



## **Pest Management Plan**

**Prepared for:**

**By:**

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**Date:**



## EnviroSolution Ltd Document Verification

<b>Site Address</b>	Arrow Bio Waste Recycling Facility, Weighbridge Road, Deeside Industrial Park, Deeside, CH5 2LL		
<b>Report Title</b>	Pest Management Plan		
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# 1 Pest management plan

## 1.1. Objective

1.1.1. The objective of this plan is to outline the means by which pests will be prevented or minimised at the Arrow Bio Waste Recycling Facility during its operational life.

## 1.2. Scope

1.2.1. The scope of this procedure includes all plant and activities and staff associated with the Arrow Bio Waste Recycling Facility.

## 1.3. Responsibility

1.3.1. It is the responsibility of the Site Manager to ensure that all personnel or companies adhere to this procedure.

## 1.4. Description of Risk

1.4.1. The Arrow Bio Waste Recycling Facility will accept, store and process waste feedstocks in a reception shed to be passed through into the digestion process.

1.4.2. The site is close to a rural area and will have standing water in the vicinity of the site. There is the potential for food, and shelter for pests at the site, and a risk of nuisance and other impacts from pests attracted to the site.

1.4.3. Impact arising from rodents, flies and birds is possible given the nature of the site and it's setting.

## 1.5. Preventative Measures

1.5.1. Table 1 below outlines preventative measures to be implemented at the site to prevent or reduce the risk of infestation.

Table 1 – Preventative Measures

Management Measure	Description of Measures to be Taken
Waste Storage and Handling	<p>Waste feedstocks will be stored for 1-2 days on average which will prevent the opportunity for pests such as flies to become established by removing breeding sites and prevent rodents from becoming established.</p> <p>A system of 'stock control' will be established to ensure that wastes are turned around within these timeframes.</p> <p>Liquid wastes and processed wastes will be stored in sealed tanks which will reduce access opportunities.</p> <p>Doorways to the reception building are to be kept closed whenever possible and foot dips placed in doorways.</p>

Management Measure	Description of Measures to be Taken
Cleaning Schedules	<p>A cleaning schedule for the waste reception building and associated plant will be in place in line with APHA requirements and as agreed on issue of approval at the site. DEFRA approved products to be used for cleaning purposes to the correct dilution.</p> <p>Drainage cleaning and maintenance schedule established and implemented.</p> <p>Foot dips and hygiene measures implemented to be implemented to ensure that wastes are controlled within the reception building.</p>
Daily Site Inspection	<p>Daily and weekly inspections of site will include monitoring for evidence of pest activity and for site issues that may increase the risk of pests. Identified issues to be reported to site manager for corrective and preventative measures to be implemented.</p> <p>State of repair of building to be inspected and monitored for evidence of potential access points.</p>
Housekeeping	<p>Yard areas to be kept clean and free of build-up of materials which may provide harbourage to pests. Spillages of wastes to be cleaned up immediately.</p> <p>General waste storage areas to be kept covered and secure and regular removal to prevent build-up of general wastes.</p> <p>Waste packaging skip to be emptied on a regular basis.</p>
Building Design	<p>State of repair of building to be inspected and monitored for evidence of potential access points.</p> <p>Building design to consider factors which may enable pests in building design, such as wall cavities, ducting and vents and measures to reduce access applied where possible.</p>

**1.6. Monitoring**

- 1.6.1. Site staff will monitor for signs of infestation and maintenance of proactive measures during regular daily and weekly checks, including checks in waste accepted at the site, which will be rejected if evidence of pests is found.
- 1.6.2. In addition to this, the operator will commission an external contractor to lay bait stations at the site and to carry out regular site monitoring for evidence of pest activity.
- 1.6.3. The contractor will conduct a minimum of eight visits to the site a year and will provide a report of their inspection during each visit.
- 1.6.4. A plan of the location of bait stations will be kept in the pest control file in the site office.
- 1.6.5. Copies of contractor monitoring reports and recommendations will be kept in the pest control file in the site office.
- 1.6.6. Any recommendations made following inspection will be reported to the site manager and corrective/preventative actions planned and tracked if required.
- 1.6.7. Rodenticides used in bait boxes will be subject to a COSHH assessment and MSDS retained in the site management system records.

**1.7. Incident Response**

- 1.7.1. If pest activity at the site is detected either during regular site staff monitoring, or following inspection by the specialist pest control contractor, then further corrective actions will be taken.
- 1.7.2. The specialist pest contractor will be commissioned to make further recommendations and to undertake measures needed to address the issue.

**1.8. Staff Training**

- 1.8.1. Site staff will be provided with training about the impacts and risks associated with pests at the site, how to detect signs of infestation during daily and weekly checks, and how to report evidence of pest activity if detected.

# Arrow Bio Waste Recycling Facility: Critical spare parts

Subject to change and adjustment



Item	Supplier / maintenance intervall period / BH	Qty	Unit	Price / Unit	Priority 1	Priority 2	Priority 3	Total	delivery time	Order (X)	Intending to order by NewE
<b>Pumps (parts for 1 pump)</b>											
<b>WANGEN KL65S 125.0 ANTIBLOCK</b>											
Rotor, 125.0 #65 1.2436 H	Wangen	1	pc	£1.902,09		1.902,09 GBP		1.902,09 GBP	2 weeks		X
Stator, 125.0 #65 s-Schliff NBR 440/60-ST		1	pc	£733,58	733,58 GBP			733,58 GBP	2 weeks		X
LWD-Patron, #65 Special ST/Q1Q1/HNBR		1	pc	£827,86		827,86 GBP		827,86 GBP	2 weeks		
Connecting ring DIN471 - 65x2,5		1	pc	£19,27		19,27 GBP		19,27 GBP	2 weeks		
GL-F/KL-S Main Group, #65 Joint completely mounted		1	pc	£1.262,10		1.262,10 GBP		1.262,10 GBP	2 weeks		
Connecting bolts #65 / NBR		2	pc	£33,72		67,44 GBP		67,44 GBP	2 weeks		
<b>Solid material charging system</b>											
<b>Depacking system</b>											
Flange bearing NAFC 216 TRL	Huning	2	pc	£239,02	478,04 GBP			478,04 GBP	3 weeks		X
Hexagon Srew DIN931 / 12.9 M8 x 60		10	pc	£3,03	30,26 GBP			30,26 GBP	3 weeks		X
Plugable miniature relay REL-MR-24DC21AU		8	pc	£12,61	100,85 GBP			100,85 GBP	3 weeks		X
Filter f. tank installation return flow HE K02-10.060-AS-SP025-VM-B17-B		4	pc	£28,24	112,95 GBP			112,95 GBP	3 weeks		X
Suction filter 3/4 f. hydraulic aggregate		4	pc	£47,90		191,62 GBP		191,62 GBP	3 weeks		
Pump for hydraulic aggregate 11ccm für 5,5kW Motor / OT200 P11 D/P P2		2	pc	£204,73		409,46 GBP		409,46 GBP	3 weeks		
Shaft f. Kernrohr Ø139, Hohlwelle 40mm		2	pc	£231,96		463,92 GBP		463,92 GBP	3 weeks		
Trough coating incl. Cleat 20x570x737.8mm, mit 6 Biegenuten		2	pc	£302,56		605,11 GBP		605,11 GBP	3 weeks		
Flat steal for tough 2500mm / V2A		2	pc	£78,66		157,33 GBP		157,33 GBP	3 weeks		
Weight cell digital RS485 Typ D150-15t 8.5V-38V		2	pc	£400,89		801,77 GBP		801,77 GBP	3 weeks		
Rondomat 2.0 stainless steal 2,8m, complete		2	pc	£4.084,50		8.169,00 GBP		8.169,00 GBP	3 weeks		
Flat gearbox engine 5.5kW, Ø40mm Hohlwelle / 36U/min		1	pc	£1.898,03		1.898,03 GBP		1.898,03 GBP	3 weeks		
Rondomat unit, black plug DC1005M T MP266 00 1131 CLEAN A2XR01 A3XR02		2	pc	£2.027,12			4.054,25 GBP	4.054,25 GBP	3 weeks		
Sealing strip set		2	pc	£622,26			1.244,51 GBP	1.244,51 GBP	3 weeks		
Container base coating Rondomat 2.0 15mm, PE300		2	pc	£1.916,19			3.832,37 GBP	3.832,37 GBP	3 weeks		
Tough auger		2	pc	£5.173,70			10.347,41 GBP	10.347,41 GBP	3 weeks		
Cutting Screen		1	pc	£ 1.360,81		1.360,81 GBP		1.360,81 GBP	3 weeks		
Cutting Blade		4	pc	£ 104,26		417,04 GBP		417,04 GBP	3 weeks		
Cylinder Head Bolt M12x1,75 65mm		6	pc	£ 0,39		2,34 GBP		2,34 GBP	3 weeks		
Wedge Lock Washer		6	pc	£ 0,94		5,64 GBP		5,64 GBP	3 weeks		
Cylinder Head Bolt M12x1,75 35mm		2	pc	£ 0,34		0,68 GBP		0,68 GBP	3 weeks		
Clamp Bolt		8	pc	£ 2,56		20,48 GBP		20,48 GBP	3 weeks		
Spring Pin 10mm		4	pc	£ 0,35		1,40 GBP		1,40 GBP	3 weeks		
Spring Pin 16mm		4	pc	£ 1,13		4,52 GBP		4,52 GBP	3 weeks		
Sealing Cord		4	pc	£ 0,11		0,44 GBP		0,44 GBP	3 weeks		
Sealing Ring		2	pc	£ 6,47		12,94 GBP		12,94 GBP	3 weeks		
Stator, painted		1	pc	£971,74		971,74 GBP		971,74 GBP	3 weeks		
O-Ring		1	pc	£12,41		12,41 GBP		12,41 GBP	3 weeks		
O-Ring		1	pc	£7,64		7,64 GBP		7,64 GBP	3 weeks		

# Arrow Bio Waste Recycling Facility: Critical spare parts

Subject to change and adjustment



Item	Supplier / maintenance intervall period / BH	Qty	Unit	Price / Unit	Priority 1	Priority 2	Priority 3	Total	delivery time	Order (X)	Intending to order by NewE
<b>BioSelect RC150</b>											
<b>Change - Filter</b>											
Filter RC150	Boerger	2.000-3.000	1	pc	£7.018,03		7.018,03 GBP	7.018,03 GBP	2 weeks		
O-Ring 615 x 8 NBR	2.000-3.000	1	pc	£40,31		40,31 GBP	40,31 GBP	40,31 GBP	2 weeks		
Flange sealing	2.000-3.000	1	pc	£39,26		39,26 GBP	39,26 GBP	39,26 GBP	2 weeks		
<b>Change - Shaft seal</b>											
Mechanical shaft seal	10.000	1	pc	£152,84			152,84 GBP	152,84 GBP	2 weeks		
O-Ring 104 x 4 NBR	10.000	1	pc	£1,78			1,78 GBP	1,78 GBP	2 weeks		
O-Ring 55 x 3 NBR	10.000	1	pc	£0,42			0,42 GBP	0,42 GBP	2 weeks		
O-Ring 89 x 3 NBR	10.000	1	pc	£1,78			1,78 GBP	1,78 GBP	2 weeks		
<b>Change - Screw Conveyor</b>											
Brushing worm GS RC150	2.000-3.000	1	pc	£7.347,79		7.347,79 GBP		7.347,79 GBP	2 weeks		
O-Ring 104 x 4 NBR	2.000-3.000	1	pc	£1,78		1,78 GBP		1,78 GBP	2 weeks		
<b>Change - Multi Disc Plate</b>											
Multi-disc-plate RC150 HP	1.000-3.000	1	pc	£254,38		254,38 GBP		254,38 GBP	2 weeks		
Hexagon Screw M10 x 20	1.000-3.000	8	pc	£0,26		2,09 GBP		2,09 GBP	2 weeks		
<b>Change - Clamping unit</b>											
Threaded rod M24	10.000+	1	pc	£13,61			13,61 GBP	13,61 GBP	2 weeks		
Compression spring 460mm Ø68mm	10.000+	3	pc	£72,02			216,06 GBP	216,06 GBP	2 weeks		
<b>Change - Bailing Channel</b>											
Bailing channel	1.000-3.000	1	pc	£2.854,74			2.854,74 GBP	2.854,74 GBP	2 weeks		
O-Ring 615 x 8 NBR	1.000-3.000	1	pc	£40,31			40,31 GBP	40,31 GBP	2 weeks		
Flange sealing 510 x 435 x 15	1.000-3.000	1	pc	£39,26			39,26 GBP	39,26 GBP	2 weeks		
<b>Maintenance Tools</b>											
Multi-Tool		1	pc	£248,11		248,11 GBP		248,11 GBP	2 weeks		
<b>CHP (MAN 14:1)</b>											
<b>maintenance parts</b>											
for 1 year (approx. 8000 operation hours)	2G	1	pc	£4.230,00		4.230,00 GBP		4.230,00 GBP	3 weeks		
spark plug sealing ring		48	pc						3 weeks		
spark plugs		24	pc						3 weeks		
spark plugs ignition cable		24	pc						3 weeks		
oil filter with sealing ring		8	pc						3 weeks		
air filter small		8	pc						3 weeks		
air filter big		1	pc						3 weeks		
biogas filter with gasket		1	pc						3 weeks		
<b>Biogas upgrading 600m³/h</b>											
<b>spare part package</b>											
	Pentair	1	pc	£27.500,00		27.500,00 GBP		27.500,00 GBP			

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<b>Agiator / Mixers</b>											
Hydromixer Typ A/B	Steivering										
<b>Spare Parts</b>											
Planetary gear unit 15kW ieff=100		1	pc	£3.298,45			3.298,45 GBP	3.298,45 GBP	1 week		
e-Engine 6 polig 15kW IE3		1	pc	£2.206,88			2.206,88 GBP	2.206,88 GBP	1 week		
Fixed Bearing RCJ120		1	pc	£569,52			569,52 GBP	569,52 GBP	1 week		
Sealing unit		1	pc	£2.134,50			2.134,50 GBP	2.134,50 GBP	1 week		
Sealing unit A3		1	pc	£2.788,26			2.788,26 GBP	2.788,26 GBP	1 week		
<b>Operating ressource</b>											
Gear unit oil Polyalphaolefine-Synthetic oil PAO ISO VG 320 4,5L		12	pc	£70,60			847,16 GBP	847,16 GBP	1 week		
Avialith 2 EP 400g cartridge		3	pc	£7,00			21,00 GBP	21,00 GBP	1 week		
RIVOLTA S.K.D 3802 400g cartridge biological multiple useable		6	pc	£29,13			174,77 GBP	174,77 GBP	1 week		
RIVOLTA S.K.M. 46 10L Canister full synthetic, high performance oil		1	pc	£344,08			344,08 GBP	344,08 GBP	1 week		
<b>Maintenance tools (buy)</b>											
Hydraulic cylinder	Steivering	1	pc	£705,96			705,96 GBP	705,96 GBP	2 month		
Hydraulic aggregate manuell		1	pc	£925,46			925,46 GBP	925,46 GBP	2 month		
Leveling board		1	pc	£142,38			142,38 GBP	142,38 GBP	2 month		
leveling screw M33		4	pc	£177,97			177,97 GBP	711,90 GBP	2 month		
Screw tap M33 with extansion		1	pc	£177,97			177,97 GBP	177,97 GBP	2 month		
Extractor f. sealing		1	pc	£166,11			166,11 GBP	166,11 GBP	2 month		
Extractor f. mixing shaft		1	pc	£161,36			161,36 GBP	161,36 GBP	2 month		
Applicator f. sealing		1	pc	£110,34			110,34 GBP	110,34 GBP	2 month		
Wood case w. wheels		1	pc	£1.637,36			1.637,36 GBP	1.637,36 GBP	2 month		
<b>Automatisation parts</b>											
<b>Electrical Cabinet</b>											
VIPA System 200, analog input SM 231	Keil	2	pc	£215,82	431,65 GBP			431,65 GBP	1 Month		X
VIPA System 200, analog output SM 232		2	pc	£215,82	431,65 GBP			431,65 GBP	1 month		X
VIPA System 200, digital input SM 221		2	pc	£61,08	122,16 GBP			122,16 GBP	1 month		X
VIPA System 200, digital output SM 222		2	pc	£71,26	142,52 GBP			142,52 GBP	1 month		X
VIPA System 200, profibus DP Slave IM253DP		2	pc	£151,68	303,36 GBP			303,36 GBP	1 month		X
VIPA System 200, Sys300S_CPU315SB/DPM Speed 7		1	pc	£1.199,33		1.199,33 GBP		1.199,33 GBP	1 month		
preconfigured personal computer		1	pc	£1.423,79		1.423,79 GBP		1.423,79 GBP	1 month		
Ethernet switch 5port unmanaged		1	pc	£79,38		79,38 GBP		79,38 GBP	1 month		
VPN Switch brand ewon		1	pc	£689,12		689,12 GBP		689,12 GBP	1 month		
Profibus plug brand SIEMENS		2	pc	£45,25	90,51 GBP			90,51 GBP	1 month		

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<b>Electrical parts</b>											
<b>Electrical cabinet</b>											
digital output for für NEMO 96/	Keil	1	pc	£33,84			33,84 GBP	33,84 GBP	1 month		
analog output for NEMO 96/		1	pc	£225,49			225,49 GBP	225,49 GBP	1 month		
power Network monitor Nemo 96/HD		1	pc	£309,51			309,51 GBP	309,51 GBP	1 month		
battery modul 3,2Ah PVA24/3,2Ah		1	pc	£141,15		141,15 GBP		141,15 GBP	1 Month		
power supply 230VAC / 24VDC 5A PVSE230/24-5		1	pc	£157,76		157,76 GBP		157,76 GBP	1 month		
power supply 400VAC / 24VDC 10A PVSE400/24-10		1	pc	£208,48		208,48 GBP		208,48 GBP	1 month		
power supply 400VAC / 24VDC 20A PVSE400/24-20		1	pc	£215,61		215,61 GBP		215,61 GBP	1 month		
NH-fuse gL/gG 50A Gr.000 3NA3820		3	pc	£2,24	6,73 GBP			6,73 GBP	1 month		X
NH-fuse gL/gG 63A Gr.000 3NA3822		3	pc	£2,24	6,73 GBP			6,73 GBP	1 month		X
NH-fuse gL/gG 80A Gr.000 3NA3824		3	pc	£2,24	6,73 GBP			6,73 GBP	1 month		X
NH-fuse gL/gG 100A Gr.000 3NA3830		3	pc	£2,24	6,73 GBP			6,73 GBP	1 month		X
NH-fuse gL/gG 125A Gr.00 3NA3832		3	pc	£3,44	10,32 GBP			10,32 GBP	1 month		X
NH-fuse gL/gG 125A Gr.000 3NA3832-8		3	pc	£12,59	37,77 GBP			37,77 GBP	1 month		X
power contactor 230VAC 15kW Bgr.S0 1Ö+1S 3RT2027-1AP00		1	pc	£82,38		82,38 GBP		82,38 GBP	1 month		
power contactor 230VAC 18,5kW Bgr.S0 1Ö+1S 3RT2028-1AP00		1	pc	£92,25		92,25 GBP		92,25 GBP	1 month		
power contactor 230VAC 18,5kW Bgr.S2 1Ö+1S 3RT2035-1AP00		1	pc	£98,87		98,87 GBP		98,87 GBP	1 month		
power contactor 230VAC 22kW Bgr.S2 3RT1036-1AP00		1	pc	£125,74		125,74 GBP		125,74 GBP	1 month		
power contactor 230VAC 37kW Bgr.S3 3RT1045-1AP00		1	pc	£208,79		208,79 GBP		208,79 GBP	1 month		
power contactor 24VDC 4kW Bgr.S00 1S 3RT2016-1BB41		1	pc	£29,00		29,00 GBP		29,00 GBP	1 month		
power contactor 24VDC 4kW Bgr.S00 1Ö 3RT2016-1BB42		1	pc	£28,86		28,86 GBP		28,86 GBP	1 month		
power switchgear 2,8-4A Bgr.S00 3RV2011-1EA10		1	pc	£47,28		47,28 GBP		47,28 GBP	1 month		
power switchgear 18-25A Bgr.S0 3RV2021-4DA10		1	pc	£71,40		71,40 GBP		71,40 GBP	1 month		
power switchgear 28-36A Bgr.S2 3RV2031-4PA10		1	pc	£134,71		134,71 GBP		134,71 GBP	1 month		
softstarter 24VDC 11kW Bgr.S0 3RW4026-1BB04		1	pc	£299,61		299,61 GBP		299,61 GBP	1 month		
softstarter 24VDC 18,5kW Bgr.S0 3RW4028-1BB04		1	pc	£426,67	426,67 GBP			426,67 GBP	1 month		X
softstarter 24VDC 22kW Bgr.S2 3RW4036-1BB04		1	pc	£506,49		506,49 GBP		506,49 GBP	1 month		
softstarter 24VDC 37kW Bgr.S2 3RW4038-1BB04		1	pc	£698,96		698,96 GBP		698,96 GBP	1 month		
additional contactor for 5SY 1NO+1NC 5ST3010		1	pc	£9,97		9,97 GBP		9,97 GBP	1 month		
low voltage control >N< AC 230/400V 1W 5TT3400		1	pc	£70,71		70,71 GBP		70,71 GBP	1 month		
over voltage control 4-pol. 230/400V DV M TNS 255 FM, 951405		1	pc	£548,04		548,04 GBP		548,04 GBP	1 month		
thermal overload control 230VAC / 50/60Hz MK 9163N.12/110 ATEX		1	pc	£57,31	57,31 GBP			57,31 GBP	1 month		X
emergency modul 24V AC/DC 3NO+1NC		1	pc	£144,35	144,35 GBP			144,35 GBP	1 month		X
relay 24V DC 1W 6A 38.51.0.024.0050 VE=10		1	pc	£6,47	6,47 GBP			6,47 GBP	1 month		X
relay 24V DC 2W 8A 38.52.7.024.0050 VE=10		1	pc	£8,42	8,42 GBP			8,42 GBP	1 month		X
current converter 35mm 25-225A / 4-20mA / 10-34VDC TT1AB252A		1	pc	£137,81	137,81 GBP			137,81 GBP	1 month		X
fuse 5x20mm flink F 40mA, 520.603 VE=10		1	pc	£0,83	0,83 GBP			0,83 GBP	1 month		X
fuse 5x20mm mittelträge M 400mA, 521.013 VE=10		1	pc	£0,12	0,12 GBP			0,12 GBP	1 month		X
Lenze frequency converter 5,5kW i550-C5,5/400-3 400V		1	pc	£992,00		992,00 GBP		992,00 GBP	1 month		
Lenze frequency converter 18,5kW i550-C18,5/400-3 400V		1	pc	£1.432,19		1.432,19 GBP		1.432,19 GBP	1 month		
Lenze frequency converter 22kW i550-C22/400-3 400V		1	pc	£2.153,00		2.153,00 GBP		2.153,00 GBP	1 month		

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Item	Supplier / maintenance intervall period / BH	Qty	Unit	Price / Unit	Priority 1	Priority 2	Priority 3	Total	delivery time	Order (X)	Intending to order by NewE
<b>Measurements</b>											
Flow meter substrate Promag DN 150 - 6"	E&H	1	pc	£1.888,90	1.888,90 GBP			1.888,90 GBP	2 month		
Level measurement Prosonic M FMU 40, +Display, 5m		1	pc	£677,49	677,49 GBP			677,49 GBP	2 month		
Pressure transmitter gas Cerabar T PMC131 -20...+20mbar		2	pc	£194,58	389,17 GBP			778,34 GBP	2 month		
Pressure transmitter water Cerabar T PMC131 heating system, 0...4bar		1	pc	£132,89	132,89 GBP			132,89 GBP	2 month		
Pressure transmitter water Cerabar T PMC131 heating system, 0...10bar		1	pc	£156,62	156,62 GBP			156,62 GBP	2 month		
Pressure transmitter substrate Cerabar T PMP131 level tank 0...1bar		1	pc	£150,68	150,68 GBP			150,68 GBP	2 month		
Pressure transmitter substrate Cerabar T PMP131 level tank 0...1bar (EX)		1	pc	£293,06	293,06 GBP			293,06 GBP	2 month		
Temperature transmitter TSM187 0-100°C 400mm		1	pc	£137,63	137,00 GBP			137,63 GBP	2 month		
Temperature transmitter TR10 0-100°C 400mm, Ex		1	pc	£372,33	63,00 GBP			372,33 GBP	2 month		
Level sensor Liquipoint T FTW31 - overflow transmitter (Ex)		1	pc	£92,55	92,55 GBP			92,55 GBP	2 month		
Temperature transmitter Easytemp length100mm 0-100°C		1	pc	£119,84	119,84 GBP			119,84 GBP	2 month		
Conductive point level switch; Nivotester FTW325		1	pc	£131,70	131,70 GBP			131,70 GBP	2 month		
Active barrier loop; RN221N		1	pc	£129,33	129,33 GBP			129,33 GBP	2 month		
Universal process transmitter with control unit; RMA42		1	pc	£281,20	281,20 GBP			281,20 GBP	2 month		
Active barrier loop; KCD2-STC-Ex1	Sonepar	1	pc	£207,64	207,64 GBP			207,64 GBP	2 month		
Float Switch		2	pc	£45,28	90,55 GBP			181,11 GBP	2 weeks		
<b>Valves</b>											
<b>Substrate valves</b>											
Ebro											
Valve DN80 hand wheel		1	pc	£198,62		198,62 GBP		198,62 GBP	2 weeks		
Valve DN150 pneumatic drive		1	pc	£474,60	474,60 GBP			474,60 GBP	2 weeks		
Valve DN150 hand wheel		1	pc	£294,72			294,72 GBP	294,72 GBP	2 weeks		
Valve DN200 WB12 manual lever		1	pc	£661,59			661,59 GBP	661,59 GBP	2 weeks		
Valve DN200 pneumatic drive		1	pc	£629,55			629,55 GBP	629,55 GBP	2 weeks		
Valve DN200 hand wheel		1	pc	£384,42		384,42 GBP		384,42 GBP	2 weeks		
Valve DN250 pneumatic drive		1	pc	£781,66		781,66 GBP		781,66 GBP	2 weeks		
Pnymatic drive EC125.1-165		1	pc	£284,76	284,76 GBP			284,76 GBP	2 weeks		
<b>Gas accumulator roof</b>											
<b>Air Blower</b>											
Karl Klein											
Air blower DNG4-14/S		1	pc	£517,77	517,77 GBP			517,77 GBP	2 month		
<b>Gas analyzer</b>											
<b>INCA 1000/3000/4000</b>											
Union Instruments											
Filter set f. INCA 1000/3000/4000	annually	1	pc	£64,73		64,73 GBP		64,73 GBP	3 weeks		
Water protection 1/8" NPT	annually	2	pc	£79,61		159,22 GBP		159,22 GBP	3 weeks		
Pump group INCA air (P1-V1)		1	pc	£365,00		365,00 GBP		365,00 GBP	1 week		
EC-Sensor H2S (will be delivered by the responsible technican)	annually	2	pc	£460,00		920,00 GBP		920,00 GBP	3 weeks		
EC-Sensor O2 (will be delivered by the responsible technican)	annually	2	pc	£477,00		954,00 GBP		954,00 GBP	3 weeks		
<b>Gas flare</b>											
<b>FlareProducts</b>											
UV-S sensor		1	pc	£557,65	557,65 GBP			557,65 GBP	1 week		
Burner control unit BCU		1	pc	£1.447,52		1.447,52 GBP		1.447,52 GBP	1 week		
Ignition transformer 7,5-12/100W		1	pc	£468,66		468,66 GBP		468,66 GBP	1 week		
spark plug, connector & cap >>> standard		1	pc	£183,91	183,91 GBP			183,91 GBP	1 week		
Motorized Valve		1	pc	£7.712,20		7.712,20 GBP		7.712,20 GBP	1 week		
spark plug cable >>> l=3000mm		1	pc	£53,39	53,39 GBP			53,39 GBP	1 week		
					<b>15.078,19 GBP</b>	<b>87.245,74 GBP</b>	<b>41.543,58 GBP</b>	<b>145.191,13 GBP</b>			



## **Raw Materials List**

**Prepared for: Bioconstruct NewEnergy Ltd**

**By:**

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**Date: February 2025**



## EnviroSolution Ltd

### Document Verification

<b>Site Address</b>	Arrow Bio Waste Recycling Facility, Weighbridge Road, Deeside Industrial Park, Deeside, CH5 2LL		
<b>Report Title</b>	Raw Materials List		
<b>Job Number</b>	ES2502	<b>Document Ref.</b>	ES2502-1
<b>Date Issued</b>	28 <sup>th</sup> February 2025	<b>Report Version</b>	Final
<b>Prepared by</b>	James Meredith	<b>Signature</b>	
<b>Checked by</b>	Gemma Lucas	<b>Signature</b>	

### Disclaimer

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## 1 Introduction

Envirosolution Ltd has prepared this formal Raw Materials List to support the Permit application for the Arrow Bio Waste recycling facility at Deeside industrial estate.

## 2 Table 1 Raw Materials List

Product	Maximum Quantities Used Per Year	Use of Raw Materials in the Facility	Potential Environmental Impact	Storage Arrangements
Fuels and Oils – Engine Oil	4000 litres	CHP engines.	Toxic to animals and humans. Can have long term, persistent impacts if areas of land or water become contaminated following uncontrolled release. Also, direct physical impact on aquatic environment if lost to sewer, via exclusion of oxygen, and physical impacts by coating plants and animals.	Stored in 1,000 litre dedicated tank inside engine container.
Diesel	On average 350 litres per month per wheel loader working 2-3 hours a day.	Operation of vehicles on site.	As above.	Stored in dedicated integrally bunded store in outer compound.
Propane	336t	Injected into upgraded biomethane to bring final gas to required calorific value.	As above.	12 tonnes max capacity at any one time at the site in 6x 2t above ground tanks.
Ferric Chloride	200t	Addition to digesters to manage hydrogen sulphide.	Corrosive – will cause skin irritation to humans and animals if it comes into contact.	Stored in HDPE tank inside process building which is located in bunded area.

Product	Maximum Quantities Used Per Year	Use of Raw Materials in the Facility	Potential Environmental Impact	Storage Arrangements
Trace elements	Unknown at present.	Dosing of digesters to maintain health of bacterial community .	May have short term localised impacts if uncontrolled release, depending on nature of bespoke mix.	Stored indoors on sealed surface in small containers raised up on pallets or in plastic containers.
Grease	60 litres of grease year dependant on feedstock.	Maintenance of site machinery.	Can cause blockages to infrastructure leading to uncontrolled releases of substances to the environment.	Stored in small plastic cartridges in indoor store.
Water for process	560,000 litres dependant on feedstock and other liquids available for use in the process	Addition to process material to optimise digestion process and usage in odour abatement system.	No identified impact. Component of final digestate spread to land.	Stored in water buffer tanks located inside main waste reception building.
Water for washing	500,000 litres pa. to wash down areas, 2000 litres a day maximum on average.	Washing of vehicles and yard areas.	Potentially lightly contaminated with oils, grit, mud, wastes or digestate, which may impact on the aquatic environment in a variety of ways if uncontrolled release.	Mains water or harvested rainwater stored in buffer tanks located inside main waste reception building
Oxygen	Unknown at present.	Injection into head of digesters for management of hydrogen sulphide.	Generated as required in small amounts and injected immediately so little potential for impacts.	Generated when needed for via oxygen generator so no storage facility required.

Product	Maximum Quantities Used Per Year	Use of Raw Materials in the Facility	Potential Environmental Impact	Storage Arrangements
Activated carbon (Gas Clean Up)	168t of active carbon per year filling: 2 x 8te 3 x 4te filters once every 8 weeks on a medium level of sulphate content in feedstock.	Maintenance of Carbon filters in upgrading unit and odour abatement system.	Replaced/removed by outside contractor responsible for maintaining equipment.	Material contained inside operating equipment. Replacement media brought to site on an as needed basis – no storage of raw material at the site.
Activated carbon (Odour Abatement)	44te of active carbon per year (2 exchanges)	Maintenance of odour abatement system.	Replaced/removed by outside contractor responsible for maintaining equipment.	Material contained inside operating equipment. Replacement media brought to site on an as needed basis – no storage of raw material at the site.
Glycol	1000 litres.	Use for weather protection in pressure relief valves and engines.	High BOD liquid – will have impact on water quality if released to ground water or surface water.	Stored on concrete surfaces on mobile bund or in inside store on a mobile bund.
Biocides - Disinfectant	50 litres of disinfectant a year on 2 x wheel washes, 6 x foot mats.	Use in foot dips, and to sterilise equipment when required.	Irritant to staff if inhaled/on skin. Accidental release to sewer may have an impact on aquatic environment or operation of sewage treatment plant.	Stored in approx. 25l plastic tubs in indoor store.
Pesticides - Rodenticide -	Small amounts in bait stations laid by contractor.	Use in designated bait stations for management of pests on site.	Anticoagulant may impact on other wildlife if not controlled in suitable bait stations.	Stored off site and provided by pest control contractor as needed.

Product	Maximum Quantities Used Per Year	Use of Raw Materials in the Facility	Potential Environmental Impact	Storage Arrangements
De Greaser	25 litres.	Maintenance of site machinery.	Potential short-term impact of uncontrolled releases of synthetic chemicals to the receiving environment. Will vary depending on the product type and use.	Stored in indoor store.
Cleaning Products	200 litres of floor and wall/surface cleaner a year of varied strengths and applications.	Cleaning of domestic facilities	Potential short-term impact of uncontrolled releases of synthetic chemicals to the receiving environment. Will vary depending on the product type and use.	Small containers stored in the lab and staff welfare areas.
Lab Chemicals	Deionised Water - 65l Sulfuric Acid - 7l Buffer pH Solution 4.01 – 2.5l Buffer Solution pH 7 – 2.5l Buffer Solution pH 10.01 – 2.5l Spectrophotometer cuvette reagents – 3l	Analysis of waste, digestate, and environmental impacts for ongoing monitoring activities and waste acceptance procedures. Spend chemicals collected by supplier for disposal.	Will vary depending on chemicals. Accidental release to sewer may impact on aquatic environment or operation of sewage treatment plant.	Small volumes stored in packaging provided by lab supply provider in trays inside the lab container.

Product	Maximum Quantities Used Per Year	Use of Raw Materials in the Facility	Potential Environmental Impact	Storage Arrangements
Gas Odorant (Tertiary Butyl Mercaptan And Dimethylsulphide)	Estimate 0.42 tonnes	Injected into upgraded biomethane to give the gas an odour to allow early detection in the event of a leak.	Even small amounts will cause a strong smell of gas and may create impacts on amenity due to odours. Also impacts on perception of releases/safety factors at the site.	Odorant is not stored on site, only one GA50 bottle in use is kept on site, this is delivered with a maximum of 40kg fill. Robinson brothers exchange the near empty bottle with a full GA50 at low level alarm. Connection is made using dry fit couplings. <a href="https://www.robinsonbrothers.uk/capabilities/gas-odorant">https://www.robinsonbrothers.uk/capabilities/gas-odorant</a>
Sulfuric acid	Unknown at present.	For use in the ammonium washing unit within the gas upgrading compound.	Toxic and corrosive to humans and animals. Acidification of water systems and impact on aquatic environments.	In bunded IBCs within the bunded area/technical building.



## **Site Condition & Baseline Report**

**Prepared for: BioConstruct  
NewEnergy Ltd**

**By:**

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3a Bridgewater Street



Liverpool

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**February 2025**



## EnviroSolution Ltd Document Verification

<b>Site Address</b>	Arrow Bio Waste Recycling Facility, Weighbridge Road, Deeside Industrial Park, Deeside, CH5 2LL		
<b>Report Title</b>	Site Condition & Baseline Report		
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<b>Prepared by</b>	Melvin Thomas	<b>Signature</b>	
<b>Checked by</b>	Gemma Lucas	<b>Signature</b>	

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## FIGURES

### Appendix A Baseline Report

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## 1 Introduction and Stage 1

### 1.1 Instruction

EnviroSolution Ltd were commissioned by TCE to prepare a Site Condition and Baseline Report for their proposed development of a new waste management facility in Deeside, North Wales, in accordance with the requirements of the Industrial Emissions Directive, 2010/75/EU (IED).

As part of the IED, there is a requirement to prepare a Baseline Report to provide information on the state of soil and groundwater contamination by relevant hazardous substances. The characterisation of any contamination of the soil and groundwater identified in the Baseline Report should be sufficiently detailed since this information will be used to determine whether or not the operation of the component manufacturing has generated soil or groundwater contamination since the baseline has been established. The baseline report will be used for a comparison with the state of contamination upon cessation of permitted activities.

The provisions concerning the baseline report are outlined in the European Commission (EC) Guidance concerning baseline reports under Article 22(2) of the IED.

Article 22(2) specifies that a baseline report should contain at least the following information:

- Information on the present and past uses of the site; and
- Where available, existing information or, new soil and groundwater measurements having regard for the possibility of soil or groundwater contamination by hazardous substance used by the installation.

### 1.2 Site Location

The Installation is located off Weighbridge Road within Zone 4 of Deeside Industrial Estate, immediately north of Flintshire Bridge Converter station and immediately south of Parc Adfer Wheelabrator ERF waste management site.

The Installation is located at National Grid Reference SJ 31114 71232 (approx.). The location is shown on **Figure 1**.

### 1.3 Information Sources

A Phase 2 Site Investigation Report prepared by Caulmert Limited in March 2021 (titled 'Deeside Waste Management Facility, Deeside Industrial Estate Logik WTE Limited Phase 2 Site Investigation Report' document reference: 4701-CAU-XX-XX-RP-V-0305.S4.P1)

The British Geological Survey Geindex database has been used to provide information on geo-environmental aspects of the land associated with the Installation and the immediate surrounding area such as geological, hydrogeological, and hydrological data.

The Natural Resources Wales (NRW) website ( [www.naturalresourceswales.gov.uk](http://www.naturalresourceswales.gov.uk)) and Magic website ([www.magic.gov.uk](http://www.magic.gov.uk)) were used to obtain additional relevant environmental information.

Industry Profiles produced by the Department of the Environment were utilised to obtain information on processes, materials and wastes associated potential contaminative land uses in the vicinity of the Installation.

#### 1.4 Stage 1: Identify All the Hazardous Substances

The EC Guidance requires that a list of all hazardous substances that are currently used, produced or released at the Installation is prepared. The list should include the hazardous substances associated with both the IED Annex I activities and directly associated activities which could influence soil and groundwater pollution.

The chemicals used at the Installation that meet any of the requirements in Annex I, Parts 2 to 5 that determines them to be hazardous are shown in **Table 1** in Section 2.

## 2 Stage 2: Identify the Relevant Hazardous Substances

This stage requires that the potential pollution risks of all hazardous substances identified in Stage 1 be determined by considering their chemical and physical properties. This information should be used to determine whether the substances have the potential to cause pollution of soil and groundwater.

Table 1 summarises the potential pollution risks associated with the hazardous substances stored at the Installation. Materials considered to be relevant hazardous substances (and potentially capable of polluting soil and/or groundwater) under IED Annex 1 are marked in the final column.

**Table 1: Summary of Potential Pollution Risk of Hazardous Substances**

Substance	Composition	Hazard Statements	Physical State	Solubility	Toxicity	Mobility	Persistence	Soil/Groundwater pollution potential	Quantity	RHS Yes/No
<b>Raw Materials</b>										
Fuels and Oils – Engine Oil	Petroleum distillates, solvent-refined heavy paraffinic 0-100% Lubricating oils, petroleum, hydrotreated spent 3-100%	None needed according to classification criteria.	Liquid	Insoluble in water	NDA	NDA	Moderate	Major constituents are inherently biodegradable but contains components that may persist in the environment.	4000 litres	Yes
Diesel	Fuels, diesel ≥75 Alkanes, C10-20-branched and linear ≤20	H227, H315, H332 H351, H373	Liquid	Very slightly soluble in water	High	High	Low	Spillages may penetrate the soil causing ground water contamination. This material may accumulate in sediments. Spills may form a film on water surfaces causing physical damage to organisms. Oxygen transfer could also be impaired.	350 litres	Yes
Propane	100		Gas	NDA	NDA	NDA	NDA	Not Applicable	336t	No
Ferric Chloride	100	H226, H290 H302, H314, H315, H318, H335, H411	Solid	soluble	High	Low	Low	Toxic to aquatic life with long lasting effects. This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.	200t	Yes
De-Foaming/Anti Foaming Agent	Siloxanes and Silicones, di-Me ≥10 - <25 benzoic acid <1	H319	Liquid. [Emulsion.]	soluble	Low	NDA	NDA	NDA	Approx. 2,000 litres	No
Grease	n-phenyl-1-naphthylamine <1 Hydroxyalkyl carboxylic acid ≤0.3	-	Grease	Insoluble in water	Low	Low	Low	No known significant effects or critical hazards.	60 litres	No
Water for process	H2O	-	Liquid	Soluble	Low	Low	Low	None	560,000 litres	No
Water for washing	H2O	-	Liquid	Soluble	Low	Low	Low	None	500,000 litres pa.	No
Oxygen	100	H270, H280	Gas	Low	Low	Low	Low	No ecological damage caused by this product.	Unknown at present.	No
Activated carbon (Odour Abatement)	100	-	Solid	NDA	NDA	NDA	NDA	NDA	50te	No
Activated carbon (Gas Clean Up)	100	H252	Solid	NDA	Low	Low	Low	Self-heating in large quantities; may catch fire	168te	No
Glycol	100	H373, H372, H370, H320, H302	Liquid	Soluble	High	High	Low	This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.	1000 litres.	Yes
Biocides - Disinfectant		H290, H303, H314	Liquid	Soluble	NDA	Low	NDA	NDA	50 litres	No
Gas Odorant (TERTIARY BUTYL MERCAPTAN and DIMETHYLSULPHIDE)		H225, H317, H411	Gas	NDA	NDA	Low	NDA	NDA	Estimate 0.42 tonnes	No

Substance	Composition	Hazard Statements	Physical State	Solubility	Toxicity	Mobility	Persistence	Soil/Groundwater pollution potential	Quantity	RHS Yes/No
Sulfuric acid		H290, H314, H318	Liquid	Soluble	NDA	NDA	NDA	This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.	Unknown at present.	No
Waste Materials										
Residual Waste	Mixed Non-Organics (Plastics, Cardboard, Films)	-	Solid	Insoluble in water	Low	Low	Low	NDA	Approx 6000te	No
Activated carbon (Odour Abatement)	100	- -	Solid	NDA	NDA	NDA	NDA	NDA	50t	No
Activated carbon (Gas Clean Up)	100	H252	Solid	NDA	Low	Low	Low	Self-heating in large quantities; may catch fire	50t	No

### 3 Stage 3: Assess the Site-Specific Pollution Possibility

From Table 1 it can be seen that there are a number of hazardous substances on the site which may theoretically have the potential to pollute soil, surface waters and/or groundwater. The operator does not produce any of these substances or knowingly release these substances in the environment.

Presented in Table 2 below is a summary of the volumes, mitigating factors and pollution prevention measures associated with these substances. At the end of the table is a Yes/No column indicating whether the RHS's propose and actual pollution risk taking into account any source-pathway-receptor linkages.

Based on the pollution prevention measures listed in Table 2, it is considered that the likelihood of pollution of soil, surface water and groundwater is highly unlikely.

**Table 2: Summary of Actual Pollution Risk for Relevant Hazardous Substances**

Substance	Mass/ Volume	Details of Existing Pollution Prevention Measures and Mitigating Factors	Actual Pollution Risk Yes/No
Fuels and Oils – Engine Oil	4000 litres	<p><b>1. Storage and Handling:</b></p> <ul style="list-style-type: none"> <li>• Engine oil is stored in designated, bunded areas with secondary containment capable of holding at least 110% of the largest container’s volume.</li> <li>• Containers are clearly labelled and kept away from heat sources to prevent degradation.</li> <li>• Spill kits and absorbent materials are readily available in storage and maintenance areas.</li> </ul> <p><b>2. Spill Prevention and Control:</b></p> <ul style="list-style-type: none"> <li>• Drip trays are used when dispensing oil to capture any spills or leaks.</li> <li>• Regular inspections of storage tanks, drums, and dispensing equipment are conducted to identify and address potential leaks.</li> <li>• Employees are trained in proper handling techniques and spill response procedures.</li> </ul> <p><b>3. Waste Management and Disposal:</b></p> <ul style="list-style-type: none"> <li>• Used engine oil is collected in dedicated waste oil containers and stored in a secure, bunded area.</li> <li>• Waste oil is disposed of via licensed waste management companies, ensuring compliance with environmental regulations.</li> <li>• Records of waste oil collection and disposal are maintained as part of environmental compliance documentation.</li> </ul> <p><b>4. Operational Controls:</b></p> <ul style="list-style-type: none"> <li>• Preventative maintenance schedules for machinery and vehicles minimize leaks and excessive oil usage.</li> <li>• Biodegradable or lower-toxicity alternatives are considered where feasible.</li> <li>• Good housekeeping practices, including regular cleaning of oil storage and maintenance areas, reduce the risk of contamination.</li> </ul> <p><b>5. Environmental Monitoring and Compliance:</b></p> <ul style="list-style-type: none"> <li>• Routine inspections and audits ensure adherence to pollution prevention measures.</li> <li>• Emergency response plans include specific procedures for oil spill containment and clean-up.</li> <li>• Compliance with relevant environmental legislation (e.g., Environmental Protection Act, Oil Storage Regulations) is regularly reviewed and updated.</li> </ul>	No
Diesel	350 litres	<b>1. Storage and Handling:</b>	

Substance	Mass/ Volume	Details of Existing Pollution Prevention Measures and Mitigating Factors	Actual Pollution Risk Yes/No
		<ul style="list-style-type: none"> <li>• Diesel is stored in bunded tanks with secondary containment designed to hold at least 110% of the largest tank’s volume to prevent leaks from contaminating the environment.</li> <li>• Double-skinned tanks and integrity-tested pipework reduce the risk of leaks.</li> <li>• Tanks and containers are clearly labelled and fitted with lockable dispensing systems to prevent unauthorized access.</li> <li>• Storage areas are located away from watercourses, drains, and sensitive habitats to minimize the risk of pollution.</li> </ul> <p><b>2. Spill Prevention and Control:</b></p> <ul style="list-style-type: none"> <li>• Automatic shut-off valves and overfill protection devices prevent accidental spillage during refuelling.</li> <li>• Drip trays are used under dispensing areas to capture minor leaks and drips.</li> <li>• Regular inspections of storage tanks, hoses, and pumps are conducted to detect wear and potential leaks.</li> <li>• Emergency spill kits, including absorbent materials and containment booms, are strategically placed near storage and refuelling areas.</li> </ul> <p><b>3. Refuelling Procedures:</b></p> <ul style="list-style-type: none"> <li>• Designated refuelling zones with impermeable surfaces and proper drainage prevent fuel from entering the soil or watercourses.</li> <li>• Supervised refuelling by trained personnel to minimize risks of overfilling or spillage.</li> <li>• Spill response procedures are in place, with staff trained in immediate containment and clean-up.</li> </ul> <p><b>4. Waste Management and Disposal:</b></p> <ul style="list-style-type: none"> <li>• Contaminated rags, absorbents, and fuel-soaked materials are stored in sealed, labeled containers and disposed of by a licensed waste contractor.</li> <li>• Waste fuel and residues are collected and managed as hazardous waste in accordance with environmental regulations.</li> </ul> <p><b>5. Environmental Monitoring and Compliance:</b></p> <ul style="list-style-type: none"> <li>• Routine site inspections ensure compliance with best practices and environmental regulations (e.g., Oil Storage Regulations, Environmental Protection Act).</li> <li>• Groundwater and soil monitoring may be conducted near storage areas to detect contamination.</li> <li>• Emergency response plans include specific protocols for dealing with diesel spills and leaks.</li> </ul>	No
Ferric Chloride	200 tonnes	<b>1. Storage and Handling:</b>	

Substance	Mass/ Volume	Details of Existing Pollution Prevention Measures and Mitigating Factors	Actual Pollution Risk Yes/No
		<ul style="list-style-type: none"> <li>• Dedicated, bunded storage areas with secondary containment designed to hold at least 110% of the largest container’s volume to prevent spills and leaks.</li> <li>• Corrosion-resistant tanks and pipework (e.g., PVC, HDPE, or rubber-lined steel) to prevent degradation and leaks.</li> <li>• Clearly labelled containers with appropriate hazard warnings and safety data sheets (SDS) available on-site.</li> <li>• Segregation from incompatible substances (e.g., bases, reducing agents, and organic materials) to prevent hazardous reactions.</li> </ul> <p><b>2. Spill Prevention and Control:</b></p> <ul style="list-style-type: none"> <li>• Drip trays used during transfer operations to capture minor spills.</li> <li>• Automated dosing systems to minimize manual handling and reduce spill risks.</li> <li>• Regular inspections of storage tanks, pipes, and pumps to detect early signs of corrosion or leaks.</li> <li>• Emergency spill kits, including neutralizing agents (e.g., lime or soda ash), absorbent materials, and PPE, are readily available.</li> </ul> <p><b>3. Safe Handling and Personal Protection:</b></p> <ul style="list-style-type: none"> <li>• Personnel training in chemical handling, emergency response, and proper PPE use.</li> <li>• Use of PPE (chemical-resistant gloves, goggles, face shields, and acid-resistant clothing) when handling ferric chloride.</li> <li>• Designated transfer areas with ventilation to prevent exposure to toxic fumes.</li> </ul> <p><b>4. Waste Management and Disposal:</b></p> <ul style="list-style-type: none"> <li>• Controlled disposal through licensed hazardous waste contractors, ensuring compliance with environmental regulations.</li> <li>• Used containers are rinsed, neutralized, and disposed of per hazardous waste guidelines.</li> <li>• Wastewater containing ferric chloride is treated in line with environmental discharge permits to prevent contamination of watercourses.</li> </ul> <p><b>5. Environmental Monitoring and Compliance:</b></p> <ul style="list-style-type: none"> <li>• Routine checks on containment integrity and chemical dosing systems.</li> <li>• Ground and surface water monitoring to detect potential contamination.</li> <li>• Compliance with COSHH regulations, the Environmental Protection Act, and Control of Major Accident Hazards (COMAH) regulations, where applicable.</li> </ul>	No
Glycol	1000 litres	<b>1. Storage and Handling:</b>	

Substance	Mass/ Volume	Details of Existing Pollution Prevention Measures and Mitigating Factors	Actual Pollution Risk Yes/No
		<ul style="list-style-type: none"> <li>• Bunded storage areas with secondary containment capable of holding at least 110% of the largest container’s volume to prevent spills from contaminating the environment.</li> <li>• Clearly labelled containers with hazard warnings, Safety Data Sheets (SDS) available on-site, and proper segregation from incompatible substances.</li> <li>• Corrosion-resistant tanks and pipework (e.g., stainless steel or HDPE) to prevent degradation and leaks.</li> <li>• Secure storage away from watercourses, drains, and heat sources to prevent accidental release and degradation.</li> </ul> <p><b>2. Spill Prevention and Control:</b></p> <ul style="list-style-type: none"> <li>• Drip trays used during transfer and dispensing to capture minor leaks and spills.</li> <li>• Automatic shut-off valves and controlled dosing systems to prevent overflows and accidental releases.</li> <li>• Regular inspections of storage tanks, hoses, and dispensing equipment to detect leaks or damage.</li> <li>• Spill kits containing absorbents, neutralizing agents, and PPE are readily available in handling areas.</li> </ul> <p><b>3. Safe Handling and Personal Protection:</b></p> <ul style="list-style-type: none"> <li>• Personnel training in chemical handling, emergency response, and proper PPE use (e.g., gloves, goggles, and chemical-resistant clothing).</li> <li>• Designated transfer and dispensing areas with proper ventilation to prevent inhalation exposure.</li> <li>• Use of closed-loop transfer systems where feasible to minimize the risk of spills.</li> </ul> <p><b>4. Waste Management and Disposal:</b></p> <ul style="list-style-type: none"> <li>• Waste glycol collection in dedicated, labelled containers for proper disposal by licensed hazardous waste contractors.</li> <li>• Separation of glycol from other waste streams to prevent contamination and ensure appropriate disposal or recycling.</li> <li>• Wastewater containing glycol is treated according to environmental discharge permits before release.</li> </ul> <p><b>5. Environmental Monitoring and Compliance:</b></p> <ul style="list-style-type: none"> <li>• Routine checks on containment integrity and dispensing equipment.</li> <li>• Ground and surface water monitoring to detect potential contamination.</li> <li>• Compliance with COSHH regulations, the Environmental Protection Act, and local water discharge regulations.</li> </ul>	<p>No</p>

## 4 Stage 4: Site History

### 4.1 Historical Ordnance Survey Map Review

The following is a summary of the site history provided in the existing Phase 2 report by Caulmert Limited, combined with publicly available information with respect to the development history of the site:

- The site is situated above the tidal marshes of the Dee Estuary. The land was reclaimed in circa the 1930s by the piping of sand from a borrow pit to the northeast of the site (the current Shotwick Lake Sailing Club) to raise the levels of the land by around 4m.
- An iron works was developed and expanded between circa the 1930s and 1950s. A cold press steel rolling building historically extended on the northern grass area of the site. In addition, large rectangular iron work buildings with chimneys and associated railway lines within the site were present from north to south along the western side of the site; however, these were demolished and remediated in the 1990s prior to the development of Shotton Combined Heat Power (CHP) Station.
- The former gas-fired Shotton CHP Power Station was constructed in 2001, comprising two gas fired turbines with a heat recovery steam generator, which ceased generating power and was subsequently demolished in 2012. During the demolition and restoration of the site, it was required that all buildings were removed, underground services removed, all pile foundations to a depth of 2m were to be scrubbed out and all demolition material not required for re-use elsewhere was crushed and screened on site and used to backfill and regrade the site, typically consisting of crushed brick and concrete. The only features retained were the asphalt entrance road onto site and the adjoining carpark in the southwestern corner of the power station area.

### 4.2 Previous Site Investigations

#### 4.3 Caulmert Limited - Phase 2 Site Investigation Report 2021

An intrusive ground investigation was undertaken at the site of the Installation in 2021. The works were undertaken to confirm the ground conditions beneath the site.

Caulmert Limited was commissioned to design and oversee the intrusive ground investigation and prepare an interpretative ground investigation report. The ground investigation work and laboratory analysis was carried out by Socotec.

The results of the investigation are reported in the following documents:

- Caulmert Limited, Phase 2 Site Investigation Report Deeside Industrial Estate
- Socotec, Deeside Industrial Park February 2021

The investigation comprised digging 22 trial pits, 7 shallow boreholes and 3 deep boreholes around the site. The trial pits were excavated using a wheeled-excavator and the boreholes were drilled with a cable-percussion drill rig. Standard Penetration Tests (SPTs) were conducted in the boreholes to collect geotechnical data about the ground encountered and soil samples were taken from both the boreholes and trial pits for chemical laboratory

analysis. Three of the shallow boreholes were installed with groundwater monitoring infrastructure.

The following areas around site were specifically targeted by the investigation:

- TP7, TP8, TP9 and SA1-4 to investigate the location of former ironworks buildings;
- BH5, TP1 and SA6 to investigate footprint of former air condensing units;
- TP7, BH1 and SA2 to investigate former location of diesel storage tanks;
- BH6 to investigate former water treatment area/sump;
- TP8, TP9, BH9 and BH10 to investigate grassed area in northern section;
- BH1, BH6 and BH9 installed with groundwater monitoring points; and,
- SA1-6 subjected to soakaway tests to determine infiltration rates in Made Ground.

Made Ground is present across the entire site, including the grassed area in the north. It consists of loose sandy demolition material on average 1.0m thick in the Power Station footprint and then into medium dense gravelly sands down to between 3.0 and 5.5, with the area to the north covered in thick grass over the sandy gravelly Made Ground. Within the footprint of the former Power Station, the Made Ground appeared to be homogenous comprising brown sandy gravel with cobbles of concrete and brick, occasional metal rebar and concrete boulders across the whole area. Whereas within the grassed area to the north, the Made Ground did not have the same demolition material layer, instead there was thick grass over gravelly sand, with different materials noted including clinker associated with the former iron works. This is consistent with the development history of the site, where it is understood that ground was 'remediated prior to the development of the former power station' whereas the grassed area falls outside of the Power Station footprint, located to the north.

The site investigation indicated the presence of three potential sources of contamination: hydrocarbons within the central area, timber containing hydrocarbons in the southwest and asbestos detected at low concentrations in the grassed area to the north. Asbestos was only detected.

Three groundwater monitoring points were installed around the site, no hydrocarbon contamination or significant levels of other pollutants were detected in any of the groundwater samples, indicating any potential localised pollution from the Made Ground at the site is not migrating into groundwater or affecting groundwater quality. The average groundwater level around the site was around 4.8m based on data from the monitoring wells and boreholes logs.

Full details of the findings are available within the Caulmert Limited, Phase 2 Site Investigation Report Deeside Industrial Estate.

#### 4.4 Pollution Incidents

There are no records of any major accidents such as spillages, leakages or loss of containment involving any hazardous substances at the land occupied by the Installation. In addition, the Installation is in the construction phase and not yet operational, therefore, there should not be any substances associated with the Installation processes present in the ground beneath the Installation.

## 5 Stage 5: Environmental Setting

### 5.1 Geology

Geological maps for the area indicate that the Installation is underlying with:

- Made Ground (Undivided);
- Tidal Flat Deposits; and
- Pennine Lower Coal Measures.

Artificial Made Ground deposits are indicated to be present onsite; a thickness of approximately 4 to 6 m below ground surface is expected based on intrusive ground investigation to the immediate north of the site and within the northern portion of the site (grassed area). The client has indicated that the power station site was demolished, and all foundations and slabs removed to a depth of 2 m. The client indicated and the provided restoration report indicated that suitable inert crushed demolition material has been used as backfill material across the central area of the site within the footprint of the former power station buildings.

Superficial deposits are recorded as Tidal Flat Deposits of soft silty clay, with interspersed layers of sand, gravel and peat. The previous ground investigations in the area show the site is underlain by dense, yellow fine to medium sand with occasional white shell and black organic wood fragments with a thickness of 18.88 m. The previous reports indicated that the deposits may extend to 20.00 or 30.00 m deep below the site.

Bedrock deposits are present as Pennine Lower Coal Measures of interbedded grey mudstone, siltstone and pale grey sandstone, and more numerous and thicker coal seams in the upper part. Approximately 5 m north of site the bedrock by sandstone of the Triassic aged Kinnerton Sandstone Formation. The nearest inferred sub-crop of a coal seam is situated approximately 700 m southwest of site. The nearest inferred fault is 800 m west of site. Bedrock was not encountered in any of the previous investigations in the vicinity of the site. The risk from mining or quarrying at the site is negligible.

### 5.2 Hydrogeology

The Tidal Flat superficial deposits are classified as a Secondary (undifferentiated) Aquifer. These are 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 soil type.

The bedrock deposits are classified as Secondary A Aquifer. These are 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.

The site is not located within a Source Protection Zone of a licensed groundwater abstraction. There are no groundwater abstractions within 1 km of the site.

Ground investigations encountered shallow groundwater typically between 5.5 and 6.6 m bgl (+4.3m to +4.5 m OD) within the Tidal Flat Deposits and exhibited a slight tidal variation of around 0.1m during a tidal cycle. No non aqueous phase liquids (NAPL), e.g. hydrocarbons, were recorded. It was also indicated that the general hydraulic gradient was to the east away from the River Dee.

### 5.3 Hydrology

The nearest Secondary River lies 15 m to the west of the site (a drain). A Primary River (another drain) lies 80 m to the east of the site, beyond the railway line. The nearest major river is the River Dee which lies 1.9 km south of the site.

The nearest surface water feature is noted as two small ponds approximately 40 m west from the site, with several reservoirs / pond features lie 300 m west of the site.

There are no surface water abstraction points or pollution incidents within 1 km of the site.

### 5.4 Waste Management Facilities

There is one historical landfill site recorded within 1 km of the Installation. This is:

Historic Landfill site	Operation dates	Waste type	Distance from site
Former British Steel Site - Shotton	1992 - 2000	NDA	870m N

### 5.5 Designated Environmentally Sensitive Sites

Following designated environmentally sensitive sites located within a 1km radius of the Installation:

#### *Sites of Special Scientific Interest*

Dee Estuary / Aber Afon Dyfrdwy  
Shotton Lagoons and Reedbeds

#### *Ramsar Sites*

The Dee Estuary

#### *Special Areas of Conservation*

Dee Estuary / Aber Dyfrdwy

#### *Special Protection Areas*

The Dee Estuary

## 6 Stage 6: Site Characterisation

### 6.1 Potential Contamination Sources

The operator employs modern storage methods and effective pollution control methods and procedures. Environmental control procedures in relation to the RHS's are listed in Table 2.

Accurate records of volumes of raw materials coming onto the Installation and volumes of materials used in the processes will highlight potential losses of hazardous substances through spillage or leakage. It has been concluded that the likelihood of sources of contamination originating from the Installation is very low.

The Installation is in the planning phase and not yet operational, therefore, there will be no contamination present in the ground beneath the Installation associated with its processes.

### 6.2 Receptors

The potential receptors considered to be at risk from soil and groundwater contamination associated with the site are summarised below.

**Table 3: Receptor Description**

Receptor	Details
Human (On Site)	<ul style="list-style-type: none"><li>- Site visitors</li><li>- Site users</li></ul>
Human (Off Site)	<ul style="list-style-type: none"><li>- Adjacent site users</li></ul>
Controlled Waters	<ul style="list-style-type: none"><li>- Ground water</li><li>- Surface waters</li></ul>
Soil (on site)	<ul style="list-style-type: none"><li>- Ground beneath the Installation</li><li>- Foundations/buried infrastructure</li></ul>

### 6.3 Pathways

The potential exposure pathways linking contamination with the receptors identified above are summarised in Table 4 below.

**Table 4: Exposure Pathways Summary**

Receptor	Details of Exposure Pathway
Human (on-site)	<ul style="list-style-type: none"><li>- Direct ingestion of contaminated soil/groundwater</li><li>- Dermal contact with soil/groundwater</li><li>- Inhalation of gases and vapours</li></ul>

Receptor	Details of Exposure Pathway
Human (off-site)	<ul style="list-style-type: none"> <li>- Inhalation of fibres and particulates (fugitive dust)</li> <li>- Inhalation of migrating gases and vapours</li> </ul>
Controlled waters	<ul style="list-style-type: none"> <li>- Vertical and lateral migration of contaminants</li> </ul>
Soil (on site)	<ul style="list-style-type: none"> <li>- Infiltration/percolation through permeable deposits</li> </ul>

## 6.4 Potential Pollution Linkages

### 6.4.1 Human Health

The presence of buildings and hardstanding at the site would eliminate the risk of exposure, via the dermal contact and ingestion pathways, to current and future sites users to any historic or novel contamination that may be present in the soil or groundwater. However, inhalation of gases (such as methane and carbon dioxide) and vapours associated with presence of any volatile organic contaminants beneath the site could be feasible.

### 6.4.2 Controlled Waters

There is limited potential for contamination to migrate via preferential pathways to the River Don as the presence of buildings and hardstanding will restrict infiltration.

### 6.4.3 Soil

There is limited potential for soils to be exposed to contamination from the site due to the presence of hardstanding and buildings at the site.

## 7 Stage 7: Ground Investigation

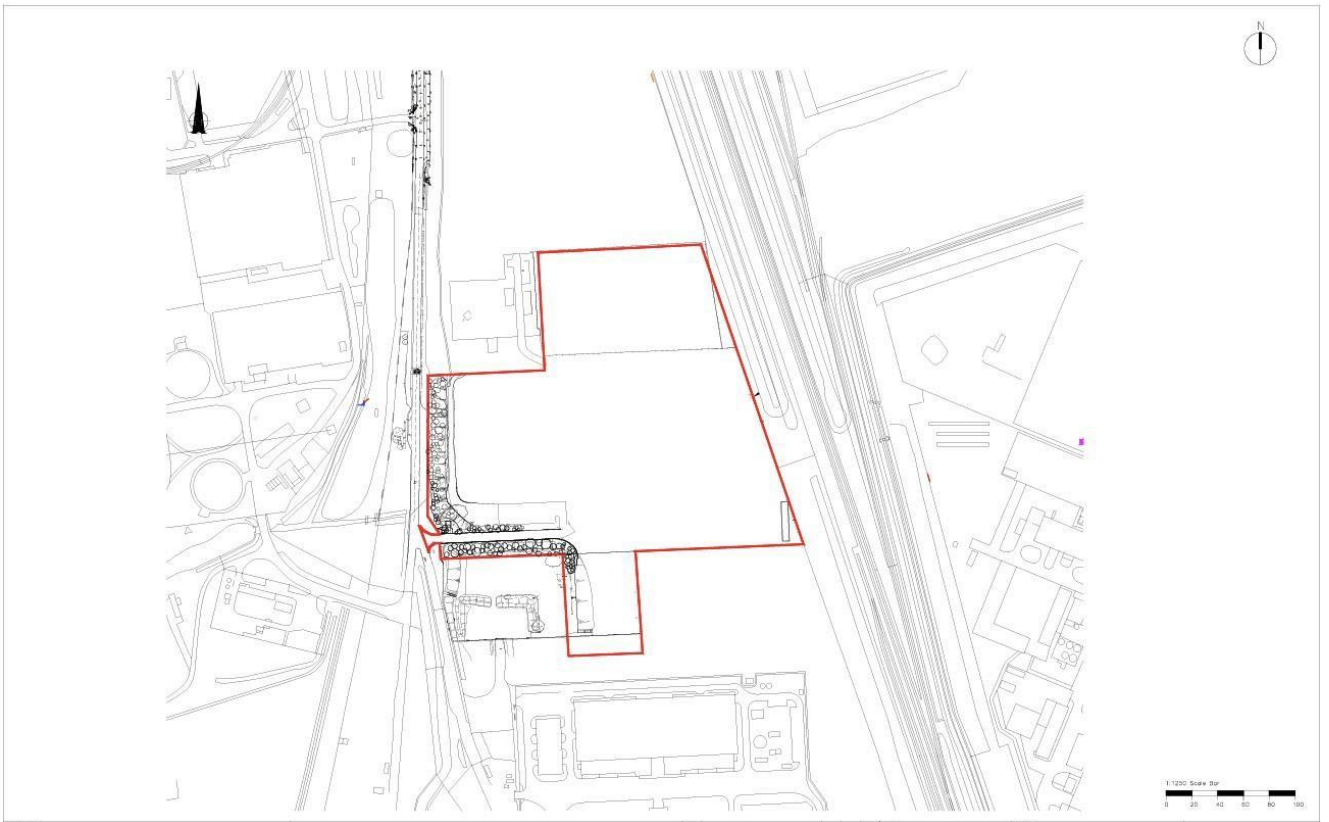
The detailed analysis of the use and storage of RHS's undertaken in Section 3 indicates that the current pollution risk from the Installation is very low. Therefore, it is not considered necessary to obtain any up-to-date information on the soil and groundwater conditions beneath the Installation once it is operational. Should future need arise through an increase in risk to the soil and groundwater beneath the Installation or if pollution incidents occur then a ground investigation may be necessitated.

## 8 Stage 8: Baseline report

The factual ground investigation report produced by Caulmert Limited and Socotec sample analysis report will form the Baseline report for the Installation. A copy of the report is included in **Appendix A**. The maximum recorded soil and groundwater concentrations for the substances analysed for as part of the investigation will form the baseline data for the Installation and this data should be used for comparison upon cessation of the Installation to inform the surrender of the environmental permit.

# FIGURES

**Figure 1: Site Location Plan**



# APPENDIX A

## Baseline Report

# Caulmert Limited

Engineering, Environmental & Planning  
Consultancy Services

**Deeside Waste Management Facility, Deeside Industrial Estate**

**Logik WTE Limited**

**Phase 2 Site Investigation Report**

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March 2021

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<b>Approved</b>	Sarah Venning (CEnv, C.WEM, MCIWEM, FGS, SoBRA, ASoBRA)	<b>Date</b>	11/03/2021

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**DRAWINGS**

4701-CAU-XX-XX-DR-V-1803.S2.P01      Site Investigation Exploratory Locations

## **APPENDICES**

<b>Appendix 1</b>	Trial Pit Photographs
<b>Appendix 2</b>	Laboratory Chemical Analysis Certificates – Soil & Groundwater
<b>Appendix 3</b>	Trial Pit Geological Logs
<b>Appendix 4</b>	Borehole Geological Logs (with SPT Results)
<b>Appendix 5</b>	Soakaway Test Results

## 1.0 INTRODUCTION

### 1.1 Background

- 1.1.1 Caulmert Limited was instructed by Logik WTE Limited to undertake a contaminated land Phase 2 Site Investigation at the former Shotton Power Station ('the site') in Deeside, North Wales, in order to discharge Condition 6 of Planning Permission 058270 for the proposed development of a new waste management facility.
- 1.1.2 The site is located off Weighbridge Road within Zone 4 of Deeside Industrial Estate, immediately north of Flintshire Bridge Converter station and immediately south of Parc Adfer Wheelabrator ERF waste management site, at postcode CH5 2LF and National Grid Reference SJ 31114 71232.
- 1.1.3 This report presents the findings from the ground investigation conducted at the site between 18<sup>th</sup> January and 4<sup>th</sup> February 2021 in order to identify the potential pollutant linkages found by both field-observations and chemical laboratory analysis of the ground conditions, and to develop a Conceptual Site Model (CSM) for the site. Photographs of the site and ground conditions are attached as Appendix 1 and the soil and groundwater sample chemical analysis certificates are presented in Appendix 2. The geological logs and geotechnical test results from the investigation are provided in Appendices 3, 4 and 5.

### 1.2 Objectives of Report

- 1.2.1 The objective of this report is to address Condition 6 of the Planning Permission 058270 in association with the proposed development as indicated in the extract below:

***"Contaminated Land***

*6. Prior to the commencement of development the following components of a scheme to deal with the risks associated with contamination of the site shall each be submitted to and approved in writing by the Local Planning Authority:*

*i) A preliminary risk assessment which has identified:*

- a) all previous uses;*
- b) potential contaminants associated with those uses;*
- c) a conceptual model of the site indicating sources, pathways and receptors;*
- d) potentially unacceptable risk arising from contamination at the site.*

*ii) A site investigation scheme, based on (i) to provide information for a detailed assessment of the risk to all receptors that may be affected, including those off site.*

*iii) The results of the site investigation and detailed risk assessment referred to in (ii) and, based on these, an options appraisal and remediation strategy giving full details of the remediation measures required and how they are to be undertaken.*

*iv) A verification plan providing details of the data that will be collected in order to demonstrate that the works set out in the remediation strategy in (iii) are complete and*

*identifying any requirements for longer term monitoring of pollutant linkages, maintenance and arrangements for contingency action.*

*The scheme shall be implemented as approved unless otherwise agreed in writing by the Local Planning Authority.*

*Reason: To ensure that the development of the site does not have an adverse impact on controlled waters which are of high environmental sensitivity and to protect future users of the site, in accordance with policies EWP 14 and EWP 16 of the adopted Flintshire Unitary Development Plan”.*

- 1.2.2 Therefore, the objective of this report is to provide a contaminated land risk assessment of the potential for unacceptable levels of contamination to be present at the site and to produce a Conceptual Site Model, identifying sources of possible ground contamination, potential pathways and sensitive receptors to the site based on the findings of the investigation.

### 1.3 Proposed Development

- 1.3.1 The site encompasses the footprint of the former Shotton Power Station and an area of grassed land to the north. The power station was constructed in the early 2000s and demolished in 2012, and this area is now derelict, with a surface of crushed construction material (mainly concrete and brick) and an old asphalt carpark area to the southwest. The section to the north is grassland with small areas of young trees and to the west of this area outside the site boundary is an electrical substation. The entire site is surrounded by security fencing with a lockable gate at the entrance. The site location is shown in Figure 1 below:

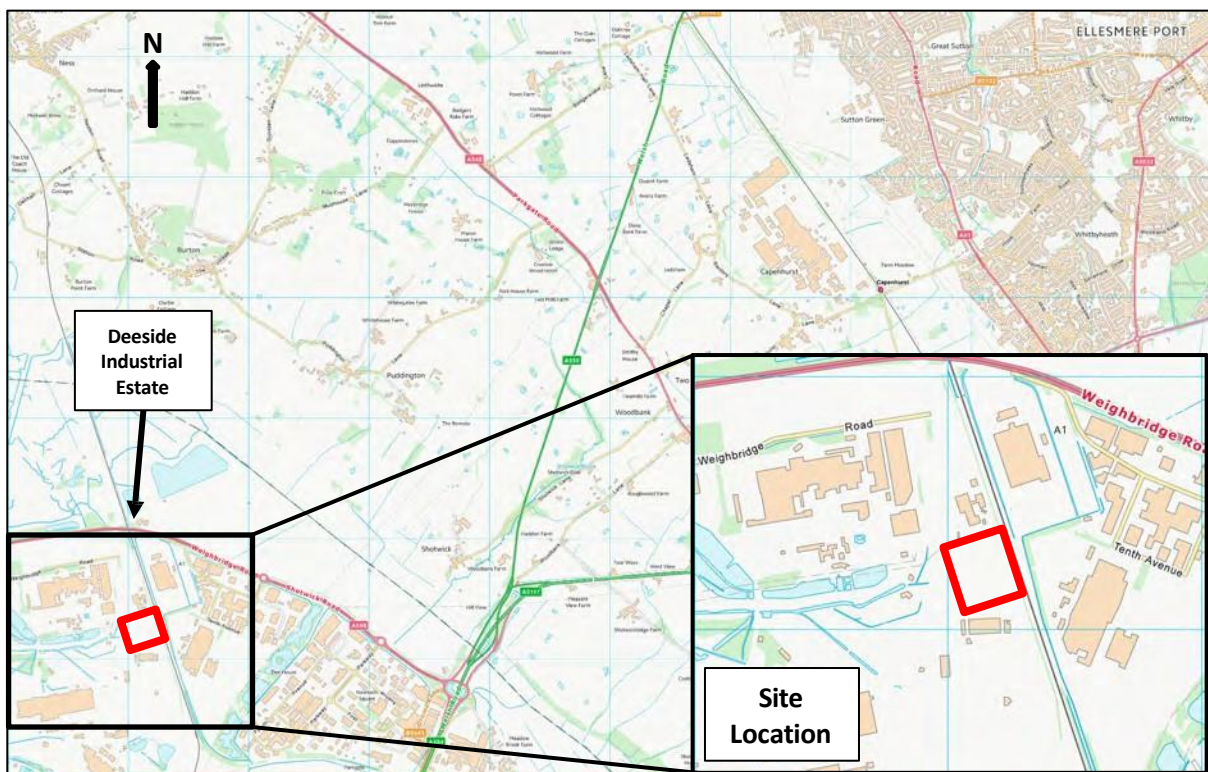


Figure 1 – Site Location

- 1.3.2 It is proposed to construct a Waste to Energy (WTE) Facility at the site for the management of municipal, commercial, and industrial waste comprising a Materials Recycling Facility (MRF), an Anaerobic Digestion Plant (AD Plant) farm and a Refuse-derived Fuel (RDF) Gasification Plant. The buildings and infrastructure will be constructed on top of hardstanding and will be installed with an engineered site drainage system.

## **1.4 Scope of Report**

- 1.4.1 This report reviews the geo-environmental information collected of the ground conditions encountered during the site investigation, which includes field observations and soil logs, photographs, the results of geo-technical testing and also the soil and groundwater laboratory chemical analysis data from samples taken at the site. From the data collected, a Conceptual Site Model (CSM) will be developed for the site area.

## **1.5 Previous Investigations**

- 1.5.1 A Phase 1 desk study report was written by TerraConsult Limited in October 2017 (titled 'Phase 1 Site Investigation Report', No.3484/06 Issue 1), and this report makes reference to the restoration scheme document of the former Shotton Power Station written by Enzygo (report ref. CRM.022.004.R.001A, November 2013) and a Site Condition Report written by Earth & Marine Environmental Consultants Ltd for the same site in August 2014. It also refers to two site investigation reports compiled by SLR Consulting Ltd for the Energy From Waste (ERF) site immediately to the north of the site (Wheelabrator) written in May 2013 (report ref. 416.04097.00003-01 and ref. 416.04097.00003-02).

## **1.6 Site History**

- 1.6.1 The following is a summary of the site history provided in the existing Phase 1 desk study report by TerraConsult Limited, combined with publicly available information with respect to the development history of the site:
- 1.6.2 The site is situated above the tidal marshes of the Dee Estuary. The land was reclaimed in circa the 1930s by the piping of sand from a borrow pit to the northeast of the site (the current Shottwick Lake Sailing Club) to raise the levels of the land by around 4m.
- 1.6.3 An iron works was developed and expanded between circa the 1930s and 1950s. A cold press steel rolling building historically extended on the northern grass area of the site. In addition, large rectangular iron work buildings with chimneys and associated railway lines within the site were present from north to south along the western side of the site; however these were demolished and remediated in the 1990s prior to the development of Shotton Combined Heat Power (CHP) Station.
- 1.6.4 The former gas-fired Shotton CHP Power Station was constructed in 2001, comprising two gas-fired turbines with a heat recovery steam generator, which ceased generating power and was subsequently demolished in 2012. During the demolition and restoration of the site, it was required that all buildings were removed, underground services removed, all pile foundations to a depth of 2m were to be scrubbed out and all demolition material not required for re-use

elsewhere was crushed and screened on site and used to backfill and regrade the site, typically consisting of crushed brick and concrete. The only features retained were the asphalt entrance road onto site and the adjoining carpark in the southwestern corner of the power station area.

## 2.0 CONCEPTUAL SITE MODEL

### 2.1 Preliminary Conceptual Site Model

2.1.1 The preliminary Conceptual Site Model (CSM) constitutes an initial or interim risk assessment which determines only the likelihood of a linkage being present, based on a desk study of available information.

2.1.2 A preliminary CSM was developed in the Phase 1 report written by TerraConsult Limited (No.3484/06 Issue 1), derived from a desk study undertaken in October 2017. A summary provided by Caulmert of the preliminary CSM is presented below and shown in Figure 2.

2.1.3 This preliminary CSM is updated by Caulmert in Section 5 of this report, to reflect the findings of the Phase 2 Site Investigation undertaken by Caulmert in January/February 2021 and the potential residual pollutant linkages at the site.

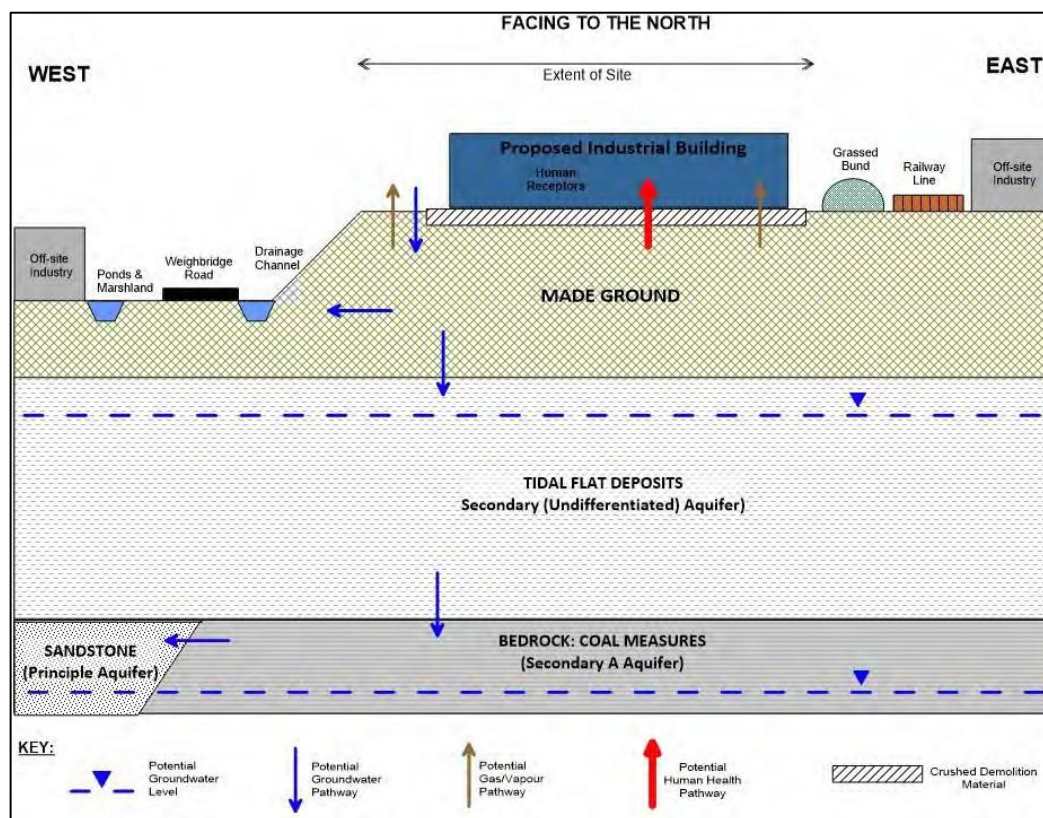


Figure 2 – Phase 1 Conceptual Site Model (based on TerraConsult Report No.3484/06)

2.1.4 The TerraConsult preliminary CSM can be summarised as follows:

#### Potential Sources

- Made ground in the central area of the site, mainly demolition material at the surface and Made Ground in the area to the north (the grassy area), including possible metal slag and clinker;
- Minor oil spills from storage of hydrocarbons on site and from site traffic during demolition and restoration of the site post-power station demolition;

- Expected low level concentrations of contaminants across the site, lower than relevant assessment criteria for an industrial end-use;
- Previous investigations in the local area have indicated very low risk of ground gases or vapours from the ground. The Made Ground is unlikely to be organic-rich and so unlikely to be producing concerning volumes of gas;
- Possible off-site sources of contamination include from historic railway lines/sidings and industrial depots to the east, the Energy From Waste (EFW) plant to the immediate north, the electrical substation to the immediate south and hydrocarbon contamination from adjacent road networks. Potential ground gas from reclaimed/infilled land in site area.

#### **Potential Receptors**

- Humans – current and future site users and off-site visitors and workers on adjacent industrial sites;
- Controlled waters – groundwater (perched within Made Ground, in natural Tidal Flat deposits and in underlying bedrock) and surface waters (including nearby surface water drains along Weighbridge Road and adjacent to site, surface water ponds and reservoirs within 40m and 300m vicinity, and the River Dee 1.9km to the south);
- Local flora and fauna; and,
- Building structures and services – current and future structures.

#### **Potential Pathways**

- During development/construction of new infrastructure/buildings – will require limited earthworks for foundations, with ground levels and services reducing long-term exposure of receptors to possible contaminants as development phase will be shorter - possible risk to human health via dust or water inhalation or ingestion, dermal contact with contaminants/Made Ground;
- Low possibility of risk from ground gas during developments works and low risk of ground gas diffusion or advection into buildings/through hardstanding;
- Post-construction the surface will be occupied mainly by hardstanding and buildings/infrastructure likely cutting off potential pathways to human receptors. All hazardous substances to be banded and correctly stored within containers and on hardstanding;
- Potential for contaminants to be leaching from the Made Ground into groundwater below the site must be considered during and after construction;
- Possible chemical attack on foundations and services and permeation of contaminants through clean water supply pipes – possible long-term health effects on humans; and,
- Potential for surface run-off of contaminated areas into local watercourses may be uncontrolled before and during the new construction phase due to lack of hardstanding areas (except old asphalt carpark area and access road).

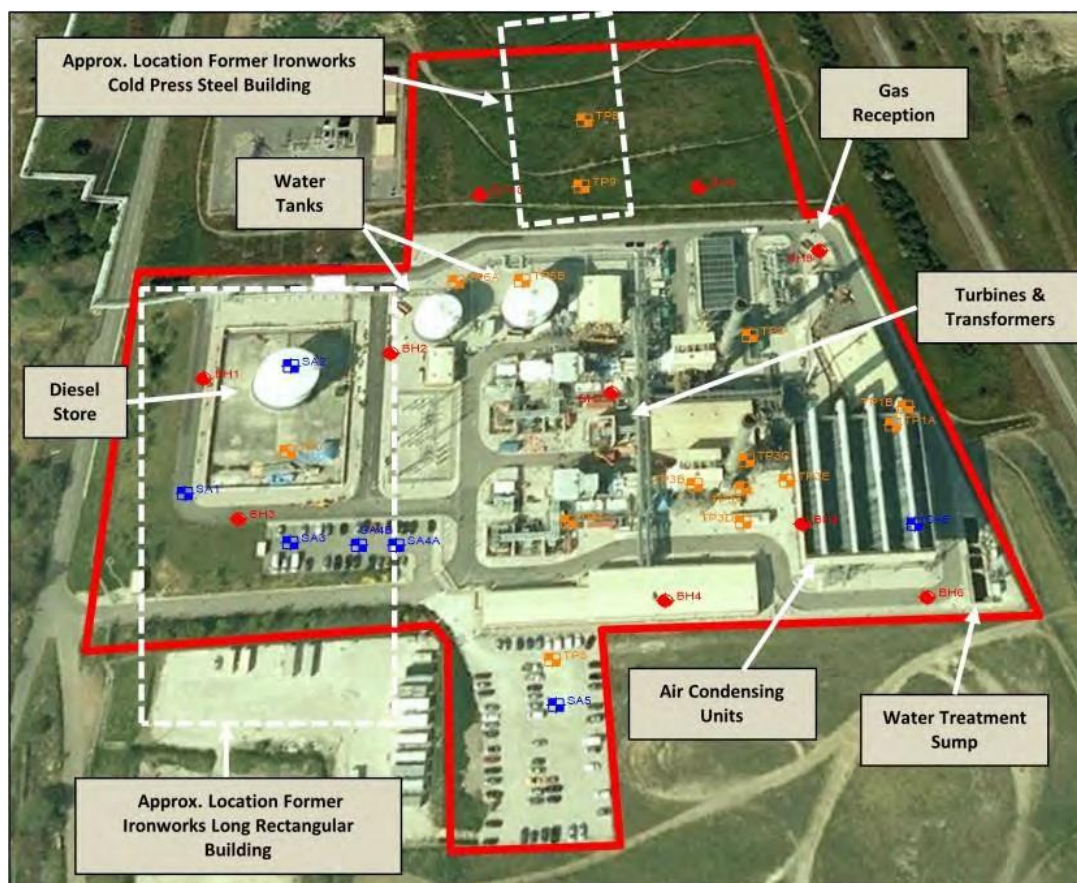
### 3.0 SITE INVESTIGATION - OVERVIEW

#### 3.1 Objectives

- 3.1.1 The Phase 2 Site Investigation for the site was designed to target the footprints of potentially contaminative areas from previous developments on site, namely the historic ironworks and later the former gas-fired Shotton Combined Heat Power (CHP) Station and associated infrastructure.
- 3.1.2 Another objective was to determine if there were any existing piles or foundations from previous structures still present below ground and to collect information on the general ground conditions across site, on a non-targeted basis.

#### 3.2 Sampling Strategy

- 3.2.1 The site investigation combined a targeted and non-targeted approach:
- 3.2.2 Boreholes were specifically located in areas of potentially historic contaminative land use, which included the former emergency diesel store for the power station and the locations of the turbines and transformers (shown in Figure 3 below, with site investigation boundary in red and exploratory positions labelled). The boreholes also targeted the former water treatment sump area and historic buildings associated with the former iron works.
- 3.2.3 The trial pits provided a non-targeted approach whilst investigating the composition of the Made Ground. Further information on ground conditions was also obtained during the completion of infiltration (soakaway) tests (see Section 4.7).



**Figure 3 – Former Shotton CHP Power Station Layout (photo: Google Earth, June 2009),**

3.2.4 The following areas around site were specifically targeted by the investigation:

- TP7, TP8, TP9 and SA1-4 to investigate the location of former ironworks buildings;
- BH5, TP1 and SA6 to investigate footprint of former air conditioning units;
- TP7, BH1 and SA2 to investigate former location of diesel storage tanks;
- BH6 to investigate former water treatment area/sump;
- TP8, TP9, BH9 and BH10 to investigate grassed area in northern section;
- BH1, BH6 and BH9 installed with groundwater monitoring points; and,
- SA1-6 subjected to soakaway tests to determine infiltration rates in Made Ground.

3.2.5 The investigation comprised digging 22 trial pits, 7 shallow boreholes and 3 deep boreholes around the site. The trial pits were excavated using a wheeled-excavator and the boreholes were drilled with a cable-percussion drill rig. Standard Penetration Tests (SPTs) were conducted in the boreholes to collect geotechnical data about the ground encountered and soil samples were taken from both the boreholes and trial pits for chemical laboratory analysis. Three of the shallow boreholes were installed with groundwater monitoring infrastructure. A location plan of all exploratory positions (trial pits and boreholes) is attached as drawing ref. 4701-CAU-XX-XX-DR-V-1803.S2.P01.

- 3.2.6 The trial pitting was conducted to various depths down to a maximum of 3.1m below ground level (bgl) and allowed for a detailed examination, lithological description and sampling of the soil arisings. Any visual or olfactory evidence of contamination was also recorded and photographs taken of each trial pit.
- 3.2.7 The drilling comprised 10 boreholes in total, with 7 shallow and 3 deep boreholes. The maximum depth of the shallow boreholes was 8m bgl, to investigate the Made Ground, and no more than 15m bgl for the deep boreholes, to investigate the geology further below the site. There were 3 shallow boreholes, placed strategically round the site, which were installed with pipework as groundwater monitoring points. SPTs were taken where possible at 1.0m intervals between 0m and 10m bgl, then every 1.5m thereafter. All arisings were recorded and described, and soil samples taken to characterise the ground conditions.
- 3.2.8 Soil sampling was undertaken at exploratory locations across the site to characterise the general conditions of the Made Ground, with more targeted sampling undertaken where there was any visual evidence of contamination suspected and a sample taken in the underlying layer where apparent. The power station was constructed after the use of asbestos containing materials (ACMs) had been banned for use in construction in the UK, therefore samples for asbestos testing were obtained solely within the top 1m of Made Ground, to reflect the level associated with the former historic iron workings.

### 3.3 Laboratory Analysis

- 3.3.1 The analytical suites for the soils and groundwater (Table 1 below) were targeted based upon the historic land uses at the site. The analytical suites contained a range of metals, and speciated and non-speciated hydrocarbons.

#### Soil Samples

- 3.3.2 Based on the historic land use of the iron works, the chemical analysis of the soils was targeted to assess for metals ions, hydrocarbons and asbestos.
- 3.3.3 The former land use of the Power Station post-dates the ban on polychlorinated bi-phenyls (PCBs) and these have therefore been excluded from the analytical suites on this basis. This is justified because the use of PCBs in new equipment was banned in the UK in 1981 and more recently, they were banned for use in existing equipment in 2000. Shotton Power Station was constructed in 2001 and therefore after the UK ban, meaning there is not a requirement to include these within the testing suite. Asbestos was banned in 1998 for use in construction and therefore legally it should not be present within the power station demolition material. Based on the previous industrial land use, the potential remains for asbestos to be present within the lower layers of Made Ground.
- 3.3.4 Contaminants associated with the former use of the Power Station are considered to be diesel associated with the former emergency fuel supply, lubricant oils and hydraulic oils associated with the turbines and transformers. These will all be captured by the Total Petroleum Hydrocarbons (TPH) analysis. Selected samples will be analysed on TPH Criteria Working Group (CWG) risk banded which will provide an indication on the nature of the hydrocarbon.

3.3.5 The analytical suites were tested for in a wide range of soil samples taken from across the site in order to evaluate the general levels of these pollutants (if any) present in the ground and provide benchmark site conditions prior to the new proposed development.

3.3.6 Table 1 below presents the scheduled analysis for a range of selected soil samples from the site. Not all soil samples sent to the laboratory were sent for chemical analysis. The green boxes with asterisks indicate the selected testing parameter for each soil sample.

**Table 1 – Analytical Test Suites - Soil**

Location / Sample	Description	Metals (As, Cd, Cr3, Cr6, Cr, Cu, Pb, Ni, V, Zn)	PAH	TPH	pH	TOC	Asbestos	Phenols
TP2 2.5m	Made Ground – Sand	*	*		*			
TP3a 0.8m	Made Ground – Sand	*	*	*	*	*	*	
TP3a 2.0m	Made Ground – Sand	*	*	*	*	*		
TP5 0.8m	Made Ground – Sand						*	
TP8 0.6m	Made Ground – Gravelly Sand						*	
TP9 0.5m	Made Ground – Gravelly Sand	*	*	*	*		*	
TP9 2.0m	Made Ground – Sand	*	*		*			
SA3 1.6m	Made Ground – Sand	*	*	*	*	*		*
BH1 0.5m	Made Ground – Sandy Gravel						*	
BH1 1.2m	Made Ground – Sandy Gravel	*	*	*	*			
BH1 5.5m	Made Ground – Gravelly Sand	*	*	*	*			
BH2 0.6m	Made Ground – Gravelly Sand						*	
BH2 1.5m	Made Ground – Sand	*	*		*			
BH2 5.0m	Made Ground – Sand	*	*		*			
BH4 0.7m	Made Ground – Sand	*	*		*		*	
BH5 3.5m	Natural - Sandy Silt	*	*	*	*			
BH6 0.5m	Made Ground – Gravelly Sand						*	
BH6 0.7m	Made Ground – Gravelly Sand	*	*	*	*			
BH7 3.5m	Made Ground – Sand	*	*	*	*			
BH8 0.5m	Made Ground – Sandy Gravel						*	
BH9 0.5m	Made Ground – Sandy Gravel						*	
BH9 2.5m	Made Ground – Gravelly Sand	*	*	*	*			

3.3.7 All soil samples were collected in appropriate containers supplied by the UKAS Accredited laboratory and stored securely within cool boxes, dispatched soon after collection.

3.3.8 The samples were analysed in accordance with the procedures set out in the Environment Agency's (EA) Monitoring Certification Scheme (MCERTS), where MCERTS methods are applicable. The testing laboratory used to complete the soils and groundwater analyses was SOCOTEC, who also supplied the cool boxes and appropriate sampling containers and labels.

#### Groundwater Samples

3.3.9 The groundwater suite reflects the likely soil contamination and specifically targets the potential presence of hydrocarbons within the groundwater.

3.3.10 Table 2 below presents the scheduled analysis for the groundwater samples taken from boreholes BH1, BH6 and BH9. The green boxes with asterisks indicate the selected testing parameter for each groundwater sample.

**Table 2 – Analytical Test Suites - Groundwater**

Location / Sample	Description	pH	Electrical Conductivity	NH4	Cl	Na	Fe	SO4	DOC	PAH	TPH	Metals (Cr, V, Mg, Ni, Cu, Zn, As, Cd, Hg, Pb)
BH1	Groundwater	*	*	*	*	*	*	*	*	*	*	*
BH6	Groundwater	*	*	*	*	*	*	*	*	*	*	*
BH9	Groundwater	*	*	*	*	*	*	*	*	*	*	*

3.3.11 Groundwater was tested to assess if any mobile contaminants were present within the water below site. Groundwater monitoring points were installed to also assess groundwater levels.

## 4.0 SITE INVESTIGATION - RESULTS

### 4.1 Preliminaries

- 4.1.1 The site investigation was undertaken between Monday 18th January and Thursday 4th February 2021. Weather overall was showery, cold and overcast for the most part, with occasional days of wintry sunshine and strong breezes. The average temperature was between 0 and 7°C. The predominant wind direction was from the west-southwest.
- 4.1.2 CC Geotechnical Limited provided a cable percussion rig and a two-man team for drilling the shallow and deep boreholes and undertaking the SPT tests, and an additional trained technician with water bowsers and CAT scanner for assisting with soakaway tests and scanning for underground services.
- 4.1.3 CC Geotechnical also organised for Thomas Plant Hire to provide a wheeled-excavator (termed a 'rubber duck' digger) on-hire for 3 days to undertake trial pitting around the site.
- 4.1.4 All site works were undertaken under the supervision of a Caulmert Engineer, who was also responsible for marking out exploratory locations (prior to CCG staff checking for services), for logging of arisings from trial pits and boreholes and for collecting soil and groundwater samples for subsequent laboratory testing.

### 4.2 Limitations

- 4.2.1 It should be noted that the trial pits and boreholes represent discrete locations of investigation, and whilst every effort has been made to characterise the development area fully, the laboratory testing results reflect the soil quality only in those specific locations.
- 4.2.2 The trial pits were excavated into the Made Ground and the depths to the base of the excavations is summarised in Table 3 below. Depths are shown in metres below ground level (bgl). The trial pits were not excavated deeper than 3.1m as this was near the limit of the wheeled-excavator's capabilities in the ground conditions present. Trial pits required for soakaway testing were excavated to specified depths depending on location and filled to specified levels prior to the start of the test. Due to limitations on the capacities of the water bowsers, distance to the nearest fire hydrant, time constraints and the relative instability of a number of pits once water was added, some tests had to be undertaken with less water than originally specified. The locations of the trial pits were chosen to provide an even spread across site but also to determine whether there were any existing foundations or piles left in the ground from previous historic structures, however planned locations occasionally had to be slightly relocated if obstructions were encountered during excavating.
- 4.2.3 The deeper boreholes were intended to be drilled to a maximum of 20m, however upon encountering very dense sands and groundwater causing losses, the maximum depths of 13.0m and 15.0m were achieved. The deeper boreholes were intended to collect further geotechnical information of ground conditions at depth below the site to inform the proposed development foundation design and SPTs were undertaken at intervals throughout. All borehole locations were distributed to provide as even a spacing as practical across the site;

however, their positioning was also based on avoiding potential underground services and to target areas of historic structures on site. The shallow boreholes were drilled to a maximum of 8.0m bgl to identify groundwater levels and the extent of Made Ground, and if possible, to find natural superficial deposits below. Standard Penetration Tests (SPTs) were undertaken at intervals throughout drilling. Three of these locations were installed with pipework for groundwater monitoring – BH1, BH6 and BH9.

### 4.3 Field Observations

4.3.1 A photographic record of the trial pit investigation is presented in Appendix 1. The field observations of the trial pit excavations are summarised below in Table 3 and the full geological descriptions are attached as trial pit logs in Appendix 3:

**Table 3 – Summary of Trial Pit Excavations**

Trial Pit Number	Depth Excavated (mbgl)	Comments
TP1a	1.8	No odour. Made Ground of concrete and brick demolition material and gravelly sand. Water seepage encountered at 0.6m. Obstruction at 1.4m – pipe.
TP1b	2.3	No odour. Made Ground of concrete and brick demolition material and gravelly sand. Pieces of metal rebar and plastic fragments.
TP2	3.1	No odour. Made Ground of concrete and brick demolition material and gravelly sand. Pieces of metal rebar.
TP3a	2.9	Strong hydrocarbon odour at 0.6-1.7m in grey fine sand. Made Ground of concrete and brick demolition material and gravelly sand.
TP3b	2.3	Strong hydrocarbon odour at 1.3-2.3m in grey fine sand. Made Ground of concrete and brick demolition material and gravelly sand.
TP3c	1.7	No odour. Made Ground of concrete and brick demolition material and gravelly sand.
TP3d	1.8	No odour. Made Ground of concrete and brick demolition material and gravelly sand. Piece of sacking and plastic fragments.
TP3e	1.7	No odour. Made Ground of concrete and brick demolition material and gravelly sand. Pieces of metal rebar. Water seepage at 0.6m.
TP4	2.9	No odour. Made Ground of concrete and brick demolition material and gravelly sand. Pieces of metal rebar and wire.
TP5	2.5	No odour. Made Ground of asphalt and gravel over gravelly sand.
TP6a	0.75	No odour. Made Ground of sandy gravel. Obstruction at 0.75m – flat concrete surface.
TP6b	2.8	No odour. Made Ground of concrete and brick demolition material and gravelly sand.
TP7	2.9	No odour. Made Ground of concrete and brick demolition material and gravelly sand. Pieces of metal rebar.
TP8	3.1	No odour. Made Ground of concrete and brick demolition material and gravelly sand. Pieces of metal rebar. Water seepage at 0.9m.
TP9	2.5	No odour. Made Ground of gravelly sand. Electrical service tape at 1.4m. Water seepage at 0.8m.
SA1	3.0	No odour. Made Ground of concrete and brick demolition material and gravelly sand. Pieces of metal wire.
SA2	3.1	No odour. Made Ground of concrete and brick demolition material and gravelly sand. Pieces of metal wire and rope. Water seepage at 1.0m
SA3	3.1	Moderate odour of creosote from wood posts. Made Ground of asphalt and gravel over gravelly sand.
SA4a	1.5	No odour. Made Ground of asphalt over gravelly sand. Obstruction at 1.5.m – flat concrete and pipe.
SA4b	1.6	No odour. Made Ground of asphalt and gravel over gravelly sand. Obstruction at 1.6.m – flat concrete.
SA5	1.5	No odour. Made Ground of concrete and brick demolition material and gravelly sand. Thin fabric liner below surface.
SA6	1.5	No odour. Made Ground of concrete and brick demolition material and gravelly sand. Pieces of metal rebar. Water seepage at 0.8m.

4.3.2 The field observations of the boreholes are summarised in Table 4 below, and the full geological descriptions are attached as borehole logs in Appendix 4:

**Table 4 – Summary of Borehole Observations**

Trial Pit Number	Depth Excavated (mBGL)	Comments
BH1	8.4	No odour. Concrete and brick demolition material and gravelly sand MADE GROUND over silty fine sand.
BH2	13.5	No odour. Concrete and brick demolition material and gravelly sand MADE GROUND over silty fine sand.
BH3	8.4	No odour. Concrete and brick demolition material and gravelly sand MADE GROUND over silty fine sand.
BH4	8.4	No odour. Concrete and brick demolition material and gravelly sand MADE GROUND over silty fine sand.
BH5	8.4	No odour. Concrete and brick demolition material and gravelly sand MADE GROUND over banded silt.
BH6	8.4	No odour. Concrete and brick demolition material and gravelly sand MADE GROUND over silty fine sand.
BH7	8.4	No odour. Concrete and brick demolition material and sand MADE GROUND over banded silt.
BH8	15.0	No odour. Concrete and brick demolition material and gravelly sand MADE GROUND over silty fine sand.
BH9	8.4	No odour. Concrete and brick demolition material and gravelly sand MADE GROUND over banded silt and shelly fine sand.
BH10	15.0	No odour. Sandy gravel MADE GROUND over silty fine sand.

### Made Ground

4.3.3 Made Ground within the area of the former Power Station was encountered at every exploratory location. It typically comprised two distinct layers:

- Demolition material layer – between 0.3 and 1.0m thick layer (less frequently down to 3.0m) of brown sandy gravel at the surface with cobbles of concrete and brick, and fragments of plastic, glass, wood and pot, metal rebar pieces, sacking and wires.
- Uniform gravelly sand layer – a light brown fine to medium slightly gravelly sand with sandstone, occasional brick and concrete fragments, limestone, and shell and coal fragments down to depths of 3.0 to 5.5m.

4.3.4 The grassed area to the north of the former Power Station area was not covered in demolition material, but with grass and was very boggy at the surface. The Made Ground in this area typically comprised:

- Gravelly slightly clayey sand layer with rootlets and occasional cobbles topped by thick grass – between 0.2 to 0.3m thick.
- Uniform gravelly sand layer – a light brown fine to medium slightly gravelly sand with concrete, limestone, coal and brick fragments.

4.3.5 Prior to drilling the boreholes, the drillers dug hand-pits down to 1.2m and these pits were difficult to advance due to the presence of large brick and concrete cobbles, occasional concrete boulders and metal and plastic pieces encountered in the top 1.0m.

4.3.6 Flat concrete surfaces (or slabs), with no obvious metal reinforcement (rebar), were encountered in trial pits SA4a and SA4b at 1.5m bgl, and in trial pit TP6a at 0.75m bgl.

4.3.7 Pieces of loose metal rebar between 0.1 and 0.3m long were found at most locations at the site surface and within the top 1.0m of Made Ground.

- 4.3.8 A layer of black asphalt, 0.1m thick, was present at the surface at trial pit locations SA3, SA4a & SA4b within the existing carpark in the southwestern portion of the site, and also at trial pit location TP5 at 0.2m bgl, hidden under a 0.2m thick limestone gravel layer.
- 4.3.9 Strong odours were noted within a layer of grey fine sand encountered between 0.6-1.7m bgl in trial pit TP3a and 1.3-2.3m bgl in trial pit TP3b (hydrocarbon odour) and this was sampled. The layer of non-odorous light brown fine sand below the contaminated layer was also sampled at 2.0m bgl in TP3a in order to delineate the depth and potential vertical migration of any contaminants. To further investigate the lateral extent of the contaminated grey sand, a further three trial pits were excavated (TP3c, TP3d and TP3e) approximately 8m to the north, east and south of TP3a, but no other visual or olfactory evidence of contamination was found, with only a light brown slightly gravelly sand encountered.
- 4.3.10 A strong odour was also detected coming from a number of dark brown wooden posts found in trial pit SA3, at 1.6m bgl, below the existing carpark asphalt surface. There were approximately five posts brought to the surface in the arisings and they were rectangular with splintered damaged ends and on average were 1.0m long and 0.1m in diameter. The odour was reminiscent of creosote and was only associated with the posts, with the surrounding sand not emitting any odour or displaying any visual evidence of contamination. A sample of the surrounding sand was taken from directly adjacent to a post and sent for chemical analysis.
- 4.3.11 The presence of possible underground services was indicated at trial pit locations TP1a (brown plastic unidentified pipe at 1.4m bgl), SA4a (corrugated black drainage pipe at 1.5m bgl) and TP9 (yellow electrical warning tape at 1.4m bgl).

#### Natural Superficial Deposits

- 4.3.12 Below the Made Ground, the boreholes encountered a grey fine silty sand or grey and black banded sandy silt with shell and coal fragments (no odour) from between 3.0 and 5.5m down to between 8.0 and 15.0m.
- 4.3.13 Visually the natural ground was very similar in appearance to the sandy Made Ground used to raise the site ground levels prior to the development of the iron works, and therefore the boundary between the Made Ground and natural deposits was very subtle. The natural alluvial deposits at each location were interpreted based on a change in colour, from the light and medium browns of the Made Ground, often into a dark brown, grey or black strata, and the sudden presence of silt bands and abundant shell fragments was also interpreted to be within the natural deposits.

#### Bedrock

- 4.3.14 No bedrock was encountered during the site investigation, with the deepest boreholes drilled to 15.0m bgl in silty sand.

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### Groundwater

- 4.3.15 Groundwater was encountered in most boreholes typically between 4.0 and 5.0m bgl. Groundwater monitoring points were installed at BH1, BH6 and BH9 to depths of 7.0m bgl and groundwater levels post-drilling were recorded as 4.80m, 4.13m and 4.83m bgl respectively. It is possible to derive a preliminary groundwater flow direction based on these groundwater levels, as flowing down-gradient to roughly the northwest.
- 4.3.16 Water seepages from the demolition material layer were common in trial pits between 0.6 and 1.0m bgl, possibly caused by the extreme inclement weather and patchy surface flooding on-site at the time. No groundwater was encountered deeper in the trial pits.

#### **4.4 Chemical Analytical Data - Soil**

- 4.4.1 The soil samples collected on site were collected predominantly from the Made Ground across the site to assess the current ground conditions overall for levels of potential contaminants.
- 4.4.2 Where obvious contamination was identified based on visual and olfactory evidence during site works, extra samples were taken within the layer affected and also the layer below to delineate any possible vertical migration of contaminants. Samples for chemical testing were taken from both the trial pits and borehole arisings.
- 4.4.3 The laboratory testing results and testing certificates for the soil are presented in Appendix 2. A summary of the soil testing results are presented below in Table 5 (split into two tables):

**Table 5 – Summary of Soil Chemical Analysis Results**

Sample Description (right)		BH2	BH2	BH2	BH4	BH6	BH6	TP2	TP3a	TP3a	TP5	TP8	TP9	TP9	SA3
Analyte (below)	units	0.6m	1.5m	5.0m	0.7m	0.5m	0.7m	2.5m	0.8m	2.0m	0.8m	0.6m	0.5m	2.0m	1.6m
PH, ASBESTOS, ORGANICS															
pH (2.5:1 extraction)	pH units	-	10	9.2	8.7	-	11.3	9.3	8.8	9.5	-	-	9.2	9.7	9.6
Asbestos Identification	-	NAIIS	-	-	NAIIS	NAIIS	-	-	NAIIS	-	NAIIS	NAIIS	NAIIS	-	-
Total Asbestos in Sample	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Moisture at 105°C	%	-	15	17.5	9.1	-	12.4	10.1	12.2	5.7	-	-	13.9	8.1	7.3
Total Moisture at 35°C	%	-	14.9	17.4	7.9	-	9.9	8.8	10.4	5.3	-	-	12.2	7.3	6.9
Total Organic Carbon <sup>^</sup>	% m/m	-	-	-	-	-	-	-	1.21	0.06	-	-	-	-	0.77
METALS															
Arsenic as As <sup>^</sup>	mg/kg	-	8.5	8.2	2.3	-	5.6	7.5	7.5	6.7	-	-	10.9	10.1	8.2
Cadmium as Cd <sup>^</sup>	mg/kg	-	0.2	<0.2	<0.2	-	0.4	0.2	0.3	<0.2	-	-	0.6	0.2	0.3
Copper as Cu <sup>^</sup>	mg/kg	-	10.8	8.3	8.2	-	12.2	9.2	18.6	4.1	-	-	35.1	16.3	14
Lead as Pb <sup>^</sup>	mg/kg	-	28.2	33.3	10.8	-	32.1	27.4	234.6	9.1	-	-	76.1	28.9	29.7
Nickel as Ni <sup>^</sup>	mg/kg	-	9.4	12.1	7	-	11.8	7.9	10	5.7	-	-	18.7	10.7	12.3
Total Chromium as Cr <sup>^</sup>	mg/kg	-	27.2	12.8	9.2	-	43.4	23.5	15.6	6.1	-	-	90.2	24.4	44.5
Vanadium as V <sup>^</sup>	mg/kg	-	28.6	14	7.9	-	27.4	23.1	15.8	9.2	-	-	60.8	21	27.4
Zinc as Zn <sup>^</sup>	mg/kg	-	89	56.3	35.3	-	135.8	99.4	117.7	28.2	-	-	211.8	129.5	111.1
Chromium (III) <sup>^</sup>	mg/kg	-	<27.2	<12.8	<9.20	-	<43.4	<23.5	<15.6	<6.10	-	-	<90.2	<24.4	<44.5
Chromium (VI) as Cr <sup>^</sup>	mg/kg	-	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1
BTEX															
Benzene <sup>^</sup>	µg/kg	-	-	-	-	-	<11	-	<11	<11	-	-	<12	-	<11
Ethylbenzene <sup>^</sup>	µg/kg	-	-	-	-	-	<11	-	<11	<11	-	-	<12	-	<11
m/p-Xylene <sup>^</sup>	µg/kg	-	-	-	-	-	<23	-	<23	<21	-	-	<23	-	<22
o-Xylene <sup>^</sup>	µg/kg	-	-	-	-	-	<11	-	<11	<11	-	-	<12	-	<11
Toluene <sup>^</sup>	µg/kg	-	-	-	-	-	<11	-	<11	<11	-	-	<12	-	<11
TPH															
>C6-C8 Aliphatic <sup>^</sup>	mg/kg	-	-	-	-	-	<0.228	-	<0.228	<0.212	-	-	<0.232	-	<0.216
>C7-C8 Aromatic <sup>^</sup>	mg/kg	-	-	-	-	-	<0.011	-	<0.011	<0.011	-	-	<0.012	-	<0.011
>C8-C10 Aliphatic <sup>^</sup>	mg/kg	-	-	-	-	-	<0.228	-	<0.228	<0.212	-	-	<0.232	-	<0.216
>C8-C10 Aromatic <sup>^</sup>	mg/kg	-	-	-	-	-	<0.046	-	<0.046	<0.043	-	-	<0.047	-	<0.044
C5-C6 Aliphatic <sup>^</sup>	mg/kg	-	-	-	-	-	<0.228	-	<0.228	<0.212	-	-	<0.232	-	<0.216
C5-C7 Aromatic <sup>^</sup>	mg/kg	-	-	-	-	-	<0.011	-	<0.011	<0.011	-	-	<0.012	-	<0.011
Total GRO <sup>^</sup>	mg/kg	-	-	-	-	-	<0.228	-	<0.228	<0.212	-	-	<0.232	-	<0.216
Total TPH <sup>^</sup>	mg/kg	-	124	26	37.7	-	-	34.4	-	-	-	-	-	51.5	-
>C10-C12 (Aliphatic) <sup>^</sup>	mg/kg	-	-	-	-	-	4.87	-	4.77	4.34	-	-	5.01	-	4.59

Sample Description (right)		BH2	BH2	BH2	BH4	BH6	BH6	TP2	TP3a	TP3a	TP5	TP8	TP9	TP9	SA3
Analyte (below)	units	0.6m	1.5m	5.0m	0.7m	0.5m	0.7m	2.5m	0.8m	2.0m	0.8m	0.6m	0.5m	2.0m	1.6m
>C12-C16 (Aliphatic)^	mg/kg	-	-	-	-	-	5.04	-	6.82	<4.24	-	-	<4.65	-	<4.31
>C16-C21 (Aliphatic)^	mg/kg	-	-	-	-	-	18.2	-	34.9	4.74	-	-	12.8	-	6.02
>C21-C35 (Aliphatic)^	mg/kg	-	-	-	-	-	136	-	1900	11.7	-	-	65.5	-	13.5
>C35-C44 (Aliphatic)^	mg/kg	-	-	-	-	-	58.6	-	496	<6.36	-	-	7.41	-	<6.47
Total TPH (Aliphatic)^	mg/kg	-	-	-	-	-	205	-	2370	24.9	-	-	90.7	-	28.9
>C10-C12 (Aromatic)^	mg/kg	-	-	-	-	-	<4.57	-	17.2	<4.24	-	-	<4.65	-	<4.31
>C12-C16 (Aromatic)^	mg/kg	-	-	-	-	-	<4.57	-	5.21	<4.24	-	-	<4.65	-	<4.31
>C16-C21 (Aromatic)^	mg/kg	-	-	-	-	-	8.98	-	17.3	6.16	-	-	8.6	-	5.89
>C21-C35 (Aromatic)^	mg/kg	-	-	-	-	-	119	-	898	14.3	-	-	38	-	22.6
>C35-C44 (Aromatic)^	mg/kg	-	-	-	-	-	103	-	404	6.98	-	-	8.57	-	<6.47
Total TPH (Aromatic)^	mg/kg	-	-	-	-	-	201	-	1250	26.6	-	-	55.1	-	33.5
PAH															
Acenaphthene^	mg/kg	-	<0.09	<0.10	<0.09	-	<0.09	<0.09	<0.09	<0.08	-	-	<0.09	<0.09	0.12
Acenaphthylene^	mg/kg	-	<0.09	<0.10	<0.09	-	<0.09	<0.09	<0.09	<0.08	-	-	<0.09	<0.09	<0.09
Anthracene^	mg/kg	-	<0.09	<0.10	<0.09	-	<0.09	<0.09	<0.09	<0.08	-	-	<0.09	<0.09	<0.09
Benzo[a]anthracene^	mg/kg	-	<0.09	<0.10	<0.09	-	<0.09	<0.09	<0.09	<0.08	-	-	<0.09	<0.09	<0.09
Benzo[a]pyrene^	mg/kg	-	<0.09	<0.10	<0.09	-	<0.09	<0.09	<0.09	<0.08	-	-	0.13	<0.09	<0.09
Benzo[b]fluoranthene^	mg/kg	-	<0.09	<0.10	<0.09	-	<0.09	<0.09	<0.09	<0.08	-	-	0.16	<0.09	<0.09
Benzo[g,h,i]perylene^	mg/kg	-	<0.09	<0.10	<0.09	-	<0.09	<0.09	<0.09	<0.08	-	-	0.1	<0.09	<0.09
Benzo[k]fluoranthene^	mg/kg	-	<0.09	<0.10	<0.09	-	<0.09	<0.09	<0.09	<0.08	-	-	0.1	<0.09	<0.09
Chrysene^	mg/kg	-	<0.09	<0.10	<0.09	-	<0.09	<0.09	<0.09	<0.08	-	-	0.11	<0.09	<0.09
Coronene^	mg/kg	-	<0.09	<0.10	<0.09	-	<0.09	<0.09	<0.09	<0.08	-	-	<0.09	<0.09	<0.09
Dibenzo[a,h]anthracene^	mg/kg	-	<0.09	<0.10	<0.09	-	<0.09	<0.09	<0.09	<0.08	-	-	<0.09	<0.09	<0.09
Fluoranthene^	mg/kg	-	<0.09	<0.10	<0.09	-	<0.09	<0.09	<0.09	<0.08	-	-	0.14	<0.09	0.13
Fluorene^	mg/kg	-	<0.09	<0.10	<0.09	-	<0.09	<0.09	<0.09	<0.08	-	-	<0.09	<0.09	<0.09
Indeno[1,2,3-cd]pyrene^	mg/kg	-	<0.09	<0.10	<0.09	-	<0.09	<0.09	<0.09	<0.08	-	-	0.12	<0.09	<0.09
Naphthalene^	mg/kg	-	<0.09	<0.10	<0.09	-	<0.09	<0.09	<0.09	<0.08	-	-	<0.09	<0.09	<0.09
Phenanthrene^	mg/kg	-	<0.09	<0.10	<0.09	-	<0.09	<0.09	<0.09	<0.08	-	-	0.09	<0.09	0.12
Pyrene^	mg/kg	-	<0.09	<0.10	<0.09	-	0.11	<0.09	0.09	<0.08	-	-	0.17	<0.09	0.13
Total PAH 16^	mg/kg	-	<1.51	<1.55	<1.41	-	<1.48	<1.42	<1.46	<1.36	-	-	<1.77	<1.39	<1.53
PHENOLS															
2,4,5-Trichlorophenol^	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02
2,4,6-Trichlorophenol^	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02
2,4-Dichlorophenol^	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.03
2,4-Dimethylphenol^	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02
2,4-Dinitrophenol^	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.04

Sample Description (right)		BH2	BH2	BH2	BH4	BH6	BH6	TP2	TP3a	TP3a	TP5	TP8	TP9	TP9	SA3
Analyte (below)	units	0.6m	1.5m	5.0m	0.7m	0.5m	0.7m	2.5m	0.8m	2.0m	0.8m	0.6m	0.5m	2.0m	1.6m
2-Chlorophenol^	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.03
2-Methylphenol^	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.03
2-Nitrophenol^	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.03
3- & 4-Methylphenol^	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02
4,6-Dinitro-2-methylphenol^	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.03
4-Chloro-3-methylphenol^	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.03
4-Chlorophenol^	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.04
4-Nitrophenol^	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.06
Pentachlorophenol^	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.03
Phenol^	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.03
Total (15) Phenols^	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.49

Table 5 – Summary of Soil Chemical Analysis Results (continued...)

Sample Description (right)		BH1	BH1	BH1	BH9	BH9	BH7	BH8	BH5
Analyte (below)	units	0.5m	1.2m	5.5m	0.5m	2.5m	3.5m	0.5m	3.5m
PH, ASBESTOS, ORGANICS									
pH (2.5:1 extraction)	pH units	-	9.1	9.3	-	9.4	10.9	-	8.8
Asbestos Identification	-	NAIIS	-	-	CH	-	-	NAIIS	-
Total Asbestos in Sample	%	-	-	-	0.003	-	-	-	-
Total Moisture at 105°C	%	-	11.8	17	-	13.4	17.5	-	24
Total Moisture at 35°C	%	-	10.2	16.3	-	12.3	16.4	-	24.1
Total Organic Carbon^	% m/m	-	-	-	-	-	-	-	-
METALS									
Arsenic as As^	mg/kg	-	7.9	8.7	-	5.9	4.9	-	15.2
Cadmium as Cd^	mg/kg	-	0.3	<0.2	-	0.3	<0.2	-	0.3
Copper as Cu^	mg/kg	-	12	10	-	19.1	4.8	-	17.6
Lead as Pb^	mg/kg	-	40.8	22.7	-	23.3	9.2	-	79.8
Nickel as Ni^	mg/kg	-	9.5	16.5	-	11.8	5	-	13.9
Total Chromium as Cr^	mg/kg	-	30.1	45.6	-	206.4	9.3	-	16.9
Vanadium as V^	mg/kg	-	28.6	43.7	-	134.4	11.3	-	19.5
Zinc as Zn^	mg/kg	-	111.8	69.2	-	86.2	32.8	-	130.5
Chromium (III)^	mg/kg	-	<30.1	<45.6	-	<206	<9.30	-	<16.9
Chromium (VI) as Cr^	mg/kg	-	<0.1	<0.1	-	<0.1	<0.1	-	<0.1

Sample Description (right)		BH1	BH1	BH1	BH9	BH9	BH7	BH8	BH5
Analyte (below)	units	0.5m	1.2m	5.5m	0.5m	2.5m	3.5m	0.5m	3.5m
BTEX									
Benzene^	µg/kg	-	<11	-	-	-	-	-	-
Ethylbenzene^	µg/kg	-	<11	-	-	-	-	-	-
m/p-Xylene^	µg/kg	-	<23	-	-	-	-	-	-
o-Xylene^	µg/kg	-	<11	-	-	-	-	-	-
Toluene^	µg/kg	-	<11	-	-	-	-	-	-
TPH									
>C6-C8 Aliphatic^	mg/kg	-	<0.227	-	-	-	-	-	-
>C7-C8 Aromatic^	mg/kg	-	<0.011	-	-	-	-	-	-
>C8-C10 Aliphatic^	mg/kg	-	<0.227	-	-	-	-	-	-
>C8-C10 Aromatic^	mg/kg	-	<0.045	-	-	-	-	-	-
C5-C6 Aliphatic^	mg/kg	-	<0.227	-	-	-	-	-	-
C5-C7 Aromatic^	mg/kg	-	<0.011	-	-	-	-	-	-
Total GRO^	mg/kg	-	<0.227	-	-	-	-	-	-
Total TPH^	mg/kg	-	-	35.1	-	38.4	36.4	-	40
>C10-C12 (Aliphatic)^	mg/kg	-	<4.54	-	-	-	-	-	-
>C12-C16 (Aliphatic)^	mg/kg	-	<4.54	-	-	-	-	-	-
>C16-C21 (Aliphatic)^	mg/kg	-	<4.54	-	-	-	-	-	-
>C21-C35 (Aliphatic)^	mg/kg	-	<11.3	-	-	-	-	-	-
>C35-C44 (Aliphatic)^	mg/kg	-	<6.80	-	-	-	-	-	-
Total TPH (Aliphatic)^	mg/kg	-	<22.7	-	-	-	-	-	-
>C10-C12 (Aromatic)^	mg/kg	-	<4.54	-	-	-	-	-	-
>C12-C16 (Aromatic)^	mg/kg	-	<4.54	-	-	-	-	-	-
>C16-C21 (Aromatic)^	mg/kg	-	4.77	-	-	-	-	-	-
>C21-C35 (Aromatic)^	mg/kg	-	<11.3	-	-	-	-	-	-
>C35-C44 (Aromatic)^	mg/kg	-	<6.80	-	-	-	-	-	-
Total TPH (Aromatic)^	mg/kg	-	<22.7	-	-	-	-	-	-
PAH									
Acenaphthene^	mg/kg	<0.09	<0.10	-	<0.09	<0.10	-	<0.11	<0.09
Acenaphthylene^	mg/kg	<0.09	<0.10	-	<0.09	<0.10	-	<0.11	<0.09
Anthracene^	mg/kg	<0.09	<0.10	-	<0.09	<0.10	-	<0.11	<0.09
Benzo[a]anthracene^	mg/kg	<0.09	<0.10	-	<0.09	<0.10	-	<0.11	<0.09
Benzo[a]pyrene^	mg/kg	<0.09	<0.10	-	<0.09	<0.10	-	<0.11	<0.09
Benzo[b]fluoranthene^	mg/kg	<0.09	<0.10	-	<0.09	<0.10	-	<0.11	<0.09
Benzo[g,h,i]perylene^	mg/kg	<0.09	<0.10	-	<0.09	<0.10	-	<0.11	<0.09
Benzo[k]fluoranthene^	mg/kg	<0.09	<0.10	-	<0.09	<0.10	-	<0.11	<0.09

Sample Description (right)		BH1	BH1	BH1	BH9	BH9	BH7	BH8	BH5
Analyte (below)	units	0.5m	1.2m	5.5m	0.5m	2.5m	3.5m	0.5m	3.5m
Chrysene^	mg/kg	<0.09	<0.10	-	<0.09	<0.10	-	<0.11	<0.09
Coronene^	mg/kg	<0.09	<0.10	-	<0.09	<0.10	-	<0.11	<0.09
Dibenzo[a,h]anthracene^	mg/kg	<0.09	<0.10	-	<0.09	<0.10	-	<0.11	<0.09
Fluoranthene^	mg/kg	<0.09	<0.10	-	<0.09	<0.10	-	0.18	<0.09
Fluorene^	mg/kg	<0.09	<0.10	-	<0.09	<0.10	-	<0.11	<0.09
Indeno[1,2,3-cd]pyrene^	mg/kg	<0.09	<0.10	-	<0.09	<0.10	-	<0.11	<0.09
Naphthalene^	mg/kg	<0.09	<0.10	-	<0.09	<0.10	-	<0.11	<0.09
Phenanthrene^	mg/kg	<0.09	<0.10	-	<0.09	<0.10	-	<0.11	<0.09
Pyrene^	mg/kg	<0.09	<0.10	-	<0.09	<0.10	-	0.15	<0.09
Total PAH 16^	mg/kg	<1.45	<1.54	-	<1.48	<1.55	-	<1.81	<1.45

NAIS – No Asbestos Identified In Sample

CH – Chrysotile detected

Risks posed to Human Health

- 4.4.4 The chemical analysis results for the soil samples indicate that there are elevated concentrations of hydrocarbons (TPH) present at 0.8m within the grey sands at trial pit location TP3a (Aliphatic 2370mg/kg and Aromatic 1250 mg/kg), but not in concentrations to indicate free product. This confirms the field observations, where strong odours were noted within the layer of grey fine sand at 0.6-1.7m in TP3a. The same strong odour was also recorded in a layer of grey fine sand in TP3b, but this was slightly deeper at 1.3-2.3m and was not sampled. There was a much lower concentration of 26.6 mg/kg detected in the sample taken in the light brown sand at 2.0m (with no odour) below the grey layer in TP3a. This indicates that the vertical migration of the hydrocarbon contamination is limited in this area. No other visual or olfactory evidence of contamination was found when excavating the additional three trial pits (TP3c, TP3d and TP3e) approximately 8m to the north, east and south of TP3a. The investigative work around the original trial pit location TP3a suggests that this area of elevated hydrocarbon concentrations is limited in both lateral and vertical extent. Based on site history, trial pit location and the specific chemical composition detected, it is considered likely that this is associated with a historic leakage or spillage, possibly of hydraulic oils.
- 4.4.5 The concentrations of total petroleum hydrocarbons (TPH) in TP3a have been compared with the LQM/CIEH Suitable 4 Use Levels at 1% Soil Organic Matter (SOM) content, for a commercial land-use, shown in Table 6 below. The TPH concentrations detected in TP3a are much lower than the LQM values and would indicate the risks posed to human health are within acceptable limits in the soil for a commercial land-use.

**Table 6 – LQM/CIEH S4UIs for TPH for commercial land-use at 1% SOM**

Commercial Land Use	LQM/CIEH S4UIs for TPHs (mg/kg)
	1% SOM
Aliphatic EC 5-6	3200 (304)
Aliphatic EC >6-8	7800 (144)
Aliphatic EC >8-10	2000 (78)
Aliphatic EC >10-12	9700 (48)
Aliphatic EC >12-16	59000 (24)
Aliphatic EC >16-35	1600000
Aliphatic EC >35-44	1600000
Aromatic EC 5-7 (benzene)	26000 (1220)
Aromatic EC >7-8 (toluene)	56000 (869)
Aromatic EC >8-10	3500 (613)
Aromatic EC >10-12	16000 (364)
Aromatic EC >12-16	36000 (169)
Aromatic EC >16-21	28000
Aromatic EC >21-35	28000
Aromatic EC >35-44	28000
Aliphatic + Aromatic EC >44-70	28000

- 4.4.6 Asbestos was tested for in 10 soil samples from across the site within the top 1.0m layer of Made Ground, with no asbestos detected in nine of the samples. Asbestos was positively identified in only one sample, BH9 at 0.5m bgl, with 0.003% of Chrysotile loose fibres. This

amount of asbestos is only just above the laboratory detection limit of 0.001% and was only identified outside of the former Power Station footprint within the Made Ground associated with the former iron works. Industry guidance has been developed by CL:AIRE and JIWG with respect to the application of the CAR 2012 Regulations to asbestos within soils and C&D (construction and demolition) materials<sup>1</sup>. This document provides guidance on the interpretation of CAR 2012 with respect to soil and C&D materials. The guidance would suggest that the concentrations of asbestos present in the soil at BH9 are “very low”, defined as concentrations between >0.001 - <0.01% w/w asbestos. The potential presence of asbestos is limited to this area due to the absence of similar made ground across the remainder of the site. This layer is considered to have been removed during remediation prior to the development of the former Power Station. The high moisture content of the Made Ground in the area around BH9 (described as boggy grassland) is such that the potential for release of free fibres from this area is considered to be very low. Following development, this layer will be contained beneath hardstanding and therefore the future health risks posed to potential receptors are again considered to be very low. The only remaining risks will be to construction workers during the development phase in this grassed area to the north, Appropriate risk assessments taking into account the potential presence of asbestos, the duration and potential exposure of ground workers would need to accompany all future work within this area.

- 4.4.7 A strong odour reminiscent of creosote was detected in trial pit SA3 coming from wooden posts discovered at 1.6m bgl, below the existing carpark asphalt surface. It is possible these posts were part of the old railway associated with the ironworks on site. A sample of the Made Ground (sand) was taken from this depth, immediately adjacent to the wooden posts and tested for a suite of phenols. No phenols were detected, all shown below the limits of detection and no elevated levels of other substances such as hydrocarbons were detected, and therefore it can be concluded it is likely no creosote has leached into the surrounding Made Ground at this location. The strong odour was emitted by the wooden posts only at this location and not from the surrounding sands. Based on olfactory evidence it is considered that the posts would potentially be classed as hazardous waste and would require disposal at a hazardous waste facility should they be encountered during the development phase.
- 4.4.8 All metals detected in the soil samples are below the LQM/CIEH Suitable for Use Levels (S4ULs) for commercial land use for the lowest soil organic matter percentage (SOM 1 %) representing the most stringent scenario for comparison.
- 4.4.9 There were no BTEX present in any of the soil samples, with all results below the laboratory limit of detection and the PAHs detected were also below their respective LQM threshold limits, as summarised in Table 7 below. There were only trace amounts of PAHs in a few locations such as TP9, BH8 and SA3, with the rest below the limit of detection.

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<sup>1</sup> CL:AIRE, 2016. Control of Asbestos Regulations 2012 - Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials: Industry guidance. CL:AIRE, London. ISBN 978-1-905046-30-0. Download at [www.claire.co.uk/asbestos](http://www.claire.co.uk/asbestos)

**Table 7 – LQM/CIEH S4UIs for PAH for commercial land-use at 1% SOM**

Commercial Land Use	LQM/CIEH S4UIs for PAHs (mg/kg)
	1% SOM
Acenaphthene	84000
Acenaphthylene	83000
Anthracene	520000
Benzo[a]anthracene	170
Benzo[a]pyrene	35
Benzo[b]fluoranthene	44
Benzo[g,h,i]perylene	3900
Benzo[k]fluoranthene	1200
Chrysene	350
Dibenzo[a,h]anthracene	3.5
Fluoranthene	23000
Fluorene	63000
Indeno[1,2,3-cd]pyrene	500
Naphthalene	190
Phenanthrene	22000
Pyrene	54000

#### 4.5 Chemical Analytical Data - Groundwater

- 4.5.1 Groundwater was sampled from boreholes BH1, BH6 and BH9 once drilling and installation was complete, and after the wells had been manually purged using balers.
- 4.5.2 The laboratory testing results and testing certificates for the groundwater are presented in Appendix 2. A summary of the soil testing results are presented below in Table 8:

**Table 8 – Summary of Groundwater Chemical Analysis Results**

Analyte	units	BH1	BH6	BH9
Ammoniacal Nitrogen as NH <sub>4</sub>	mg/l	<0.02	<0.02	<0.02
Sodium as Na	mg/l	46	23	51
Total Sulphur as SO <sub>4</sub>	mg/l	65	99	262
Chloride as Cl	mg/l	7	10	12
Total Alkalinity	mg/l	437	229	368
Dissolved Organic Carbon	mg/l	2.2	3.7	3.2
Conductivity at 25°C	µS/cm	966	698	1080
pH	pH units	7.7	7.7	7.7
BTEX				
Benzene	µg/l	<5	<5	<5
Ethylbenzene	µg/l	<5	<5	<5
m/p-Xylene	µg/l	<10	<10	<10
o-Xylene	µg/l	<5	<5	<5
Toluene	µg/l	<5	<5	<5
METALS				
Arsenic as As	mg/l	0.002	0.002	0.004
Cadmium as Cd	mg/l	0.00003	0.00003	<0.00002
Copper as Cu	mg/l	0.001	0.001	<0.001
Lead as Pb	mg/l	<0.001	<0.001	<0.001
Manganese as Mn	mg/l	0.224	0.025	0.712
Chromium (III)	mg/l	<0.003	<0.003	<0.003
Mercury as Hg	mg/l	<0.00003	<0.00003	<0.00003
Nickel as Ni	mg/l	0.002	<0.001	0.002
Total Chromium as Cr	mg/l	0.001	0.005	<0.001
Vanadium as V	mg/l	<0.001	<0.001	0.001
Zinc as Zn	mg/l	0.007	0.011	0.003

Analyte	units	BH1	BH6	BH9
Iron as Fe	mg/l	<0.01	0.01	<0.01
Chromium (VI) as Cr	mg/l	<0.003	0.006	<0.003
TPH				
>C6-C8 Aliphatic	mg/l	<0.100	<0.100	<0.100
>C7-C8 Aromatic	mg/l	<0.005	<0.005	<0.005
>C8-C10 Aliphatic	mg/l	<0.100	<0.100	<0.100
>C8-C10 Aromatic	mg/l	<0.020	<0.020	<0.020
C5-C6 Aliphatic	mg/l	<0.100	<0.100	<0.100
C5-C7 Aromatic	mg/l	<0.005	<0.005	<0.005
Total GRO	mg/l	<0.100	<0.100	<0.100
>C10-C12 (Aliphatic)	mg/l	<0.01	<0.01	<0.01
>C12-C16 (Aliphatic)	mg/l	<0.01	<0.01	<0.01
>C16-C21 (Aliphatic)	mg/l	<0.01	<0.01	<0.01
>C21-C35 (Aliphatic)	mg/l	<0.01	<0.01	<0.01
>C35-C44 (Aliphatic)	mg/l	<0.01	<0.01	<0.01
Total TPH (Aliphatic)	mg/l	<0.01	<0.01	0.03
>C10-C12 (Aromatic)	mg/l	<0.01	<0.01	<0.01
>C12-C16 (Aromatic)	mg/l	<0.01	<0.01	<0.01
>C16-C21 (Aromatic)	mg/l	<0.01	<0.01	<0.01
>C21-C35 (Aromatic)	mg/l	<0.01	0.01	<0.01
>C35-C44 (Aromatic)	mg/l	<0.01	<0.01	<0.01
Total TPH (Aromatic)	mg/l	0.01	0.02	<0.01
PAH				
Acenaphthene	µg/l	0.02	<0.01	0.02
Acenaphthylene	µg/l	<0.01	<0.01	<0.01
Anthracene	µg/l	<0.01	<0.01	<0.01
Benzo[a]anthracene	µg/l	<0.01	<0.01	<0.01
Benzo[a]pyrene	µg/l	<0.01	<0.01	<0.01
Benzo[b]fluoranthene	µg/l	<0.01	<0.01	<0.01
Benzo[g,h,i]perylene	µg/l	<0.01	<0.01	<0.01
Benzo[k]fluoranthene	µg/l	<0.01	<0.01	<0.01
Chrysene	µg/l	<0.01	<0.01	<0.01
Coronene	µg/l	<0.01	<0.01	<0.01
Dibenzo[a,h]anthracene	µg/l	<0.01	<0.01	<0.01
Fluoranthene	µg/l	0.02	<0.01	0.02
Fluorene	µg/l	<0.01	<0.01	0.02
Indeno[1,2,3-cd]pyrene	µg/l	<0.01	<0.01	<0.01
Naphthalene	µg/l	0.03	<0.01	0.02
Phenanthrene	µg/l	0.04	<0.01	0.03
Pyrene	µg/l	0.02	<0.01	0.01
Total PAH 16	µg/l	<0.25	<0.16	<0.21

4.5.3 The groundwater results indicate most substances tested for are below the limit of detection in all three samples. Chloride, ammoniacal nitrogen and sulphur are all at low concentrations and the pH is stable across the site. There are no BTEX present, and the concentrations of metals, TPH and PAH are all very low. All substances are below generic screening criteria for groundwater.

#### 4.6 Ground Gas Risk Assessment

4.6.1 The site investigation confirmed the absence of any significant sources of ground gas. There is no evidence of significant concentrations of degradable or putrescible materials present within the Made Ground or deeper alluvial deposits at the site. Wooden fragments were occasionally found in the demolition rubble in the top 1.0m of Made Ground, but not in any

significant quantity. There was only one location, SA3, where a small amount of wooden posts were encountered, but this was localised and no other degradable materials were encountered during the investigation. Therefore, as part of this site investigation, subsequent monitoring of ground gas is not proposed.

- 4.6.2 There is no evidence for significant quantities of organic-rich alluviums present at the site, from which natural gases could permeate, and the thickness of the demolition material Made Ground (between 0.3 and 1.0m thick) is not substantial, with predominantly unsaturated, relatively uniform gravelly sands located below the demolition material, down to the water table between 4.0 and 5.0m.
- 4.6.3 Furthermore, the proposed development will comprise a large industrial warehouse building on top of hardstanding, which will have a significant air exchange capacity within and so the potential for ground gas permeation and accumulation is low.
- 4.6.4 For completeness, the groundwater monitoring points at boreholes BH1, BH6 and BH9 were fitted with bungs and gas taps, and during the site works one-round of ground gas monitoring was undertaken by Caulmert to confirm the above conclusions. The initial round of gas monitoring results was obtained 2 days after installation of the last monitoring well and are presented in Table 9 below.

**Table 9 – Ground Gas Monitoring Results**

ID	Date	Gas data							
		Methane (%)	Carbon dioxide (%)	Oxygen (%)	CO <sup>+</sup> (ppm)	HS2 (ppm)	Balance (%)	Barometric Pressure (mb)	Flow (l/hr)
BH1	29/01/21	0	0.9	10.9	2	0	86.2	996	0
BH6	29/01/21	0.1*	0.2	20.4	0	0	79.0	996	0
BH9	29/01/21	0	1.2	14.4	1	0	83.4	996	0

\*This reading is not considered accurate as the results are likely to reflect the interference due to the inclement weather conditions during siteworks. Methane would not be present without an associated decrease in oxygen concentrations. Similarly carbon monoxide concentrations (CO) are within the accuracy of the gas analyser and are again subject to interference during inclement conditions.

- 4.6.5 The monitoring was undertaken during inclement weather and the results appear to reflect some interference possibly due the weather. No methane was recorded was recorded in BH1 or BH9, and the 0.1% concentration recorded for BH6 is considered to be an anomalous result due to interference. There were no flows detected in any of the boreholes.
- 4.6.6 The ground gas monitoring data is evidence of the absence of any discernible ground gas concentrations at the site and would indicate, when combined with the soil field observations, that there is no significant risk to the proposed industrial development and associated infrastructure from ground gas at the site from the underlying deposits.

#### 4.7 Soakaway Tests - Results

- 4.7.1 As part of the site investigation, six locations were selected for soakaway testing (SA1-6) in trial pits within the Made Ground. They were focussed mainly in the southern and western portions of the site, with one located in the southeast. Of these six locations, only five were successfully tested, as two attempts to excavate SA4 (SA4a and SA4b) failed when obstructions were encountered at 1.5m bgl. Once the obstruction, a flat concrete surface, had

been encountered in both trial pit attempts, it was decided to abandon this location, which was in the existing carpark, due to impracticality and time constraints.

4.7.2 The soakaway tests were undertaken in accordance with BRE365 guidance and specific target depths were detailed for each location within the Made Ground. SA1, SA2, SA3, SA5 and SA6 were all successfully tested. Due to time constraints, excavator machine-hire duration (only hired for 3-days) and water availability (there was no water supply on-site), only one test could be undertaken at each location. The results of the soakaway tests are presented in graphs in Appendix 5 and a summary of the calculated infiltration rate results is presented in Table 10 below.

4.7.3 Table 10 presents the specific (planned) target depths of each trial pit with starting water levels compared with the achieved (excavated) depths with actual starting water levels (all depths are measured from ground level down). The limitations and additional observations of each test location are also included in Table 10. The soil infiltration rates calculated are provided in metres per second (m/s).

**Table 10 – Soakaway Test Results**

Location	Target Depth of Pit (m)	Target Depth of Water Level (m)	Achieved Depth of Pit (m)	Start of Test Water Level (m)	Limitations/Observations	Soil Infiltration Rate (m/s)
SA1	3.1	1.9	3.0	2.22	Pit sides became unstable upon addition of water. Dimensions of base of pit so large due to depth of excavation, insufficient water from bowsers to fill to 1.9m target depth. Started test at 2.22m once water bowsers had emptied. End of test - water soaked away to base of pit in 2hrs – new base depth 2.67m.	$2.7 \times 10^5$
SA2	3.1	1.9	3.1	1.55	Pit sides became unstable upon addition of water. Sufficient water from bowsers to fill to above 1.9m target depth. Started test at 1.55m once water bowsers had emptied. End of test - little movement in over 2hrs.	$9.4 \times 10^6$
SA3	3.1	1.9	3.1	2.51	Pit sides became unstable upon addition of water. Dimensions of base of pit so large due to depth of excavation, insufficient water from bowsers to fill to 1.9m target depth. Started test at 2.51m once water bowsers had emptied. End of test – water soaked away to base of pit in over 2hours – new base depth 2.95m.	$2.3 \times 10^5$
SA4a	3.1	1.9	1.5	N/A	Abandoned – flat concrete obstruction	N/A
SA4b	3.1	1.9	1.6	N/A	Abandoned – flat concrete obstruction	N/A
SA5	1.5	0.75	1.5	0.75	Pit sides became unstable upon addition of water. Sufficient water from bowsers to fill to 0.75m target depth. Started test at 0.75m once water bowsers had emptied. End of test – water soaked away to base of pit in 4hrs – new base depth 1.29m as sand collapsed in.	$1.3 \times 10^5$
SA6	1.5	0.75	1.5	0.71	Pit sides became unstable upon addition of water. Sufficient water from bowsers to fill to above 0.75m target depth. Started test at 0.71m once water bowsers had emptied. End of test – little movement in 4hrs.	$3.7 \times 10^6$

- 4.7.4 The soakaway test results indicate moderate soil infiltration rates in locations in the southwest of the site (SA1, SA3 and SA5), where water eventually soaked away over 2 to 4 hours. The locations tested in the northwest (SA2) and southeast (SA6) showed slower infiltration rates.
- 4.7.5 It should be noted that even though SA1, SA3 and SA5 showed similar soil infiltration rates, SA1 and SA3 were excavated to much greater depths in the gravelly sand Made Ground than SA5, and so comparisons should take into account the depths at which the tests took place. Equally, SA2 was a deep test, whereas SA6 was a shallow test, but both tests showed little movement from the original water levels at the start of the tests.

#### 4.8 Geotechnical Tests – SPT Results

- 4.8.1 Standard Penetration Tests (SPTs) were undertaken by the drillers in every borehole (10 boreholes in total) where possible every 1.0m down to 10m deep and then every 1.5m thereafter. The drillers used 450mm long open cones and conducted the tests in accordance with BS EN ISO 22476-4 (2005). The open cones allowed for a small soil sample to be taken after each test, with variable rates of recovery, which were put into a plastic 1L tub and labelled.
- 4.8.2 The SPT results are presented in the logs for each borehole in Appendix 4. The results are presented in the format of a set of six numbers with a number in brackets at the end, for example: 2/2/4/5/6/7 (26). The end numbers correspond to soil consistency/density values, as shown in Table 11, where the end values for sands and gravels are provided:

**Table 11 – Soil Consistency/Density SPT Values for Sands and Gravels**

No. blows	Force required (kPa)	Soil Density
0-4	<20	Very loose
4-10	20-40	Loose
10-30	40-75	Medium dense
30-50	75-150	Dense
50+ (refusal)	150-300	Very Dense

- 4.8.3 The SPT results for the 10 boreholes at the site indicate the Made Ground in the top 1.0m near the surface is fairly loose, except when cobbles or boulders of concrete were encountered, which caused refusals due to anomalously high values (50+ blows). The gravelly sand Made Ground appears on average to be medium dense down to around 8.0m in most boreholes. The three deeper boreholes indicate the silty sands below the Made Ground become dense from 7.0m down to 15.0m, where the natural silts and sands were indicated to be very dense with the drillers unable to progress the boreholes past 15.0m and the SPT results showing very high values.

## 5.0 REVISED CONCEPTUAL SITE MODEL

### 5.1 Discussion

- 5.1.1 In summary, Made Ground is present across the entire site, including the grassed area in the north. It consists of loose sandy demolition material on average 1.0m thick in the Power Station footprint and then into medium dense gravelly sands down to between 3.0 and 5.5, with the area to the north covered in thick grass over the sandy gravelly Made Ground. Within the footprint of the former Power Station, the Made Ground appeared to be homogenous comprising brown sandy gravel with cobbles of concrete and brick, occasional metal rebar and concrete boulders across the whole area. Whereas within the grassed area to the north, the Made Ground did not have the same demolition material layer, instead there was thick grass over gravelly sand, with different materials noted including clinker associated with the former iron works. This is consistent with the development history of the site, where it is understood that ground was 'remediated prior to the development of the former power station' whereas the grassed area falls outside of the Power Station footprint, located to the north.
- 5.1.2 The natural tidal flat deposits (silty sands and silt layers) are present between 5.5 and 15.0m, with SPT results indicating the deposits get much denser with depth, becoming very dense at 15.0m bgl. Visually the natural ground was very similar in appearance to the sandy Made Ground used to raise the site ground levels prior to the development of the iron works. The boundary between the two layers was therefore interpreted based on a marked change in colour, from the light and medium browns of the Made Ground to the dark brown, grey and black of the alluvial deposits, and also based on the obvious presence of silt bands and abundant shell fragments within the sands.
- 5.1.3 The site investigation indicated the presence of three potential sources of contamination: hydrocarbons within the central area, timber containing hydrocarbons in the south west and asbestos detected at low concentrations in the grassed area to the north.
- 5.1.4 The moderate concentrations of hydrocarbons within the Made Ground around TP3a and TP3b appears to be localised and no free product was seen or detected. The hydrocarbons appear to be concentrated in a layer of grey fine sand within the Made Ground, proven to be around 1.0m thick at TP3a. The absence of any elevated hydrocarbon or metal ion concentrations in the underlying Made Ground sand in TP3a indicates that the contamination is confined to this layer and does not pose a risk to any deeper strata. There was no visual or olfactory evidence of any further lateral migration of the hydrocarbon contamination approximately 8m to the north, south and east when excavating TP3c, TP3d and TP3e around TP3a.
- 5.1.5 All piling methods during the construction phase of the proposed development must take into consideration the potential for creating vertical pathways down through the superficial deposits below the contaminated area at TP3a and TP3b, to prevent vertical migration of hydrocarbon contaminants into the groundwater and deeper strata below.

- 5.1.6 The presence of timber (wooden posts) at location SA3 that emitted a strong odour reminiscent of creosote (or other similar substance) should be considered during the construction phase of the development. The posts were found below the existing asphalt car park in the southwest of the site at 1.6m bgl and likely pre-date the Power Station, possibly associated with the railways of the former ironworks. No phenols were detected in the surrounding Made Ground and there were no significant concentrations of other hydrocarbons. Based on olfactory evidence only, it is considered that the posts would potentially be classed as hazardous waste and would require disposal at a hazardous waste facility should they be encountered during the development phase.
- 5.1.7 Asbestos was only detected in one location, BH9, in the northern grassed area of the site, specifically Chrysotile loose fibres at 0.5m bgl. This location is not associated with the former Shotton Power Station demolition, as it was not part of the developed area and therefore is not covered with any demolition material from this time. No asbestos was detected in any of the other soil samples from across the site and it is not expected to be present due to the Made Ground composed primarily of demolition material from the building built after asbestos use was banned in construction. The amount of asbestos detected was only slightly above the laboratory limit of detection. No other concerning levels of contaminants were detected in the Made Ground below the site, with all metals, PAHs and TPHs below screening levels for a commercial land-use. It is considered the risk of asbestos fibres in the ground reaching human users of the site once development is complete will be very low, due to the movement of fibres being restricted by the very wet soil matrix of the grassed area, but also by the hardstanding that will cover much of the site surface post-development. Consideration should be given however to the potential risks to construction workers from asbestos fibres in the grassed area released during the development phase, with operations fully risk-assessed and care taken during earthworks.
- 5.1.8 Three groundwater monitoring points were installed around the site (in BH1, BH6 and BH9) and no hydrocarbon contamination or significant levels of other pollutants were detected in any of the groundwater samples, indicating any potential localised pollution from the Made Ground (particularly from the area around TP3a and TP3b) at the site is not migrating into groundwater or affecting groundwater quality. The average groundwater level around the site was around 4.8m based on data from the monitoring wells and boreholes logs. When groundwater levels from all three monitoring wells is compared, an indicative hydraulic gradient can be surmised, with groundwater theoretically flowing from the southeast towards the northwest.
- 5.1.9 Flat concrete surfaces/slabs were found in three locations, SA4a, SA4b and TP6a, considered to possibly be the remnants of former foundations of previous buildings. A number of suspected services were also discovered within the Made Ground, with black drainage pipe found in SA4a, brown plastic pipe and yellow electric warning tape in TP1a and yellow electric warning tape in TP9.
- 5.1.10 The soakaway test results proved some areas of Made Ground were more suitable than others for water to drain away, with the faster infiltration rates recorded in the trial pits located in the southwestern portion of the site.

5.1.11 The risk from ground gases is considered to be negligible, due to the lack of evidence found during the investigation that any organic-rich sources exist below the site. A single round of ground gas monitoring from the newly installed boreholes indicated the lack of any methane or elevated carbon dioxide levels in the ground.

## 5.2 Revised Conceptual Site Model

5.2.1 The site observations made during the ground investigations and subsequent chemical analysis have been included in the updated Conceptual Site Model (CSM) for the site in Figure 4 and a plan view in Figure 5, and the potential pathways and risks to receptors are presented in Tables 12 and 13 below.

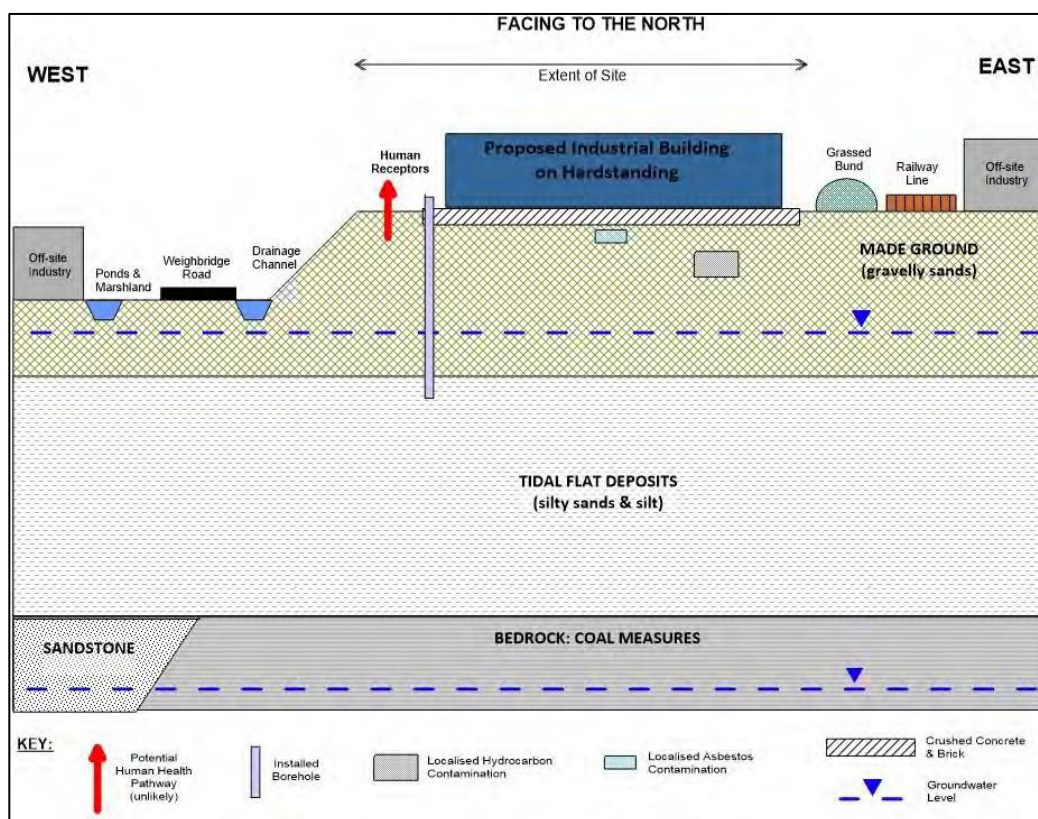


Figure 4 – Updated Conceptual Site Model (cross-section from east to west, looking north)

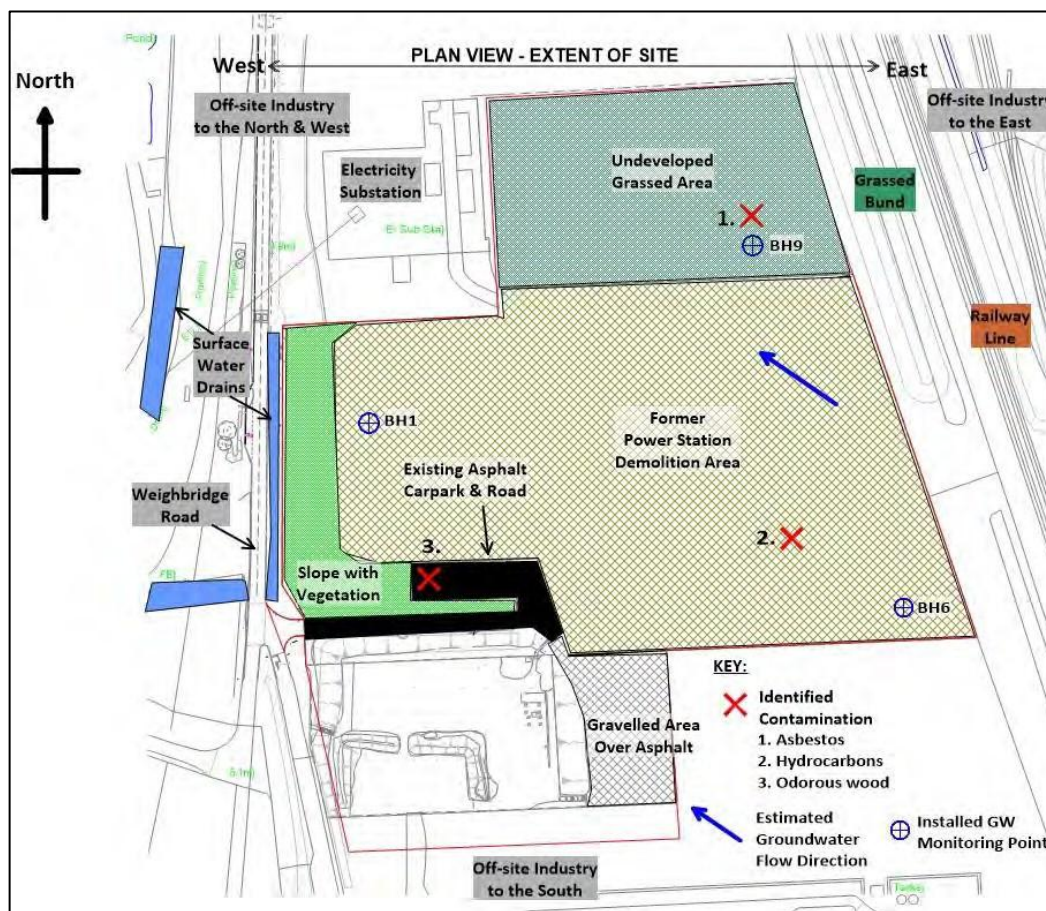


Figure 5 – Plan View of Revised Conceptual Site Model

5.2.2 Table 12 details the potential pathways by which a contaminant/hazard could reach a sensitive receptor at the site, such as a human receptor or controlled waters.

Table 12 – Summary of Potential Contaminant Pathways

Reference Number	Pathway
P1	Ingestion of soil and dust on site
P2	Inhalation of soil and dust on site
P3	Dermal / direct contact with soil and dust on site
P4	Inhalation of vapours and gases
P5	Inhalation of fibres (asbestos)
P6	Infiltration of rainwater through contaminated soils
P7	Migration through variably permeable made ground
P8	Migration through variably permeable superficial drift deposits
P9	Migration through variably permeable rock strata
P10	Preferential migration through services ducts, culverts and trenches
P11	Explosion (accumulation of gases in confined spaces)

**Table 13 – Revised Conceptual Site Model Breakdown**

Potential Source	Potential Hazard	Potential Pathways	Potential Receptor	Pollutant Linkage Present	Comments
Made Ground (TP3a and TP3b locations)	Total Petroleum Hydrocarbons (TPH) within sand layer	P1, P2, P3, P5, P6	Site users / Infrastructure	Low	The residual concentrations of hydrocarbons within the soils are below the commercial land use screening values and therefore, this pollutant linkage is considered to be negligible  In addition, the proposed development of buildings and concrete hardstanding across the site will break the pollutant linkages between any contamination in the underlying soils and the site users.  Any potable water supplies through this area should be constructed from chemical resistant pipework in accordance with the water supplier's guidance.
			Controlled waters	Possible	The proposed development of buildings and concrete hardstanding across the site will minimise the infiltration of water into the Made Ground, therefore minimising the potential of mobilisation of residue contamination into controlled waters. This would reduce the current infiltration through this area and reduce the potential mobilisation of any current contamination.  Surface water run-off will also be controlled during the construction phase of the development, protecting local surface water receptors from any potential contamination leaving site.
			Construction workers / infrastructure	Low	Appropriate Personal Protective Equipment (PPE) should be worn at all times, welfare units provided, and risk assessments completed prior to work commencing, taking into consideration known areas of hydrocarbon contamination.
Made Ground (grassed area around BH9)	Asbestos fibres	P5	Site users / construction workers	Possible	The presence of asbestos within the made ground in the grassy area is considered to represent a low but possible risk to construction workers. The area is extremely wet and the potential of mobilisation of asbestos fibres from the ground is low based on the high moisture content locking the fibres within the soil and the low initial fibre concentration detected in laboratory analysis.  Future site development comprising hardstanding will create a barrier between this material and future site users however the presence of this material should be documented  All future works undertaken in this area will require appropriate risk assessments to be undertaken with respect to the potential exposure to asbestos.

Potential Source	Potential Hazard	Potential Pathways	Potential Receptor	Pollutant Linkage Present	Comments
Made ground (area under existing carpark - SA3)	Odorous Wood (possibly treated with creosote)	P7	Controlled waters	Low	<p>The strong hydrocarbon odour (reminiscent of creosote) arising from the wooden posts / timbers suggests that these may potentially contain elevated concentrations of creosote, however chemical testing of the surrounding sand (Made Ground) matrix indicated that this was not contaminated. The location of the wood is in a provisional location for surface water drainage. Any such wood fragments would need to be removed from these areas and disposed of appropriately.</p> <p>The risks from the occasional wood fragments within the demolition material in other areas of the site is considered very low due to the reduction in infiltration caused by the development of the site's hardstanding.</p>

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

### 6.1 General

6.1.1 This report summarises the findings of the Phase 2 Site Investigation undertaken by Caulmert Limited in January and February 2021 at the former Shotton Power Station site in Zone 4 of Deeside Industrial Estate, with respect to possible sources of contamination. The Phase 2 Site Investigation was used to make a more detailed assessment of the potential hazards identified in the TerraConsult Limited Phase 1 report (2017) and to confirm if pollutant linkages are present. Additional geotechnical information was also collected during the investigation from infiltration (soakaway) testing in trial pits and Standard Penetration Testing (SPTs) during drilling.

### 6.2 Soil Assessment

6.2.1 The site investigation indicated localised elevated hydrocarbon concentrations in the Made Ground at the site in trial pit locations TP3a and TP3b, however concentrations were not above screening criteria for a commercial land-use and appeared to be limited in vertical and lateral extent. There was no evidence of this contaminated area impacting on the groundwater quality at the site boundary. The nature of the proposed development, with most of the site to be covered in hardstanding and buildings, means this contamination will not pose a risk to site users or controlled waters in the future. However, the residual hydrocarbon contamination should be considered during any foundation or pile design to minimise the potential mobilisation of the hydrocarbon contamination. During the construction phase in this area, any contaminated arisings from excavations should be kept segregated from other arisings on an impermeable surface and disposed of appropriately.

6.2.2 A small amount of loose asbestos fibres (Chrysotile) were detected within the Made Ground at 0.5m bgl in BH9, which is within the grassed area to the north, however no other areas sampled across the site contained asbestos. It is noted that the Made Ground in the grassed area is slightly different to that in the footprint of the Power Station and represents the different historic development history of the area. The asbestos fibres detected are considered to be a localised issue and likely bound within the very wet soil matrix and therefore the risk to receptors remains very low, in part due to the high moisture content of the soils in this area minimising the risk of generating free fibres and also due to the low concentration identified. The concentrations are significantly below the hazardous waste threshold. However, the possible presence of asbestos in this area should be managed accordingly and included within risk assessments during construction phases to protect construction workers. The risks to end-users of the final development of the site is considered to be very low as this layer will be sealed beneath the development.

6.2.3 The wooden posts found in trial pit location SA3 (see photographs in Appendix 1) in the southwestern area of the site beneath the existing carpark, which emitted a strong odour reminiscent of creosote, were not found to be leaching phenols / other hydrocarbon contaminants into the surrounding Made Ground and therefore do not pose a risk to receptors, humans or controlled waters. However, it is recommended that where

encountered during the construction of the surface water drainage system, that these posts are removed and disposed of at a suitable waste disposal facility.

### **6.3 Geotechnical Assessment**

- 6.3.1 The site investigation has shown that when water interacts with the gravelly sand Made Ground it is likely to become very unstable, as recorded during the soakaway tests (up to 3.1m deep) and therefore it is very likely that any excavations below the water table, typically between 4.0 and 5.0m bgl, will collapse unless dewatering is carried out.

### **6.4 Discharge of Planning Conditions**

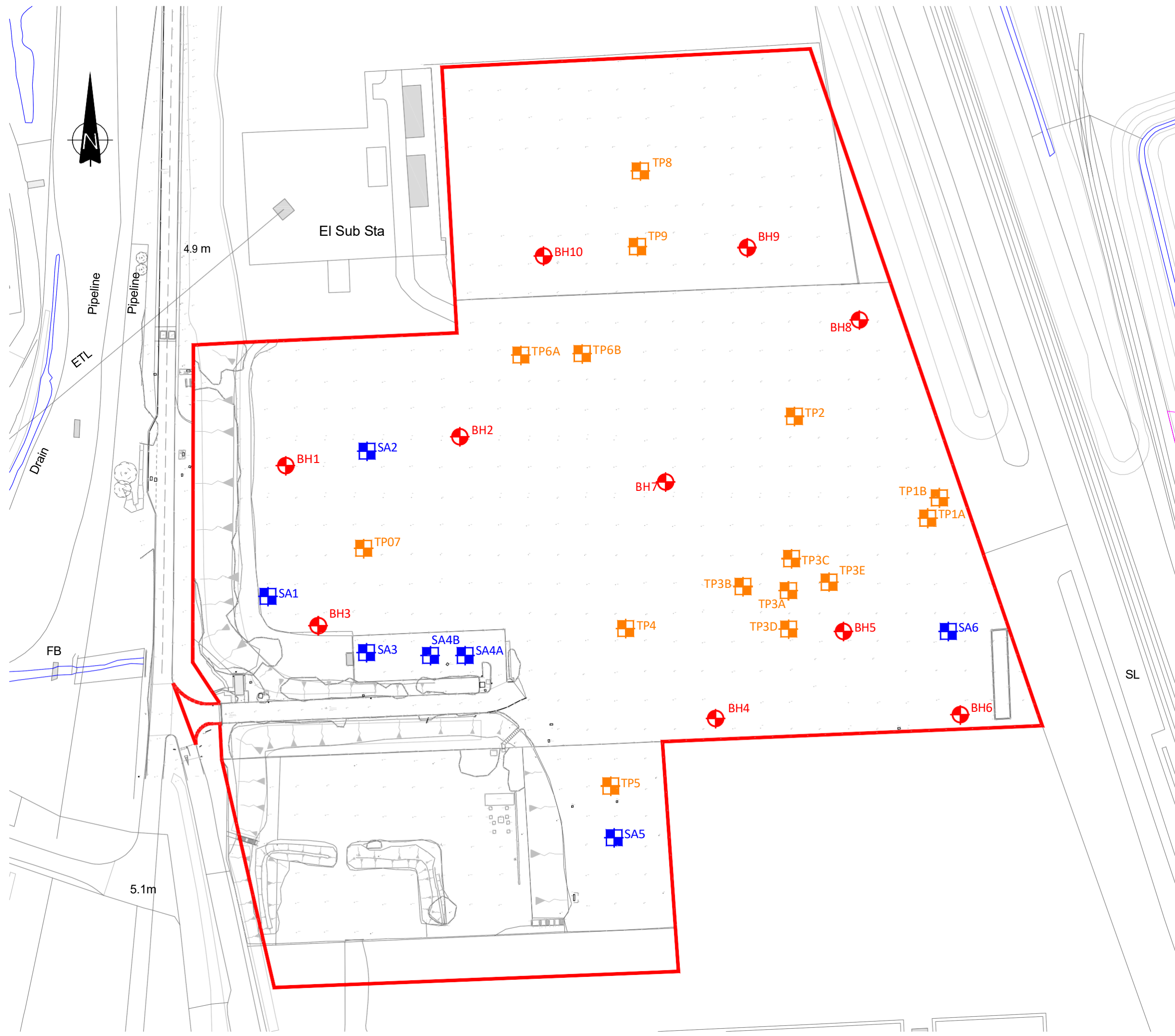
- 6.4.1 In summary the site investigation has confirmed that whilst there are some elevated concentrations of residual hydrocarbons present in very localised areas within the Made Ground, the concentrations are below the commercial land use screening values for soil and therefore the land at the site is suitable for development for a commercial land-use. The site investigation has demonstrated that the elevated hydrocarbon concentrations are limited in vertical extent and chemical analysis has indicated that the contamination has not reached the underlying groundwater at 4.0-5.0m bgl. The absence of discernible concentrations in the groundwater at the site confirms that the residual hydrocarbon contamination does not pose a risk to the groundwater environment. No other contaminants of concern were detected in significant concentrations within the ground at the site. Therefore, it is considered that this report has satisfied the requirements of Condition 6 of Planning Permission 058270 for the site, as outlined in Section 1.2.1 of this report, and the site investigation has demonstrated that there is no significant contamination present within the ground which would represent a risk to human health, controlled waters, or infrastructure present on the site for a commercial land use.



**DRAWINGS**

**4701-CAU-XX-XX-DR-V-1803.S2.P01**

**Site Investigation Exploratory Locations Plan**



**NOTES**

- DO NOT SCALE FROM THIS DRAWING, WORK FROM FIGURED DIMENSIONS ONLY. ALL DIMENSIONS ARE IN METRES AND ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM UNLESS NOTED OTHERWISE.
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALIST DRAWINGS AND SPECIFICATIONS.

**LEGEND**

- TP10 TRIAL PITS
- BH4 BORHOLES
- SA3 SOAK AWAY

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P01	ISSUED FOR INFORMATION	EJD	SV	SV	03.02.21
REV	MODIFICATIONS	BY	RE	AP	DATE
PURPOSE OF ISSUE					STATUS
FOR INFORMATION					S2

CLIENT:	LOGIK WTE LTD
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PROJECT:	DEESIDE WASTE MANAGEMENT FACILITY AND AD PLANT
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TITLE:	SITE INVESTIGATION EXPLORATORY LOCATIONS
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DESIGNED BY	DRAWN BY	REVIEWED BY	AUTHORISED BY
EJD	EJD	SV	SV
DATE	SCALE @ A3	JOB REF:	REVISION
21.01.2021	1:1250	4701	P01

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**APPENDIX 1**

**Trial Pit Photographs**

## Appendix 1 – Photographs of Trial Pits from Site Investigation at Deeside

### For information:

When photographing the trial pits, the sides or faces have been labelled Face A, B, C or D, where Face A is the side closest to the excavator machine, as shown in Figure 1 below:

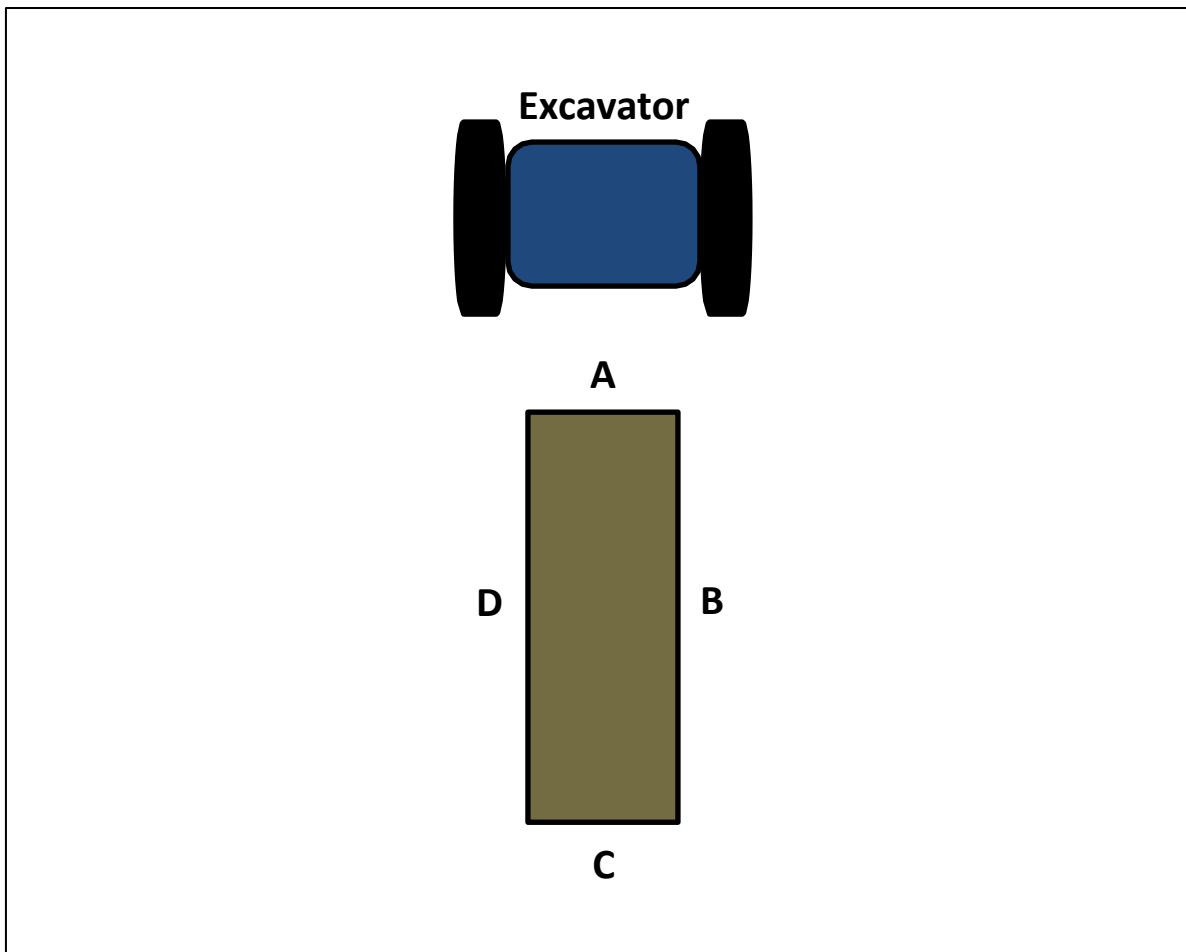


Figure 1 – Diagram above showing location of trial pit faces in relation to the excavator.

**TP1a**



**Face A**



**Face B**



**Face D**



**Arisings**

**TP1b**



**Face A**



**Face B**



**Face D**



**Arisings**

**TP2**



**Face A**



**Face B**



**Face D**

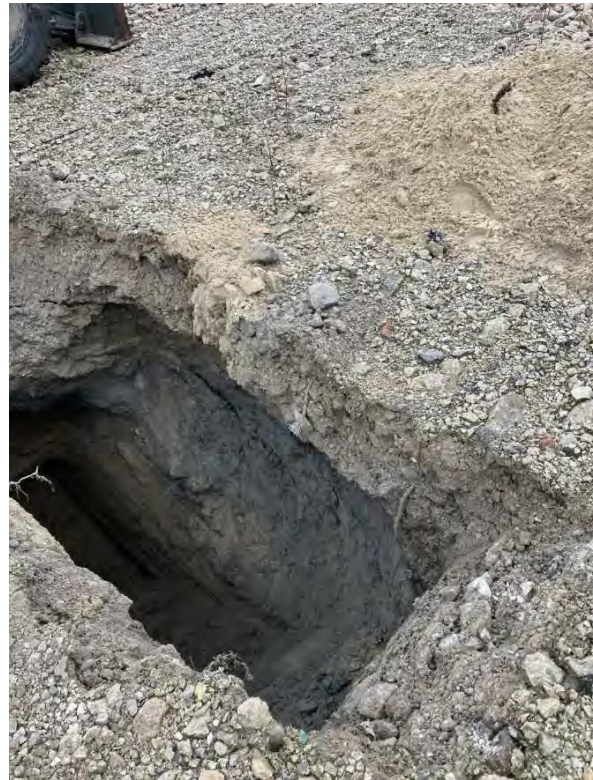


**Arisings**

**TP3a**



**Face A**



**Face B**



**Face D**

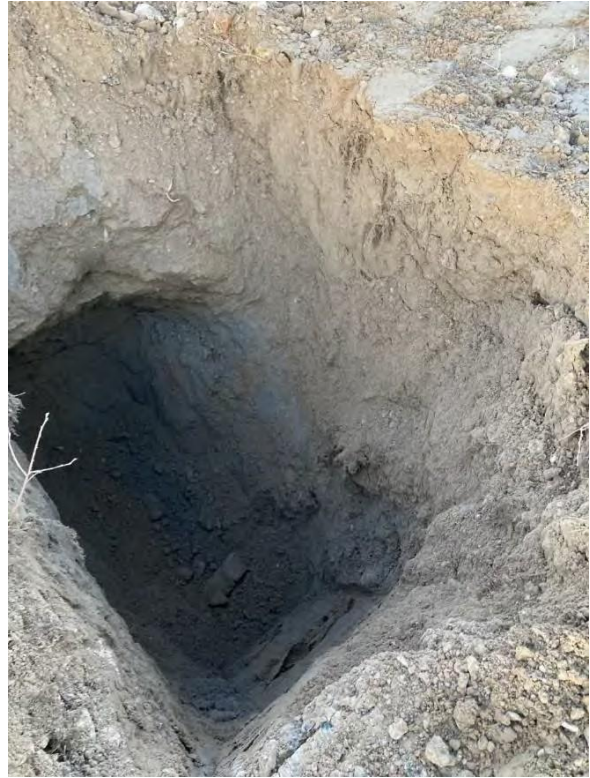


**Arisings**

**TP3b**



**Face A**



**Face B**



**Face D**



**Arisings**

**TP3c**



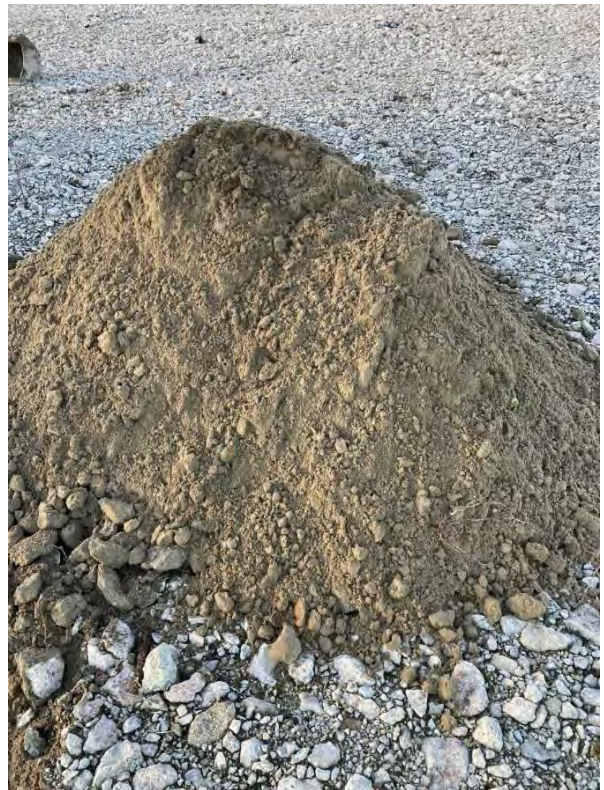
**Face A**



**Face B**



**Face D**



**Arisings**

**TP3d**



**Face A**



**Face B**



**Face D**



**Arisings**

**TP3e**



**Face A**



**Face B**



**Face D**



**Arisings**

**TP4**



**Face A**



**Face B**



**Face D**



**Arisings**

**TP5**



**Face A**



**Face B**



**Face D**



**Arisings**

**TP6a**



**Face A**



**Face B**



**Face D**



**Arisings**

**TP6b**



**Face A**



**Face B**



**Face D**



**Arisings**

**TP7**



**Face A**



**Face B**



**Face D**



**Arisings**

**TP8**



**Face A**



**Face B**



**Face D**



**Arisings**

**TP9**



**Face A**



**Face B**



**Face D**



**Arisings**

**SA1**



**Face A**



**Face B**



**Face D**



**Arisings**

**SA2**



**Face A**



**Face B**



**Face D**



**Arisings**

**SA3**



**Wooden Post from Arisings**



**Face B**



**Face D**



**Arisings**

**SA4a**



**Face A**



**Face B**



**Face D**



**Arisings**

**SA4b**



**Face A**



**Face A again**



**Face B**



**Face D & Some Arisings**

**SA5**



**Face A**



**Face B**



**Face D**



**Arisings**

**SA6**



**Face A**



**Face B**



**Face D**



**Arisings**



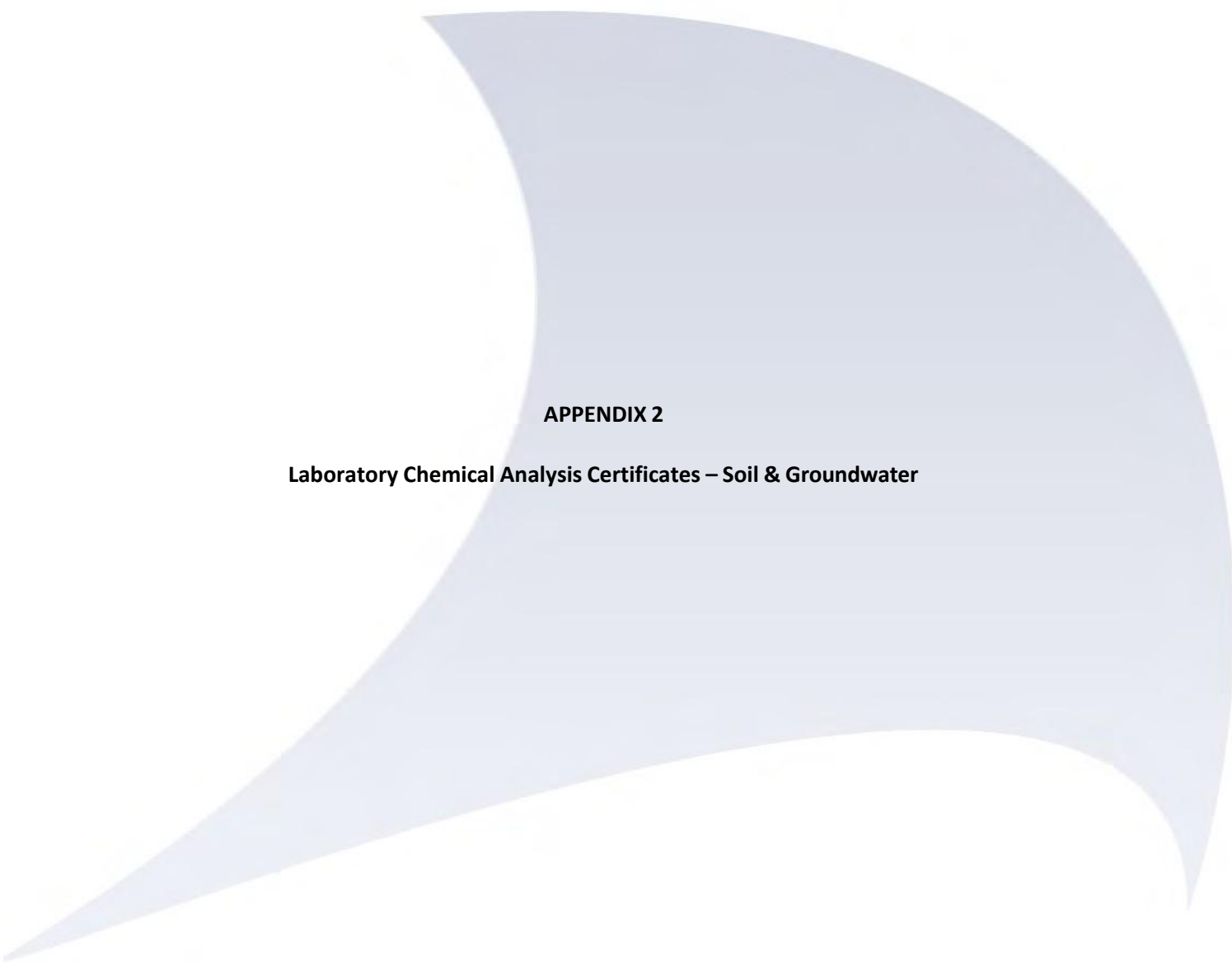
Registered Office: InTec, Parc Menai, Bangor, Gwynedd, LL57 4FG

**Tel:** 01248 672666

**Fax:** 01248 672601

**Email:** [contact@caulmert.com](mailto:contact@caulmert.com)

**Web:** [www.caulmert.com](http://www.caulmert.com)



**APPENDIX 2**

**Laboratory Chemical Analysis Certificates – Soil & Groundwater**



**SOCOTEC**

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## CERTIFICATE OF ANALYSIS

**ANALYSIS REQUESTED BY:** SOCOTEC UK Ltd  
 Environmental Chemistry  
 PO Box 100  
 Burton upon Trent  
 Staffordshire  
 DE15 0XD

**CONTRACT NO:** S16497-1

**DATE OF ISSUE:** 05.02.21

**DATE SAMPLES RECEIVED:** 29.01.21

**DATE ANALYSIS COMPLETED:** 05.02.21

**DESCRIPTION:** Seven soil/loose aggregate samples each weighing approximately 1.0-1.7kg.

**ANALYSIS REQUESTED:** Qualitative and quantitative analysis of soil/loose aggregate samples for mass determination of asbestos.

### METHODS:

**Qualitative** - The samples were analysed qualitatively for asbestos by polarised light and dispersion staining as described by the Health and Safety Executive in HSG 248.

**Quantitative** - The analysis was carried out using our documented in-house method based on HSE Contract Research Report No. 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies *et al*, 1996) and HSG 248. Our method includes initial examination of the entire sample, detailed analysis of a representative sub-sample and quantification by hand picking/weighing and/or fibre counting/sizing as appropriate.

### RESULTS:

#### Initial Screening

No asbestos was detected in any of the soil samples by stereo-binocular and polarised light microscopy.

A summary of the results is given in Table 1.





**CONTRACT NO:** 516497-1  
**DATE OF ISSUE:** 05.02.21

**RESULTS: (cont.)**

**Table 1: Qualitative Results**

**SOCOTEC Job I.D:** 21011616

IOM sample number	Client sample number	ACM type detected	PLM result
S79360	21011616-001-8	-	No Asbestos Detected
S79361	21011616-003-1	-	No Asbestos Detected
S79362	21011616-005-10	-	No Asbestos Detected
S79363	21011616-008-1	-	No Asbestos Detected
S79364	21011616-009-9	-	No Asbestos Detected
S79365	21011616-011-1	-	No Asbestos Detected
579366	21011616-012-1	-	No Asbestos Detected

Our detection limit for this method is 0.001%.

**COMMENTS:**

IOM Consulting cannot accept responsibility for samples that have been incorrectly collected or despatched by external clients.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.



AUTHORISED BY: .....

**DThird**  
*Scientific Technician*









**SOCOTEC**

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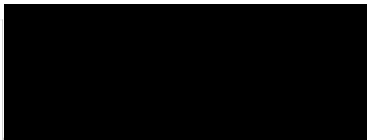
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# Additional Report Notes

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
PAHMSUS	002,003,005,006,008	The Primary process control data associated with this Test has not wholly met the requirements of the Laboratory Quality Management System QMS with one or more target analytes falling outside acceptable limits. However the remaining data gives the Laboratory confidence that the test has performed satisfactorily and that the validity of the data may not have been significantly affected. However in line with our QMS policy we have removed accreditation, where applicable, from the affected analytes (Indeno[1,2,3-cd]pyrene). These circumstances should be taken into consideration when utilising the data.
BTEXHSA	002	Due to matrix interference, the Internal Standard recovery for this Test is below the required QMS specification. This has been confirmed by repeating the analysis. All other Laboratory Process Controls meet the requirements of the QMS unless otherwise stated. These circumstances should be taken into consideration when utilising the data.
GROHSA	002	Due to matrix interference, the Internal Standard recovery for this Test is below the required QMS specification. This has been confirmed by repeating the analysis. All other Laboratory Process Controls meet the requirements of the QMS unless otherwise stated. These circumstances should be taken into consideration when utilising the data.



## CERTIFICATE OF ANALYSIS

**ANALYSIS REQUESTED BY:** SOCOTEC UK Ltd  
Environmental Chemistry  
PO Box 100  
Burton upon Trent  
Staffordshire  
DE15 0XD

**CONTRACT NO:** S16599-5

**DATE OF ISSUE:** 11.02.21

**DATE SAMPLES RECEIVED:** 04.02.21

**DATE ANALYSIS COMPLETED:** 11.02.21

**DESCRIPTION:** Three soil/loose aggregate samples each weighing approximately 1.5-1.6kg.

**ANALYSIS REQUESTED:** Qualitative and quantitative analysis of soil/loose aggregate samples for mass determination of asbestos.

### METHODS:

**Qualitative** - The samples were analysed qualitatively for asbestos by polarised light and dispersion staining as described by the Health and Safety Executive in HSG 248.

**Quantitative** - The analysis was carried out using our documented in-house method based on HSE Contract Research Report No. 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies *et al*, 1996) and HSG 248. Our method includes initial examination of the entire sample, detailed analysis of a representative sub-sample and quantification by hand picking/weighing and/or fibre counting/sizing as appropriate.

### RESULTS:

#### Initial Screening

Asbestos was detected in one of the soil samples by stereo-binocular and polarised light microscopy.

A summary of the qualitative and quantitative results are given in Tables 1 & 2 respectively.





**CONTRACT NO:** S16599-5  
**DATE OF ISSUE:** 11.02.21

**RESULTS: (cont.)**

**Table 1: Qualitative Results**

**SOCOTEC Job I.D:** 21020172

IOM sample number	Client sample number	ACM type detected	PLM result
S79498	21020172-001-1	-	No Asbestos Detected
S79499	21020172-004-1	Loose Insulation <sup>2</sup>	Chrysotile
S79500	21020172-007-1	-	No Asbestos Detected

Our detection limit for this method is 0.001%.

**Table 2: Quantitative Analysis Results**

Client Sample Number	Sample Weight (g)	% Asbestos in Sample from <b>ACM's</b>	% Asbestos in Sample as Unbound Fibres	Total% Asbestos in Sample
21020172-004-1	1540	-	0.003	0.003

Our limit of quantification for gravimetric analysis of soil samples is 0.001%.

**COMMENTS:**

<sup>1</sup> ACM was visible during initial examination of the sample.

<sup>2</sup> ACM was detected during microscopic examination of the sample.

IOM Consulting cannot accept responsibility for samples that have been incorrectly collected or despatched by external clients.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.



AUTHORISED BY: .....

**D Third**  
*Scientific Technician*









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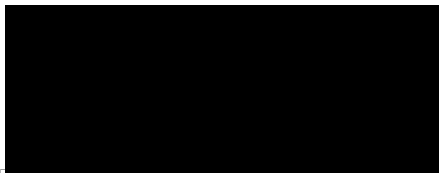
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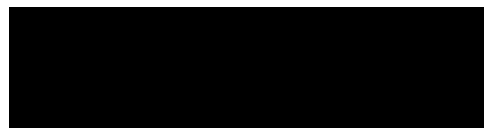
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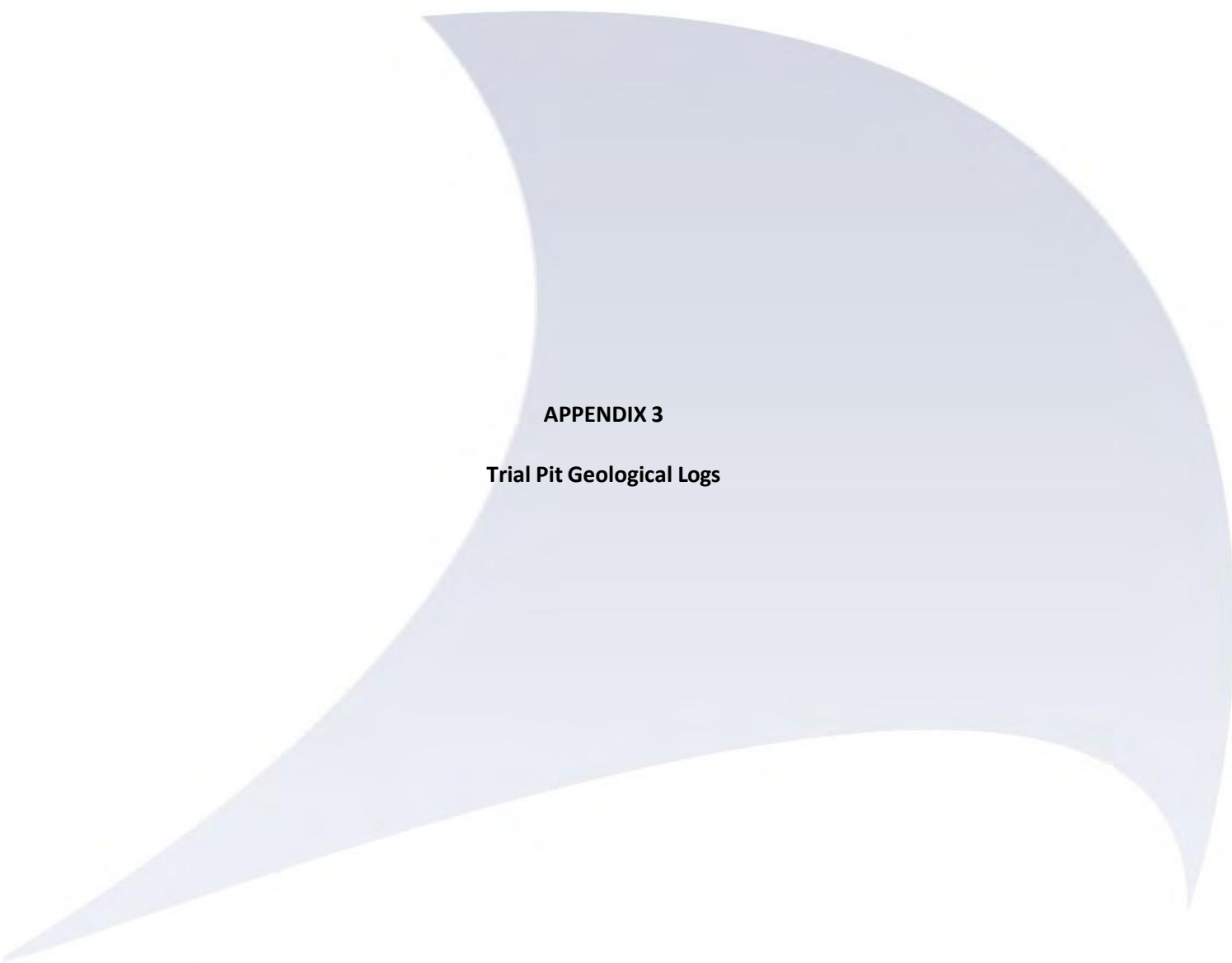


# Additional Report Notes

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
icpwatvart	1;3	The matrix of this sample has been found to interfere with the result for this test. The sample has therefore been diluted, but in doing so, the detection limit for this test has been elevated.
PAHMSW	001-003	The Primary process control data associated with this Test has not wholly met the requirements of the Laboratory Quality Management System QMS with one or more target analytes falling outside acceptable limits. However the remaining data gives the Laboratory confidence that the test has performed satisfactorily and that the validity of the data may not have been significantly affected. However in line with our QMS policy we have removed accreditation, where applicable, from the affected analytes (Anthracene) . These circumstances should be taken into consideration when utilising the data.





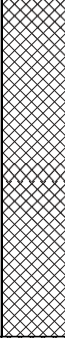
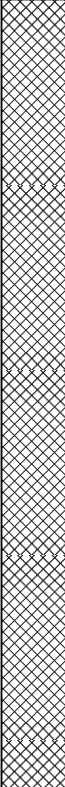


**APPENDIX 3**

**Trial Pit Geological Logs**

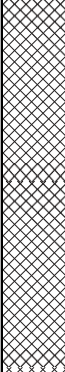
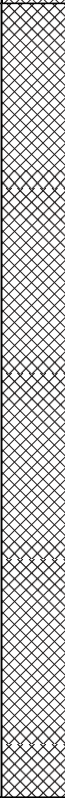
<b>PROJECT NUMBER:</b> 4701 <b>PROJECT NAME:</b> Deeside <b>CLIENT:</b> Logik WTE Ltd. <b>DATE:</b> 20.01.2021	<b>METHOD:</b> Mechanically Excavated <b>PLANT:</b> Wheeled Excavator <b>WEATHER:</b> Heavy Rain <b>LOGGED BY:</b> SB - Caulmert Ltd. <b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>COORDINATES:</b> E 330992 N 371209 <b>BEARING (degrees):</b> 090 <b>WIDTH:</b> 0.9m <b>LENGTH:</b> 2.6m <b>TOTAL DEPTH:</b> 3.0m
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**COMMENTS** On addition of water for soakaway testing the sides were unstable.

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
0.5	N/A	0.9		Wet	Very loose brown sandy gravel MADE GROUND. Gravel is angular to sub-rounded fine to coarse of concrete, brick, asphalt, wood fragments, tile pieces and plastic fragments.	Rare thin pieces metal wire (5mm) sticking out side of pit (<1%). No odour.
1	N/A	2.1		Damp	Loose light brown slightly gravelly sand MADE GROUND. Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of brick, and concrete.	No odour.
3					Base of Excavation [TARGET DEPTH]	
3.5						

<b>PROJECT NUMBER:</b> 4701	<b>METHOD:</b> Mechanically Excavated	<b>COORDINATES:</b> E 331026 N 371259
<b>PROJECT NAME:</b> Deeside	<b>PLANT:</b> Wheeled Excavator	<b>BEARING (degrees):</b> 085
<b>CLIENT:</b> Logik WTE Ltd.	<b>WEATHER:</b> Heavy Rain	<b>WIDTH:</b> 1.1m
<b>DATE:</b> 20.01.2021	<b>LOGGED BY:</b> SB - Caulmert Ltd.	<b>LENGTH:</b> 2.5m
	<b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>TOTAL DEPTH:</b> 3.1m

**COMMENTS** Water seepage from the sides of the pit at 1.0m possibly due to weather. On addition of water for soakaway test the sides were unstable.

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
0.5	N/A	1.0		Wet	Very loose brown sandy gravel MADE GROUND with frequent cobbles (30%) and rare boulders (<1%). Gravel is angular to sub-angular fine to coarse of concrete, brick, limestone and plastic fragments. Cobbles are angular to sub-rounded of concrete and brick. Boulders are sub-rounded of concrete.	Thin pieces metal wire (5mm) sticking out side of pit and 0.1m long piece of blue rope. No odour.
1	N/A	2.1		Damp	Loose light brown slightly gravelly sand MADE GROUND. Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of brick, concrete, limestone and coal.	Water seepage at 1.0m
3					Base of Excavation [TARGET DEPTH]	
3.5						

<b>PROJECT NUMBER:</b> 4701 <b>PROJECT NAME:</b> Deeside <b>CLIENT:</b> Logik WTE Ltd. <b>DATE:</b> 19.01.2021	<b>METHOD:</b> Mechanically Excavated <b>PLANT:</b> Wheeled Excavator <b>WEATHER:</b> Overcast with showers <b>LOGGED BY:</b> SB - Caulmert Ltd. <b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>COORDINATES:</b> E 331026 N 371190 <b>BEARING (degrees):</b> 080 <b>WIDTH:</b> 0.7m <b>LENGTH:</b> 2.3m <b>TOTAL DEPTH:</b> 3.1m
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**COMMENTS** On addition of water for soakaway testing the sides became unstable.

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
	N/A	0.1		Dry	Hard black asphalt MADE GROUND.	Carpark surface. No odour.
	N/A	0.3		Dry	Light grey angular coarse limestone gravel MADE GROUND.	Limestone sub-base on a thin white fabric liner. No odour.
0.5	N/A	0.45		Dry	Loose light brown slightly gravelly sand MADE GROUND. Sand is fine to medium. Gravel is angular coarse of concrete, brick and limestone.	No odour.
1	1L tub 1.6m	2.15		Damp	Loose light brown slightly gravelly sand MADE GROUND with occasional cobbles (10%) and rare boulders (1%). Sand fine to medium. Gravel is angular to sub-angular fine to coarse of brick, concrete, sandstone, coal and asphalt. Cobbles are sub-angular to sub-rounded of concrete and brick. Boulders are sub-rounded of concrete.	Creosote-like odour from rare wooden posts/planks (~1.2m long by 0.1m wide) found at 1.6m. Rare black rubber pieces 0.2m long.
1.5						
2						
2.5						
3	N/A	0.1		Damp	Loose brown sand MADE GROUND. Sand fine to medium.	No odour.
3.5					Base of Excavation [TARGET DEPTH]	

<b>PROJECT NUMBER:</b> 4701 <b>PROJECT NAME:</b> Deeside <b>CLIENT:</b> Logik WTE Ltd. <b>DATE:</b> 19.01.2021	<b>METHOD:</b> Mechanically Excavated <b>PLANT:</b> Wheeled Excavator <b>WEATHER:</b> Overcast with showers <b>LOGGED BY:</b> SB - Caulmert Ltd. <b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>COORDINATES:</b> E 331047 N 371188 <b>BEARING (degrees):</b> 080 <b>WIDTH:</b> 0.7m <b>LENGTH:</b> 2.4m <b>TOTAL DEPTH:</b> 1.5m
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**COMMENTS** Refusal at 1.5m - encountered flat concrete surface.

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
	N/A	0.1		Dry	Hard black asphalt MADE GROUND.	Carpark surface. No odour.
	N/A	0.2		Dry	Dense light grey angular coarse limestone gravel MADE GROUND.	Limestone sub-base on a thin white fabric liner. No odour.
0.5	N/A	0.40		Dry	Medium dense grey slightly silty sand MADE GROUND. Sand is fine.	No odour.
1	N/A	0.8		Dry	Loose brown slightly gravelly sand MADE GROUND with frequent cobbles (30%) and rare boulders (1%). Sand is fine to medium. Gravel is angular to sub-angular fine to coarse of brick, concrete and sandstone. Cobbles are sub-angular to sub-rounded of concrete and brick. Boulders are sub-rounded of concrete.	Rare 0.2m long pieces of metal rebar (<1%). Rare cobble-sized wood fragments (<1%). Black and blue corrugated plastic pipe 0.25m diameter, 0.1m long (<1%). No odour.
1.5					Base of Excavation [TERMINATED DUE TO OBSTRUCTION]	
2						
2.5						
3						
3.5						


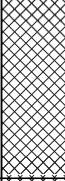
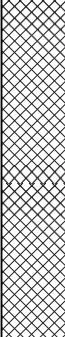
<b>PROJECT NUMBER:</b> 4701 <b>PROJECT NAME:</b> Deeside <b>CLIENT:</b> Logik WTE Ltd. <b>DATE:</b> 19.01.2021	<b>METHOD:</b> Mechanically Excavated <b>PLANT:</b> Wheeled Excavator <b>WEATHER:</b> Overcast with showers <b>LOGGED BY:</b> SB - Caulmert Ltd. <b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>COORDINATES:</b> E 331059 N 371188 <b>BEARING (degrees):</b> 080 <b>WIDTH:</b> 0.9m <b>LENGTH:</b> 2.3m <b>TOTAL DEPTH:</b> 1.6m
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**COMMENTS** Refusal at 1.6m - encountered flat concrete surface.

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
	N/A	0.1		Dry	Hard black asphalt MADE GROUND.	Carpark surface. No odour.
	N/A	0.3		Dry	Dense light grey angular coarse limestone gravel MADE GROUND.	Limestone sub-base on a thin white fabric liner. No odour.
0.5	N/A	1.2		Dry	Loose brown slightly gravelly sand MADE GROUND with occasional cobbles (10%). Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of brick, concrete and sandstone. Cobbles are sub-angular to sub-rounded of brick and concrete.	Rare 0.1m pieces of metal rebar and full-sized bricks (<1%). No odour.
1						
1.5						
2					Base of Excavation [TERMINATED DUE TO OBSTRUCTION]	
2.5						
3						
3.5						

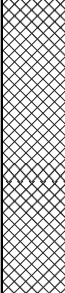
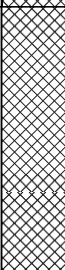
<b>PROJECT NUMBER:</b> 4701	<b>METHOD:</b> Mechanically Excavated	<b>COORDINATES:</b> E 331111 N 371126
<b>PROJECT NAME:</b> Deeside	<b>PLANT:</b> Wheeled Excavator	<b>BEARING (degrees):</b> 090
<b>CLIENT:</b> Logik WTE Ltd.	<b>WEATHER:</b> Sunny with cloud	<b>WIDTH:</b> 0.8m
<b>DATE:</b> 21.01.2021	<b>LOGGED BY:</b> SB - Caulmert Ltd.	<b>LENGTH:</b> 1.7m
	<b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>TOTAL DEPTH:</b> 1.5m

**COMMENTS** On addition of water for soakaway testing the sides became unstable.

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
0.5	N/A	0.1		Damp	Loose grey angular to sub-angular medium to coarse limestone gravel MADE GROUND.	Thin fabric lining below limestone gravel. No odour.
	1L tub - 0.5m	0.5		Damp	Very loose brown sandy gravel MADE GROUND with occasional cobbles (10%). Gravel is angular to sub-rounded fine to coarse of concrete, brick and limestone. Cobbles are sub-angular to sub-rounded of brick.	Occasional fine rootlets. No odour.
1	N/A	0.9		Damp	Loose light brown slightly gravelly sand MADE GROUND. Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of brick, coal and sandstone.	No odour.
1.5					Base of Excavation [TARGET DEPTH]	
2						
2.5						
3						
3.5						

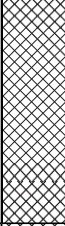
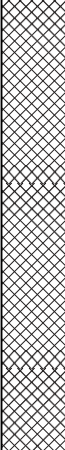
<b>PROJECT NUMBER:</b> 4701	<b>METHOD:</b> Mechanically Excavated	<b>COORDINATES:</b> E 331226 N 371197
<b>PROJECT NAME:</b> Deeside	<b>PLANT:</b> Wheeled Excavator	<b>BEARING (degrees):</b> 100
<b>CLIENT:</b> Logik WTE Ltd.	<b>WEATHER:</b> Overcast with showers	<b>WIDTH:</b> 0.7m
<b>DATE:</b> 19.01.2021	<b>LOGGED BY:</b> SB - Caulmert Ltd.	<b>LENGTH:</b> 1.3m
	<b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>TOTAL DEPTH:</b> 1.5m

**COMMENTS** Water seepage from the sides at 0.8m possibly due to weather. On addition of water for soakaway testing the sides were unstable.

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
0.5	N/A	0.8		Wet	Very loose brown and grey sandy gravel MADE GROUND with frequent cobbles (30%). Gravel is angular to sub-angular fine to coarse of concrete, brick, glass and plastic fragments. Cobbles are angular to sub-rounded of concrete and brick.	Piece of metal wire rebar at surface 0.2m long. Some black sacking found at 0.5m deep. No odour.
1	N/A	0.7		Damp	Loose light brown slightly gravelly sand MADE GROUND with occasional cobbles (5%). Sand fine to medium. Gravel angular to sub-rounded fine to coarse of brick, concrete, sandstone, coal and asphalt. Cobbles sub-angular to sub-rounded of concrete and brick.	No odour.
1.5					Base of Excavation [TARGET DEPTH]	
2						
2.5						
3						
3.5						

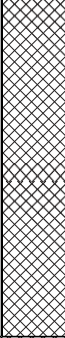
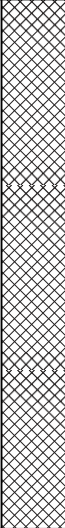
<b>PROJECT NUMBER:</b> 4701	<b>METHOD:</b> Mechanically Excavated	<b>COORDINATES:</b> E 331219 N 371236
<b>PROJECT NAME:</b> Deeside	<b>PLANT:</b> Wheeled Excavator	<b>BEARING (degrees):</b> 170
<b>CLIENT:</b> Logik WTE Ltd.	<b>WEATHER:</b> Heavy Rain	<b>WIDTH:</b> 0.9m
<b>DATE:</b> 20.01.2021	<b>LOGGED BY:</b> SB - Caulmert Ltd.	<b>LENGTH:</b> 2.8m
	<b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>TOTAL DEPTH:</b> 1.8m

**COMMENTS** Excavation terminated upon encountering unidentified plastic pipework oriented E-W.

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
0.5	N/A	0.6		Wet	Very loose brown and grey sandy gravel MADE GROUND with frequent cobbles (30%). Gravel is angular to sub-subrounded fine to coarse of concrete, brick, asphalt and plastic fragments. Cobbles are angular to sub-rounded of concrete and brick.	No odour.
1.0	N/A	1.2		Damp	Loose light brown slightly gravelly sand MADE GROUND. Sand fine to medium. Gravel is angular to sub-rounded fine to coarse of brick, coal, concrete and sandstone.	Water seepage at 0.6m Plastic pipework encountered at 1.4m. No odour.
2.0					Base of Excavation [TARGET DEPTH]	
2.5						
3.0						
3.5						

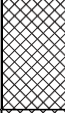
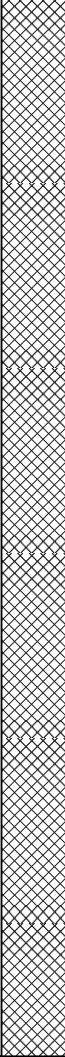
<b>PROJECT NUMBER:</b> 4701	<b>METHOD:</b> Mechanically Excavated	<b>COORDINATES:</b> E 331223 N 371243
<b>PROJECT NAME:</b> Deeside	<b>PLANT:</b> Wheeled Excavator	<b>BEARING (degrees):</b> 190
<b>CLIENT:</b> Logik WTE Ltd.	<b>WEATHER:</b> Heavy Rain	<b>WIDTH:</b> 1.0m
<b>DATE:</b> 20.01.2021	<b>LOGGED BY:</b> SB - Caulmert Ltd.	<b>LENGTH:</b> 3.0m
	<b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>TOTAL DEPTH:</b> 2.3m

**COMMENTS**

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
0.5	N/A	0.9		Wet	Very loose brown sandy gravel MADE GROUND with occasional cobbles (10%) and rare boulders (<1%). Gravel is angular to sub-rounded fine to coarse of concrete, brick and plastic fragments. Cobbles are sub-angular to sub-rounded of brick and concrete. Boulders are sub-rounded of brick and concrete.	Rare 0.1m long piece of metal rebar and 0.1m long pieces of rigid blue plastic pipe. No odour.
1	N/A	1.4		Damp	Loose light brown slightly gravelly sand MADE GROUND. Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of concrete, brick, sandstone and coal.	No odour.
2.5					Base of Excavation [TARGET DEPTH]	
3						
3.5						

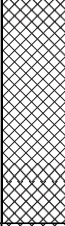
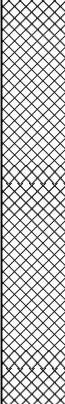
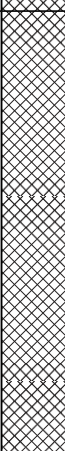
<b>PROJECT NUMBER:</b> 4701	<b>METHOD:</b> Mechanically Excavated	<b>COORDINATES:</b> E 331173 N 371271
<b>PROJECT NAME:</b> Deeside	<b>PLANT:</b> Wheeled Excavator	<b>BEARING (degrees):</b> 080
<b>CLIENT:</b> Logik WTE Ltd.	<b>WEATHER:</b> Sunny with cloud	<b>WIDTH:</b> 0.9m
<b>DATE:</b> 21.01.2021	<b>LOGGED BY:</b> SB - Caulmert Ltd.	<b>LENGTH:</b> 2.8m
	<b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>TOTAL DEPTH:</b> 3.1m

**COMMENTS**

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
	N/A	0.3		Damp	Very loose brown sandy gravel MADE GROUND with rare cobbles (<2%). Gravel is angular to sub-rounded fine to coarse of concrete, brick, limestone, asphalt, plastic and pot fragments. Cobbles are sub-rounded of concrete.	Frequent fine rootlets near surface. Rare 0.1m long piece of metal rebar sticking out side of pit. No odour.
0.5	1L tub - 2.5m	2.8		Damp	Loose light brown slightly gravelly sand MADE GROUND. Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of concrete, brick, coal and sandstone.	Occasional cobble-sized lumps of stiff brown clay (10%). No odour.
1						
1.5						
2						
2.5						
3						
3.5					Base of Excavation [TARGET DEPTH]	





<b>PROJECT NUMBER:</b> 4701	<b>METHOD:</b> Mechanically Excavated	<b>COORDINATES:</b> E 331171 N 371211
<b>PROJECT NAME:</b> Deeside	<b>PLANT:</b> Wheeled Excavator	<b>BEARING (degrees):</b> 180
<b>CLIENT:</b> Logik WTE Ltd.	<b>WEATHER:</b> Heavy rain	<b>WIDTH:</b> 0.9m
<b>DATE:</b> 20.01.2021	<b>LOGGED BY:</b> SB - Caulmert Ltd.	<b>LENGTH:</b> 2.7m
	<b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>TOTAL DEPTH:</b> 2.9m

**COMMENTS**

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
0.5	N/A	0.6		Wet	Very loose brown and grey sandy gravel MADE GROUND with frequent cobbles (30%). Gravel is angular to sub-rounded fine to coarse of concrete, brick, asphalt and plastic fragments. Cobbles are angular to sub-rounded of concrete and brick.	Frequent fine rootlets from small saplings at surface. Rare 0.2m long piece of metal rebar. No odour.
1	1L tub 120ml jar 60ml jar - 1.80m	1.1		Damp	Loose grey slightly gravelly sand MADE GROUND with occasional cobbles (10%). Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of brick, coal, concrete and sandstone. Cobbles are sub-angular to sub-rounded of brick and concrete.	Strong hydrocarbon-type odour.
2	1L tub 120ml jar - 2.0m	1.2		Damp	Loose light brown slightly gravelly sand MADE GROUND. Sand is fine to medium. Gravel is sub-angular to sub-rounded fine to coarse of , brick, concrete, sandstone.	No odour.
3					Base of Excavation [TARGET DEPTH]	
3.5						

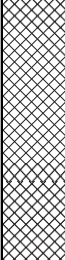
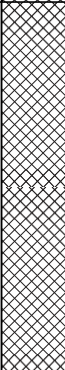
<b>PROJECT NUMBER:</b> 4701	<b>METHOD:</b> Mechanically Excavated	<b>COORDINATES:</b> E 331155 N 371212
<b>PROJECT NAME:</b> Deeside	<b>PLANT:</b> Wheeled Excavator	<b>BEARING (degrees):</b> 170
<b>CLIENT:</b> Logik WTE Ltd.	<b>WEATHER:</b> Sunny with cloud	<b>WIDTH:</b> 1.0m
<b>DATE:</b> 21.01.2021	<b>LOGGED BY:</b> SB - Caulmert Ltd.	<b>LENGTH:</b> 3.1m
	<b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>TOTAL DEPTH:</b> 2.3m

**COMMENTS** Purpose of excavation - to delineate extent of hydrocarbon-type contamination in area around TP3a

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
0.0 - 0.1	N/A	0.1		Damp	Very loose brown sandy gravel MADE GROUND with frequent cobbles (30%). Gravel is sub-angular to rounded fine to coarse of brick, concrete, limestone, plastic and wood fragments. Cobbles are sub-angular to sub-rounded of brick and concrete.	Occasional fine rootlets. No odour.
0.1 - 0.5	N/A	1.2		Damp		
0.5 - 1.5	N/A - already sampled TP3a	1.0		Damp	Loose brown slightly gravelly sand MADE GROUND with occasional cobbles (10%) and rare boulders (<1%). Gravel is angular to sub-rounded fine to coarse of concrete, brick and limestone. Cobbles are sub-angular to sub-rounded of brick and concrete. Boulders are sub-rounded of concrete.	Strong hydrocarbon-like odour. Sand matt in appearance, not oily.
1.5 - 2.5					Loose grey slightly gravelly sand MADE GROUND. Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of brick, concrete and sandstone.	
2.5 - 3.5					Base of Excavation [TERMINATED DUE TO COLLAPSING SIDES]	

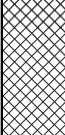
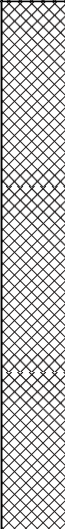
<b>PROJECT NUMBER:</b> 4701	<b>METHOD:</b> Mechanically Excavated	<b>COORDINATES:</b> E 331172 N 371222
<b>PROJECT NAME:</b> Deeside	<b>PLANT:</b> Wheeled Excavator	<b>BEARING (degrees):</b> 180
<b>CLIENT:</b> Logik WTE Ltd.	<b>WEATHER:</b> Sunny with cloud	<b>WIDTH:</b> 0.8m
<b>DATE:</b> 21.01.2021	<b>LOGGED BY:</b> SB - Caulmert Ltd.	<b>LENGTH:</b> 2.1m
	<b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>TOTAL DEPTH:</b> 1.7m

**COMMENTS** Purpose of excavation - to delineate extent of hydrocarbon-type contamination in area around TP3a

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
0.5	N/A	0.7		Damp	Very loose brown sandy gravel MADE GROUND with frequent cobbles (30%). Gravel is sub-angular to rounded fine to coarse of brick, concrete, limestone, plastic and wood fragments. Cobbles are sub-angular to sub-rounded of brick and concrete.	Occasional fine rootlets. No odour.
1	N/A	1.0		Damp	Loose light brown slightly gravelly sand MADE GROUND with occasional cobbles (10%). Gravel is angular to sub-rounded fine to coarse of concrete, brick and limestone. Cobbles are sub-angular to sub-rounded of brick and concrete.	No odour.
2					Base of Excavation [TARGET DEPTH]	
2.5						
3						
3.5						

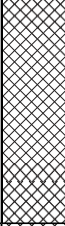
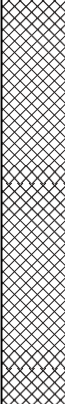
<b>PROJECT NUMBER:</b> 4701	<b>METHOD:</b> Mechanically Excavated	<b>COORDINATES:</b> E331171 N 371198
<b>PROJECT NAME:</b> Deeside	<b>PLANT:</b> Wheeled Excavator	<b>BEARING (degrees):</b> 180
<b>CLIENT:</b> Logik WTE Ltd.	<b>WEATHER:</b> Sunny with cloud	<b>WIDTH:</b> 0.9m
<b>DATE:</b> 21.01.2021	<b>LOGGED BY:</b> SB - Caulmert Ltd.	<b>LENGTH:</b> 2.1m
	<b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>TOTAL DEPTH:</b> 1.8m

**COMMENTS** Purpose of excavation - to delineate extent of hydrocarbon-type contamination in area around TP3a

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
0.4	N/A	0.4		Damp	Very loose brown sandy gravel MADE GROUND with frequent cobbles (30%). Gravel is sub-angular to rounded fine to coarse of brick, concrete, plastic and metal fragments. Cobbles are sub-angular to sub-rounded of brick and concrete.	Occasional fine rootlets. No odour.
0.5	N/A	1.4		Damp	Loose light brown slightly gravelly sand MADE GROUND with occasional cobbles (10%). Gravel is angular to sub-rounded fine to coarse of concrete, brick and limestone. Cobbles are sub-angular to sub-rounded of brick and concrete.	Rare piece of sacking (<1%) and cobble-sized angular fragments of rigid black plastic (<1%). No odour.
2.0					Base of Excavation [TARGET DEPTH]	

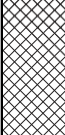
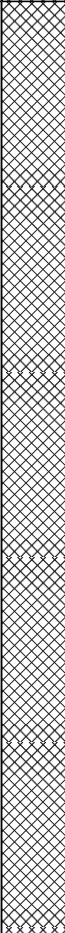
<b>PROJECT NUMBER:</b> 4701	<b>METHOD:</b> Mechanically Excavated	<b>COORDINATES:</b> E331185 N 371214
<b>PROJECT NAME:</b> Deeside	<b>PLANT:</b> Wheeled Excavator	<b>BEARING (degrees):</b> 180
<b>CLIENT:</b> Logik WTE Ltd.	<b>WEATHER:</b> Sunny with cloud	<b>WIDTH:</b> 1.0m
<b>DATE:</b> 21.01.2021	<b>LOGGED BY:</b> SB - Caulmert Ltd.	<b>LENGTH:</b> 1.9m
	<b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>TOTAL DEPTH:</b> 1.7m

**COMMENTS** Purpose of excavation - to delineate extent of hydrocarbon-type contamination in area around TP3a

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
0.5	N/A	0.6		Wet	Very loose brown sandy gravel MADE GROUND with frequent cobbles (30%) and rare boulders (<1%). Gravel is sub-angular to rounded fine to coarse of brick, concrete, limestone, glass and plastic fragments. Cobbles are sub-angular to sub-rounded of brick and concrete. Boulders are sub-rounded of concrete.	Rare 0.3m long pieces of metal rebar (<1%). No odour.
1.0	N/A	1.1		Damp	Loose light brown slightly gravelly sand MADE GROUND with rare cobbles (<5%). Gravel is angular to sub-rounded fine to coarse of concrete, coal, brick and sandstone. Cobbles are sub-angular to sub-rounded of concrete.	No odour.
2.0					Base of Excavation [TARGET DEPTH]	



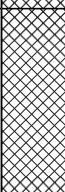
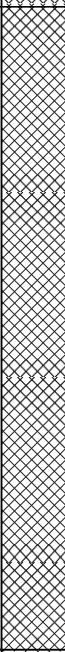
<b>PROJECT NUMBER:</b> 4701	<b>METHOD:</b> Mechanically Excavated	<b>COORDINATES:</b> E 331115 N 371198
<b>PROJECT NAME:</b> Deeside	<b>PLANT:</b> Wheeled Excavator	<b>BEARING (degrees):</b> 180
<b>CLIENT:</b> Logik WTE Ltd.	<b>WEATHER:</b> Heavy rain	<b>WIDTH:</b> 0.8m
<b>DATE:</b> 20.01.2021	<b>LOGGED BY:</b> SB - Caulmert Ltd.	<b>LENGTH:</b> 2.9m
	<b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>TOTAL DEPTH:</b> 2.9m

**COMMENTS**

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
0.4	N/A	0.4		Wet	Very loose brown and grey sandy gravel MADE GROUND with frequent cobbles (30%). Gravel is angular to sub-rounded fine to coarse of concrete, brick, asphalt, pot fragments, plastic fragments and wood fragments. Cobbles are angular to sub-rounded of concrete and brick.	Frequent fine rootlets from small saplings at surface. Rare 0.1m long piece of metal rebar and red rubber coated wire 0.1m long. Rare cobble-sized angular fragments of rigid black plastic (<1%). No odour.
0.5	N/A	2.5		Damp	Loose brown slightly gravelly sand MADE GROUND with occasional cobbles (10%). Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of brick, coal, concrete and sandstone. Cobbles are sub-angular to sub-rounded of brick and concrete.	No odour.
3.0					Base of Excavation [TARGET DEPTH]	

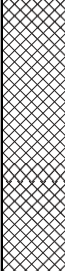
<b>PROJECT NUMBER:</b> 4701	<b>METHOD:</b> Mechanically Excavated	<b>COORDINATES:</b> E 331110 N 371144
<b>PROJECT NAME:</b> Deeside	<b>PLANT:</b> Wheeled Excavator	<b>BEARING (degrees):</b> 090
<b>CLIENT:</b> Logik WTE Ltd.	<b>WEATHER:</b> Sunny with cloud	<b>WIDTH:</b> 0.9m
<b>DATE:</b> 21.01.2021	<b>LOGGED BY:</b> SB - Caulmert Ltd.	<b>LENGTH:</b> 2.1m
	<b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>TOTAL DEPTH:</b> 2.5m

**COMMENTS**

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
	N/A	0.2		Damp	Loose grey angular to sub-angular medium to coarse limestone gravel MADE GROUND.	Thin fabric lining below limestone gravel. No odour.
	N/A	0.1		Dry	Hard black asphalt MADE GROUND.	No odour.
0.5	N/A	0.5		Dry	Loose light grey angular to sub-angular medium to coarse gravel MADE GROUND.	Thin fabric lining below limestone gravel subbase. No odour.
1	1L tub - 0.8m 1L tub 120ml jar - 2.0m	1.7		Damp	Loose light brown slightly gravelly sand MADE GROUND. Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of brick, coal, limestone and sandstone.	Occasional cobble-sized lumps of stiff brown clay (10%). No odour.
2.5					Base of Excavation [TARGET DEPTH]	
3						
3.5						

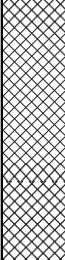
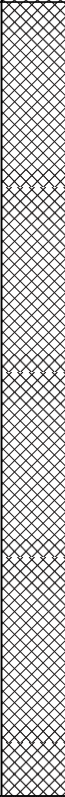
<b>PROJECT NUMBER:</b> 4701	<b>METHOD:</b> Mechanically Excavated	<b>COORDINATES:</b> E 331079 N 371292
<b>PROJECT NAME:</b> Deeside	<b>PLANT:</b> Wheeled Excavator	<b>BEARING (degrees):</b> 070
<b>CLIENT:</b> Logik WTE Ltd.	<b>WEATHER:</b> Heavy Rain	<b>WIDTH:</b> 0.7m
<b>DATE:</b> 20.01.2021	<b>LOGGED BY:</b> SB - Caulmert Ltd.	<b>LENGTH:</b> 2.5m
	<b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>TOTAL DEPTH:</b> 0.75m

**COMMENTS** Excavation terminated at 0.75m upon encountering a flat concrete surface.

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
0.5	N/A	0.75		Wet	Very loose brown sandy gravel MADE GROUND with occasional cobbles (10%) and rare boulders (<1%). Gravel is angular to sub-rounded fine to coarse of concrete, brick, limestone, pot and plastic fragments. Cobbles are sub-angular to sub-rounded of brick and concrete. Boulders are sub-rounded of brick and concrete.	Rare 0.3m long piece of metal rebar sticking out side of pit. Black discolouration of flat concrete surface at 0.75m. No odour.
1					Base of Excavation [TERMINATED DUE TO OBSTRUCTION]	
1.5						
2						
2.5						
3						
3.5						

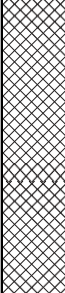
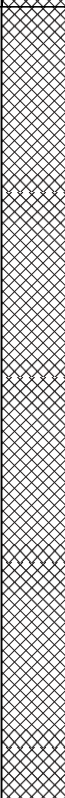
<b>PROJECT NUMBER:</b> 4701	<b>METHOD:</b> Mechanically Excavated	<b>COORDINATES:</b> E 331100 N 371293
<b>PROJECT NAME:</b> Deeside	<b>PLANT:</b> Wheeled Excavator	<b>BEARING (degrees):</b> 180
<b>CLIENT:</b> Logik WTE Ltd.	<b>WEATHER:</b> Heavy Rain	<b>WIDTH:</b> 0.9m
<b>DATE:</b> 20.01.2021	<b>LOGGED BY:</b> SB - Caulmert Ltd.	<b>LENGTH:</b> 3.0m
	<b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>TOTAL DEPTH:</b> 2.8m

**COMMENTS**

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
0.5	N/A	0.7		Wet	Very loose brown sandy gravel MADE GROUND with occasional cobbles (10%). Gravel is angular to sub-rounded fine to coarse of concrete, brick, limestone, plastic and glass fragments. Cobbles are sub-angular to sub-rounded of brick and concrete.	Occasional fine rootlets near surface. No odour.
1	N/A	2.1		Damp	Loose light brown slightly gravelly sand MADE GROUND. Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of concrete, brick and sandstone.	No odour.
3					Base of Excavation [TARGET DEPTH]	
3.5						


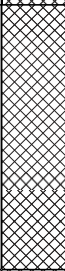
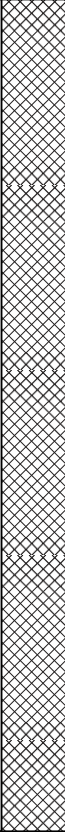
<b>PROJECT NUMBER:</b> 4701 <b>PROJECT NAME:</b> Deeside <b>CLIENT:</b> Logik WTE Ltd. <b>DATE:</b> 19.01.2021	<b>METHOD:</b> Mechanically Excavated <b>PLANT:</b> Wheeled Excavator <b>WEATHER:</b> Overcast with showers <b>LOGGED BY:</b> SB - Caulmert Ltd. <b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>COORDINATES:</b> E 331025 N 371225 <b>BEARING (degrees):</b> 090 <b>WIDTH:</b> 0.8m <b>LENGTH:</b> 3.1m <b>TOTAL DEPTH:</b> 2.9m
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**COMMENTS**

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
0.5	N/A	0.8		Damp	Very loose brown and grey sandy gravel MADE GROUND with frequent cobbles (30%). Gravel is angular to sub-angular fine to coarse of concrete, brick, asphalt, pot fragments, plastic fragments and wood fragments. Cobbles are angular to sub-rounded of concrete and brick.	Frequent fine rootlets from small saplings at surface. Rare 0.3m long piece of metal rebar. No odour.
1	N/A	2.10		Damp	Loose brown gravelly sand MADE GROUND with occasional cobbles (10%). Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of brick, concrete and sandstone. Cobbles are sub-angular to sub-rounded of brick and concrete.	No odour.
3					Base of Excavation [TARGET DEPTH]	
3.5						

<b>PROJECT NUMBER:</b> 4701 <b>PROJECT NAME:</b> Deeside <b>CLIENT:</b> Logik WTE Ltd. <b>DATE:</b> 21.01.2021	<b>METHOD:</b> Mechanically Excavated <b>PLANT:</b> Wheeled Excavator <b>WEATHER:</b> Sunny with cloud <b>LOGGED BY:</b> SB - Caulmert Ltd. <b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>COORDINATES:</b> E 331120 N 371355 <b>BEARING (degrees):</b> 100 <b>WIDTH:</b> 0.9m <b>LENGTH:</b> 2.9m <b>TOTAL DEPTH:</b> 3.1m
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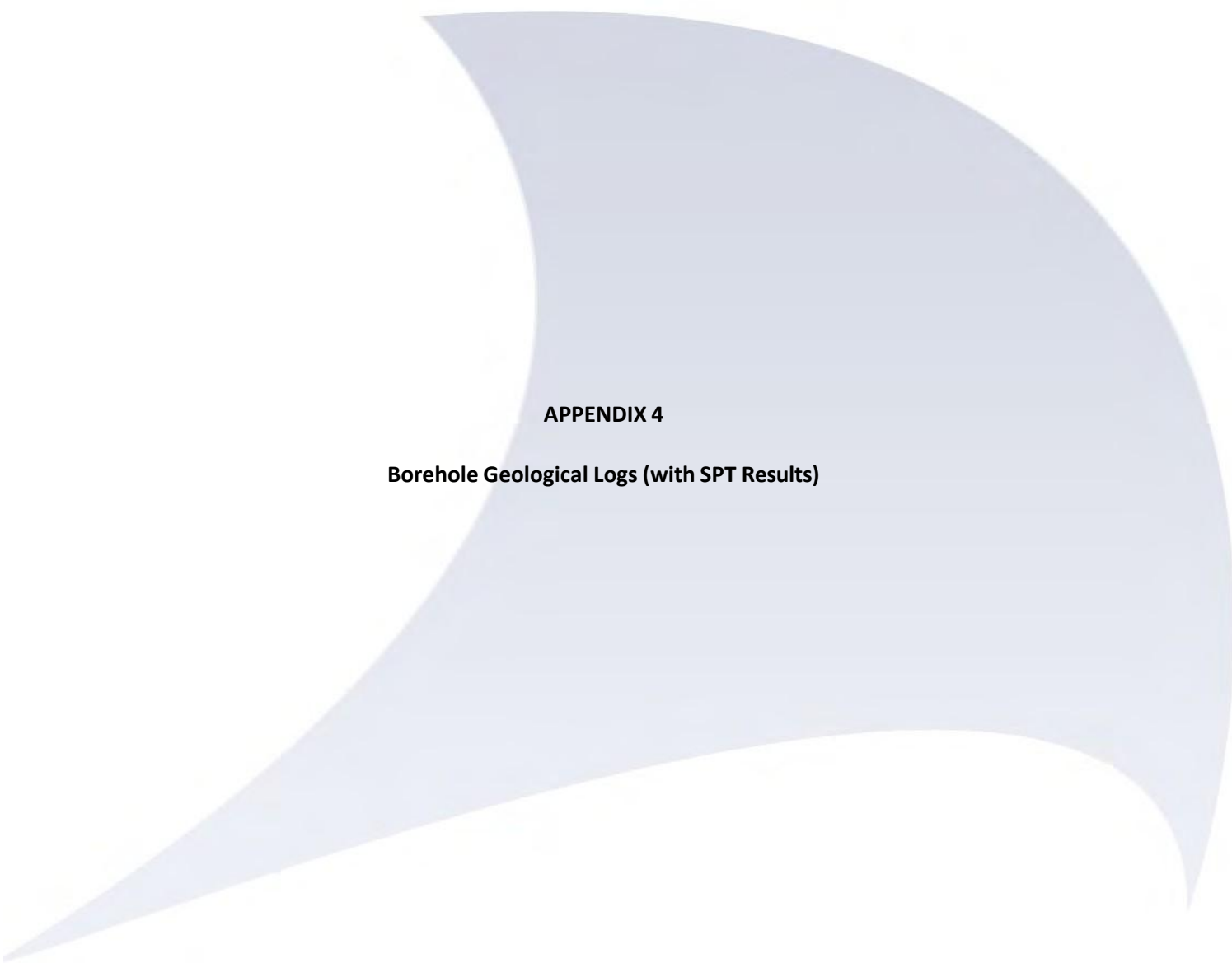
**COMMENTS**

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
	N/A	0.2		Wet	Loose brown clayey gravelly sand MADE GROUND with occasional cobbles (10%). Sand is fine to medium. Gravel is sub-angular to rounded fine to coarse of sandstone, limestone, brick, concrete. Cobbles are sub-angular to sub-rounded of brick.	Abundant fine rootlets from grass at surface. No odour.
0.5	1L tub 120ml jar 60ml jar - 0.6m	0.7		Wet	Very loose brown slightly clayey sandy gravel MADE GROUND with occasional cobbles (10%). Gravel is angular to sub-rounded fine to coarse of concrete, brick and limestone. Cobbles are sub-angular to sub-rounded of brick and concrete.	Rare 0.3m long pieces of metal rebar.
1	N/A	2.2		Damp	Loose light brown slightly gravelly sand MADE GROUND. Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of brick, concrete and sandstone.	Water seepage at 0.9m Rare sub-rounded cobble-sized pieces of black shiny clinker (<1%). No odour.
3.5					Base of Excavation [TARGET DEPTH]	

<b>PROJECT NUMBER:</b> 4701 <b>PROJECT NAME:</b> Deeside <b>CLIENT:</b> Logik WTE Ltd. <b>DATE:</b> 21.01.2021	<b>METHOD:</b> Mechanically Excavated <b>PLANT:</b> Wheeled Excavator <b>WEATHER:</b> Sunny with cloud <b>LOGGED BY:</b> SB - Caulmert Ltd. <b>CHECKED BY:</b> SV - Caulmert Ltd.	<b>COORDINATES:</b> E 331119 N 371329 <b>BEARING (degrees):</b> 100 <b>WIDTH:</b> 0.9m <b>LENGTH:</b> 2.3m <b>TOTAL DEPTH:</b> 2.5m
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**COMMENTS**

Depth (m below ground level)	Samples	Thickness (m)	Graphic Log	Moisture Content	Stratum Description	Additional Observations
	N/A	0.3	[Cross-hatched pattern]	Wet	Loose brown clayey gravelly sand MADE GROUND with occasional cobbles (10%). Sand is fine to medium. Gravel is sub-angular to rounded fine to coarse of sandstone, limestone, brick, concrete. Cobbles are sub-angular to sub-rounded of brick.	Abundant fine rootlets from grass at surface. No odour.
0.5	1L tub - 0.5m	0.5	[Cross-hatched pattern]	Wet	Very loose brown slightly clayey sandy gravel MADE GROUND with occasional cobbles (10%). Gravel is angular to sub-rounded fine to coarse of concrete, coal, brick and limestone. Cobbles are sub-angular to sub-rounded of brick and concrete.	No odour.
1	1L tub - 2.0m	1.7	[Cross-hatched pattern]	Damp	Loose light brown slightly gravelly sand MADE GROUND. Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of brick, concrete and sandstone.	Water seepage at 0.8m Occasional cobble-sized lumps of stiff brown clay (5%). Yellow 'electric cable' warning tape discovered at 1.4m in side wall at back when some sand collapsed in after digging. Appeared to be oriented east to west, same as pit. No cables seen or encountered. Not detected as 'live' by CAT scanner. No odour.
2.5					Base of Excavation [TARGET DEPTH]	
3						
3.5						



**APPENDIX 4**

**Borehole Geological Logs (with SPT Results)**

<b>PROJECT NUMBER</b> 4701	<b>DRILLING COMPANY</b> CC Geotechnical Ltd.	<b>COORDINATES</b> E 330998 N 371254
<b>PROJECT NAME</b> Deeside	<b>DRILLER</b> NW & SH	<b>LOGGED BY</b> SB - Caulmert Ltd.
<b>CLIENT</b> Logik WTE Ltd.	<b>DRILL RIG &amp; SPT HAMMER</b> R2 & 2	<b>CHECKED BY</b> SV - Caulmert Ltd.
<b>START DATE</b> 25.01.2021	<b>DRILLING METHOD</b> Cable Percussion	<b>CASING DEPTH</b> 8.0m
<b>END DATE</b> 26.01.2021	<b>DRILL DIAMETER</b> 150mm	<b>TOTAL HOLE DEPTH</b> 8.4m
	<b>CASING DIAMETER</b> 10"	

<b>INSTALLATION</b> 50mm UPVC pipe down to 7m	<b>PLAIN PIPE</b> 0 - 4m bgl with 0.5m stick-up	<b>SLOTTED PIPE</b> 4 - 7m bgl
<b>BACKFILL</b> 0-4m bentonite pellets 4-7m gravel 7-8.4m gravel		

Depth (m below ground level)	Thickness (m)	SPTs (no. of blows per 75mm increment)	Waterstrike	Well Installation / Backfill	Graphic Log	Stratum Description	Samples & Additional Observations
1	1.6	1.5m - 1/2/6/6/9/9 (30) 3.0m - 2/4/7/7/11/14 (39) 4.0m - 3/4/7/9/10/15 (41) 5.0m - 2/2/5/9/21/26 (61)				Grey and brown sandy gravel MADE GROUND with frequent cobbles. Gravel is angular to sub-rounded fine to coarse of concrete, brick, glass, sandstone, plastic and wood fragments. Cobbles are sub-angular to sub-rounded of concrete and brick.	Geotechnical Samples: 1L tub at 1.5, 3.0, 4.0, 5.0, 6.0, 7.0 and 8.0m  Bulk bag at 0.5, 1.2, 2.5, 3.5, 4.5, 5.5, 6.5 and 7.5m
2	3.7	6.0m - 2/2/3/4/5/7 (19) 7.0m - 2/2/4/5/6/4 (21) 8.0m - 4/3/6/6/6/7 (25)				Light brown slightly gravelly sand MADE GROUND. Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of concrete, brick, sandstone and glass.	Environmental Samples: 1L tub at 0.5m 1L tub 120ml jar 60ml jar at 0.7m
6	3.1		▽			Grey and brown silty slightly gravelly fine SAND with occasional cobble-sized grey silt pockets.	
9						End of Borehole [TARGET DEPTH]	

## BOREHOLE LOG BH2

<b>PROJECT NUMBER</b> 4701 <b>PROJECT NAME</b> Deeside <b>CLIENT</b> Logik WTE Ltd.	<b>DRILLING COMPANY</b> CC Geotechnical Ltd. <b>DRILLER</b> CB, NW & AW <b>DRILL RIG &amp; SPT HAMMER</b> R7 & 2 <b>DRILLING METHOD</b> Cable Percussion <b>DRILL DIAMETER</b> 150mm <b>CASING DIAMETER</b> 10"	<b>COORDINATES</b> E 331058 N 371264 <b>LOGGED BY</b> SB - Caulmert Ltd. <b>CHECKED BY</b> SV - Caulmert Ltd.  <b>CASING DEPTH</b> 13.5m <b>TOTAL HOLE DEPTH</b> 13.5m
<b>START DATE</b> 22.01.2021 <b>END DATE</b> 22.01.2021		

<b>INSTALLATION</b> N/A	<b>PLAIN PIPE</b> N/A	<b>SLOTTED PIPE</b> N/A
<b>BACKFILL</b> 0-13.5m arisings		

Depth (m below ground level)	Thickness (m)	SPTs (no. of blows per 75mm increment)	Waterstrike	Well Installation / Backfill	Graphic Log	Stratum Description	Samples & Additional Observations
1	0.8	1.2m - 3/3/4/4/4/4 (16) 3.0m - 3/3/4/8/10/10 (32)				Brown gravelly sand MADE GROUND with frequent cobbles Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of concrete, brick, plastic, mudstone, limestone, metal fragments. Cobbles are sub-angular to sub-rounded of concrete and brick.	Geotechnical Samples: 1L tub at 1.2, 3.0, 4.5, 6.0, 7.5, 9.0, 10.5, 12.0 and 13.5
	0.7	4.5m - 3/4/4/6/9/8 (27) 6.0m - 2/2/4/9/7/9 (29) 7.5m - 2/3/4/5/8/12 (34) 9.0m - 9/10/8/7/7/9 (30)					
2	3.0	10.5m - 5/6/10/13/17/10 (70mm) (50) 12.0m - 6/5/9/10/12/14 (45) 13.5m - 6/6/11/10/13/15 (37)				Light brown gravelly sand MADE GROUND. Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of brick, sandstone, concrete and limestone.  Light brown fine to medium sand MADE GROUND with occasional fine shell and coal fragments.	Bulk bag at 0.5, 0.9, 1.5, 2.5, 3.5, 5.0, 6.5, 8.0, 9.5, 11.0 and 12.0m
3							Environmental Samples: 1L tub at 0.6m 1L tub 120ml jar 60ml jar at 1.0m 1L tub at 1.5m 1L tub 120ml jar 60ml jar at 5.0m
4							
5	9.0					Brown silty fine SAND with occasional fine shell fragments.	
6							
7							
8							
9							
10							
11							
12							
13							
14						End of Borehole [TERMINATED - UNABLE TO PROGRESS]	

# BOREHOLE LOG BH3

<b>PROJECT NUMBER</b> 4701	<b>DRILLING COMPANY</b> CC Geotechnical Ltd.	<b>COORDINATES</b> E331009 N 371199
<b>PROJECT NAME</b> Deeside	<b>DRILLER</b> NW & SH	<b>LOGGED BY</b> SB - Caulmert Ltd.
<b>CLIENT</b> Logik WTE Ltd.	<b>DRILL RIG &amp; SPT HAMMER</b> R2 & 2	<b>CHECKED BY</b> SV - Caulmert Ltd.
<b>START DATE</b> 30.01.2021	<b>DRILLING METHOD</b> Cable Percussion	<b>CASING DEPTH</b> 8.0m
<b>END DATE</b> 30.01.2021	<b>DRILL DIAMETER</b> 150mm	<b>TOTAL HOLE DEPTH</b> 8.4m
	<b>CASING DIAMETER</b> 10"	

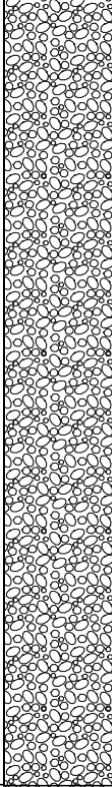

<b>INSTALLATION</b> N/A	<b>PLAIN PIPE</b> N/A	<b>SLOTTED PIPE</b> N/A
<b>BACKFILL</b> 0-8.4m arisings		

Depth (m below ground level)	Thickness (m)	SPTs (no. of blows per 75mm increment)	Waterstrike	Well Installation / Backfill	Graphic Log	Stratum Description	Samples & Additional Observations
1	1.0	1.5m - 3/3/6/6/7/8 (27) 3.0m - 4/4/6/7/9/11 (32) 4.0m - 4/5/5/6/7/7 (25) 5.0m - 3/4/5/5/5/6 (21)	▽	Well Installation / Backfill	Graphic Log	Brown gravelly sand MADE GROUND with frequent cobbles Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of concrete, brick and plastic. Cobbles are sub-angular to sub-rounded of concrete and brick.	Geotechnical Samples: 1L tub at 1.5, 3.0, 4.0, 5.0, 6.0, 7.0 and 8.0m
2	3.1	6.0m - 3/3/4/5/5/6 (20) 7.0m - 4/3/4/4/5/5 (18) 8.0m - 4/5/4/5/5/5 (19)				Light brown slightly gravelly sand MADE GROUND. Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of brick, sandstone and concrete.	Bulk bag at 0.5, 1.2, 2.5, 4.5, 5.5, 6.5 and 7.5m  Environmental Samples: N/A
4	4.3					Greyish brown silty fine SAND with occasional fine shell and coal fragments.	
9						End of Borehole [TARGET DEPTH]	

# BOREHOLE LOG BH4

<b>PROJECT NUMBER</b> 4701	<b>DRILLING COMPANY</b> CC Geotechnical Ltd.	<b>COORDINATES</b> E 331146 N 371167
<b>PROJECT NAME</b> Deeside	<b>DRILLER</b> CB & MW	<b>LOGGED BY</b> SB - Caulmert Ltd.
<b>CLIENT</b> Logik WTE Ltd.	<b>DRILL RIG &amp; SPT HAMMER</b> R7 & 8	<b>CHECKED BY</b> SV - Caulmert Ltd.
<b>START DATE</b> 18.01.2021	<b>DRILLING METHOD</b> Cable Percussion	<b>CASING DEPTH</b> 8.0m
<b>END DATE</b> 19.01.2021	<b>DRILL DIAMETER</b> 150mm	<b>TOTAL HOLE DEPTH</b> 8.4m
	<b>CASING DIAMETER</b> 10"	

<b>INSTALLATION</b> N/A	<b>PLAIN PIPE</b> N/A	<b>SLOTTED PIPE</b> N/A
<b>BACKFILL</b> 0-8.4m with arisings		

Depth (m below ground level)	Thickness (m)	SPTs (no. blows per 75mm increment)	Waterstrike	Well Installation / Backfill	Graphic Log	Stratum Description	Samples & Additional Observations
1	0.6	1.2m - 4/9/8/9/7/7 (31)	▽			Grey and brown sandy gravel MADE GROUND with frequent cobbles. Gravel is angular to sub-rounded fine to coarse of concrete, brick and plastic. Cobbles are sub-angular to sub-rounded of concrete and brick.	0.6 - 2.4m Occasional cobble-sized rounded lumps of stiff brown clay.  Geotechnical Samples: 1L tub at 1.2, 2.7, 4.5, 5.5, 7.0 and 8.0m  Bulk bag at 0.4, 0.7, 1.5, 2.5, 3.5, 5.2, 6.5 and 7.5m  Environmental Samples: 1L tub 120ml jar at 0.7m
	1.8	2.7m - 3/6/6/6/7/7 (26)				Brown gravelly sand MADE GROUND with occasional cobbles. Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of concrete and brick. Cobbles are sub-angular of concrete.	
2		4.5m - 2/2/4/5/7/6 (22)					
3	2.7	5.5m - 1/3/5/5/5/6 (21)				Light brown slightly gravelly sand MADE GROUND. Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of sandstone, limestone and shell fragments.	
4		7.0m - 2/4/5/4/5/6 (20)					
5	2.3	8.0m - 2/2/5/5/6/7 (23)				Grey silty fine SAND with occasional fine shell fragments.	
6							
7							
8	1.0			Light brown fine SAND with occasional coal and shell fragments / flecks.			
9					End of Borehole [TARGET DEPTH]		
10							
11							
12							
13							
14							

# BOREHOLE LOG BH5

<b>PROJECT NUMBER</b> 4701	<b>DRILLING COMPANY</b> CC Geotechnical Ltd.	<b>COORDINATES</b> E331190 N 371197
<b>PROJECT NAME</b> Deeside	<b>DRILLER</b> CB, NW & SH	<b>LOGGED BY</b> SB - Caulmert Ltd.
<b>CLIENT</b> Logik WTE Ltd.	<b>DRILL RIG &amp; SPT HAMMER</b> R7 & 2	<b>CHECKED BY</b> SV - Caulmert Ltd.
<b>START DATE</b> 29.01.2021	<b>DRILLING METHOD</b> Cable Percussion	<b>CASING DEPTH</b> 8.0m
<b>END DATE</b> 29.01.2021	<b>DRILL DIAMETER</b> 150mm	<b>TOTAL HOLE DEPTH</b> 8.4m
	<b>CASING DIAMETER</b> 10"	

<b>INSTALLATION</b> N/A	<b>PLAIN PIPE</b> N/A	<b>SLOTTED PIPE</b> N/A
<b>BACKFILL</b> 0-8.4m arisings		

Depth (m below ground level)	Thickness (m)	SPTs (no. of blows per 75mm increment)	Waterstrike	Well Installation / Backfill	Graphic Log	Stratum Description	Samples & Additional Observations
1	0.3	1.8m - 3/4/4/3/4/5 (16)	∇	[Well Installation / Backfill]	[Graphic Log]	Brown and grey sand gravel MADE GROUND with frequent cobbles. Gravel is angular to sub-rounded fine to coarse of concrete and brick. Cobbles are sub-angular to sub-rounded of concrete and brick.	Geotechnical Samples: 1L tub at 1.8, 3.0, 4.0, 5.0, 6.0, 7.0 and 8.0m
	0.9	3.0m - 2/2/3/4/4/5 (16) 4.0m - 3/2/3/3/3/4 (13) 5.0m - 2/3/2/3/3/6 (14) 6.0m - 3/3/3/4/5/10 (22) 7.0m - 3/4/5/4/4/4 (17) 8.0m - 4/4/5/5/4/4 (18)					
2	1.7						
3	2.4						
4	3.1						
5						Light brown fine to medium SAND with occasional fine shell and coal fragments.	Bulk bag at 0.5, 1.0, 1.5, 2.5, 3.5, 4.5, 5.5, 6.5 and 7.5m
6						Light grey and black banded SILT with frequent thin bands of grey fine sand.	Environmental Samples: 1L tub at 0.5m 1L tub 120ml jar 60ml jar at 1.2m 1L tub at 3.5m
7						Grey silty fine SAND with occasional bands of black silt.	
8						End of Borehole [TARGET DEPTH]	
9							
10							
11							
12							
13							
14							

<b>PROJECT NUMBER</b> 4701	<b>DRILLING COMPANY</b> CC Geotechnical Ltd.	<b>COORDINATES</b> E 331230 N 371168
<b>PROJECT NAME</b> Deeside	<b>DRILLER</b> CB & MW	<b>LOGGED BY</b> SB - Caulmert Ltd.
<b>CLIENT</b> Logik WTE Ltd.	<b>DRILL RIG &amp; SPT HAMMER</b> R7 & 8	<b>CHECKED BY</b> SV - Caulmert Ltd.
<b>START DATE</b> 20.01.2021	<b>DRILLING METHOD</b> Cable Percussion	<b>CASING DEPTH</b> 8.0m
<b>END DATE</b> 21.01.2021	<b>DRILL DIAMETER</b> 150mm	<b>TOTAL HOLE DEPTH</b> 8.4m
	<b>CASING DIAMETER</b> 10"	

<b>INSTALLATION</b> 50mm UPVC pipe down to 7m	<b>PLAIN PIPE</b> 0 - 4m bgl with 0.5m stick-up	<b>SLOTTED PIPE</b> 4 - 7m bgl
<b>BACKFILL</b> 0-4m bentonite pellets 4-7m gravel 7-8.4m gravel		

Depth (m below ground level)	Thickness (m)	SPTs (no. of blows per 75mm increment)	Waterstrike	Well Installation / Backfill	Graphic Log	Stratum Description	Samples & Additional Observations
1	1.8	1.2m - 1/2/2/2/3/3 (10) 1.8m - 2/3/4/3/5/4 (16) 2.5m - 3/3/4/5/7/7 (23) 4.3m - 2/2/3/3/3/4 (13) 6.0m - 1/2/3/5/5/5 (18) 7.5m - 2/2/5/5/5/6 (21) 8.0m - 2/3/6/5/6/7 (24)				Grey and brown sandy gravel MADE GROUND with frequent cobbles. Gravel is angular to sub-rounded fine to coarse of concrete, brick, glass, sandstone and plastic. Cobbles are sub-angular to sub-rounded of concrete and brick.	Geotechnical Samples: 1L tub at 1.2, 1.8, 2.8, 4.3, 6.0, 7.5 and 8.0m
2	0.5					Brown gravelly sand MADE GROUND with occasional cobbles. Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of concrete and brick. Cobbles are sub-angular of concrete.	Bulk bag at 0.4, 0.7, 0.9, 1.6, 2.5, 4.0, 4.5, 6.5 and 7.7m
3	1.7					Light brown fine to medium SAND with occasional fine black coal and white shell fragments / flecks.	Environmental Samples: 1L tub at 0.5m 1L tub 120ml jar 60ml jar at 0.7m
4	2.5					Grey silty fine SAND with occasional fine white shell and black coal fragments / flecks.	
5							
6							
7	1.2					Dark grey silty fine SAND with rare black coal and white shell fragments / flecks.	
8	0.8					Light grey fine SAND with occasional black coal and white shell fragments.	
9						End of Borehole [TARGET DEPTH]	
10							
11							
12							
13							
14							

<b>PROJECT NUMBER</b> 4701	<b>DRILLING COMPANY</b> CC Geotechnical Ltd.	<b>COORDINATES</b> E 331129 N 371248
<b>PROJECT NAME</b> Deeside	<b>DRILLER</b> NW & SH	<b>LOGGED BY</b> SB - Caulmert Ltd.
<b>CLIENT</b> Logik WTE Ltd.	<b>DRILL RIG &amp; SPT HAMMER</b> R2 & 1	<b>CHECKED BY</b> SV - Caulmert Ltd.
<b>START DATE</b> 28.01.2021	<b>DRILLING METHOD</b> Cable Percussion	<b>CASING DEPTH</b> 8.0m
<b>END DATE</b> 28.01.2021	<b>DRILL DIAMETER</b> 150mm	<b>TOTAL HOLE DEPTH</b> 8.4m
	<b>CASING DIAMETER</b> 10"	

<b>INSTALLATION</b> N/A	<b>PLAIN PIPE</b> N/A	<b>SLOTTED PIPE</b> N/A
<b>BACKFILL</b> 0-8.4m arisings		

Depth (m below ground level)	Thickness (m)	SPTs (no. of blows per 75mm increment)	Waterstrike	Well Installation / Backfill	Graphic Log	Stratum Description	Samples & Additional Observations
1	2.5	1.5m - 5/3/2/2/3/4 (11) 3.0m - 5/4/2/4/4/6 (16) 4.0m - 2/4/2/4/6/5 (17) 5.0m - 2/5/3/4/4/5 (16) 6.0m - 5/4/5/5/5/6 (21) 7.0m - 2/2/4/4/4/4/ (16) 8.0m - 2/2/3/4/5/5 (17)	IV	Well Installation / Backfill	Graphic Log	Brown and grey sandy gravel MADE GROUND with frequent cobbles. Gravel is angular to sub-rounded fine to coarse of concrete, pot, asphalt and brick. Cobbles are sub-angular to sub-rounded of concrete and brick.	Geotechnical Samples: 1L tub at 1.5, 3.0, 4.0, 5.0, 6.0, 7.0 and 8.0m  Bulk bag at 0.5, 1.2, 2.0, 2.5, 3.5, 4.5, 5.5, 6.5 and 7.5m  Environmental Samples: 1L tub at 0.5m 1L tub 120ml jar at 1.2m 1L tub 120ml jar at 3.5m 1L tub 120ml jar 60ml jar at 6.5m
3	2.9	Light brown fine to medium sand MADE GROUND.					
6	0.6	Light brown fine to medium SAND with occasional bands of grey silt and grey fine sand. Frequent fine fragments of shell and coal.					
7	2.4	Dark grey and black banded SILT with occasional thin bands of fine light brown sand.					
9		End of Borehole [TARGET DEPTH]					
10							
11							
12							
13							
14							

# BOREHOLE LOG BH8

<b>PROJECT NUMBER</b> 4701	<b>DRILLING COMPANY</b> CC Geotechnical Ltd.	<b>COORDINATES</b> E 331195 N 371304
<b>PROJECT NAME</b> Deeside	<b>DRILLER</b> CB & MW	<b>LOGGED BY</b> SB - Caulmert Ltd.
<b>CLIENT</b> Logik WTE Ltd.	<b>DRILL RIG &amp; SPT HAMMER</b> R7 & 8	<b>CHECKED BY</b> SV - Caulmert Ltd.
<b>START DATE</b> 01.02.2021	<b>DRILLING METHOD</b> Cable Percussion	<b>CASING DEPTH</b> 14.5m
<b>END DATE</b> 03.02.2021	<b>DRILL DIAMETER</b> 150mm	<b>TOTAL HOLE DEPTH</b> 15.0m
	<b>CASING DIAMETER</b> 10"	

<b>INSTALLATION</b> N/A	<b>PLAIN PIPE</b> N/A	<b>SLOTTED PIPE</b> N/A
<b>BACKFILL</b> 0-15m arisings		

Depth (m below ground level)	Thickness (m)	SPTs (no. of blows per 75mm increment)	Waterstrike	Well Installation / Backfill	Graphic Log	Stratum Description	Samples & Additional Observations
1	1.2	1.5m - 3/3/4/3/4/4 (15) 3.0m - 1/2/4/4/6/5 (19) 4.5m - 2/2/4/5/5/6 (20) 5.8m - 4/4/7/7/11/11 (36)	▽	Well Installation / Backfill	Graphic Log	Brown and grey sandy gravel MADE GROUND with frequent cobbles. Gravel is angular to sub-rounded fine to coarse of concrete and brick. Cobbles are sub-angular to sub-rounded of concrete and brick.	Geotechnical Samples: 1L tub at 1.5, 3.0, 4.5, 5.8, 7.5, 10.5 and 13.5m
2	1.3	7.5m - 1/3/4/9/9/14 (36) 10.5m - 3/5/8/11/11/15 (45) 13.5m - 3/6/9/12/13/12 (46)				Reddish brown coarse sand MADE GROUND.	Bulk bag at 0.5, 1.2, 2.5, 3.5, 5.0, 5.4, 7.0, 8.5, 11.5 and 14.5m
3	2.8					Light brown fine to medium slightly gravelly sand MADE GROUND with occasional fine fragments of shell and coal. Gravel is sub-angular to sub-rounded of fine to coarse of sandstone and brick.	Environmental Samples: 1L tub at 0.5m
6	9.7					Greyish brown fine silty SAND with occasional fine shell fragments.	
15						End of Borehole [TERMINATED - UNABLE TO ADVANCE]	

<b>PROJECT NUMBER</b> 4701	<b>DRILLING COMPANY</b> CC Geotechnical Ltd.	<b>COORDINATES</b> E 331157 N 371329
<b>PROJECT NAME</b> Deeside	<b>DRILLER</b> NW & SH	<b>LOGGED BY</b> SB - Caulmert Ltd.
<b>CLIENT</b> Logik WTE Ltd.	<b>DRILL RIG &amp; SPT HAMMER</b> R2 & 1	<b>CHECKED BY</b> SV - Caulmert Ltd.
<b>START DATE</b> 26.01.2021	<b>DRILLING METHOD</b> Cable Percussion	<b>CASING DEPTH</b> 8.0m
<b>END DATE</b> 27.01.2021	<b>DRILL DIAMETER</b> 150mm	<b>TOTAL HOLE DEPTH</b> 8.4m
	<b>CASING DIAMETER</b> 10"	

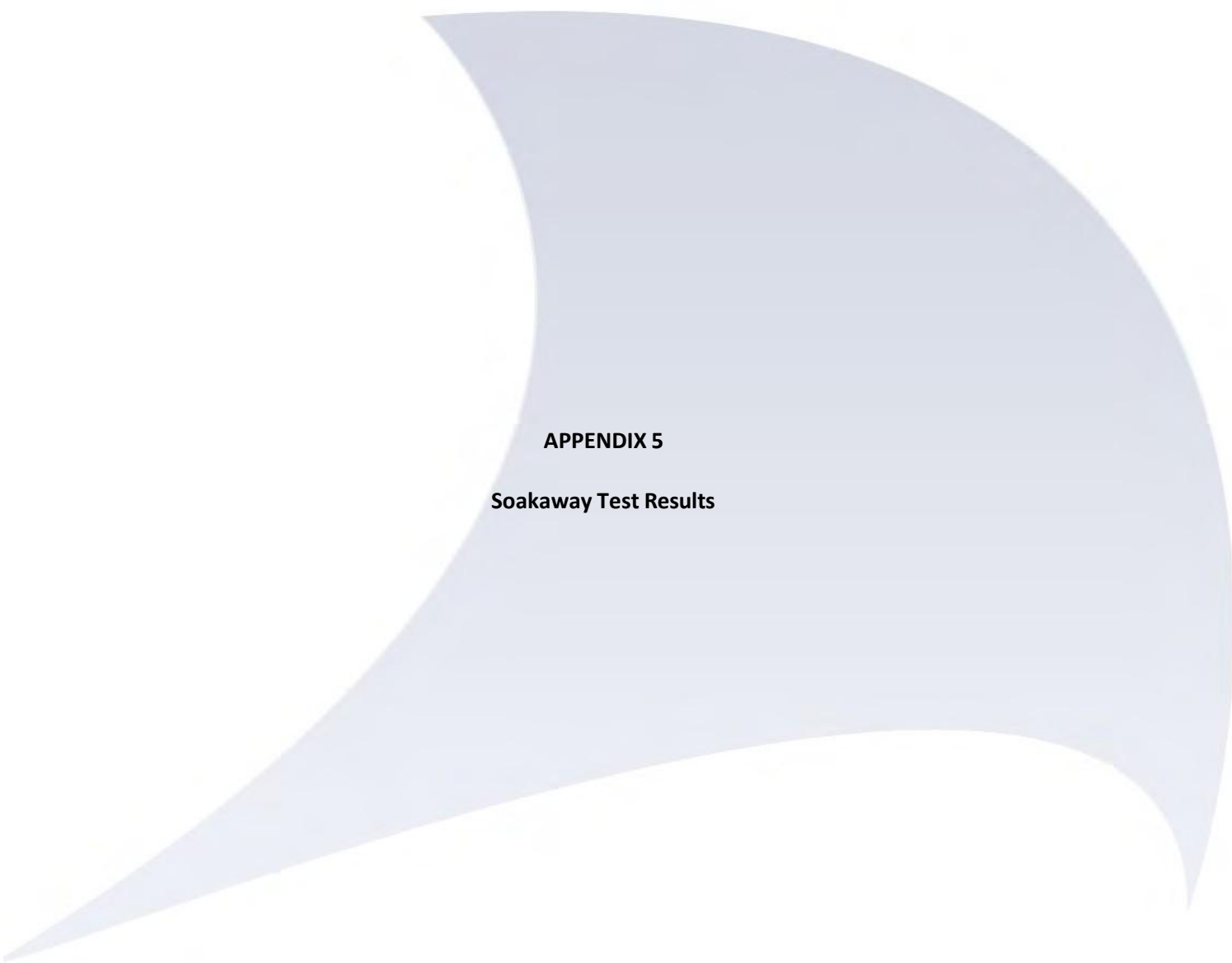
<b>INSTALLATION</b> 50mm UPVC pipe down to 7m	<b>PLAIN PIPE</b> 0 - 4m bgl with 0.5m stick-up	<b>SLOTTED PIPE</b> 4 - 7m bgl
<b>BACKFILL</b> 0-4m bentonite pellets 4-7m gravel 7-8.4m gravel		

Depth (m below ground level)	Thickness (m)	SPTs (no. of blows per 75mm increment)	Waterstrike	Well Installation / Backfill	Graphic Log	Stratum Description	Samples & Additional Observations
0.0 - 0.4	0.4	1.5m - 3/1/2/3/10/16 (31)				Light brown gravelly sand MADE GROUND with occasional cobbles. Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of brick, sandstone, concrete and coal. Cobbles are sub-angular of brick.	0.0 - 0.4m Rare 0.2m long pieces metal rebar.
0.4 - 3.0	2.1	3.0m - 2/4/5/5/5/5 (20) 4.0m - 2/1/3/4/4/5 (17) 5.0m - 2/3/3/3/3/6 (16) 5.8m - 4/4/4/7/8/10 (29) 7.0m - 2/2/4/5/11/12 (33) 8.0m - 3/6/7/7/8/10 (32)				Brown sandy gravel MADE GROUND with occasional cobbles. Gravel is angular to sub-rounded fine to coarse of concrete, brick, glass, pot and coal. Cobbles are sub-angular to sub-rounded of concrete and brick.	Geotechnical Samples: 1L tub at 1.5, 3.0, 4.0, 5.0, 5.8, 7.0 and 8.0m
3.0 - 4.0	3.0					Light brown slightly gravelly sand MADE GROUND. Sand is fine to medium. Gravel is angular to sub-rounded fine to coarse of brick and occasional shell fragments.	Bulk bag at 0.5, 1.2, 2.0, 2.6, 3.5, 4.5, 5.5, 6.5 and 7.5m
4.0 - 5.5							Environmental Samples: 1L tub at 0.5m 1L tub 120ml jar 60ml jar at 1.2m 1L tub at 2.5m 1L tub 120ml jar at 5.5m
5.5 - 7.0	1.5					Light brown silty fine SAND with thin bands (100mm) grey silt and thin bands (100mm) shell fragments.	
7.0 - 8.4	1.4					Light brown fine to medium SAND with occasional shell and coal fragments.	
8.4 - 14.0						End of Borehole [TARGET DEPTH]	

<b>PROJECT NUMBER</b> 4701	<b>DRILLING COMPANY</b> CC Geotechnical Ltd.	<b>COORDINATES</b> E 331087 N 371326
<b>PROJECT NAME</b> Deeside	<b>DRILLER</b> CB & MW	<b>LOGGED BY</b> SB - Caulmert Ltd.
<b>CLIENT</b> Logik WTE Ltd.	<b>DRILL RIG &amp; SPT HAMMER</b> R7 & 8	<b>CHECKED BY</b> SV - Caulmert Ltd.
<b>START DATE</b> 03.02.2021	<b>DRILLING METHOD</b> Cable Percussion	<b>CASING DEPTH</b> 15.0m
<b>END DATE</b> 04.02.2021	<b>DRILL DIAMETER</b> 150mm	<b>TOTAL HOLE DEPTH</b> 15.0m
	<b>CASING DIAMETER</b> 10"	

<b>INSTALLATION</b> N/A	<b>PLAIN PIPE</b> N/A	<b>SLOTTED PIPE</b> N/A
<b>BACKFILL</b> 0-15m with arisings		

Depth (m below ground level)	Thickness (m)	SPTs (no. of blows per 75mm increment)	Waterstrike	Well Backfill	Graphic Log	Stratum Description	Samples & Additional Observations
1	3.5	1.2m - 1/4/3/50/-/- (30mm) Refusal 3.0m - 1/3/4/5/5/7 (21) 4.0m - 1/3/3/5/7/6 (21) 5.7m - 3/4/3/4/5/7 (19) 8.0m - 2/3/6/7/7/11 (31) 11.0m - 2/3/6/8/11/13 (38) 14.0m - 3/3/7/10/13/13 (43)	∇	∇	∇	Grey and brown sandy gravel MADE GROUND with frequent cobbles. Gravel is angular to sub-rounded fine to coarse of concrete, brick and plastic. Cobbles are sub-angular to sub-rounded of concrete and brick.	Rare pieces of metal rebar at surface (<1%)  Geotechnical Samples: 1L tub at 1.2, 3.0, 4.0, 5.7, 8.0, 11.0 and 14.0m  Bulk bag at 0.5, 2.0, 3.6, 5.0, 6.0, 9.0, 12.0 and 15.0m  Environmental Samples: N/A
4	1.9	Light brown silty fine sand MADE GROUND with occasional fine white shell fragments.					
6	9.6	Grey and brown becoming more brown silty fine SAND with occasional thin bands of silt and fine white shell fragments.					
15						End of Borehole [TERMINATED - UNABLE TO ADVANCE]	



**APPENDIX 5**

**Soakaway Test Results**



# BRE365 SOIL INFILTRATION RATE TEST - SA2

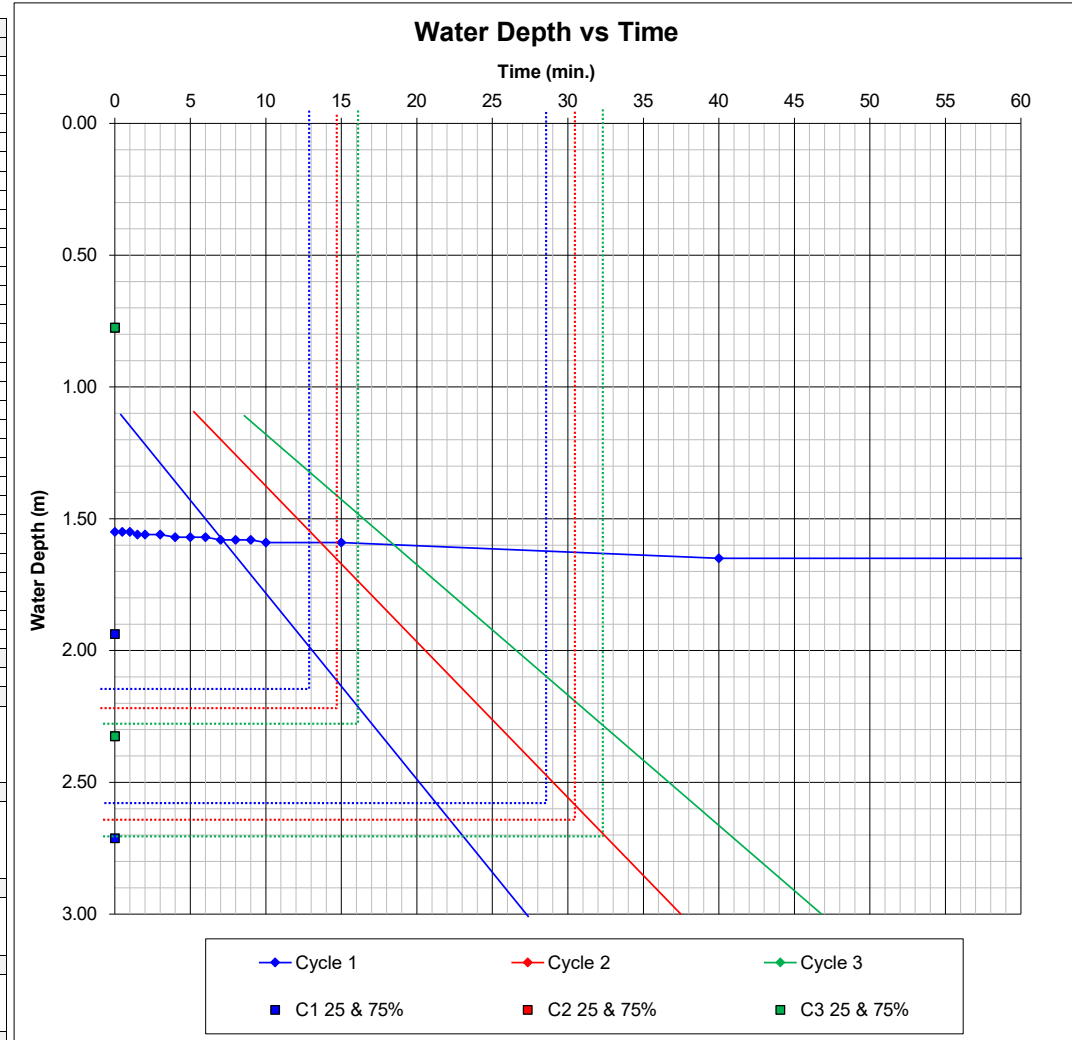
## 4701 Deeside WTE - Site Investigation

Trial Pit Information	
Length (m)	2.50
Width (m)	1.10
Depth (m)	3.10
Groundwater	None
Weather Conditions	Heavy Rain
Date	20.02.2021

Remarks	

Cycle 1		Cycle 2		Cycle 3	
Time (min)	Depth (m)	Time (min)	Depth (m)	Time (min)	Depth (m)
0	1.55				
0.5	1.55				
1	1.55				
1.5	1.56				
2	1.56				
3	1.56				
4	1.57				
5	1.57				
6	1.57				
7	1.58				
8	1.58				
9	1.58				
10	1.59				
15	1.59				
40	1.65				
140	1.65				

Final Excavation Depth (m)	Cycle 1	Cycle 2	Cycle 3
At end of testing cycle	3.10		
<b>Water Depths (m)</b>			
Water depth at start of test	1.55		
Water depth at end of test	1.65		
Effective depth (measured)	0.10		
% Effective storage depth	0.06		
<b>Effective Storage Depths (m)</b>			
Effective storage depth (100%)	1.55		
Effective storage depth (75%)	1.16		
Effective storage depth (50%)	0.78		
Effective storage depth (25%)	0.39		
<b>Outflow Time (min)</b>			
Time for measured outflow	140		
Time for 100% outflow			
Time for 75-25% outflow			
<b>Volume of Outflow (m³)</b>			
Over measured effective depth	0.28		
Over 100% effective depth	4.26		
From 75% - 25% effective depth	2.13		
<b>Surface Area (m²)</b>			
For 100% effective storage	13.91		
For 50% effective storage	8.33		
Over measured depth	3.47		
<b>Soil Infiltration Rate (m/s)</b>			
Over 100% effective depth	#DIV/0!		
Over measured depth	9.4E-06		
Over 75% - 25% effective depth	#DIV/0!		



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# BRE365 SOIL INFILTRATION RATE TEST - SA3

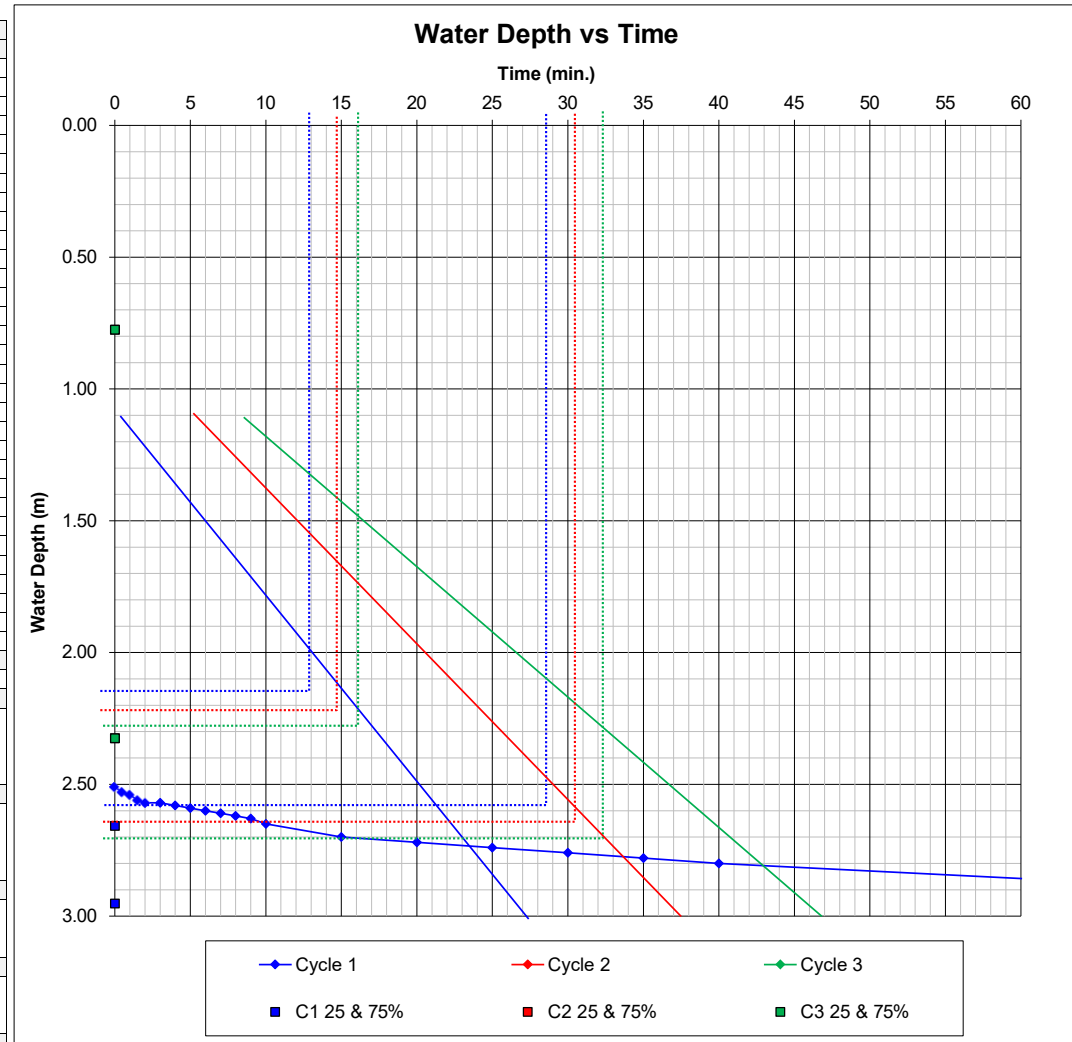
## 4701 Deeside WTE - Site Investigation

Trial Pit Information	
Length (m)	2.30
Width (m)	0.70
Depth (m)	3.10
Groundwater	None
Weather Conditions	Showers
Date	19.01.2021

Remarks

Cycle 1		Cycle 2		Cycle 3	
Time (min)	Depth (m)	Time (min)	Depth (m)	Time (min)	Depth (m)
0	2.51				
0.5	2.53				
1	2.54				
1.5	2.56				
2	2.57				
3	2.57				
4	2.58				
5	2.59				
6	2.60				
7	2.61				
8	2.62				
9	2.63				
10	2.65				
15	2.70				
20	2.72				
25	2.74				
30	2.76				
35	2.78				
40	2.8				
75	2.9				
120	2.95				

Final Excavation Depth (m)	Cycle 1	Cycle 2	Cycle 3
At end of testing cycle	3.10		
<b>Water Depths (m)</b>			
Water depth at start of test	2.51		
Water depth at end of test	2.95		
Effective depth (measured)	0.44		
% Effective storage depth	0.75		
<b>Effective Storage Depths (m)</b>			
Effective storage depth (100%)	0.59		
Effective storage depth (75%)	0.44		
Effective storage depth (50%)	0.30		
Effective storage depth (25%)	0.15		
<b>Outflow Time (min)</b>			
Time for measured outflow	120		
Time for 100% outflow			
Time for 75-25% outflow			
<b>Volume of Outflow (m³)</b>			
Over measured effective depth	0.71		
Over 100% effective depth	0.95		
From 75% - 25% effective depth	0.47		
<b>Surface Area (m²)</b>			
For 100% effective storage	5.15		
For 50% effective storage	3.38		
Over measured depth	4.25		
<b>Soil Infiltration Rate (m/s)</b>			
Over 100% effective depth	#DIV/0!		
Over measured depth	2.3E-05		
Over 75% - 25% effective depth	#DIV/0!		



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# BRE365 SOIL INFILTRATION RATE TEST - SA5

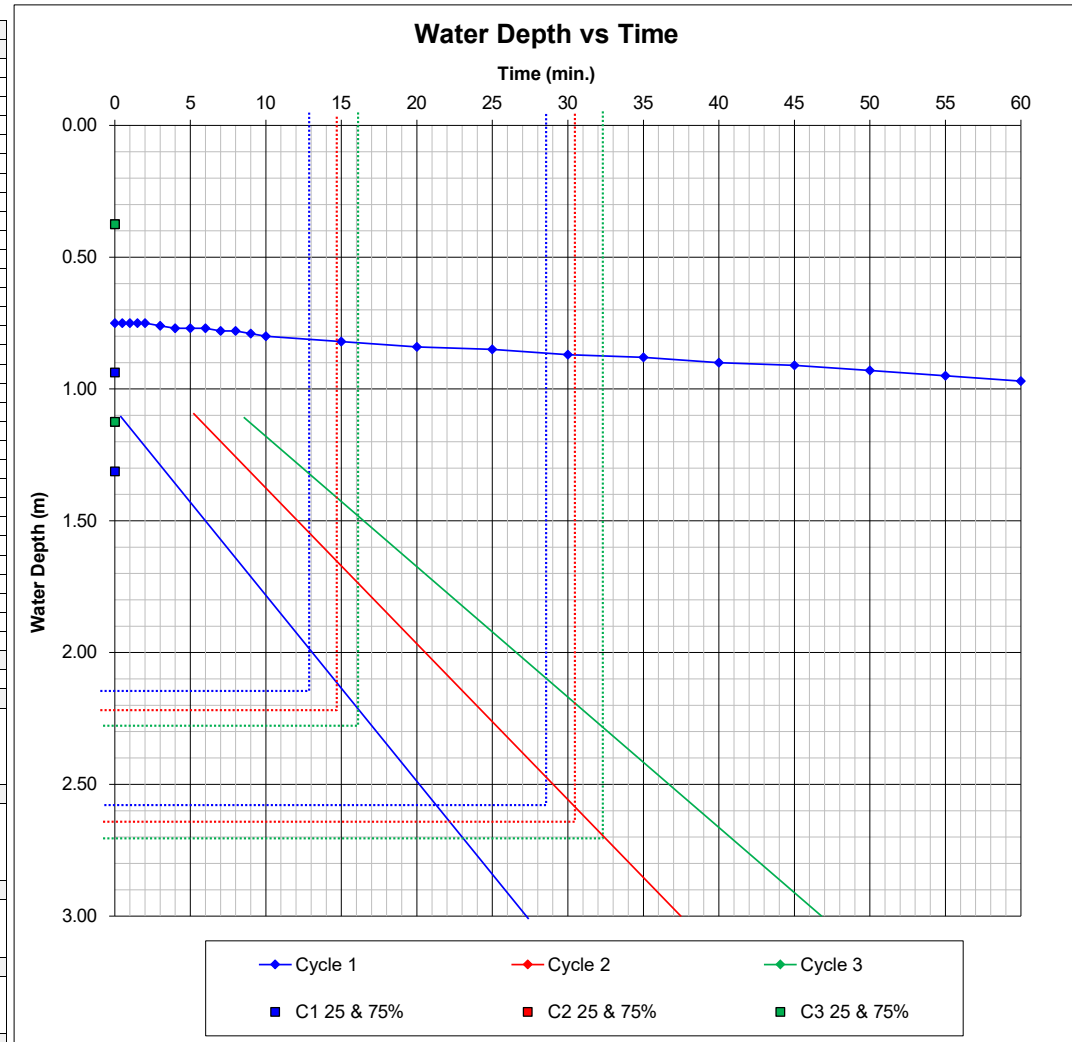
4701 Deeside WTE - Site Investigation

Trial Pit Information	
Length (m)	1.70
Width (m)	0.80
Depth (m)	1.50
Groundwater	None
Weather Conditions	Dry
Date	21.01.2021

Remarks	

Cycle 1		Cycle 2		Cycle 3	
Time (min)	Depth (m)	Time (min)	Depth (m)	Time (min)	Depth (m)
0	0.75				
0.5	0.75				
1	0.75				
1.5	0.75				
2	0.75				
3	0.76				
4	0.77				
5	0.77				
6	0.77				
7	0.78				
8	0.78				
9	0.79				
10	0.80				
15	0.82				
20	0.84				
25	0.85				
30	0.87				
35	0.88				
40	0.9				
45	0.91				
50	0.93				
55	0.95				
60	0.97				
75	0.98				
120	1.05				
180	1.13				
240	1.29				

Final Excavation Depth (m)	Cycle 1	Cycle 2	Cycle 3
At end of testing cycle	1.50		
<b>Water Depths (m)</b>			
Water depth at start of test	0.75		
Water depth at end of test	1.29		
Effective depth (measured)	0.54		
% Effective storage depth	0.72		
<b>Effective Storage Depths (m)</b>			
Effective storage depth (100%)	0.75		
Effective storage depth (75%)	0.56		
Effective storage depth (50%)	0.38		
Effective storage depth (25%)	0.19		
<b>Outflow Time (min)</b>			
Time for measured outflow	240		
Time for 100% outflow			
Time for 75-25% outflow			
<b>Volume of Outflow (m³)</b>			
Over measured effective depth	0.73		
Over 100% effective depth	1.02		
From 75% - 25% effective depth	0.51		
<b>Surface Area (m²)</b>			
For 100% effective storage	5.11		
For 50% effective storage	3.24		
Over measured depth	4.06		
<b>Soil Infiltration Rate (m/s)</b>			
Over 100% effective depth	#DIV/0!		
Over measured depth	1.3E-05		
Over 75% - 25% effective depth	#DIV/0!		



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# BRE365 SOIL INFILTRATION RATE TEST - SA6

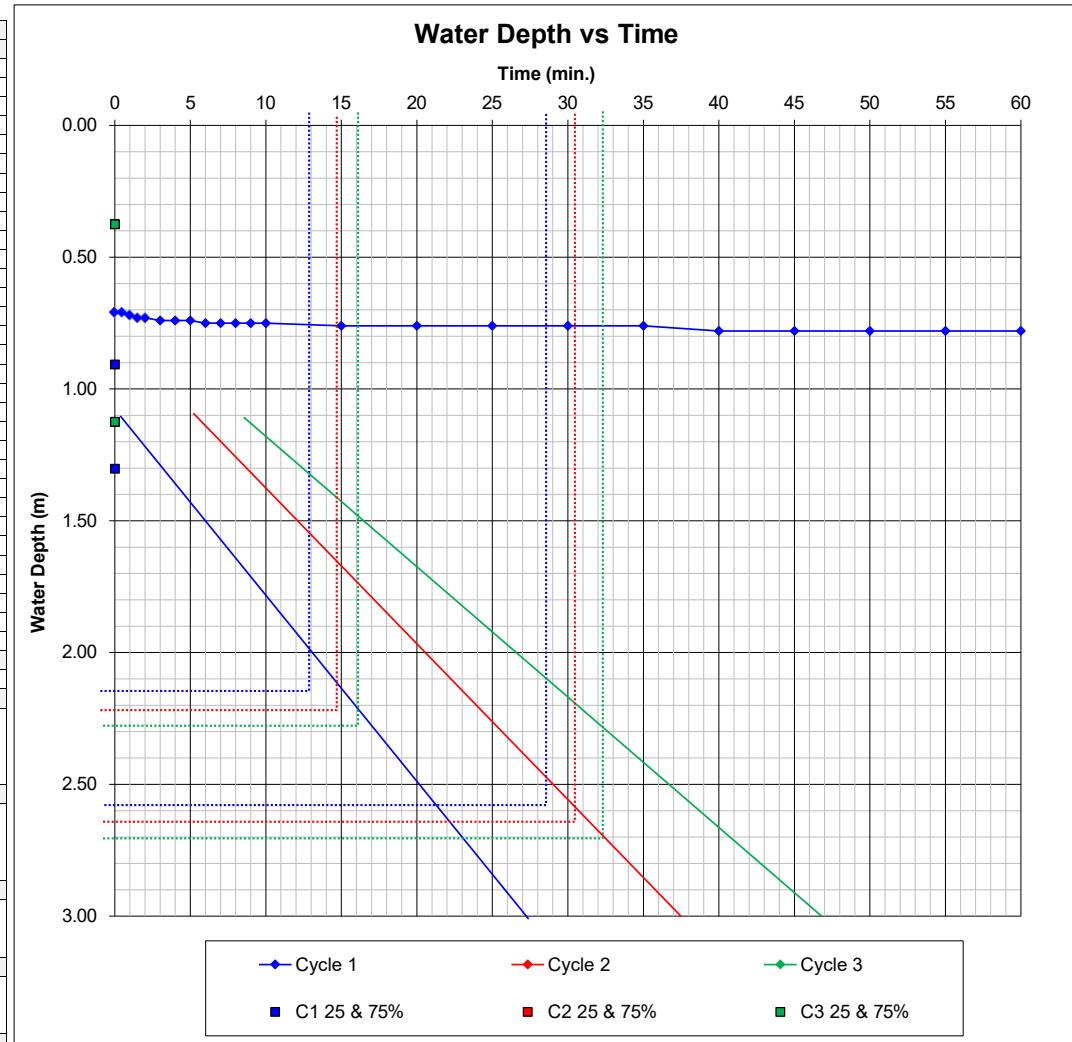
4701 Deeside WTE - Site Investigation

Trial Pit Information	
Length (m)	1.30
Width (m)	0.70
Depth (m)	1.50
Groundwater	None
Weather Conditions	Showers
Date	19.01.2021

Remarks	

Cycle 1		Cycle 2		Cycle 3	
Time (min)	Depth (m)	Time (min)	Depth (m)	Time (min)	Depth (m)
0	0.71				
0.5	0.71				
1	0.72				
1.5	0.73				
2	0.73				
3	0.74				
4	0.74				
5	0.74				
6	0.75				
7	0.75				
8	0.75				
9	0.75				
10	0.75				
15	0.76				
20	0.76				
25	0.76				
30	0.76				
35	0.76				
40	0.76				
45	0.78				
50	0.78				
55	0.78				
60	0.78				
75	0.78				
90	0.78				
105	0.78				
120	0.78				
180	0.78				
240	0.78				

Final Excavation Depth (m)	Cycle 1	Cycle 2	Cycle 3
At end of testing cycle	1.50		
<b>Water Depths (m)</b>			
Water depth at start of test	0.71		
Water depth at end of test	0.78		
Effective depth (measured)	0.07		
% Effective storage depth	0.09		
<b>Effective Storage Depths (m)</b>			
Effective storage depth (100%)	0.79		
Effective storage depth (75%)	0.59		
Effective storage depth (50%)	0.40		
Effective storage depth (25%)	0.20		
<b>Outflow Time (min)</b>			
Time for measured outflow	240		
Time for 100% outflow			
Time for 75-25% outflow			
<b>Volume of Outflow (m³)</b>			
Over measured effective depth	0.06		
Over 100% effective depth	0.72		
From 75% - 25% effective depth	0.36		
<b>Surface Area (m²)</b>			
For 100% effective storage	4.07		
For 50% effective storage	2.49		
Over measured depth	1.19		
<b>Soil Infiltration Rate (m/s)</b>			
Over 100% effective depth	#DIV/0!		
Over measured depth	3.7E-06		
Over 75% - 25% effective depth	#DIV/0!		



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## **7 AIR QUALITY AND ODOUR**

### **7.1 INTRODUCTION**

7.1.1 This chapter assesses the likely significant effects of the Proposed Development on local air quality. In particular, it considers the potential impacts of odours and biogas engine stack emissions on human and ecological receptors as a result of the Proposed Development. The chapter has been prepared by Smith Grant LLP.

7.1.2 The Chapter describes the methods used to assess the baseline conditions currently existing at the Site and surroundings, the potential severity of direct and indirect air quality impacts of the Proposed Development, and the mitigation measures required to prevent, reduce or offset the impacts and the significance of residual effects.

### **7.2 ASSESSMENT APPROACH**

#### **Technical Context**

7.2.1 Initial site preparation, earthworks and construction activities may give rise to airborne particulate matter, which is made up of condensed phase (solid or liquid) particles suspended in the atmosphere ranging in size from a few nanometers to around 100 µm. Particulate matter (PM) can give rise to both soiling effects through dust deposition (often referred to as 'disamenity dust') and human health effects through inhalation of suspended particles.

7.2.2 Dust soiling will arise from the deposition of particulate matter in all size fractions, but will mostly be associated with particulate matter of greater than 30 µm. Particulates below 10 µm (referred to as PM<sub>10</sub>) correspond to the inhalable fraction of PM and have been related to various adverse health effects. PM<sub>10</sub> includes both fine fractions (those particles of diameter less than 2.5 µm, referred to as PM<sub>2.5</sub>) and coarse fractions (diameter of between 2.5-10 µm; PM<sub>2.5-10</sub>) of airborne particulate matter which normally arise from different sources.

7.2.3 Vehicles travelling to the site during both the construction and operational phases will give rise to exhaust combustion emissions, primarily comprising oxides of nitrogen (NO<sub>x</sub>: comprises nitrogen dioxide (NO<sub>2</sub>) and nitric oxide (NO)) and PM<sub>10</sub>. NO itself is not considered harmful to human health. However, on release to atmosphere it usually rapidly oxidises to NO<sub>2</sub> which is associated with adverse effects on human health. Non-road mobile machinery (NRMM) operating on site will also give rise to exhaust combustion emissions.

7.2.4 The primary aerial emissions arising from the combustion of biogas arising from the AD Plant within the CHP Plant will be NO<sub>2</sub>. Other potential emissions from the CHP Plant will be carbon monoxide (CO) and volatile organic compounds (VOCs).

7.2.5 The handling, storage and treatment of waste materials, and the operation of the AD Plant, can give rise to odourous emissions. An odour is the organoleptic attribute perceptible by the olfactory organ on sniffing certain volatile substances. Odours may be perceived as pleasant or unpleasant, and the key concern with odour is its ability to cause a response in an individual that is considered to be objectionable or offensive. There is a wide variation between individuals as to what is deemed unacceptable and as to what can affect an individual's quality of life. As it may cause offense to human senses odour is defined as a pollutant.

### Air Quality and Odour

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- 7.2.6 The handling and treatment of biological wastes can also give rise to bioaerosols. These consist of airborne particles that contain living organisms such as bacteria, fungi and viruses or parts of living organisms such as plant pollen and spores.

#### **Legislative and Policy Framework**

- 7.2.7 National and local planning policies relevant to the EIA have been reviewed previously (see **Chapter 5**). Policies relevant to air quality are identified in the following section.

#### European Legislation

- 7.2.8 Action to manage and improve air quality within the UK is currently driven largely by European (EU) legislation. The majority of European air quality legislation is consolidated under Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe, which came into force on 11<sup>th</sup> June 2008 consolidating an earlier Directive and three daughter directives. The legislation sets legally binding European-wide air quality limit and interim target values (Ambient Air Directive (AAD) Limit and Target Values) for concentrations in outdoor air of major air pollutants for the protection of human health and ecosystems and prescribes how air quality should be assessed and managed by Member States.

#### UK Legislation

- 7.2.9 ~~The Air Quality (Standards) (Wales) Regulations 2010 implement EU Directives 2008/50/EC and 2004/107/EC, a fourth daughter directive, transposing the AAD values into UK legislation. In the UK responsibility for meeting the AAD Limit and Target Values is devolved to the national administrations; the Department for Environment, Food and Rural Affairs (Defra) co-ordinates assessment and air quality plans for the UK as a whole.~~
- 7.2.10 Under the Environment Act 1995 the UK Government and the devolved administrations are required to produce a national Air Quality Strategy (AQS). This was last reviewed and published in 2007<sup>1</sup>. The UK AQS sets out air quality objectives (AQOs) and policy options to improve air quality within the UK. The strategy sets AQOs for specific pollutants deemed to pose a risk for human health or other receptors, a number of which are derived from the EU limit and target values, although requirements for compliance vary. The UK AQS includes more exacting AQOs for some pollutants than those required by EU legislation.
- 7.2.11 Part IV of the Environment Act 1995 imposes a duty on local authorities in the UK to review existing and projected air quality in their area. Any location likely to exceed the UK AQOs must be declared an Air Quality Management Area (AQMA) and an Action Plan prepared and implemented, with the aim of achieving the objectives. This process is referred to as Local Air Quality Management (LAQM). The LAQM process is supported by national statutory policy<sup>2</sup>, which is published by each country within the UK separately, and technical guidance<sup>3</sup>, which is published by Defra at a UK level.

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<sup>1</sup> DEFRA (2007), The Air Quality Strategy for England, Scotland, Wales and Northern Ireland

<sup>2</sup> Defra (June 2017), Local Air Quality Management, Policy Guidance (PG(W)17)

<sup>3</sup> Defra (April 2016), Local Air Quality Management, Technical Guidance (TG16)

7.2.12 The standards and objectives relevant to the LAQM framework are prescribed through the Air Quality (Wales) Regulations (2000) and Air Quality (Wales)(Amendments) Regulations 2002.

7.2.13 The air quality objectives and limit values currently applicable to the UK can therefore be split into two groups. Each has a different legal status and is therefore handled differently within the framework of UK air quality policy. These are:

- UK AQOs set down in regulations for the purposes of local air quality management; and,
- European Union (EU) AAD limit values transposed into UK legislation for which compliance is mandatory.

7.2.14 The applicable EU limit and target values and UK AQOs relevant to the Site and proposed development with regards to protection of human health, referred to in this report as Air Quality Assessment Levels (AQALs), are summarised in Table 7.1. below.

**Table 7.1: Relevant Air Quality Assessment Levels (AQALs)**

Pollutant	AQAL	Averaging Period	Source
NO <sub>2</sub>	40 µg/m <sup>3</sup>	annual mean	AAD Limit Value / AQO
	200 µg/m <sup>3</sup>	hourly mean, not to be exceeded more than 18 times per annum	AAD Limit Value / AQO
PM <sub>10</sub>	40 µg/m <sup>3</sup>	annual mean	AAD Limit Value / AQO
	50 µg/m <sup>3</sup>	24 hour mean, not to be exceeded more than 35 times per annum	AAD Limit Value / AQO
PM <sub>2.5</sub>	25 µg/m <sup>3</sup>	annual mean	AAD Limit Value / AQO
	% reduction relative to average exposure indicator (AEI), dependant on initial concentration; to at least 18 µg/m <sup>3</sup>	annual mean	AAD Target Value / AQO
CO	10 mg/m <sup>3</sup>	Maximum daily running 8 hour mean	AAD Limit Value

7.2.15 Statutory objectives, limit and / or target values for NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> are provided in the Air Quality Standards Regulations 2010 and Air Quality Strategy 2007, the 2010

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Regulations imposing stricter standards on PM<sub>2.5</sub> than the Strategy. However, there are no regulatory standards for PM<sub>2.5</sub> within the LAQM system, and PM<sub>2.5</sub> is currently regulated at a national, rather than local, level. Local Authorities do not presently have an obligation to review and monitor PM<sub>2.5</sub> but are expected to work towards reducing PM<sub>2.5</sub> emissions and concentrations in their area as practicable.

7.2.16 For the purposes of the AQALs ambient air refers to the outdoor air and excludes workplaces where members of the public do not have regular access. Advice is given in Defra guidance<sup>3</sup> as to where the UK AQOs should apply as summarised below; slightly different compliance requirements are provided for EU limit values compared to UK AQOs:

**Table 7.2: Summary of where AQOs should apply**

<b>Averaging period</b>	<b>Objective should apply at</b>
annual mean	all locations where members of the public might be regularly exposed; including facades of residential properties, schools, hospitals, care homes etc
24-hour mean and 8-hr mean	all locations where the annual mean objectives apply together with hotels and gardens of residential properties
1-hr mean	all locations where the annual mean, 24-hour and 8-hour means apply; also kerbside Sites, parts of car parks, bus stations and railway stations which are not fully enclosed and any outdoor locations where members of the public might reasonably be expected to spend 1 hour or longer.
15-min mean	all locations where members of the public may be reasonably exposed for a period of 15 minutes

Note: the AQOs do not apply at building facades or other places of work where members of the public do not have regular access

Dust Standards and Controls

7.2.17 Disamenity dust as such is not regulated as a pollutant under the above requirements and there are no European or UK statutory or otherwise recommended levels to define the point when deposited dust causes annoyance or disamenity. Public concerns in relation to dust accumulation and soiling may be related to a range of factors including the nature of a site and locality, baseline levels and duration and type of dust generating activity.

7.2.18 Controls of soiling and nuisance impacts are typically achieved through conditions within planning permissions and / or Environmental Permits requiring the implementation of a dust management plan to prevent amenity impacts. Deposited dust may also give rise to a 'nuisance' through the unacceptable effects of emissions, with statutory nuisances being defined and controlled in accordance with Part 3 of the Environmental Protection Act 1990 as amended. It is recognised however that a significant loss of amenity may occur at lower levels of amenity that would constitute a statutory nuisance.

### Odour Standards and Controls

- 7.2.19 There are no mandatory numerical standards in the UK for assessing odour levels, although some guideline values can be used for assessing potential odour impacts. Although odours can be due to a single chemical, they are typically due to a complex mixture of compounds making reliable 'chemical' analysis or measurement at source difficult. As such, there is no single method for reliably measuring or assessing odour pollution, and the potential for an odour disamenity or nuisance, and any conclusion is best based on a number of pieces of evidence.
- 7.2.20 The potential for an odour impact will be dependent on a number of factors including:
- likely magnitude of odour emissions (source strength)
  - likely meteorological conditions at a site
  - sensitivity of the receptors;
  - frequency: how often a receptor / individual is exposed to odour
  - offensiveness: type of odour; some odours are generally regarded as more unpleasant than others
- 7.2.21 Once exposure to odour has occurred, it may lead to adverse effects such as disamenity, annoyance, nuisance and possibly complaints, where annoyance is an adverse effect arising from an immediate exposure and nuisance is caused by cumulatively by repeated events of annoyance.

### Bioaerosol Standards and Controls

- 7.2.22 The Environment Agency requires a Site Specific Bioaerosol Risk Assessment (SSBRA) for Environmental Permit applications for composting and other biowaste treatment operations within 250m of workplaces or dwellings. Before granting a permit the EA must be satisfied that bioaerosols can, and will be, maintained no higher than acceptable levels at the sensitive receptors. There are no mandatory numerical standards in the UK for assessing bioaerosol concentrations. However, EA Position Statement on composting and potential health effect from bioaerosols<sup>4</sup> sets out acceptable concentrations of bioaerosols at sensitive receptors that are attributable to the permitted composting activities. These are 300, 1,000 and 500 cfu/m<sup>3</sup> for gram-negative bacteria, total bacterial and *Aspergillus fumigatus* respectively. It is understood this is also applicable to NRW and that these levels are applicable to other biowaste facilities in addition to composting sites.

### Ecological Standards

- 7.2.23 Statutory and non-statutory ambient air quality standards (termed Critical Levels) are also provided by legislation and guidance for the protection of vegetation and ecosystems to be applied at designated nature conservation sites. Standards applicable to this assessment are detailed below.

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<sup>4</sup> Environment Agency (November 2010), Composting and potential health effects from bioaerosols: out interim guidance for permit applicants, 1.0; Position Statement 031

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**Table 7.3: Ambient Air Environmental Standards for Protection of Vegetation and Ecosystems**

Pollutant	Concentration ( $\mu\text{g}/\text{m}^3$ )	Measured As
NO <sub>x</sub> (total NO <sub>x</sub> expressed as NO <sub>2</sub> )	30	annual mean
	75	daily mean

- 7.2.24 The critical levels for ecosystems only apply to sites **“more than 20km from an agglomeration; more than 5km from an industrial source; motorways and built up areas of more than 5,000 people.”** However, under NRW/EA guidance, these standards are to be applied as non-statutory critical levels to all nature conservation sites regardless of location
- 7.2.25 In addition, Critical Loads are provided for nutrient nitrogen and acidity deposition; these are dependent on the location and are discussed further in Appendix 7.1.

Industrial Pollution Control

- 7.2.26 A wide range of industrial, waste and agricultural installations require an Environmental Permit to operate under the Environmental Permitting (England and Wales) Regulations 2010 (EPR), and subsequent amendments. The aim of the permitting system is to prevent, and where that is not practicable reduce, emissions to air, water and land by potentially polluting and other installations.
- 7.2.27 Premises that are operated under a Permit are required to operate in such a way that a) all the appropriate preventative measures are taken against pollution, in particular through the application of the best available technique; and b) no significant pollution is caused. Permits are issued by either NRW or the Local Authority dependant on the nature and size of the facility.
- 7.2.28 The Proposed Development will fall within the Environmental Permitting regime and be controlled under a Part A1 Environment Permit issued by NRW. NRW follows the air emissions risk assessment methodology<sup>5</sup> provided by the Environment Agency (EA) to be followed by applicants in support of environmental permit applications. Separate guidance is provided by NRW with regards to odour management<sup>6</sup> in relation to permitted facilities.
- 7.2.29 EA guidance<sup>7</sup> regarding development requiring both a planning permission and environmental permit application clarifies that when deciding on a planning application the authorities should a) be confident that the development will not result in unacceptable risks from pollution when considering if the development is an appropriate use of the land and b) not focus on controlling pollution where it can be controlled by other pollution regulations, such as EPR.

<sup>5</sup> Environment Agency (EA) and Defra, Air Emission Risk Assessment for your environmental permit, <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit>; last updated August 2016

<sup>6</sup> Natural Resources Wales (October 2014), How to comply with your environmental permit, Additional guidance for: H4, Odour Management

<sup>7</sup> Environment Agency (EA), Guidelines for developments requiring planning permission and environmental permits (England), 9<sup>th</sup> October 2013

### National Planning Policy and Guidance

7.2.30 Planning Policy Wales (PPW, Edition 9, November 2016) sets out the Welsh Government's land use planning policies and how these are expected to be applied. Chapter 13 of PPW deals with minimising and managing environmental risks and pollution, including air quality issues. Section 13.1.1 of PPW states that:

**"Planning and environmental management are separate but complementary. By controlling where development can take place and what operations may be carried out, the planning system has an important role in avoiding or minimising the adverse effects of any environmental risks on present or future land use."**

7.2.31 The Framework provides guidance to local authorities on taking air pollution into account in planning policies and decisions. Section 13.10.1 states:

**"The planning system should determine whether a development is an acceptable use of land and should control other development in proximity to potential sources of pollution rather than seeking to control the processes or substances used in any particular development."**

7.2.32 Of note, the different roles of a planning authority and a pollution control authority are addressed by PPW in section 13.10.2:

**"Planning authorities should operate on the basis that the relevant pollutant control regimes will be properly applied and enforced by other agencies. They should not seek to control through planning measures, matters that are the proper concern of the pollution control authority. These regimes are set out in the Environment Act 1995, the Environmental Protection Act 1990, the Water Resources Act 1991 and the regulatory regimes introduced by the Pollution Prevention and Control Act 1999. Each of these may have a bearing on the environmental controls imposed on the development in respect of environmental and health concerns and planning authorities will need to ensure that planning conditions do not duplicate or contradict measures more appropriately controlled under these regimes."**

7.2.33 PPW sets out the position for development management in relation to air (and water) quality in section 13.12.1 as follows:

**"The potential for pollution affecting the use of land will be a material consideration in deciding whether to grant planning permission. Material considerations in determining applications for potentially polluting development are likely to include:**

- **location, taking into account such considerations as the reasons for selecting the chosen Site itself;**
- **impact on health and amenity;**
- **the risk and impact of potential pollution from the development, insofar as this might have an effect on the use of other land and the surrounding environment (the environmental regulatory regime may well have an interest in these issues, particularly if the development would impact on an Air Quality Management Area or a SAC);**
- **prevention of nuisance;**
- **impact on the road and other transport networks, and in particular on traffic generation; and**

### Air Quality and Odour

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- **the need, where relevant, and feasibility of restoring the land (and water resources) to standards sufficient for an appropriate after use. (Powers under the Pollution Prevention and Control Act 1999 require an operator to return a Site to a satisfactory state on surrender of an Integrated Pollution Prevention and Control Permit)."**

#### Additional Guidance and Best Practice

- 7.2.34 The IAQM Planning for Air Quality<sup>8</sup> document provides specific non-statutory guidance on air quality and the planning system for new development. The guidance clarifies when an air quality assessment is required, what it should contain and how impacts should be described and assessed. In addition, the guidance sets out suggested approaches to reducing emissions and impacts.
- 7.2.35 The IAQM Guidance on the Assessment of Dust from Demolition and Construction document<sup>9</sup> provides specific non-statutory guidance on the assessment of the impacts of dust and fine particulate matter (PM<sub>10</sub>) from demolition and construction activities. The guidance also provides recommended mitigation measures taking into account the risk posed by the site.
- 7.2.36 The IAQM Guidance on the Assessment of Odour for Planning document<sup>10</sup> provides non-statutory guidance on the assessment of odour impacts on amenity for planning purposes. The guidance outlines an approach for carrying out odour assessments and details information that should be contained in such an assessment.

#### **Assessment Methodology**

- 7.2.37 The scope of the assessment was based on consideration of the Proposed Development and likely effects on the local environment. The scope of the assessment has been agreed in consultation with Dave Jones, Pollution Control Officer, FCC.
- 7.2.38 The principal aspects considered during this assessment are:

#### Construction phase

- Site preparation and construction activities: disamenity dust and fine particulate matter;
- Construction plant combustion emissions: oxides of nitrogen and particulate matter;
- Road vehicle emissions: oxides of nitrogen and particulate matter;

#### Operational phase

- Waste receipt, handling and treatment: fugitive odours and bioaerosols;
  - Biogas engine combustion emissions: primarily oxides of nitrogen and carbon monoxide;
  - Road vehicle emissions: primarily oxides of nitrogen and fine particulate matter
- 7.2.39 In undertaking the air quality assessment the following has been undertaken:
- visit to view the Site and walkover of the surrounding area;

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<sup>8</sup> Institute of Air Quality Management (January 2017), Land Use Planning and Development Control: Planning for Air (v1.2)

<sup>9</sup> Institute of Air Quality Management (February 2014), Guidance on the assessment of dust from construction and demolition

<sup>10</sup> Institute of Air Quality Management (May 2014), Guidance on the assessment of odour for planning

- review of development proposals, including current and proposed landuses;
- review of baseline air quality, including existing potential pollution sources and planning application data for nearby facilities;
- review of FCC air quality reports and monitoring data;
- review of appropriate meteorological data including local wind speed and direction statistics;
- qualitative assessment of vehicle emissions;
- qualitative assessment of odour and bioaerosols;
- modelling of stack emissions from the biogas engine plant, specifically oxides of nitrogen (NO<sub>x</sub>) and carbon monoxide (CO), using the ADMS atmospheric dispersion model;
- assessment of biogas stack emission impacts on human health and ecological receptors;
- provision of recommendations for mitigation;
- assessment of residual effects.

Receptors

7.2.40 Receptors considered in this assessment constitute human receptors, that is locations where a person or property may experience adverse impacts of airborne dust or exposure to ambient pollution (i.e. residential, leisure use, amenity and sensitive commercial use) and ecological receptors where this refers to any sensitive habitat that may be affected by dust soiling or increased ambient pollution (e.g. locations with an international, national or local designation and sensitive habitat features).

7.2.41 In identifying potential receptors to be considered in the assessment reference has been made to IAQM and EA guidance. Potential receptors have been considered on the following basis:

**Table 7.4: Receptor Selection Principles**

<b>Human Health Receptors</b>	<b>Comment</b>
Houses / groups of houses Schools, hospitals, shops, factories Public rights of way, recreational areas Allotments	Identified based on distance from Site boundaries, operational areas and haulage distances, sensitivity and likely duration of exposure
<b>Nature Conservation Sites</b>	<b>Comment</b>
European designated sites - SPAs, SACs and RAMSAR Sites	within 5km of Site boundaries
National and local designated sites – SSSIs, National Nature Reserves (NNRs), Local Nature Reserves (LNRs), Local Wildlife Sites (LWSs) and ancient woodland	within 2km of Site boundaries

7.2.42 EA guidance for Environmental Permit applications requires consideration of internationally designated Sites within 10km of an installation; given the nature of the development significant impacts are not anticipated beyond 5km.

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Biogas Engine Stack Emissions Assessment

- 7.2.43 The potential impacts of emissions from the stack associated with CHP Plant on nearby receptors have been assessed using atmospheric dispersion modelling. The modelling has been undertaken using ADMS 5.2 supplied by Cambridge Environmental Research Consultants (CERC). The derivation of emission rates and modelling methodology are detailed in Appendix 7.2.
- 7.2.44 Technical details of the processes and plant have been provided by Pwer Gwyrdd Ltd and Arrow Green Ecology Ltd and have been incorporated as necessary in the description of the Proposed Development and modelling methodology.
- 7.2.45 The model outputs have been compared to the relevant AQALs as described in Section 7.2. Detailed assessment with regards to human health receptors has been undertaken in accordance with IAQM guidance<sup>7</sup> in relation to planning applications and air quality. The IAQM guidance does not replace the NRW / EA guidance developed for industrial facilities requiring an Environmental Permit<sup>4</sup> and subject to the NRW / EA risk assessment methodology but has been specifically developed for professional working with the planning system. Where applicable therefore reference has also been made to the NRW / EA guidance.
- 7.2.46 The severity of an impact of a pollutant at individual receptors is determined taking into account the predicted Process Contribution (PC) as a percentage of the AQAL and the resulting total concentration (as a long-term average) as summarised below:

**Table 7.5: Impact Descriptors for Individual Receptors – Long-term Concentrations**

Long term average concentration at receptor in assessment year	% Change in Concentration relative to Air Quality Assessment Level (AQAL)				
	0	1	2-5	6-10	>10
75% or less of AQAL	negligible	negligible	negligible	slight	moderate
79-94% of AQAL	negligible	negligible	slight	moderate	moderate
95-102% of AQAL	negligible	slight	moderate	moderate	substantial
103-109% of AQAL	negligible	moderate	moderate	substantial	substantial
110% or more of AQAL	negligible	moderate	substantial	substantial	substantial

- 7.2.47 The % change in concentration relative to the AQAL is rounded to the nearest whole number. For example, where the % change is less than 0.5%, the % change is 0% and impact descriptor is *negligible* irrespective of the background concentration; where between 0.5% and 1.5% the change is 1% and further assessment is required.

7.2.48 This approach is only applicable to long-term average concentrations (annual means). The guidance does not include reference to background concentrations for determining the severity of impacts for short-term concentrations due to the non-additive nature of peak concentrations from a source and the background. In considering short-term peak concentrations (i.e. those averaged over periods of an hour or less) the following impact descriptors are referred to:

**Table 7.6: Impact Descriptors for Individual Receptors – Short-term concentrations**

<b>% of relevant short-term AQAL</b>	<b>Magnitude</b>	<b>Impact Descriptor</b>
10% or less	negligible	negligible
11-20%	small	slight
21-50%	medium	moderate
51% or above	large	substantial

7.2.49 Where process related contributions are less than 10% of the short-term standard then the severity of impacts is *negligible* irrespective of the background concentrations.

7.2.50 The IAQM guidance is not applicable to the assessment of air quality impacts on ecological / nature conservation receptors. The ecological assessment is therefore undertaken in accordance with the NRW / EA guidance<sup>4</sup> for environmental permitting applications. This provides the following screening criteria:

**Table 7.7: Screening Criteria for Nature Conservation Receptors**

<b>European Sites and SSSIs</b>
PC <sub>long-term</sub> is <i>insignificant</i> where less than 1% of the relevant Critical Level / Load
PC <sub>short-term</sub> is <i>insignificant</i> where less than 10% of relevant Critical Level / Load
PEC <sub>long-term</sub> will result in <i>no likely significant effect</i> where 70% of the relevant Critical Level / Load
<b>Local Nature Sites (NNRs, LNRs, LWSs and Ancient Woodland)</b>
PC <sub>long-term</sub> is <i>insignificant</i> where less than 10% of relevant Critical Level / Load
PC <sub>short-term</sub> is <i>insignificant</i> where less than 100% of relevant Critical level / Load

7.2.51 Where the PC<sub>long-term</sub> and PC<sub>short-term</sub> are below the screening thresholds of 1% and 10% respectively no further assessment is necessary irrespective of background concentrations. Exceedance of the screening thresholds does not indicate that significant adverse effects are predicted, but that further assessment is required.

**Air Quality and Odour**

Odour Assessment

7.2.52 A qualitative assessment of the potential for the Proposed Development to result in adverse impacts on sensitive receptors due to odour has been carried out. The assessment has incorporated consideration of potential key sources of odour from the facility and operations, nature of the local environment, distance and orientation to receptors, and prevailing weather conditions. The assessment has been undertaken with reference to non-statutory guidance provided by the IAQM on odour and planning<sup>9</sup>.

7.2.53 The assessment takes into account the potential magnitude of odour release (i.e. Source Odour Potential), the effectiveness of the pathway, i.e. dispersion of odour towards a receptor, and the sensitivity of the receptor. The Source Odour Potential considers the scale of release (taking into account odour control measures), how inherently odorous the emission is and the relative pleasantness / unpleasantness. Examples are provided below:

**Table 7.8: Examples of Odour Source Potential**

Odour Source Potential	Examples
Large	<ul style="list-style-type: none"> <li>• larger permitted process of odorous materials</li> <li>• large sewage treatment works</li> <li>• materials usage hundred thousands tonnes / m<sup>3</sup> per year</li> <li>• area sources thousands of m<sup>2</sup></li> <li>• processes classed as most offensive</li> <li>• open air operation with no containment / control</li> </ul>
Medium	<ul style="list-style-type: none"> <li>• smaller permitted processes</li> <li>• small STWs</li> <li>• materials usage thousands tonnes / m<sup>3</sup> per year</li> <li>• area hundreds of m<sup>2</sup></li> <li>• process classed as moderately offensive</li> <li>• some mitigation in place but significant residual odour remains</li> </ul>
Small	<ul style="list-style-type: none"> <li>• falls below EPR Part B threshold</li> <li>• materials usage hundreds of tonnes / m<sup>3</sup> per year</li> <li>• areas source tends of m<sup>2</sup></li> <li>• processes classed as less offensive</li> <li>• effective tangible mitigation measures in place</li> </ul>

7.2.54 The effectiveness of the pollutant pathway is dependent on the distance of receptors from the source, the orientation with respect to the prevailing wind direction, the local topography and terrain, the nature of release and dilution and dispersion. The resulting pollutant pathway from a source to a specific receptor can be categorised as follows:

- **highly effective:** receptor adjacent to source; high frequency of winds from source to receptor; low effectiveness of dispersion / dilution e.g. open processes with low level releases;
- **moderately effective:** receptor local to source; mitigation relies on dispersion / dilution e.g. releases elevated but compromised by buildings;
- **ineffective:** receptor remote from source; low frequency of winds from source to receptor; releases are from high level e.g. stacks >3m from ridge height.

7.2.55 The IAQM guidance identifies three tiers of receptor sensitivity with respect to odours, taking into account aspects such as the level of amenity that may be expected and the

length of time people may be present at the location. The three tiers are **low** (e.g. footpaths, roads, industrial premises), **medium** (e.g. retail / commercial premises, playing / recreational fields) and **high** (e.g. housing, hospitals, schools).

7.2.56 The overall risk of odour exposure (impact) at a specific receptor can be assessed as follows:

**Table 7.9: Risk of Odour Impact at a Specific Receptor Location**

pathway effectiveness	source odour potential		
	small	medium	large
highly effective pathway	low risk	medium risk	high risk
moderately effective pathway	negligible risk	low risk	medium risk
ineffective pathway	negligible risk	negligible risk	low risk

7.2.57 The effect of an odour impact on the individual receptor, taking into account its sensitivity, is estimated as follows:

**Table 7.10: Potential Odour Effect at a Specific Receptor**

risk of odour exposure	receptor sensitivity		
	low	medium	high
high	slight adverse	moderate adverse	substantial adverse
medium	negligible	slight adverse	moderate adverse
low	negligible	negligible	slight adverse
negligible	negligible	negligible	negligible

Vehicle Emissions Assessment

7.2.58 The assessment of vehicle emissions during the construction and operational phases has been undertaken in accordance with the IAQM guidance<sup>7</sup> which is deemed appropriate for the Proposed Development.

7.2.59 The level of assessment required was determined through an initial screening review taking into account the predicted changes in traffic flows along the roads and junctions within the transport assessment study area and locations of sensitive receptors.

7.2.60 The following criteria were used to determine potentially affected roads as provided in the IAQM guidance:

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- LDV flow change by 500 AADT or more outside an AQMA, or 100 AADT or more within or adjacent to an AQMA;
- HDV flows change by 100 AADT or more outside an AQMA, or 25 AADT or more within or adjacent to an AQMA;
- Road alignment changing by 5m or more;
- Introduction or removal of a junction.

7.2.61 Where these criteria are met and there are relevant receptors present further assessment is required. This may take the form of a Simple or Detailed Assessment. Relevant receptors include residential dwellings, schools and hospitals, areas of leisure use and ecologically sensitive sites.

7.2.62 The IAQM guidance does not specify at what distance a receptor should be to an affected road to indicate the need for further assessment. However, pollution concentrations fall rapidly away from the roadside and are expected to return to background levels within 100m of a road source<sup>11</sup>. For the purposes of the assessment reference is made to HE DMRB<sup>12</sup> guidance which requires assessment of receptors within 200m of affected roads. Where there are no receptors within 200m of affected roads vehicle emissions are not considered further and potential impacts can be considered *negligible*.

7.2.63 The screening assessment determined that further detailed assessment with respects to impacts of vehicle movements was not necessary as detailed below in Section 9.4.

#### Scoped Out Matters

7.2.64 All delivery and handling of waste is to be undertaken within the internal areas of the building which is to be subject to extraction and ventilation to maintain negative pressure. Accordingly, the potential for significant fugitive emissions of dust during the operational phase that may pose a loss of amenity or nuisance is considered to be low. The potential for dust impacts can be readily mitigated through the incorporation of best practice measures as required by the Environmental Permit; on this basis further assessment of dust impacts is not considered necessary and has been scoped out of the EIA.

#### **Assessment of Significance**

##### Biogas Engine Emissions / Vehicle Emissions

7.2.65 The predicted resulting effects of aerial emissions are the consequences of the potential impacts, i.e. changes in pollutant concentrations at receptors. IAQM guidelines do not provide a traditional matrix for the assessment of significant effects with regards to air quality. The framework for describing air quality impacts at individual receptors detailed above in tables 7.5 and 7.6 are therefore used as a starting point to assess the significance of predicted effects.

7.2.66 Where negligible impacts are predicted the overall effects will be not significant. In general, where slight impacts at receptors are predicted the resulting effects would be considered to be **not significant**. Moderate and substantial impacts could result in **significant** effects. However, the judgement of the overall significance of air quality effects takes into account a number of additional factors, including but not limited to:

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<sup>11</sup> Air Quality Consultants (AQC), NO2 Concentrations and Distance from Roads, J504, 18th July 2008

<sup>12</sup> Highways England (HE), Design Manual for Roads and Bridges (DMRB), Volume II Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 1, HA 207/07, Air Quality, May 2007

- the existing and predicted future air quality in the absence of the proposed development;
- the extent of current and future population exposure to the predicted impacts and the severity of those impacts;
- whether the predicted impacts potentially result in failure to achieve compliance, or enhance compliance, with EU AAD values and / or UK AQOs and national and / or local air quality action plans;
- whether the predicted impacts potentially result in the need for declaration of a new or extended AQMA, or removal of an existing AQMA;
- whether the predicted impacts potentially result in permanent or temporary damage, or improvements, to nature conservation sites of local, national or international importance and the geographical extent of those impacts;
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts.

### Odours

- 7.2.67 The assessment of the overall significance of odour effects is determined based on professional judgement and taking into account aspects including the different effects at each specific receptor and number of affected receptors.

### Study Area

- 7.2.68 Owing to the different spatial extents at which likely significant effects could arise from the development different Study Areas were adopted in the assessment for the different aspects. These areas are discussed in the relevant sections above.

### Limitations to the Assessment

- 7.2.69 Baseline air quality data has been obtained through a review of existing information and additional monitoring has not been undertaken. The available data is considered appropriate for the Site and assessment.
- 7.2.70 The assessment has been based on information provided to SGP. Where information is not readily available assumptions have been made where appropriate; this is highlighted within the text.

## **7.3 BASELINE CONDITIONS**

### Site Description and Context

- 7.3.1 The Site is located on land off Weighbridge Road within the Deeside Industrial Park and is bound to the north by the Parc Adfer Energy Recovery Plant which is currently undergoing construction; to the east by a railway line; to the south by the Flintshire Bridge 400kV Converter Station; and to the west by Weighbridge Road and an electrical substation.
- 7.3.2 The surrounding landuse is predominantly industrial including a paper mill to the northwest and steelworks to the southwest. The nearest residential receptors are distant to the Site, located between Connah's Quay and Shotton 2.2km to the south-southwest, and in Garden City 2.2km to the southeast. There are no schools, hospitals, or other such highly sensitive facilities within 2km of the Site.

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- 7.3.3 National cycle route 568 passes through Deeside Industrial Park to the east. The closest point of the route to the Site, on Tenth Avenue, is 460m to the east. Shotwick Lake Sailing Club is located 955m to the northeast on Shotwick Lake and a Ministry of Defence rifle range is located 1.1km to the northwest.
- 7.3.4 The nearest statutory designated nature conservation site is the Dee Estuary Ramsar / SPA / SAC / SSSI located 560m to the northeast.

#### **Baseline Survey Information**

##### Air Quality Review

- 7.3.5 In determining the existing local air quality reference has been made to the reports and information prepared by FCC in fulfilment of the LAQM reporting requirements, including the 2017 Air Quality Annual Progress Report<sup>13</sup>. This details the local air quality monitoring and assessment undertaken by the North Wales Local Authorities, including FCC, up until the end of 2016.
- 7.3.6 FCC has not declared any Air Quality Management Areas (AQMAs) within the Council area. In addition, FCC has not identified any areas of potential poor air quality where further assessment is required. Several AQMAs have been declared by the neighbouring local authority, Cheshire West and Chester Council, however the closest of these are over 10km from the Site.

##### Background Airborne Pollutant Concentrations

- 7.3.7 Defra publishes predicted background airborne pollutant concentration maps for the UK. These are updated on a regular basis due to updates in background data such as vehicle emissions factors. The current maps were issued in 2017 and are based on 2015 ambient monitoring and meteorological data and incorporate information on the age and distribution of vehicles and emission factors. These predicted concentrations take into account existing local sources of emissions. Predicted data is provided by Defra for each year from 2015 to 2030.
- 7.3.8 Predicted background air quality data for NO<sub>2</sub>, NO<sub>x</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> obtained from the Defra LAQM website for the 1km x 1km grid square in which the Site is located for 2018 and a future year (2023) are summarised in Table 7.11 below. Data for CO for 2001 has also been obtained and extrapolated to 2018 and 2023 in accordance with Defra guidance<sup>14</sup>.

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<sup>13</sup> North Wales Combined Authority (September 2017), Air Quality Annual Progress Report, Bureau Veritas [awaiting Defra approval at time of preparation of this report]

<sup>14</sup> Defra (November 2017), Air Pollution Background Concentrations Maps, A User Guide for Local Authorities

**Table 7.11: Predicted Background Air Quality Data (NO<sub>x</sub> & PM)**

Grid Square	Location	Concentrations (µg/m <sup>3</sup> )				
		NO <sub>2</sub>	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO
2018						
331500, 371500	Site	14.47	20.16	12.99	8.46	0.12
2023						
331500, 371500	Site	12.70	17.45	12.76	8.19	0.13
AQAL average)	(annual	40	30	40	25	

7.3.9 The average background NO<sub>2</sub> and PM<sub>10</sub> concentrations for the grid square in which the Application Site is located are both predicted to be substantially below the relevant AQS objectives of 40 µg/m<sup>3</sup> at 36% and 32% of the objective(s) in 2018. NO<sub>2</sub> concentrations are predicted to fall to 32% by 2023; PM<sub>10</sub> concentrations are also predicted to fall although to a lesser extent.

7.3.10 It should be noted that the data are effectively an average concentration across each 1 km square. The pollutant concentrations will therefore be higher close to any significant source, such as main roads, junctions and industrial facilities, including the A548, A494 and the nearby paper mill and steelworks.

#### Monitored Air Quality

7.3.11 FCC undertakes ambient air quality monitoring within the Council area using a combination of continuous analysers and diffusion tubes. Monitoring considered of relevance to the assessment is discussed below.

#### Continuous Monitoring

7.3.12 No real-time continuous monitoring was undertaken within the FC area in 2016. Historically monitoring was undertaken at one location at Rose Cottage near Mold at a junction on the A5119, 9km southwest of the Site; monitoring here ceased in 2016. The location is distant from the site and formed a 'roadside' location; as such it is not considered of relevance to the assessment.

#### Diffusion Tube Monitoring

7.3.13 FCC operates a network of diffusion tubes for monitoring NO<sub>2</sub> concentrations across the Council area; in 2016 52 locations were monitored. Those considered of relevance to the Site and assessment are detailed in Appendix 7.1.

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7.3.14 Exceedances of the annual mean NO<sub>2</sub> AQAL are not reported at any location deemed of relevance to the assessment.

Industrial Emissions and Other Emission Sources

7.3.15 Several industrial facilities operate in the local area, including a paper mill, a steelworks, a motor engine manufacturing plant and a power station. These, along with the A548 to the north, will contribute emissions to the background local air quality. Air emissions from existing facilities will be incorporated within existing monitoring data and modelling undertaken to inform Defra predicted background data.

7.3.16 The adjoining Parc Adfer facility is currently undergoing construction and is expected to be operational by the end of 2019. As such contributions of airborne pollutants to the local background air quality from the facility will not be included within the existing predicted future background air quality data detailed above. Where applicable therefore reference has been made to the air quality assessment report produced in the support for the planning application<sup>15</sup>, <sup>16</sup> to determine the contributions of the facility to the future background pollutant concentrations, and as detailed in Appendix 7.2.

Nature Conservation Sites

7.3.17 There are a number of European nature conservation sites within 5km, and national and local designated sites within 2km, as summarised below in Table 7.14. For full details reference should be made to the Ecology documentation submitted alongside the application.

**Table 7.14: Nature Conservation Sites**

Description	Designation	Distance from Site Boundary	Direction from Site
<b>Designated European Nature Conservation Sites within 5km</b>			
The Dee Estuary	Ramsar, SAC, SPA, SSSI	0.8km	NNW
		0.75km	WSW
River Dee and Bala Lake	SAC, SSSI	1.5km	SW
Deeside and Buckley Newt Sites	SAC	3km	SW
<b>Designated National Nature Conservation Sites within 2km</b>			
Shotton Lagoons and Reedbeds ( <i>also part of The Dee Estuary</i> )	SSSI	1.2km	S

<sup>15</sup> SLR Consulting Ltd, Parc Adfer Energy Recovery Facility, Deeside; Environmental Statement, Chapter 6: Air Quality

<sup>16</sup> SLR Consulting Ltd, Parc Adfer Energy Recovery Facility, Deeside; Environmental Statement, Appendix 6/1 Atmospheric Dispersion Modelling Ref: 403.040907.00006, August 2014

Inner Marsh Farm <i>(also part of The Dee Estuary)</i>	SSSI	1.3km	N
<b>Designated Local Nature Conservation Sites within 2km</b>			
Shotton Steelworks	LWS	0.7km	S

7.3.18 Of these the Dee Estuary Ramsar / SAC / SPA / SSSI forms the closest site lying within 0.75km of the Site boundary.

Meteorological Conditions

7.3.19 The most important meteorological parameters governing the atmospheric dispersion of pollutants are:

- wind direction: determines the broad direction of the transport of the emission;
- wind speed: affects the ground levels concentrations by determining the initial dilution of pollutants emitted; and,
- atmospheric stability: a measure of atmospheric turbulence and hence dispersion of pollutants.

7.3.20 The closest location for which appropriate meteorological data for use within atmospheric dispersion modelling (hourly sequential) is available is located at Hawarden Airport (NGR: 334100 364700; 10m aod), about 7.1km to the southeast. This station provides temperature, wind, humidity, cloud data and rainfall.

7.3.21 Windroses derived from data provided by the Met Office for the period January 2012 to December 2016 are provided in Appendix 7.2. These depict average wind speeds and directions for each year.

7.3.22 The windroses show the prevailing wind direction to be from sectors 140° through to 380° (predominantly southeasterly) and from 310 through to 330° (predominantly northwesterly). These are atypical of UK conditions. However, given the location of the Site at the southeastern end of the Dee Estuary the monitored Hawarden data is considered likely to be representative of conditions at the site.

**7.4 ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS**

**Construction**

Construction Dust

7.4.1 The IAQM guidance<sup>8</sup> provides the following screening criteria to determine where a detailed assessment of potential impacts and effects associated with construction dust:

- A human receptor within:
  - 350m of a Site boundary;
  - 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the Site entrance.
- An ecological receptor within:
  - 50m of the boundary of a Site; or
  - 50m of the route(s) used by construction vehicles on the public highway up to 500m from the Site entrance.

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- 7.4.2 With reference to Section 7.3 there are no receptors that meet these criteria. On this basis the overall risk for significant adverse impacts due to disamenity dust and PM<sub>10</sub> emissions during the construction phase is *negligible* and further detailed assessment is not required. The overall significance of effects is **not significant**. The potential for adverse dust impacts during the construction phase can be readily mitigated through the implementation standard dust control measures. These would be detailed in the Construction Environmental Management Plan (CEMP) which would be agreed with FCC in advance of the commencement of construction works.

#### Non-Road Mobile Machinery (NRMM), Site Plant and Road Vehicles

- 7.4.3 The operation of on-site plant and machinery (non-road mobile machinery (NRMM)) and generator plant during the construction phase will give rise to vehicle exhaust and combustion plant emissions. However, given the nature of the locality, absence of nearby sensitive receptors to the Site and the short-term timeframe for the construction phase such emissions potential adverse impacts are likely to be *negligible*. Detailed assessment of these emissions is not considered necessary and the resulting effects are considered **not significant**.
- 7.4.4 Similarly, transportation to and from the Site during the construction phase would give rise to vehicle exhaust emissions. However, given the nature of the local road network, set-back distance of any receptors to the road network as discussed below, expected construction vehicle movements and short time-frame potential adverse impacts on local air quality are likely to be *negligible*. Further assessment is not considered necessary and resulting effects are considered to be **not significant**.

#### **Operation**

##### Biogas Gas Engine Stack Emissions

- 7.4.5 Biogas generated by the AD Plant would be directed to a CHP Plant and combusted in a gas engine. The engine is to be housed in a container in the eastern part of the Site and provided with a 3m stack. The gas engine / CHP Plant will be operated in accordance with the Environmental Permit which will include specified emissions limits for certain pollutants for the exhaust stack.
- 7.4.6 Full details on the model approach, model results and assessment are provided in Appendices 7.2 and 7.3. The predicted impacts and overall significance of effects on human health and ecological receptors are summarised below.

##### Human Health Assessment

- 7.4.7 The modelling predicts the potential severity of impacts due to increases in long-term and short-term concentrations of NO<sub>2</sub> and CO at all modelled residential and leisure receptors to be *negligible*, as summarised below:

**Table 7.15: Summary of Predicted Impacts (Human Health)**

Pollutant	Impact Descriptor at Most Receptor(s) Affected	Comments
<b>Long-term PCs</b>		
<b>NO<sub>2</sub></b>	<b>negligible</b>	<b>all PCs substantially below the screening criteria at all modelled receptors</b>
<b>Short-term PCs</b>		
<b>NO<sub>2</sub></b>	<b>negligible</b>	<b>all PCs substantially below the screening criteria at all modelled receptors</b>
<b>CO</b>	<b>negligible</b>	

7.4.8 On this basis, and in the absence of any known areas of poor air quality in the locality, the overall significance of the gas engine emissions in relation to effects on human health is **not significant**.

Ecological Assessment

7.4.9 The modelling predicts the impacts due to ambient NO<sub>x</sub>, nitrification and acidification at all modelled nature conservation sites to be insignificant and further detailed assessment is not necessary. On this basis, the overall significance of the gas engine emissions in relation to effects on nature conservation sites is **not significant**.

Odours

7.4.10 The receipt, storage, handling and treatment of waste materials and operation of the AD Plant will give rise to the generation of odorous emissions. The generation of odour in waste is primarily related to the release of odorous volatile organic compounds during the anaerobic breakdown of organic material. The degree of odour generated by such material depends on the quantity of organic materials present within the wastes, the age of the organic material, and hence extent of degradation, the surface area of exposed materials and the quantity of material stored on site.

7.4.11 The waste materials to be handled include municipal wastes which would be delivered to Site from a combination of kerbside collections and waste transfer stations. As such the materials may contain a substantial proportion of degrading organic materials. Principal potential sources of odours within the facility would include waste reception and handling, open top tanks, condensate handling and storage of biogas.

7.4.12 In accordance with NRW guidance the Environmental Permit for the facility will include the following condition relating to odour:

**Emissions from the activities shall be free from odour at levels likely to cause pollution outside the site, as perceived by an authorised officer of the Authority, unless the operator has used appropriate measures, including but not limited to, those specified in an approved odour**

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#### **management plan, to prevent or where that is not practicable to minimise odour.**

- 7.4.13 The Permit will include the requirement for operation of the site in accordance with an Odour Management Plan (OMP) in agreement with NRW. This will set out aspects relating to the management and operation of the facility along with requirements for record keeping and monitoring.
- 7.4.14 The plant is to be of modern construction that will be constructed and operated in accordance with Best Available Techniques (BAT). Mitigation measures that are to be incorporated within the facility design include:
- tipping of waste materials directly within the reception area of the facility by HGVs;
  - containment of waste receipt, storage and handling operations within a fully enclosed building;
  - waste reception area to be provided with fast-acting automatic roller shutter doors;
  - air to be actively extracted from within the main building to maintain negative pressure to minimise fugitive odour emissions;
  - extracted air from within main building to be passed through a biofilter to reduce odours;
  - design of reception area to facilitate cleaning and provision of appropriate drainage;
  - containment of AD Plant screens within enclosed buildings; extracted air from the AD Plant to be passed to filters for odour treatment.
- 7.4.15 Additional measures that would be incorporated within the management and operation of the facility to minimise the generation and fugitive release of odours include:
- delivery of all waste to site in enclosed or covered vehicles;
  - application of appropriate waste acceptable procedures;
  - appropriate control and management of materials within reception area including use of continuous process for sorting waste materials, minimising potential for build up within the reception area prior to treatment and thereby reducing potential for odour generation;
  - all product to be baled within the building;
  - routine maintenance of all equipment;
  - external containers used for temporary storage of AD Plant screenings and reject materials to be contained;
  - minimisation of time period for external storage of reject material, where possible to be retained for no longer than 24 hours.

Assessment

- 7.4.16 Given the above designed-in mitigation measures the principal residual potential sources of odour associated with the operations will be:
- residual odours within treated air released from the biofilter;
  - residual odours within CHP Plant exhaust gas;
  - occasional releases from vents from AD Plant tanks;
  - emissions from open AD Plant balance tank and waste water treatment (WWT) plant tanks.
- 7.4.17 The facility is a large-scale odour source in terms of its potential to generate odours. However, it will include a high level of control to minimise the risk of odour releases. Given the handling of waste products at the Site the potential odours generate by the facility would be classed as 'most offensive'. Overall, with the installation of the proposed odour abatement and management control, the odour source potential is judged to 'medium'.
- 7.4.18 As detailed in Section 7.3 the nearest residential receptors are distant to the Site being located 2.2km to the south-southwest and 2.2km to the southeast. Other receptors that may be sensitive to odours are the national cycle route extending to 460m east of the Site at its closest point and the Lake Sailing Club 995m. There are no other receptors nearby that may be considered of medium or high sensitivity to odours such as commercial and retail facilities. Given the distance and orientation of these receptors to the Site there is considered to be an *ineffective* pathway for odour flux to the receptors.
- 7.4.19 Overall, the risk of impacts due to odours at each of these receptors is considered to be *negligible*.
- 7.4.20 Haulage of waste may also give rise to transient odorous emissions from RCVs, although this is minimised through the use of contained or sheeted vehicles. However, there are no receptors located on the immediate road network that may be sensitive to transient odours associated with haulage.
- 7.4.21 As such the potential for significant adverse impacts at sensitive receptors due to odours are considered to be *negligible*. The overall effects are considered to be **not significant**.

Bioaerosols

- 7.4.22 The principal source of bioaerosols from the facility will be the biofilter used to treat the extracted air from the main reception and waste handling building. This is to be sited in the eastern area of the site. Bioaerosols concentrations are expected to fall to background levels within about 200m from a source, and as such the EA requirements are for a SSBRA (Site Specific Bioaerosol Risk Assessment) when 250m from a workplace or dwelling. The only such receptor is the Parc Adfer facility to the north, the boundary of which lies about 130m from the proposed biofilter location.
- 7.4.23 Bioaerosols are primarily released during agitation of material, with reduced emissions from any static processes. Hence, given the distance to the nearest receptor the potential impacts of bioaerosols is unlikely to be significant. Furthermore, it is anticipated NRW will require the submission of a SSBRA with the Environmental Permit

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application. A recently issued EA Regulatory Position Statement<sup>17</sup> also indicates that NRW may require monitoring of bioaerosols in accordance with EA guidance<sup>18</sup>. Overall, the potential adverse effects associated with bioaerosols is considered **not significant**.

#### Vehicle Exhaust Emissions

- 7.4.24 As described in Chapter 4, the proposed development is predicted to generate an average of 292 working day vehicle movements (146 in / 146 out) on the surrounding highway. Predicted working day vehicle movements comprise, on average, 160 movements of refuse collection vehicles, 40 residue trucks, 4 recyclable trucks and 8 RDF vehicles resulting in 212 two-way Heavy Duty Vehicle (HDV) movements (106 in / 106 out). Staff and delivery movements are predicted to generate 80 two-way LDV (Light Duty Vehicle) movements (40 in / 40 out). These figures are for working days only; proposals are for 5 days a week operation and the resulting annual average daily traffic (AADT) figures will therefore be reduced at about 151 HDV AADT and 57 LDVs AADT.
- 7.4.25 The development related LDV movements fall substantially below the screening criteria provided by IAQM<sup>1</sup> as indicating the need for an air quality assessment (change of LDV flows of more than 500 AADT (annual average daily traffic) for areas outside and distant from an Air Quality Management Area (AQMA)). The HDV movements however are above the IAQM indicative criteria (change of HDV flows of more than 100 AADT for HDVs for areas outside an AQMA). Further consideration therefore is made of the potential HDV routing and presence of any nearby sensitive receptors to the affected roads to determine the need for detailed assessment.
- 7.4.26 All HDV movements will be via Weighbridge Road and the A548. It is anticipated that movements will be via the A548 to both the east and west of the junction with Weighbridge Road; the actual east to west distribution will be dependent on the source of the wastes being delivered. At this stage it is assumed a 54:46 % west / east split, resulting in 114 movements along the western stretch of the A548 and 98 along the eastern stretch. The resulting additional HDV movements along the western stretch would therefore be marginally above the IAQM indicative criteria and on the eastern stretch below the criteria.
- 7.4.27 No relevant receptors (such as residential properties) are located at the A548 / Weighbridge Road junction where the greatest development related HDV movements will be experienced. Similarly, there are no relevant receptors located along the eastern stretch of the A548. Possible residential use exists close to the A548 / A5117 roundabout, however this property is set back about 47m from the roadside. With reference to Appendix 7.1, the FCC monitoring location Site 22 is located close to the area. Annual mean NO<sub>2</sub> concentrations at this location have been consistently well below the AQAL at 18.6-32.6 µg/m<sup>3</sup> over 2012-2016. From the roundabout all movements will thereafter be further distributed north / south via the A550 / A494 / A5517.
- 7.4.28 Several sensitive receptors are located close to the western stretch of the A548 distant from the Site. However, none of these are located in immediate proximity of the roadside, the façade of the closest being about 10m from the roadside. FCC monitoring location Site 7 is located close to this area on Kelsterton Road. Annual mean NO<sub>2</sub> concentrations at this location have been consistently well below the AQAL at 14.7-21.0 µg/m<sup>3</sup> over 2012-2016.

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17 Environment Agency (23 January 2018); Bioaerosol monitoring at regulated facilities – use of M9: RPS 209

18 Environment Agency (January 2017), Technical Guidance Note (Monitoring), Environmental Monitoring of bioaerosol at regulated facilities, M9, v1

- 7.4.29 Taking into account the absence of any known areas of air quality concern in the locality, as discussed in Section 9.3, that the additional vehicle movements away from the A548 / Weighbridge Road junction are expected to be only marginally above the above the IAQM screening thresholds on the western stretch and below on the eastern stretch, potential impacts associated with development related vehicle emissions are considered to be *negligible* and further detailed assessment is not considered necessary.
- 7.4.30 The overall effects of vehicle emissions associated with additional traffic movements generated by the Proposed Development are therefore considered to be **not significant**.

### 7.5 MITIGATION, ENHANCEMENT AND RESIDUAL EFFECTS

#### Mitigation by Design

- 7.5.1 As detailed above the facility will require an Environmental Permit issued by the NRW to operate. As such the plant will be constructed in accordance with Best Available Techniques (BAT) with certain mitigation measures incorporated within the design. In relation to air quality aspects this will primarily be related to the control of fugitive odour and dust releases, such as through the installation of appropriate extraction and treatment systems, and the use of a gas engine that meets specified emission limit values.

#### Additional Mitigation

##### Construction

- 7.5.2 Given the absence of nearby sensitive receptors the construction phase is not predicted to result in significant adverse effects due to dust and particulate matter. Notwithstanding this the management and control of dust during the construction phase would be included within the Construction Environmental Management Plan (CEMP) to be agreed in advance with FCC. This would incorporate the employment of Industry standard mitigation measures.

##### Operation

- 7.5.3 The Environmental Permit will also require appropriate operation of the facility to minimise aerial emissions. This will include operation in accordance with an OMP, to be agreed in advance with NRW, to minimise potential odorous emissions from the Site; minimisation of dust emissions from the site; provision of a site-specific risk assessment in relation to bioaerosols and monitoring; and operation of the gas engine in accordance with specific emission limits.
- 7.5.4 As such the overall likely effects with regards to gas engine, odours, dust and bioaerosol emissions are **not significant**. Additional control through the planning permission is not considered necessary.
- 7.5.5 The Environmental Permit will not control vehicle movements to and from the Site, such as limiting vehicle numbers or specifying routing options etc. However, given the absence of any known local air quality concerns and the estimated vehicle movements associated with the Development, additional mitigation has not been identified as necessary.
- 7.5.6 No additional recommended mitigation measures have been identified as necessary.

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**Enhancements**

7.5.7 No additional enhancement measures have been identified as necessary.

**Residual Effects**

7.5.8 Given the in-design mitigation and subsequent management and control mitigation measures required under the Environmental Permit the overall residual effects are **not significant**.

**7.6 CUMULATIVE AND IN-COMBINATION EFFECTS**

7.6.1 The adjoining Parc Adfer waste recovery facility commenced construction in December 2016 and is expected to be operational by the end of 2019. As such is it unlikely that there will be any overlap with the Proposed Development construction. In the event there is any overlap this is not considered likely to result in significant cumulative adverse effects through the standard management and control of dust that would be implemented through the CEMP.

7.6.2 Both facilities would be operated in accordance with Environmental Permits to be issued by the NRW. In the absence of any sensitive receptors no significant in-combination effects associated with dust and odour have been identified. Similarly, no significant in-combination effects have been identified in relation to gas engine emissions.

**7.7 SUMMARY**

**Introduction**

7.7.1 An assessment of the potential impacts and effects of the Proposed Development on local air quality has been undertaken. The assessment has considered the key potential aerial emissions from the development as follows:

- Site plant and vehicle exhaust emissions during the construction and operational phases;
- Dust emissions during the construction and operational phases;
- Odour and bioaerosol emissions during the operational phase;
- Combustion emissions from the CHP Plant gas engine.

7.7.2 The potential impacts and effects on nearby human health and ecological receptors of these emissions has been considered.

**Baseline Conditions**

7.7.3 The assessment has considered the existing baseline air quality conditions in the locality. The Site is located in a predominantly industrial setting with the nearest residential properties being at least 2km distant. Ambient air quality monitoring undertaken by FCC in the area has not identified any areas of concern and the Site is distant from any declared Air Quality Management Areas (AQMAs).

7.7.4 There are several statutory and non-statutory designated nature conservation sites within 5km of the Site, the closest of which is the Dee Estuary Ramsar, SAC, SPA and SSSI which extends to within 0.75km of the Site to the southwest.

**Likely Significant Effects**

- 7.7.5 The construction dust assessment has considered the potential for dust to be generated and to impact any nearby receptors during the construction phase. Given the nature of the locality the overall significance of effects is not significant.
- 7.7.6 The assessment of construction and operational vehicle emissions has considered the predicted traffic movements associated with the Proposed Development, the nature of the local road network to be used, presence of any sensitive receptors to the affected road network and existing local air quality. Taking into account the expected distribution of vehicles on the A548, absence of nearby receptors and existing good local air quality the overall significance of effects is not significant.
- 7.7.7 The facility would be operated in accordance with an Environmental Permit that would be issued by Natural Resources Wales (NRW). As such the plant will be designed and operated in accordance with Best Available techniques (BAT). This will include consideration of the initial design and construction, along with subsequent management, control and monitoring required to minimise the generation of emissions. The main process building will be provided with an appropriate ventilation system to maintain negative pressure with the resulting extracted air treated to minimise dust, odour and bioaerosol emissions. As such the overall significance of effects associated with dust, odours and bioaerosols is not significant.
- 7.7.8 The gas engine utilised to combust the AD Plant biogas will also be operated in accordance with the Environmental Permit which will specify required stack emission limit values. The assessment has included atmospheric dispersion modelling of the resulting emissions and prediction of potential pollutant concentrations at sensitive receptors. All predicted concentrations at receptors are at or below relevant screening criteria. The overall significance of effects at relevant human health and ecological receptors is not significant.

**Mitigation and Enhancement**

- 7.7.9 The requirement for specific mitigation measures during the construction phase has not been identified. However, the Construction Environmental Management Plan (CEMP) that would be agreed with FCC in advance of commencement of construction would outline standard mitigation measures that would be employed to further minimise the potential for dust emissions and any adverse effects.
- 7.7.10 The requirement for the implementation of additional mitigation measures to those that would be implemented as part of the design, management and control to meet the requirements of the Environmental Permit have not been identified.

**Conclusion**

- 7.7.11 The Proposed Development at the Application Site is considered to be acceptable with no significant adverse effects identified. No significant constraints with regards to air quality have been identified.

**Air Quality and Odour**

**Table 7.16: Summary of Effects, Mitigation and Residual Effects.**

<b>Receptor / Receiving Environment</b>	<b>Description of Effect</b>	<b>Nature of Effect</b>	<b>Sensitivity Value</b>	<b>Magnitude of Effect</b>	<b>Geographical Importance</b>	<b>Significance of Effects</b>	<b>Mitigation / Enhancement Measures</b>	<b>Residual Effects</b>
<b>Construction</b>								
human health (residential / leisure use)	fugitive dust and fine particulate matter	temporary / direct	n/a	n/a	Local	negligible	standard dust mitigation measures within CEMP	negligible
	vehicle exhaust emissions	temporary / direct	n/a	n/a	County	negligible	none	negligible
nature conservation sites	fugitive dust and fine particulate matter	temporary / direct	n/a	n/a	European	negligible	standard dust mitigation measures within CEMP	negligible
	vehicle exhaust emissions	temporary / direct	n/a	n/a	European	negligible	none	negligible
<b>Operation</b>								
human health (residential / leisure use)	fugitive dust and fine particulate matter	temporary / direct	n/a	n/a	Local	negligible	controlled under Environmental Permit	negligible
	vehicle exhaust emissions	temporary / direct	n/a	n/a	County	negligible	none	negligible
	odours / bioaerosols	temporary / direct	n/a	n/a	Local	negligible	controlled under	negligible

## ENVIRONMENTAL STATEMENT

### Air Quality and Odour

							Environmental Permit	
	combustion emissions	temporary direct	/ n/a	n/a	Local	negligible	controlled under Environmental Permit	negligible
nature conservation sites	fugitive dust and fine particulate matter	temporary direct	/ n/a	n/a	European	negligible	standard dust mitigation measures within CEMP	negligible
	vehicle exhaust emissions	temporary direct	/ n/a	n/a	European	negligible	none	negligible
<b>Cumulative and In-combination</b>								
human health (residential / leisure use)	fugitive dust and fine particulate matter	temporary direct	/ n/a	n/a	Local	negligible	controlled under Environmental Permit	negligible
	vehicle exhaust emissions	temporary direct	/ n/a	n/a	County	negligible	none	negligible
	odours / bioaerosols	temporary direct	/ n/a	n/a	Local	negligible	controlled under Environmental Permit	negligible
	combustion emissions	temporary direct	/ n/a	n/a	Local	negligible	controlled under Environmental Permit	negligible
nature conservation sites	fugitive dust and fine particulate matter	temporary direct	/ n/a	n/a	European	negligible	standard dust mitigation	negligible

## ENVIRONMENTAL STATEMENT

### Air Quality and Odour

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							measures within CEMP	
	vehicle exhaust emissions	temporary direct	/ n/a	n/a	European	negligible	none	negligible