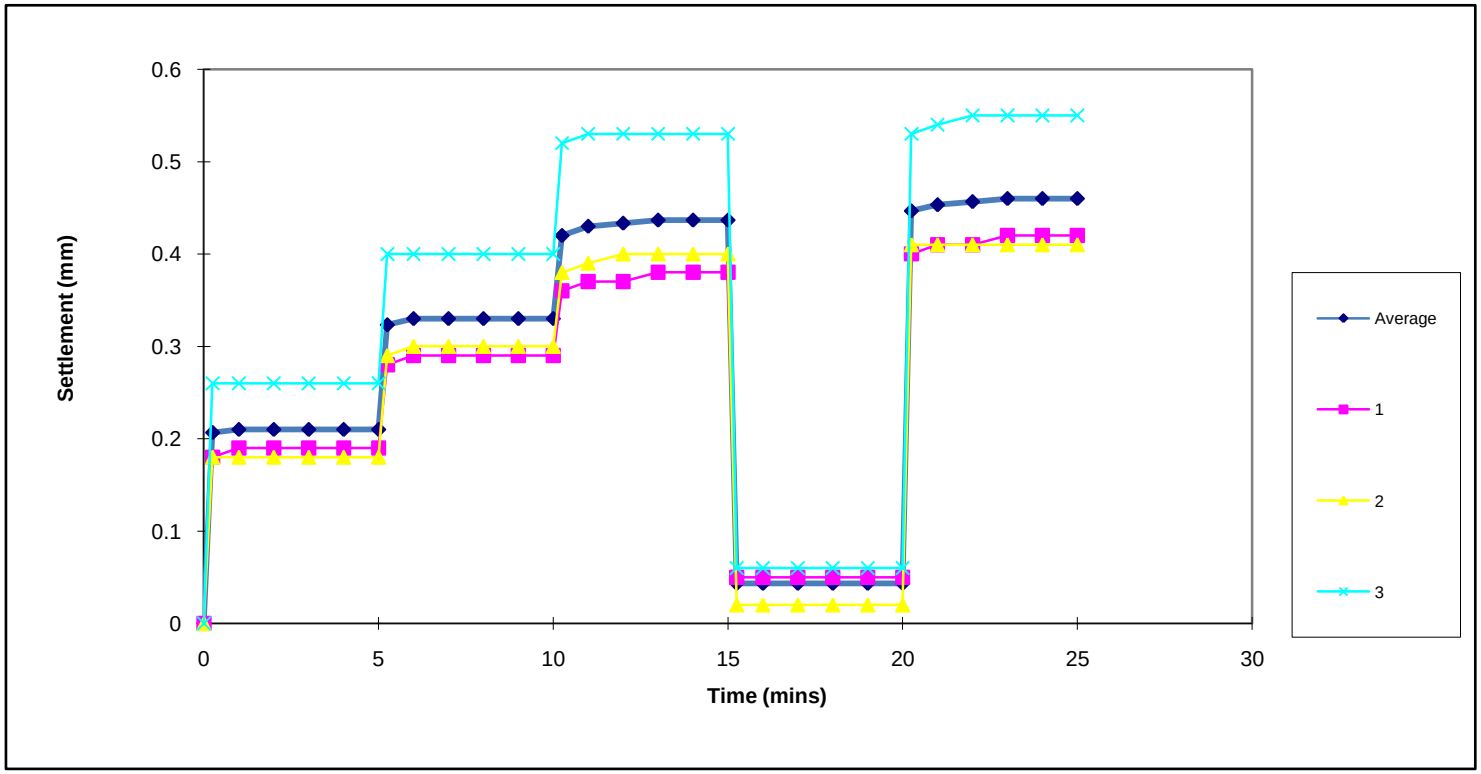
Test Reference: Test 3 | Test Depth: Surface | Plate Diameter: 600mm | Seating Load: 7.5kN/m^2

		Travel Gauges set on plate			
	Time (mins)	Gauge 1	Gauge 2	Gauge 3	Average Plate Settlement mm
100kN/m^2 Load	0	0	0	0	0
	0.25	0.18	0.18	0.26	0.21
	1	0.19	0.18	0.26	0.21
	2	0.19	0.18	0.26	0.21
	3	0.19	0.18	0.26	0.21
	4	0.19	0.18	0.26	0.21
	5	0.19	0.18	0.26	0.21
200kN/m^2 Load	5.25	0.28	0.29	0.40	0.32
	6	0.29	0.30	0.40	0.33
	7	0.29	0.30	0.40	0.33
	8	0.29	0.30	0.40	0.33
	9	0.29	0.30	0.40	0.33
	10	0.29	0.30	0.40	0.33
300kN/m^2 Load	10.25	0.36	0.38	0.52	0.42
	11	0.37	0.39	0.53	0.43
	12	0.37	0.40	0.53	0.43
	13	0.38	0.40	0.53	0.44
	14	0.38	0.40	0.53	0.44
	15	0.38	0.40	0.53	0.44
0kN/m^2 Unload	15.25	0.05	0.02	0.06	0.04
	16	0.05	0.02	0.06	0.04
	17	0.05	0.02	0.06	0.04
	18	0.05	0.02	0.06	0.04
	19	0.05	0.02	0.06	0.04
	20	0.05	0.02	0.06	0.04
300kN/m^2 Load	20.25	0.40	0.41	0.53	0.45
	21	0.41	0.41	0.54	0.45
	22	0.41	0.41	0.55	0.46
	23	0.42	0.41	0.55	0.46
	24	0.42	0.41	0.55	0.46
	25	0.42	0.41	0.55	0.46

SOUTH WALES GROUND TESTING

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Plot	Test Reference: Test 3



Contract:	Date:
Celsa, Rover Way, Cardiff	27.04.22

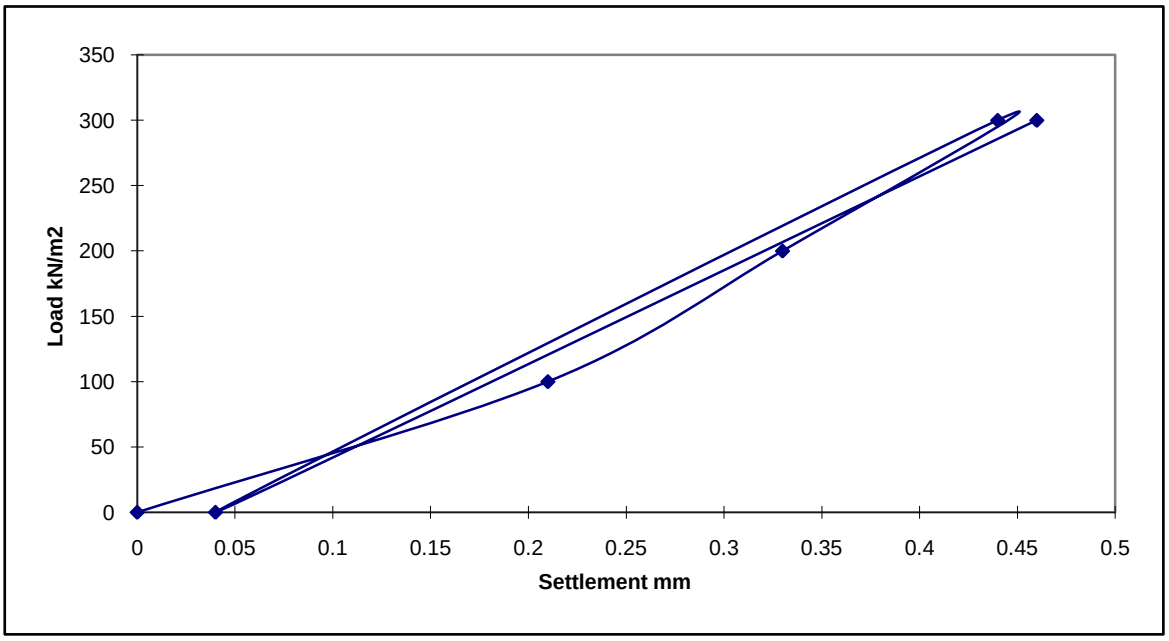
SOUTH WALES GROUND TESTING

PLATE LOAD TEST SUMMARY

Test Reference: Test 3	Test Depth: GL	Plate Diameter: 600mm	Soil Description: Compacted slag

Average Plate Settlement (mm)	Load (kN/m^2)	Time (mins)
0	0	0
0.21	100	5
0.33	200	10
0.44	300	15
0.04	0	20
0.46	300	25

Deformation Modulus (Ev1)	293.2	MN/m2
Elastic Modulus (Ev2)	307.1	MN/m2
Compaction Ratio (Ev2/Ev1)	1.0	
Degree of Rebound	90.9	%
Modulus of subgrade reaction (k762)	707.4	MPa/m
Approximate CBR value	**837.1**	%



Notes:

1: Circular steel plate bedded on uniform coarse sand.
2: Tracked excavator used as counter weight.
3: Load applied to plate via hydraulic jack and loading columns.
4: Each load increment applied until plate settlement less than 0.01mm per minute.
5: Plate settlement measured by three travel gauges fixed to datum beams.
6: Load measured using UKAS calibrated electric load cell.

SOUTH WALES GROUND TESTING

Approved by : D. McArthur

David McArthur BSc MSc ARSM

REMARKS: Test carried out in accordance with BS1377.1990, Part 9.
k752 for 600mm circular plate = pressure requied to achieve 1.25mm penetration x 0.83

CONTRACT:	Date: 27.04.22
Celsa,m Rover Way, Cardiff	Sheet 1 of 1

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Data

Contract: Celsa, Rover Way, Cardiff | Date: 27.04.22

Test Reference: Test 4 | Test Depth: Surface | Plate Diameter: 600mm | Seating Load: 7.5kN/m^2

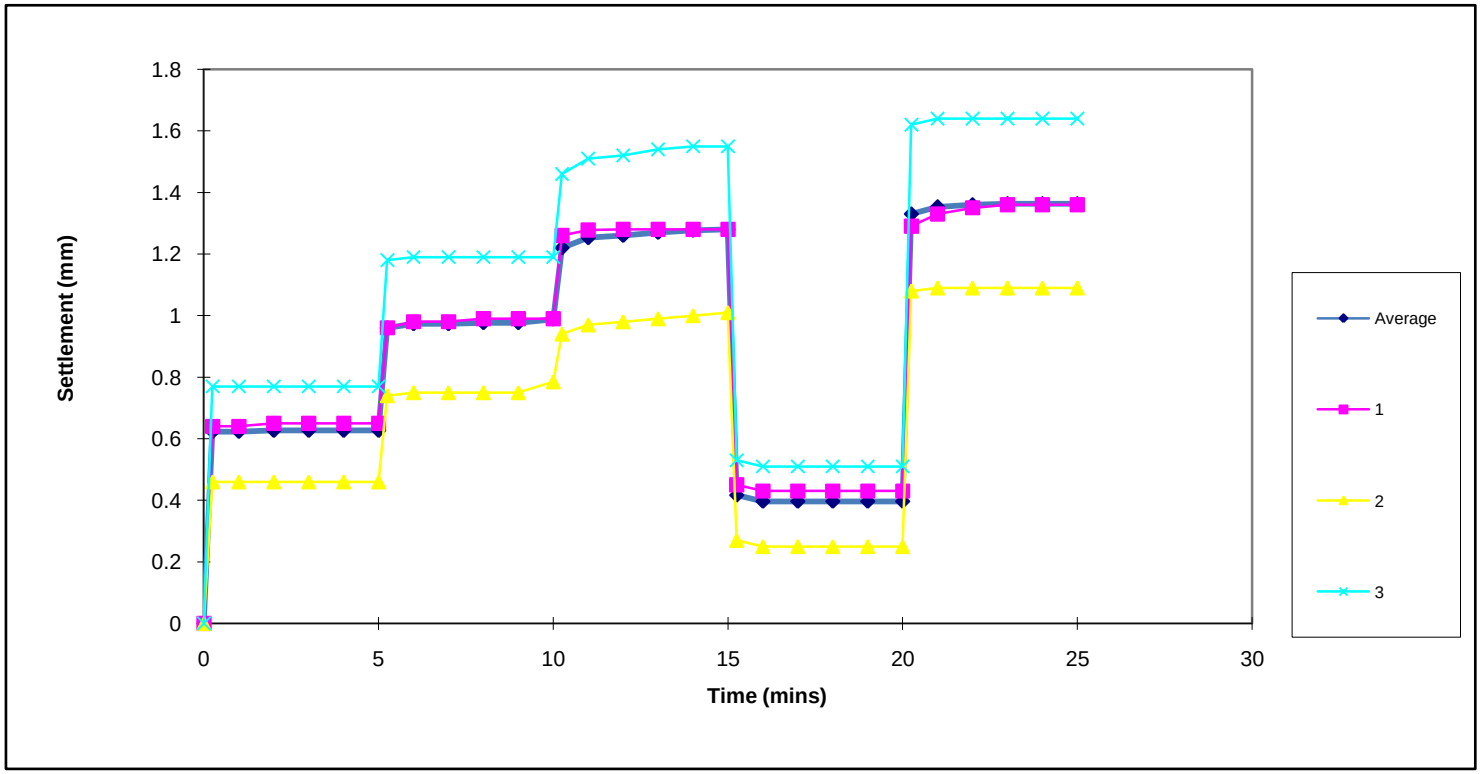
		Travel Gauges set on plate			
	Time (mins)	Gauge 1	Gauge 2	Gauge 3	Average Plate Settlement mm
100kN/m^2 Load	0	0	0	0	0
	0.25	0.64	0.46	0.77	0.62
	1	0.64	0.46	0.77	0.62
	2	0.65	0.46	0.77	0.63
	3	0.65	0.46	0.77	0.63
	4	0.65	0.46	0.77	0.63
	5	0.65	0.46	0.77	0.63
200kN/m^2 Load	5.25	0.96	0.74	1.18	0.96
	6	0.98	0.75	1.19	0.97
	7	0.98	0.75	1.19	0.97
	8	0.99	0.75	1.19	0.98
	9	0.99	0.75	1.19	0.98
	10	0.99	0.79	1.19	0.99
300kN/m^2 Load	10.25	1.26	0.94	1.46	1.22
	11	1.28	0.97	1.51	1.25
	12	1.28	0.98	1.52	1.26
	13	1.28	0.99	1.54	1.27
	14	1.28	1.00	1.55	1.28
	15	1.28	1.01	1.55	1.28
0kN/m^2 Unload	15.25	0.45	0.27	0.53	0.42
	16	0.43	0.25	0.51	0.40
	17	0.43	0.25	0.51	0.40
	18	0.43	0.25	0.51	0.40
	19	0.43	0.25	0.51	0.40
	20	0.43	0.25	0.51	0.40
300kN/m^2 Load	20.25	1.29	1.08	1.62	1.33
	21	1.33	1.09	1.64	1.35
	22	1.35	1.09	1.64	1.36
	23	1.36	1.09	1.64	1.36
	24	1.36	1.09	1.64	1.36
	25	1.36	1.09	1.64	1.36

SOUTH WALES GROUND TESTING

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Plot

Test Reference: Test 4



Contract:

Celsa, Rover Way, Cardiff

Date:

27.04.22

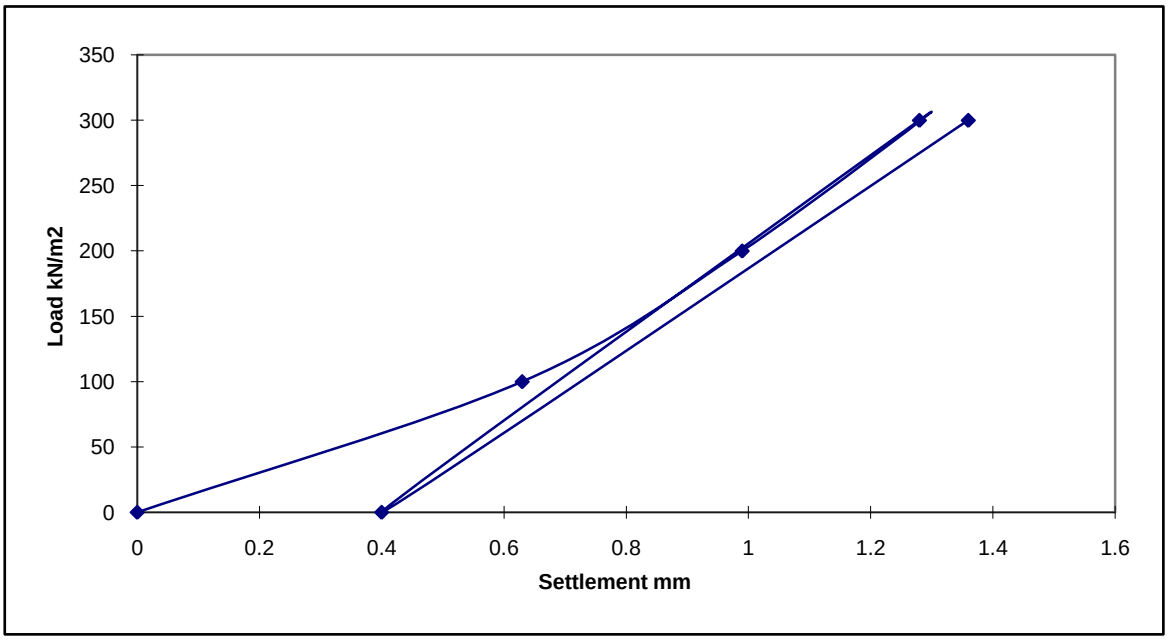
SOUTH WALES GROUND TESTING

PLATE LOAD TEST SUMMARY

Test Reference: Test 4	Test Depth: GL	Plate Diameter: 600mm	Soil Description: Compacted slag

Average Plate Settlement (mm)	Load (kN/m^2)	Time (mins)
0	0	0
0.63	100	5
0.99	200	10
1.28	300	15
0.40	0	20
1.36	300	25

Deformation Modulus (Ev1)	100.8	MN/m2
Elastic Modulus (Ev2)	134.4	MN/m2
Compaction Ratio (Ev2/Ev1)	1.3	
Degree of Rebound	68.8	%
Modulus of subgrade reaction (k762)	243.2	MPa/m
Approximate CBR value	**131.6**	%



Notes:

1: Circular steel plate bedded on uniform coarse sand.
2: Tracked excavator used as counter weight.
3: Load applied to plate via hydraulic jack and loading columns.
4: Each load increment applied until plate settlement less than 0.01mm per minute.
5: Plate settlement measured by three travel gauges fixed to datum beams.
6: Load measured using UKAS calibrated electric load cell.

SOUTH WALES GROUND TESTING

Approved by : D. McArthur

David McArthur BSc MSc ARSM

REMARKS: Test carried out in accordance with BS1377.1990, Part 9.
k752 for 600mm circular plate = pressure requied to achieve 1.25mm penetration x 0.83

CONTRACT:	Date: 27.04.22
Celsa,m Rover Way, Cardiff	Sheet 1 of 1

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Data

Contract: Celsa, Rover Way, Cardiff | Date: 27.04.22

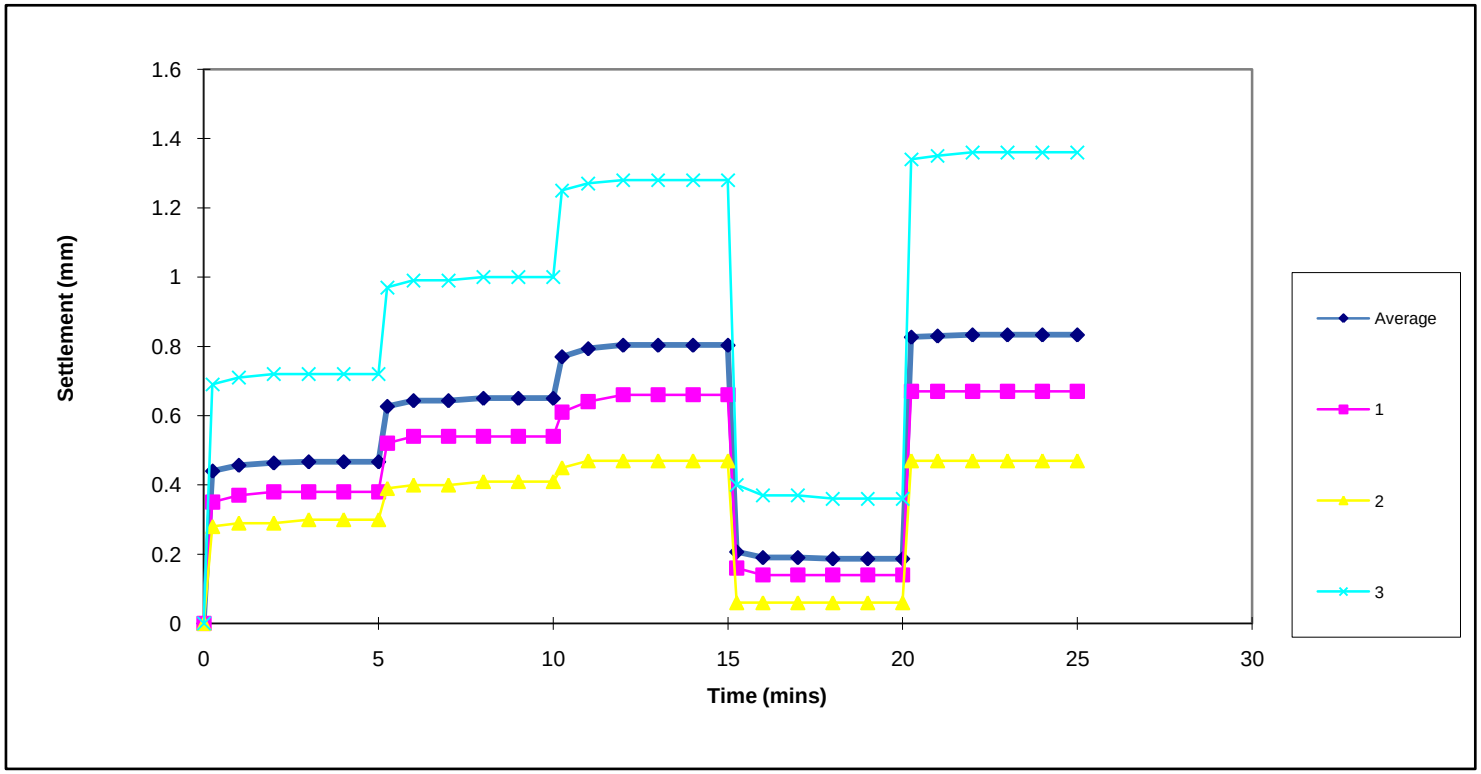
Test Reference: Test 5 | Test Depth: Surface | Plate Diameter: 600mm | Seating Load: 7.5kN/m^2

		Travel Gauges set on plate			
	Time (mins)	Gauge 1	Gauge 2	Gauge 3	Average Plate Settlement mm
100kN/m^2 Load	0	0	0	0	0
	0.25	0.35	0.28	0.69	0.44
	1	0.37	0.29	0.71	0.46
	2	0.38	0.29	0.72	0.46
	3	0.38	0.30	0.72	0.47
	4	0.38	0.30	0.72	0.47
	5	0.38	0.30	0.72	0.47
200kN/m^2 Load	5.25	0.52	0.39	0.97	0.63
	6	0.54	0.40	0.99	0.64
	7	0.54	0.40	0.99	0.64
	8	0.54	0.41	1.00	0.65
	9	0.54	0.41	1.00	0.65
	10	0.54	0.41	1.00	0.65
300kN/m^2 Load	10.25	0.61	0.45	1.25	0.77
	11	0.64	0.47	1.27	0.79
	12	0.66	0.47	1.28	0.80
	13	0.66	0.47	1.28	0.80
	14	0.66	0.47	1.28	0.80
	15	0.66	0.47	1.28	0.80
0kN/m^2 Unload	15.25	0.16	0.06	0.40	0.21
	16	0.14	0.06	0.37	0.19
	17	0.14	0.06	0.37	0.19
	18	0.14	0.06	0.36	0.19
	19	0.14	0.06	0.36	0.19
	20	0.14	0.06	0.36	0.19
300kN/m^2 Load	20.25	0.67	0.47	1.34	0.83
	21	0.67	0.47	1.35	0.83
	22	0.67	0.47	1.36	0.83
	23	0.67	0.47	1.36	0.83
	24	0.67	0.47	1.36	0.83
	25	0.67	0.47	1.36	0.83

SOUTH WALES GROUND TESTING

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Plot	Test Reference: Test 5



Contract:	Date:
Celsa, Rover Way, Cardiff	27.04.22

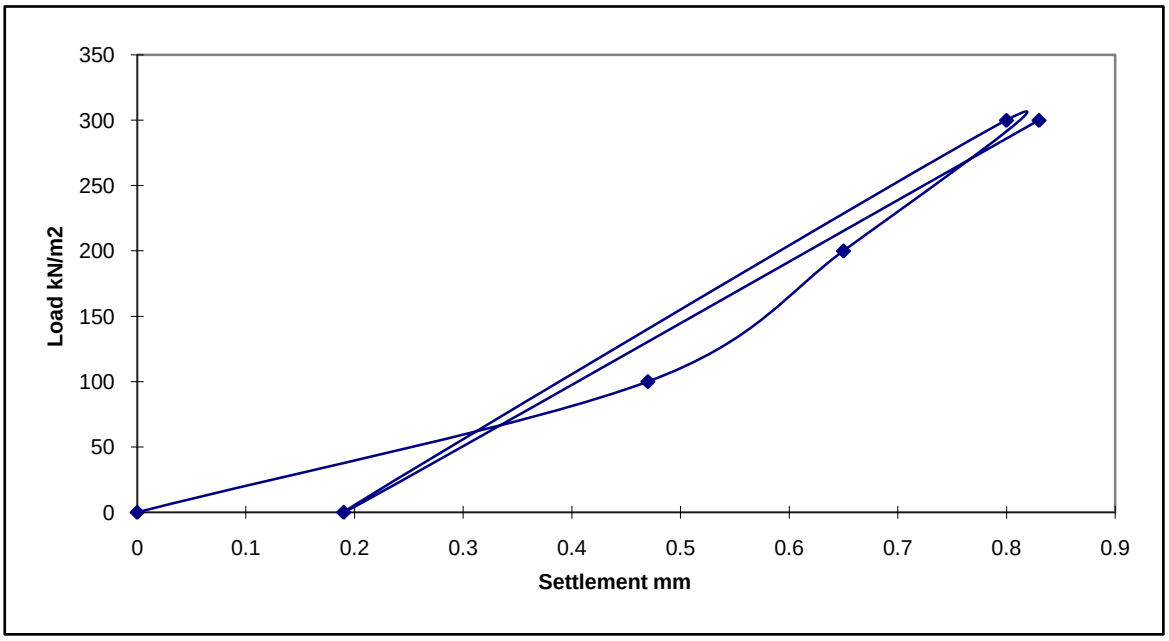
SOUTH WALES GROUND TESTING

PLATE LOAD TEST SUMMARY

Test Reference: Test 5	Test Depth: GL	Plate Diameter: 600mm	Soil Description: Compacted slag

Average Plate Settlement (mm)	Load (kN/m^2)	Time (mins)
0	0	0
0.47	100	5
0.65	200	10
0.80	300	15
0.19	0	20
0.83	300	25

Deformation Modulus (Ev1)	161.3	MN/m2
Elastic Modulus (Ev2)	201.6	MN/m2
Compaction Ratio (Ev2/Ev1)	1.3	
Degree of Rebound	76.3	%
Modulus of subgrade reaction (k762)	389.1	MPa/m
Approximate CBR value	**297.1**	%



Notes:

1: Circular steel plate bedded on uniform coarse sand.
2: Tracked excavator used as counter weight.
3: Load applied to plate via hydraulic jack and loading columns.
4: Each load increment applied until plate settlement less than 0.01mm per minute.
5: Plate settlement measured by three travel gauges fixed to datum beams.
6: Load measured using UKAS calibrated electric load cell.

SOUTH WALES GROUND TESTING

Approved by : D. McArthur

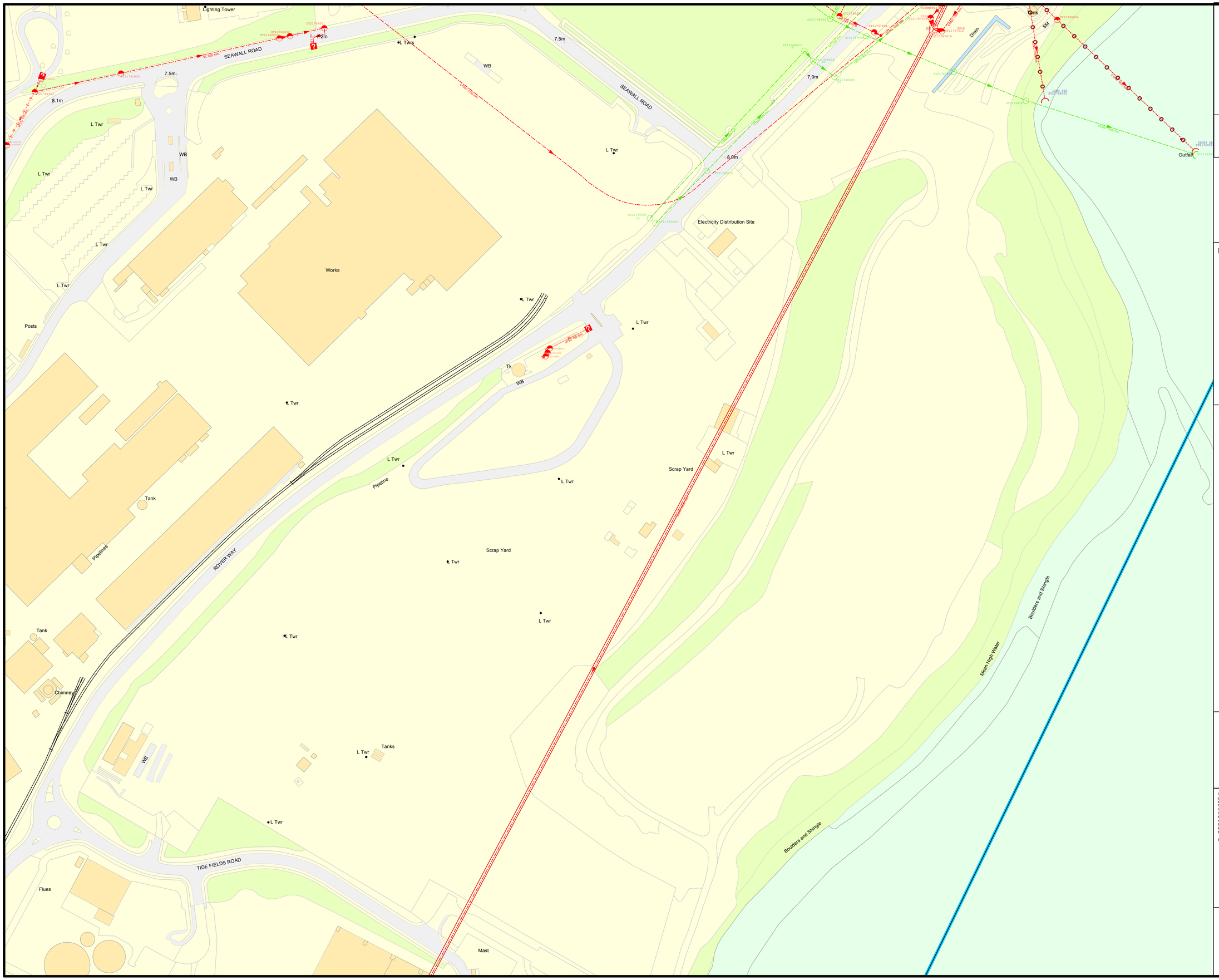
David McArthur BSc MSc ARSM

REMARKS: Test carried out in accordance with BS1377.1990, Part 9.
k752 for 600mm circular plate = pressure requied to achieve 1.25mm penetration x 0.83

CONTRACT:	Date: 27.04.22
Celsa,m Rover Way, Cardiff	Sheet 1 of 1

APPENDIX B

DCWW MAP



Dŵr Cymru
Welsh Water

PPA0006475

N
W E
S

LEGEND(Representative of most common features)

Waste network:

- Foul chamber
- Surface water chamber
- Combined chamber
- Combined sewer overflow
- Special purpose chamber
- Treatment works
- Pumping station
- Outfall
- Lamphole
- Storm Overflow
- Rising main
- Gravity sewer
- Private sewer
- Private sewer subject to Sect. 104 adoption agreement
- Private Sewer Transfer
- Lateral Drain
- Inspection Chamber

NB: Sewer symbol colour indicates the type.

RED - Combined
GREEN - Surface Water
BROWN - Foul
Purple - Former S24 sewers (for indicative purposes only)

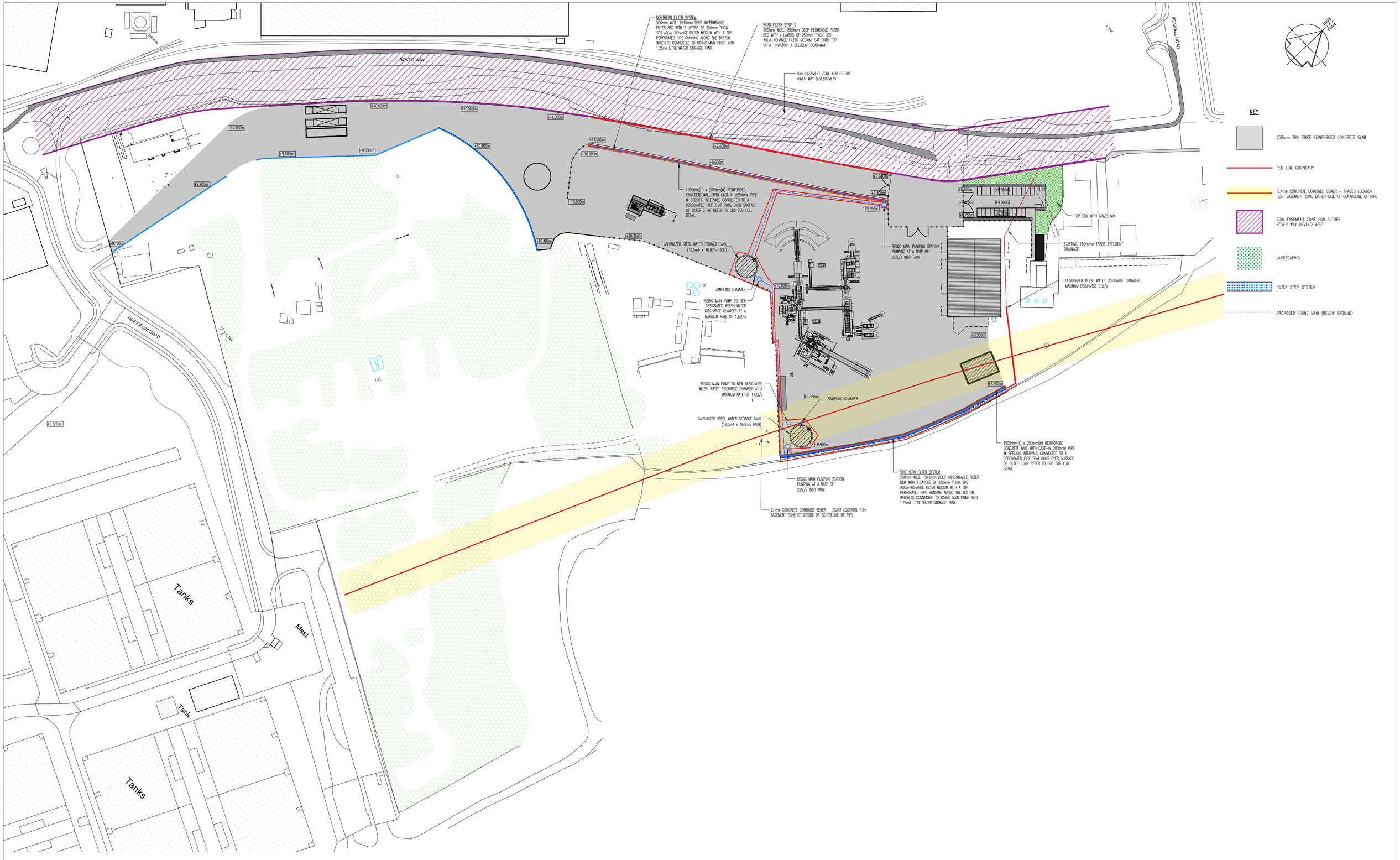
Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF). It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Map Ref:	321525,176305
Map scale:	1:1250
Printed by:	Sara Edwards
Printed on:	10 Mar 2022

APPENDIX C

PROPOSED DRAINAGE DESIGN LAYOUT



Job No:	Drawing No:	Rev:
23.105	C04	/

scales: SCALE @ A1

No.	REVISION	by	date

No.	REVISION	by	date

NOTES
1 Do not scale from this drawing
2 All dimensions to be checked on site
3 'As built' drawings are prepared, in part, based upon information furnished by others. While this information is believed to be reliable, James & Nicholas LLP assume no responsibility for the accuracy of 'As built' drawings or for any errors or omissions that may have been incorporated into them as a result of incorrect information provided to us by others. Those relying on an 'As built' drawing are advised to obtain independent verification of its accuracy.

STAGE
PLANNING

REFER ALSO TO THE FOLLOWING:
Drawings:

Bending Schedules:

CLIENT
CELSA GROUP™ CELSA STEEL UK

james&nicholas
Grove House, Grove Place, Port Talbot SA13 1XA • Tel 01639 885431 • Fax 01639 891687
admin@jamesandnicholas.com • www.jamesandnicholas.com
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Job title
DRAINAGE TO PROCESSING AREA, SHREDDER PROJECT, SCRAP HANDLING FACILITY, MINERAL SITE, TREMORFA, CELSA

Drawing title
PROPOSED DRAINAGE PLAN

	by	date
drawn	R.P	29.11.23
checked	K.J	29.11.23
approved	K.J.T	29.11.23

Job No:	Drawing No:	Rev:
23.105	C04	/

scales: SCALE @ A1

APPENDIX D

NORTHERN FILTER STRIP 1 IN 2, 1 IN 30 AND 1 IN 100-YEAR CALCULATIONS

james&nicholas		Micro Drainage
Date 07/12/2023 13:39	Designed by karlj	
File Northern Filter Strip.SRCX	Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 2 year Return Period

Half Drain Time : 0 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	8.468	0.013	0.0	172.8	172.8	0.0	O K
30 min Summer	8.460	0.005	0.0	152.4	152.4	0.0	O K
60 min Summer	8.455	0.000	0.0	110.4	110.4	0.0	O K
120 min Summer	8.455	0.000	0.0	79.6	79.6	0.0	O K
180 min Summer	8.455	0.000	0.0	64.0	64.0	0.0	O K
240 min Summer	8.455	0.000	0.0	54.0	54.0	0.0	O K
360 min Summer	8.455	0.000	0.0	41.5	41.5	0.0	O K
480 min Summer	8.455	0.000	0.0	34.2	34.2	0.0	O K
600 min Summer	8.455	0.000	0.0	29.4	29.4	0.0	O K
720 min Summer	8.455	0.000	0.0	25.9	25.9	0.0	O K
960 min Summer	8.455	0.000	0.0	21.1	21.1	0.0	O K
1440 min Summer	8.455	0.000	0.0	15.7	15.7	0.0	O K
2160 min Summer	8.455	0.000	0.0	11.8	11.8	0.0	O K
2880 min Summer	8.455	0.000	0.0	9.6	9.6	0.0	O K
4320 min Summer	8.455	0.000	0.0	7.4	7.4	0.0	O K
5760 min Summer	8.455	0.000	0.0	6.2	6.2	0.0	O K
7200 min Summer	8.455	0.000	0.0	5.5	5.5	0.0	O K
8640 min Summer	8.455	0.000	0.0	5.0	5.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	34.419	0.0	66.9	10
30 min Summer	22.669	0.0	87.9	17
60 min Summer	14.480	0.0	112.5	0
120 min Summer	9.747	0.0	151.5	0
180 min Summer	7.633	0.0	177.9	0
240 min Summer	6.379	0.0	198.3	0
360 min Summer	4.906	0.0	228.7	0
480 min Summer	4.046	0.0	251.5	0
600 min Summer	3.472	0.0	269.8	0
720 min Summer	3.057	0.0	285.1	0
960 min Summer	2.489	0.0	309.5	0
1440 min Summer	1.860	0.0	346.8	0
2160 min Summer	1.390	0.0	388.9	0
2880 min Summer	1.138	0.0	424.3	0
4320 min Summer	0.873	0.0	488.3	0
5760 min Summer	0.733	0.0	547.1	0
7200 min Summer	0.649	0.0	604.8	0
8640 min Summer	0.591	0.0	661.5	0

james&nicholas

Micro Drainage

Date 07/12/2023 13:39 | Designed by karlj
File Northern Filter Strip.SRCX | Checked by
Innovyze | Source Control 2019.1

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	8.455	0.000	0.0	4.7	4.7	0.0	O K
15 min Winter	8.473	0.018	0.0	185.5	185.5	0.0	O K
30 min Winter	8.455	0.000	0.0	133.7	133.7	0.0	O K
60 min Winter	8.455	0.000	0.0	89.0	89.0	0.0	O K
120 min Winter	8.455	0.000	0.0	60.8	60.8	0.0	O K
180 min Winter	8.455	0.000	0.0	47.8	47.8	0.0	O K
240 min Winter	8.455	0.000	0.0	40.0	40.0	0.0	O K
360 min Winter	8.455	0.000	0.0	30.8	30.8	0.0	O K
480 min Winter	8.455	0.000	0.0	25.4	25.4	0.0	O K
600 min Winter	8.455	0.000	0.0	21.8	21.8	0.0	O K
720 min Winter	8.455	0.000	0.0	19.2	19.2	0.0	O K
960 min Winter	8.455	0.000	0.0	15.6	15.6	0.0	O K
1440 min Winter	8.455	0.000	0.0	11.7	11.7	0.0	O K
2160 min Winter	8.455	0.000	0.0	8.7	8.7	0.0	O K
2880 min Winter	8.455	0.000	0.0	7.1	7.1	0.0	O K
4320 min Winter	8.455	0.000	0.0	5.5	5.5	0.0	O K
5760 min Winter	8.455	0.000	0.0	4.6	4.6	0.0	O K
7200 min Winter	8.455	0.000	0.0	4.1	4.1	0.0	O K
8640 min Winter	8.455	0.000	0.0	3.7	3.7	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.550	0.0	717.9	0
15 min Winter	34.419	0.0	76.8	10
30 min Winter	22.669	0.0	101.2	0
60 min Winter	14.480	0.0	129.2	0
120 min Winter	9.747	0.0	174.0	0
180 min Winter	7.633	0.0	204.4	0
240 min Winter	6.379	0.0	227.7	0
360 min Winter	4.906	0.0	262.7	0
480 min Winter	4.046	0.0	288.9	0
600 min Winter	3.472	0.0	309.9	0
720 min Winter	3.057	0.0	327.4	0
960 min Winter	2.489	0.0	355.5	0
1440 min Winter	1.860	0.0	398.4	0
2160 min Winter	1.390	0.0	446.7	0
2880 min Winter	1.138	0.0	487.4	0
4320 min Winter	0.873	0.0	560.9	0
5760 min Winter	0.733	0.0	628.4	0
7200 min Winter	0.649	0.0	694.7	0
8640 min Winter	0.591	0.0	759.8	0

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Micro Drainage

Date 07/12/2023 13:39 | Designed by karlj
File Northern Filter Strip.SRCX | Checked by
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Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	8.455	0.000	0.0	3.4	3.4	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	0.550	0.0	824.6	0

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.740
Cv (Winter)	0.850
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.050

Time (mins) From:	To:	Area (ha)
0	4	1.050

Model Details

Storage is Online Cover Level (m) 10.000

Swale Structure

Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	142.0
Infiltration Coefficient Side (m/hr)	0.00000	Side Slope (1:X)	1.0
Safety Factor	1.5	Slope (1:X)	150.0
Porosity	0.50	Cap Volume Depth (m)	0.000
Invert Level (m)	8.455	Cap Infiltration Depth (m)	0.000
Base Width (m)	0.5		

Pump Outflow Control

Invert Level (m) 8.400

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	255.0000	1.200	255.0000	3.000	255.0000	7.000	255.0000
0.200	255.0000	1.400	255.0000	3.500	255.0000	7.500	255.0000
0.300	255.0000	1.600	255.0000	4.000	255.0000	8.000	255.0000
0.400	255.0000	1.800	255.0000	4.500	255.0000	8.500	255.0000
0.500	255.0000	2.000	255.0000	5.000	255.0000	9.000	255.0000
0.600	255.0000	2.200	255.0000	5.500	255.0000	9.500	255.0000
0.800	255.0000	2.400	255.0000	6.000	255.0000		
1.000	255.0000	2.600	255.0000	6.500	255.0000		

james&nicholas		Micro Drainage
Date 07/12/2023 13:37	Designed by karlj	
File Northern Filter Strip.SRCX	Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 30 year Return Period

Half Drain Time : 1 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.142	0.687	0.0	255.0	255.0	16.9	O K
30 min Summer	9.015	0.560	0.0	255.0	255.0	10.3	O K
60 min Summer	8.489	0.034	0.0	226.3	226.3	0.0	O K
120 min Summer	8.465	0.010	0.0	165.1	165.1	0.0	O K
180 min Summer	8.455	0.000	0.0	121.7	121.7	0.0	O K
240 min Summer	8.455	0.000	0.0	100.0	100.0	0.0	O K
360 min Summer	8.455	0.000	0.0	74.5	74.5	0.0	O K
480 min Summer	8.455	0.000	0.0	60.2	60.2	0.0	O K
600 min Summer	8.455	0.000	0.0	50.9	50.9	0.0	O K
720 min Summer	8.455	0.000	0.0	44.3	44.3	0.0	O K
960 min Summer	8.455	0.000	0.0	35.4	35.4	0.0	O K
1440 min Summer	8.455	0.000	0.0	25.8	25.8	0.0	O K
2160 min Summer	8.455	0.000	0.0	18.8	18.8	0.0	O K
2880 min Summer	8.455	0.000	0.0	15.1	15.1	0.0	O K
4320 min Summer	8.455	0.000	0.0	11.3	11.3	0.0	O K
5760 min Summer	8.455	0.000	0.0	9.4	9.4	0.0	O K
7200 min Summer	8.455	0.000	0.0	8.2	8.2	0.0	O K
8640 min Summer	8.455	0.000	0.0	7.4	7.4	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	72.726	0.0	146.2	11
30 min Summer	48.916	0.0	191.8	19
60 min Summer	31.512	0.0	243.1	30
120 min Summer	19.336	0.0	299.6	62
180 min Summer	14.516	0.0	338.4	0
240 min Summer	11.821	0.0	367.4	0
360 min Summer	8.805	0.0	410.5	0
480 min Summer	7.114	0.0	442.2	0
600 min Summer	6.013	0.0	467.2	0
720 min Summer	5.232	0.0	487.8	0
960 min Summer	4.185	0.0	520.3	0
1440 min Summer	3.045	0.0	567.8	0
2160 min Summer	2.219	0.0	620.6	0
2880 min Summer	1.783	0.0	665.2	0
4320 min Summer	1.337	0.0	747.9	0
5760 min Summer	1.107	0.0	825.9	0
7200 min Summer	0.970	0.0	904.6	0
8640 min Summer	0.879	0.0	983.5	0

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Micro Drainage

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	8.455	0.000	0.0	6.9	6.9	0.0	O K
15 min Winter	9.196	0.741	0.0	255.0	255.0	20.4	O K
30 min Winter	8.875	0.420	0.0	255.0	255.0	5.2	O K
60 min Winter	8.494	0.039	0.0	239.1	239.1	0.0	O K
120 min Winter	8.455	0.000	0.0	120.6	120.6	0.0	O K
180 min Winter	8.455	0.000	0.0	90.9	90.9	0.0	O K
240 min Winter	8.455	0.000	0.0	74.1	74.1	0.0	O K
360 min Winter	8.455	0.000	0.0	55.2	55.2	0.0	O K
480 min Winter	8.455	0.000	0.0	44.6	44.6	0.0	O K
600 min Winter	8.455	0.000	0.0	37.7	37.7	0.0	O K
720 min Winter	8.455	0.000	0.0	32.8	32.8	0.0	O K
960 min Winter	8.455	0.000	0.0	26.2	26.2	0.0	O K
1440 min Winter	8.455	0.000	0.0	19.1	19.1	0.0	O K
2160 min Winter	8.455	0.000	0.0	13.9	13.9	0.0	O K
2880 min Winter	8.455	0.000	0.0	11.2	11.2	0.0	O K
4320 min Winter	8.455	0.000	0.0	8.4	8.4	0.0	O K
5760 min Winter	8.455	0.000	0.0	6.9	6.9	0.0	O K
7200 min Winter	8.455	0.000	0.0	6.1	6.1	0.0	O K
8640 min Winter	8.455	0.000	0.0	5.5	5.5	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.814	0.0	1063.2	0
15 min Winter	72.726	0.0	166.6	12
30 min Winter	48.916	0.0	218.9	19
60 min Winter	31.512	0.0	280.9	28
120 min Winter	19.336	0.0	345.1	0
180 min Winter	14.516	0.0	388.7	0
240 min Winter	11.821	0.0	422.0	0
360 min Winter	8.805	0.0	471.5	0
480 min Winter	7.114	0.0	507.9	0
600 min Winter	6.013	0.0	536.7	0
720 min Winter	5.232	0.0	560.4	0
960 min Winter	4.185	0.0	597.7	0
1440 min Winter	3.045	0.0	652.3	0
2160 min Winter	2.219	0.0	712.8	0
2880 min Winter	1.783	0.0	764.0	0
4320 min Winter	1.337	0.0	859.1	0
5760 min Winter	1.107	0.0	948.6	0
7200 min Winter	0.970	0.0	1039.1	0
8640 min Winter	0.879	0.0	1129.7	0

Date 07/12/2023 13:37	Designed by karlj
File Northern Filter Strip.SRCX	Checked by
Innovyze	Source Control 2019.1

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	8.455	0.000	0.0	5.1	5.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	0.814	0.0	1221.2	0

james&nicholas		Micro Drainage
Date 07/12/2023 13:37	Designed by karlj	
File Northern Filter Strip.SRCX	Checked by	
Innovyze	Source Control 2019.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.740
Cv (Winter)	0.850
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.050

Time (mins) From:	To:	Area (ha)
0	4	1.050

Model Details

Storage is Online Cover Level (m) 10.000

Swale Structure

Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	142.0
Infiltration Coefficient Side (m/hr)	0.00000	Side Slope (1:X)	1.0
Safety Factor	1.5	Slope (1:X)	150.0
Porosity	0.50	Cap Volume Depth (m)	0.000
Invert Level (m)	8.455	Cap Infiltration Depth (m)	0.000
Base Width (m)	0.5		

Pump Outflow Control

Invert Level (m) 8.400

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	255.0000	1.200	255.0000	3.000	255.0000	7.000	255.0000
0.200	255.0000	1.400	255.0000	3.500	255.0000	7.500	255.0000
0.300	255.0000	1.600	255.0000	4.000	255.0000	8.000	255.0000
0.400	255.0000	1.800	255.0000	4.500	255.0000	8.500	255.0000
0.500	255.0000	2.000	255.0000	5.000	255.0000	9.000	255.0000
0.600	255.0000	2.200	255.0000	5.500	255.0000	9.500	255.0000
0.800	255.0000	2.400	255.0000	6.000	255.0000		
1.000	255.0000	2.600	255.0000	6.500	255.0000		

Date 07/12/2023 13:30	Designed by karlj
File Northern Filter Strip.SRCX	Checked by
Innovyze	Source Control 2019.1

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 4 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.801	1.346	0.0	255.0	255.0	90.4	Flood Risk
30 min Summer	9.801	1.346	0.0	255.0	255.0	90.4	Flood Risk
60 min Summer	9.620	1.165	0.0	255.0	255.0	63.8	O K
120 min Summer	8.922	0.467	0.0	255.0	255.0	6.6	O K
180 min Summer	8.491	0.036	0.0	232.7	232.7	0.0	O K
240 min Summer	8.479	0.024	0.0	202.1	202.1	0.0	O K
360 min Summer	8.455	0.000	0.0	136.6	136.6	0.0	O K
480 min Summer	8.455	0.000	0.0	110.0	110.0	0.0	O K
600 min Summer	8.455	0.000	0.0	92.6	92.6	0.0	O K
720 min Summer	8.455	0.000	0.0	80.2	80.2	0.0	O K
960 min Summer	8.455	0.000	0.0	63.6	63.6	0.0	O K
1440 min Summer	8.455	0.000	0.0	45.5	45.5	0.0	O K
2160 min Summer	8.455	0.000	0.0	32.4	32.4	0.0	O K
2880 min Summer	8.455	0.000	0.0	25.6	25.6	0.0	O K
4320 min Summer	8.455	0.000	0.0	18.7	18.7	0.0	O K
5760 min Summer	8.455	0.000	0.0	15.3	15.3	0.0	O K
7200 min Summer	8.455	0.000	0.0	13.3	13.3	0.0	O K
8640 min Summer	8.455	0.000	0.0	12.0	12.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	132.256	0.0	250.6	13
30 min Summer	89.648	0.0	352.3	21
60 min Summer	58.187	0.0	439.6	36
120 min Summer	35.502	0.0	552.5	64
180 min Summer	26.659	0.0	618.4	92
240 min Summer	21.716	0.0	672.5	124
360 min Summer	16.145	0.0	752.7	0
480 min Summer	13.001	0.0	808.2	0
600 min Summer	10.944	0.0	850.4	0
720 min Summer	9.481	0.0	884.0	0
960 min Summer	7.517	0.0	934.5	0
1440 min Summer	5.373	0.0	1001.9	0
2160 min Summer	3.828	0.0	1070.7	0
2880 min Summer	3.025	0.0	1128.1	0
4320 min Summer	2.215	0.0	1239.1	0
5760 min Summer	1.806	0.0	1347.2	0
7200 min Summer	1.568	0.0	1462.3	0
8640 min Summer	1.413	0.0	1581.2	0

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Micro Drainage

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	8.455	0.000	0.0	11.0	11.0	0.0	O K
15 min Winter	9.937	1.482	0.0	255.0	255.0	113.3	Flood Risk
30 min Winter	9.870	1.415	0.0	255.0	255.0	101.8	Flood Risk
60 min Winter	9.499	1.044	0.0	255.0	255.0	48.7	O K
120 min Winter	8.736	0.281	0.0	255.0	255.0	2.0	O K
180 min Winter	8.473	0.018	0.0	185.5	185.5	0.0	O K
240 min Winter	8.455	0.000	0.0	136.2	136.2	0.0	O K
360 min Winter	8.455	0.000	0.0	101.2	101.2	0.0	O K
480 min Winter	8.455	0.000	0.0	81.5	81.5	0.0	O K
600 min Winter	8.455	0.000	0.0	68.6	68.6	0.0	O K
720 min Winter	8.455	0.000	0.0	59.4	59.4	0.0	O K
960 min Winter	8.455	0.000	0.0	47.1	47.1	0.0	O K
1440 min Winter	8.455	0.000	0.0	33.7	33.7	0.0	O K
2160 min Winter	8.455	0.000	0.0	24.0	24.0	0.0	O K
2880 min Winter	8.455	0.000	0.0	19.0	19.0	0.0	O K
4320 min Winter	8.455	0.000	0.0	13.9	13.9	0.0	O K
5760 min Winter	8.455	0.000	0.0	11.3	11.3	0.0	O K
7200 min Winter	8.455	0.000	0.0	9.8	9.8	0.0	O K
8640 min Winter	8.455	0.000	0.0	8.9	8.9	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.306	0.0	1704.2	0
15 min Winter	132.256	0.0	299.9	13
30 min Winter	89.648	0.0	401.4	22
60 min Winter	58.187	0.0	515.5	38
120 min Winter	35.502	0.0	628.7	66
180 min Winter	26.659	0.0	705.5	90
240 min Winter	21.716	0.0	775.3	0
360 min Winter	16.145	0.0	864.6	0
480 min Winter	13.001	0.0	928.3	0
600 min Winter	10.944	0.0	976.8	0
720 min Winter	9.481	0.0	1015.5	0
960 min Winter	7.517	0.0	1073.5	0
1440 min Winter	5.373	0.0	1150.9	0
2160 min Winter	3.828	0.0	1229.8	0
2880 min Winter	3.025	0.0	1295.7	0
4320 min Winter	2.215	0.0	1423.2	0
5760 min Winter	1.806	0.0	1547.4	0
7200 min Winter	1.568	0.0	1679.7	0
8640 min Winter	1.413	0.0	1816.2	0

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	8.455	0.000	0.0	8.2	8.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	1.306	0.0	1957.5	0

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.740
Cv (Winter)	0.850
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.050

Time (mins) From:	To:	Area (ha)
0	4	1.050

Model Details

Storage is Online Cover Level (m) 10.000

Swale Structure

Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	142.0
Infiltration Coefficient Side (m/hr)	0.00000	Side Slope (1:X)	1.0
Safety Factor	1.5	Slope (1:X)	150.0
Porosity	0.50	Cap Volume Depth (m)	0.000
Invert Level (m)	8.455	Cap Infiltration Depth (m)	0.000
Base Width (m)	0.5		

Pump Outflow Control

Invert Level (m) 8.400

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	255.0000	1.200	255.0000	3.000	255.0000	7.000	255.0000
0.200	255.0000	1.400	255.0000	3.500	255.0000	7.500	255.0000
0.300	255.0000	1.600	255.0000	4.000	255.0000	8.000	255.0000
0.400	255.0000	1.800	255.0000	4.500	255.0000	8.500	255.0000
0.500	255.0000	2.000	255.0000	5.000	255.0000	9.000	255.0000
0.600	255.0000	2.200	255.0000	5.500	255.0000	9.500	255.0000
0.800	255.0000	2.400	255.0000	6.000	255.0000		
1.000	255.0000	2.600	255.0000	6.500	255.0000		

APPENDIX E

NORTHERN TANK STRIP 1 IN 2, 1 IN 30 AND 1 IN 100-YEAR CALCULATIONS

james&nicholas		Micro Drainage
Date 07/12/2023 13:51	Designed by karlj	
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Summary of Results for 100 year Return Period (+40%)

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	12.121	2.121	1.7	258.8	O K
30 min Summer	12.868	2.868	1.7	349.9	O K
60 min Summer	13.708	3.708	1.7	452.3	O K
120 min Summer	14.487	4.487	1.7	547.5	O K
180 min Summer	15.019	5.019	1.7	612.3	O K
240 min Summer	15.416	5.416	1.7	660.8	O K
360 min Summer	15.967	5.967	1.7	727.9	O K
480 min Summer	16.332	6.332	1.7	772.5	O K
600 min Summer	16.587	6.587	1.7	803.6	O K
720 min Summer	16.772	6.772	1.7	826.1	O K
960 min Summer	17.000	7.000	1.7	854.1	O K
1440 min Summer	17.179	7.179	1.7	875.9	O K
2160 min Summer	17.180	7.180	1.7	875.9	O K
2880 min Summer	17.088	7.088	1.7	864.8	O K
4320 min Summer	16.890	6.890	1.7	840.6	O K
5760 min Summer	16.817	6.817	1.7	831.7	O K
7200 min Summer	16.918	6.918	1.7	844.0	O K
8640 min Summer	17.106	7.106	1.7	866.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	132.256	0.0	142.3	19
30 min Summer	89.648	0.0	142.3	34
60 min Summer	58.187	0.0	284.8	64
120 min Summer	35.502	0.0	284.6	124
180 min Summer	26.659	0.0	284.5	184
240 min Summer	21.716	0.0	284.4	244
360 min Summer	16.145	0.0	284.1	364
480 min Summer	13.001	0.0	283.9	484
600 min Summer	10.944	0.0	283.6	604
720 min Summer	9.481	0.0	283.4	724
960 min Summer	7.517	0.0	282.9	962
1440 min Summer	5.373	0.0	281.9	1442
2160 min Summer	3.828	0.0	565.5	2160
2880 min Summer	3.025	0.0	563.6	2880
4320 min Summer	2.215	0.0	558.3	4108
5760 min Summer	1.806	0.0	1116.3	4840
7200 min Summer	1.568	0.0	1097.1	5624
8640 min Summer	1.413	0.0	1074.7	6480

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	17.355	7.355	1.7	897.4	O K
15 min Winter	12.377	2.377	1.7	290.0	O K
30 min Winter	13.216	3.216	1.7	392.3	O K
60 min Winter	14.159	4.159	1.7	507.4	O K
120 min Winter	15.039	5.039	1.7	614.8	O K
180 min Winter	15.642	5.642	1.7	688.3	O K
240 min Winter	16.093	6.093	1.7	743.4	O K
360 min Winter	16.723	6.723	1.7	820.2	O K
480 min Winter	17.146	7.146	1.7	871.8	O K
600 min Winter	17.446	7.446	1.7	908.4	O K
720 min Winter	17.666	7.666	1.7	935.3	O K
960 min Winter	17.950	7.950	1.7	969.9	O K
1440 min Winter	18.206	8.206	1.7	1001.2	O K
2160 min Winter	18.295	8.295	1.7	1012.0	O K
2880 min Winter	18.281	8.281	1.7	1010.3	O K
4320 min Winter	18.232	8.232	1.7	1004.3	O K
5760 min Winter	18.177	8.177	1.7	997.6	O K
7200 min Winter	18.214	8.214	1.7	1002.2	O K
8640 min Winter	18.397	8.397	1.7	1024.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.306	0.0	1050.5	7360
15 min Winter	132.256	0.0	142.3	19
30 min Winter	89.648	0.0	142.3	34
60 min Winter	58.187	0.0	284.7	64
120 min Winter	35.502	0.0	284.5	122
180 min Winter	26.659	0.0	284.2	182
240 min Winter	21.716	0.0	284.0	242
360 min Winter	16.145	0.0	283.6	360
480 min Winter	13.001	0.0	283.1	478
600 min Winter	10.944	0.0	282.7	596
720 min Winter	9.481	0.0	282.3	716
960 min Winter	7.517	0.0	281.4	952
1440 min Winter	5.373	0.0	279.6	1424
2160 min Winter	3.828	0.0	562.1	2116
2880 min Winter	3.025	0.0	559.1	2796
4320 min Winter	2.215	0.0	552.8	4148
5760 min Winter	1.806	0.0	1115.8	5424
7200 min Winter	1.568	0.0	1107.1	6560
8640 min Winter	1.413	0.0	1092.1	6920

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Winter	18.678	8.678	1.7	1058.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	1.306	0.0	1073.4	7872

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Micro Drainage

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.050

Time (mins) From:	To:	Area (ha)
0	4	1.050

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Model Details

Storage is Online Cover Level (m) 20.000

Tank or Pond Structure

Invert Level (m) 10.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	122.0	10.000	122.0

Pump Outflow Control

Invert Level (m) 10.000

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.6500	1.200	1.6500	3.000	1.6500	7.000	1.6500
0.200	1.6500	1.400	1.6500	3.500	1.6500	7.500	1.6500
0.300	1.6500	1.600	1.6500	4.000	1.6500	8.000	1.6500
0.400	1.6500	1.800	1.6500	4.500	1.6500	8.500	1.6500
0.500	1.6500	2.000	1.6500	5.000	1.6500	9.000	1.6500
0.600	1.6500	2.200	1.6500	5.500	1.6500	9.500	1.6500
0.800	1.6500	2.400	1.6500	6.000	1.6500		
1.000	1.6500	2.600	1.6500	6.500	1.6500		

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Micro Drainage

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	11.161	1.161	1.7	141.6	O K
30 min Summer	11.555	1.555	1.7	189.7	O K
60 min Summer	11.987	1.987	1.7	242.4	O K
120 min Summer	12.403	2.403	1.7	293.2	O K
180 min Summer	12.671	2.671	1.7	325.9	O K
240 min Summer	12.866	2.866	1.7	349.6	O K
360 min Summer	13.130	3.130	1.7	381.9	O K
480 min Summer	13.300	3.300	1.7	402.7	O K
600 min Summer	13.415	3.415	1.7	416.6	O K
720 min Summer	13.493	3.493	1.7	426.1	O K
960 min Summer	13.576	3.576	1.7	436.3	O K
1440 min Summer	13.600	3.600	1.7	439.2	O K
2160 min Summer	13.493	3.493	1.7	426.1	O K
2880 min Summer	13.393	3.393	1.7	414.0	O K
4320 min Summer	13.319	3.319	1.7	404.9	O K
5760 min Summer	13.315	3.315	1.7	404.4	O K
7200 min Summer	13.356	3.356	1.7	409.4	O K
8640 min Summer	13.419	3.419	1.7	417.1	O K
10080 min Summer	13.499	3.499	1.7	426.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	72.726	0.0	138.3	19
30 min Summer	48.916	0.0	142.2	34
60 min Summer	31.512	0.0	247.9	64
120 min Summer	19.336	0.0	284.3	124
180 min Summer	14.516	0.0	284.0	184
240 min Summer	11.821	0.0	283.8	244
360 min Summer	8.805	0.0	283.3	362
480 min Summer	7.114	0.0	282.9	482
600 min Summer	6.013	0.0	282.4	602
720 min Summer	5.232	0.0	281.9	722
960 min Summer	4.185	0.0	280.9	962
1440 min Summer	3.045	0.0	278.7	1440
2160 min Summer	2.219	0.0	559.5	2092
2880 min Summer	1.783	0.0	552.0	2396
4320 min Summer	1.337	0.0	527.1	3156
5760 min Summer	1.107	0.0	837.0	3984
7200 min Summer	0.970	0.0	916.8	4896
8640 min Summer	0.879	0.0	992.4	5712
10080 min Summer	0.814	0.0	961.1	6560

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Micro Drainage

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	11.302	1.302	1.7	158.8	O K
30 min Winter	11.744	1.744	1.7	212.8	O K
60 min Winter	12.232	2.232	1.7	272.3	O K
120 min Winter	12.704	2.704	1.7	329.9	O K
180 min Winter	13.011	3.011	1.7	367.4	O K
240 min Winter	13.236	3.236	1.7	394.8	O K
360 min Winter	13.546	3.546	1.7	432.6	O K
480 min Winter	13.749	3.749	1.7	457.4	O K
600 min Winter	13.891	3.891	1.7	474.7	O K
720 min Winter	13.992	3.992	1.7	487.0	O K
960 min Winter	14.113	4.113	1.7	501.7	O K
1440 min Winter	14.195	4.195	1.7	511.7	O K
2160 min Winter	14.153	4.153	1.7	506.7	O K
2880 min Winter	14.049	4.049	1.7	494.0	O K
4320 min Winter	13.910	3.910	1.7	477.0	O K
5760 min Winter	13.873	3.873	1.7	472.5	O K
7200 min Winter	13.880	3.880	1.7	473.4	O K
8640 min Winter	13.909	3.909	1.7	476.9	O K
10080 min Winter	13.957	3.957	1.7	482.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	72.726	0.0	142.3	19
30 min Winter	48.916	0.0	142.2	34
60 min Winter	31.512	0.0	275.3	64
120 min Winter	19.336	0.0	284.2	122
180 min Winter	14.516	0.0	283.9	182
240 min Winter	11.821	0.0	283.5	240
360 min Winter	8.805	0.0	282.9	358
480 min Winter	7.114	0.0	282.3	476
600 min Winter	6.013	0.0	281.7	594
720 min Winter	5.232	0.0	281.0	710
960 min Winter	4.185	0.0	279.8	944
1440 min Winter	3.045	0.0	277.2	1400
2160 min Winter	2.219	0.0	558.2	2076
2880 min Winter	1.783	0.0	553.3	2708
4320 min Winter	1.337	0.0	536.6	3412
5760 min Winter	1.107	0.0	937.4	4328
7200 min Winter	0.970	0.0	1026.4	5328
8640 min Winter	0.879	0.0	1026.8	6232
10080 min Winter	0.814	0.0	997.8	7168

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.050

Time (mins) From:	To:	Area (ha)
0	4	1.050

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Model Details

Storage is Online Cover Level (m) 20.000

Tank or Pond Structure

Invert Level (m) 10.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	122.0	10.000	122.0

Pump Outflow Control

Invert Level (m) 10.000

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.6500	1.200	1.6500	3.000	1.6500	7.000	1.6500
0.200	1.6500	1.400	1.6500	3.500	1.6500	7.500	1.6500
0.300	1.6500	1.600	1.6500	4.000	1.6500	8.000	1.6500
0.400	1.6500	1.800	1.6500	4.500	1.6500	8.500	1.6500
0.500	1.6500	2.000	1.6500	5.000	1.6500	9.000	1.6500
0.600	1.6500	2.200	1.6500	5.500	1.6500	9.500	1.6500
0.800	1.6500	2.400	1.6500	6.000	1.6500		
1.000	1.6500	2.600	1.6500	6.500	1.6500		

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Micro Drainage

Date 07/12/2023 13:53 | Designed by karlj
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Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	10.544	0.544	1.7	66.4	O K
30 min Summer	10.710	0.710	1.7	86.6	O K
60 min Summer	10.892	0.892	1.7	108.8	O K
120 min Summer	11.171	1.171	1.7	142.8	O K
180 min Summer	11.346	1.346	1.7	164.2	O K
240 min Summer	11.470	1.470	1.7	179.3	O K
360 min Summer	11.633	1.633	1.7	199.2	O K
480 min Summer	11.732	1.732	1.7	211.3	O K
600 min Summer	11.794	1.794	1.7	218.8	O K
720 min Summer	11.831	1.831	1.7	223.4	O K
960 min Summer	11.857	1.857	1.7	226.5	O K
1440 min Summer	11.842	1.842	1.7	224.7	O K
2160 min Summer	11.802	1.802	1.7	219.8	O K
2880 min Summer	11.771	1.771	1.7	216.0	O K
4320 min Summer	11.733	1.733	1.7	211.4	O K
5760 min Summer	11.707	1.707	1.7	208.2	O K
7200 min Summer	11.695	1.695	1.7	206.7	O K
8640 min Summer	11.690	1.690	1.7	206.1	O K
10080 min Summer	11.691	1.691	1.7	206.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	34.419	0.0	67.7	19
30 min Summer	22.669	0.0	89.2	34
60 min Summer	14.480	0.0	114.0	64
120 min Summer	9.747	0.0	153.5	124
180 min Summer	7.633	0.0	180.3	182
240 min Summer	6.379	0.0	200.9	242
360 min Summer	4.906	0.0	231.7	362
480 min Summer	4.046	0.0	254.4	482
600 min Summer	3.472	0.0	270.8	602
720 min Summer	3.057	0.0	279.0	720
960 min Summer	2.489	0.0	277.1	960
1440 min Summer	1.860	0.0	271.8	1226
2160 min Summer	1.390	0.0	394.2	1604
2880 min Summer	1.138	0.0	430.0	2016
4320 min Summer	0.873	0.0	489.5	2856
5760 min Summer	0.733	0.0	554.5	3696
7200 min Summer	0.649	0.0	613.0	4544
8640 min Summer	0.591	0.0	670.4	5360
10080 min Summer	0.550	0.0	727.6	6160

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Micro Drainage

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Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	10.610	0.610	1.7	74.5	O K
30 min Winter	10.798	0.798	1.7	97.3	O K
60 min Winter	11.004	1.004	1.7	122.5	O K
120 min Winter	11.323	1.323	1.7	161.4	O K
180 min Winter	11.525	1.525	1.7	186.0	O K
240 min Winter	11.670	1.670	1.7	203.7	O K
360 min Winter	11.864	1.864	1.7	227.4	O K
480 min Winter	11.988	1.988	1.7	242.5	O K
600 min Winter	12.070	2.070	1.7	252.5	O K
720 min Winter	12.124	2.124	1.7	259.1	O K
960 min Winter	12.177	2.177	1.7	265.6	O K
1440 min Winter	12.184	2.184	1.7	266.5	O K
2160 min Winter	12.117	2.117	1.7	258.3	O K
2880 min Winter	12.065	2.065	1.7	252.0	O K
4320 min Winter	11.974	1.974	1.7	240.8	O K
5760 min Winter	11.888	1.888	1.7	230.3	O K
7200 min Winter	11.819	1.819	1.7	221.9	O K
8640 min Winter	11.761	1.761	1.7	214.8	O K
10080 min Winter	11.713	1.713	1.7	208.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	34.419	0.0	75.8	19
30 min Winter	22.669	0.0	99.8	33
60 min Winter	14.480	0.0	127.7	62
120 min Winter	9.747	0.0	171.9	122
180 min Winter	7.633	0.0	202.0	180
240 min Winter	6.379	0.0	225.0	240
360 min Winter	4.906	0.0	258.9	356
480 min Winter	4.046	0.0	279.0	472
600 min Winter	3.472	0.0	280.0	588
720 min Winter	3.057	0.0	279.1	702
960 min Winter	2.489	0.0	277.2	930
1440 min Winter	1.860	0.0	273.0	1368
2160 min Winter	1.390	0.0	441.5	1728
2880 min Winter	1.138	0.0	481.6	2188
4320 min Winter	0.873	0.0	507.6	3112
5760 min Winter	0.733	0.0	621.0	4032
7200 min Winter	0.649	0.0	686.5	4904
8640 min Winter	0.591	0.0	750.9	5800
10080 min Winter	0.550	0.0	814.9	6664

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File Northern Tank.SRCX	Checked by	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.050

Time (mins) From:	To:	Area (ha)
0	4	1.050

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Model Details

Storage is Online Cover Level (m) 20.000

Tank or Pond Structure

Invert Level (m) 10.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	122.0	10.000	122.0

Pump Outflow Control

Invert Level (m) 10.000

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.6500	1.200	1.6500	3.000	1.6500	7.000	1.6500
0.200	1.6500	1.400	1.6500	3.500	1.6500	7.500	1.6500
0.300	1.6500	1.600	1.6500	4.000	1.6500	8.000	1.6500
0.400	1.6500	1.800	1.6500	4.500	1.6500	8.500	1.6500
0.500	1.6500	2.000	1.6500	5.000	1.6500	9.000	1.6500
0.600	1.6500	2.200	1.6500	5.500	1.6500	9.500	1.6500
0.800	1.6500	2.400	1.6500	6.000	1.6500		
1.000	1.6500	2.600	1.6500	6.500	1.6500		

APPENDIX F

SOUTHERN FILTER STRIP 1 IN 2, 1 IN 30 AND 1 IN 100-YEAR CALCULATIONS

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Micro Drainage

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Summary of Results for 2 year Return Period

Half Drain Time : 0 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	8.479	0.024	0.0	202.1	202.1	0.0	O K
30 min Summer	8.471	0.016	0.0	180.4	180.4	0.0	O K
60 min Summer	8.455	0.000	0.0	121.0	121.0	0.0	O K
120 min Summer	8.455	0.000	0.0	87.2	87.2	0.0	O K
180 min Summer	8.455	0.000	0.0	70.1	70.1	0.0	O K
240 min Summer	8.455	0.000	0.0	59.1	59.1	0.0	O K
360 min Summer	8.455	0.000	0.0	45.5	45.5	0.0	O K
480 min Summer	8.455	0.000	0.0	37.5	37.5	0.0	O K
600 min Summer	8.455	0.000	0.0	32.2	32.2	0.0	O K
720 min Summer	8.455	0.000	0.0	28.3	28.3	0.0	O K
960 min Summer	8.455	0.000	0.0	23.1	23.1	0.0	O K
1440 min Summer	8.455	0.000	0.0	17.2	17.2	0.0	O K
2160 min Summer	8.455	0.000	0.0	12.9	12.9	0.0	O K
2880 min Summer	8.455	0.000	0.0	10.5	10.5	0.0	O K
4320 min Summer	8.455	0.000	0.0	8.1	8.1	0.0	O K
5760 min Summer	8.455	0.000	0.0	6.8	6.8	0.0	O K
7200 min Summer	8.455	0.000	0.0	6.0	6.0	0.0	O K
8640 min Summer	8.455	0.000	0.0	5.5	5.5	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	34.419	0.0	71.4	9
30 min Summer	22.669	0.0	95.5	17
60 min Summer	14.480	0.0	123.2	0
120 min Summer	9.747	0.0	165.9	0
180 min Summer	7.633	0.0	194.9	0
240 min Summer	6.379	0.0	217.1	0
360 min Summer	4.906	0.0	250.5	0
480 min Summer	4.046	0.0	275.5	0
600 min Summer	3.472	0.0	295.5	0
720 min Summer	3.057	0.0	312.2	0
960 min Summer	2.489	0.0	339.0	0
1440 min Summer	1.860	0.0	379.9	0
2160 min Summer	1.390	0.0	426.0	0
2880 min Summer	1.138	0.0	464.7	0
4320 min Summer	0.873	0.0	534.8	0
5760 min Summer	0.733	0.0	599.2	0
7200 min Summer	0.649	0.0	662.4	0
8640 min Summer	0.591	0.0	724.5	0

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Micro Drainage

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Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	8.455	0.000	0.0	5.1	5.1	0.0	O K
15 min Winter	8.485	0.030	0.0	216.1	216.1	0.0	O K
30 min Winter	8.455	0.000	0.0	140.2	140.2	0.0	O K
60 min Winter	8.455	0.000	0.0	97.5	97.5	0.0	O K
120 min Winter	8.455	0.000	0.0	66.6	66.6	0.0	O K
180 min Winter	8.455	0.000	0.0	52.3	52.3	0.0	O K
240 min Winter	8.455	0.000	0.0	43.8	43.8	0.0	O K
360 min Winter	8.455	0.000	0.0	33.7	33.7	0.0	O K
480 min Winter	8.455	0.000	0.0	27.8	27.8	0.0	O K
600 min Winter	8.455	0.000	0.0	23.8	23.8	0.0	O K
720 min Winter	8.455	0.000	0.0	21.0	21.0	0.0	O K
960 min Winter	8.455	0.000	0.0	17.1	17.1	0.0	O K
1440 min Winter	8.455	0.000	0.0	12.8	12.8	0.0	O K
2160 min Winter	8.455	0.000	0.0	9.5	9.5	0.0	O K
2880 min Winter	8.455	0.000	0.0	7.8	7.8	0.0	O K
4320 min Winter	8.455	0.000	0.0	6.0	6.0	0.0	O K
5760 min Winter	8.455	0.000	0.0	5.0	5.0	0.0	O K
7200 min Winter	8.455	0.000	0.0	4.5	4.5	0.0	O K
8640 min Winter	8.455	0.000	0.0	4.1	4.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.550	0.0	786.3	0
15 min Winter	34.419	0.0	84.0	9
30 min Winter	22.669	0.0	110.2	0
60 min Winter	14.480	0.0	141.5	0
120 min Winter	9.747	0.0	190.6	0
180 min Winter	7.633	0.0	223.8	0
240 min Winter	6.379	0.0	249.4	0
360 min Winter	4.906	0.0	287.7	0
480 min Winter	4.046	0.0	316.4	0
600 min Winter	3.472	0.0	339.4	0
720 min Winter	3.057	0.0	358.6	0
960 min Winter	2.489	0.0	389.3	0
1440 min Winter	1.860	0.0	436.3	0
2160 min Winter	1.390	0.0	489.3	0
2880 min Winter	1.138	0.0	533.8	0
4320 min Winter	0.873	0.0	614.3	0
5760 min Winter	0.733	0.0	688.3	0
7200 min Winter	0.649	0.0	760.9	0
8640 min Winter	0.591	0.0	832.2	0

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Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	8.455	0.000	0.0	3.8	3.8	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	0.550	0.0	903.1	0

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Innovyze	Source Control 2019.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.740
Cv (Winter)	0.850
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.150

Time (mins) From:	To:	Area (ha)
0	4	1.150

james&nicholas		Micro Drainage
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Model Details

Storage is Online Cover Level (m) 10.000

Swale Structure

Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	180.0
Infiltration Coefficient Side (m/hr)	0.00000	Side Slope (1:X)	1.0
Safety Factor	1.5	Slope (1:X)	150.0
Porosity	0.50	Cap Volume Depth (m)	0.000
Invert Level (m)	8.455	Cap Infiltration Depth (m)	0.000
Base Width (m)	0.5		

Pump Outflow Control

Invert Level (m) 8.400

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	255.0000	1.200	255.0000	3.000	255.0000	7.000	255.0000
0.200	255.0000	1.400	255.0000	3.500	255.0000	7.500	255.0000
0.300	255.0000	1.600	255.0000	4.000	255.0000	8.000	255.0000
0.400	255.0000	1.800	255.0000	4.500	255.0000	8.500	255.0000
0.500	255.0000	2.000	255.0000	5.000	255.0000	9.000	255.0000
0.600	255.0000	2.200	255.0000	5.500	255.0000	9.500	255.0000
0.800	255.0000	2.400	255.0000	6.000	255.0000		
1.000	255.0000	2.600	255.0000	6.500	255.0000		

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Micro Drainage

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Summary of Results for 30 year Return Period

Half Drain Time : 1 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.247	0.792	0.0	255.0	255.0	24.2	O K
30 min Summer	9.148	0.693	0.0	255.0	255.0	17.3	O K
60 min Summer	8.604	0.149	0.0	255.0	255.0	0.5	O K
120 min Summer	8.468	0.013	0.0	172.8	172.8	0.0	O K
180 min Summer	8.455	0.000	0.0	133.3	133.3	0.0	O K
240 min Summer	8.455	0.000	0.0	109.5	109.5	0.0	O K
360 min Summer	8.455	0.000	0.0	81.6	81.6	0.0	O K
480 min Summer	8.455	0.000	0.0	65.9	65.9	0.0	O K
600 min Summer	8.455	0.000	0.0	55.7	55.7	0.0	O K
720 min Summer	8.455	0.000	0.0	48.5	48.5	0.0	O K
960 min Summer	8.455	0.000	0.0	38.8	38.8	0.0	O K
1440 min Summer	8.455	0.000	0.0	28.2	28.2	0.0	O K
2160 min Summer	8.455	0.000	0.0	20.6	20.6	0.0	O K
2880 min Summer	8.455	0.000	0.0	16.5	16.5	0.0	O K
4320 min Summer	8.455	0.000	0.0	12.4	12.4	0.0	O K
5760 min Summer	8.455	0.000	0.0	10.3	10.3	0.0	O K
7200 min Summer	8.455	0.000	0.0	9.0	9.0	0.0	O K
8640 min Summer	8.455	0.000	0.0	8.1	8.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	72.726	0.0	158.7	12
30 min Summer	48.916	0.0	209.3	19
60 min Summer	31.512	0.0	269.1	32
120 min Summer	19.336	0.0	329.0	62
180 min Summer	14.516	0.0	370.6	0
240 min Summer	11.821	0.0	402.4	0
360 min Summer	8.805	0.0	449.6	0
480 min Summer	7.114	0.0	484.3	0
600 min Summer	6.013	0.0	511.7	0
720 min Summer	5.232	0.0	534.3	0
960 min Summer	4.185	0.0	569.9	0
1440 min Summer	3.045	0.0	621.9	0
2160 min Summer	2.219	0.0	679.7	0
2880 min Summer	1.783	0.0	728.5	0
4320 min Summer	1.337	0.0	819.2	0
5760 min Summer	1.107	0.0	904.5	0
7200 min Summer	0.970	0.0	990.8	0
8640 min Summer	0.879	0.0	1077.2	0

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Micro Drainage

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	8.455	0.000	0.0	7.5	7.5	0.0	O K
15 min Winter	9.311	0.856	0.0	255.0	255.0	29.4	O K
30 min Winter	9.072	0.617	0.0	255.0	255.0	13.0	O K
60 min Winter	8.496	0.041	0.0	245.4	245.4	0.0	O K
120 min Winter	8.455	0.000	0.0	132.1	132.1	0.0	O K
180 min Winter	8.455	0.000	0.0	99.5	99.5	0.0	O K
240 min Winter	8.455	0.000	0.0	81.2	81.2	0.0	O K
360 min Winter	8.455	0.000	0.0	60.5	60.5	0.0	O K
480 min Winter	8.455	0.000	0.0	48.9	48.9	0.0	O K
600 min Winter	8.455	0.000	0.0	41.3	41.3	0.0	O K
720 min Winter	8.455	0.000	0.0	35.9	35.9	0.0	O K
960 min Winter	8.455	0.000	0.0	28.7	28.7	0.0	O K
1440 min Winter	8.455	0.000	0.0	20.9	20.9	0.0	O K
2160 min Winter	8.455	0.000	0.0	15.2	15.2	0.0	O K
2880 min Winter	8.455	0.000	0.0	12.2	12.2	0.0	O K
4320 min Winter	8.455	0.000	0.0	9.2	9.2	0.0	O K
5760 min Winter	8.455	0.000	0.0	7.6	7.6	0.0	O K
7200 min Winter	8.455	0.000	0.0	6.7	6.7	0.0	O K
8640 min Winter	8.455	0.000	0.0	6.0	6.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.814	0.0	1164.5	0
15 min Winter	72.726	0.0	183.4	12
30 min Winter	48.916	0.0	242.1	20
60 min Winter	31.512	0.0	307.9	34
120 min Winter	19.336	0.0	378.0	0
180 min Winter	14.516	0.0	425.7	0
240 min Winter	11.821	0.0	462.2	0
360 min Winter	8.805	0.0	516.4	0
480 min Winter	7.114	0.0	556.3	0
600 min Winter	6.013	0.0	587.8	0
720 min Winter	5.232	0.0	613.7	0
960 min Winter	4.185	0.0	654.6	0
1440 min Winter	3.045	0.0	714.4	0
2160 min Winter	2.219	0.0	780.7	0
2880 min Winter	1.783	0.0	836.8	0
4320 min Winter	1.337	0.0	940.9	0
5760 min Winter	1.107	0.0	1039.0	0
7200 min Winter	0.970	0.0	1138.1	0
8640 min Winter	0.879	0.0	1237.3	0

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	8.455	0.000	0.0	5.6	5.6	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	0.814	0.0	1337.5	0

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Micro Drainage

Date 07/12/2023 13:26	Designed by karlj
File Southern Filter Strip.SRCX	Checked by
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.740
Cv (Winter)	0.850
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.150

Time (mins) From:	To:	Area (ha)
0	4	1.150

james&nicholas		Micro Drainage
Date 07/12/2023 13:26	Designed by karlj	
File Southern Filter Strip.SRCX	Checked by	
Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 10.000

Swale Structure

Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	180.0
Infiltration Coefficient Side (m/hr)	0.00000	Side Slope (1:X)	1.0
Safety Factor	1.5	Slope (1:X)	150.0
Porosity	0.50	Cap Volume Depth (m)	0.000
Invert Level (m)	8.455	Cap Infiltration Depth (m)	0.000
Base Width (m)	0.5		

Pump Outflow Control

Invert Level (m) 8.400

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	255.0000	1.200	255.0000	3.000	255.0000	7.000	255.0000
0.200	255.0000	1.400	255.0000	3.500	255.0000	7.500	255.0000
0.300	255.0000	1.600	255.0000	4.000	255.0000	8.000	255.0000
0.400	255.0000	1.800	255.0000	4.500	255.0000	8.500	255.0000
0.500	255.0000	2.000	255.0000	5.000	255.0000	9.000	255.0000
0.600	255.0000	2.200	255.0000	5.500	255.0000	9.500	255.0000
0.800	255.0000	2.400	255.0000	6.000	255.0000		
1.000	255.0000	2.600	255.0000	6.500	255.0000		

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Micro Drainage

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Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 5 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.876	1.421	0.0	255.0	255.0	108.4	Flood Risk
30 min Summer	9.885	1.430	0.0	255.0	255.0	110.1	Flood Risk
60 min Summer	9.750	1.295	0.0	255.0	255.0	85.5	Flood Risk
120 min Summer	9.253	0.798	0.0	255.0	255.0	24.6	O K
180 min Summer	8.787	0.332	0.0	255.0	255.0	3.0	O K
240 min Summer	8.500	0.045	0.0	254.4	254.4	0.1	O K
360 min Summer	8.462	0.007	0.0	157.5	157.5	0.0	O K
480 min Summer	8.455	0.000	0.0	120.5	120.5	0.0	O K
600 min Summer	8.455	0.000	0.0	101.4	101.4	0.0	O K
720 min Summer	8.455	0.000	0.0	87.9	87.9	0.0	O K
960 min Summer	8.455	0.000	0.0	69.7	69.7	0.0	O K
1440 min Summer	8.455	0.000	0.0	49.8	49.8	0.0	O K
2160 min Summer	8.455	0.000	0.0	35.5	35.5	0.0	O K
2880 min Summer	8.455	0.000	0.0	28.0	28.0	0.0	O K
4320 min Summer	8.455	0.000	0.0	20.5	20.5	0.0	O K
5760 min Summer	8.455	0.000	0.0	16.7	16.7	0.0	O K
7200 min Summer	8.455	0.000	0.0	14.5	14.5	0.0	O K
8640 min Summer	8.455	0.000	0.0	13.1	13.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	132.256	0.0	284.8	13
30 min Summer	89.648	0.0	387.8	21
60 min Summer	58.187	0.0	495.5	38
120 min Summer	35.502	0.0	594.1	66
180 min Summer	26.659	0.0	675.4	90
240 min Summer	21.716	0.0	738.2	120
360 min Summer	16.145	0.0	824.1	184
480 min Summer	13.001	0.0	885.1	0
600 min Summer	10.944	0.0	931.3	0
720 min Summer	9.481	0.0	968.2	0
960 min Summer	7.517	0.0	1023.5	0
1440 min Summer	5.373	0.0	1097.3	0
2160 min Summer	3.828	0.0	1172.7	0
2880 min Summer	3.025	0.0	1235.5	0
4320 min Summer	2.215	0.0	1357.1	0
5760 min Summer	1.806	0.0	1475.5	0
7200 min Summer	1.568	0.0	1601.6	0
8640 min Summer	1.413	0.0	1731.8	0

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Micro Drainage

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	8.455	0.000	0.0	12.1	12.1	0.0	O K
15 min Winter	9.998	1.543	0.0	255.0	255.0	133.3	Flood Risk
30 min Winter	9.969	1.514	0.0	255.0	255.0	127.2	Flood Risk
60 min Winter	9.670	1.215	0.0	255.0	255.0	72.5	O K
120 min Winter	8.580	0.125	0.0	255.0	255.0	0.3	O K
180 min Winter	8.488	0.033	0.0	223.8	223.8	0.0	O K
240 min Winter	8.459	0.004	0.0	149.8	149.8	0.0	O K
360 min Winter	8.455	0.000	0.0	110.9	110.9	0.0	O K
480 min Winter	8.455	0.000	0.0	89.3	89.3	0.0	O K
600 min Winter	8.455	0.000	0.0	75.2	75.2	0.0	O K
720 min Winter	8.455	0.000	0.0	65.1	65.1	0.0	O K
960 min Winter	8.455	0.000	0.0	51.6	51.6	0.0	O K
1440 min Winter	8.455	0.000	0.0	36.9	36.9	0.0	O K
2160 min Winter	8.455	0.000	0.0	26.3	26.3	0.0	O K
2880 min Winter	8.455	0.000	0.0	20.8	20.8	0.0	O K
4320 min Winter	8.455	0.000	0.0	15.2	15.2	0.0	O K
5760 min Winter	8.455	0.000	0.0	12.4	12.4	0.0	O K
7200 min Winter	8.455	0.000	0.0	10.8	10.8	0.0	O K
8640 min Winter	8.455	0.000	0.0	9.7	9.7	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.306	0.0	1866.5	0
15 min Winter	132.256	0.0	323.7	14
30 min Winter	89.648	0.0	436.6	23
60 min Winter	58.187	0.0	576.0	40
120 min Winter	35.502	0.0	689.8	62
180 min Winter	26.659	0.0	772.1	80
240 min Winter	21.716	0.0	845.8	116
360 min Winter	16.145	0.0	946.9	0
480 min Winter	13.001	0.0	1016.7	0
600 min Winter	10.944	0.0	1069.8	0
720 min Winter	9.481	0.0	1112.2	0
960 min Winter	7.517	0.0	1175.7	0
1440 min Winter	5.373	0.0	1260.5	0
2160 min Winter	3.828	0.0	1347.0	0
2880 min Winter	3.025	0.0	1419.2	0
4320 min Winter	2.215	0.0	1558.8	0
5760 min Winter	1.806	0.0	1694.8	0
7200 min Winter	1.568	0.0	1839.6	0
8640 min Winter	1.413	0.0	1989.2	0

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Micro Drainage

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	8.455	0.000	0.0	9.0	9.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	1.306	0.0	2144.0	0

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.740
Cv (Winter)	0.850
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.150

Time (mins) From:	To:	Area (ha)
0	4	1.150

Model Details

Storage is Online Cover Level (m) 10.000

Swale Structure

Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	180.0
Infiltration Coefficient Side (m/hr)	0.00000	Side Slope (1:X)	1.0
Safety Factor	1.5	Slope (1:X)	150.0
Porosity	0.50	Cap Volume Depth (m)	0.000
Invert Level (m)	8.455	Cap Infiltration Depth (m)	0.000
Base Width (m)	0.5		

Pump Outflow Control

Invert Level (m) 8.400

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	255.0000	1.200	255.0000	3.000	255.0000	7.000	255.0000
0.200	255.0000	1.400	255.0000	3.500	255.0000	7.500	255.0000
0.300	255.0000	1.600	255.0000	4.000	255.0000	8.000	255.0000
0.400	255.0000	1.800	255.0000	4.500	255.0000	8.500	255.0000
0.500	255.0000	2.000	255.0000	5.000	255.0000	9.000	255.0000
0.600	255.0000	2.200	255.0000	5.500	255.0000	9.500	255.0000
0.800	255.0000	2.400	255.0000	6.000	255.0000		
1.000	255.0000	2.600	255.0000	6.500	255.0000		

APPENDIX G

SOUTHERN TANK STRIP 1 IN 2, 1 IN 30 AND 1 IN 100-YEAR CALCULATIONS

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Micro Drainage

Date 07/12/2023 13:46 | Designed by karlj
File Southern Area 1in100 +40... | Checked by
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Summary of Results for 100 year Return Period (+40%)

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	12.324	2.324	1.7	283.5	O K
30 min Summer	13.144	3.144	1.7	383.6	O K
60 min Summer	14.065	4.065	1.7	495.9	O K
120 min Summer	14.924	4.924	1.7	600.7	O K
180 min Summer	15.510	5.510	1.7	672.3	O K
240 min Summer	15.950	5.950	1.7	725.9	O K
360 min Summer	16.561	6.561	1.7	800.5	O K
480 min Summer	16.971	6.971	1.7	850.4	O K
600 min Summer	17.259	7.259	1.7	885.6	O K
720 min Summer	17.470	7.470	1.7	911.3	O K
960 min Summer	17.738	7.738	1.7	944.0	O K
1440 min Summer	17.969	7.969	1.7	972.3	O K
2160 min Summer	18.022	8.022	1.7	978.7	O K
2880 min Summer	17.974	7.974	1.7	972.8	O K
4320 min Summer	17.848	7.848	1.7	957.5	O K
5760 min Summer	17.774	7.774	1.7	948.4	O K
7200 min Summer	17.900	7.900	1.7	963.7	O K
8640 min Summer	18.124	8.124	1.7	991.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	132.256	0.0	142.4	19
30 min Summer	89.648	0.0	142.3	34
60 min Summer	58.187	0.0	284.8	64
120 min Summer	35.502	0.0	284.7	124
180 min Summer	26.659	0.0	284.5	184
240 min Summer	21.716	0.0	284.4	244
360 min Summer	16.145	0.0	284.2	364
480 min Summer	13.001	0.0	284.0	484
600 min Summer	10.944	0.0	283.8	604
720 min Summer	9.481	0.0	283.6	724
960 min Summer	7.517	0.0	283.1	962
1440 min Summer	5.373	0.0	282.2	1442
2160 min Summer	3.828	0.0	566.0	2160
2880 min Summer	3.025	0.0	564.4	2880
4320 min Summer	2.215	0.0	560.4	4320
5760 min Summer	1.806	0.0	1122.8	5024
7200 min Summer	1.568	0.0	1107.8	5904
8640 min Summer	1.413	0.0	1088.8	6736

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Micro Drainage

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	18.419	8.419	1.7	1027.1	O K
15 min Winter	12.605	2.605	1.7	317.8	O K
30 min Winter	13.524	3.524	1.7	430.0	O K
60 min Winter	14.559	4.559	1.7	556.2	O K
120 min Winter	15.528	5.528	1.7	674.4	O K
180 min Winter	16.192	6.192	1.7	755.4	O K
240 min Winter	16.691	6.691	1.7	816.3	O K
360 min Winter	17.389	7.389	1.7	901.5	O K
480 min Winter	17.861	7.861	1.7	959.1	O K
600 min Winter	18.198	8.198	1.7	1000.2	O K
720 min Winter	18.448	8.448	1.7	1030.7	O K
960 min Winter	18.777	8.777	1.7	1070.7	O K
1440 min Winter	19.091	9.091	1.7	1109.2	O K
2160 min Winter	19.238	9.238	1.7	1127.1	O K
2880 min Winter	19.272	9.272	1.7	1131.2	O K
4320 min Winter	19.313	9.313	1.7	1136.2	O K
5760 min Winter	19.342	9.342	1.7	1139.7	O K
7200 min Winter	19.458	9.458	1.7	1153.9	O K
8640 min Winter	19.636	9.636	1.7	1175.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.306	0.0	1067.8	7568
15 min Winter	132.256	0.0	142.4	19
30 min Winter	89.648	0.0	142.3	34
60 min Winter	58.187	0.0	284.7	64
120 min Winter	35.502	0.0	284.5	124
180 min Winter	26.659	0.0	284.3	182
240 min Winter	21.716	0.0	284.0	242
360 min Winter	16.145	0.0	283.6	360
480 min Winter	13.001	0.0	283.2	478
600 min Winter	10.944	0.0	282.8	598
720 min Winter	9.481	0.0	282.4	716
960 min Winter	7.517	0.0	281.6	952
1440 min Winter	5.373	0.0	279.9	1426
2160 min Winter	3.828	0.0	562.5	2120
2880 min Winter	3.025	0.0	559.8	2820
4320 min Winter	2.215	0.0	554.0	4152
5760 min Winter	1.806	0.0	1117.8	5480
7200 min Winter	1.568	0.0	1110.5	6768
8640 min Winter	1.413	0.0	1101.9	7864

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Winter	19.953	9.953	1.7	1214.2	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	1.306	0.0	1087.7	8160

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Micro Drainage

Date 07/12/2023 13:46	Designed by karlj
File Southern Area 1in100 +40...	Checked by
Innovyze	Source Control 2019.1

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.150

Time (mins) From:	To:	Area (ha)
0	4	1.150

Model Details

Storage is Online Cover Level (m) 20.000

Tank or Pond Structure

Invert Level (m) 10.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	122.0	10.000	122.0

Pump Outflow Control

Invert Level (m) 10.000

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.6500	1.200	1.6500	3.000	1.6500	7.000	1.6500
0.200	1.6500	1.400	1.6500	3.500	1.6500	7.500	1.6500
0.300	1.6500	1.600	1.6500	4.000	1.6500	8.000	1.6500
0.400	1.6500	1.800	1.6500	4.500	1.6500	8.500	1.6500
0.500	1.6500	2.000	1.6500	5.000	1.6500	9.000	1.6500
0.600	1.6500	2.200	1.6500	5.500	1.6500	9.500	1.6500
0.800	1.6500	2.400	1.6500	6.000	1.6500		
1.000	1.6500	2.600	1.6500	6.500	1.6500		

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Micro Drainage

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	11.273	1.273	1.7	155.3	O K
30 min Summer	11.705	1.705	1.7	208.0	O K
60 min Summer	12.181	2.181	1.7	266.0	O K
120 min Summer	12.640	2.640	1.7	322.1	O K
180 min Summer	12.938	2.938	1.7	358.5	O K
240 min Summer	13.156	3.156	1.7	385.0	O K
360 min Summer	13.454	3.454	1.7	421.4	O K
480 min Summer	13.649	3.649	1.7	445.1	O K
600 min Summer	13.782	3.782	1.7	461.5	O K
720 min Summer	13.876	3.876	1.7	472.9	O K
960 min Summer	13.984	3.984	1.7	486.1	O K
1440 min Summer	14.043	4.043	1.7	493.3	O K
2160 min Summer	13.969	3.969	1.7	484.2	O K
2880 min Summer	13.863	3.863	1.7	471.3	O K
4320 min Summer	13.791	3.791	1.7	462.5	O K
5760 min Summer	13.803	3.803	1.7	463.9	O K
7200 min Summer	13.869	3.869	1.7	472.0	O K
8640 min Summer	13.960	3.960	1.7	483.1	O K
10080 min Summer	14.070	4.070	1.7	496.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	72.726	0.0	142.3	19
30 min Summer	48.916	0.0	142.2	34
60 min Summer	31.512	0.0	270.2	64
120 min Summer	19.336	0.0	284.4	124
180 min Summer	14.516	0.0	284.1	184
240 min Summer	11.821	0.0	283.9	244
360 min Summer	8.805	0.0	283.5	364
480 min Summer	7.114	0.0	283.1	482
600 min Summer	6.013	0.0	282.6	602
720 min Summer	5.232	0.0	282.2	722
960 min Summer	4.185	0.0	281.4	962
1440 min Summer	3.045	0.0	279.5	1442
2160 min Summer	2.219	0.0	561.1	2160
2880 min Summer	1.783	0.0	555.4	2508
4320 min Summer	1.337	0.0	534.4	3284
5760 min Summer	1.107	0.0	916.7	4096
7200 min Summer	0.970	0.0	1004.0	4968
8640 min Summer	0.879	0.0	1011.3	5800
10080 min Summer	0.814	0.0	977.5	6664

james&nicholas

Micro Drainage

Date 07/12/2023 13:48 | Designed by karlj
File Southern Area 1in100 +40... | Checked by
Innovyze | Source Control 2019.1

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	11.427	1.427	1.7	174.1	O K
30 min Winter	11.913	1.913	1.7	233.3	O K
60 min Winter	12.448	2.448	1.7	298.7	O K
120 min Winter	12.970	2.970	1.7	362.4	O K
180 min Winter	13.311	3.311	1.7	403.9	O K
240 min Winter	13.561	3.561	1.7	434.4	O K
360 min Winter	13.908	3.908	1.7	476.8	O K
480 min Winter	14.140	4.140	1.7	505.0	O K
600 min Winter	14.303	4.303	1.7	525.0	O K
720 min Winter	14.422	4.422	1.7	539.5	O K
960 min Winter	14.570	4.570	1.7	557.6	O K
1440 min Winter	14.692	4.692	1.7	572.5	O K
2160 min Winter	14.693	4.693	1.7	572.5	O K
2880 min Winter	14.620	4.620	1.7	563.7	O K
4320 min Winter	14.475	4.475	1.7	546.0	O K
5760 min Winter	14.467	4.467	1.7	544.9	O K
7200 min Winter	14.510	4.510	1.7	550.3	O K
8640 min Winter	14.577	4.577	1.7	558.4	O K
10080 min Winter	14.665	4.665	1.7	569.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	72.726	0.0	142.3	19
30 min Winter	48.916	0.0	142.2	34
60 min Winter	31.512	0.0	284.6	64
120 min Winter	19.336	0.0	284.2	122
180 min Winter	14.516	0.0	283.9	182
240 min Winter	11.821	0.0	283.6	240
360 min Winter	8.805	0.0	283.0	358
480 min Winter	7.114	0.0	282.4	476
600 min Winter	6.013	0.0	281.9	596
720 min Winter	5.232	0.0	281.3	712
960 min Winter	4.185	0.0	280.1	944
1440 min Winter	3.045	0.0	277.7	1410
2160 min Winter	2.219	0.0	559.0	2080
2880 min Winter	1.783	0.0	554.7	2736
4320 min Winter	1.337	0.0	542.4	3504
5760 min Winter	1.107	0.0	1026.7	4440
7200 min Winter	0.970	0.0	1065.5	5400
8640 min Winter	0.879	0.0	1039.1	6320
10080 min Winter	0.814	0.0	1012.0	7272

Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.150

Time (mins) From:	To:	Area (ha)
0	4	1.150

james&nicholas		Micro Drainage
Date 07/12/2023 13:48	Designed by karlj	
File Southern Area 1in100 +40...	Checked by	
Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 20.000

Tank or Pond Structure

Invert Level (m) 10.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	122.0	10.000	122.0

Pump Outflow Control

Invert Level (m) 10.000

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.6500	1.200	1.6500	3.000	1.6500	7.000	1.6500
0.200	1.6500	1.400	1.6500	3.500	1.6500	7.500	1.6500
0.300	1.6500	1.600	1.6500	4.000	1.6500	8.000	1.6500
0.400	1.6500	1.800	1.6500	4.500	1.6500	8.500	1.6500
0.500	1.6500	2.000	1.6500	5.000	1.6500	9.000	1.6500
0.600	1.6500	2.200	1.6500	5.500	1.6500	9.500	1.6500
0.800	1.6500	2.400	1.6500	6.000	1.6500		
1.000	1.6500	2.600	1.6500	6.500	1.6500		

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Micro Drainage

Date 07/12/2023 16:00 | Designed by karlj

File SOUTHERN AREA 1IN100 +40... | Checked by

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Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	10.597	0.597	1.7	72.8	O K
30 min Summer	10.779	0.779	1.7	95.1	O K
60 min Summer	10.980	0.980	1.7	119.6	O K
120 min Summer	11.290	1.290	1.7	157.3	O K
180 min Summer	11.485	1.485	1.7	181.2	O K
240 min Summer	11.625	1.625	1.7	198.3	O K
360 min Summer	11.811	1.811	1.7	221.0	O K
480 min Summer	11.928	1.928	1.7	235.2	O K
600 min Summer	12.003	2.003	1.7	244.4	O K
720 min Summer	12.052	2.052	1.7	250.3	O K
960 min Summer	12.094	2.094	1.7	255.5	O K
1440 min Summer	12.089	2.089	1.7	254.9	O K
2160 min Summer	12.051	2.051	1.7	250.3	O K
2880 min Summer	12.024	2.024	1.7	247.0	O K
4320 min Summer	12.002	2.002	1.7	244.2	O K
5760 min Summer	11.991	1.991	1.7	242.9	O K
7200 min Summer	11.997	1.997	1.7	243.6	O K
8640 min Summer	12.010	2.010	1.7	245.2	O K
10080 min Summer	12.029	2.029	1.7	247.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	34.419	0.0	74.2	19
30 min Summer	22.669	0.0	97.6	34
60 min Summer	14.480	0.0	124.8	64
120 min Summer	9.747	0.0	168.1	124
180 min Summer	7.633	0.0	197.5	182
240 min Summer	6.379	0.0	220.0	242
360 min Summer	4.906	0.0	253.4	362
480 min Summer	4.046	0.0	275.4	482
600 min Summer	3.472	0.0	280.6	602
720 min Summer	3.057	0.0	279.8	722
960 min Summer	2.489	0.0	278.0	960
1440 min Summer	1.860	0.0	273.5	1286
2160 min Summer	1.390	0.0	431.7	1668
2880 min Summer	1.138	0.0	470.9	2072
4320 min Summer	0.873	0.0	499.7	2900
5760 min Summer	0.733	0.0	607.3	3752
7200 min Summer	0.649	0.0	671.3	4608
8640 min Summer	0.591	0.0	734.3	5448
10080 min Summer	0.550	0.0	796.9	6256

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Winter	10.670	0.670	1.7	81.7	O K
30 min Winter	10.875	0.875	1.7	106.8	O K
60 min Winter	11.103	1.103	1.7	134.5	O K
120 min Winter	11.456	1.456	1.7	177.6	O K
180 min Winter	11.681	1.681	1.7	205.1	O K
240 min Winter	11.844	1.844	1.7	225.0	O K
360 min Winter	12.065	2.065	1.7	251.9	O K
480 min Winter	12.208	2.208	1.7	269.4	O K
600 min Winter	12.305	2.305	1.7	281.3	O K
720 min Winter	12.372	2.372	1.7	289.4	O K
960 min Winter	12.445	2.445	1.7	298.3	O K
1440 min Winter	12.480	2.480	1.7	302.5	O K
2160 min Winter	12.417	2.417	1.7	294.9	O K
2880 min Winter	12.373	2.373	1.7	289.5	O K
4320 min Winter	12.305	2.305	1.7	281.2	O K
5760 min Winter	12.242	2.242	1.7	273.5	O K
7200 min Winter	12.194	2.194	1.7	267.7	O K
8640 min Winter	12.157	2.157	1.7	263.1	O K
10080 min Winter	12.128	2.128	1.7	259.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	34.419	0.0	83.1	19
30 min Winter	22.669	0.0	109.2	33
60 min Winter	14.480	0.0	139.9	62
120 min Winter	9.747	0.0	188.3	122
180 min Winter	7.633	0.0	221.2	180
240 min Winter	6.379	0.0	246.3	240
360 min Winter	4.906	0.0	278.9	356
480 min Winter	4.046	0.0	281.2	474
600 min Winter	3.472	0.0	280.4	590
720 min Winter	3.057	0.0	279.5	706
960 min Winter	2.489	0.0	277.8	932
1440 min Winter	1.860	0.0	274.1	1372
2160 min Winter	1.390	0.0	483.5	1944
2880 min Winter	1.138	0.0	526.0	2224
4320 min Winter	0.873	0.0	513.7	3160
5760 min Winter	0.733	0.0	680.2	4096
7200 min Winter	0.649	0.0	751.9	5040
8640 min Winter	0.591	0.0	822.4	5888
10080 min Winter	0.550	0.0	892.5	6768

james&nicholas		Micro Drainage
Date 07/12/2023 16:00	Designed by karlj	
File SOUTHERN AREA 1IN100 +40...	Checked by	
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.150

Time (mins) From:	To:	Area (ha)
0	4	1.150

james&nicholas		Micro Drainage
Date 07/12/2023 16:00	Designed by karlj	
File SOUTHERN AREA 1IN100 +40...	Checked by	
Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 20.000

Tank or Pond Structure

Invert Level (m) 10.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	122.0	10.000	122.0

Pump Outflow Control

Invert Level (m) 10.000

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.6500	1.200	1.6500	3.000	1.6500	7.000	1.6500
0.200	1.6500	1.400	1.6500	3.500	1.6500	7.500	1.6500
0.300	1.6500	1.600	1.6500	4.000	1.6500	8.000	1.6500
0.400	1.6500	1.800	1.6500	4.500	1.6500	8.500	1.6500
0.500	1.6500	2.000	1.6500	5.000	1.6500	9.000	1.6500
0.600	1.6500	2.200	1.6500	5.500	1.6500	9.500	1.6500
0.800	1.6500	2.400	1.6500	6.000	1.6500		
1.000	1.6500	2.600	1.6500	6.500	1.6500		

APPENDIX H

ROAD FILTER STRIP 3 - 1 IN 2, 1 IN 30 AND 1 IN 100-YEAR CALCULATIONS

Summary of Results for 2 year Return Period

Half Drain Time : 54 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	8.609	0.409	6.8	27.5	O K
30 min Summer	8.649	0.449	7.5	33.1	O K
60 min Summer	8.672	0.472	7.9	36.6	O K
120 min Summer	8.701	0.501	8.3	41.2	O K
180 min Summer	8.706	0.506	8.4	42.1	O K
240 min Summer	8.704	0.504	8.4	41.7	O K
360 min Summer	8.689	0.489	8.1	39.3	O K
480 min Summer	8.670	0.470	7.8	36.3	O K
600 min Summer	8.651	0.451	7.5	33.5	O K
720 min Summer	8.633	0.433	7.2	30.8	O K
960 min Summer	8.599	0.399	6.7	26.2	O K
1440 min Summer	8.545	0.345	5.7	19.5	O K
2160 min Summer	8.488	0.288	4.8	13.6	O K
2880 min Summer	8.450	0.250	4.2	10.2	O K
4320 min Summer	8.403	0.203	3.4	6.8	O K
5760 min Summer	8.375	0.175	2.9	5.0	O K
7200 min Summer	8.356	0.156	2.6	4.0	O K
8640 min Summer	8.343	0.143	2.4	3.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	34.419	0.0	17
30 min Summer	22.669	0.0	30
60 min Summer	14.480	0.0	48
120 min Summer	9.747	0.0	82
180 min Summer	7.633	0.0	116
240 min Summer	6.379	0.0	152
360 min Summer	4.906	0.0	218
480 min Summer	4.046	0.0	282
600 min Summer	3.472	0.0	346
720 min Summer	3.057	0.0	408
960 min Summer	2.489	0.0	530
1440 min Summer	1.860	0.0	768
2160 min Summer	1.390	0.0	1128
2880 min Summer	1.138	0.0	1496
4320 min Summer	0.873	0.0	2204
5760 min Summer	0.733	0.0	2936
7200 min Summer	0.649	0.0	3672
8640 min Summer	0.591	0.0	4400

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	8.333	0.133	2.2	2.9	O K
15 min Winter	8.609	0.409	6.8	27.5	O K
30 min Winter	8.650	0.450	7.5	33.3	O K
60 min Winter	8.671	0.471	7.9	36.5	O K
120 min Winter	8.694	0.494	8.2	40.2	O K
180 min Winter	8.693	0.493	8.2	39.9	O K
240 min Winter	8.683	0.483	8.1	38.4	O K
360 min Winter	8.656	0.456	7.6	34.2	O K
480 min Winter	8.627	0.427	7.1	30.0	O K
600 min Winter	8.600	0.400	6.7	26.3	O K
720 min Winter	8.575	0.375	6.3	23.1	O K
960 min Winter	8.532	0.332	5.5	18.1	O K
1440 min Winter	8.469	0.269	4.5	11.9	O K
2160 min Winter	8.410	0.210	3.5	7.3	O K
2880 min Winter	8.375	0.175	2.9	5.0	O K
4320 min Winter	8.336	0.136	2.3	3.0	O K
5760 min Winter	8.315	0.115	1.9	2.2	O K
7200 min Winter	8.301	0.101	1.7	1.7	O K
8640 min Winter	8.292	0.092	1.5	1.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Summer	0.550	0.0	5128
15 min Winter	34.419	0.0	17
30 min Winter	22.669	0.0	30
60 min Winter	14.480	0.0	50
120 min Winter	9.747	0.0	88
180 min Winter	7.633	0.0	126
240 min Winter	6.379	0.0	160
360 min Winter	4.906	0.0	230
480 min Winter	4.046	0.0	296
600 min Winter	3.472	0.0	360
720 min Winter	3.057	0.0	422
960 min Winter	2.489	0.0	546
1440 min Winter	1.860	0.0	780
2160 min Winter	1.390	0.0	1128
2880 min Winter	1.138	0.0	1496
4320 min Winter	0.873	0.0	2204
5760 min Winter	0.733	0.0	2936
7200 min Winter	0.649	0.0	3672
8640 min Winter	0.591	0.0	4400

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	8.286	0.086	1.4	1.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Winter	0.550	0.0	5096

Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.390

Time (mins) From:	To:	Area (ha)
0	4	0.390

Model Details

Storage is Online Cover Level (m) 10.000

Complex Structure

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.26000	Trench Width (m)	1.0
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	180.0
Safety Factor	1.5	Slope (1:X)	346.0
Porosity	0.95	Cap Volume Depth (m)	0.000
Invert Level (m)	8.200	Cap Infiltration Depth (m)	0.000

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.26000	Trench Width (m)	0.5
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	180.0
Safety Factor	1.5	Slope (1:X)	346.0
Porosity	0.50	Cap Volume Depth (m)	0.000
Invert Level (m)	9.000	Cap Infiltration Depth (m)	0.000

Summary of Results for 30 year Return Period

Half Drain Time : 99 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	8.817	0.617	8.7	61.1	O K
30 min Summer	8.920	0.720	8.7	78.7	O K
60 min Summer	9.005	0.805	8.7	93.2	O K
120 min Summer	9.033	0.833	8.8	98.0	O K
180 min Summer	9.036	0.836	8.9	98.6	O K
240 min Summer	9.029	0.829	8.8	97.4	O K
360 min Summer	9.000	0.800	8.7	92.3	O K
480 min Summer	8.961	0.761	8.7	85.7	O K
600 min Summer	8.922	0.722	8.7	78.9	O K
720 min Summer	8.883	0.683	8.7	72.3	O K
960 min Summer	8.811	0.611	8.7	60.1	O K
1440 min Summer	8.711	0.511	8.5	42.9	O K
2160 min Summer	8.629	0.429	7.1	30.2	O K
2880 min Summer	8.572	0.372	6.2	22.7	O K
4320 min Summer	8.500	0.300	5.0	14.8	O K
5760 min Summer	8.458	0.258	4.3	11.0	O K
7200 min Summer	8.431	0.231	3.8	8.8	O K
8640 min Summer	8.411	0.211	3.5	7.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	72.726	0.0	18
30 min Summer	48.916	0.0	32
60 min Summer	31.512	0.0	60
120 min Summer	19.336	0.0	100
180 min Summer	14.516	0.0	132
240 min Summer	11.821	0.0	166
360 min Summer	8.805	0.0	236
480 min Summer	7.114	0.0	304
600 min Summer	6.013	0.0	368
720 min Summer	5.232	0.0	434
960 min Summer	4.185	0.0	558
1440 min Summer	3.045	0.0	792
2160 min Summer	2.219	0.0	1148
2880 min Summer	1.783	0.0	1500
4320 min Summer	1.337	0.0	2208
5760 min Summer	1.107	0.0	2944
7200 min Summer	0.970	0.0	3672
8640 min Summer	0.879	0.0	4408

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	8.396	0.196	3.3	6.3	O K
15 min Winter	8.818	0.618	8.7	61.1	O K
30 min Winter	8.921	0.721	8.7	78.8	O K
60 min Winter	9.007	0.807	8.7	93.5	O K
120 min Winter	9.031	0.831	8.8	97.6	O K
180 min Winter	9.028	0.828	8.8	97.2	O K
240 min Winter	9.013	0.813	8.7	94.5	O K
360 min Winter	8.961	0.761	8.7	85.7	O K
480 min Winter	8.902	0.702	8.7	75.5	O K
600 min Winter	8.844	0.644	8.7	65.6	O K
720 min Winter	8.791	0.591	8.7	56.5	O K
960 min Winter	8.711	0.511	8.5	42.9	O K
1440 min Winter	8.618	0.418	7.0	28.6	O K
2160 min Winter	8.527	0.327	5.4	17.5	O K
2880 min Winter	8.470	0.270	4.5	12.0	O K
4320 min Winter	8.407	0.207	3.4	7.0	O K
5760 min Winter	8.372	0.172	2.9	4.9	O K
7200 min Winter	8.351	0.151	2.5	3.8	O K
8640 min Winter	8.337	0.137	2.3	3.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Summer	0.814	0.0	5136
15 min Winter	72.726	0.0	17
30 min Winter	48.916	0.0	31
60 min Winter	31.512	0.0	60
120 min Winter	19.336	0.0	108
180 min Winter	14.516	0.0	138
240 min Winter	11.821	0.0	178
360 min Winter	8.805	0.0	252
480 min Winter	7.114	0.0	322
600 min Winter	6.013	0.0	388
720 min Winter	5.232	0.0	450
960 min Winter	4.185	0.0	562
1440 min Winter	3.045	0.0	808
2160 min Winter	2.219	0.0	1164
2880 min Winter	1.783	0.0	1504
4320 min Winter	1.337	0.0	2208
5760 min Winter	1.107	0.0	2936
7200 min Winter	0.970	0.0	3672
8640 min Winter	0.879	0.0	4400

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	8.327	0.127	2.1	2.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Winter	0.814	0.0	5136

Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.390

Time (mins) From:	To:	Area (ha)
0	4	0.390

Model Details

Storage is Online Cover Level (m) 10.000

Complex Structure

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.26000	Trench Width (m)	1.0
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	180.0
Safety Factor	1.5	Slope (1:X)	346.0
Porosity	0.95	Cap Volume Depth (m)	0.000
Invert Level (m)	8.200	Cap Infiltration Depth (m)	0.000

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.26000	Trench Width (m)	0.5
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	180.0
Safety Factor	1.5	Slope (1:X)	346.0
Porosity	0.50	Cap Volume Depth (m)	0.000
Invert Level (m)	9.000	Cap Infiltration Depth (m)	0.000

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 169 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	9.129	0.929	9.7	115.1	O K
30 min Summer	9.317	1.117	11.3	150.9	O K
60 min Summer	9.476	1.276	12.6	183.5	O K
120 min Summer	9.541	1.341	13.0	197.5	O K
180 min Summer	9.564	1.364	13.0	202.4	O K
240 min Summer	9.570	1.370	13.0	203.8	O K
360 min Summer	9.553	1.353	13.0	200.0	O K
480 min Summer	9.517	1.317	13.0	192.3	O K
600 min Summer	9.476	1.276	12.6	183.6	O K
720 min Summer	9.433	1.233	12.3	174.5	O K
960 min Summer	9.347	1.147	11.6	156.8	O K
1440 min Summer	9.190	0.990	10.2	126.3	O K
2160 min Summer	8.988	0.788	8.7	90.3	O K
2880 min Summer	8.816	0.616	8.7	60.9	O K
4320 min Summer	8.673	0.473	7.9	36.7	O K
5760 min Summer	8.605	0.405	6.8	27.0	O K
7200 min Summer	8.563	0.363	6.0	21.7	O K
8640 min Summer	8.533	0.333	5.6	18.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	132.256	0.0	18
30 min Summer	89.648	0.0	33
60 min Summer	58.187	0.0	62
120 min Summer	35.502	0.0	114
180 min Summer	26.659	0.0	144
240 min Summer	21.716	0.0	176
360 min Summer	16.145	0.0	244
480 min Summer	13.001	0.0	314
600 min Summer	10.944	0.0	382
720 min Summer	9.481	0.0	450
960 min Summer	7.517	0.0	586
1440 min Summer	5.373	0.0	850
2160 min Summer	3.828	0.0	1232
2880 min Summer	3.025	0.0	1560
4320 min Summer	2.215	0.0	2248
5760 min Summer	1.806	0.0	2944
7200 min Summer	1.568	0.0	3680
8640 min Summer	1.413	0.0	4408

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	8.511	0.311	5.2	15.9	O K
15 min Winter	9.130	0.930	9.7	115.2	O K
30 min Winter	9.319	1.119	11.3	151.3	O K
60 min Winter	9.480	1.280	12.7	184.4	O K
120 min Winter	9.551	1.351	13.0	199.6	O K
180 min Winter	9.566	1.366	13.0	202.8	O K
240 min Winter	9.567	1.367	13.0	203.2	O K
360 min Winter	9.534	1.334	13.0	195.9	O K
480 min Winter	9.482	1.282	12.7	184.8	O K
600 min Winter	9.424	1.224	12.2	172.5	O K
720 min Winter	9.364	1.164	11.7	160.3	O K
960 min Winter	9.247	1.047	10.7	137.2	O K
1440 min Winter	9.034	0.834	8.9	98.2	O K
2160 min Winter	8.742	0.542	8.7	48.2	O K
2880 min Winter	8.645	0.445	7.4	32.5	O K
4320 min Winter	8.538	0.338	5.6	18.8	O K
5760 min Winter	8.479	0.279	4.7	12.8	O K
7200 min Winter	8.444	0.244	4.1	9.8	O K
8640 min Winter	8.420	0.220	3.7	8.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Summer	1.306	0.0	5136
15 min Winter	132.256	0.0	18
30 min Winter	89.648	0.0	32
60 min Winter	58.187	0.0	60
120 min Winter	35.502	0.0	116
180 min Winter	26.659	0.0	146
240 min Winter	21.716	0.0	184
360 min Winter	16.145	0.0	262
480 min Winter	13.001	0.0	336
600 min Winter	10.944	0.0	410
720 min Winter	9.481	0.0	482
960 min Winter	7.517	0.0	620
1440 min Winter	5.373	0.0	896
2160 min Winter	3.828	0.0	1212
2880 min Winter	3.025	0.0	1556
4320 min Winter	2.215	0.0	2248
5760 min Winter	1.806	0.0	2944
7200 min Winter	1.568	0.0	3672
8640 min Winter	1.413	0.0	4408

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	8.404	0.204	3.4	6.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Winter	1.306	0.0	5136

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.390

Time (mins) From:	To:	Area (ha)
0	4	0.390

Model Details

Storage is Online Cover Level (m) 10.000

Complex Structure

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.26000	Trench Width (m)	1.0
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	180.0
Safety Factor	1.5	Slope (1:X)	346.0
Porosity	0.95	Cap Volume Depth (m)	0.000
Invert Level (m)	8.200	Cap Infiltration Depth (m)	0.000

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.26000	Trench Width (m)	0.5
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	180.0
Safety Factor	1.5	Slope (1:X)	346.0
Porosity	0.50	Cap Volume Depth (m)	0.000
Invert Level (m)	9.000	Cap Infiltration Depth (m)	0.000