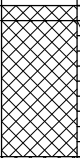
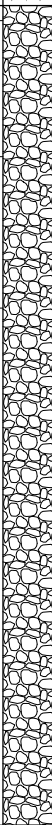
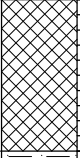
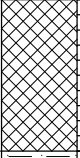
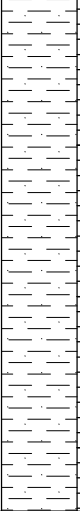
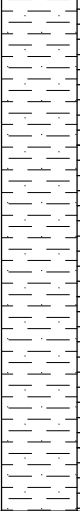
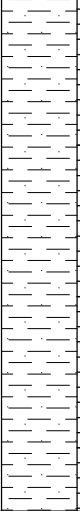
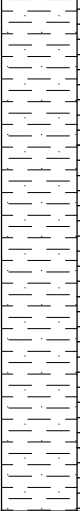
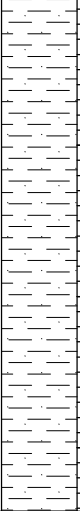
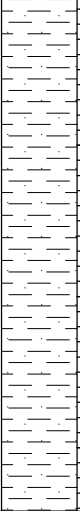
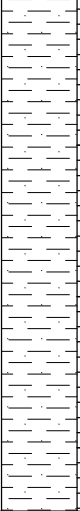
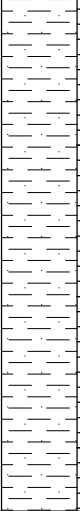
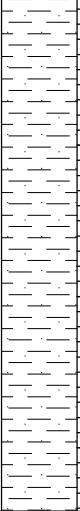
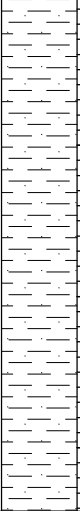
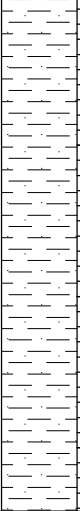
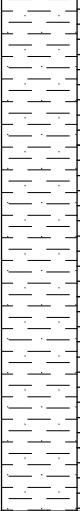
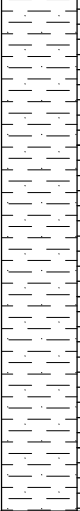
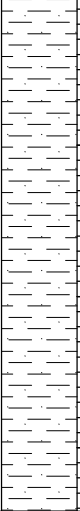
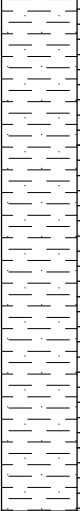
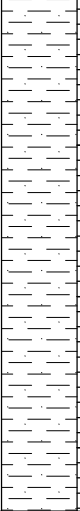
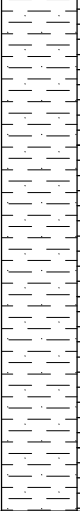
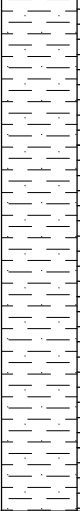
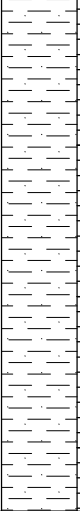
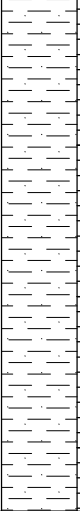
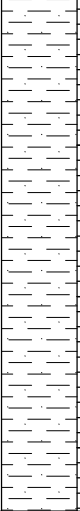
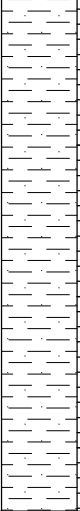
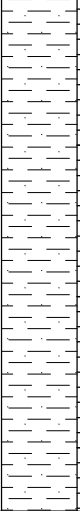
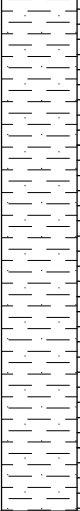
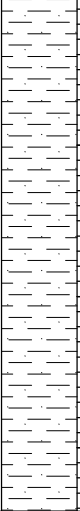
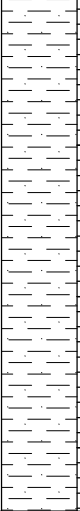
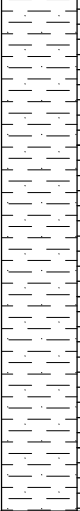
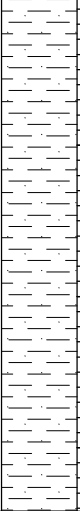
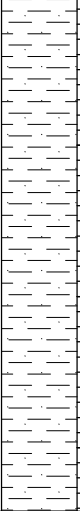
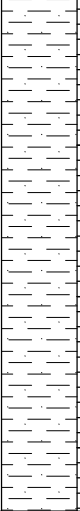
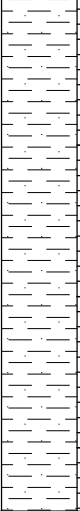
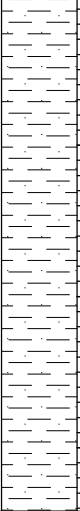
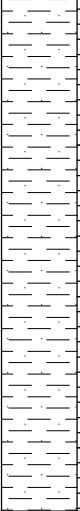
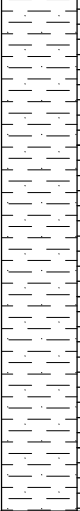
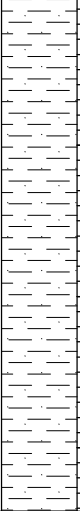
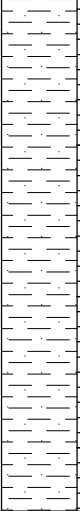
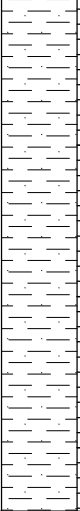
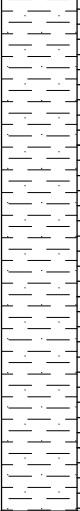
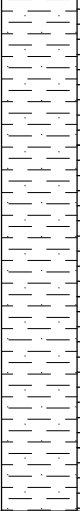
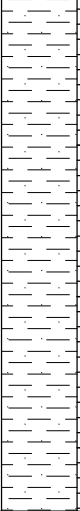
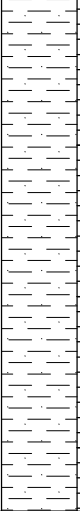
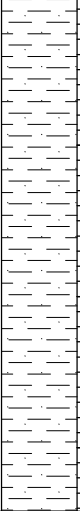
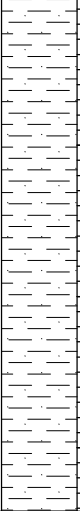
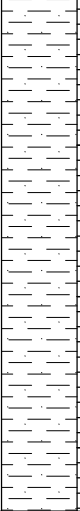
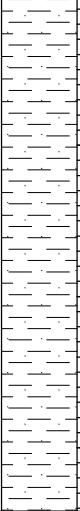
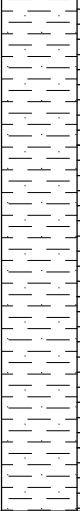
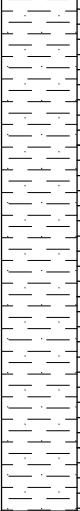
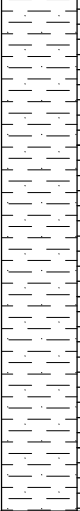
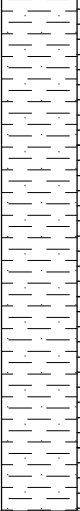
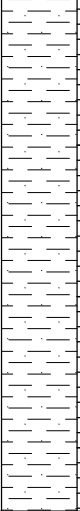
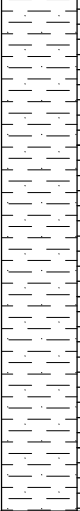
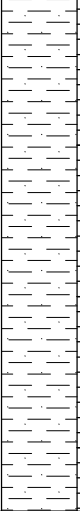
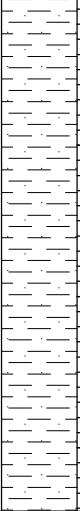
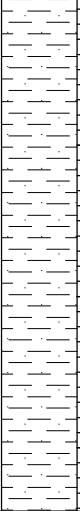
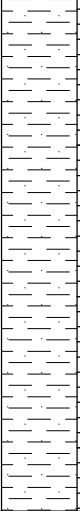
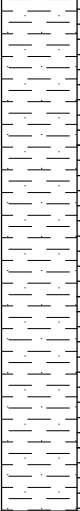
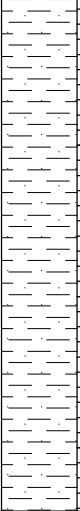
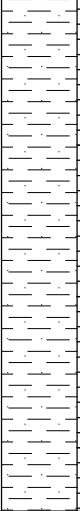
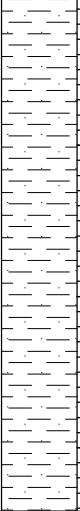
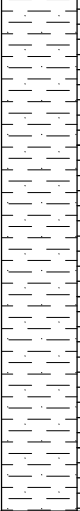
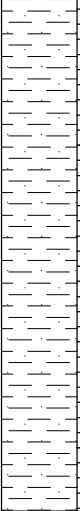
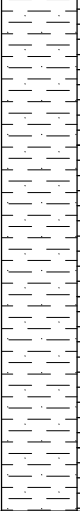


APPENDIX G

Borehole Logs

BOREHOLE LOG

Project Wynnstay Technology Park, Ruabon				BOREHOLE No WS01	
Job No 2387	Date 09-09-20 09-09-20	Ground Level (m)	Co-Ordinates ()		
Contractor Regional Drilling				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
1.00		N14				0.10	Grass over loose dark brown sandy gravelly SILT. Gravel is subangular to angular fine to coarse of mudstone (MADE GROUND- Colliery Spoil).		
						(0.90)	Medium dense brown to black clayey gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of mudstone and burnt shale (MADE GROUND- Colliery Spoil).		
1.00		N14				1.00	Firm black sandy gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone, burnt shale and brick (MADE GROUND).		
						(1.00)			
2.00		N3				2.00	Very soft becoming firm light greyish brown very sandy CLAY (GLACIAL TILL).		
3.00		N5				(3.42)			
4.00		N12							
5.00		N50/ 250 mm				5.42			
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											1.) Water strike @ 1.00m, 2.) SPT Refusal @ 5.42m.
All dimensions in metres Scale 1:50			Client Gratton Oaks Ltd			Method/ Plant Used			Logged By AB		

BOREHOLE LOG

Project Wynnstay Technology Park, Ruabon				BOREHOLE No WS02	
Job No 2387	Date 09-09-20 09-09-20	Ground Level (m)	Co-Ordinates ()		
Contractor Regional Drilling				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
1.00		N10				(2.10)	Medium dense black sandy angular to subangular fine to coarse GRAVEL of mudstone and burnt shale (MADE GROUND- Colliery Spoil).		
2.00		N10				2.10 (0.40) 2.50	Firm black slightly sandy slightly gravelly CLAY. Gravel is angular to suangular fine to coarse of burnt shale. (MADE GROUND- Colliery Spoil)		
3.00		N12				(0.70) 3.20	Firm silty sandy CLAY (GLACIAL TILL).		
4.00		N27				(2.25)	Stiff brown sandy gravelly CLAY (GLACIAL TILL).		
5.00		N23				5.45			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											1.) Water strike @ 2.00m.
All dimensions in metres Scale 1:50			Client Gratton Oakes Ltd			Method/ Plant Used				Logged By TG	

BOREHOLE LOG

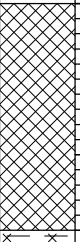
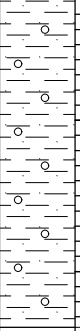
Project Wynnstay Technology Park, Ruabon				BOREHOLE No WS03	
Job No 2387	Date 09-09-20 09-09-20	Ground Level (m)	Co-Ordinates ()		
Contractor Regional Drilling				Sheet 1 of 1	

SAMPLES & TESTS			STRATA					Geology	Instrument/ Backfill
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
1.00		N13				(1.50)	Grass over dense brown becoming black clayey gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of mudstone, burnt shale and brick (MADE GROUND).		
						(0.50) 2.00	Very stiff black sandy gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone (GLACIAL TILL).		
2.00		N14					Firm becoming very stiff greyish brown sandy CLAY (GLACIAL TILL).		
3.00		N25				(2.20)			
4.00		N39				4.20			
5.00		N31				(1.25) 5.45	Very stiff dark brown slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse of mudstone (GLACIAL TILL).		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											1.) Water strike @ 1.50m.
All dimensions in metres Scale 1:50						Client Gratton Oakes Ltd			Method/ Plant Used		Logged By AB

BOREHOLE LOG

Project Wynnstay Technology Park, Ruabon				BOREHOLE No WS04	
Job No 2387	Date 09-09-20 09-09-20	Ground Level (m)	Co-Ordinates ()		
Contractor Regional Drilling				Sheet 1 of 1	

SAMPLES & TESTS			STRATA					Geology	Instrument/ Backfill
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
1.00		N8				(1.50) 1.50	Loose reddish brown to light brown sandy angular to subangular fine to coarse GRAVEL of mudstone and burnt shale (MADE GROUND-Colliery Spoil).		
2.00		N8				(0.60) 2.10	Firm black to grey silty CLAY (GLACIAL TILL).		
3.00		N6				(2.27) 4.37	Soft becoming very stiff greyish brown sandy gravelly CLAY. Gravel is subrounded to rounded fine to coarse of sandstone (GLACIAL TILL).		
4.00		N50/ 220 mm							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											1.) Water strike @ 1.50m, 2.) SPT Refusal @ 4.37m.
All dimensions in metres Scale 1:50			Client Gratton Oaks Ltd			Method/ Plant Used			Logged By TG		

BOREHOLE LOG

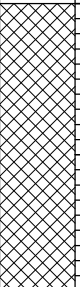
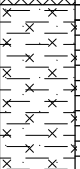
Project Wynnstay Technology Park, Ruabon				BOREHOLE No WS05	
Job No 2387	Date 09-09-20 09-09-20	Ground Level (m)	Co-Ordinates ()		
Contractor Regional Drilling				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
						1.00	Grass over dense brown becoming black clayey gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of mudstone, burnt shale and brick (MADE GROUND- Colliery Spoil).		
1.00		N31				1.00	Very stiff black sandy gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone (GLACIAL TILL).		
2.00		N3				2.00	Soft becoming very stiff greyish brown sandy CLAY (GLACIAL TILL).		
3.00		N14				(3.35)			
4.00		N40							
5.00		N50/ 200 mm				5.35			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											1.) Water strike @ 1.00m, 2.) SPT Refusal @ 4.35m.
All dimensions in metres Scale 1:50			Client Gratton Oaks Ltd			Method/ Plant Used			Logged By AB		

BOREHOLE LOG

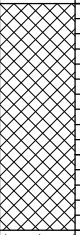
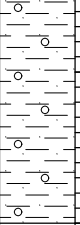
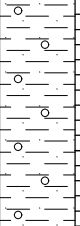
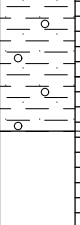
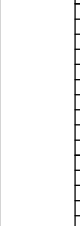
Project Wynnstay Technology Park, Ruabon				BOREHOLE No WS06	
Job No 2387	Date 09-09-20 09-09-20	Ground Level (m)	Co-Ordinates ()		
Contractor Regional Drilling				Sheet 1 of 1	

SAMPLES & TESTS			STRATA					Geology	Instrument/ Backfill
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
1.00		N14				(1.90)	Medium dense black sandy angular to subangular fine to coarse GRAVEL of mudstone and burnt shale (MADE GROUND- Colliery Spoil).		
2.00		N7				1.90 (1.10)	Firm to stiff brown silty sandy CLAY (GLACIAL TILL).		
3.00		N30				3.00 (1.41)	No Recovery- Probably SAND (GLACIAL DEPOSITS).		
4.00		N50/ 255 mm				4.41			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											1.) Water strike @ 1.80m, 2.) SPT Refusal @ 4.41m.
All dimensions in metres Scale 1:50			Client Gratton Oakes Ltd			Method/ Plant Used			Logged By TG		

BOREHOLE LOG

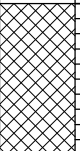
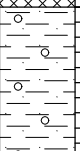
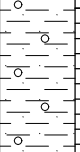
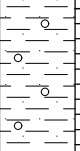
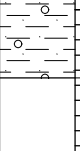
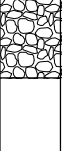
Project Wynnstay Technology Park, Ruabon				BOREHOLE No WS07	
Job No 2387	Date 09-09-20 09-09-20	Ground Level (m)	Co-Ordinates ()		
Contractor Regional Drilling				Sheet 1 of 1	

SAMPLES & TESTS			STRATA					Geology	Instrument/ Backfill
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
1.00		N33				(1.50)	Scrub over dense grey to black clayey gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of brick and clinker (MADE GROUND- Colliery Spoil).		
2.00		N3				(1.50)	Very soft grey sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone (GLACIAL TILL).		
3.00		N24				3.00	Stiff to very stiff grey very sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone (GLACIAL TILL).		
4.00		N26				(2.36)			
5.00		N50/ 215 mm				5.36			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											1.) Water strike @ 1.50m, 2.) SPT Refusal @ 5.36m.
All dimensions in metres Scale 1:50			Client Gratton Oakes Ltd			Method/ Plant Used			Logged By AB		

BOREHOLE LOG

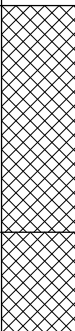
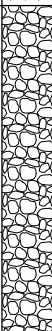
Project Wynnstay Technology Park, Ruabon				BOREHOLE No WS08	
Job No 2387	Date 09-09-20 09-09-20	Ground Level (m)	Co-Ordinates ()		
Contractor Regional Drilling				Sheet 1 of 1	

SAMPLES & TESTS			STRATA					Geology	Instrument/ Backfill
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
1.00		N34				(1.00) 1.00	Medium dense black sandy angular to subangular fine to coarse GRAVEL of mudstone and burnt shale (MADE GROUND).		
						(0.50) 1.50	Dense black SILT (MADE GROUND).		
						(0.50) 2.00	Firm black slightly sandy CLAY (MADE GROUND).		
2.00		N10				(3.45) 2.00	Stiff to very stiff greyish brown sandy gravelly CLAY (GLACIAL TILL).		
3.00		N30				(3.45) 2.00			
4.00		N24				(3.45) 2.00			
5.00		N34				(3.45) 2.00			
						5.45			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											1.) No groundwater encountered.
All dimensions in metres Scale 1:50			Client Gratton Oaks Ltd			Method/ Plant Used			Logged By TG		

BOREHOLE LOG

Project Wynnstay Technology Park, Ruabon				BOREHOLE No WS09	
Job No 2387	Date 09-09-20 09-09-20	Ground Level (m)	Co-Ordinates ()		
Contractor Regional Drilling				Sheet 1 of 1	

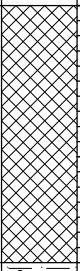
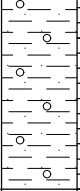
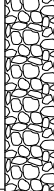
SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
1.00		N26				(1.50)	Scrub over medium dense black slightly clayey very gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of burnt shale and brick. (MADE GROUND)		
						1.50			
2.00		N50/ 95 mm				(0.68)	Very dense black asphalt. (MADE GROUND)		
					2.18				
			</						

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											1.) Water strike @ 1.50m, 2.) SPT Refusal @ 5.42m.

All dimensions in metres Scale 1:50	Client Gratton Oakes Ltd	Method/ Plant Used	Logged By AB
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BOREHOLE LOG

Project Wynnstay Technology Park, Ruabon				BOREHOLE No WS10	
Job No 2387	Date 09-09-20 09-09-20	Ground Level (m)	Co-Ordinates ()		
Contractor Regional Drilling				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
1.00		N37				(1.70) 1.70	Scrub over dense grey to black gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of burnt shale and brick (MADE GROUND).		
2.00		N42				(1.30) 3.00	Very stiff dark grey sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mudstone (GLACIAL TILL).		
3.00		N39				(0.72) 3.72	Very stiff grey slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone (GLACIAL TILL).		
3.60		N50/ 155 mm							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											1.) Water strike @ 1.70m, 2.) SPT Refusal @ 5.42m.
All dimensions in metres Scale 1:50			Client Gratton Oakes Ltd			Method/ Plant Used			Logged By AB		

APPENDIX H
CBR Testing Results

Units 1 & 2
Deltic Place
Deltic Way
Knowsley Industrial Estate
Liverpool
L33 7BU

Telephone: (0151) 545 2750
Fax: (0151) 548 7892
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www.ccgeotechnical.com



LABORATORY REPORT

CONTRACT NUMBER: CCG-C-20-11845

CONTRACT TITLE: WYNNSTAY TECH PARK, RUABON

CLIENT: GROUNDSOLVE LTD

Unit 1 Charter Court, Well House Barns, Chester Road, Bretton, Flintshire, CH4 0DH

DATE RECEIVED: 04/09/20
DATE COMMENCED: 09/09/20
DATE COMPLETED: 09/09/20
REPORT DATE: 12/09/20

Test Description	Qty
Dynamic Cone Penetrometer (TRRL Method) (#)	18

Notes: Observations and interpretations are not accredited by UKAS
All testing undertaken at laboratory permanent facilities

denotes non-accredited test

a denotes UKAS accredited test

s denotes test undertaken by approved subcontractor

Test locations determined and recorded by client

This report is issued in accordance with the requirements of the United Kingdom Accreditation Services and EN ISO/IEC 17025:2005. The results reported herein relate only to the material supplied to the laboratory. This report shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved Signatories: Chris Bolan (Managing Director) – Daniel Kerfoot (Laboratory Manager)



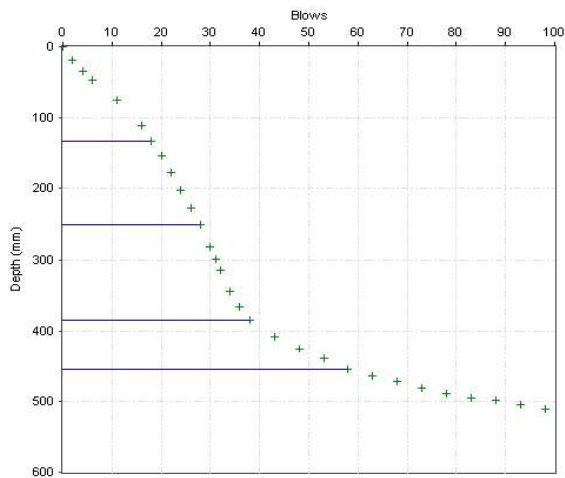
Dynamic Cone Penetrometer Strength Analysis Report

Site: WYNNSTAY TECH PARK, RUABON
 Location: DCP1
 Cone Angle: 60 degrees
 Zero Error: 86
 Test Date: 09/09/2020

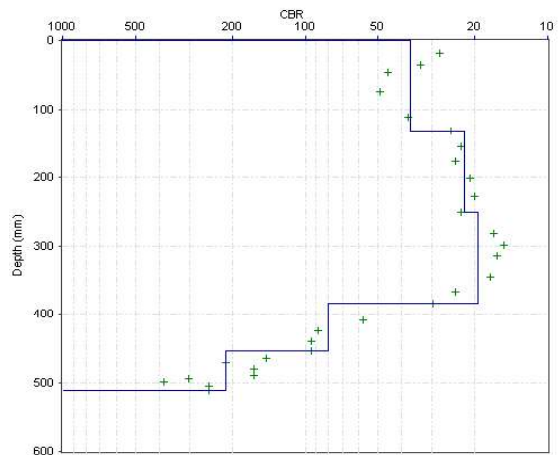
Job Number: CCG-C-20-11845
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	105	0	21	5	53	545	3.0
2	2	2	124	9.5	22	5	58	560	3.0
3	2	4	140	8.0	23	5	63	570	2.0
4	2	6	152	6.0	24	5	68	577	1.4
5	5	11	180	5.6	25	5	73	586	1.8
6	5	16	216	7.2	26	5	78	595	1.8
7	2	18	237	10.5	27	5	83	600	1.0
8	2	20	260	11.5	28	5	88	604	0.8
9	2	22	282	11.0	29	5	93	610	1.2
10	2	24	307	12.5	30	5	98	616	1.2
11	2	26	333	13.0					
12	2	28	356	11.5					
13	2	30	387	15.5					
14	1	31	404	17.0					
15	1	32	420	16.0					
16	2	34	450	15.0					
17	2	36	472	11.0					
18	2	38	490	9.0					
19	5	43	514	4.8					
20	5	48	530	3.2					

Layer Boundaries: Chainage 1.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Depth (mmbgl)	Strength Coefficient
1	37	132	132	218	
2	22	119	251	337	
3	19	134	385	471	
4	80	70	455	541	
5	212	56	511	597	

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Dark brown silty sandy GRAVEL



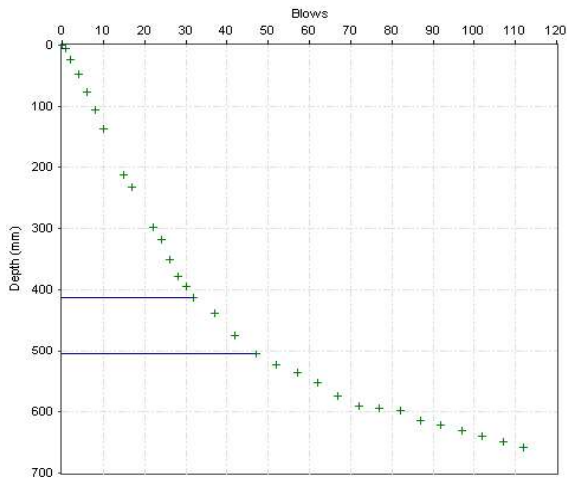
Dynamic Cone Penetrometer Strength Analysis Report

Site: WYNNSTAY TECH PARK, RUABON
 Location: DCP2
 Cone Angle: 60 degrees
 Zero Error: 98
 Test Date: 09/09/2020

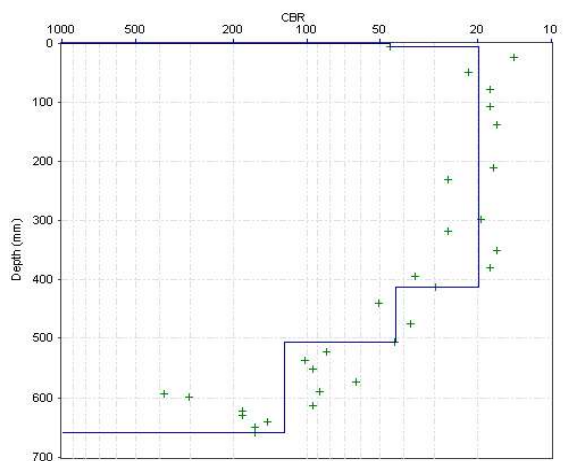
Job Number: CCG-C-20-11845
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	98	0	21	5	62	650	3.0
2	1	1	104	6.0	22	5	67	672	4.4
3	1	2	122	18.0	23	5	72	688	3.2
4	2	4	146	12.0	24	5	77	692	0.8
5	2	6	175	14.5	25	5	82	697	1.0
6	2	8	204	14.5	26	5	87	712	3.0
7	2	10	235	15.5	27	5	92	720	1.6
8	5	15	310	15.0	28	5	97	728	1.6
9	2	17	330	10.0	29	5	102	738	2.0
10	5	22	397	13.4	30	5	107	747	1.8
11	2	24	417	10.0	31	5	112	756	1.8
12	2	26	448	15.5					
13	2	28	477	14.5					
14	2	30	492	7.5					
15	2	32	510	9.0					
16	5	37	537	5.4					
17	5	42	573	7.2					
18	5	47	604	6.2					
19	5	52	621	3.4					
20	5	57	635	2.8					

Layer Boundaries: Chainage 2.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Depth (mmbgl)	Strength Coefficient
1	45	6	6	104	
2	20	406	412	510	
3	43	94	506	604	
4	123	152	658	756	

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Dark brown silty sandy GRAVEL



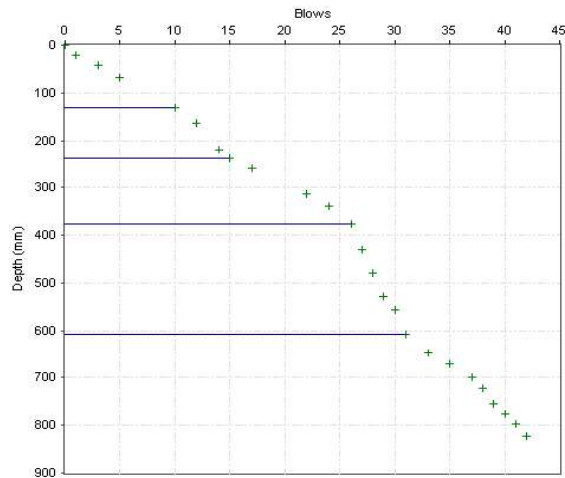
Dynamic Cone Penetrometer Strength Analysis Report

Site: WYNNSTAY TECH PARK, RUABON
 Location: DCP3
 Cone Angle: 60 degrees
 Zero Error: 98
 Test Date: 09/09/2020

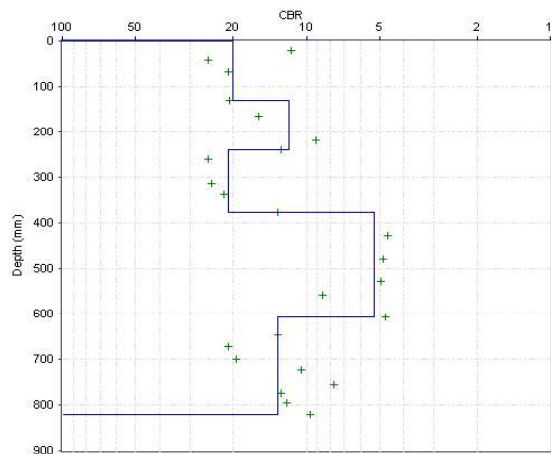
Job Number: CCG-C-20-11845
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	98	0	21	1	38	821	24.0
2	1	1	120	22.0	22	1	39	853	32.0
3	2	3	141	10.5	23	1	40	873	20.0
4	2	5	166	12.5	24	1	41	894	21.0
5	5	10	229	12.6	25	1	42	920	26.0
6	2	12	262	16.5					
7	2	14	317	27.5					
8	1	15	337	20.0					
9	2	17	358	10.5					
10	5	22	412	10.8					
11	2	24	436	12.0					
12	2	26	475	19.5					
13	1	27	527	52.0					
14	1	28	577	50.0					
15	1	29	626	49.0					
16	1	30	655	29.0					
17	1	31	706	51.0					
18	2	33	745	19.5					
19	2	35	770	12.5					
20	2	37	797	13.5					

Layer Boundaries: Chainage 3.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Depth (mmbgl)	Strength Coefficient
1	20	131	131	229	
2	12	108	239	337	
3	21	138	377	475	
4	5	231	608	706	
5	13	214	822	920	

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Dark brown silty sandy GRAVEL



Dynamic Cone Penetrometer Strength Analysis Report

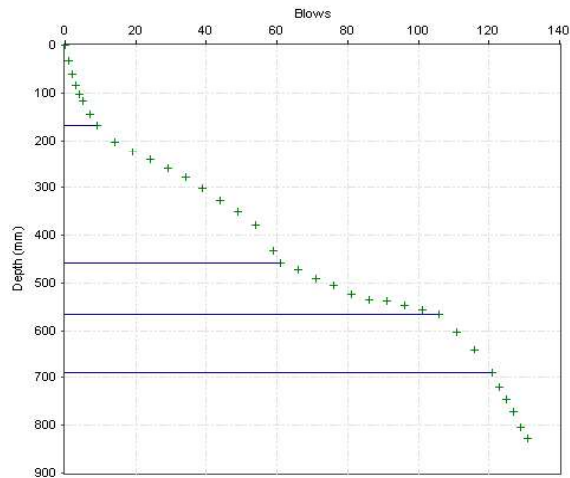
Site: WYNNSTAY TECH PARK, RUABON
 Location: DCP4
 Cone Angle: 60 degrees
 Zero Error: 92
 Test Date: 09/09/2020

Job Number: CCG-C-20-11845
 Surface Type: -
 Thickness (mm): -

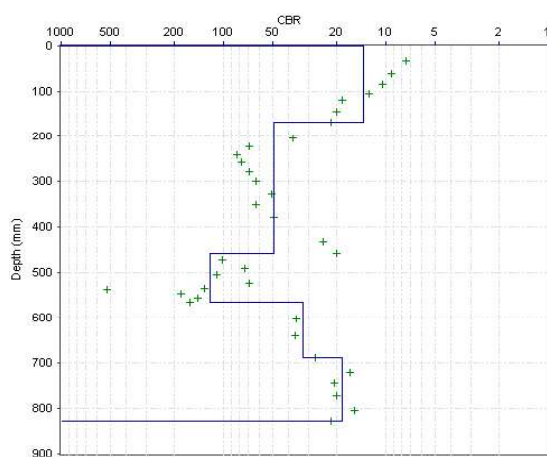
No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	92	0
2	1	1	125	33.0
3	1	2	152	27.0
4	1	3	176	24.0
5	1	4	196	20.0
6	1	5	210	14.0
7	2	7	236	13.0
8	2	9	260	12.0
9	5	14	296	7.2
10	5	19	316	4.0
11	5	24	333	3.4
12	5	29	351	3.6
13	5	34	371	4.0
14	5	39	393	4.4
15	5	44	420	5.4
16	5	49	442	4.4
17	5	54	470	5.6
18	5	59	524	10.8
19	2	61	550	13.0
20	5	66	564	2.8

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
21	5	71	583	3.8
22	5	76	596	2.6
23	5	81	616	4.0
24	5	86	627	2.2
25	5	91	630	0.6
26	5	96	638	1.6
27	5	101	648	2.0
28	5	106	657	1.8
29	5	111	695	7.6
30	5	116	732	7.4
31	5	121	781	9.8
32	2	123	812	15.5
33	2	125	837	12.5
34	2	127	863	13
35	2	129	896	16.5
36	2	131	920	12

Layer Boundaries: Chainage 4.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Depth (mmbgl)	Strength Coefficient
1	14	168	168	260	
2	49	290	458	550	
3	121	107	565	657	
4	32	124	689	781	
5	19	139	828	920	

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Dark brown silty sandy GRAVEL



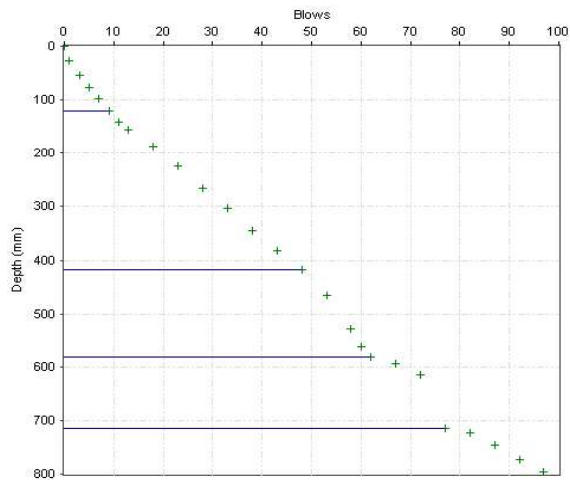
Dynamic Cone Penetrometer Strength Analysis Report

Site: WYNNSTAY TECH PARK, RUABON
 Location: DCP5
 Cone Angle: 60 degrees
 Zero Error: 96
 Test Date: 09/09/2020

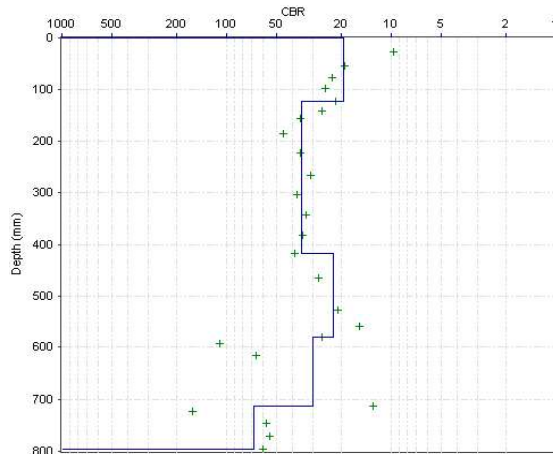
Job Number: CCG-C-20-11845
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	96	0	21	5	72	711	4.2
2	1	1	122	26.0	22	5	77	810	19.8
3	2	3	149	13.5	23	5	82	819	1.8
4	2	5	172	11.5	24	5	87	843	4.8
5	2	7	193	10.5	25	5	92	868	5.0
6	2	9	217	12.0	26	5	97	891	4.6
7	2	11	237	10.0					
8	2	13	252	7.5					
9	5	18	282	6.0					
10	5	23	320	7.6					
11	5	28	363	8.6					
12	5	33	399	7.2					
13	5	38	440	8.2					
14	5	43	479	7.8					
15	5	48	514	7.0					
16	5	53	562	9.6					
17	5	58	624	12.4					
18	2	60	657	16.5					
19	2	62	677	10.0					
20	5	67	690	2.6					

Layer Boundaries: Chainage 5.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Depth (mmbgl)	Strength Coefficient
1	19	121	121	217	
2	35	297	418	514	
3	23	163	581	677	
4	30	133	714	810	
5	69	81	795	891	

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Dark brown silty sandy GRAVEL



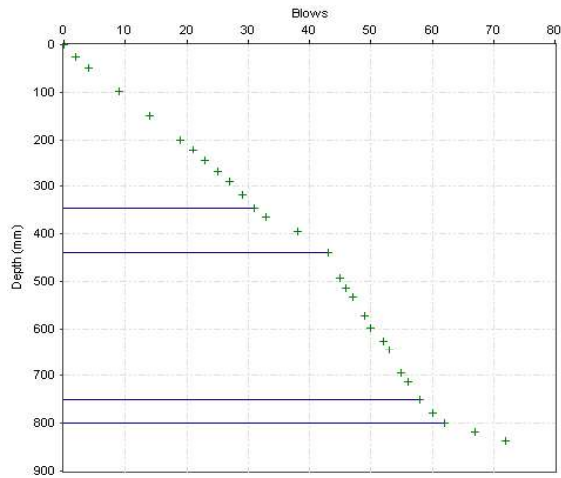
Dynamic Cone Penetrometer Strength Analysis Report

Site: WYNNSTAY TECH PARK, RUABON
 Location: DCP6
 Cone Angle: 60 degrees
 Zero Error: 92
 Test Date: 09/09/2020

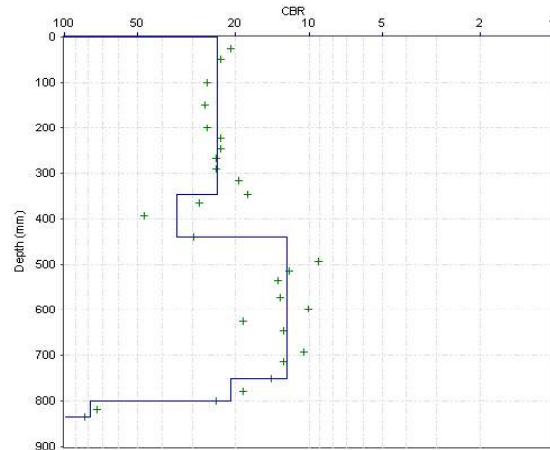
Job Number: CCG-C-20-11845
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	92	0	21	2	52	718	14.0
2	2	2	117	12.5	22	1	53	738	20.0
3	2	4	140	11.5	23	2	55	786	24.0
4	5	9	191	10.2	24	1	56	806	20.0
5	5	14	241	10.0	25	2	58	842	18.0
6	5	19	292	10.2	26	2	60	870	14.0
7	2	21	315	11.5	27	2	62	892	11.0
8	2	23	338	11.5	28	5	67	911	3.8
9	2	25	360	11.0	29	5	72	928	3.4
10	2	27	382	11.0					
11	2	29	409	13.5					
12	2	31	438	14.5					
13	2	33	457	9.5					
14	5	38	486	5.8					
15	5	43	531	9.0					
16	2	45	586	27.5					
17	1	46	607	21.0					
18	1	47	626	19.0					
19	2	49	665	19.5					
20	1	50	690	25.0					

Layer Boundaries: Chainage 6.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Depth (mmbgl)	Strength Coefficient
1	24	346	346	438	
2	35	93	439	531	
3	12	311	750	842	
4	21	50	800	892	
5	78	36	836	928	

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Dark brown silty sandy GRAVEL



Dynamic Cone Penetrometer Strength Analysis Report

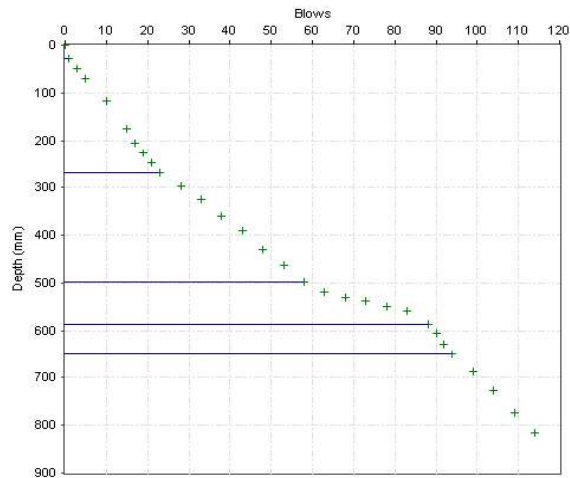
Site: WYNNSTAY TECH PARK, RUABON
 Location: DCP7
 Cone Angle: 60 degrees
 Zero Error: 94
 Test Date: 09/09/2020

Job Number: CCG-C-20-11845
 Surface Type: -
 Thickness (mm): -

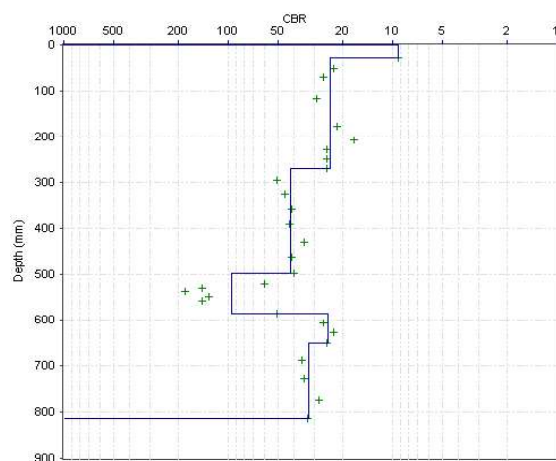
No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	86	0
2	1	1	113	27.0
3	2	3	136	11.5
4	2	5	156	10.0
5	5	10	202	9.2
6	5	15	262	12.0
7	2	17	292	15.0
8	2	19	313	10.5
9	2	21	334	10.5
10	2	23	355	10.5
11	5	28	382	5.4
12	5	33	412	6.0
13	5	38	445	6.6
14	5	43	477	6.4
15	5	48	516	7.8
16	5	53	549	6.6
17	5	58	583	6.8
18	5	63	606	4.6
19	5	68	616	2.0
20	5	73	624	1.6

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
21	5	78	635	2.2
22	5	83	645	2.0
23	5	88	672	5.4
24	2	90	692	10.0
25	2	92	715	11.5
26	2	94	736	10.5
27	5	99	774	7.6
28	5	104	813	7.8
29	5	109	860	9.4
30	5	114	901	8.2

Layer Boundaries: Chainage 7.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Depth (mmbgl)	Strength Coefficient
1	9	27	27	121	
2	24	242	269	363	
3	42	228	497	591	
4	96	89	586	680	
5	25	64	650	744	
6	32	165	815	909	

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Dark brown silty sandy GRAVEL



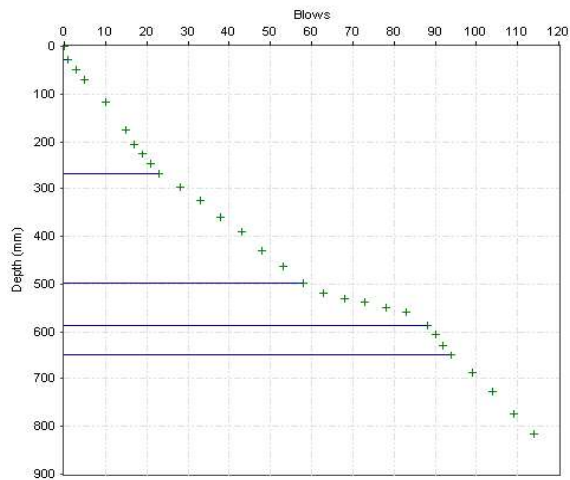
Dynamic Cone Penetrometer Strength Analysis Report

Site: WYNNSTAY TECH PARK, RUABON
 Location: DCP8
 Cone Angle: 60 degrees
 Zero Error: 101
 Test Date: 09/09/2020

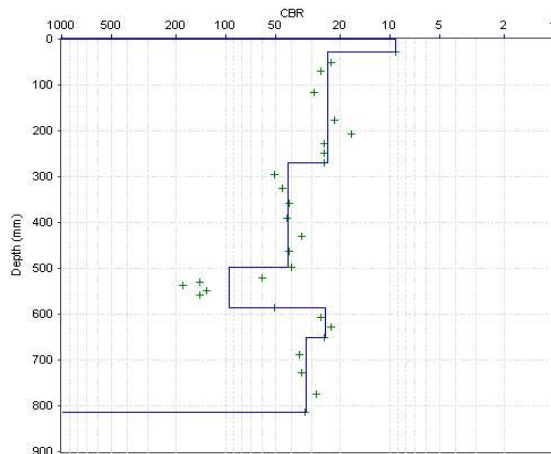
Job Number: CCG-C-20-11845
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	101	0	21	5	78	731	1.8
2	1	1	123	22.0	22	5	83	743	2.4
3	2	3	151	14.0	23	5	88	752	1.8
4	2	5	179	14.0	24	5	93	763	2.2
5	2	7	217	19.0	25	5	98	778	3.0
6	5	12	260	8.6	26	5	103	790	2.4
7	5	17	300	8.0	27	5	108	802	2.4
8	5	22	324	4.8	28	5	113	819	3.4
9	5	27	344	4.0	29	5	118	837	3.6
10	5	32	373	5.8	30	5	123	851	2.8
11	5	37	409	7.2	31	5	128	877	5.2
12	5	42	451	8.4	32	5	133	900	4.6
13	5	47	496	9.0					
14	5	52	550	10.8					
15	2	54	581	15.5					
16	5	59	607	5.2					
17	5	64	654	9.4					
18	2	66	679	12.5					
19	2	68	697	9.0					
20	5	73	722	5.0					

Layer Boundaries: Chainage 7.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Depth (mmbgl)	Strength Coefficient
1	16	116	116	217	
2	34	480	596	697	
3	55	25	621	722	
4	126	80	701	802	
5	71	98	799	900	

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Dark brown silty sandy GRAVEL



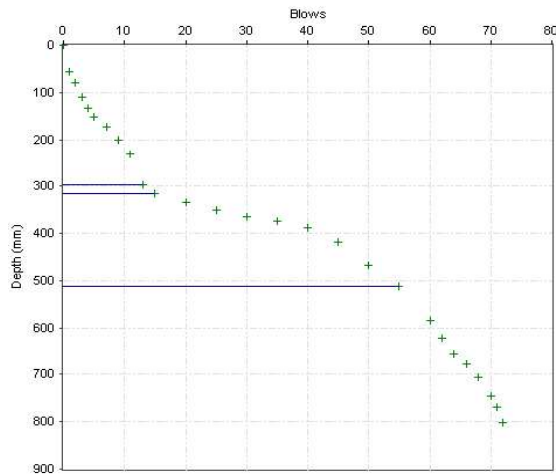
Dynamic Cone Penetrometer Strength Analysis Report

Site: WYNNSTAY TECH PARK, RUABON
 Location: DCP10
 Cone Angle: 60 degrees
 Zero Error: 130
 Test Date: 09/09/2020

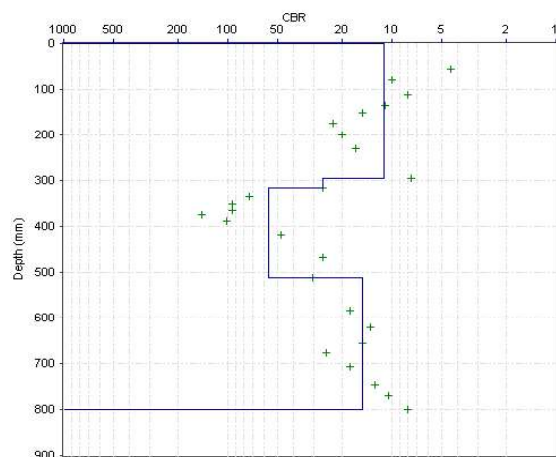
Job Number: CCG-C-20-11845
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	130	0	21	2	62	752	19.0
2	1	1	185	55.0	22	2	64	786	17.0
3	1	2	210	25.0	23	2	66	807	10.5
4	1	3	241	31.0	24	2	68	836	14.5
5	1	4	264	23.0	25	2	70	876	20.0
6	1	5	281	17.0	26	1	71	900	24.0
7	2	7	304	11.5	27	1	72	931	31.0
8	2	9	330	13.0					
9	2	11	361	15.5					
10	2	13	426	32.5					
11	2	15	446	10.0					
12	5	20	465	3.8					
13	5	25	480	3.0					
14	5	30	495	3.0					
15	5	35	505	2.0					
16	5	40	519	2.8					
17	5	45	548	5.8					
18	5	50	598	10.0					
19	5	55	642	8.8					
20	5	60	714	14.4					

Layer Boundaries: Chainage 10.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Depth (mmbgl)	Strength Coefficient
1	11	296	296	426	
2	26	20	316	446	
3	56	196	512	642	
4	15	289	801	931	

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Grassed TOPSOIL



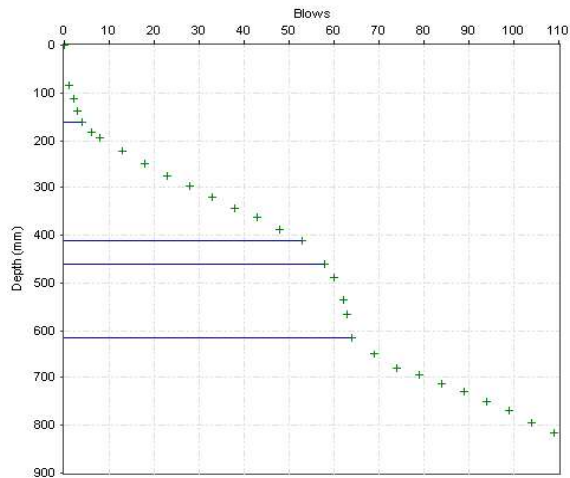
Dynamic Cone Penetrometer Strength Analysis Report

Site: WYNNSTAY TECH PARK, RUABON
 Location: DCP11
 Cone Angle: 60 degrees
 Zero Error: 139
 Test Date: 09/09/2020

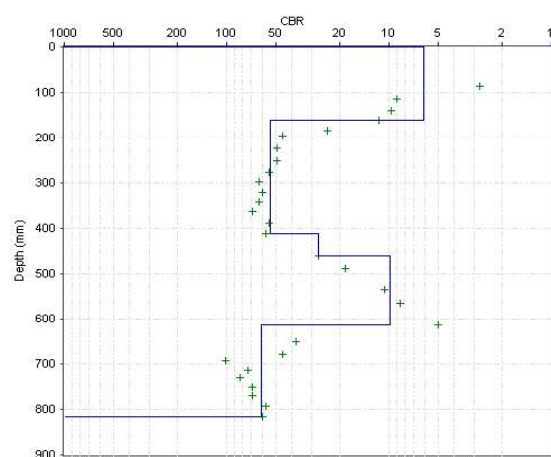
Job Number: CCG-C-20-11845
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	139	0	21	1	64	753	49.0
2	1	1	224	85.0	22	5	69	789	7.2
3	1	2	252	28.0	23	5	74	819	6.0
4	1	3	278	26.0	24	5	79	833	2.8
5	1	4	300	22.0	25	5	84	852	3.8
6	2	6	322	11.0	26	5	89	869	3.4
7	2	8	334	6.0	27	5	94	889	4.0
8	5	13	362	5.6	28	5	99	909	4.0
9	5	18	390	5.6	29	5	104	933	4.8
10	5	23	415	5.0	30	5	109	956	4.6
11	5	28	437	4.4					
12	5	33	460	4.6					
13	5	38	482	4.4					
14	5	43	502	4.0					
15	5	48	527	5.0					
16	5	53	551	4.8					
17	5	58	600	9.8					
18	2	60	628	14.0					
19	2	62	675	23.5					
20	1	63	704	29.0					

Layer Boundaries: Chainage 11.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Depth (mmbgl)	Strength Coefficient
1	6	161	161	300	
2	54	251	412	551	
3	27	49	461	600	
4	10	153	614	753	
5	61	203	817	956	

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Grassed TOPSOIL



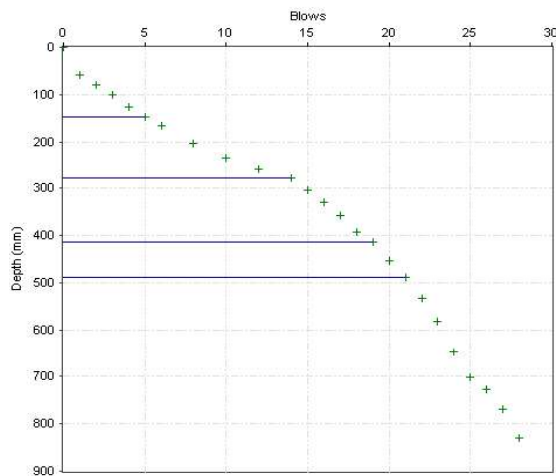
Dynamic Cone Penetrometer Strength Analysis Report

Site: WYNNSTAY TECH PARK, RUABON
 Location: DCP12
 Cone Angle: 60 degrees
 Zero Error: 103
 Test Date: 09/09/2020

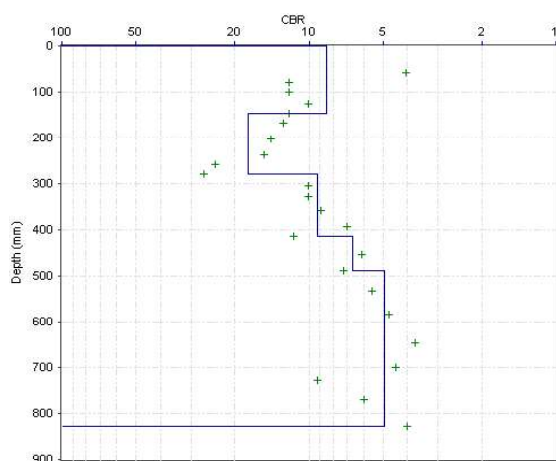
Job Number: CCG-C-20-11845
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	103	0	21	1	24	750	64.0
2	1	1	162	59.0	22	1	25	804	54.0
3	1	2	183	21.0	23	1	26	831	27.0
4	1	3	204	21.0	24	1	27	872	41.0
5	1	4	229	25.0	25	1	28	932	60.0
6	1	5	250	21.0					
7	1	6	270	20.0					
8	2	8	306	18.0					
9	2	10	340	17.0					
10	2	12	362	11.0					
11	2	14	382	10.0					
12	1	15	407	25.0					
13	1	16	432	25.0					
14	1	17	460	28.0					
15	1	18	495	35.0					
16	1	19	517	22.0					
17	1	20	557	40.0					
18	1	21	591	34.0					
19	1	22	635	44.0					
20	1	23	686	51.0					

Layer Boundaries: Chainage 12.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Depth (mmbgl)	Strength Coefficient
1	8	147	147	250	
2	18	132	279	382	
3	9	135	414	517	
4	7	74	488	591	
5	5	341	829	932	

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Dark brown silty sandy GRAVEL



Dynamic Cone Penetrometer Strength Analysis Report

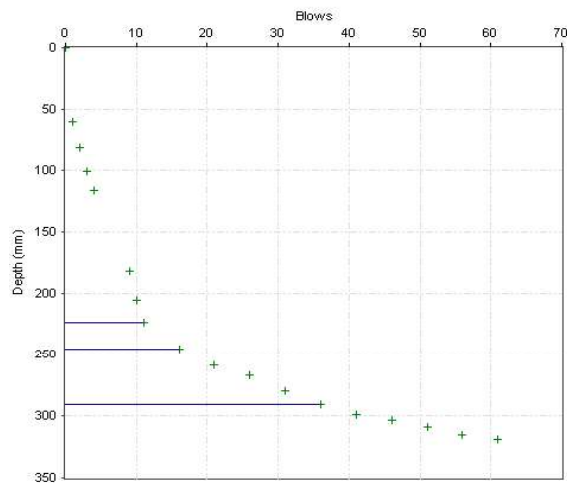
Site: WYNNSTAY TECH PARK, RUABON
 Location: DCP13
 Cone Angle: 60 degrees
 Zero Error: 151
 Test Date: 09/09/2020

Job Number: CCG-C-20-11845
 Surface Type: -
 Thickness (mm): -

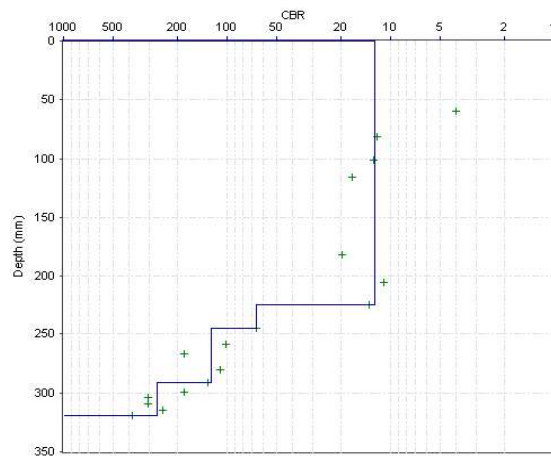
No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	151	0
2	1	1	211	60.0
3	1	2	232	21.0
4	1	3	252	20.0
5	1	4	267	15.0
6	5	9	333	13.2
7	1	10	356	23.0
8	1	11	375	19.0
9	5	16	396	4.2
10	5	21	410	2.8
11	5	26	418	1.6
12	5	31	431	2.6
13	5	36	442	2.2
14	5	41	450	1.6
15	5	46	455	1.0
16	5	51	460	1.0
17	5	56	466	1.2
18	5	61	470	0.8

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)

Layer Boundaries: Chainage 13.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Depth (mmbgl)	Strength Coefficient
1	12	224	224	375	
2	66	21	245	396	
3	125	46	291	442	
4	268	28	319	470	

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Dark brown silty sandy GRAVEL



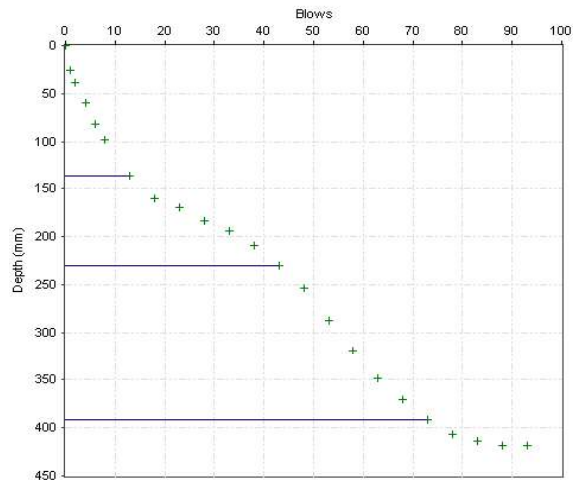
Dynamic Cone Penetrometer Strength Analysis Report

Site: WYNNSTAY TECH PARK, RUABON
 Location: DCP14
 Cone Angle: 60 degrees
 Zero Error: 103
 Test Date: 09/09/2020

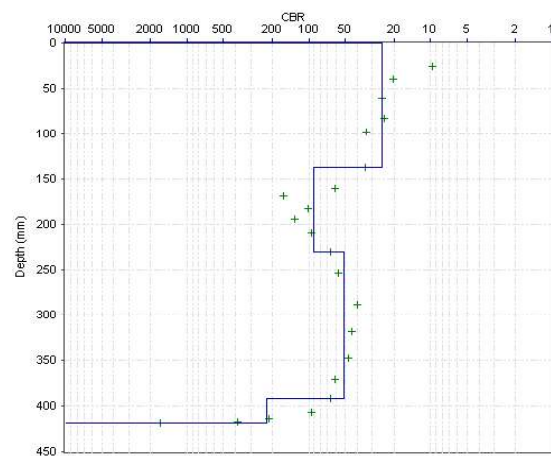
Job Number: CCG-C-20-11845
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	103	0	21	5	83	517	1.4
2	1	1	129	26.0	22	5	88	521	0.8
3	1	2	142	13.0	23	5	93	522	0.2
4	2	4	163	10.5					
5	2	6	185	11.0					
6	2	8	201	8.0					
7	5	13	240	7.8					
8	5	18	263	4.6					
9	5	23	272	1.8					
10	5	28	286	2.8					
11	5	33	297	2.2					
12	5	38	312	3.0					
13	5	43	333	4.2					
14	5	48	357	4.8					
15	5	53	391	6.8					
16	5	58	422	6.2					
17	5	63	451	5.8					
18	5	68	474	4.6					
19	5	73	495	4.2					
20	5	78	510	3.0					

Layer Boundaries: Chainage 14.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Depth (mmbgl)	Strength Coefficient
1	25	137	137	240	
2	91	93	230	333	
3	51	162	392	495	
4	220	27	419	522	

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Dark brown silty sandy GRAVEL



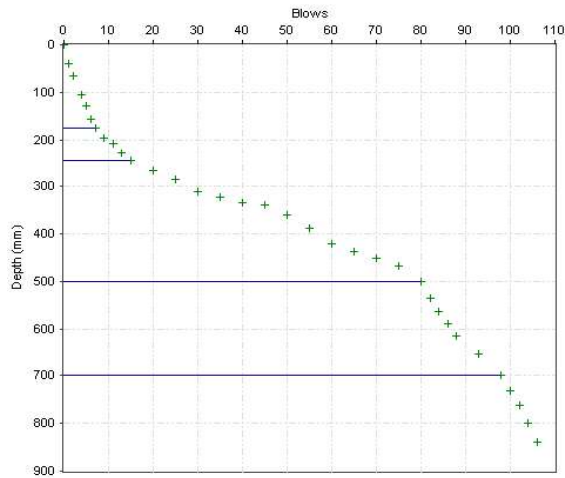
Dynamic Cone Penetrometer Strength Analysis Report

Site: WYNNSTAY TECH PARK, RUABON
 Location: DCP15
 Cone Angle: 60 degrees
 Zero Error: 96
 Test Date: 09/09/2020

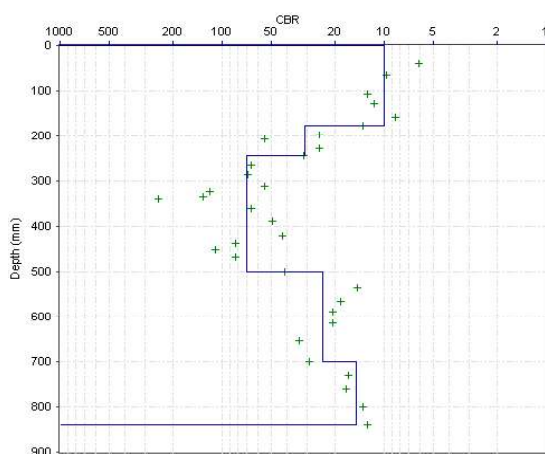
Job Number: CCG-C-20-11845
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	96	0	21	5	65	534	3.4
2	1	1	136	40.0	22	5	70	547	2.6
3	1	2	162	26.0	23	5	75	564	3.4
4	2	4	202	20.0	24	5	80	597	6.6
5	1	5	224	22.0	25	2	82	632	17.5
6	1	6	253	29.0	26	2	84	660	14.0
7	1	7	272	19.0	27	2	86	685	12.5
8	2	9	293	10.5	28	2	88	710	12.5
9	2	11	303	5.0	29	5	93	750	8.0
10	2	13	324	10.5	30	5	98	796	9.2
11	2	15	341	8.5	31	2	100	827	15.5
12	5	20	362	4.2	32	2	102	857	15
13	5	25	382	4.0	33	2	104	895	19
14	5	30	407	5.0	34	2	106	935	20
15	5	35	419	2.4					
16	5	40	430	2.2					
17	5	45	436	1.2					
18	5	50	457	4.2					
19	5	55	485	5.6					
20	5	60	517	6.4					

Layer Boundaries: Chainage 15.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Depth (mmbgl)	Strength Coefficient
1	10	176	176	272	
2	31	69	245	341	
3	71	256	501	597	
4	24	199	700	796	
5	15	139	839	935	

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Dark brown silty sandy GRAVEL



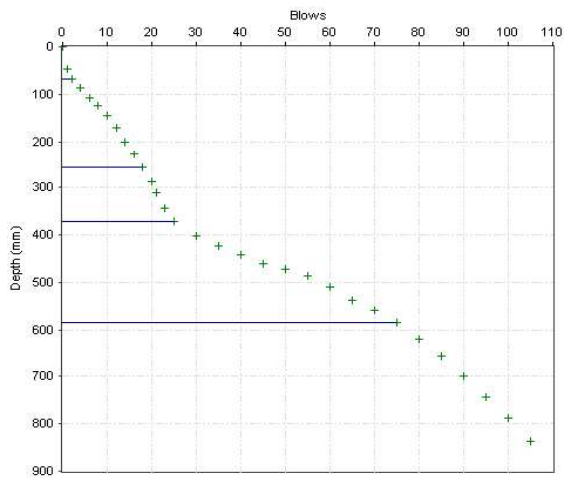
Dynamic Cone Penetrometer Strength Analysis Report

Site: WYNNSTAY TECH PARK, RUABON
 Location: DCP17
 Cone Angle: 60 degrees
 Zero Error: 90
 Test Date: 09/09/2020

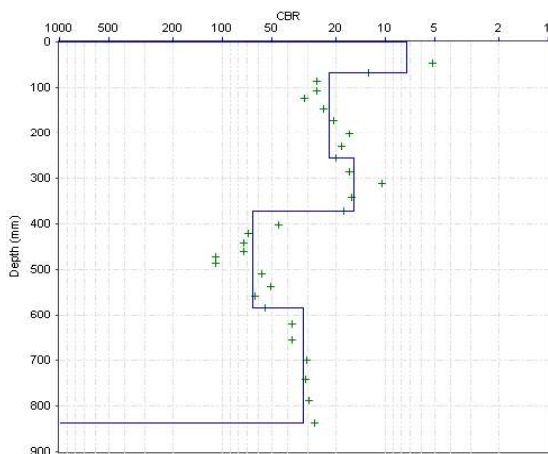
Job Number: CCG-C-20-11845
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	90	0	21	5	55	576	2.6
2	1	1	137	47.0	22	5	60	600	4.8
3	1	2	157	20.0	23	5	65	627	5.4
4	2	4	177	10.0	24	5	70	649	4.4
5	2	6	197	10.0	25	5	75	674	5.0
6	2	8	214	8.5	26	5	80	710	7.2
7	2	10	236	11.0	27	5	85	746	7.2
8	2	12	261	12.5	28	5	90	790	8.8
9	2	14	292	15.5	29	5	95	833	8.6
10	2	16	320	14.0	30	5	100	878	9
11	2	18	346	13.0	31	5	105	927	9.8
12	2	20	377	15.5					
13	1	21	401	24.0					
14	2	23	433	16.0					
15	2	25	462	14.5					
16	5	30	492	6.0					
17	5	35	512	4.0					
18	5	40	531	3.8					
19	5	45	550	3.8					
20	5	50	563	2.6					

Layer Boundaries: Chainage 17.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Depth (mmbgl)	Strength Coefficient
1	7	67	67	157	
2	22	189	256	346	
3	16	116	372	462	
4	66	212	584	674	
5	32	253	837	927	

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Dark brown silty sandy GRAVEL



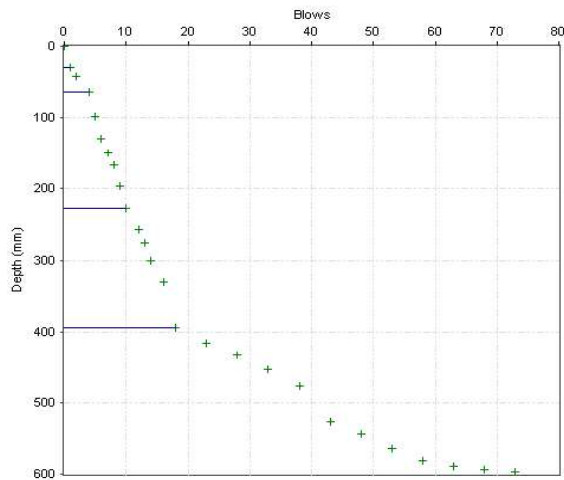
Dynamic Cone Penetrometer Strength Analysis Report

Site: WYNNSTAY TECH PARK, RUABON
 Location: DCP18
 Cone Angle: 60 degrees
 Zero Error: 113
 Test Date: 09/09/2020

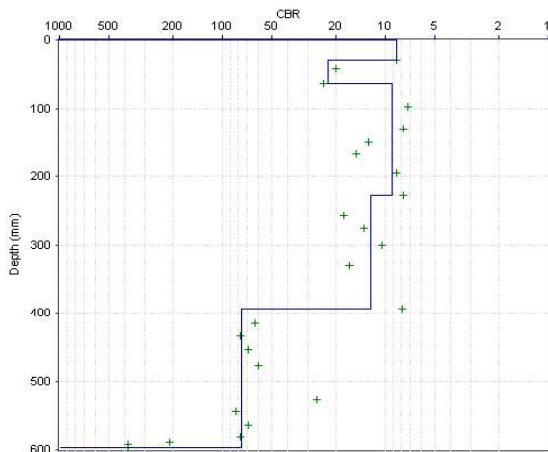
Job Number: CCG-C-20-11845
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	113	0	21	5	48	657	3.4
2	1	1	142	29.0	22	5	53	677	4.0
3	1	2	155	13.0	23	5	58	695	3.6
4	2	4	177	11.0	24	5	63	702	1.4
5	1	5	211	34.0	25	5	68	706	0.8
6	1	6	243	32.0	26	5	73	710	0.8
7	1	7	263	20.0					
8	1	8	280	17.0					
9	1	9	309	29.0					
10	1	10	341	32.0					
11	2	12	370	14.5					
12	1	13	389	19.0					
13	1	14	413	24.0					
14	2	16	444	15.5					
15	2	18	507	31.5					
16	5	23	529	4.4					
17	5	28	547	3.6					
18	5	33	567	4.0					
19	5	38	590	4.6					
20	5	43	640	10.0					

Layer Boundaries: Chainage 18.000



Layer Boundaries Chart



CBR Chart

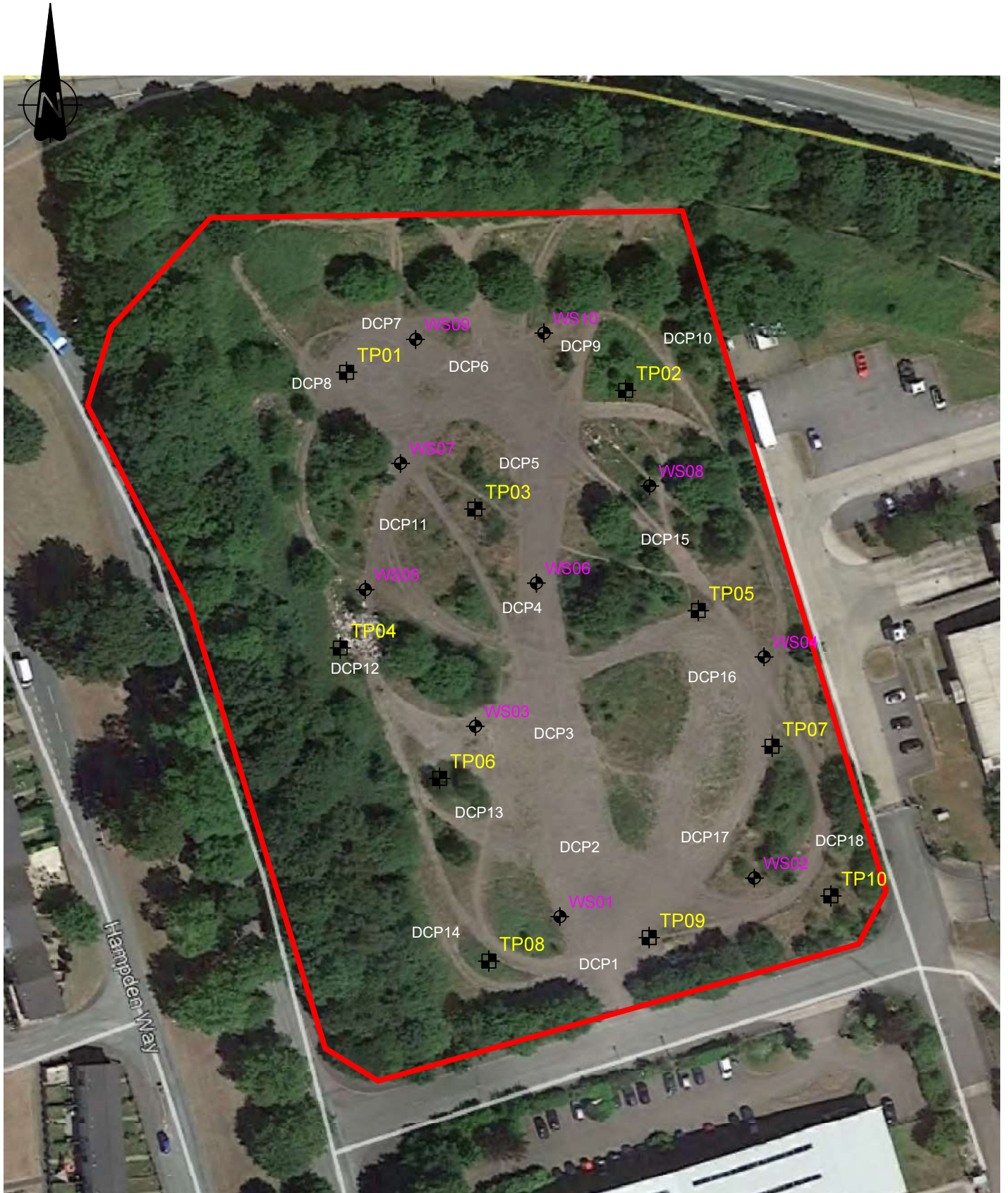
Layer Properties

No.	CBR value	Thickness	Depth	Depth (mmbgl)	Strength Coefficient
1	9	29	29	142	
2	23	35	64	177	
3	9	164	228	341	
4	12	166	394	507	
5	76	203	597	710	

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Dark brown silty sandy GRAVEL



SCALE 1: 500 @ A3

Figure Title
Site Layout & Exploratory
Hole Location Plan

FIGURE 2

APPENDIX I

Physical Testing Results

Certificate of Accreditation



Geotechnics Limited

Testing Laboratory No. 1365

**Is accredited in accordance with International Standard ISO/IEC 17025:2017
– General Requirements for the competence of testing and calibration
laboratories.**

This accreditation demonstrates technical competence for a defined scope specified in the schedule to this certificate, and the operation of a management system (refer joint ISO-ILAC-IAF Communiqué dated April 2017). The schedule to this certificate is an essential accreditation document and from time to time may be revised and reissued.

The most recent issue of the schedule of accreditation, which bears the same accreditation number as this certificate, is available from www.ukas.com.

This accreditation is subject to continuing conformity with United Kingdom Accreditation Service requirements.

A handwritten signature in black ink, reading "Matt Gantley", is positioned above a horizontal line.

Matt Gantley, *Chief Executive Officer*
United Kingdom Accreditation Service

Initial Accreditation: 1 September 1993
Certificate Issued: 9 December 2019



Scan QR Code to
verify

Schedule of Accreditation

issued by

United Kingdom Accreditation Service

2 Pine Trees, Chertsey Lane, Staines-Upon-Thames, Middlesex TW18 3HR

 1365 Accredited to ISO/IEC 17025:2017	Geotechnics Limited Issue No: 021 Issue date: 14 September 2020	
	The Geotechnical Centre 203 Torrington Avenue Tile Hill Coventry CV4 9AP	Contact: Mr Stephane Schiano Tel: +44 (0)24 7662 9024 E-Mail: sschiano@geotechnics.co.uk Website: www.geotechnics.co.uk
	Testing performed at the above address only	

DETAIL OF ACCREDITATION

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
AGGREGATES	Particle size distribution - sieving method	BS EN 933-1:2012
	Water content	BS EN 1097-5:2008
ROCK	Point load strength and anisotropy indices	ISRM Commission on Testing Methods. Suggested Method for Determining Point Load Strength 1985
	Water content – method 1	International Society for Rock Mechanics – suggested methods, Part 1 Test 1: 1981
GEOTECHNICAL INVESTIGATION and TESTING - Laboratory testing of soil	Water content	BS EN ISO 17892-1:2014
	Bulk density - linear measurement method	BS EN ISO 17892-2:2014
	Determination of particle density – fluid pycnometer method,	BS EN ISO 17892-3:2015
	Determination of particle size distribution - Sieving method	BS EN ISO 17892-4:2016
	Determination of particle size distribution - Pipette method	BS EN ISO 17892-4:2016
	Incremental loading odometer test	BS EN ISO 17892-5:2017
	Unconsolidated undrained triaxial test	BS EN ISO 17892-8:2018
	Direct shear (small shearbox)	BS EN ISO 17892-10:2018
	Determination of liquid limit (fall cone method)	BS EN ISO 17892-12:2018



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ISO/IEC 17025:2017

Schedule of Accreditation
issued by
United Kingdom Accreditation Service
2 Pine Trees, Chertsey Lane, Staines-Upon-Thames, Middlesex TW18 3HR

Geotechnics Limited

Issue No: 021 Issue date: 14 September 2020

Testing performed at main address only

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
GEOTECHNICAL INVESTIGATION and TESTING - Laboratory testing of soil (cont'd) SOILS for civil engineering purposes	Determination of liquid limit (one-point fall cone method)	BS EN ISO 17892-12:2018
	Determination of plastic limit	BS EN ISO 17892-12:2018
	Determination of plasticity index	BS EN ISO 17892-12:2018
	Moisture content - oven drying method	BS 1377-2:1990
	Saturation moisture content of chalk	BS 1377-2:1990
	Liquid limit - cone penetrometer	BS 1377-2:1990
	Liquid limit - cone penetrometer - one point	BS 1377-2:1990
	Plastic limit	BS 1377-2:1990
	Plasticity index	BS 1377-2:1990
	Linear shrinkage	BS 1377-2:1990
	Density - linear measurement	BS 1377-2:1990
	Particle density - gas jar	BS 1377-2:1990
	Particle density - small pycnometer	BS 1377-2:1990
	Particle density - large pycnometer	BS 1377-2:1990
	Particle size distribution - wet sieving	BS 1377-2:1990
	Particle size distribution - dry sieving	BS 1377-2:1990
	Particle size distribution - sedimentation - pipette method	BS 1377-2:1990
	Sulphate content of soil and ground water gravimetric method	BS 1377-3:1990 (withdrawn)



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Schedule of Accreditation

issued by

United Kingdom Accreditation Service

2 Pine Trees, Chertsey Lane, Staines-Upon-Thames, Middlesex TW18 3HR

Geotechnics Limited

Issue No: 021 Issue date: 14 September 2020

Testing performed at main address only

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
SOILS for civil engineering purposes (cont'd)	pH value	BS 1377-3:1990 (withdrawn)
	California Bearing Ratio (CBR)	BS 1377-4:1990
	Dry density/moisture content relationship (vibrating hammer)	BS 1377-4:1990
	Maximum and minimum dry densities for granular soils	BS 1377-4:1990
	Moisture condition value (MCV)	BS 1377-4:1990
	MCV/moisture content relation	BS 1377-4:1990
	Chalk crushing value	BS 1377-4:1990
	One-dimensional consolidation properties	BS 1377-5:1990
	Shear strength - small shear box	BS1377-7:1990
	Residual strength - small ring shear apparatus	BS1377-7:1990
	Unconfined compressive strength - load frame method	BS 1377-7:1990
	Undrained shear strength - triaxial compression without measurement of pore pressure	BS 1377-7:1990
	Undrained shear strength - triaxial compression with multistage loading and without measurement of pore pressure	BS 1377-7:1990
Hydraulically bound and stabilized materials for civil engineering purposes	Initial consumption of lime	BS 1924-2:2018
	California Bearing Ratio / immediate bearing index	BS EN 13286-47:2012
	Moisture content - oven drying method (definitive)	BS EN 17892-1:2014
	Plastic limit	BS 1924-2:2018
	Liquid limit	BS 1924-2:2018
	Plasticity index	BS 1924-2:2018



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Schedule of Accreditation
issued by
United Kingdom Accreditation Service
2 Pine Trees, Chertsey Lane, Staines-Upon-Thames, Middlesex TW18 3HR

Geotechnics Limited

Issue No: 021 **Issue date:** 14 September 2020

Testing performed at main address only

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
Hydraulically bound and stabilized Materials for civil engineering purposes	Dry density/moisture content relationship (2.5 kg rammer)	BS 1924-2:2018 and BS EN 13826-2:2010
	Dry density/moisture content relationship (4.5 kg rammer)	BS 1924-2:2018 and BS EN 13826-2:2010
	Dry density/moisture content relationship (vibrating hammer - subsidiary method)	BS 1924-2:2018 and BS EN 13826-4:2003
	Moisture condition value (MCV)	BS EN 13826-46:2003
END		

Classification and Strength

Symbol	C - Clay (0 - containing organic matter) Plasticity	M - Silt L - Low I - Intermediate H - High V - Very High E - Extremely High
I_p	Plasticity Index	
%	% retained on 425 μ m sieve, shown under I_p value	
w_L	Liquid Limit	
w_p	Plastic Limit	
NP	Non-Plastic	
NAT	Sample tested in natural state	
w	Water Content	
ρ_d	Particle Density	
Test	Quick undrained triaxial tests	
	SS	Single stage - 102mm diameter.
	S3	Single stage - set of 3 38mm diameter.
	MS	Multistage - 102mm diameter.
	D	Drained Test
	HV	Hand Vane
	PP	Pocket Penetrometer (kg/cm^2)
	NST	Not suitable for test
γ_b	Bulk Density	
σ_3	Triaxial Cell Pressure	
$\sigma_1 - \sigma_3$	Deviator Stress	
##	Excessive Strain	
c_u	Undrained Cohesion	
c	Cohesion Intercept	
ϕ	Angle of Shearing Resistance	
Linear Shrink	Linear Shrinkage	
Stab add-	Stabiliser which is added	

Consolidation

m_v	Coefficient of Volume Compressibility
c_{v50}	Coefficient of Consolidation - Log t
c_{v90}	Coefficient of Consolidation - $\sqrt{t}$

Rock

UF	Unacceptable Failure
----	----------------------

Chemical Analysis

Acid Soluble	Total sulphate in specimen, expressed as SO_3 %, value in brackets expressed as SO_4 %
Water Soluble	Soluble sulphate in 2:1 water : soil extract, expressed as SO_3 g/l, value in brackets expressed as SO_4 g/l
In Water	Sulphate content of groundwater, expressed as SO_3 g/l, value in brackets expressed as SO_4 g/l
pH	pH value
Organic content	Organic content expressed as a percentage of dry weight
Chloride	Chloride Ion content expressed as a percentage of dry weight

MCV, Compaction, CBR

MCV	Moisture Condition Value at natural water content
MCC	Moisture Condition Calibration
CCV	Chalk Crushing Value

Compaction

Type	2.5	=	2.5 kg Rammer
	4.5	=	4.5 kg Rammer
	V	=	Vibrating Hammer
γ_b	Bulk Density		
γ_d	Dry Density		
CBR California Bearing Ratio			
Type	2.5	=	Test on Specimen Recompacted using 2.5 kg Rammer
	4.5	=	As above but using 4.5 kg Rammer
	V	=	As above but using Vibrating Hammer
	M	=	Test on open drive mould specimen cut in field
	S	=	Soaked Specimen

Top	CBR at top of mould
Bottom	CBR at bottom of mould
ND	None Detected

* In the Sample Description denotes a laboratory only description

Laboratory Test Certificate

Form REP008 Rev 3

Issued To	Tyler Goodrick Groundsolve Ltd Unit 1 Charter Court, Well House Barns Chester Road, Bretton Flintshire, CH4 0DH	Date of issue	25/09/2020
		Issue No.	1
		Client Ref. No.	2387/WNY/TG
		Samples / Material Source	
		Samples Recv'd	14/09/2020
Testing Start Date	14/09/2020	Sample State	As received
Testing Complete	25/09/2020	Sampled by	Groundsolve Ltd
Comments			
Project No	PC207961		
Project Name	2387 - WYNNSTAY, RUABON		

Summary of Tests

Standard	Test Description	Test Quantity	UKAS
BS EN ISO 17892-1:2014	Water Content	5	Yes
BS EN ISO 17892-12:2018 Cl. 5.3 & 5.5	Liquid Limit and Plastic Limit (4 Points Method)	5	Yes
BS EN ISO 17892-4:2016 Cl. 5.2	Particle Size Distribution by Sieving Method	10	Yes
BS 1377-4:1990 Cl. 3.3	2.5 kg Rammer Dry Density/Moisture Content Relationship (Compaction)	3	Yes

Note: Any descriptions, opinions or interpretations are outside the scope of UKAS accreditation.
The results within this report relate only to the samples tested and received from the client.



Test Results checked and approved for issue.
Signed for and on behalf of Geotechnics Limited

Stephane Schiano (Laboratory Testing Manager)

GEOTECHNICS
geotechnical and geoenvironmental specialists

203 Torrington Avenue, Tile Hill,
Coventry, CV4 9UT

LABORATORY RESULTS - Atterberg Limit

Project 2387 - WYNNSTAY, RUABON

Project No: PC207961

Sample					Results							
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	Test Type	Point Data		Sym- bol	p %	>425 sieve µm	w _L %	w _p %
						Cone Pene.	Water % (Factor)					
TP01	1.50 (1.50)	D	C48351	Dark grey slightly sandy organic slightly gravelly CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CI	20	20%	35	15
TP04	2.00 (2.00)	D	C48352	Dark grey slightly sandy organic slightly gravelly CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CL	16	8%	33	17
WS03	3.00 (3.00)	D	C48353	Brown occasionally light grey slightly sandy slightly gravelly CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CL	13	37%	26	13
WS05	2.00 (2.00)	D	C48354	Grey slightly sandy slightly gravelly slightly organic CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CI	17	17%	36	19
WS08	1.50 (1.50)	D	C48355	Greenish brown occasionally light grey slightly sandy slightly gravelly CLAY.	Fall Cone 4pt with increasing water content, cone type: 80g/30, washed over 425um sieve			CL	17	17%	32	15

Remarks





geotechnical and geoenvironmental specialists

LABORATORY RESULTS - Classification and Strength

Project 2387 - WYNNSTAY, RUABON

Project No: PC207961

Sample					Classification					Strength					
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	Symbol	I_p (>425) %	w_L %	w_p %	w (p_d) %	Test	γ_b (γ_d) ³ Mg/m ³	σ_3 kN/m ²	$\sigma_1 - \sigma_3$ kN/m ²	c_u kN/m ²	c_{Avg} kN/m ²
TP01	1.50 (1.50)	D	C48351	Dark grey slightly sandy organic slightly gravelly CLAY.	CI	20 (20%)	35	15	24.1						
TP04	2.00 (2.00)	D	C48352	Dark grey slightly sandy organic slightly gravelly CLAY.	CL	16 (8%)	33	17	23.4						
WS03	3.00 (3.00)	D	C48353	Brown occasionally light grey slightly sandy slightly gravelly CLAY.	CL	13 (37%)	26	13	14.2						
WS05	2.00 (2.00)	D	C48354	Grey slightly sandy slightly gravelly slightly organic CLAY.	CI	17 (17%)	36	19	31.2						
WS08	1.50 (1.50)	D	C48355	Greenish brown occasionally light grey slightly sandy slightly gravelly CLAY.	CL	17 (17%)	32	15	20.4						

Remarks

AGS

NST - Not suitable for Test

For Standards followed see Laboratory Test Certificate

w% - ^ = Rock water content test; x = Aggregate moisture content test

QUT Water Contents: <Failure Zone>, [After test]

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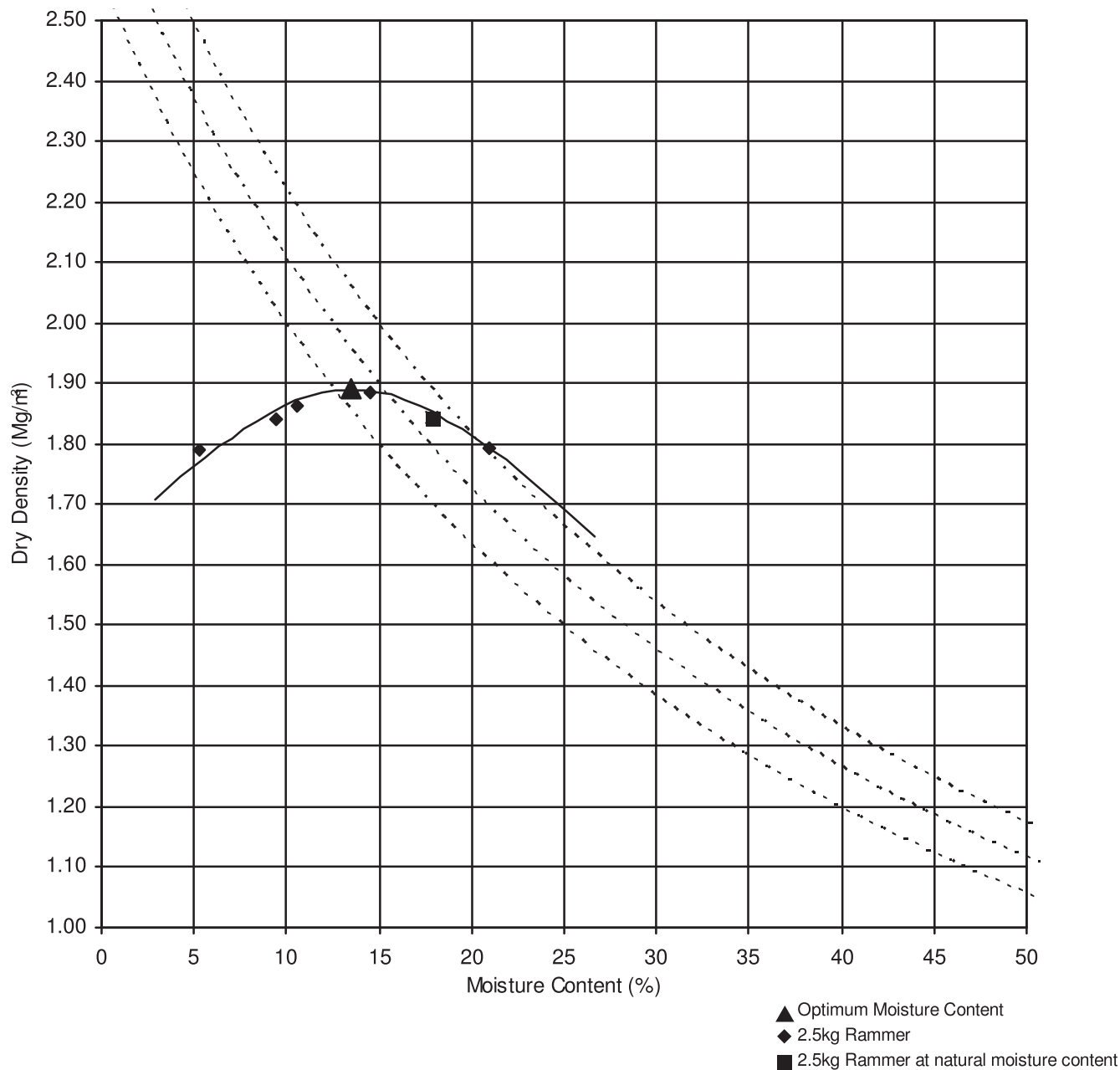
geotechnical and geoenvironmental specialists

LABORATORY RESULTS - *Compaction*

Project: 2387 - WYNNSTAY, RUABON

Hole TP03
Sample Depth 1.00m
Sample Type B
Sample Ref C48343

Project No: PC207961



Optimum Moisture Content 13.5
Maximum Dry Density 1.89 Mg/m³

Particles retained on 37.5mm sieve 5 %
 20mm sieve 12 %

Particle Density 2.85 (Ass'm) Mg/m³
 Preparation Single Sample
 2.5kg Rammer

Description MADE GROUND: dark grey mottled reddish brown sandy shale/gravel.

Remarks  BS1377 Part 4 1990 : Clause 3.3 and 3.4

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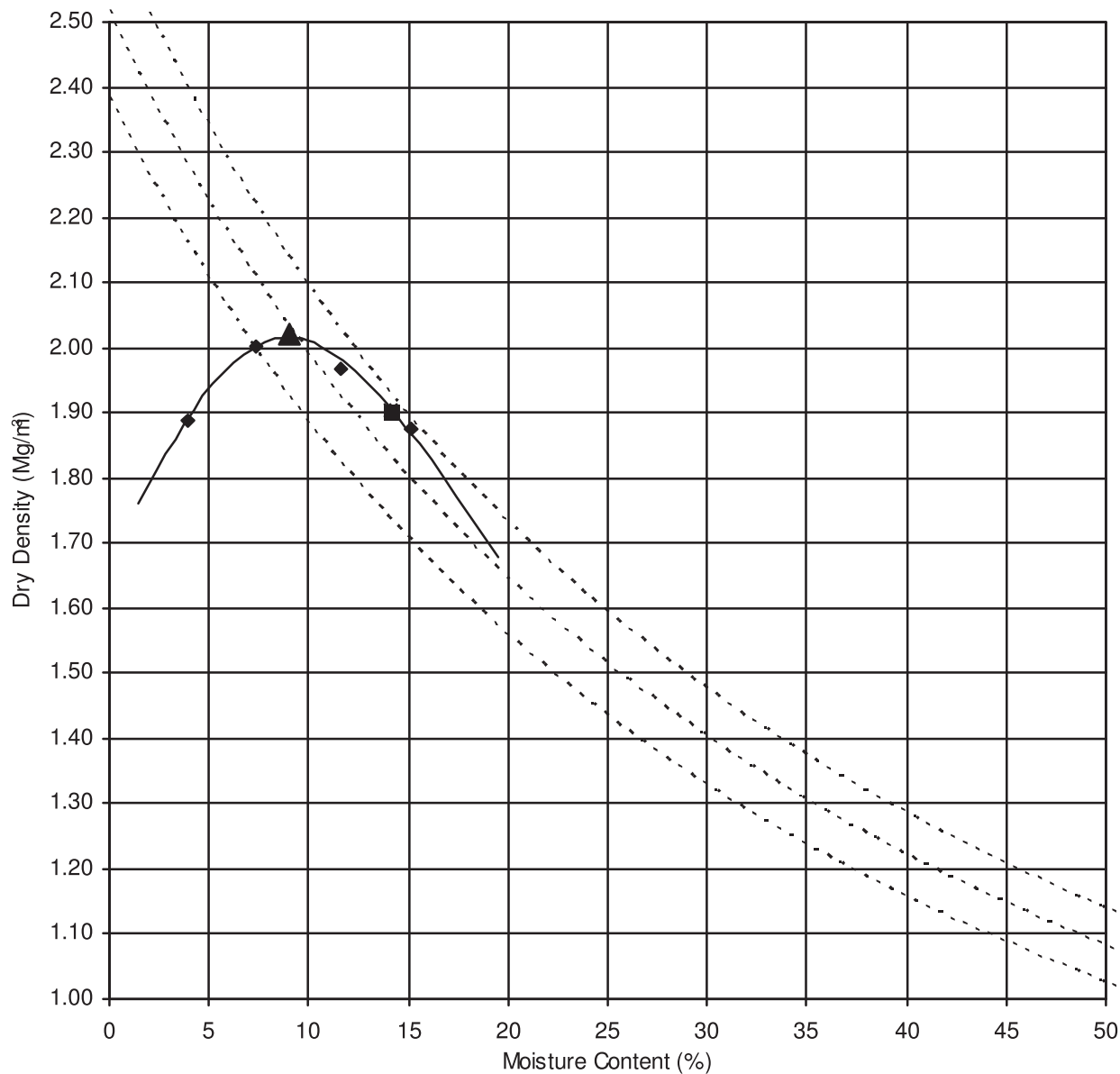
25/09/2020

LABORATORY RESULTS - *Compaction*

Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP06
Sample Depth 1.00m
Sample Type B
Sample Ref C48346



▲ Optimum Moisture Content
 ◆ 2.5kg Rammer
 ■ 2.5kg Rammer at natural moisture content

Optimum Moisture Content 9.0
Maximum Dry Density 2.02 Mg/m³

Particles retained on 37.5mm sieve 7 %
 20mm sieve 14 %

Particle Density 2.65 (Assumed) Mg/m³
 Preparation Single Sample
 2.5kg Rammer

Description MADE GROUND: brown clayey shale/gravel (wet).

Remarks  BS1377 Part 4 1990 : Clause 3.3 and 3.4

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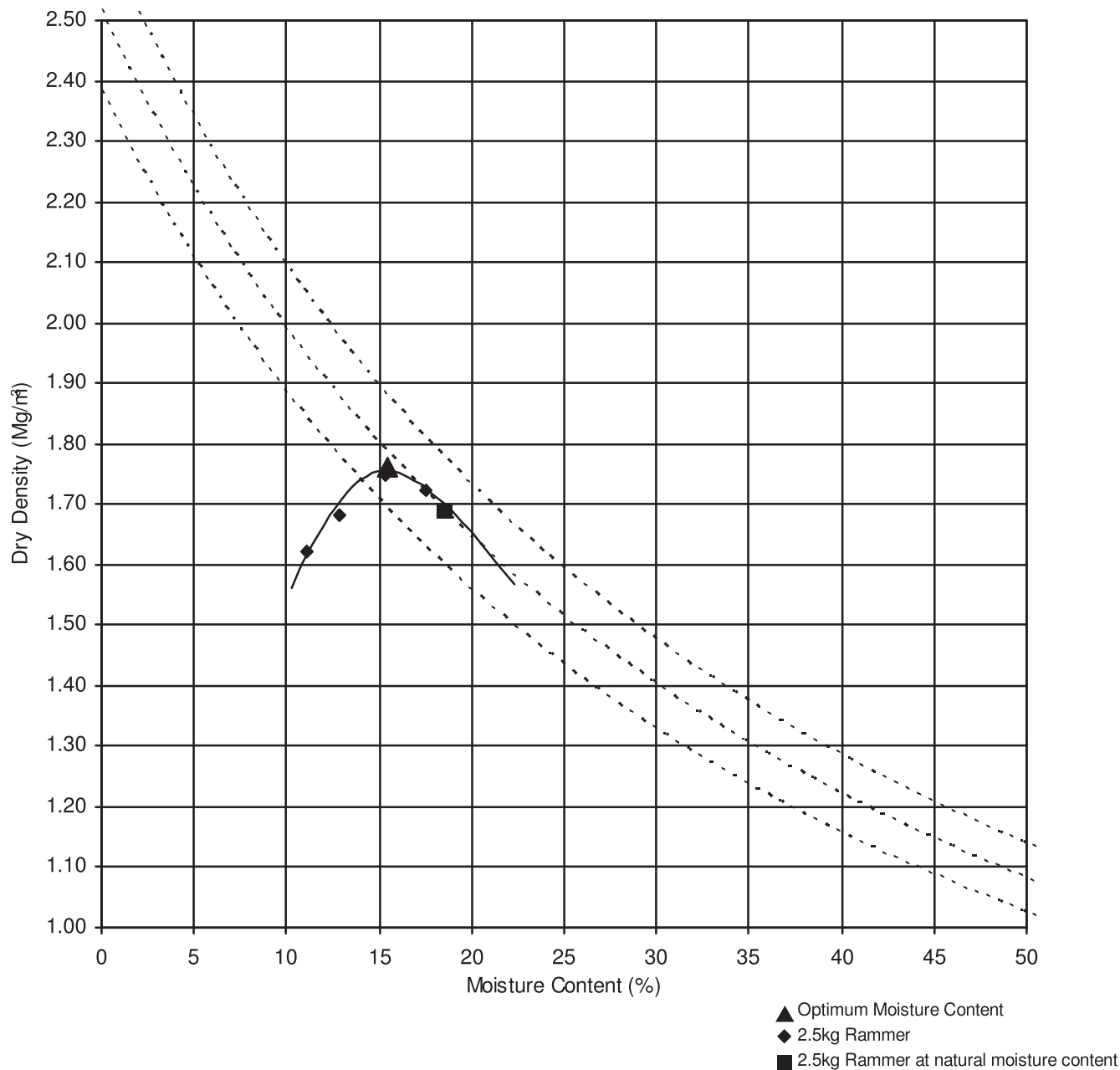
25/09/2020

LABORATORY RESULTS - *Compaction*

Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP09
Sample Depth 0.50m
Sample Type B
Sample Ref C48349



Optimum Moisture Content 15.5
Maximum Dry Density 1.76 Mg/m³

Particles retained on 37.5mm sieve 8 %
 20mm sieve 23 %

Particle Density 2.65 (Assumed) Mg/m³
 Preparation Single Sample
 2.5kg Rammer

Description MADE GROUND: dark brown clayey sandy shale/gravel with brick fragments.

Remarks  BS1377 Part 4 1990 : Clause 3.3 and 3.4

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25/09/2020

LABORATORY RESULTS - MCV, Compaction, CBR

Project 2387 - WYNNSTAY, RUABON

Project No: PC207961

Sample					MCV		Compaction					CBR				
Hole	Depth (Specimen Depth) m	Type	Sample Ref	Description	MCV	w %	Type	w (Opt) %	ρ_d Mg/m ³	γ_b Mg/m ³	γ_d (Max) Mg/m ³	Type	Top		Bottom	
													CBR %	w %	CBR %	w %
TP03	1.00 (1.00)	B	C48343	MADE GROUND: dark grey mottled reddish brown sandy shale/gravel.			2.5kg	(13.5)	2.85a		(1.89)					
								10.6		2.06	1.86					
								14.5		2.16	1.89					
								17.9*		*2.18	*1.85					
								21.0		2.17	1.79					
								5.3		1.88	1.79					
								9.4		2.01	1.84					
TP06	1.00 (1.00)	B	C48346	MADE GROUND: brown clayey shale/gravel (wet).			2.5kg	(9.0)	2.65a		(2.02)					
								14.1*		*2.17	*1.91					
								11.7		2.20	1.97					
								15.2		2.16	1.88					
								4.0		1.96	1.89					
TP09	0.50 (0.50)	B	C48349	MADE GROUND: dark brown clayey sandy shale/gravel with brick fragments.			2.5kg	(15.5)	2.65a		(1.76)					
								12.9		1.90	1.68					
								15.3		2.02	1.75					
								17.5		2.03	1.72					
								18.5*		*2.00	*1.69					
								11.1		1.80	1.62					

Remarks

Particle Density - a=assumed, m=measured
w% - * = at natural moisture content; x = aggregate moisture content
= stabilised, see relevant test plot for details
NST = Not suitable for Test
For Standards followed see Laboratory Test Certificate

LABORATORY RESULTS - Particle Size Distribution

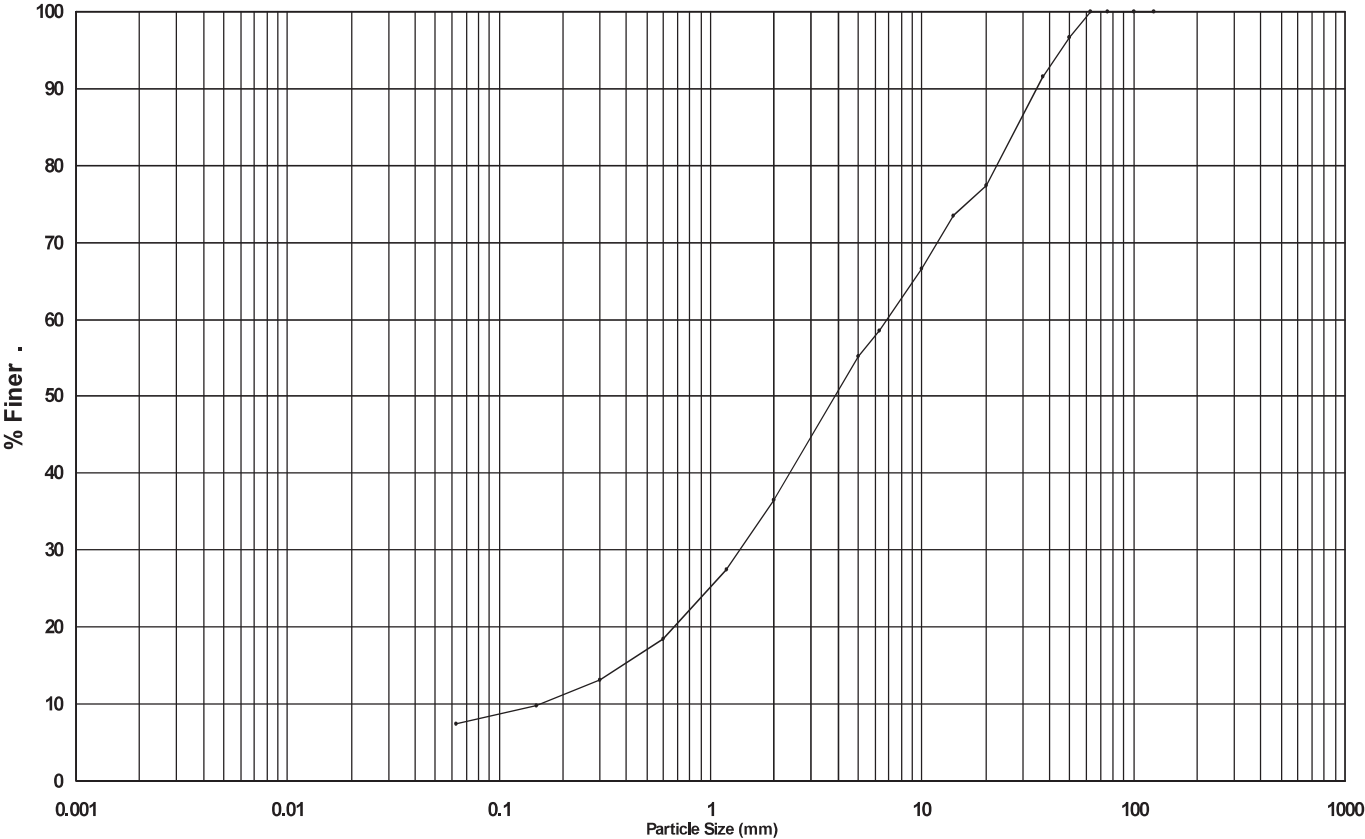
Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP01
Sample Depth 0.50m
Sample Type B
Sample Ref C48341

Sample Description

MADE GROUND: dark grey clayey very sandy shale/gravel.



Classification	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
CLAY	SILT			SAND			Gravel				

Classification	% of each
SILT (including CLAY)	7
SAND	30
GRAVEL	63
COBBLES	0
BOULDERS	0

Size	% Finer
125 mm	100
100 mm	100
75 mm	100
63 mm	100
50 mm	97
37.5 mm	92
20 mm	77
14 mm	73
10 mm	67
6.3 mm	59
5 mm	55
2 mm	37
1.18 mm	27
600 µm	19
300 µm	13
150 µm	10

Size	% Finer
63 µm	7

Uniformity Coefficient	
44.71	
Sieving Method	
Wet sieve	
Fine Particle Analysis	
Method	
Pre-treated with	
% loss on Pre-treatment	
Particle Density	

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020

LABORATORY RESULTS - Particle Size Distribution

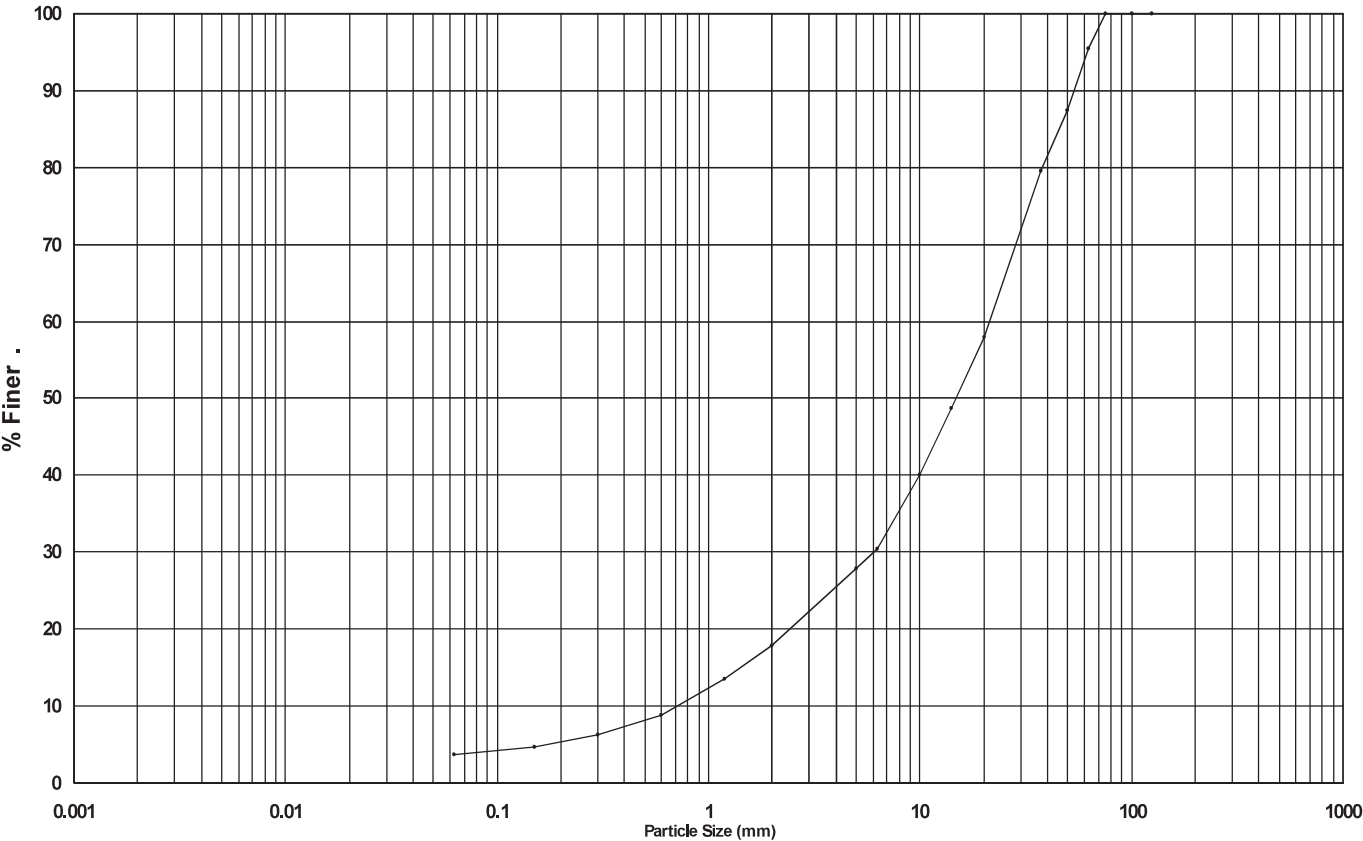
Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP02
Sample Depth 1.00m
Sample Type B
Sample Ref C48342

Sample Description

MADE GROUND: reddish brown slightly clayey sandy gravel with roots and occasional cobbles.
Gravel/cobble are mainly brick fragments.



Classification	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
CLAY	SILT			SAND			Gravel				

Classification	% of each
SILT (including CLAY)	4
SAND	14
GRAVEL	78
COBBLES	4
BOULDERS	0

Size	% Finer
125 mm	100
100 mm	100
75 mm	100
63 mm	96
50 mm	87
37.5 mm	80
20 mm	58
14 mm	49
10 mm	40
6.3 mm	31
5 mm	28
2 mm	18
1.18 mm	14
600 μm	9
300 μm	6
150 μm	5

Size	% Finer
63 μm	4

Uniformity Coefficient	
29.77	
Sieving Method	
Wet sieve	
Fine Particle Analysis	
Method	
Pre-treated with	
% loss on Pre-treatment	
Particle Density	

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020

LABORATORY RESULTS - Particle Size Distribution

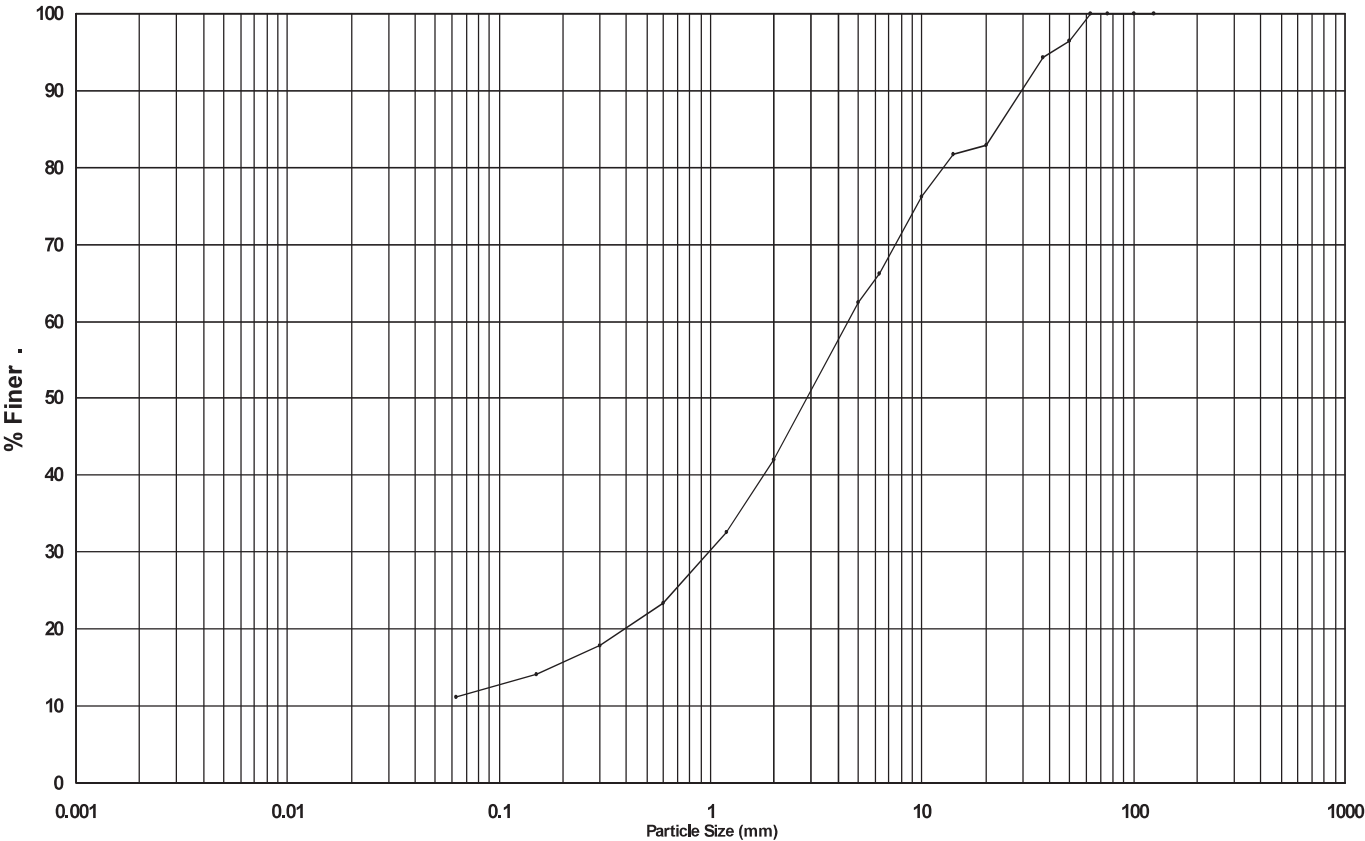
Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP03
Sample Depth 1.00m
Sample Type B
Sample Ref C48343

Sample Description

MADE GROUND: dark grey mottled reddish brown sandy shale/gravel.



Classification	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
CLAY	SILT			SAND			Gravel				

Classification	% of each
SILT (including CLAY)	11
SAND	31
GRAVEL	58
COBBLES	0
BOULDERS	0

Size	% Finer
125 mm	100
100 mm	100
75 mm	100
63 mm	100
50 mm	97
37.5 mm	94
20 mm	83
14 mm	82
10 mm	76
6.3 mm	66
5 mm	63
2 mm	42
1.18 mm	33
600 μm	23
300 μm	18
150 μm	14

Size	% Finer
63 μm	11

Uniformity Coefficient	
Not Available	
Sieving Method	
Wet sieve	
Fine Particle Analysis	
Method	
Pre-treated with	
% loss on Pre-treatment	
Particle Density	

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020

LABORATORY RESULTS - Particle Size Distribution

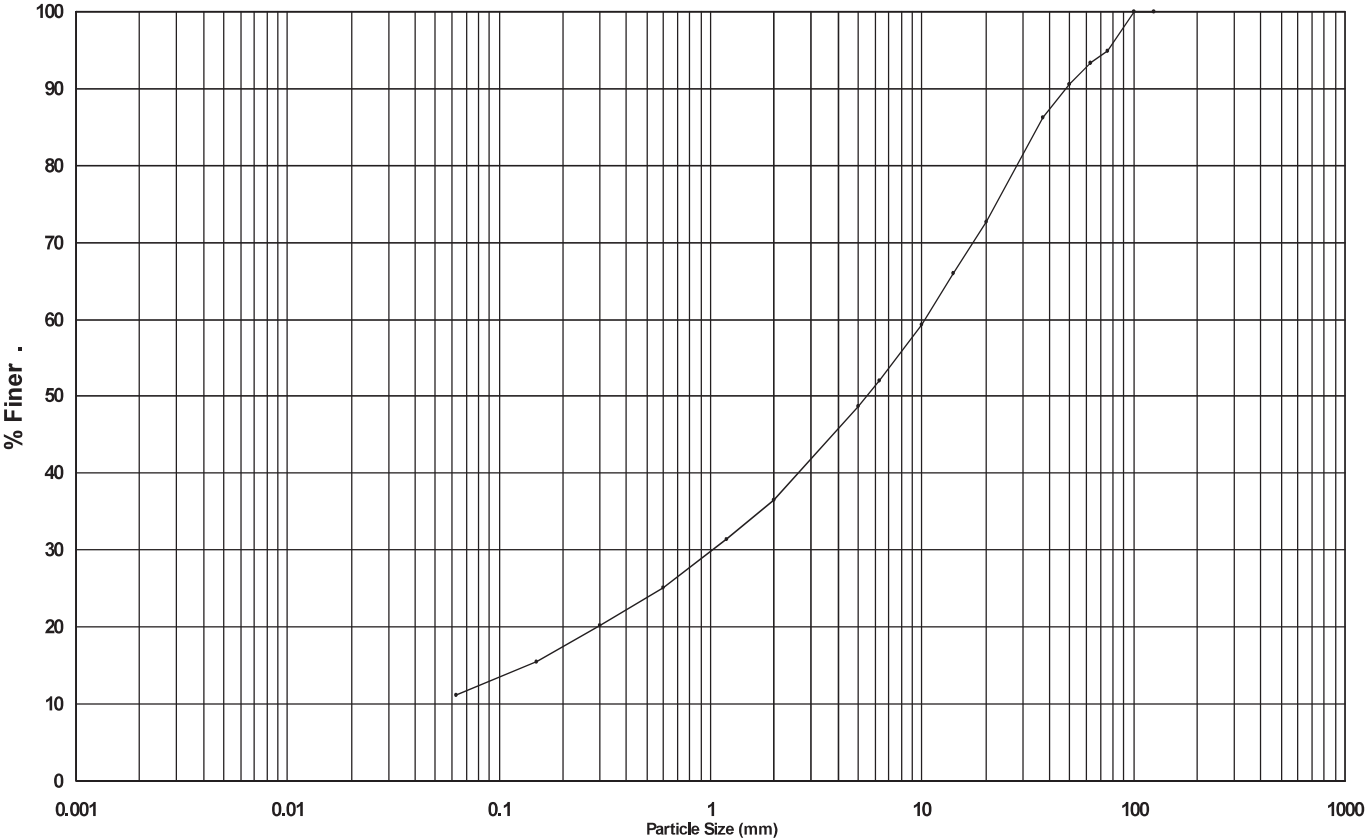
Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP04
Sample Depth 0.50m
Sample Type B
Sample Ref C48344

Sample Description

MADE GROUND: dark grey clayey sandy gravel with occasional brick fragments.



Classification	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
CLAY	SILT			SAND			Gravel				

Classification	% of each
SILT (including CLAY)	11
SAND	26
GRAVEL	56
COBBLES	7
BOULDERS	0

Size	% Finer
125 mm	100
100 mm	100
75 mm	95
63 mm	93
50 mm	90
37.5 mm	86
20 mm	73
14 mm	66
10 mm	59
6.3 mm	52
5 mm	49
2 mm	37
1.18 mm	31
600 μm	25
300 μm	20
150 μm	15

Size	% Finer
63 μm	11

Uniformity Coefficient	
Not Available	
Sieving Method	
Wet sieve	
Fine Particle Analysis	
Method	
Pre-treated with	
% loss on Pre-treatment	
Particle Density	

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020

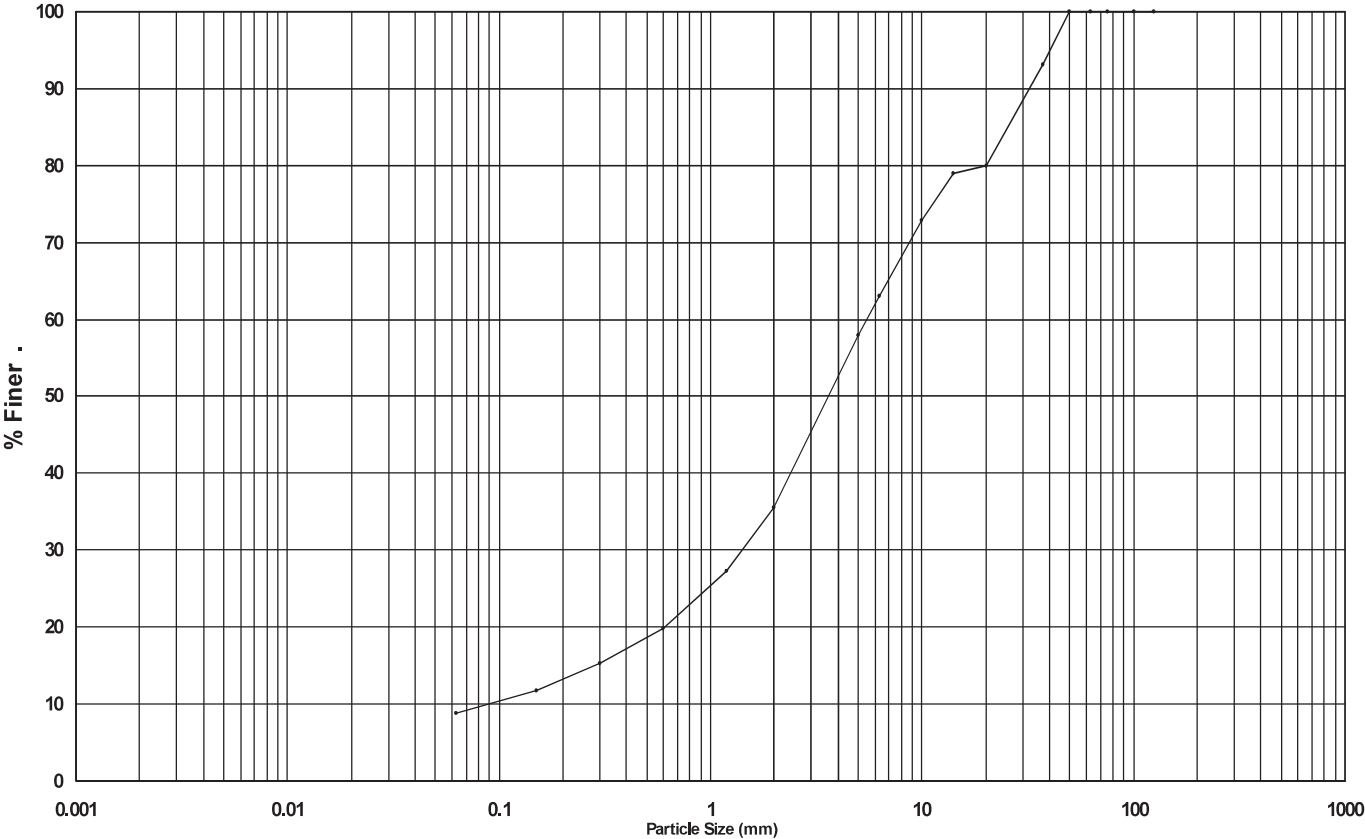
LABORATORY RESULTS - Particle Size Distribution

Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP05
Sample Depth 0.50m
Sample Type B
Sample Ref C48345

Sample Description
MADE GROUND: dark grey clayey sandy shale/gravel.



Classification	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
CLAY	SILT			SAND			Gravel				

Classification	% of each
SILT (including CLAY)	9
SAND	27
GRAVEL	64
COBBLES	0
BOULDERS	0

Size	% Finer
125 mm	100
100 mm	100
75 mm	100
63 mm	100
50 mm	100
37.5 mm	93
20 mm	80
14 mm	79
10 mm	73
6.3 mm	63
5 mm	58
2 mm	36
1.18 mm	27
600 µm	20
300 µm	15
150 µm	12

Size	% Finer
63 µm	9

Uniformity Coefficient	
61.07	
Sieving Method	
Wet sieve	
Fine Particle Analysis	
Method	
Pre-treated with	
% loss on Pre-treatment	
Particle Density	

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020

LABORATORY RESULTS - Particle Size Distribution

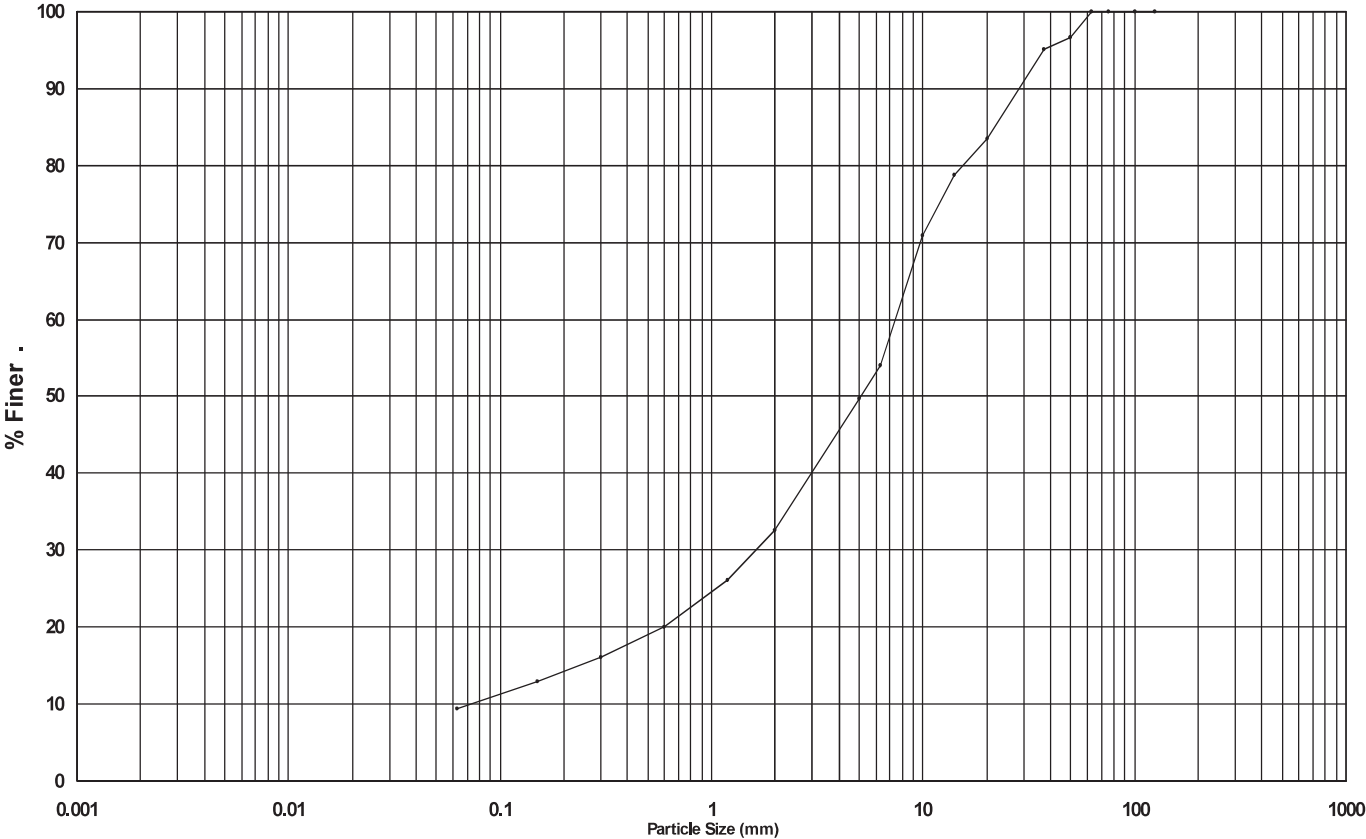
Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP06
Sample Depth 1.00m
Sample Type B
Sample Ref C48346

Sample Description

MADE GROUND: brown clayey shale/gravel (wet).



Classification	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
CLAY	SILT			SAND			Gravel				

Classification	% of each
SILT (including CLAY)	9
SAND	24
GRAVEL	67
COBBLES	0
BOULDERS	0

Size	% Finer
125 mm	100
100 mm	100
75 mm	100
63 mm	100
50 mm	97
37.5 mm	95
20 mm	83
14 mm	79
10 mm	71
6.3 mm	54
5 mm	50
2 mm	33
1.18 mm	26
600 µm	20
300 µm	16
150 µm	13

Size	% Finer
63 µm	9

Uniformity Coefficient	
102.73	
Sieving Method	
Wet sieve	
Fine Particle Analysis	
Method	
Pre-treated with	
% loss on Pre-treatment	
Particle Density	

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020

LABORATORY RESULTS - Particle Size Distribution

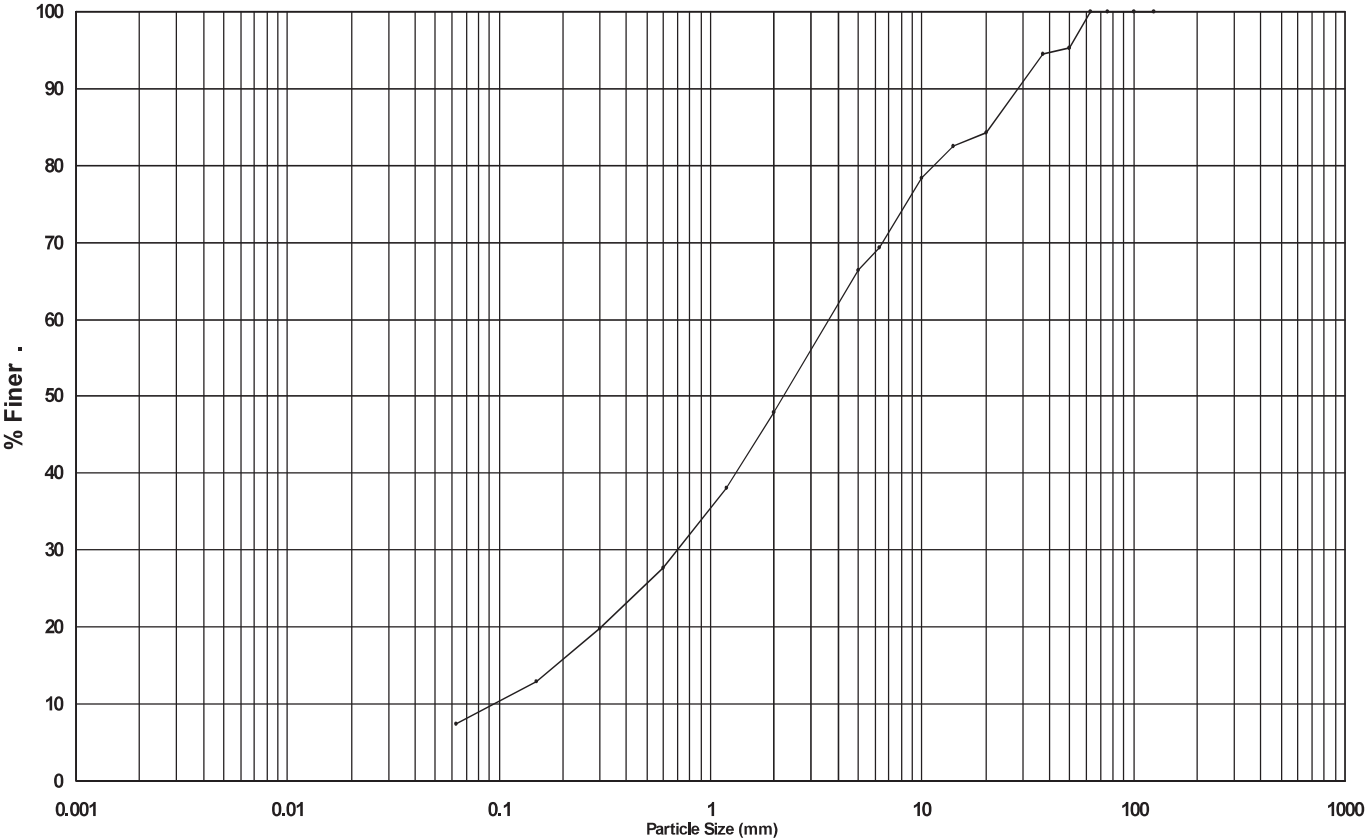
Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP07
Sample Depth 1.00m
Sample Type B
Sample Ref C48347

Sample Description

MADE GROUND: dark grey clayey very sandy shale/gravel with brick fragments.



Classification	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
CLAY	SILT			SAND			Gravel				

Classification	% of each
SILT (including CLAY)	7
SAND	41
GRAVEL	52
COBBLES	0
BOULDERS	0

Size	% Finer
125 mm	100
100 mm	100
75 mm	100
63 mm	100
50 mm	95
37.5 mm	94
20 mm	84
14 mm	83
10 mm	78
6.3 mm	69
5 mm	66
2 mm	48
1.18 mm	38
600 μm	28
300 μm	20
150 μm	13

Size	% Finer
63 μm	7

Uniformity Coefficient	
38.43	
Sieving Method	
Wet sieve	
Fine Particle Analysis	
Method	
Pre-treated with	
% loss on Pre-treatment	
Particle Density	

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020

LABORATORY RESULTS - Particle Size Distribution

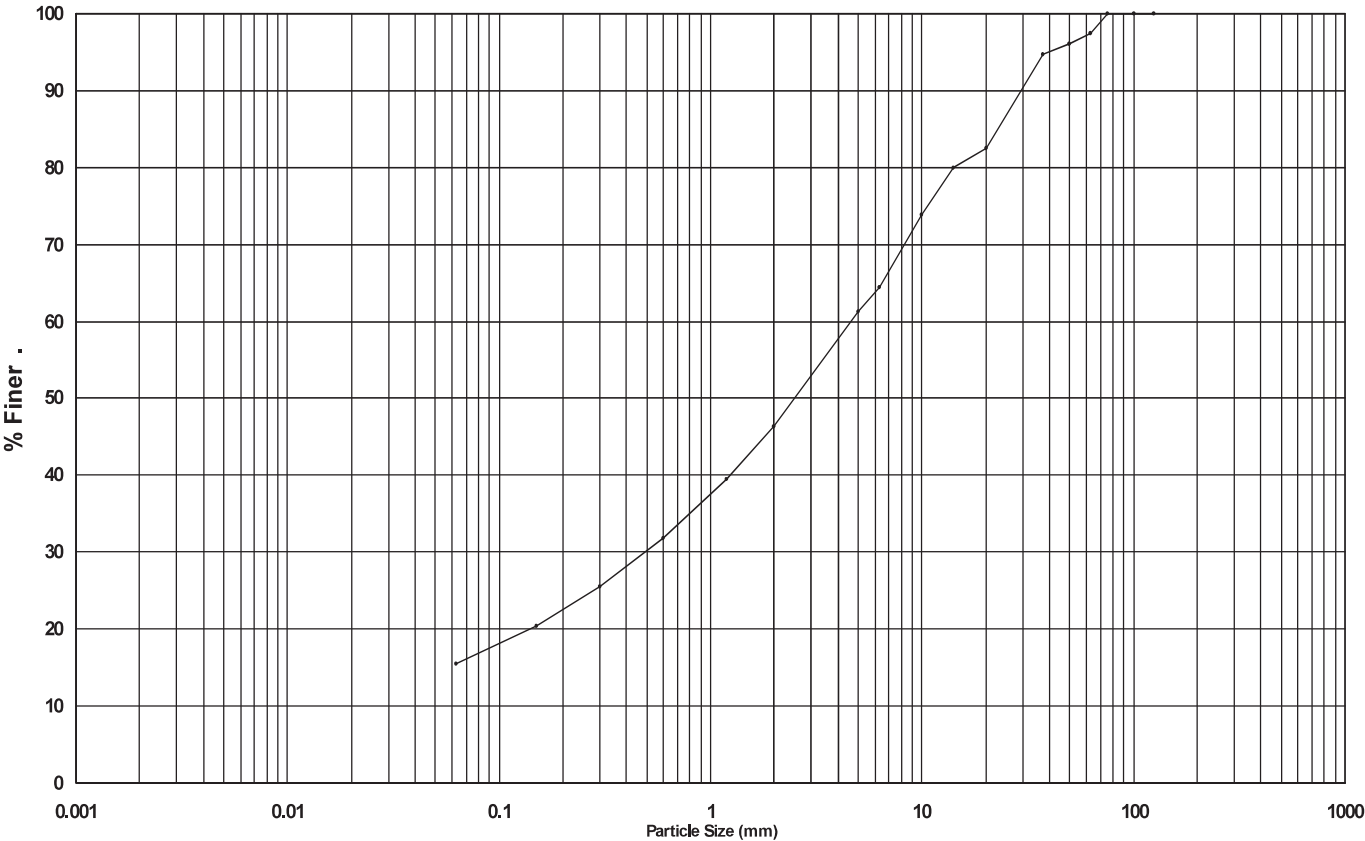
Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP08
Sample Depth 1.00m
Sample Type B
Sample Ref C48348

Sample Description

MADE GROUND: brown clayey very sandy shale/gravel with brick and roots.



Classification	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
CLAY	SILT			SAND			Gravel				

Classification	% of each
SILT (including CLAY)	15
SAND	31
GRAVEL	52
COBBLES	2
BOULDERS	0

Size	% Finer
125 mm	100
100 mm	100
75 mm	100
63 mm	98
50 mm	96
37.5 mm	95
20 mm	83
14 mm	80
10 mm	74
6.3 mm	64
5 mm	61
2 mm	46
1.18 mm	40
600 μm	32
300 μm	26
150 μm	20

Size	% Finer
63 μm	15

Uniformity Coefficient	
Not Available	
Sieving Method	
Wet sieve	
Fine Particle Analysis	
Method	
Pre-treated with	
% loss on Pre-treatment	
Particle Density	

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020

LABORATORY RESULTS - Particle Size Distribution

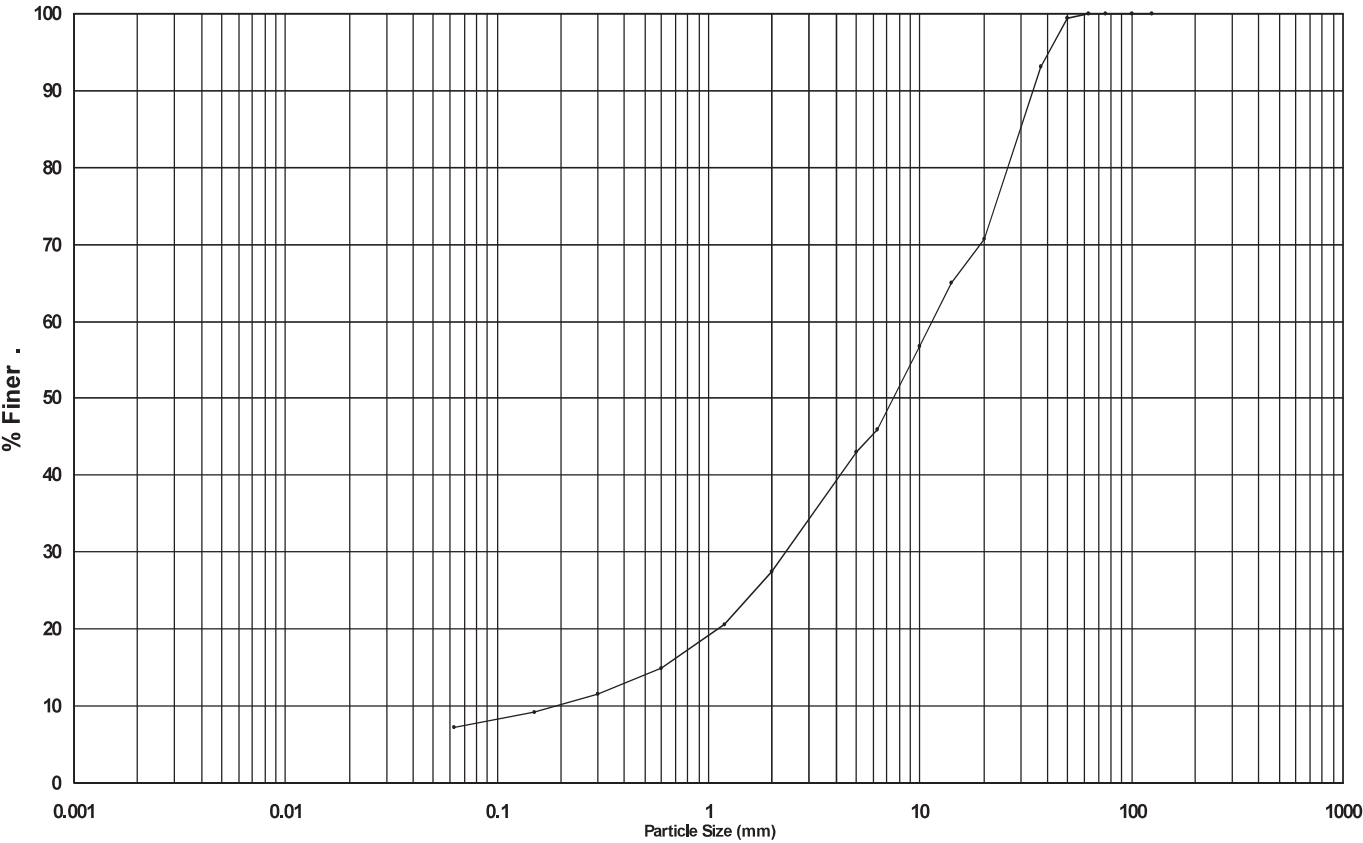
Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP09
Sample Depth 0.50m
Sample Type B
Sample Ref C48349

Sample Description

MADE GROUND: dark brown clayey sandy shale/gravel with brick fragments.



Classification	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
		SILT			SAND			Gravel				

Classification	% of each
SILT (including CLAY)	7
SAND	21
GRAVEL	72
COBBLES	0
BOULDERS	0

Size	% Finer
125 mm	100
100 mm	100
75 mm	100
63 mm	100
50 mm	99
37.5 mm	93
20 mm	71
14 mm	65
10 mm	57
6.3 mm	46
5 mm	43
2 mm	28
1.18 mm	21
600 µm	15
300 µm	12
150 µm	9

Size	% Finer
63 µm	7

Uniformity Coefficient	
59.81	
Sieving Method	
Wet sieve	
Fine Particle Analysis	
Method	
Pre-treated with	
% loss on Pre-treatment	
Particle Density	

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020

LABORATORY RESULTS - Particle Size Distribution

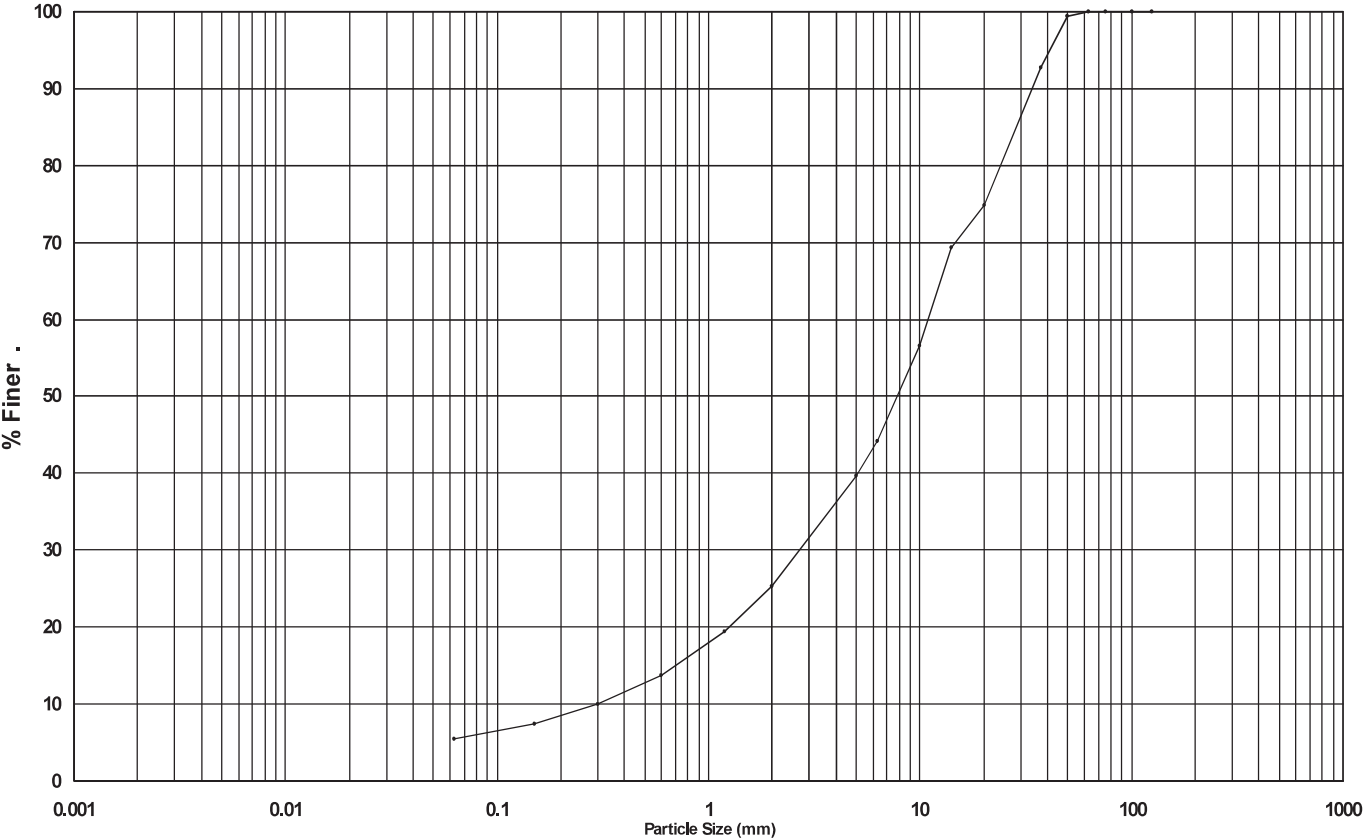
Project: 2387 - WYNNSTAY, RUABON

Project No: PC207961

Hole TP10
Sample Depth 1.00m
Sample Type B
Sample Ref C48350

Sample Description

MADE GROUND: dark grey slightly clayey shale gravel with brick.



Classification	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulders
CLAY	SILT			SAND			Gravel				

Classification	% of each
SILT (including CLAY)	5
SAND	20
GRAVEL	75
COBBLES	0
BOULDERS	0

Size	% Finer
125 mm	100
100 mm	100
75 mm	100
63 mm	100
50 mm	99
37.5 mm	93
20 mm	75
14 mm	69
10 mm	56
6.3 mm	44
5 mm	40
2 mm	25
1.18 mm	20
600 μm	14
300 μm	10
150 μm	7

Size	% Finer
63 μm	5

Uniformity Coefficient	
36.73	
Sieving Method	
Wet sieve	
Fine Particle Analysis	
Method	
Pre-treated with	
% loss on Pre-treatment	
Particle Density	

Remarks Sieve:-Test performed in accordance with BS EN ISO 17892-4:2016

25/09/2020

APPENDIX J

Chemical Testing Results



Certificate of Analysis

Certificate Number 20-17753

23-Sep-20

Client GroundSolve Limited
Unit 1
Well House Barns
Bretton
Flintshire
FAO Adam Fenwick
CH4 0DH

Our Reference 20-17753

Client Reference 2387

Order No (not supplied)

Contract Title Wynnstay

Description 12 Soil samples.

Date Received 15-Sep-20

Date Started 15-Sep-20

Date Completed 23-Sep-20

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager



2139



Summary of Chemical Analysis

Soil Samples

Our Ref 20-17753

Client Ref 2387

Contract Title Wynnstay

Lab No	1726746	1726747	1726748	1726749	1726901	1726902	1726903	1726904	1726905	1726906	1726907	1726908
Sample ID	TP02	TP04	TP06	TP10	WS02	WS04	TP01	TP01	TP02	TP05	TP07	TP08
Depth	2.10	0.50	1.00	0.50	3.50	2.00	2.00	0.50	0.50	0.50	0.50	0.50
Other ID												
Sample Type	D	ES	ES	ES	D	D	D	ES	ES	ES	ES	ES
Sampling Date	08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units
Metals			
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l
Inorganics			
pH	DETSC 2008#		pH
Chloride Aqueous Extract	DETSC 2055	1	mg/l
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l
Sulphur as S, Total	DETSC 2320	0.01	%
Sulphate as SO4, Total	DETSC 2321#	0.01	%

Information in Support of the Analytical Results

Our Ref 20-17753
Client Ref 2387
Contract Wynnstay

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1726746	TP02 2.10 SOIL	08/09/20	PT 1L		
1726747	TP04 0.50 SOIL	08/09/20	GJ 250ml, GJ 60ml x2, PT 1L		
1726748	TP06 1.00 SOIL	08/09/20	GJ 250ml, GJ 60ml x2, PT 1L		
1726749	TP10 0.50 SOIL	08/09/20	GJ 250ml, GJ 60ml x2, PT 1L		
1726901	WS02 3.50 SOIL	08/09/20	PT 1L		
1726902	WS04 2.00 SOIL	08/09/20	PT 1L		
1726903	TP01 2.00 SOIL	08/09/20	PT 1L		
1726904	TP01 0.50 SOIL	08/09/20	GJ 250ml, GJ 60ml x2, PT 1L		
1726905	TP02 0.50 SOIL	08/09/20	GJ 250ml, GJ 60ml x2, PT 1L		
1726906	TP05 0.50 SOIL	08/09/20	GJ 250ml, GJ 60ml x2, PT 1L		
1726907	TP07 0.50 SOIL	08/09/20	GJ 250ml, GJ 60ml x2, PT 1L		
1726908	TP08 0.50 SOIL	08/09/20	GJ 250ml, GJ 60ml x2, PT 1L		

Key: P-Plastic T-Tub G-Glass J-Jar

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report



Certificate of Analysis

Certificate Number 20-17753-1

06-Oct-20

Client GroundSolve Limited
Unit 1
Well House Barns
Bretton
Flintshire
FAO Adam Fenwick
CH4 ODH

Our Reference 20-17753-1

Client Reference 2387

Order No (not supplied)

Contract Title Wynnstay

Description 12 Soil samples.

Date Received 15-Sep-20

Date Started 15-Sep-20

Date Completed 06-Oct-20

Test Procedures Identified by prefix DETSn (details on request).

Notes **This report supersedes 20-17753, extra testing added**

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in grey ink, appearing to read "A. Fenwick", is positioned below the "Approved By" label.

Adam Fenwick
Contracts Manager



2139

Summary of Chemical Analysis Soil Samples

Our Ref 20-17753-1

Client Ref 2387

Contract Title Wynnstay

Lab No	1726746	1726747	1726748	1726749	1726901	1726902
Sample ID	TP02	TP04	TP06	TP10	WS02	WS04
Depth	2.10	0.50	1.00	0.50	3.50	2.00
Other ID						
Sample Type	D	ES	ES	ES	D	D
Sampling Date	08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg		16	2.8	14		
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg		0.4	0.5	0.5		
Cadmium	DETSC 2301#	0.1	mg/kg		0.3	< 0.1	0.5		
Chromium	DETSC 2301#	0.15	mg/kg		15	16	10		
Chromium III	DETSC 2301*	0.15	mg/kg		15	16	10		
Chromium, Hexavalent	DETSC 2204*	1	mg/kg		< 1.0	< 1.0	< 1.0		
Copper	DETSC 2301#	0.2	mg/kg		45	24	31		
Lead	DETSC 2301#	0.3	mg/kg		49	15	30		
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l		< 10	< 10	< 10		
Mercury	DETSC 2325#	0.05	mg/kg		0.10	< 0.05	< 0.05		
Nickel	DETSC 2301#	1	mg/kg		32	56	62		
Selenium	DETSC 2301#	0.5	mg/kg		2.2	< 0.5	3.3		
Zinc	DETSC 2301#	1	mg/kg		91	59	92		
Inorganics									
pH	DETSC 2008#		pH	7.8	6.7	7.6	7.6	7.7	7.6
Cyanide, Total	DETSC 2130#	0.1	mg/kg		0.1	< 0.1	< 0.1		
Organic matter	DETSC 2002#	0.1	%		1.8	2.0	0.6		
Chloride Aqueous Extract	DETSC 2055	1	mg/l		< 10.00	4.3	2.2		
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l		5.3	< 1.0	< 1.0		
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	1700	89	110	110	94	100
Sulphide	DETSC 2024*	10	mg/kg		24	52	< 10		
Sulphur (free)	DETSC 3049#	0.75	mg/kg		13	5.0	< 0.75		
Sulphur as S, Total	DETSC 2320	0.01	%		0.08	0.04	0.12		
Sulphate as SO4, Total	DETSC 2321#	0.01	%		0.11	0.05	0.25		
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg		< 0.01	< 0.01	< 0.01		
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg		< 0.01	< 0.01	< 0.01		
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg		< 0.01	< 0.01	< 0.01		
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg		< 1.5	< 1.5	< 1.5		
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg		< 1.2	< 1.2	< 1.2		
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg		< 1.5	< 1.5	< 1.5		
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg		< 3.4	< 3.4	< 3.4		
Aliphatic C35-C40	DETSC 3072*	3.4	mg/kg		< 3.4	< 3.4	< 3.4		
Aliphatic C5-C35	DETSC 3072*	10	mg/kg		< 10	< 10	< 10		
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg		< 0.01	< 0.01	< 0.01		
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg		< 0.01	< 0.01	< 0.01		
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg		< 0.01	< 0.01	< 0.01		
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg		< 0.9	< 0.9	< 0.9		
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg		< 0.5	< 0.5	< 0.5		
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg		< 0.6	< 0.6	< 0.6		
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg		< 1.4	< 1.4	< 1.4		
Aromatic C35-C40	DETSC 3072*	1.4	mg/kg		< 1.4	< 1.4	< 1.4		

Summary of Chemical Analysis

Soil Samples

Our Ref 20-17753-1

Client Ref 2387

Contract Title Wynnstay

Lab No	1726746	1726747	1726748	1726749	1726901	1726902
Sample ID	TP02	TP04	TP06	TP10	WS02	WS04
Depth	2.10	0.50	1.00	0.50	3.50	2.00
Other ID						
Sample Type	D	ES	ES	ES	D	D
Sampling Date	08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Aromatic C5-C35	DETSC 3072*	10	mg/kg		< 10	< 10	< 10		
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg		< 10	< 10	< 10		
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03		
Acenaphthylene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03		
Acenaphthene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03		
Fluorene	DETSC 3303	0.03	mg/kg		< 0.03	< 0.03	< 0.03		
Phenanthrene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03		
Anthracene	DETSC 3303	0.03	mg/kg		< 0.03	< 0.03	< 0.03		
Fluoranthene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03		
Pyrene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03		
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03		
Chrysene	DETSC 3303	0.03	mg/kg		< 0.03	< 0.03	< 0.03		
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03		
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03		
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03		
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03		
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03		
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03		
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg		< 0.10	< 0.10	< 0.10		
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg		1.7	< 0.3	< 0.3		

Summary of Chemical Analysis

Soil Samples

Our Ref 20-17753-1

Client Ref 2387

Contract Title Wynnstay

Lab No	1726903	1726904	1726905	1726906	1726907	1726908
Sample ID	TP01	TP01	TP02	TP05	TP07	TP08
Depth	2.00	0.50	0.50	0.50	0.50	0.50
Other ID						
Sample Type	D	ES	ES	ES	ES	ES
Sampling Date	08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg		9.0	57	10	15	20
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg		0.3	0.8	0.5	0.7	0.5
Cadmium	DETSC 2301#	0.1	mg/kg		0.3	< 0.1	0.3	0.7	0.4
Chromium	DETSC 2301#	0.15	mg/kg		15	29	11	15	17
Chromium III	DETSC 2301*	0.15	mg/kg		15	29	11	15	17
Chromium, Hexavalent	DETSC 2204*	1	mg/kg		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg		27	60	49	43	53
Lead	DETSC 2301#	0.3	mg/kg		72	68	24	69	36
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l		< 10	< 10	< 10	< 10	< 10
Mercury	DETSC 2325#	0.05	mg/kg		< 0.05	< 0.05	< 0.05	0.12	0.18
Nickel	DETSC 2301#	1	mg/kg		27	37	30	31	33
Selenium	DETSC 2301#	0.5	mg/kg		< 0.5	< 0.5	1.6	1.0	1.6
Zinc	DETSC 2301#	1	mg/kg		79	71	83	220	91
Inorganics									
pH	DETSC 2008#		pH	5.4	8.0	6.6	6.3	7.0	7.1
Cyanide, Total	DETSC 2130#	0.1	mg/kg		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Organic matter	DETSC 2002#	0.1	%		0.8	0.6	5.7	7.4	5.1
Chloride Aqueous Extract	DETSC 2055	1	mg/l		21	2.7	2.8	9.1	3.5
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l		1.4	< 1.0	2.9	7.6	1.3
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	110	55	17	15	30	18
Sulphide	DETSC 2024*	10	mg/kg		< 10	< 10	< 10	60	16
Sulphur (free)	DETSC 3049#	0.75	mg/kg		< 0.75	< 0.75	< 0.75	5.3	1.9
Sulphur as S, Total	DETSC 2320	0.01	%		0.05	0.06	0.06	0.07	0.19
Sulphate as SO4, Total	DETSC 2321#	0.01	%		0.04	0.12	0.06	0.09	0.28
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg		< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg		< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg		< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg		< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C35-C40	DETSC 3072*	3.4	mg/kg		< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg		< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg		< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg		< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg		< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C35-C40	DETSC 3072*	1.4	mg/kg		< 1.4	< 1.4	< 1.4	< 1.4	< 1.4

Summary of Chemical Analysis

Soil Samples

Our Ref 20-17753-1

Client Ref 2387

Contract Title Wynnstay

Lab No	1726903	1726904	1726905	1726906	1726907	1726908
Sample ID	TP01	TP01	TP02	TP05	TP07	TP08
Depth	2.00	0.50	0.50	0.50	0.50	0.50
Other ID						
Sample Type	D	ES	ES	ES	ES	ES
Sampling Date	08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020	08/09/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Aromatic C5-C35	DETSC 3072*	10	mg/kg		< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg		< 10	< 10	< 10	< 10	< 10
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	0.05	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	0.44	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg		< 0.03	< 0.03	< 0.03	0.09	0.04
Fluoranthene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	1.1	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	0.96	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	0.34	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg		< 0.03	< 0.03	< 0.03	0.39	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	0.35	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	0.14	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	0.27	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	0.12	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	0.13	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg		< 0.10	< 0.10	< 0.10	4.4	< 0.10
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg		< 0.3	< 0.3	< 0.3	0.4	0.3

Summary of Asbestos Analysis Soil Samples

Our Ref 20-17753-1

Client Ref 2387

Contract Title Wynnstay

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1726747	TP04 0.50	SOIL	NAD	none	Joanne Luscombe
1726748	TP06 1.00	SOIL	NAD	none	Joanne Luscombe
1726749	TP10 0.50	SOIL	NAD	none	Joanne Luscombe
1726904	TP01 0.50	SOIL	NAD	none	Joanne Luscombe
1726905	TP02 0.50	SOIL	NAD	none	Joanne Luscombe
1726906	TP05 0.50	SOIL	NAD	none	Joanne Luscombe
1726907	TP07 0.50	SOIL	NAD	none	Joanne Luscombe
1726908	TP08 0.50	SOIL	NAD	none	Joanne Luscombe

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 20-17753-1
 Client Ref 2387
 Contract Wynnstay

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Hold time exceeded for tests	Inappropriate container for tests
1726746	TP02 2.10 SOIL	08/09/20	PT 1L		
1726747	TP04 0.50 SOIL	08/09/20	GJ 250ml, GJ 60ml x2, PT 1L		
1726748	TP06 1.00 SOIL	08/09/20	GJ 250ml, GJ 60ml x2, PT 1L		
1726749	TP10 0.50 SOIL	08/09/20	GJ 250ml, GJ 60ml x2, PT 1L		
1726901	WS02 3.50 SOIL	08/09/20	PT 1L		
1726902	WS04 2.00 SOIL	08/09/20	PT 1L		
1726903	TP01 2.00 SOIL	08/09/20	PT 1L		
1726904	TP01 0.50 SOIL	08/09/20	GJ 250ml, GJ 60ml x2, PT 1L		
1726905	TP02 0.50 SOIL	08/09/20	GJ 250ml, GJ 60ml x2, PT 1L		
1726906	TP05 0.50 SOIL	08/09/20	GJ 250ml, GJ 60ml x2, PT 1L		
1726907	TP07 0.50 SOIL	08/09/20	GJ 250ml, GJ 60ml x2, PT 1L		
1726908	TP08 0.50 SOIL	08/09/20	GJ 250ml, GJ 60ml x2, PT 1L		

Key: P-Plastic T-Tub G-Glass J-Jar

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report



**WYNNSTAY TECHNOLOGY PARK,
RUABON, WREXHAM.**

DRAINAGE STRATEGY REPORT

CLIENT:-
HATRICK PROPERTIES

CONSULTING ENGINEER:-

Tier Consult Ltd
Richmond House
Sandpiper Court
Chester Business Park
Chester
CH4 9QZ

Tel: 01244 684900

Prepared By:
S Jones

Date:
April 2017

Report No:
T/16/1794-DS1/SGJ

CONTENTS

1. Introduction
2. Site Description & Development Proposal
3. Existing Drainage
4. Surface Water Drainage Options
5. Proposed Surface Water Drainage Strategy
6. Proposed Foul Water Drainage Strategy
7. Preliminary Storm Water Storage Design
8. Summary

APPENDICES

- A Public Sewer Records
- Existing Run-off Calculation
- Microdrainage Storage Tank Calculations
- Proposed Drainage Strategy Drawing

1.0 INTRODUCTION

- 1.1 Tier Consult was appointed by Hatrick Properties to prepare a drainage strategy proposal for a proposed mixed use development of residential and commercial units at Wynnstay Technology Park near Ruabon, Wrexham.
- 1.2 The report aims to provide a basis for future agreement with the various authorities in terms of maintaining water quality and flood protection.
- 1.3 The report shall propose a strategy for the discharge of both foul and surface water from the development.

2.0 SITE DESCRIPTION AND DEVELOPMENT PROPOSAL

- 2.1 The site is located on the western side of Ruabon approximately 1.1 km from the town centre. The National Grid Reference for the centre of the site is Easting: 329199, Northing: 343567 at approx. postcode LL14 6EN. The site is an undeveloped plot within the existing technology park, which comprises light industrial units, and is bounded on all sides by existing roads.
- 2.2 The site has an overall area of 2.0 Ha, of which 1.7 Ha is developable. The site has been previously prepared for development so is moderately level and clear of major vegetation and obstructions, and has a gentle fall towards the existing park access road to the south. The site is classed as "Greenfield" for rainwater run-off estimation purposes.
- 2.3 The development proposal is for mixed use commercial and residential, comprising 6 light industrial units, 1 retail unit and 35 housing units, with associated access roads and parking areas.

3.0 EXISTING DRAINAGE

- 3.1 Although being part of a larger development proposal, this plot does not appear to have been provided with drainage connections to existing infrastructure.
- 3.2 Existing public sewers near to the site comprise separate foul and surface water sewers, which are shown on the attached drawings. The public sewer record extract is also appended to this report.
- 3.3 A culverted watercourse runs along and outside the west boundary of the site. An existing surface water sewer in the existing estate access road is shown to discharge into the culvert via a manhole located at the estate entrance junction.

4.0 SURFACE WATER DRAINAGE OPTIONS

- 4.1 The Building Regulations Part H prescribes a hierarchical approach to surface water discharge. In order of preference, surface water should be discharged to:
- a) Infiltration systems / soakaways
 - b) To a watercourse
 - c) To a public sewer.

4.2 INFILTRATION/SOAKAWAYS

- 4.2.1 The ground infiltration testing has not been carried out on the site as it is evident from the ground condition report that the site is unsuitable for soakaway systems due to c2.5m depth of unsuitable made ground overlying impermeable clay sub-stratum.
- 4.2.2 For further information, refer to separate geotechnical site investigation report by Tier Environmental, ref. T/16/1794 GIR, dated October 2016.

4.3 DISCHARGES TO WATERCOURSE

- 4.3.1 A culverted watercourse flows along the west boundary of the site from north to south in 450mm dia. pipework. Discharge to this culvert is feasible, subject to approval from Natural Resources Wales.

4.4 DISCHARGES TO PUBLIC SEWER

- 4.4.1 There are existing public surface water sewers near to the site in the access road. However discharge to the sewer is not pursued within this strategy due to the availability of the adjacent culverted watercourse.

5.0 PROPOSED SURFACE WATER DRAINAGE STRATEGY

- 5.1 New surface water drainage system for the site is proposed to discharge to adjacent culverted watercourses.
- 5.2 The storm water drainage system is to be designed in accordance with the requirements of the Wrexham County Borough Council, Planning Guidance Notes for “*MANAGEMENT OF SURFACE WATER GENERATED FROM NEW DEVELOPMENT*”, to ensure that flood risk is not increased, either on or off site, for all storm events up to and including the 1 in 100 year + 30% climate change event.

- 5.3 Discharge rates shall be limited to the existing “Greenfield” run-off rate to the watercourse, with attenuation storage provided to accommodate flows in excess of the greenfield rate for all storm events, up to and including 100 year event +30% climate change allowance.
- 5.5 Exceedance flows in excess of the design storm are to be directed through the site away from proposed buildings to follow the natural topography towards existing highways. This will ensure no increased flooding to properties either on or off site.
- 5.6 Water quality control is to be achieved by provision of trapped drainage fittings in conjunction with a petrol / oil separator units to serve the parking and delivery areas designed in accordance with The Pollution Prevention Guidelines - PPG3.
- 5.7 Attenuation storage is to be provided by oversized pipework within the site, with discharge rates restricted by a vortex control unit prior to discharge to the culvert.

6.0 PROPOSED FOUL WATER DRAINAGE STRATEGY

- 6.1 A new foul water drainage system serving the site is proposed to re-use the existing connection to the public sewer system.
- 6.2 There are no industrial processes involved in the proposed development, with foul water drainage provided for amenity purposes only.
- 6.3 The development topography is favourable for gravity drainage, therefore pumping stations are not anticipated to be required.

7.0 PRELIMINARY STORM WATER STORAGE DESIGN

- 7.1 The average annual greenfield runoff rate from the existing site is calculated as “Qbar” using the methodology from the Institute of Hydrology Report 124. Microdrainage software was used to perform the calculation and estimates Qbar as 4.4 litres/second. Therefore the minimum practical rate of 5.0 litres/second is to be used in the design. The Microdrainage results are included in Appendix A of this report.
- 7.2 Microdrainage “Pond” calculations appended to this report demonstrate the storage volume required to accommodate the 100 year storm + 30% allowance for climate change, without flooding or exceeding the design discharge rate, is 773 m³.
- 7.3 Attenuation volumes will be provided using lined modular crate storage systems located beneath the public open space and communal parking areas. The schematic drainage layout appended to this report illustrates the arrangement of the drainage systems, and identifies 3 suitable locations for storage tanks, which together provide storage volume of up to 840 m³. This is more than sufficient to accommodate the design volume of 773 m³ and can be further rationalised at detailed design stage.

8.0 SUMMARY

- 8.1 Development proposal is for mixed use residential and commercial units with access roads and parking on existing greenfield site.
- 8.2 Foul drainage will discharge to public sewer.
- 8.1 Due to unfavourable ground conditions for infiltration drainage, the surface water drainage will discharge to adjacent culverted watercourse.
- 8.3 Storm water discharge rates are maintained to minimum acceptable flow rate of 5.0 litres/second for all storm events up to 100 year + 30% climate change allowance, without flooding of the system or buildings on or off site.
- 8.4 Water quality is maintained by provision of an appropriate oil separator units designed in accordance with The Pollution Prevention Guidelines - PPG3.

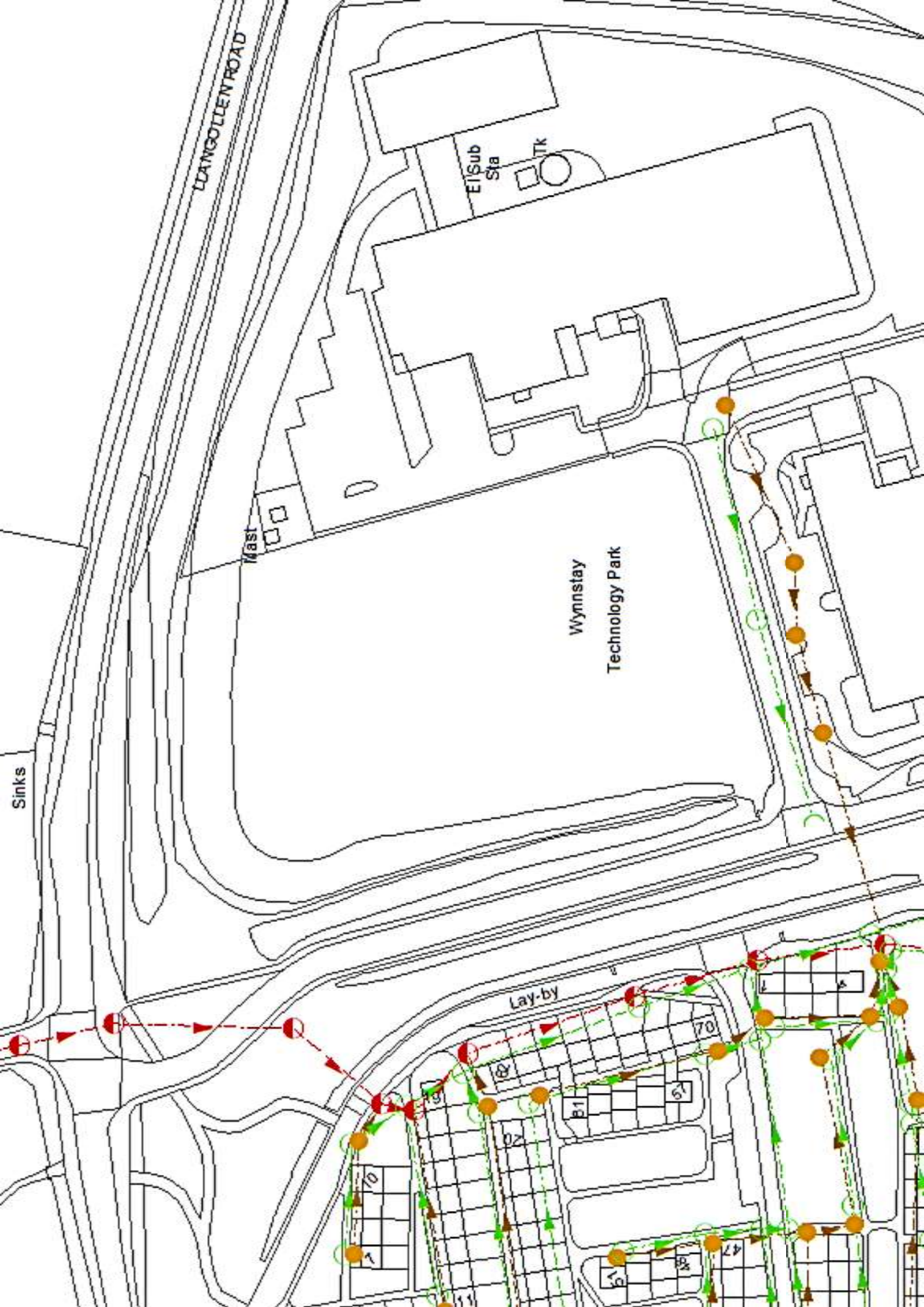
APPENDIX A

PUBLIC SEWER RECORDS

EXISTING RUN-OFF CALCULATION

MICRODRAINAGE STORAGE TANK CALCULATIONS

PROPOSED DRAINAGE STRATEGY DRAWING



Tier Consult		Page 1
Richmond House Chester Bus. Park CH4 9QZ		
Date 07/04/2017 16:35 File 170405 STORAGE TANK.SRCX	Designed by SteveJones Checked by	
Micro Drainage		Source Control 2016.1
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 2 Soil 0.300 Area (ha) 2.014 Urban 0.000 SAAR (mm) 822 Region Number Region 9 Results 1/s QBAR Rural 4.4 QBAR Urban 4.4 Q2 years 4.1 Q1 year 3.9 Q30 years 7.8 Q100 years 9.7		
©1982-2016 XP Solutions		

Tier Consult		Page 1
Richmond House Chester Bus. Park CH4 9QZ	WYNNSTAY TECH PARK RUABON WREXHAM	
Date 7/4/17 File 170405 STORAGE TANK.SRCX	Designed by SGJ Checked by	
Micro Drainage		Source Control 2016.1

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 1334 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	97.309	0.309	0.0	5.0	5.0	205.6	O K
30 min Summer	97.425	0.425	0.0	5.0	5.0	282.5	O K
60 min Summer	97.556	0.556	0.0	5.0	5.0	370.0	O K
120 min Summer	97.700	0.700	0.0	5.0	5.0	465.7	O K
180 min Summer	97.786	0.786	0.0	5.0	5.0	522.5	O K
240 min Summer	97.842	0.842	0.0	5.0	5.0	559.8	O K
360 min Summer	97.909	0.909	0.0	5.0	5.0	604.8	O K
480 min Summer	97.953	0.953	0.0	5.0	5.0	633.5	O K
600 min Summer	97.980	0.980	0.0	5.0	5.0	651.7	O K
720 min Summer	97.997	0.997	0.0	5.0	5.0	662.9	O K
960 min Summer	98.011	1.011	0.0	5.0	5.0	672.3	O K
1440 min Summer	98.005	1.005	0.0	5.0	5.0	668.2	O K
2160 min Summer	97.978	0.978	0.0	5.0	5.0	650.7	O K
2880 min Summer	97.945	0.945	0.0	5.0	5.0	628.2	O K
4320 min Summer	97.869	0.869	0.0	5.0	5.0	577.9	O K
5760 min Summer	97.788	0.788	0.0	5.0	5.0	523.8	O K
7200 min Summer	97.694	0.694	0.0	5.0	5.0	461.5	O K
8640 min Summer	97.608	0.608	0.0	5.0	5.0	404.3	O K
10080 min Summer	97.533	0.533	0.0	5.0	5.0	354.5	O K
15 min Winter	97.347	0.347	0.0	5.0	5.0	230.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	96.918	0.0	196.2	19
30 min Summer	67.029	0.0	271.8	34
60 min Summer	44.405	0.0	376.0	64
120 min Summer	28.487	0.0	482.4	124
180 min Summer	21.655	0.0	549.1	184
240 min Summer	17.694	0.0	596.8	242
360 min Summer	13.184	0.0	662.9	362
480 min Summer	10.704	0.0	710.2	482
600 min Summer	9.097	0.0	741.1	602
720 min Summer	7.960	0.0	753.9	720
960 min Summer	6.440	0.0	746.3	960
1440 min Summer	4.766	0.0	713.1	1226
2160 min Summer	3.518	0.0	1084.6	1620
2880 min Summer	2.831	0.0	1161.3	2020
4320 min Summer	2.079	0.0	1257.4	2856
5760 min Summer	1.668	0.0	1378.7	3696
7200 min Summer	1.408	0.0	1454.4	4472
8640 min Summer	1.226	0.0	1518.6	5192
10080 min Summer	1.090	0.0	1573.3	5944
15 min Winter	96.918	0.0	220.1	19

Tier Consult		Page 2
Richmond House Chester Bus. Park CH4 9QZ	WYNNSTAY TECH PARK RUABON WREXHAM	
Date 7/4/17 File 170405 STORAGE TANK.SRCX	Designed by SGJ Checked by	
Micro Drainage		Source Control 2016.1

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m ³)	Status
30 min Winter	97.477	0.477	0.0	5.0	5.0	317.1	O K
60 min Winter	97.625	0.625	0.0	5.0	5.0	415.7	O K
120 min Winter	97.789	0.789	0.0	5.0	5.0	525.0	O K
180 min Winter	97.886	0.886	0.0	5.0	5.0	589.0	O K
240 min Winter	97.950	0.950	0.0	5.0	5.0	631.4	O K
360 min Winter	98.029	1.029	0.0	5.0	5.0	684.0	O K
480 min Winter	98.081	1.081	0.0	5.0	5.0	718.6	O K
600 min Winter	98.115	1.115	0.0	5.0	5.0	741.6	O K
720 min Winter	98.138	1.138	0.0	5.0	5.0	757.0	O K
960 min Winter	98.162	1.162	0.0	5.0	5.0	773.1	O K
1440 min Winter	98.162	1.162	0.0	5.0	5.0	772.9	O K
2160 min Winter	98.125	1.125	0.0	5.0	5.0	748.0	O K
2880 min Winter	98.078	1.078	0.0	5.0	5.0	717.1	O K
4320 min Winter	97.966	0.966	0.0	5.0	5.0	642.3	O K
5760 min Winter	97.843	0.843	0.0	5.0	5.0	560.9	O K
7200 min Winter	97.698	0.698	0.0	5.0	5.0	463.9	O K
8640 min Winter	97.561	0.561	0.0	5.0	5.0	373.0	O K
10080 min Winter	97.452	0.452	0.0	5.0	5.0	300.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
30 min Winter	67.029	0.0	303.5	33
60 min Winter	44.405	0.0	421.3	62
120 min Winter	28.487	0.0	539.6	122
180 min Winter	21.655	0.0	613.2	180
240 min Winter	17.694	0.0	664.9	240
360 min Winter	13.184	0.0	732.0	356
480 min Winter	10.704	0.0	766.7	472
600 min Winter	9.097	0.0	770.7	588
720 min Winter	7.960	0.0	766.6	702
960 min Winter	6.440	0.0	753.6	924
1440 min Winter	4.766	0.0	727.7	1354
2160 min Winter	3.518	0.0	1213.5	1688
2880 min Winter	2.831	0.0	1297.5	2164
4320 min Winter	2.079	0.0	1348.8	3108
5760 min Winter	1.668	0.0	1544.2	4032
7200 min Winter	1.408	0.0	1629.1	4832
8640 min Winter	1.226	0.0	1701.4	5528
10080 min Winter	1.090	0.0	1763.3	6160

Tier Consult		Page 3
Richmond House Chester Bus. Park CH4 9QZ	WYNNSTAY TECH PARK RUABON WREXHAM	
Date 7/4/17 File 170405 STORAGE TANK.SRCX	Designed by SGJ Checked by	
Micro Drainage		Source Control 2016.1

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	17.000	Shortest Storm (mins)	15
Ratio R	0.300	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 1.150

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



STORAGE TANK 2
365m² PLAN AREA x 1.0m DEPTH
PROVIDES 345m³ VOLUME

STORAGE TANK 3
225m² PLAN AREA x 1.0m DEPTH
PROVIDES 210m³ VOLUME

PETROL/OIL SEPARATOR UNIT PROVIDED
TO INDUSTRIAL UNIT PARKING

Public Open
Space (500m²)

Pedestrian Link to
Light Industrial

Area for
LEAP/Playground

Proposed Minseshaft
with 20mΦ
basement area

13.7 m



Tier Environmental Ltd
Chadwick House
Warrington Road
Warrington
WA3 6AE

Neil Taunt
Senior Flood Management Officer
Environment and Planning
Wrexham County Borough Council
Abbey Road South
Wrexham
LL13 9PW

BY EMAIL

23 August 2016

Ref: T/16/1794/PRA/L01

Dear Neil,

RE: PLANNING APPLICATION P/2016/0735, WYNNSTAY TECHNOLOGY PARK, RUABON. ROUTE OF SURFACE WATER CULVERT BENEATH THE SITE.

This letter is provided in support of planning application P/2016/0735 for the proposed development of land at Wynnstay Technology Park, Ruabon. and follows from your email to Sharron Holman (dated 8th August 2016) and our telephone conversation on 22nd August 2016.

This letter present findings of investigation works undertaken by Tier Environmental to determine the route of the surface water course which is identified on mapping as passing beneath the Site in a generally north to south direction. I have attached copy of the GroundSure drawing is which shows the culvert beneath the Site.

Investigation Works

GroundSure have confirmed that their mapping determines the route of the culvert by simply drawing a straight line between the sinks and the outfall. In order to confirm the actual route of the culvert on 15th July 2016 Tier Environmental undertook a sonde survey and the route mapped at surface using a CAT scanner.

The culvert was found to run in a southwesterly direction from the headwall, passing beneath the northwestern corner of the Site before heading south along the footpath to the west of the Site. The route of the culvert is shown on drawing T/16/1794/PRA/3 which is appended to this letter.

• Structural Engineering	• Civil Engineering	• Project Management	• Planning Supervision
Telephone 01925 818388		Fax 01244 333081	
Website: www.tieruk.com		Email: info@tieruk.com	
Tier Environmental is a trading name of Tier Environmental Ltd. Registered in England and Wales no 05441804			



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Chadwick House
Warrington Road
Warrington
WA3 6AE

Impact on Development

The proposed development has been designed such that no buildings are proposed over the confirmed route of the culvert. A plan showing the proposed layout is appended to this letter.

Kind Regards,

A handwritten signature in black ink, appearing to read 'Jeff Shuttleworth', is written over a horizontal line.

Jeff Shuttleworth BSc (Hons)

Senior Geoenvironmental Consultant

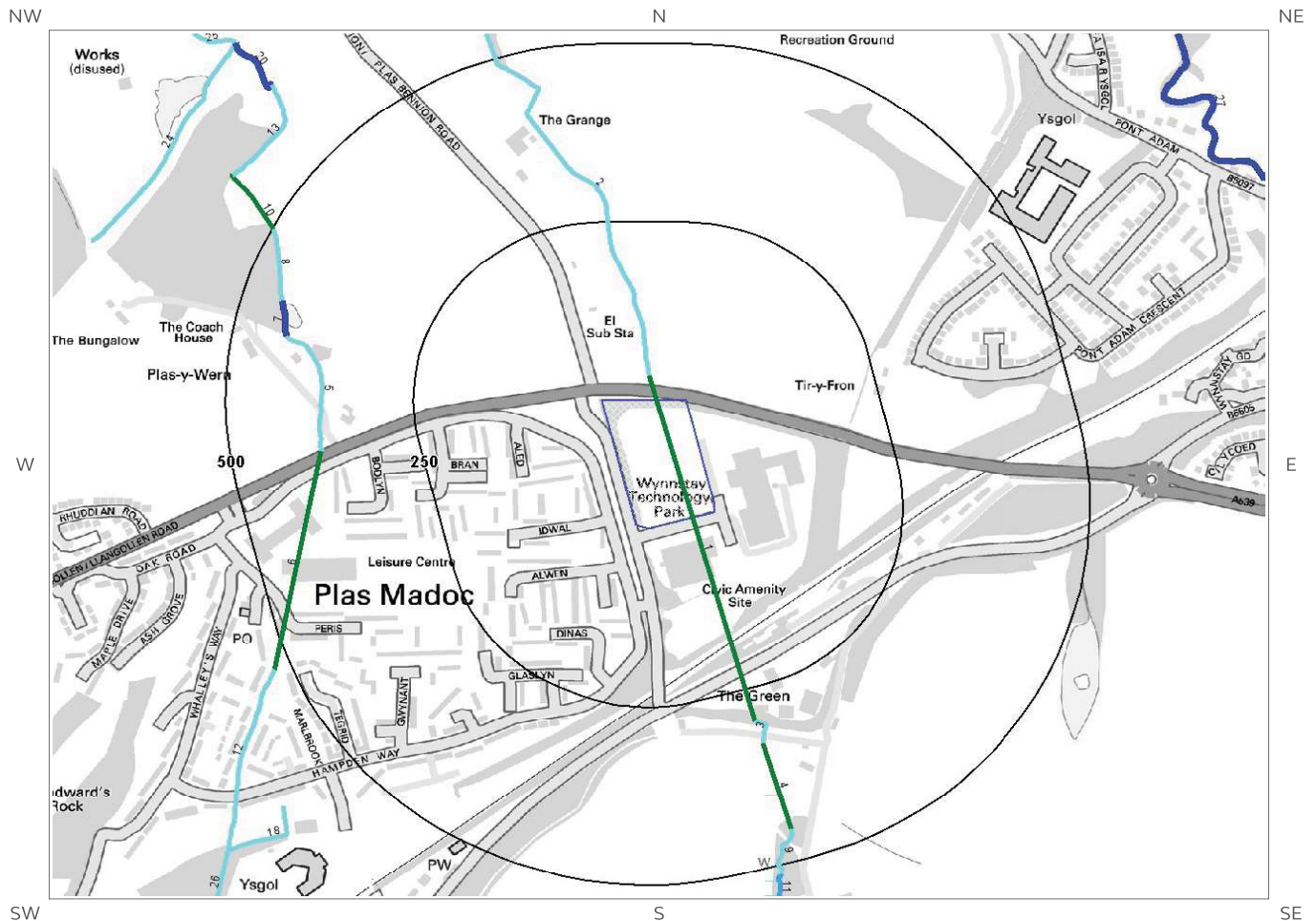
Tier Environmental Ltd

Encs. Culvert Location Plan – Groundsure

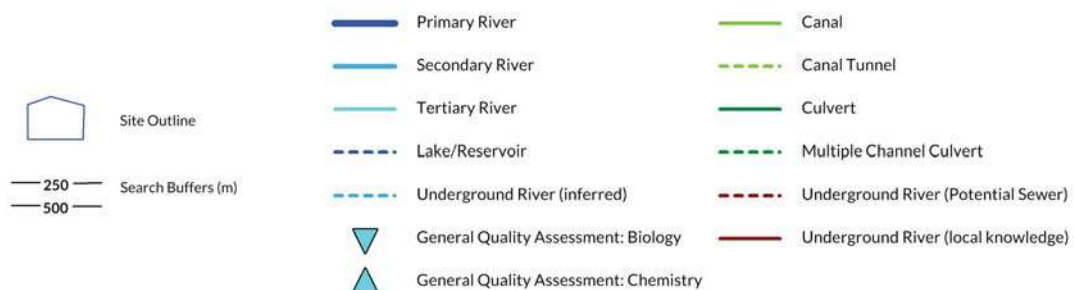
Culvert Trace Plan

Proposed Development Plan

6e. Hydrology – Detailed River Network and River Quality

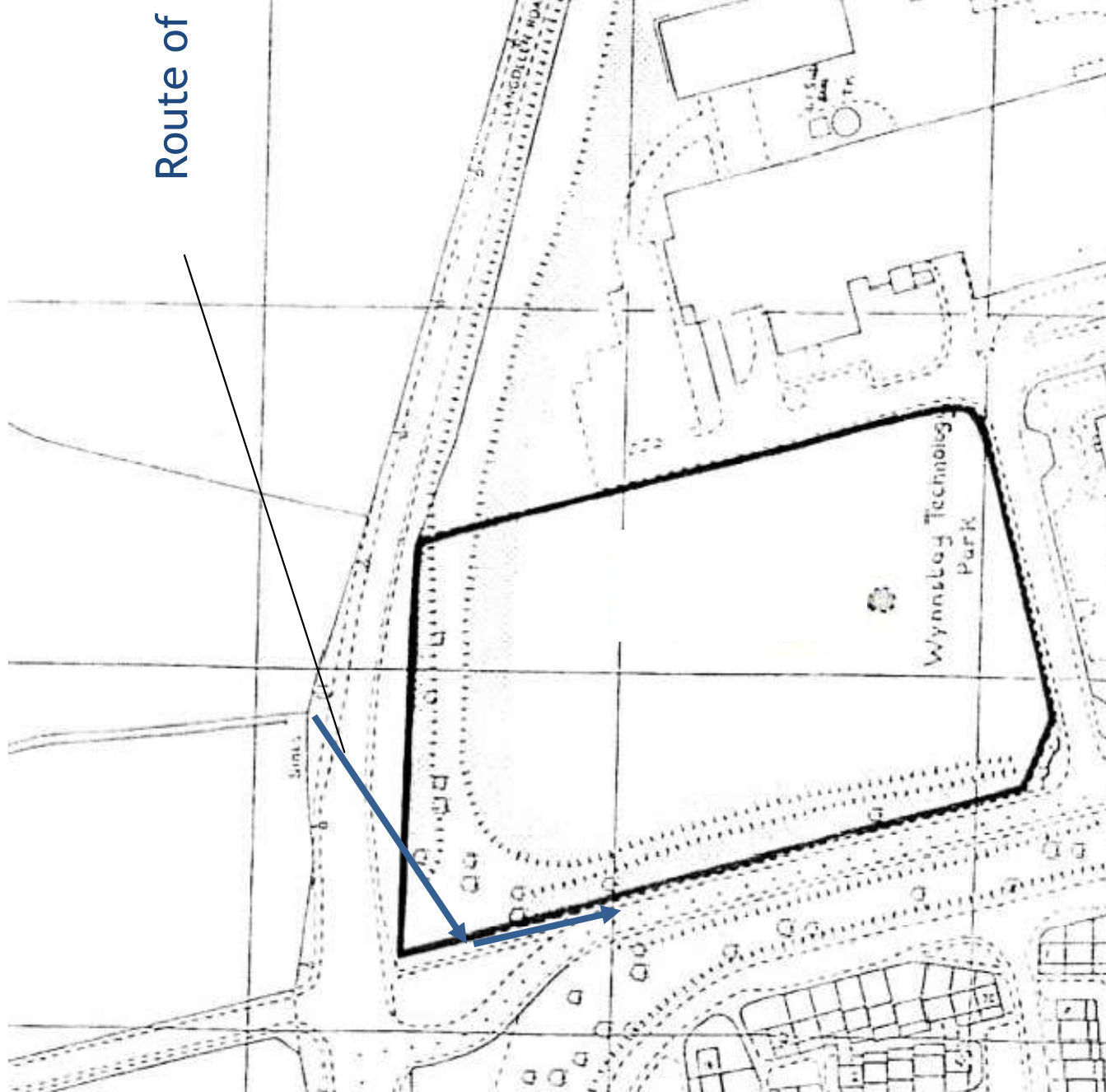


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Route

Route of culvert as determined by sonde





Public Open Space

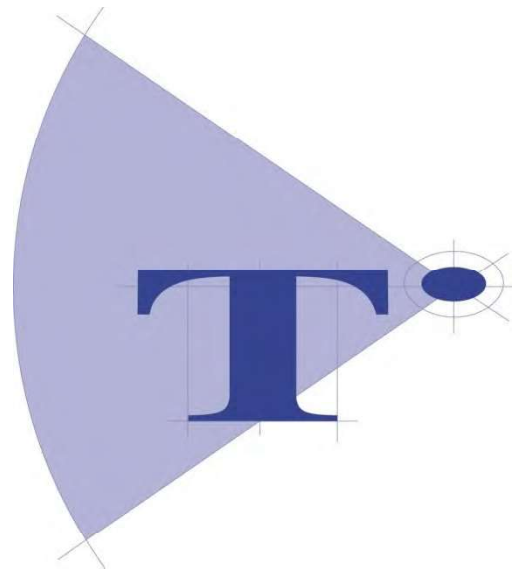
Capped Minseshaft
with 20mØ
easement area

Residents
Parking

Residents Parking

15 no. Car
Parking Spaces

Space



PRELIMINARY RISK ASSESSMENT FOR LAND AT WYNNSTAY TECHNOLOGY PARK, RUABON

ISSUE 2.0

T/16/1794/PRA

25 JULY 2016

J Shuttleworth

Prepared for:

NS Holdings Limited

c/o Carstairs Avenue,
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SK2 7DS

Prepared by:

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Chadwick House,
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DOCUMENT CONTROL

Project No. : T/16/1794/PRA

Report Status: Second Draft

Issue No.: 2.0

Project Engineer: J Shuttleworth

Date of Issue: 25/07/2016

Signature:



This report has been prepared by Tier with all reasonable skill, care and diligence, within the best practice and guidance current at the time of issue within the scope of works which have been agreed with the client. This report is confidential to the client and Tier accepts no responsibility whatsoever to third parties to whom this report, or any part thereof is made presented, unless this is formally agreed in writing by a Director of Tier Environmental Ltd before any reliance is made. Any such party relies upon the report at their own risk. Tier disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

Issue No.	Description of Issue / Revision	Date of Issue	Reviewed By	Author Initial
1.0	Original Draft	10/06/2016	JRB	JS
2.0	Updated Draft	25/07/2016	AR	JS



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**PRELIMINARY RISK ASSESSMENT
FOR LAND AT WYNNSTAY
TECHNOLOGY PARK, RUABON**

Date: 25/07/2016

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TECHNOLOGY PARK, RUABON**

Date: 25/07/2016

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APPENDIX C - PHOTOGRAPHS TAKEN DURING SITE WALKOVER

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PRELIMINARY RISK ASSESSMENT FOR LAND AT WYNNSTAY TECHNOLOGY PARK, RUABON

Date: 25/07/2016

EXECUTIVE SUMMARY

Introduction	Tier Environmental was commissioned by NS Holdings Limited to undertake a Preliminary Risk Assessment of Land at Wynnstay Technology Park, Ruabon, LL14 6EN. The purpose of the investigation was to determine the environmental setting of the Site, undertake a desk based shallow coal mining risk assessment and determine potential contaminant linkages associated with the proposed development.
Site location	The Site is located at Wynnstay Technology Park, Ruabon, LL14 6EN, approximately 1km west of Ruabon town centre.
Site history	At the time of the earliest available mapping of 1873, the majority of the Site was undeveloped. An air shaft was shown within the southern part of the Site and a stream flowed through the Site from north to south. By 1910 the Site and surrounding land was re-graded with arisings from Wynnstay Colliery. By 1981 the site formed part of Wynnstay Technology Park with commercial/industrial units subsequently developed to the east and south of the Site and residential housing comprising Plas Madoc to the west of the Site.
Probable Ground conditions	Ground conditions are anticipated to include Made Ground derived predominantly of mudstone, coal and sandstone, overlying Glaciofluvial Deposits (Unproductive Strata) comprising sand and gravel to a depth of approximately 14.2m bgl. Bedrock of the Lower Coal Measures (Secondary A Aquifer) comprises sandstone and mudstone. The shallowest coal seams are anticipated from a depth of approximately 52m bgl and are not considered to present a potential risk to the proposed development.
Ground stability	A treated and capped air shaft is located within the Site. In March 1990 Wrexham Maelor Borough Council provided information that they had treated and capped (121.15m AOD) this shaft in accordance with British Coal recommendations. Based on the recorded geology beneath the Site and the Coal Authority information, the potential for coal mining to impact upon the proposed development has been discounted due to the depth of the recorded coal deposits and the treatment of the on-site shaft.
Hydrology	The nearest surface water receptor to the Site is an unnamed stream which flows from north to south and enters a culvert 35m north of the Site which runs down , before emerging 470m south of the Site. There are no licences surface water abstractions within 1km of the Site. The risk to surface water receptors has been discounted due to the distance to the open water courses.
Hydrogeology	The Site is indicated to be underlain by natural strata comprising Glaciofluvial Deposits to a depth of 14.2m bgl and bedrock of the Lower Coal Measures (Secondary A Aquifer) extending to considerable depth. The Site is not located within a groundwater Source Protection Zone and there are no licensed abstractions within 500m of the Site. Given the low sensitivity and the recorded Site history, the Site is not considered to present a significant risk to groundwater receptors.
Potential Soil Contamination	There is the potential for contaminants associated with Made Ground present beneath the Site; however, the potential risk to the proposed development is considered to be low.
Potential for Gas protection	Whilst the potential for ground gas associated with on-site and off-site Made Ground cannot be discounted, the risk to users of the future development is considered to be low as the implementation of control measures, such as inclusion of gas protection measures within the development is, if required, readily achievable.
Radon	The Site is in an area where radon protection measures are required.



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PRELIMINARY RISK ASSESSMENT FOR LAND AT WYNNSTAY TECHNOLOGY PARK, RUABON

1. INTRODUCTION

Tier Environmental was commissioned by NS Holdings Limited (NS Holdings) to undertake a desk study and Phase I Preliminary Risk Assessment of land at Wynnstay Technology Park, (the "Site") located at Ruabon, LL14 6EN. The Site is located within Wynnstay Technology Park approximately 1km west of Ruabon Town Centre. The Site is proposed for development as mixed use commercial and residential land use.

Taking into account the planned future use of the Site, the objectives of this appraisal were:

- To determine the land use history from review of available historical documentation and maps.
- To establish the environmental setting of the Site.
- To determine the likely soil and groundwater conditions, including whether significant contamination could have resulted from past or current land use(s).
- To determine the potential risks posed by any ground contamination.
- To determine the potential for risks posed to the Site from hazardous ground gases.
- To evaluate whether past mining or other extractive industries could have an influence on the Site.

The desk-study part of this investigation included the assessment of information provided by Groundsure, the Coal Authority and the British Geological Survey (BGS). The information provided by these organisations is provided in Appendix F.

This report, which was designed to meet the requirements of all relevant current guidance including the remaining CLR reports, presents the factual information available during this appraisal, interpretation of the data obtained and recommendations relevant to the defined objectives.

It has been assumed in the production of this report that the Site is to be developed as mixed use commercial and residential land use. In addition, it is assumed that ground levels will not change significantly from those described in this report. If this is not the case, then amendments to the recommendations made in this report may be required.

Where the report refers to the potential presence of invasive plants (such as Japanese Knotweed) or asbestos-containing materials, such observations are for information only and should be verified by a suitably qualified expert.

The comments and opinions presented in this report are based on the findings of the desk study. There may be other conditions prevailing on the Site which have not been revealed by this investigation and which have not been taken into account by this report. Responsibility cannot be accepted for any conditions not revealed by this investigation. Any diagram or opinion on the possible configuration of the findings is conjectural and given for guidance only. Confirmation of intermediate ground conditions should be undertaken if deemed necessary.

This report has been prepared for the sole use of NS Holdings. No other third party may rely upon or reproduce the contents of this report without the written approval of Tier Environmental. If any unauthorised third party comes into possession of this report, they rely on it entirely at their own risk and the authors do not owe them any Duty of Care or Skill.



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PRELIMINARY RISK ASSESSMENT FOR LAND AT WYNNSTAY TECHNOLOGY PARK, RUABON

2. SITE DETAILS AND DESCRIPTION

Table 2.1. Current Site Overview.

Site name	Land at Wynnstay Technology Park
Site address	Wynnstay Technology Park, Ruabon, Wrexham, LL14 6EN. A site location plan is included as Drawing No. T/16/1794/PRA/1 within Appendix A.
National Grid Reference	329208,343589
Location description	The Site is located within Wynnstay Technology Park, approximately 1km west of Ruabon Town Centre.
Approximate Site area	1.04ha
Site shape	The Site is broadly rectangular.
General topography and ground levels	The majority of the Site is generally flat lying at an approximate elevation of 125m AOD. Embankments are present along the western and northern boundaries of the Site.
Current land use	The Site is currently vacant.
Existing structures	No above ground structures were noted during the Site walkover undertaken on 1 st June 2016.
Site ground surfaces	The Site is ostensibly surfaced with gravel of mudstone, sandstone and rare brick and concrete. Localised areas of trees, small shrubs and rough scrub were present as localised areas within the Site and along the western and northern Site boundaries.
Sub-surface structures	Sub surface structures include the treated on-site air shaft, the cap of which is reported at an elevation of 121.15m AOD.
Invasive plant species	None were noted during the Site walkover; however, this should be confirmed through a specialist ecological survey.

The main Site features are shown on Drawing No. T/16/1794/PRA/1 within Appendix A. Relevant Site photographs are presented in Appendix C.



PRELIMINARY RISK ASSESSMENT FOR LAND AT WYNNSTAY TECHNOLOGY PARK, RUABON

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3. ENVIRONMENTAL SETTING

3.1. Site History

Extracts of Ordnance Survey (OS) plans dated from 1873 to 2014 were reviewed. These were obtained as part of the GroundSure report for the Site, which is presented in Appendix F.

Table 3.1 presents a summary of the main aspects of the Site from 1873 - 2014 relevant to the current and proposed future end uses. It is not the intention of this report to describe in detail all of the changes that have occurred on or adjacent to the Site, where these are not relevant to the land use.

Table 3.1. Site History.

Source (Map edition, scale)	On-Site features	Off-Site features
1873, 1:2,500 and 1:10,560	- A shaft surrounded by a small mound is shown within the central southern area of the Site. - A small unlabelled building and chimney are shown to the northeast of the mound. - A stream is shown flowing from north to south through the Site.	- A road is shown adjoining the northern and western boundaries of the Site. - A railway is shown 10m west of the Site. - Wynnstay Colliery is shown beyond 150m south of the Site with extensive railway sidings, structures and shafts noted. - A Brick Works and kilns is shown beyond 500m northwest of the Site with brick pits located beyond 400m northwest of the Site. - The New British Iron Works is shown beyond 750m southwest of the Site.
1899, 1:2,500 and 1900, 1:10,560.	No significant changes.	- Land to the immediate south of the Site comprises a spoil tip associated with Wynnstay Colliery. - An old quarry is shown beyond 110m east of the Site.
1910, 1:10,560 and 1912, 1:2,500.	A tramway extends into the Site from Wynnstay Colliery and the northwestern area of the Site has been subject to re-grading with colliery spoil.	- Further tipping of colliery spoil has taken place towards the east and south of the Site and includes infilling of the small 'old quarry' 110m east of the Site. - The brick works to the northwest of the Site is shown to be disused.
1938, 1:10,560	No significant changes.	No significant changes.
1949, 1:10,560	No significant changes.	No significant changes.
1960, 1:10,560 and 1961, 1:2,500.	The on-site tramway is no longer shown; the air shaft is shown as disused.	- The railway to the west of the Site is no longer shown; the embankments remain. - The Wynnstay Colliery is shown as disused.
1967, 1:2,500.	No significant changes.	No significant changes.
1971, 1:2,500 and 1977, 1:10,000	The on-site 'disused shaft' is no longer shown. The Site is shown as comprising a level area of land.	Land to the west of the Site has been developed as residential housing.
1985, 1:10,000	No significant changes.	No significant changes.



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PRELIMINARY RISK ASSESSMENT FOR LAND AT WYNNSTAY TECHNOLOGY PARK, RUABON

Date: 25/07/2016

1989, 1:2,500	The Site remains undeveloped with embankments along the northern and western boundaries of the Site.	- The road to the north of the Site appears to have been improved. - An unspecified commercial/industrial building with an electrical substation and unspecified tank is shown 20m from the eastern Site boundary; the tank and substation are 30m and 80m from the Site respectively.
1991, 1:2,500	No significant changes.	An unspecified commercial/industrial building is shown 10m south of the Site.
1994, 1:2,500 and 1:10,000	No significant changes.	No significant changes.
2002, 1:10,000	No significant changes.	No significant changes.
2010, 1:10,000	No significant changes.	No significant changes.
2014, 1:10,000	No significant changes.	No significant changes.

3.2. Geology

Table 3.2. Geological Summary.

Maps and publications referenced	Groundsure Report, Coal Authority Report and BGS log SJ24/44 of the air shaft located within the Site.
Made ground	The Site is not indicated to be underlain by Made Ground; however, the historical mapping and site walkover indicates Made Ground is present at the Site. Made Ground was observed to comprise clayey sandy cobbly gravel comprising mudstone, sandstone, coal and locally anthropogenic materials including brick and concrete.
Drift geology	The Site is shown to be underlain by Glaciofluvial Deposits comprising sand and gravel. The on-site borehole log records superficial deposits of 'Glacial Drift' comprising 'sand and gravel' to a depth of 14.2m bgl (109.6m AOD).
Solid geology	Bedrock of the Lower Coal Measures is anticipated at a depth of approximately 14.2m bgl and comprises blue and grey mudstone and fine sandstone/siltstone with coal encountered at 52m bgl.
Dip of solid strata	Not established.
Faults	2 No. faults striking northeast/southwest are shown within the Site. The dip and offset of the faults is not known. Given the thickness of the overlying superficial deposits, the faults are not considered to present a significant risk to the proposed development.
Coal seams	The on-site borehole log SJ24/44 records the shallowest coal seam at a depth of 52m bgl with a thickness of 0.30m. A deeper coal seam is recorded at 55.8m bgl with a thickness of 1.21m. Given the depth and thickness of the coal seams there is not considered to be a risk of void migration impacting at surface.



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PRELIMINARY RISK ASSESSMENT FOR LAND AT WYNNSTAY TECHNOLOGY PARK, RUABON

3.3. Mining and Quarrying

A disused air shaft is shown within the Site and the Site is underlain by coal measures strata anticipated at a depth of approximately 14.2m bgl. A Coal Authority Non-Residential Mining Report ordered for the Site reports the following:

- The property is in a surface area that could be affected by underground mining in 6 seams of coal at 140m to 320m depth, and last worked in 1927. Any movement in the ground due to coal mining activity should have stopped.
- A decommissioned and treated air shaft, Coal Authority reference No. 329343-194 is located within the Site. In March 1990 Wrexham Maelor Borough Council provided information that they had treated and capped this shaft in accordance with British Coal recommendations. They state that 515 tonne of 9:1 PFA/OPC grout was pressure injected into the shaft fill. The shaft was then covered with a 9.6m X 9.6m X 600mm thick reinforced concrete cap situated in competent clay some 2.6m BGL. Level of top of cap is 121.15m AOD. The shaft was conveyed to Tsuda (UK) Co. Ltd in 1991.

The Coal Authority Website interactive map viewer indicates that the Site is not located in an area potentially affected by shallow coal workings and the Site does not lie within a development high risk area, with the exception of the air shaft which is recorded as having been treated and capped.

Based on the recorded geology beneath the Site and the Coal Authority information, the potential for coal mining to impact upon the proposed development has been discounted due to the depth of the recorded coal deposits and the treatment of the on-site shaft. Notwithstanding this, it is recommended that buildings or structures are not positioned directly over the decommissioned air shaft.

Table 3.3. Other Extractive Industries.

	Yes/No	Comments
Superficial drift deposits		
Evidence of extraction on or within 250 m of the Site?	Yes	Localised quarrying of superficial deposits 110m east of the Site.
Action required?	No	Due to the scale of the extraction and distance from the Site, these industries would not impact upon the proposed development.

Other, undocumented mineral workings on or close to the Site cannot be completely dismissed.



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PRELIMINARY RISK ASSESSMENT FOR LAND AT WYNNSTAY TECHNOLOGY PARK, RUABON

3.4. Hydrogeology

Table 3.4. Groundwater Occurrence and Abstraction.

	Presence/location	Comments
Depth(s)	On-Site	Superficial deposits are designated as Unproductive Strata. Bedrock is designated as a Secondary (A) Aquifer.
Direction of flow	Not established	
Licensed abstractions	NR	
Private wells	NR	
Source Protection Zones	NR	
Springs	NR	

NR - none recorded.

For definition of Source Protection Zones, see Appendix D.

3.5. Hydrology

Table 3.5. Surface Water Features.

	Presence/location	Comments
Environment Agency GQA classified watercourses	NR	
Unclassified watercourse(s)	35m north of the Site.	A Tertiary River is shown running north to south and entering a culvert 35m north of the Site before emerging 470m south of the Site.
Licensed abstractions	NR	
Canals, ponds, lakes, etc.	NR	
Flood risk status	NR	
Surface run-off and Site drainage	On-Site	The Site is open ground and currently drains via infiltration.

NR - none recorded

Environment Agency GQA assessments: A = very good to E = poor



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PRELIMINARY RISK ASSESSMENT FOR LAND AT WYNNSTAY TECHNOLOGY PARK, RUABON

Date: 25/07/2016

3.6. Ecological Features

Table 3.6. Ecological Features.

	Presence/location	Comments
Designated locations	NR	
Other sensitive locations	NR	
Land use controls	NR	
Invasive plants	NR	A survey by a qualified invasive plant consultant is required to confirm the absence or extent of invasive species.
Trees and shrubs	On-site	During the site walkover, semi mature trees and shrubs were noted along the northern and western boundaries of the Site.

NR - none recorded

3.7. Landfill and Waste Management Activity

Table 3.7. Waste Management Activities.

	Presence/location	Comments
Local authority recorded landfills	NR	
BGS recorded landfills	NR	
Other licensed waste management facilities within 250 m	NR	
Is there evidence of other infilling on or within 250 m of Site?	Yes	Colliery spoil was placed across the Site prior to 1910. The Site was subsequently re-graded as part of the redevelopment of the Site as Wynnstay Technology Park prior to 1971.
Is a landfill/ground gas risk assessment required?	Yes	Made Ground is anticipated beneath the Site from historic mapping and the site walkover and was observed to comprise mudstone, sandstone, coal and occasional anthropogenic material. The potential for gas generation from the on-site Made Ground is considered to be low as the degradation of mudstone and coal are ' <i>generally not readily degradable so produce no more than low volumes per unit time of methane or carbon dioxide</i> ' (Annex D of BS 8485:2015). Furthermore, given the time since the material was placed, the potential for the Made Ground to present a significant ongoing source of ground gas is considered to be low.

NR - none recorded



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3.8. Local Potentially Contaminative Activities

Other potentially contaminative activities are shown in Table 3.8. The entries relate to activities within *circa* 250 m of the Site, with the exception of COMAH facilities where the assessment is extended to a distance of *circa* 1 km from the Site.

Table 3.8. Other Potentially Contaminative Processes in the Locality.

	Location	Comments
Discharge Consents	NR	
Prosecutions relating to controlled waters	NR	
Substantiated pollution incidents	NR	
IPPC permits/air pollution controls	NR	
Registered radioactive substances	NR	
Prosecutions relating to authorised processes	NR	
Enforcement and prohibition notices	NR	
Planning - hazardous substances consents and enforcements	NR	
COMAH sites	NR	
NIHHS sites	NR	
Fuel station entries	NR	

NR - none recorded

COMAH - Control of Major Accident Hazards (regulations); NIHHS - Notification of Installations Handling Hazardous Substances (regulations)

3.9. Radon Risk

Table 3.9. Radon Risk Status.

	Radon protection measures required? (Yes/No)	Comments
BRE (1999), Report 211	Yes	The Site is located in an area where between 3% and 5% of homes are above the Action Level. Basic radon protection measures <u>are</u> required.
BGS Site-specific report	Not requested	



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4. PREVIOUS INVESTIGATION FINDINGS

No previous desk study or site investigation reports pertaining to this Site have been made available.



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5. PROPOSED DEVELOPMENT

It is understood that the Site is to be developed as mixed use commercial/industrial and residential with plant uptake land uses.

The proposed layout of the Site is presented in Appendix A to this report.



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6. PRELIMINARY CONCEPTUAL MODEL

Based on the desk study, a combined preliminary conceptual site model and conceptual exposure model has been developed for the proposed future land use. This summarises the understanding of surface and sub-surface features, the potential contaminant sources, transport pathways and receptors. In assessing the likely contaminants present at the Site, reference has also been made to Defra and Environment Agency supporting documentation. A preliminary qualitative risk assessment has also been made of the likelihood of the linkage operating and its potential significance.

The potential pollutant linkages identified and the qualitative risk assessment for these are presented in Table 6.1. The terms used in the preliminary qualitative risk assessment are defined in Appendix E.

6.1. Justification

The following factors are considered pertinent in defining the conceptual model.

Land Use

- The Site is currently vacant land proposed for development as commercial and residential with gardens land use. It is understood that the site levels will not change markedly from the current levels, although it is anticipated that under current proposals the embankment along the western Site boundary of the Site will require local removal to facilitate access.
- At the time of the earliest available mapping of 1873, the majority of the Site was undeveloped. An air shaft was shown within the southern part of the Site and a stream flowed through the Site from north to south. By 1910 the Site and surrounding land was re-graded with arisings from Wynnstay Colliery. By 1981 the site formed part of Wynnstay Technology Park with commercial/industrial units subsequently developed to the east and south of the Site and residential housing comprising Plas Madoc was present to the west of the Site.
- The Site and surrounding land is directly underlain by Made Ground derived from colliery spoil which has been re-graded with off-site development including commercial/industrial and residential properties.
- The Site is shown to be underlain by Glaciofluvial Deposits (Unproductive Strata) comprising sand and gravel to a depth of approximately 14.2m bgl overlying bedrock of Lower Coal Measures (Secondary (A) Aquifer). Given the low sensitivity of the underlying controlled waters, the Site is not considered to present a potentially significant risk to controlled waters receptors. Furthermore, the on-site air shaft is reported as decommissioned and treated; as such, this is not considered to present a potential pathway for groundwater migration to the underlying bedrock.



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- Bedrock of Lower Coal Measures comprises mudstone and siltstone with the shallowest coal seams reported at a depth of approximately 52m bgl. The Coal Authority report states that the shallowest recorded coal workings are at 140m to 320m depth. Given the thickness and depth, historic coal workings beneath the Site are not considered to present a significant risk to the proposed.
- The nearest surface water receptor is tertiary stream flowing north to south which enters a culvert 35m north of the Site. Given the flow direction and the culverted nature of the water course in the vicinity of the Site, surface water receptors have been discounted as a potential receptor.
- The potential for on-site and off-site Made Ground to present a significant source of ground gas is considered to be low due to the anticipated low degradation potential of the Made Ground within and outwith the Site and the time since the Made Ground was re-graded as part of the development of Wynnstay Technology Park.
- On-site and off-site Made Ground is considered to be derived from colliery spoil and may present a potential source of ground gas, PAHs, metals and sulphates. The Made Ground includes localised evidence of demolition rubble (bricks and concrete); the presence of asbestos cannot be discounted. The effects of such contaminants, if present, with respect to the proposed development is considered to be manageable through the implementation of control measures. As such, the severity of the impact is considered to be mild.

Potential Sources

- On-Site Made Ground (PAHs, metals, asbestos, sulphate).
- Off-site Made Ground and coal measures (bulk ground gas).

Potential Pathways

- Dermal contact, ingestion and inhalation of contaminants on-site.
- Migration of ground gas / explosion.
- Migration of mobile contaminants from Made Ground soils to adjacent sites along services and conduits.
- Contaminated dust migration during construction.
- Migration via water pipes.

Potential Receptors

- Future users of the Site and adjacent land.
- Buildings, hardstanding and services.
- Site investigation, demolition and construction staff and future underground service maintenance workers from hazardous short term exposure.



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6.2. Uncertainties

The following uncertainties exist in the preliminary conceptual model:

- The presence of any features unrecorded by the historical maps.
- Any unrecorded geological features.
- The current nature of the ground conditions following re-grading of the Site.
- Any unreported pollution events during the site's history.



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Table 6.1. Preliminary Assessment of Potential Pollutant Linkages.

Pollutant linkage		Pathway(s)	Receptor(s)	Generic quantitative risk assessment
	Source			
1	Possible metal, PAH, sulphate and asbestos contamination of on-site Made Ground from previous Site uses.	Inhalation of vaporous contaminants.	Future users of the Site. (residential)	Mild x Low Likelihood = Low risk
2		Dermal contact and ingestion of contaminants. Contaminated dust migration during construction.	Site investigation, demolition and construction staff and future underground service maintenance workers from hazardous short term exposure.	Mild x Low Likelihood = Low risk
3		Contaminated dust migration during construction. Migration of mobile contaminants from Made Ground soils to adjacent sites along services and conduits.	Adjacent users of the Site.	Mild x Low Likelihood = Low risk
4	Bulk ground gas generation from coal seams at depth, on-site and off-site Made Ground soils.	Migration via water pipes.	Future users of the Site.	Mild x Low Likelihood = Low risk
5		Migration of ground gas / explosion.	Buildings, hardstanding and services. Future users of the Site. (residential)	Mild x Low Likelihood = Low risk

For definition of the terms used in the qualitative risk assessment, please see Appendix E.



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7. REGULATORY APPROVALS

The conclusions and recommendations presented above are considered reasonable based on the findings of the site investigation. However, these cannot be guaranteed to gain regulatory approval and, therefore, the report should be passed to the appropriate regulatory authorities and/or other organisations for their comment and approval prior to undertaking any works on site.

It is recommended that conditions placed on any planning permission are discharged prior to commencement of site works.



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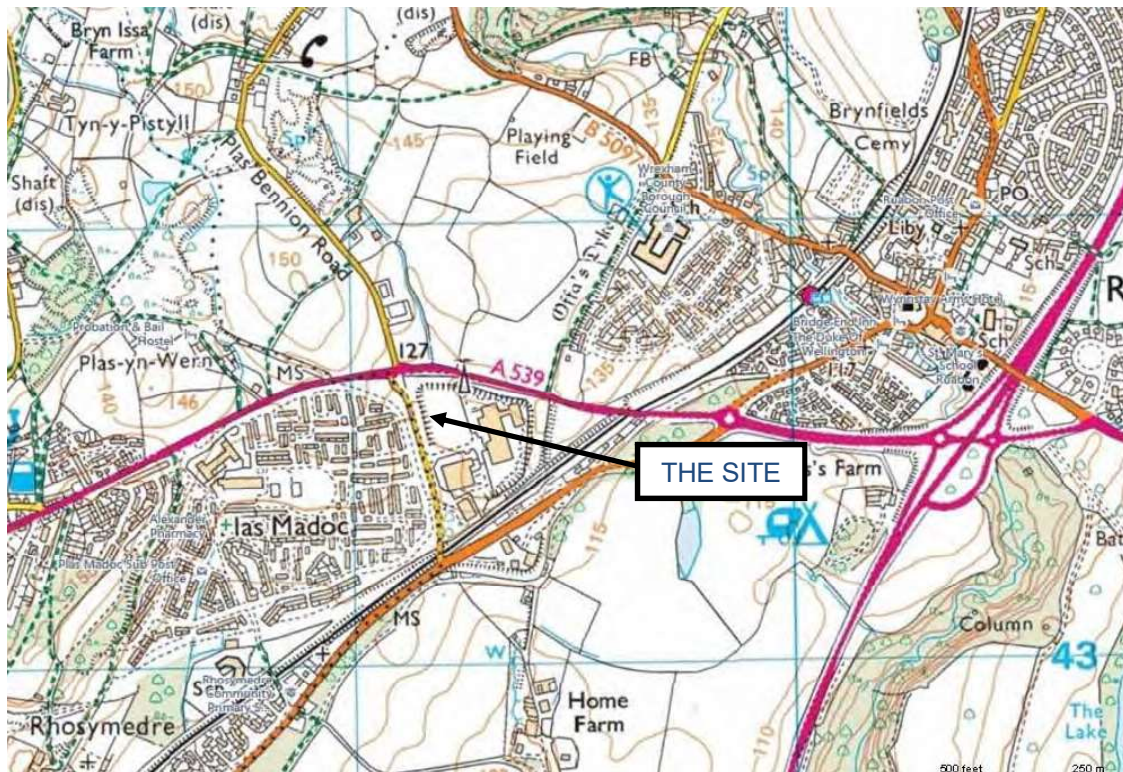
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APPENDIX A - FIGURES AND DRAWINGS



Contract Number	T/16/1794/PRA/1
Contract	Wynnstey Technology Park
Client	NS Holdings

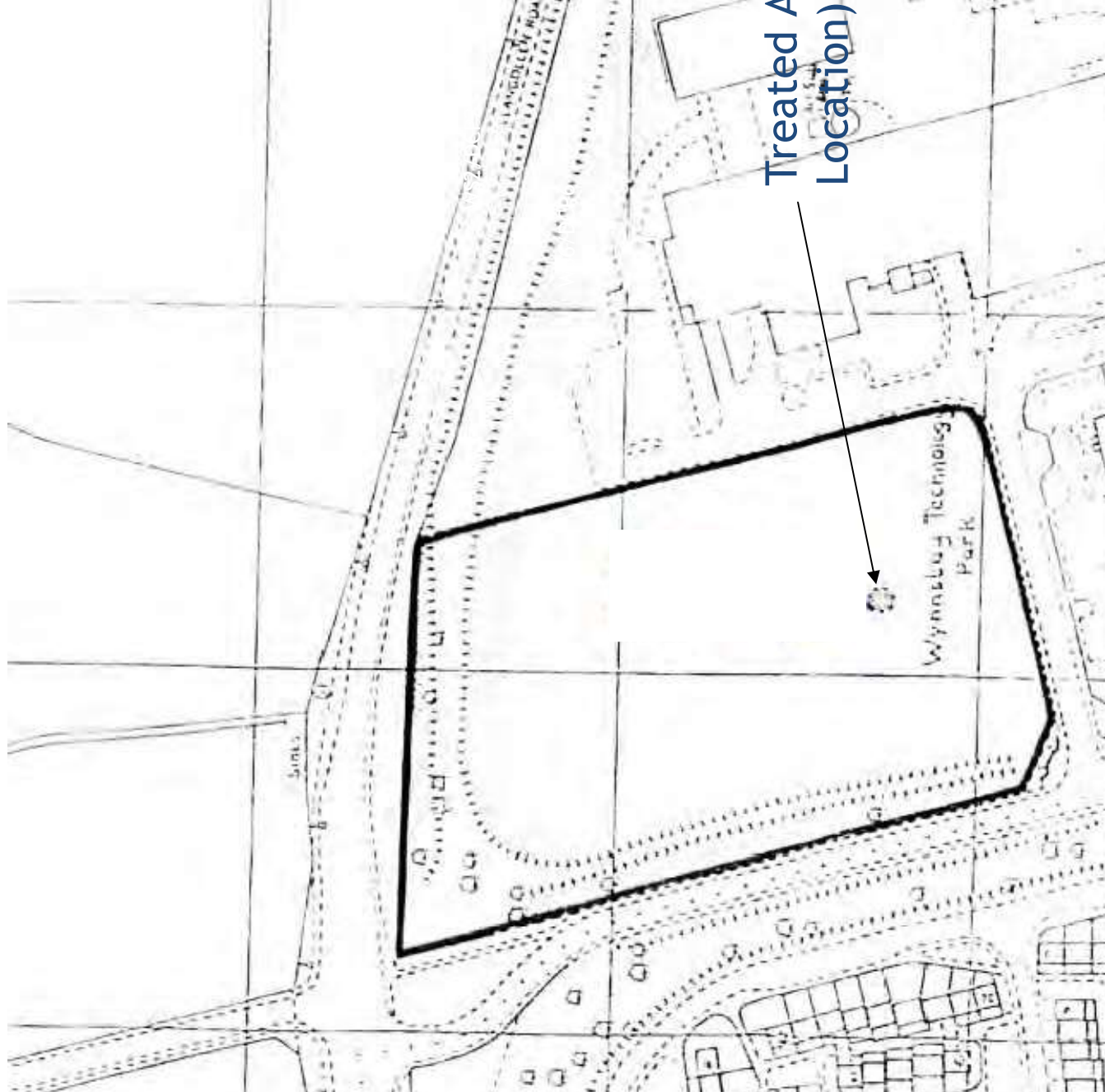
Site Location Plan



Reproduced from the Ordnance Survey map with the permission of The Controller of Her Majesty's Stationary Office, © Crown Copyright. All rights reserved.

Scale	NTS	
Drawn by	JS	Approved JS
Drawing Number	T/16/1794/PRA/1	

atory Hole Location



Treated Air Shaft (Approximate Location)



Public Open Space

Capped Minseshaft
with 20mØ
easement area

Residents
Parking

Residents Parking

Space

15 no. Car
Parking Spaces

APPENDIX B - GLOSSARY OF TERMS

ACEC	Aggressive Chemical Environment for Concrete (classification)
aOD	Above Ordnance Datum
bgl	Below ground level
BGS	British Geological Survey
BRE	Building Research Establishment
CBR	California Bearing Ratio (test)
COMAH	Control of Major Accident Hazards (regulations)
Designated location	Site (and the ecosystem on that site) protected under national or international legislation. A potential ecological receptor to be considered as part of the assessment of land contamination. Example designated locations include SSSIs (q.v.), SACs (q.v.), national nature reserves, Ramsar sites and bird special protection areas.
DQA	Data Quality Assessment
DQO	Data Quality Objective
DQRA	Detailed Quantitative Risk Assessment
DWS	Drinking Water Standard
EQS	Environmental Quality Standard
GAC	Generic Assessment Criterion
GQA	General Quality Assessment (Environment Agency)
GSV	Gas Screening Value
HCV	Health Criteria Value
IPPC	Integrated Pollution Prevention and Control (regulations)
K _{ow}	Octanol-water partition coefficient
LEL	Lower Explosive Limit
LL	Liquid Limit
LoD	Limit of Detection (analytical)
LoQ	Limit of Quantification (analytical)
Mean Value Test	Statistical test (described in CLR7) to estimate the mean value of a normally distributed population of data at a given level of confidence. Normally for contaminated land assessment, the 95th percentile (referred to as the 95%UCL or US95) is applied as a reasonable but conservative estimate of the mean concentration for comparison with the relevant assessment criteria.
Maximum Value Test	Statistical test (described in CLR7) to identify whether an elevated concentration within a normally distributed data set forms part of the underlying population from which it has been sampled or whether it is an outlier (such as a localised area of contamination) that merits further consideration.
MC	Moisture Content
NGR	National Grid Reference
NIHHS	Notification of Installations Handling Hazardous Substances (regulations)
OS	Ordnance Survey
PI	Plasticity Index
PID	Photoionisation Detector
PL	Plastic Limit
ppm	Parts per million
ppmv	Parts per million by volume
QA	Quality Assurance
QC	Quality Control
SAC	Special Area of Conservation
SOM	Soil Organic Matter
SPT	Standard Penetration Test
SPZ	Source Protection Zone (see Appendix E)
SSAC	Site-Specific Assessment Criterion
SSSI	Site of Special Scientific Interest
SVOC	Semi-Volatile Organic Compound

TEF	Toxicity Equivalent Factor
TPH	Total Petroleum Hydrocarbons
TWA	Time Weighted Average
US95	95 th percentile estimate of the true mean value of a data population (also known as 95%UCL).
VOC	Volatile Organic Compound

APPENDIX C - PHOTOGRAPHS TAKEN DURING SITE WALKOVER

Photo 1: General view of the Site looking north



Photo 2: View of vegetated areas towards the north and northwest of the Site.



Photo 3: View looking south over the Site from the top of the embankment along the northern Site boundary.



APPENDIX D - DEFINITION OF SOURCE PROTECTION ZONES AND GROUNDWATER VULNERABILITY ASSESSMENTS

Source Protection Zones

Source Protection Zones (SPZs) are defined by the Environment Agency (for England and Wales), SEPA (Scotland) and the Environment and Heritage Service (Northern Ireland) for groundwater sources such as wells, boreholes and springs that are used for public drinking water supply. The zones show the risk of contamination from activities that might cause groundwater pollution in the area. The size and shape of a zone depends upon subsurface conditions, how the groundwater is removed, and other environmental factors.

SPZs are classified into four categories:

- **Zone 1 (Inner protection zone).** Any pollution that can travel to the abstraction point within 50 days from any point within the zone is classified as being inside Zone 1. This applies at and below the groundwater table. This zone also has a minimum 50 m protection radius around the abstraction point. These criteria are designed to protect against the transmission of toxic chemicals and water-borne disease.
- **Zone 2 (Outer protection zone).** The outer zone covers pollution that takes up to 400 days to travel to the abstraction point, or 25% of the total catchment area, whichever area is the largest. This travel time is the minimum period over which the Environment Agency considers that pollutants need to be diluted, reduced in strength or delayed by the time they reach the abstraction point.
- **Zone 3 (Total catchment).** This is the total area needed to support removal of water from the abstraction point, and to support any discharge from this.
- **Zone of special interest.** This may occasionally be defined as a special case. This is usually where local conditions mean that industrial sites and other potential sources of contamination could affect the groundwater source, even though they are outside the normal catchment area.

Groundwater Vulnerability Assessments

From 1 April 2010 The Environment Agency Groundwater Protection Policy began to use aquifer designations which are consistent with the Water Framework Directive. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems.

The aquifer designation data is based on geological mapping provided by the British Geological Survey. It is updated regularly to reflect their ongoing programme of improvements to these maps. The maps are split into two different type of aquifer designation:

- **Superficial (Drift)** - permeable unconsolidated (loose) deposits. For example, sands and gravels.
- **Bedrock** -solid permeable formations e.g. sandstone, chalk and limestone.

The maps display the following aquifer designations:

Table 1. Aquifer Classification (“Geological Classification”).

Classification	Definition
Principal Aquifers (Highly Permeable)	These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.
Secondary A Aquifers	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.
Secondary B Aquifers	Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.
Secondary Undifferentiated Aquifers	This has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
Unproductive Strata	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

APPENDIX E - DEFINITIONS OF TERMS USED IN QUALITATIVE AND QUANTITATIVE RISK ASSESSMENTS

For the qualitative and quantitative assessment of risks posed by potential pollutant linkages have been undertaken using the risk matrix adapted from CIRIA C552 and outlined in the table below.

	Category	Definition
Potential severity	Severe	Acute (short term) risk to human health, Major pollution of sensitive controlled waters, ecosystems or habitat. Catastrophic damage to buildings or property or crops.
	Medium	Chronic (Medium / long term) risk to human health Pollution of sensitive controlled waters, ecosystems or species, Significant damage to crops, buildings or structures
	Mild	Easily preventable permanent health effects on humans. Pollution of non-sensitive controlled waters. Minor damage to buildings or structures.
	Minor	Easily preventable non-permanent health effects on humans, or no effects. Minor, low level and localised contamination of on-site soil. Easily repairable damage to buildings or structures.
Probability of risk	High Likelihood	Pollutant linkage may be present and the risk is almost certain to occur , or there is evidence of harm already occurring.
	Likely	Pollutant linkage may be present and it is probable that the risk will occur over the long term.
	Low Likelihood	Pollutant linkages may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
	Unlikely	Pollutant linkage may be present but the circumstances under which harm would occur are improbable.

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

APPENDIX F - GROUNDSURE REPORT



The Coal
Authority

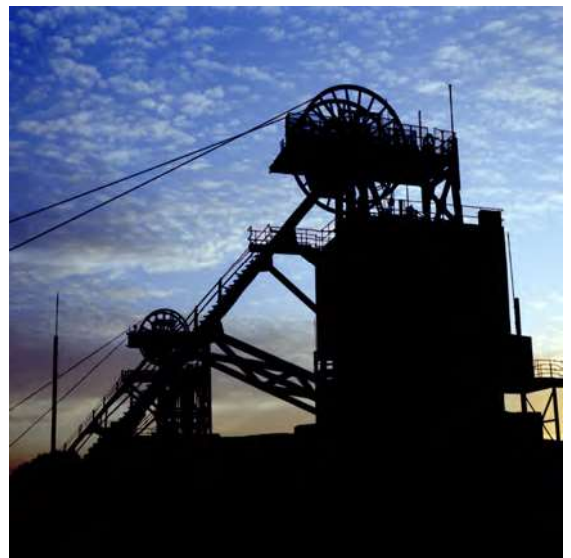
Resolving the **impacts** of mining

CON29M Non-Residential Mining Report

WYNNSTAY TECHNOLOGY PARK
RUOBON
WREXHAM
LL14 6EN

Date of enquiry: 31 May 2016
Date enquiry received: 31 May 2016
Issue date: 31 May 2016

Our reference: 51001169438001
Your reference: T/16/1794 - PE00902



CON29M Non-Residential Mining Report

This report is based on, and limited to, the records held by the Coal Authority and the Cheshire Brine Subsidence Compensation Board's records, at the time we answer the search.

Client name

Tier Environmental

Enquiry address

WYNNSTAY TECHNOLOGY PARK, RUOBON,
WREXHAM, LL14 6EN

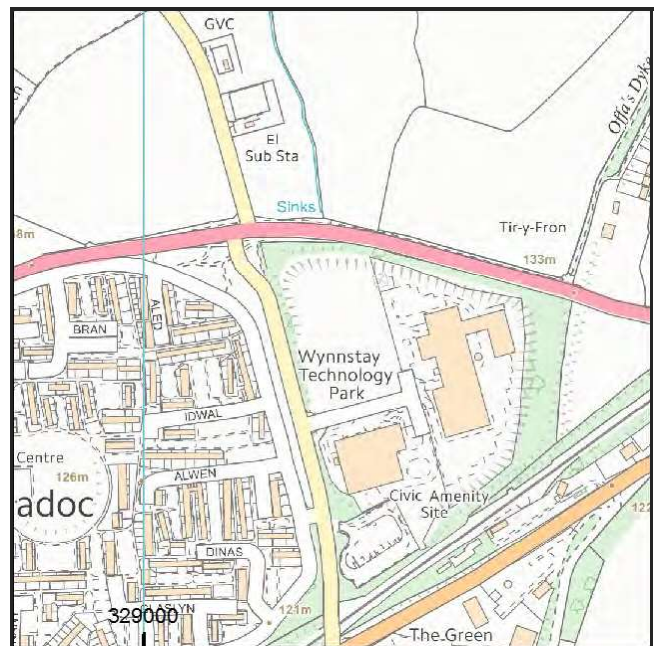
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200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

www.gov.uk/coalauthority

 /company/the-coal-authority
 /thecoalauthority
 /coalauthority



Approximate position of property



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Summary

Has the search report highlighted evidence or potential of		
1	Past underground coal mining	Yes
2	Present underground coal mining	No
3	Future underground coal mining	Yes
4	Mine entries	Yes
5	Coal mining geology	No
6	Past opencast coal mining	No
7	Present opencast coal mining	No
8	Future opencast coal mining	No
9	Coal mining subsidence	No
10	Mine gas	No
11	Hazards related to coal mining	No
12	Withdrawal of support	No
13	Working facilities order	No
14	Payments to owners of former copyhold land	No
15	Information from the Cheshire Brine Subsidence Compensation Board	No

Further recommended reports
Mine entry interpretive report
Mine entry plan and data sheets

For detailed findings, please go to page 4.

Detailed findings

1. Past underground coal mining

The property is in a surface area that could be affected by underground mining in 6 seams of coal at 140m to 320m depth, and last worked in 1927.

Any movement in the ground due to coal mining activity should have stopped.

2. Present underground coal mining

The property is not within a surface area that could be affected by present underground mining.

3. Future underground coal mining

The property is not in an area where the Coal Authority has plans to grant a licence to remove coal using underground methods.

The property is not in an area where a licence has been granted to remove or otherwise work coal using underground methods.

The property is not in an area likely to be affected from any planned future underground coal mining.

However, reserves of coal exist in the local area which could be worked at some time in the future.

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

4. Mine entries

Within, or within 20 metres of, the boundary of the property there is 1 mine entry, the approximate position of which is shown on the enquiry boundary plot.

Our records disclose the following information:

329343-194. This entry was initially filled with colliery shale by the owners circa 1970 to an unknown specification. In March 1990 Wrexham Maelor Borough Council provided information that they had treated and capped this shaft in accordance with British Coal recommendations. They state that 515 tonne of 9:1 PFA/OPC grout was pressure injected into the shaft fill. The shaft was then covered with a 9.6m X 9.6m X 600mm thick reinforced concrete cap situated in competent clay some 2.6m BGL. Level of top of cap is 121.15m A.O.D..

Mine entry 329343-194 was conveyed to Tsuda (UK) Co. Ltd in 1991.

For an additional fee, the Coal Authority can provide a Mine Entry Interpretive Report. The report will provide a separate assessment for the mine entry/entries referred to in this report. It gives an opinion on the likelihood of mining subsidence damage caused from ground movement as a consequence of the mine entry/entries. It also gives details of the remedies available for subsidence damage where the mine entry was sunk in connection with coal mining.

Please note that it may not be possible to produce a report if the main building to the property cannot be identified from Coal Authority plans (ie for development sites and new build).

For further advice on how to order this additional information please visit www.groundstability.com.

5. Coal mining geology

The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining.

6. Past opencast coal mining

The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.

7. Present opencast coal mining

The property does not lie within 200 metres of the boundary of an opencast site from which coal is being removed by opencast methods.

8. Future opencast coal mining

There are no licence requests outstanding to remove coal by opencast methods within 800 metres of the boundary.

The property is not within 800 metres of the boundary of an opencast site for which a licence to remove coal by opencast methods has been granted.

9. Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres, since 31st October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

10. Mine gas

The Coal Authority has no record of a mine gas emission requiring action.

11. Hazards related to coal mining

The property has not been subject to remedial works, by or on behalf of the Authority, under its Emergency Surface Hazard Call Out procedures.

12. Withdrawal of support

The property is not in an area where a notice to withdraw support has been given.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

13. Working facilities order

The property is not in an area where an order has been made, under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification or amendment thereof.

14. Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

15. Information from the Cheshire Brine Subsidence Compensation Board

The property lies outside the Cheshire Brine Compensation District.

Comments on the Coal Authority information

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The boundary plot shows the approximate location of the disused mine entry/entries referred to in this report. For reasons of clarity, mine entry symbols may not be drawn to the same scale as the plan.

Property owners have the benefit of statutory protection (under the Coal Mining Subsidence Act 1991*). This contains provision for the making good, to the reasonable satisfaction of the owner, of physical damage from disused coal mine workings including disused coal mine entries. A leaflet setting out the rights and obligations of either the Coal Authority or other responsible persons under the 1991 Act can be obtained by visiting www.groundstability.com.

If you wish to discuss the relevance of any of the information contained in this report, you should seek the advice of a qualified mining engineer or surveyor. If you or your advisor wish to examine the source plans from which the information has been taken, these are available to view, free of charge, at our Head Office in Mansfield. To book an appointment please ring 01623 637225. Should you or your advisor wish to carry out a physical investigation that may enter, disturb or interfere with any disused mine entry, prior permission of the owner must be sought. For coal mine entries, the owner will normally be the Coal Authority.

The Coal Authority, regardless of responsibility and in conjunction with other public bodies, provide an emergency call out facility in coalfield areas to assess the public safety implications of mining features (including disused mine entries). Our emergency telephone number is 01623 646333.

*Note, this Act does not apply where coal was worked or gotten by virtue of the grant of a gale in the Forest of Dean, or any other part of the Hundred of St. Briavels in the county of Gloucester.

In view of the mining circumstances a prudent developer would seek appropriate technical advice before any works are undertaken.

Therefore if development proposals are being considered, technical advice relating to both the investigation of coal and former coal mines and their treatment should be obtained before

beginning work on site. All proposals should apply good engineering practice developed for mining areas. No development should be undertaken that intersects, disturbs or interferes with any coal or mines of coal without the permission of the Coal Authority. Developers should be aware that the investigation of coal seams/former mines of coal may have the potential to generate and/or displace underground gases and these risks both under and adjacent to the development should be fully considered in developing any proposals. The need for effective measures to prevent gases entering into public properties either during investigation or after development also needs to be assessed and properly addressed. This is necessary due to the public safety implications of any development in these circumstances.

Additional remarks

Information provided by the Coal Authority in this report is compiled in response to the Law Society's Con29M Coal Mining and Brine Subsidence Claim enquiries. The said enquiries are protected by copyright owned by the Law Society of 113 Chancery Lane, London WC2A 1PL. Please note that Brine Subsidence Claim enquiries are only relevant for England and Wales. This report is prepared in accordance with the Law Society's Guidance Notes 2006, the User Guide 2006 and the Coal Authority and Cheshire Brine Board's Terms and Conditions applicable at the time the report was produced.

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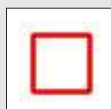
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If you would like this report in an alternative format, please contact our communications team.

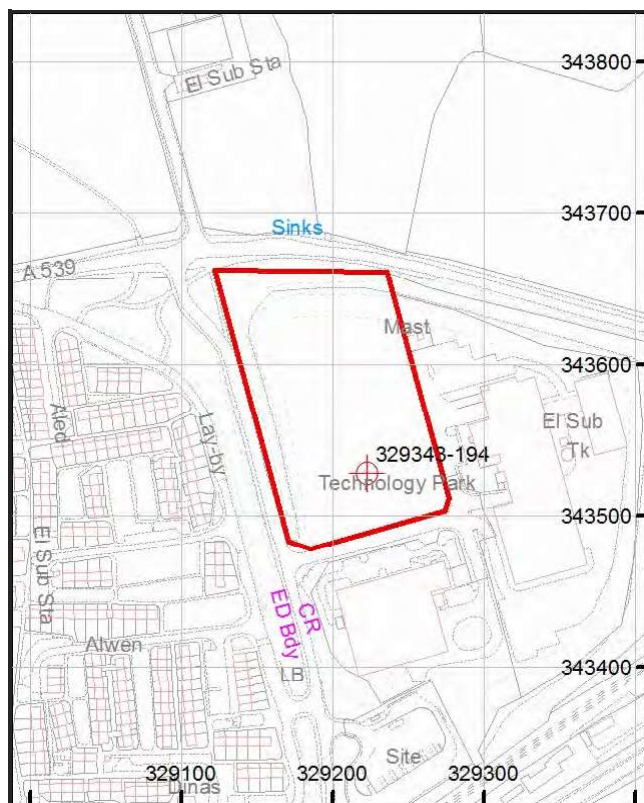
Enquiry boundary

Key

Approximate position of enquiry boundary shown



Disused mineshaft



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+44 (0)1623 637 000 (International)

200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

www.gov.uk/coalauthority

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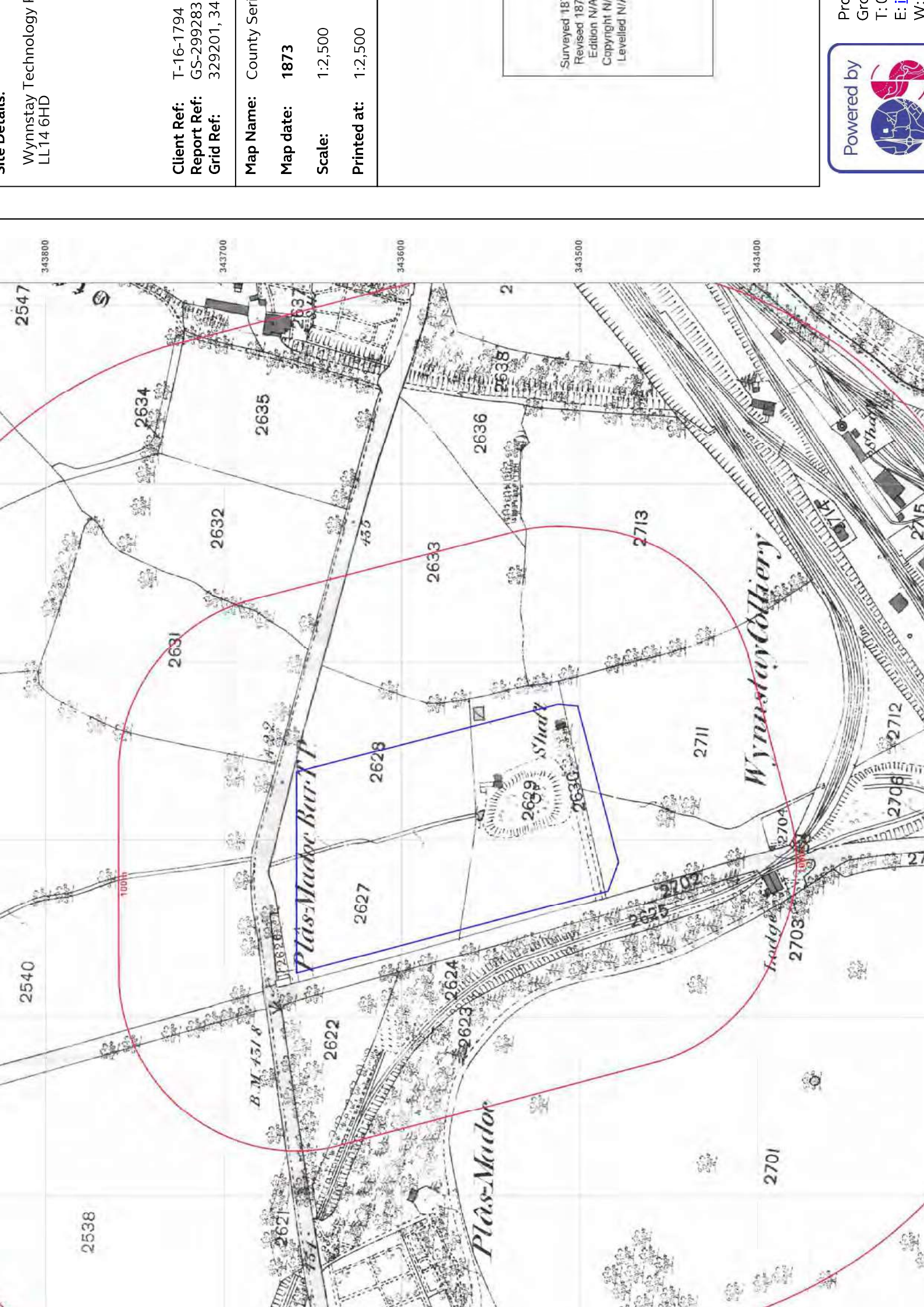
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Site Details:

Wynnstay Technology
LL14 6HD

Client Ref: T-16-1794
Report Ref: GS-299283
Grid Ref: 329201, 34

Map Name: County Ser
Map date: 1873
Scale: 1:2,500
Printed at: 1:2,500

Surveyed 18
Revised 187
Edition N/A
Copyright N/A
Levelled N/A

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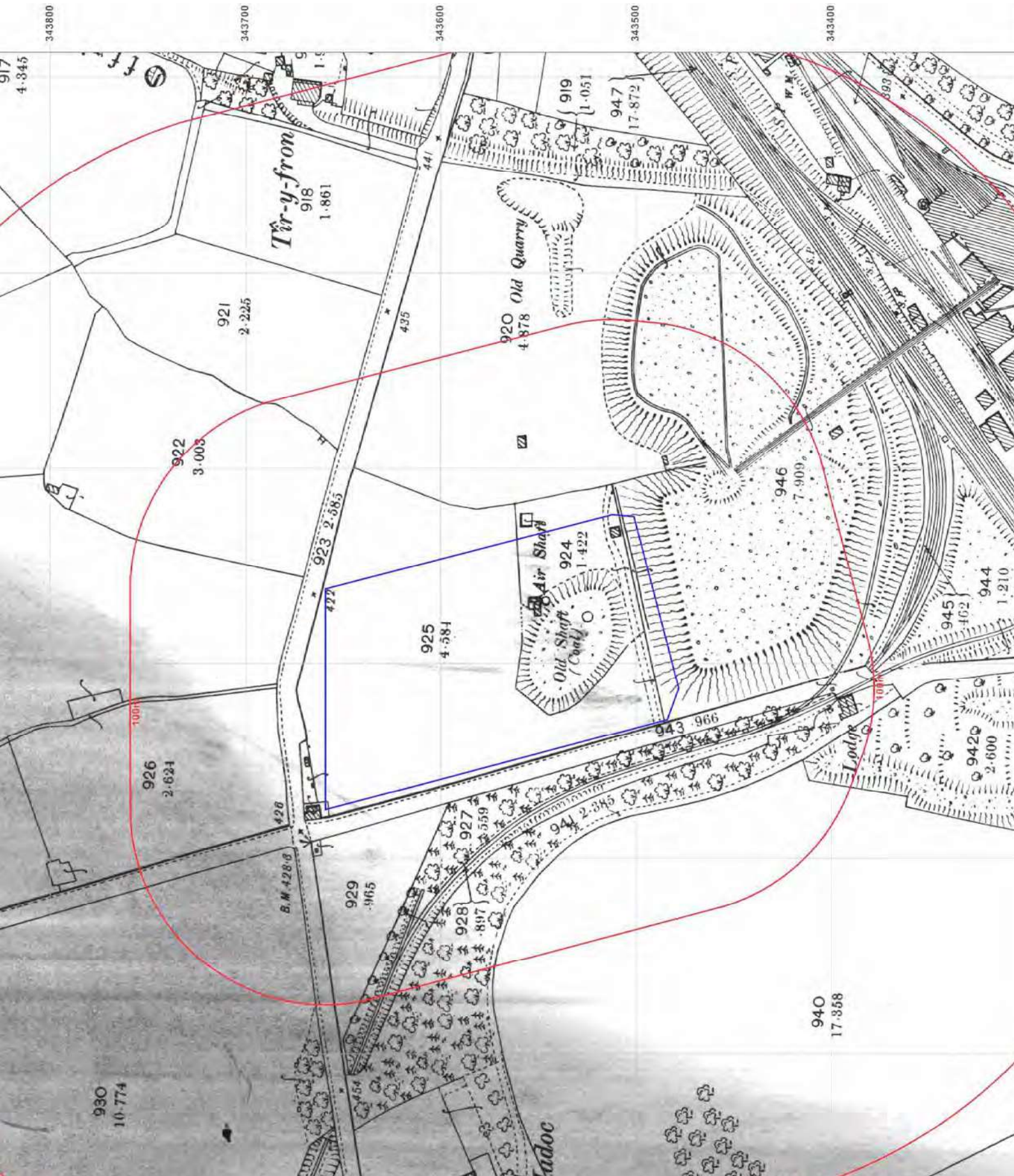


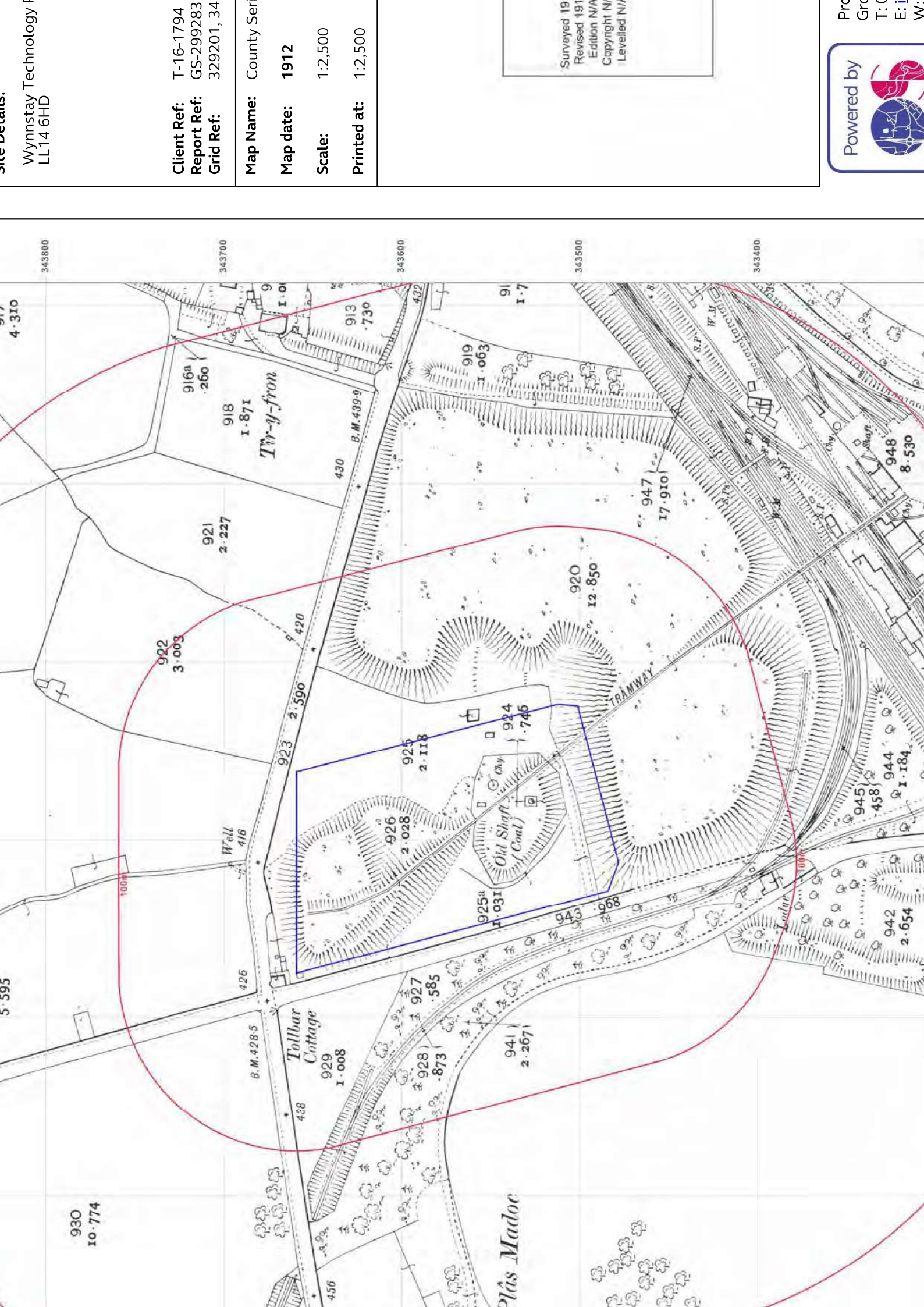
Pro
Gro
T: C
E: I
W:

Client Ref: T-16-1794
Report Ref: GS-299283
Grid Ref: 329201, 34

Map Name: County Ser
Map date: 1899
Scale: 1:2,500
Printed at: 1:2,500

Surveyed 1899
Revised 1899
Edition N/A
Copyright N/A
Levelled N/A





Site Details:

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Client Ref: T-16-1794
Report Ref: GS-299283
Grid Ref: 329201, 34

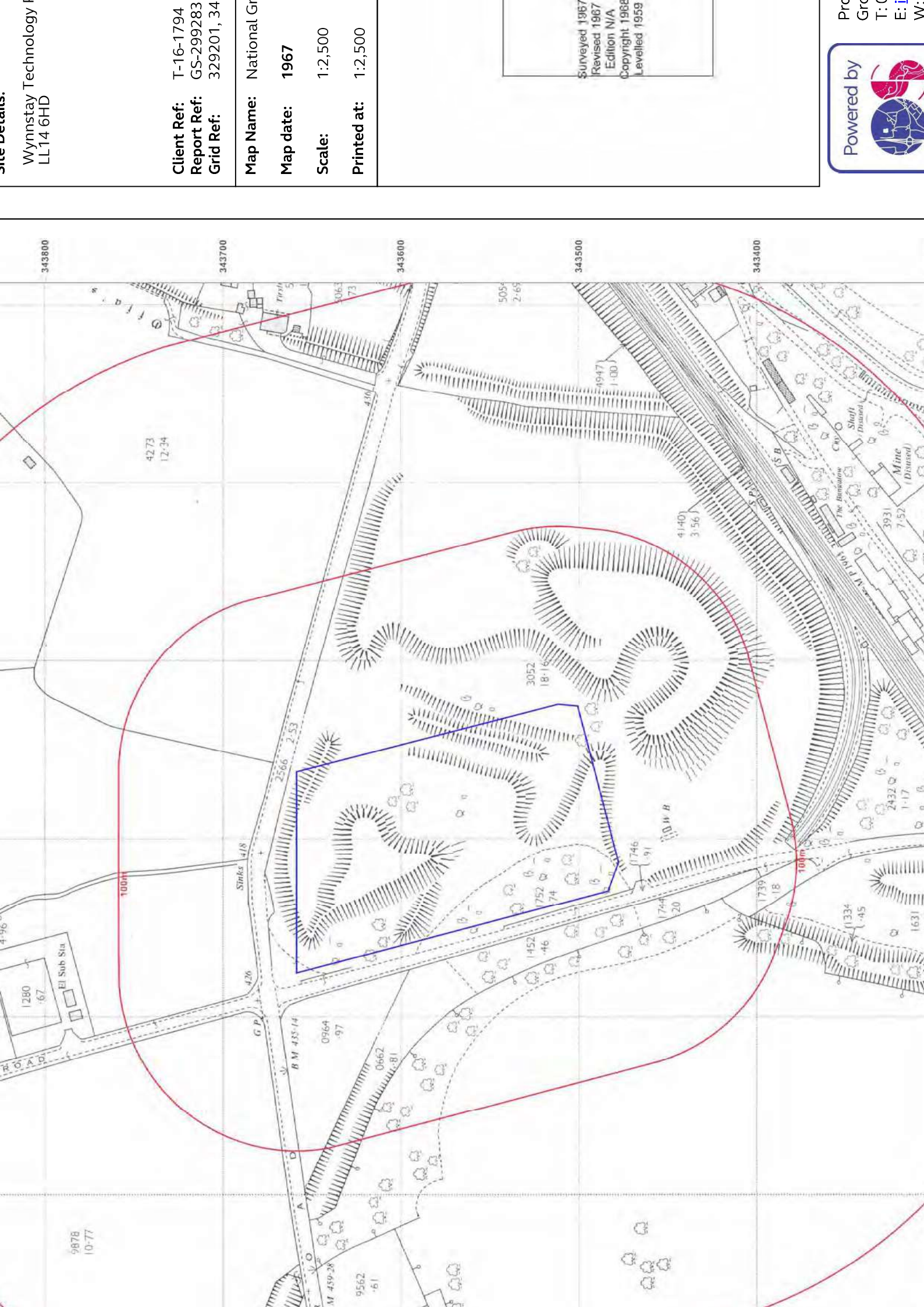
Map Name: County Ser
Map date: 1912
Scale: 1:2,500
Printed at: 1:2,500

Surveyed 19
Revised 191
Edition N/A
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Map Name: National Grid
Map date: 1961
Scale: 1:2,500
Printed at: 1:2,500

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LL14 6HD

Client Ref: T-16-1794
Report Ref: GS-299283
Grid Ref: 329201, 34

Map Name: National Grid
Map date: 1967
Scale: 1:2,500
Printed at: 1:2,500

Surveyed 1967
Revised 1967
Edition N/A
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