



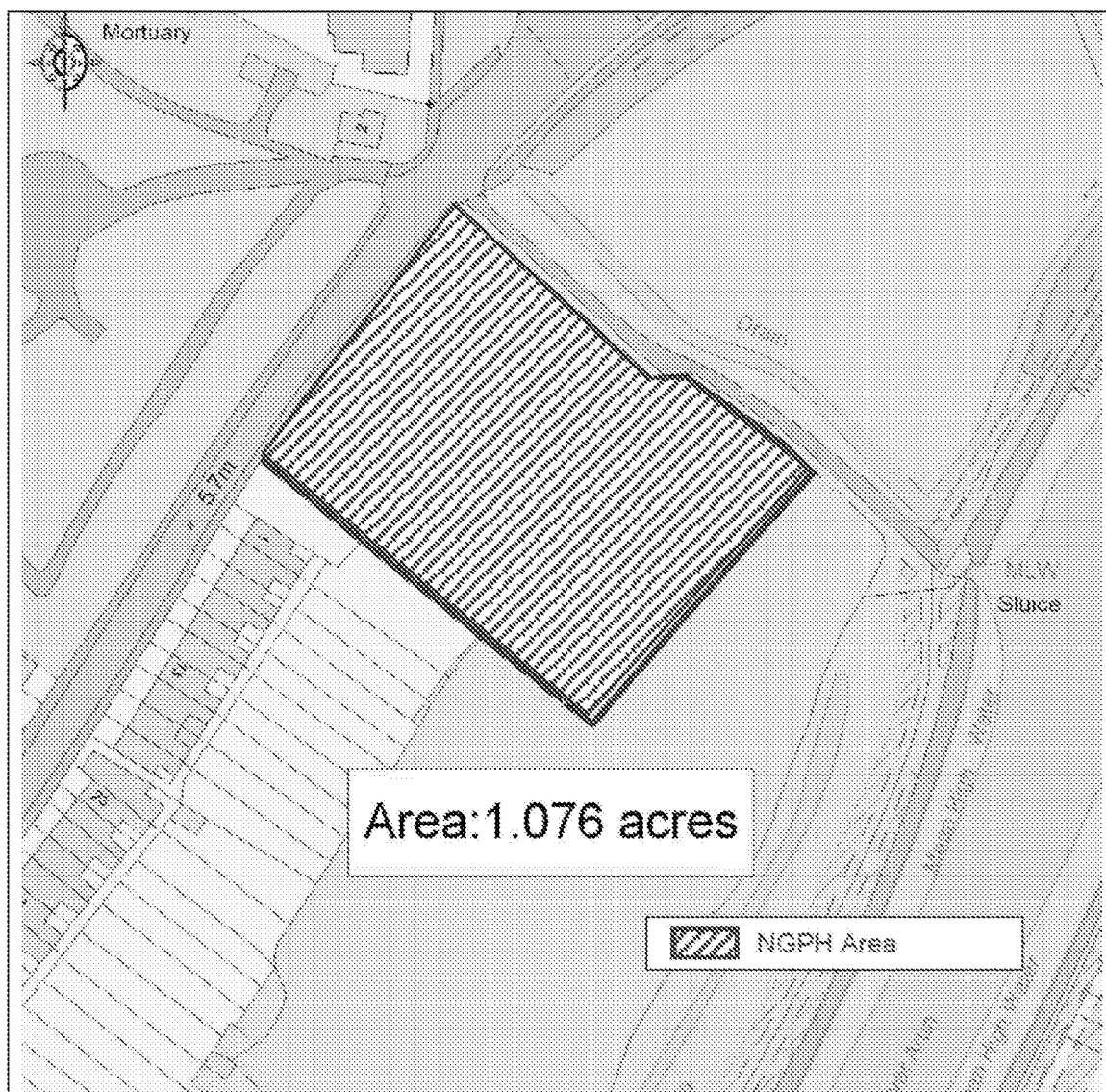
FORD ROAD, ARUNDEL
NATIONAL GRID PROPERTY
HOLDINGS

R1820/20/5043

SUPPLEMENTARY SITE
INVESTIGATION FACTUAL
REPORT

FINAL REV 1

December 2020



Site Address:	Ford Road, Arundel, West Sussex BN18 9DX	NGP Document Tracking Code	
Report Title	Ford Road, Arundel – Supplementary Site Investigation Factual Report		
Report Type:	Contamination	Retention Period	
Site Code	2551	Author (Company)	Celtic Technologies
Report Date	December 2020	Factual/Interpretative	Factual
Draft / Final	Draft	H & S File?	No
Work Stage	SI		
Brief description of contents	Factual Site Investigation to provide further information for the design of remediation works proposed for the site.		
Access Permitted	NGP Land Regeneration Team	NGP Contact	Gareth Taylor eAOC Nicola Carver

Client:	National Grid Property Holdings Ltd
Report Number:	R1820/20/5043
Report Title:	Ford Road, Arundel – Supplementary Site Investigation Factual Report
Report Status:	Final
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Celtic is the trading name of Celtic Technologies Limited.

This report has been prepared for National Grid Property Holdings Ltd. and their advisors as part of the 2012-2015 Framework Agreement for the provision of Land Remediation Contracting Services (Design and Build) Soils South in accordance with the terms and conditions set out therein.

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1.0 INTRODUCTION

Celtic Technologies Limited (Celtic) has been commissioned by National Grid Property Holdings (NGPH) to provide a Factual Site Investigation Report on NGPH land at The Former Holder Station, Ford Road, Arundel, West Sussex BN18 9DX.

The objective of the Factual Site Investigation was to provide further information for the design of remediation works proposed for the site as part of the Stage 1 Pre-Remediation Risk Mitigation and Site Investigation Works. The investigation focussed on filling data gaps and collecting baseline monitoring data to inform the remediation design and implementation plan.

Contact points for the work are detailed in Table 1, below:

Table 1 – Contact Points

<i>Organisation</i>	<i>Name</i>	<i>Role</i>	<i>Contact Details</i>
NGPH	Gareth Taylor / eAOC Nicola Carver	Regeneration Manager / Advisor	National Grid House, Warwick Technology Park Gallows Hill Warwick CV34 6DA
Atkins (SNC-Lavalin Group)	Lucy Hay	Principal Designer	24 th Floor South, Euston Tower, 286 Euston Road, London NW1 3AT
Celtic Technologies (Celtic EnGlobe)	Steve Gronow	Principal Contractor	Columbus House, Greenmeadow Springs, Tongwynlais, Cardiff CF15 7NE
RSK	Simon Penney	CDM-Advisor	Spring Lodge, 172 Chester Road, Helsby, Cheshire WA6 0AR

2.0 SITE INFORMATION

2.1 Site Location

The site is situated approximately 40 m north west of the River Arun. The site is owned by NGPH, is currently unoccupied and comprises secure vacant land. The site has a postal address of Former Holder Station, Ford Road, Arundel BN18 9DX and is located at approximate National Grid Reference 501308E, 106749N.

2.2 Previous Investigation at the Site

Previous Investigations undertaken at the site include:

1. British Gas Environmental Liability Report, Report ref. E5347/LR860.NL/gp, Atkins April 1994;
2. Environmental Assessment Site Investigation, Final Factual Report, Report ref. A71430/GTG.20000078/R002rev1/December2000, Atkins December 2000;
3. Environmental Groundwater Monitoring Letter Report, Ford Road, Arundel, Mentor No. 015162, Report ref. A71430/GTG.2000078/Arundel/R004rev0/mg, Atkins July 2001; and
4. Ford Road, Arundel (Site No. 2551) Site Investigation Report, Report ref. 5104362/GTG.20100923/Arundel2011/R001v0, Atkins October 2011.

2.3 Site Description

The site entrance can be accessed from Ford Road off an access track which runs along the north-eastern site boundary. The site is then accessed from the east through a pair of metal access gates. The site is an approximately rectangular shaped area of land covering an area of approximately 0.44 hectares (Ha).

An electricity sub-station is located on the north-eastern site boundary adjacent to the site entrance and concrete slab foundations are in the northern and eastern corners of the site. No other above ground structures or buildings are present on the site.

The site surface comprises approximately 25% tarmac, with the remainder comprising of either gravel, wood chippings or bare earth. The site is generally level at an approximate elevation of 3 m above ordnance datum (aOD). The site is generally level with surrounding land, except for residential properties to the south/ south-west of the site which are raised above the site level by approximately 1 m.

Site location and surrounding areas are presented on drawing D1820/A1 within Appendix A of this report. A site hazard plan is provided as D1820/A2 and a traffic management plan as D1820/A3.

2.4 Site History

The site was operated as a gasworks from at least 1840, expanding in the west circa 1899, and in the south and south east in circa 1937. It is understood that the gasworks continued operation until the late 20th century.

The historical layout plan is provided on Drawing D1820/A4, Appendix A.

The historical gasworks structures comprised up to 4 No. gasholders, a Retort House, including chimney/ tank, a Boiler House, condensers, governor compound, liquor/ tar tanks, and associated offices and stores.

The gas work structures were widespread across the site, however, they are concentrated in the north eastern corner, where two of the four gasholders were located, along with the retort house, including chimney and the liquor/ tar tank.

2.5 Neighbouring Land

The site is surrounded by a combination of residential properties, grazing land and a cemetery as follows:

- South-west: Residential houses with gardens;
- South-east: Private grazing land with the River Arun behind;
- North-west: Ford Road, beyond which is a cemetery; and
- North-east: an access track leading off Ford Road, beyond which is a small surface water drain (which runs towards the River Arun via a sluice gate), and private grazing land.

3.0 INVESTIGATION METHODOLOGY

3.1 Enabling Works

Prior to the site investigation works, enabling works were carried out. This comprised the establishment of a welfare compound and parking area, a site boundary dilapidation survey was then undertaken followed by the clearance of vegetation across the site. Approximately half of the cleared vegetation was removed from site and the remaining half has been stockpiled, covered and weighted, so that it can be dealt with and removed from site during the enabling period of the remediation works.

A site boundary and dilapidation survey was undertaken and the type of fencing and gates, together with their condition and need for repairs were recorded. In general, the perimeter was found to be secure with no obvious evidence of recent trespass attempts.

Details of the fencing and access gates can be found on drawings 1120/Celtic/8244 and D1820/A4, a full description of the site boundary dilapidation survey is presented in Appendix B and photographs are presented within Appendix C.

3.2 Surveying of Existing Utilities and Exploratory Hole Positions

Prior to intrusive investigation, up-to-date utility plans were procured and a utilities surveyor employed to survey and mark up known and potential services on-site. Contact was made with plant protection departments of SGN and SSE to inform them of the investigation works and discuss any issues. SGN confirmed that they had no services on-site and that they had no concerns regarding the proposed investigation works. SSE requested a site meeting and duly attended site to discuss the works, in relation to their substation and live cables adjacent to the site, prior to works commencing. A drawing illustrating the findings of the survey works is provided as 1120/Celtic/8244 in Appendix A, together with the available up-to-date utility provider drawings.

The positions of all exploratory holes were set out on-site on the 10th November 2020 together with the surveying and mark up of utilities on-site to minimise risks of clashing with services. GPS survey equipment was used to OS National Grid datum.

3.3 Trial Pitting Works

A total of 15 trial pits were excavated using an 8T tracked excavator between the 11th and 13th of November 2020. The pits were excavated to depths between 1 m to 2.2 m and ground conditions were observed and recorded. Samples were retrieved and submitted to i2 Analytical laboratories and scheduled for chemical analysis. The trial pits were backfilled using excavated arisings in the approximate order of excavation.

The locations of all trial pits are shown on Drawing D1820/A4 in Appendix A. Engineers logs for the trial pits are presented in Appendix D.

3.4 Drilling Works

A total of 4 boreholes (BH201-204) were drilled using rotary drilling techniques between the 16th and 18th of November 2020. The boreholes were drilled and standpipes constructed by ADP Group. At each location, a hand dug trial pit was excavated to 1.2 m to check for services. The boreholes

were sunk to a maximum depth of 10.2 m. The locations of the boreholes are shown on Drawing D1820/A4 in Appendix A. Engineers logs for the boreholes are presented in Appendix D.

3.5 Waste Disposal

Two no. 20 yard 'roll-on roll-off' skips were used to dispose vegetation arising from the initial clearance works off-site under appropriate Duty of Care. A 4 yard skip was also used on-site to dispose of general construction waste comprising plastic off-cuts and packaging material resulting from the drilling works.

Soil cores generated during the drilling works were placed on 1000 gauge membrane and covered so as to minimise risk of human/animal contact and prevent rainwater ingress with associated risk of potential cross contamination from leachate run-off. These materials will be dealt with during the remediation phase of works.

All consignment notes for waste disposal during the works are included in Appendix E.

3.6 Environmental Monitoring

Prior to and during the site investigation works, environmental air monitoring was carried out. Total volatile organic compounds (VOCs) levels were monitored using a hand held photo ionisation detector (PID) meter. Noise levels were monitored using a hand held noise meter. Dust monitoring was undertaken on a visual basis given the low risk of dust generating activities and cold/damp time of year. The baseline monitoring was undertaken following vegetation clearance works but before the intrusive investigation. On-going monitoring during intrusive works was generally carried out once a day at locations around the site as shown on D1820/A4.

The environmental monitoring data is included in Appendix F and no significant vapour, noise or dust levels were measured during the works with all measured levels below appropriate safety legislation thresholds. No complaints were received during the works.

3.7 Well Dipping

The installed boreholes (BH201-BH204) and existing boreholes (BH101s, BH101d, BH102 & BH105) on the site were dipped on four occasions – 19th November, 1st December and twice on the 2nd December 2020. The wells were dipped using an oil/water interface meter and following these works, level loggers were installed with BH101d, BH102, BH105 and BH204 to record detailed fluctuations across site and tidal influence. The dipping records are included in Appendix G.

3.8 Sampling and Chemical Analysis

A total of 15 soil samples were retrieved during the trial pitting. Generally, one sample was retrieved and submitted for laboratory chemical analysis from each trial pit during the investigation. The exceptions to this were TP206 where two samples were retrieved and TP215 where no samples were retrieved. The deeper sample from TP206 was also scheduled for leachate analysis. The samples were typically retrieved from impacted Made Ground strata or shallow natural material.

Soil samples were also retrieved from cores produced during the drilling of the four boreholes. The samples were not submitted for laboratory analysis but were subject to on-site PID headspace analysis to assist with the decision making regarding the position of well response zones.

The newly installed wells were developed by the removal of at least ten well volumes of water from each borehole and were subsequently left for two weeks to stabilise. Samples were then recovered from all available wells on-site (BH101s, BH101d, BH102, BH105, BH201, BH202, BH203 & BH204) using a low flow peristaltic pump to purge the wells and water quality parameters measured and recorded with a YSI multi-parameter probe, until they stabilised. A duplicate sample was retrieved from BH102 in order to assess laboratory QA/QC.

All samples submitted for laboratory chemical analysis were scheduled for the following suites of analysis within Table 2.

Table 2 – Suites of Laboratory Chemical Analysis

<i>Soils</i>	<i>Leachate</i>	<i>Groundwater</i>
Moisture content	pH	pH
Asbestos screen	Electrical Conductivity	Electrical Conductivity
Asbestos quantification (if +ve screen)	Total, Complex and Free Cyanide,	Total, Complex and Free Cyanide,
pH	Total Sulphate as SO ₄	Total Sulphate as SO ₄
Electrical Conductivity	Sulphide	Sulphide
Total, Complex and Free Cyanide,	Total Chloride	Total Chloride
Total Sulphate as SO ₄	Ammonium as NH ₄	Ammonium as NH ₄
Sulphide	Total Organic Carbon (TOC)	Total Organic Carbon (TOC)
Total Chloride	Speciated and Total Phenols	Total Suspended Solids
Ammonium as NH ₄	Speciated and Total PAHs (EPA-16)	Speciated and Total Phenols
Total Organic Carbon (TOC)	Heavy Metals: As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn	Speciated and Total PAHs (EPA-16)
Speciated and Total Phenols	BTEX compounds	Heavy Metals: Fe, As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn
Speciated and Total PAHs (EPA-16)	TPH-CWG	BTEX compounds
Heavy Metals: As, B, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn		TPH-CWG
BTEX compounds		
TPH-CWG		

The results of all soil, water, and leachate testing analysis is presented in Appendix H and summaries of soil and groundwater analysis are presented in Section 4.2.

3.9 Incidents and Near Misses

No accidents, incidents or near misses occurred during the works. A copy of the low level hazards reports issued during the project are included in Appendix I.

4.0 FINDINGS OF INVESTIGATION WORKS

4.1 Ground Conditions Encountered

The ground conditions encountered are summarised in Table 3, below. The information presented is based on the materials encountered within the exploratory holes.

Table 3 - Summary of Ground Conditions Encountered

<i>Geological Unit and Lithology</i>	<i>Depth and Thickness Encountered</i>
Made Ground Tarmac, concrete slabs, gravels of ash, clinker, bricks, concrete, timber and metal. Reworked natural material of alluvium, flint and chalk.	Encountered to depths between 0.3 – approx. 4.5 m bgl.
Alluvium Clay, clayey gravel and gravelly clay.	Encountered between 1.2 to 5.7 m bgl, not fully penetrated in some areas during investigation.
Spetisbury Chalk Member Clayey chalk with gravels and cobbles of flint and chalk.	> 2.7 m bgl.

Groundwater is present typically between 2 to 3 m bgl. Tidal fluctuations were apparent with shallower depths of groundwater at near surface level within BH105 (closest position to river Arun) during high tide events. Pockets of shallower perched water ingress were also apparent during trial pitting. The water quality data recorded from the borehole sampling event is presented within Table 4.

Table 4 – Groundwater quality data during sampling event

<i>Borehole</i>	<i>Temp</i>	<i>DO%</i>	<i>SPC us/cm</i>	<i>pH</i>	<i>pH mv</i>	<i>ORP mv</i>	<i>Time 2/12/2020</i>
105	12.2	36	1329	7.13	-7.9	51.6	08:43
	12.1	21.3	1442	7.04	-3.4	-109.4	08:48
	12.1	7.5	1516	7.02	-1.9	-124.7	08:53
	12	4.8	1503	7.02	-2	-128.4	08:58
	12	4	1456	7.03	-2.6	-132.4	09:03
	12	3.5	1443	7.03	-2.6	-134.7	09:08
102	11.3	10.7	1188	6.99	-0.2	-51.1	09:15
	12.2	25.2	879	7	-1	38.8	09:20
	12.2	34.2	821	7.01	-1.3	113.8	09:25
	12.2	36.3	820	7.01	-1.2	135.4	09:30
	12.2	36.7	821	7	-1.2	156.2	09:35
204	11.9	38.2	866	6.93	3.6	56.3	09:40
	12.6	19.3	932	6.87	6.5	5.2	09:45
	12.7	13.5	929	6.87	6.2	4.5	09:50
	12.7	13.4	926	6.87	6.7	3.1	09:55
203	12.2	13.1	1052	6.9	4.4	-14.8	10:00
	12.4	6.1	1083	6.92	3.6	-49.4	10:05
	12.4	4.9	1076	6.92	3.6	-54.8	10:10
	12.3	4.7	1070	6.92	3.6	-55.3	10:15
202	12.2	8.9	2463	6.76	12.8	-20.3	10:20
	12.6	4	2748	6.73	14.3	-10.7	10:25
	12.6	3.8	2739	6.73	14.3	-10.5	10:30
	12.6	3.7	2737	6.73	14.3	-9.9	10:35
201	12.4	7.6	2576	7.21	-12.9	-59.9	10:40
	12.4	3.2	2529	7.25	-14.8	-104.6	10:45
	12.4	2.8	2613	7.32	-19.7	-124.2	10:50
	12.4	2.6	2662	7.4	-23.6	-132.5	10:55
	12.4	2.6	2682	7.43	-25	-139.8	11:00
101s	12.6	6.4	3120	6.75	16.7	-49.1	11:08
	12.8	3.8	3210	6.58	23.2	213.8	11:13
	12.7	38.1	3172	6.62	21.1	233.8	11:18
101d	12.3	33.6	2893	7.91	-52.3	-113.7	11:23
	12.2	32.3	2789	8.43	-82.3	-167.7	11:28
	12.1	32	2635	8.4	-86	-184.2	11:33
	12.1	32	2552	8.53	-87.6	-188	11:38
	12.1	31	2476	8.55	-88.9	-186.4	11:43

4.2 Chemical Results

The following tables summarise the chemical analysis results from soil and groundwater samples taken from the site. Full copies of certificates of chemical analysis are included in Appendix H. A duplicate groundwater sample was retrieved from BH102 for laboratory quality assurance.

Table 5 – Summary of Soil Analysis

<i>Determinand</i>	<i>No. of Samples Analysed</i>	<i>Concentration (mg/kg unless otherwise stated)</i>		
		<i>Min.</i>	<i>Max.</i>	<i>Average</i>
Cyanide, Total	15	<1	260	44
Cyanide, Free	15	<1	2	<2
Total Sulphate as SO ₄	15	260	11,000	2,921
Sulphide	15	<1	160	36
Total Chloride	15	71	360	194
Ammonium as NH ₄	15	<0.5	1,100	75
Total Organic Carbon (%)	15	0.2	5.2	2.1
Total Phenols	15	<1	69	5.6
Arsenic	15	13	69	24
Cadmium	15	<0.2	1.1	0.4
Chromium	15	15	35	22
Copper	15	11	67	36
Lead	15	17	510	205
Mercury	15	<0.3	1.5	0.6
Nickel	15	9.6	44	24.8
Zinc	15	40	670	209
Benzene	15	<0.01	2.3	0.156
Toluene	15	<0.01	2.5	0.178
Ethyl benzene	15	<0.01	0.11	0.009
p/m-Xylene	15	<0.01	2.7	0.2
o-Xylene	15	<0.01	1.2	0.113
Naphthalene	15	<0.05	1,100	120
Benzo(a)pyrene	15	<0.05	380	52
PAH, Total Detected USEPA 16	15	1.33	9,410	1,114
Total TPH Aliphatics & Aromatics C5-C44	15	<20	10,300	1,537

Table 6 – Summary of Groundwater Analysis

<i>Determinand</i>	<i>No. of Samples Analysed</i>	<i>Concentration (mg/l unless otherwise stated)</i>		
		<i>Min.</i>	<i>Max.</i>	<i>Average</i>
Cyanide, Total	8	<0.01	1.3	0.37
Cyanide, Free	8	<0.01	<0.01	<0.01
Sulphate as SO ₄	8	34.6	1,020	463
Sulphide	8	<0.005	<0.005	<0.005
Chloride	8	39	160	91.5
Ammonium as NH ₄	8	0.038	350	120
Total Organic Carbon	8	1.68	263	61
Total Phenols	8	<0.0035	300	44.4
Naphthalene	8	<0.00001	1.8	0.45
PAH, Total Detected USEPA 16	8	<0.00016	2.15	0.534
Iron	8	0.018	0.73	0.32
Arsenic	8	0.00034	0.049	0.01
Cadmium	8	<0.00002	0.00003	0.000025
Chromium	8	0.003	0.011	0.005
Copper	8	0.0015	0.0058	0.0035
Nickel	8	0.002	0.032	0.01
Zinc	8	0.003	0.033	0.01
Benzene	8	<0.001	12.9	1.94
Toluene	8	<0.001	4.95	0.74
Ethyl benzene	8	<0.001	0.077	0.019
p/m-Xylene	8	<0.001	0.695	0.158
o-Xylene	8	<0.001	0.328	0.074
Total TPH Aliphatics & Aromatics C5-C35	8	<0.02	27	8.374

4.3 Other Findings

The main findings of the investigation are shown on Drawing D1820/A3 and D1820/A4 within Appendix A and are detailed below.

- There remains a significant number of stumps and roots from vegetation growth at the site. The clearance works undertaken have removed the vast majority of above ground vegetation; however, the boundary fence remains heavily overgrown and a further phase of stump removal and vegetation clearance within the southern corner of site will be required during the preliminary phase of remediation works.
- Previous phases of investigation did not record the presence of asbestos fibres or products on-site. This investigation recorded the presence of asbestos within three of the 15 samples. Two of the samples (TP204 at 1m and TP206 at 1.2 m) recorded loose fibres of chrysotile, with one of those samples (TP204 at 1 m) also recording the presence of amosite fibres. The third sample (TP207 at 1.8 m) detected loose fibres of amosite and

crocidolite and fibrous debris of amosite and chrysotile. This area on-site is associated with the presence of a below ground brick structure, which also exhibited the highest concentrations of aromatic hydrocarbons on-site.

- Access into site is challenging for large vehicles, given the presence of the narrow access track, encroaching vegetation, potential presence of parked cars and public use of the track to access the river Arun tow path. The high and low voltage cables present within the verge of the access track also presents a substantial risk should vehicles veer into the verge. The presence of the electrical substation also inhibits the ability to alter or widen the access gate. Further discussion with SSE will be required to discuss the remediation works and potential risks involved.
- There is adequate tarmac hardstanding to accommodate a welfare compound within the eastern corner of site and the presence of tarmac, along the access track significantly reduces the risk of rutting and damage. Although detailed assessment; depending on delivery vehicles, plant and equipment requirements; will be required to assess additional mitigation measures and any temporary work requirements.
- The presence of the tarmac hardstand also improves the ability to protect the surface water drain which bisects the site. Due to the likely heavy nature of plant and equipment required for the remediation works, further assessment and protection measures are likely to be required to protect the access chambers and prevent any debris and especially contamination from entering the drain.
- The area accommodating the former gas governor (shown as Feature 19 on Drawing D1820/A4) is approximately 0.5 m (to the north) and 0.9 m (to the south) higher than the surrounding site level. There is also historic cast iron pipework (approx. 0.5 m diameter) together with brick and concrete obstructions that are likely to be higher than the surrounding levels should this area be required to be reduced in level.

5.0 REFERENCES

Redacted (to remove interpretative information) copies of previous investigation reports were made available to Celtic as follows:

1. British Gas Environmental Liability Report, Report ref. E5347/LR860.NL/gp, Atkins April 1994;
2. Environmental Assessment Site Investigation, Final Factual Report, Report ref. A71430/GTG.20000078/R002rev1/December2000, Atkins December 2000;
3. Environmental Groundwater Monitoring Letter Report, Ford Road, Arundel, Mentor No. 015162, Report ref. A71430/GTG.20000078/Arundel/R004rev0/mg, Atkins July 2001;
4. Ford Road, Arundel (Site No. 2551) Site Investigation Report, Report ref. 5104362/GTG.20100923/Arundel2011/R001v0, Atkins October 2011; and
5. Detailed Quantitative Risk Assessment Report, Ford Road, Arundel (Site No. 2551), Report ref. 5104362/GTG.20100923/Arundel DQRA 2012/R002v1, Atkins October 2012.

APPENDICES