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REMEDIATION STRATEGY - LAND OFF VICTORIA AVENUE, HIGHER BLACKLEY

Introduction

This report pertains to a c. 0.59 Ha site located to the south of Victoria Avenue, c. 6km north west of Manchester city centre at the approximate postcode M9 0SR. The National Ordnance Survey Grid Reference for the centre of the site is 385276E, 404107N. The site is shown on the below image:



Figure 1 - Aerial image of the site dated March 2021. The approximate site boundary is highlighted in pink.

The site currently comprises an area undergoing active demolition, as well as level adjustments. Access to the site is off Victoria Avenue along the northern boundary. The site was historically used as a community centre for Higher Blackley, with Club and Community Centre buildings present in the

western, central and eastern site sections. Currently, the central and eastern buildings are no longer present, and half of the westernmost community centre building, which makes up the western site boundary, is undergoing demolition. A site location plan is contained in Appendix 1.

This Remediation Strategy is to be used for submission to Manchester City Council to develop the site into a low-rise residential development comprising 25 No. detached and semi-detached houses with associated private gardens, soft landscaping and access roads.

The site had been developed by *Mulbury Homes* at the time of the first stage of ground investigation undertaken in May 2019 by E3P. By 2021 – 22, the build contractor changed given *Mulbury Homes* went into administration, and the *second* and *third* stages of ground investigation completed in February 2023 once a new build contractor *John Southworth* had been appointed.

The existing site levels recorded during the first stage of intrusive site investigation in May 2019 have been subject to change across time, with the following investigation stages being carried out at different site elevations. The level changes across site are detailed in the below table, compared against the Finished Floor Levels (FFL) of the nearby proposed plots.

Site Area	Plot No.	Original Site Level (m AOD)	FFL (m AOD)	Level Change Difference (m AOD)
East	Plot 1	101.60	102.10	+ 0.50
	Plot 2	102.10	102.70	+ 0.60
	Plot 5	100.70	102.70	+ 2.00
Centre	Plot 6	99.80	101.80	+2.00
	Plot 8	100.20	102.70	+2.50
	Plot 14	99.90	101.65	+1.75
West	Plot 17	100.40	101.85	+1.45
	Plot 21	100.20	101.65	+1.45
	Plot 22	105.80	101.95	-3.85
	Plot 25	102.80	102.40	-0.40

Green = level increase.

Red = level decrease.

Previous Work / Reports

E3P Ground Investigation (May 2019 – February 2023)

This report follows the below geo-environmental report on a previous site investigation, undertaken by E3P in May 2019:

- 1) E3P. *Phase II Geo-environmental Site Assessment* (ref: 12-787-r2-2, dated: August 2019).

The results of an intrusive site investigation and an outline remedial strategy are contained within the aforementioned report. For brevity, the findings have not been repeated here, but selected findings are summarised below:

E3P has previously undertaken an intrusive ground investigation of the site, which took place over several stages. Stage 1 has been completed in May 2019, and Stages 2 and 3 have been completed in February 2023. The ground investigation comprised 2 No. Cable Percussive Boreholes, 12 No. Trial Pits and 7 No. Dynamic Sample Boreholes during Stage 1, 4 No. Trial Pits during Stage 2 and 10 No. Trial Pits during Stage 3.

It is anticipated that Stage 1 intrusive ground investigation (exploratory hole series 100) has potentially been undertaken prior to up-building of the site, which saw a general increase in site levels across the area, therefore the results from the investigation in May 2019 may differ to the results from February 2023.

Chemical testing was undertaken on soil samples from across the site, with the exception of the north-western site section where a former community central building was located at the time of the E3P site investigation. Concentrations of PAHs in exceedance of their respective GACs for a '*residential with plant uptake*' end use were found within the analysed samples. Slightly elevated TPHs were also detected.

Asbestos was also detected in 4 No. Stage 1 samples, which are located in the central site section, to the west and east of the former club building in the centre of the site.

The exceedances and contamination recorded during the E3P site investigation are presented in the table below. It is important to note that no testing was available for Stage 2 ground investigation. Full chemical test results are included within Appendix 5.

Series	Exploratory Hole	Depth (m bgl)	Exceedances	Asbestos
100 (Year: 2019) (prior to level change)	TP101	0.20	-	Amosite (0.001%)
	TP111	0.80	PAH: Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene	-
	TP112	1.00		Chrysotile (0.001%)
	WS101	0.10	-	Amosite (0.159%)
	WS105A	0.40	-	Crocidolite (0.001%)
300 (Year: 2023) (following level change)	TP303	0.40	PAH: Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene; TPH: elevated concentrations across the series	-
	TP304	0.50		-
		2.00		-
	TP305	0.40		-
	TP306	0.50		-
Stockpiles (Year: 2023)	SP101	-	PAH: Naphthalene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene	-
	SP102	-		-
	SP401	-		-
	SP402	-		-
	SP403	-		-

With respect to the 4 No. stockpiles previously present on site, GAC exceedances were found in 5. No samples taken from 2 No. stockpiles. These affected stockpiles, Stockpile 1 and 4, were noted to have been located in the south-western site corner, as well as near the former club building in the central site section.

Exploratory hole Series 100 samples recorded GAC exceedances of 4. No PAH compounds in the samples taken from the eastern site section, located near the easternmost former club building. Slightly elevated TPH concentrations were also recorded across the samples from this stage of investigation. Exploratory hole series 300 samples recorded GAC exceedances of 5. No PAH compounds. As this stage of exploratory holes was focused on investigating the central site section, it is anticipated that these exceedances relate to the historical location of a former club building in the centre of the site.

Ground Gas and Groundwater Monitoring

A summary of the 9 No. monitoring results is given below:

Monitoring Well	Response Zone (m bgl)	Water Level (m bgl)	Steady O ₂ (%v/v)	Peak CO ₂ (%v/v)	Peak CH ₄ (%v/v)	Atmos. Pressure (mbar)	Steady Gas Flow (l/hr)
WS101 (MG)	0.5 – 4.0	DRY	18.8 – 19.6	1.4 – 2.2	0.1	990 - 1001	0.1 – 3.9
WS102 (MG)	0.5 – 2.0	0.9 – 1.26	11.7 -19.5	0.6 – 2.1	0.1	990 - 1001	0 – 1.28
WS103 (NATURAL CLAY)	0.5 – 4.5	0.88 – 1.52	15.2 – 20.1	0.6 – 3.6	0 – 2.2	990 - 1001	0 – 0.88
WS105A (MG)	0.5 – 1.4	DRY – 1.48	14.2 – 18.5	1.3 – 6.7	0.1	990 - 1017	0.1 – 1.44

Response Zone strata type: MG = Made Ground

Summary of Findings

IGE undertook an intrusive site investigation in March and April 2023 comprising 3 No. deep cable percussive boreholes and 5 No. mechanically excavated trial pits undertaken spatially across the site, with geotechnical laboratory testing. The findings of the IGE ground investigation are summarised below. An exploratory hole location plan is contained in Appendix 2.

The typical ground conditions encountered were as follows:

- **Made Ground** comprising soft to firm, dark brown, mottled black, gravelly, sandy CLAY and dark, reddish brown, very sandy, clayey angular to subangular, fine to coarse GRAVEL to a depth of between 0.40m – 2.50m bgl, underlain by:
- **Glacial Till** comprising firm, dark greyish brown, slightly gravelly, slightly sandy CLAY and loose to medium dense, dark brown, gravelly, very silty, fine to coarse SAND to a depth of at least 20.00m bgl.

Groundwater was encountered in a single exploratory hole (TP23-05) at a depth of 1.70m bgl in the Glacial Till deposits. Exploratory hole logs are contained in Appendix 2.

Chemical testing was undertaken in 2019 + 2023 on soil samples gathered from the central, eastern and southern site sections, however, due to the inaccessibility of the western site section, it is required that additional chemical sampling and subsequent laboratory analysis is carried out to gain a comprehensive understanding of the ground conditions and contamination levels across site.

Further Ground Investigation Recommendations

Due to the lack of access into the north-western site section, occupied by the former community centre building, it is recommended that additional exploratory holes comprising Trial Pits with associated chemical testing is undertaken once the demolition process of the building is finalised.

The Electricity Sub-Station located in the centre of the site is to remain in its original location, according to the proposed development plan. The contaminative risk posed by this feature is regarded as low, furthermore it is considered an increased risk to the health and safety to undertake investigation at the location of the feature, therefore the sub-station will remain unchanged.

Summary of Human Health Conceptual Site Model

Due to the elevated concentrations of potential contaminants found within the materials sampled from across the site, a pathway to the end user exists in areas where the end user may come into contact with the site soils i.e., soft landscaping and private gardens. The site poses a moderate risk to human health in these areas.

Therefore, it was recommended to break this pathway in the proposed development a clean cover system is installed in areas of soft landscaping and private gardens. Full details are presented in the Remedial Strategy section, below.

The elevated PAHs and TPHs are also a risk to construction workers due to their acute interaction with the soil. However, it is envisaged that this can be mitigated with the appropriate use of PPE and health and safety management practices.

Summary of Controlled Waters Conceptual Site Model

No visual or olfactory evidence of contamination was recorded. Although Made Ground was recorded across the site and elevated concentrations of PAHs were noted, the contaminants of concern are of relatively low mobility and solubility. Additionally, the presence of cohesive deposits beneath the Made Ground will reduce vertical migration of contaminants to the underlying aquifers. Overland flow to the nearest surface water feature, the River Irk c. 1.28 km west of the site, was also not considered a feasible pathway given the considerable distance from site. Consequently, the risk to controlled waters was deemed very low as no contaminative linkages have been identified. No controlled waters remediation is required.

Summary of Ground Gas Conceptual Site Model

The Made Ground was not considered a significant ground gas source, however it was found to be deep in places, the deepest recorded by E3P was noted to be 5.45m deep, and recorded by IGE was 2.50m deep. The highest value of Total Organic Carbon (TOC) recorded on-site was noted to be 2.4%, which indicated low ground gas generation potential in line with BS 8576 (2013) guidance. As no steady

flow rates were recorded on-site, the GSV and the worst case GSV for carbon dioxide at the site were calculated as $(9.0/100) * 0.1 = 0.009\text{l/hr}$. The GSV and the worst case GSV for methane were calculated as $(5.7/100) * 0.1 = 0.0057\text{l/hr}$.

The results of the GSV indicate that the site is in-line with Characteristic Situation 1 (CS1), however, due to the sensitivity of the end-use, the presence of a potential ground gas source and elevated ground gas concentrations recorded, it was considered necessary to increase the designation to Characteristic Situation 2 (CS2) / NHBC Amber 1.

Based on the proposed development (Type A Building), in accordance with BS8485+A1 (2019) ground gas protection measures are recommended. Full details are presented in the Remedial Strategy section, below.

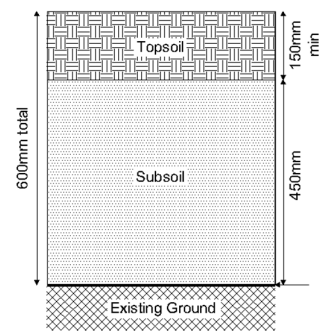
The Indicative Atlas of Radon in England and Wales produced by the Health Protection Agency and British Geological Survey indicates that the site lies within a lower probability area, less than 1% of homes are above the action level. Consequently, BR211 (2015) indicates that no radon protection measures are necessary in the construction of new dwellings or extensions.

REMEDIAL STRATEGY

Clean Cover System

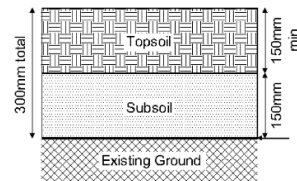
The following procedure is outlined for use in private gardens and in areas of soft landscaping where Made Ground is deeper than 600mm below finalised levels (300mm in areas of soft landscaping):

1. Excavate to 600mm bgl in private gardens (300mm in soft landscaping areas).
2. A 600mm clean cover system is recommended to be added to the proposed private gardens (300mm in soft landscaping areas). This is to consist of:
 -
 - No less than 150mm and no more than 300mm suitable topsoil, underlain by;
 - Suitable subsoil to a total (topsoil + subsoil) depth of 600mm (300mm in areas of soft landscaping), underlain by;
 - Validate in line with the below strategy.



Where Made Ground is shallower than 600mm in garden areas or shallower than 300mm in soft landscaped areas, excavating to the required depth for a cover system in these areas would constitute source removal. Therefore, where this is the case, the following procedure is proposed:

1. Excavate to the base of the Made Ground (<600mm in gardens and <300mm in soft landscaping areas). A clean cover system is not necessary.
2. Add suitable subsoil and topsoil to create a garden / soft landscaping to the client's specification.
3. Validate in line with the below strategy.



No topsoil is present on-site so it will need to be imported and this must be validated as detailed below to ensure its suitability for use (i.e., no glass or plastic is to be included and meets chemical testing acceptability criteria). Based upon initial chemical testing it is anticipated that it will be feasible to reuse the site-won subsoil on-site which may be won from drainage trench excavation arisings and the like during development. These must also be chemically tested as with imported soils to ensure their suitability for use.

Upon the initial testing it has been determined that materials from Stockpile 2 may be suitable to be repurposed on-site and make up the subsoil for the proposed gardens. This is subject to further chemical testing of the materials to ensure their suitability for use in line with the below validation testing ratio and suite.

Ground Gas Protection Measures

The site has been designated as CS2 and the proposed houses are Type A buildings. To protect the proposed building against the ground gas risks identified, **3.5 points** must be achieved in accordance with BS8485+A1 (2019). The proposed construction elements to achieve the required points score are given below:

- It is understood that a beam and block floor construction is to be utilised. This achieves 0 points.
- A ground gas resistant membrane is recommended. This achieves 2 points.
- A clear void passive venting layer with 'very good' performance is recommended. This achieves 2.5 points.

Further details on the above measures are included in the below table:

Design Requirements	
A pre-cast suspended segmental subfloor (beam and block) This floor type contains many construction joints and discontinuities and can be affected by cracking. As such, it offers little resistance to the passage of ground gas and has high permeability.	0 points
and	
A passive subfloor dispersal layer – clear void connecting to periscopic vents terminating in vents above ground level To comply with BS8485+A1 (2019) and to achieve 2.5 points (for 'very good' performance): • the subfloor void must be min 150mm thick, and; • the minimum area of ventilation should be 1 No. standard airbrick every 2m of wall, and; • where there are multiple internal obstructions to air flow (caused by beams), there should be four or five times the area of the side vents provided in the internal obstructions (e.g. minimum 1 air brick per 1m of internal obstructions).	2.5 points
and	
A ground gas resistant membrane To comply with BS8485+A1 (2019) and to achieve the 2 points, the gas resistant membrane must: • be made from virgin polymer and have a methane transmission rate of less than 40.0ml/day/m²/atm (average); • have lapped and taped joints and 'top hats' around service penetrations (make allowance for jointing) – joint the membrane in accordance with the manufacturer's specification (typically 150mm laps with jointing tape or heat welded seams); • be chemically resistant to degradation by other contaminants that may be present;	2 points

• be sufficiently impervious, both in the sheet material and in the sealing of sheets and sealing around sheet penetrations, to prevent any significant passage of methane and/or carbon dioxide through the membrane; • be sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions; • be sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc); and to withstand in-service stresses (e.g. settlement if placed below a floor slab); • be capable, after installation, of providing a complete barrier to the entry of the relevant gas; and • be verified in accordance with CIRIA C735.	
	Total = 4.5

Cross-sectional slab details are shown below:

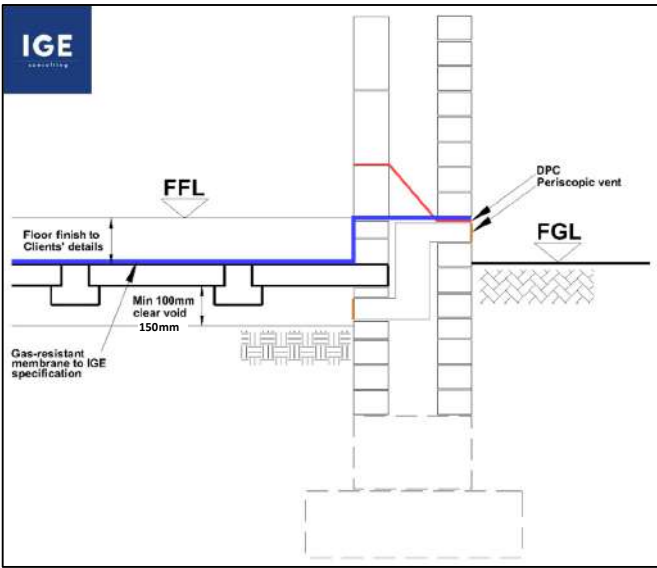


Figure 2 – Edge detail including periscopic vents (brown) and location of ground gas-resistant membrane (blue). This drawing is not to scale. Use detailed dimensions only.

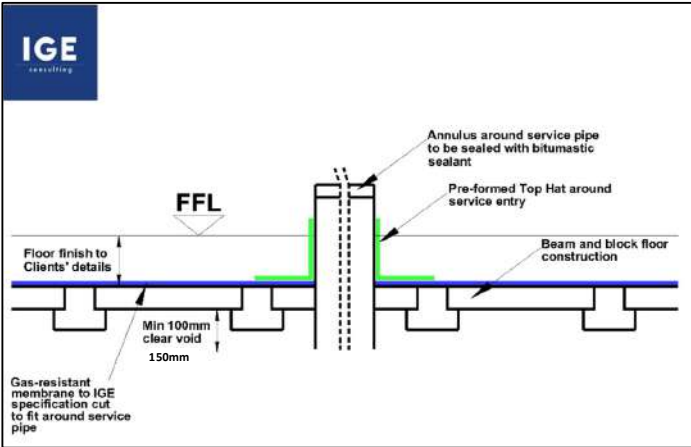


Figure 3 – Service entry detail including pre-formed top hat (green) and location of ground gas-resistant membrane (blue). This drawing is not to scale. Use detailed dimensions only.

Ground Gas Membrane Installation Guidance

Some ground gas resistant membranes which meet the above required specification are:

- Visqueen 'Gas Barrier'
- Radbar 'Amber 2 Foil Barrier'
- Juta 'GP1'
- Monarflex 'Reflex Super'
- Protech 'GM Super'

Please note IGE Consulting are not affiliated with any of these brands and do not endorse any specific brand.

Installation accessories will also be necessary, including:

- Jointing tape (double sided, gas resistant tape) or heat welding
- Pre-formed top hats
- Jubilee clips
- Although not essential, gas resistant 'detail tape' is an easy way to install complex joints such as corners and non-standard service entries.

All membrane installation must be undertaken to manufacturer's specification. An example of correct installation* is enclosed.

**It must be noted that this is a Visqueen information sheet, however, whilst this is considered a good example, IGE do not endorse any specific brand and the methods can be applied to any membrane brand.*

All service entry points should be fitted with pre-formed gas resistant 'top hats'. Top hats should be sealed to the pipe and gas membrane utilising double sided jointing tape and fixed with a jubilee clip. An example of the method of installation of these top hats is shown above. Adequate ventilation through internal obstructions to be installed in line with above recommendations. Joints between sheets of gas membrane should be lapped (minimum overlap of 150mm) and taped between sheets with appropriate double-sided tape in accordance with the manufacturer's recommendations.

A set of example photographs of good practice installation is contained in Appendix 3. A gas barrier warning poster is also contained in Appendix 3 which can be printed and displayed on site.

Ground Gas Protection Measures Validation

The installers will be required to be trained and experienced in the installation of ground gas resistant membranes. In line with CIRIA 735 (2014) / NHBC Guidance, IGE Consulting will independently verify the installation of the gas protection measures for the proposed plots, utilising a visual inspection method, including pick testing. This will be undertaken following the laying of the gas membrane, but prior to laying insulation and finishes.

The IGE Consulting verifier will:

- Identify that the correct membrane has been used, including sealing / jointing tape and pre-formed components e.g. tophats, corners.
- Inspect the general condition of the membrane for rips, tears and punctures.
- Check that all jointing has been carried out to the manufacturer's specification.
- Check that the membrane has been installed correctly across cavities, including correct jointing in these areas.
- Check that top hats have been correctly installed around service entries, including jubilee clip around pipe and correct lapping and jointing to membrane at base.
- Check that vents have been installed around the perimeter of the building in sufficient number and in the correct locations, including inspecting the condition i.e. not blocked or otherwise restricted.
- Check the presence of a clear >150mm clear void, including measuring that this is of a sufficient depth and the void has not been filled or otherwise compromised. Check that internal sleeper walls are also vented to provide adequate flow-through within the void so that none of the walls are blocking off unvented sections within the void.
- Take photographs to provide evidence of the above

The IGE Consulting verifier will record the above information using the IGE Consulting 'Ground Gas Resistant Membrane Inspection Record' sheet, an example of which is contained in Appendix 3.

Export of Materials

Any soils to be removed from site must be classified in accordance with WM3 under the definition of waste and chemically tested to determine their destination, i.e. reuse or landfill. Waste ticket records must also be retained as proof of the export of materials from site.

Stockpile Management

During the course of the development there will be areas of stockpiled soils intended for use within the proposed gardens that will have been approved for use on site. It is imperative that the stockpiles are well managed to avoid inadvertent mixing or depositing of surplus or deleterious materials that would compromise the continued use. We would recommend that the site management reviews the proposed positions for placement of stockpiles and places either fencing or warning signs to ensure compliance.

Unexpected Contamination

If any visual or olfactory evidence of contamination is encountered during construction work, then the work must be halted, and the Local Authority Environmental Health Officer and Environment Agency should be contacted immediately in order to agree any necessary remediation measures.

VALIDATION REQUIREMENTS

Clean Cover System Validation

Topsoil will be imported and subsoil for use in the clean cover system may be won from site or imported, but nevertheless all soils for use in the proposed garden area shall be subject to the below validation and testing to determine that they are '*suitable for use*':

- Details of the source of the topsoil and subsoil.
- Visual inspection to determine the absence of deleterious anthropogenic constituents.
- Waste transfer notes to provide evidence of source of imported soils.
- Confirmation of addition of suitable topsoil and subsoil with photographs.
- If imported, topsoil and subsoil is required to be tested at source prior to import to confirm suitability. In line with Cheshire East Council's guidance, no soils are to be imported to site until information on their source, the results of any soil analysis, and an assessment of their suitability for use has been submitted to and agreed in writing by the LPA.
- All topsoil and subsoil, whether site-won or imported is required to be tested at the following frequency, in line with Manchester City Council's 'Planning and Contaminated Land Technical Guidance':

Table 2 Sampling frequencies for imported or site-won fill materials

End-Use	Greenfield Soils	Remediated Soils	Brownfield Soils	Unknown Soil Source
Residential Gardens	1:200m ³	1:100m ³	1:50m ³	1:50m ³
Soft landscaping	1:200m ³	1:150m ³	1:150m ³	1:150m ³
Other	1:200m ³	1:200m ³	1:200m ³	1:200m ³

Extract taken from Manchester City Council 'Planning and Contaminated Land, Technical Guidance' (dated February 2021).
https://www.manchester.gov.uk/download/downloads/id/11878/planning_guidance_relating_to_ground_contamination.pdf

Once tested, the results are to be compared against the GACs for a 'residential with home grown produce' end use, noted below:

Suite	Determinand (mg/kg unless stated)	Acceptability Criteria for:			
		Private Gardens	Public Open Space (residential)	Soft Landscaping or Public Open Space (Park)	General Fill
A	Asbestos (%)	ND	ND	ND	<0.001 – 0.01%
B	pH	>6 - <8 ⁽³⁾	>6 - <8 ⁽³⁾	>6 - <8 ⁽³⁾	>5 - <10 ⁽³⁾
	Total Cyanide	0.5 ⁽³⁾	0.5 ⁽³⁾	0.5 ⁽³⁾	0.5 ⁽³⁾
	Free Cyanide	0.5 ⁽³⁾	0.5 ⁽³⁾	0.5 ⁽³⁾	0.5 ⁽³⁾
	Soluble Sulphate (mg/l)	500 ⁽³⁾	500 ⁽³⁾	500 ⁽³⁾	500 ⁽³⁾
C	Arsenic	37	79	170	640
	Beryllium	1.7	2.2	63	12
	Boron	290	21000	46000	240000
	Cadmium	11	120	560	190
	Chromium (III)	910	1500	33000	8600
	Chromium (VI)	6	7.7	220	33
	Copper	2400	12000	44000	68000
	Lead	200 ⁽¹⁾	630 ⁽¹⁾	1300	2330 ⁽¹⁾
	Inorganic Mercury	40	120	240	1100
	Nickel	130	230	800	980
	Selenium	250	1100	1800	12000
	Vanadium	410	2000	5000	9000
	Zinc	3700	81000	170000	730000
	Naphthalene	2.3	4900	1200	
	Acenaphthylene	170	15000	29000	
	Acenaphthene	210	15000	29000	
D	Fluorene	170	9900	20000	
	Phenanthrene	95	3100	6200	
	Anthracene	2400	74000	150000	
	Fluoranthene	280	3100	6300	
	Pyrene	620	7400	15000	
	Benzo(a)anthracene	7.2	29	49	
	Chrysene	15	57	93	
	Benzo(b)fluoranthene	2.6	7.1	13	
	Benzo(k)fluoranthene	77	190	370	
	Benzo(a)pyrene	2.2	5.7	11	
	Indeno(1,2,3-cd)pyrene	27	82	150	
	Dibenz(a,h)anthracene	0.24	0.57	1.1	
	Benzo(ghi)perylene	320	640	1400	
E	Total PAHs				1000 ⁽⁴⁾
F	TPH-CWG - Aliphatic >EC5 - EC6	42	570000	95000	
	TPH-CWG - Aliphatic >EC6 - EC8	100	600000	150000	
	TPH-CWG - Aliphatic >EC8 - EC10	27	13000	14000	
	TPH-CWG - Aliphatic >EC10 - EC12	130	13000	21000	
	TPH-CWG - Aliphatic >EC12 - EC16	1100	13000	25000	
	TPH-CWG - Aliphatic >EC16 - EC21	65000	250000	450000	
	TPH-CWG - Aliphatic >EC21 - EC35				
	TPH-CWG - Aliphatic >EC35 - EC44	65000	250000	450000	
	TPH-CWG - Aromatic >EC5 - EC7	70	56000	76000	
	TPH-CWG - Aromatic >EC7 - EC8	130	56000	87000	
	TPH-CWG - Aromatic >EC8 - EC10	34	5000	7200	
	TPH-CWG - Aromatic >EC10 - EC12	74	5000	9200	
	TPH-CWG - Aromatic >EC12 - EC16	140	5100	10000	
	TPH-CWG - Aromatic >EC16 - EC21	260	3800	7600	
	TPH-CWG - Aromatic >EC21 - EC35	1100	3800	7800	
	TPH-CWG - Aromatic >EC35 - EC44	1100	3800	7800	
G	TPH > EC6 - EC40				5000 ⁽⁴⁾
H	Benzene	0.087	72	90	
	Toluene	130	56000	87000*	
	Ethylbenzene	47	24000	17000*	
	p & m-xylene	56	41000	17000* ^{**}	
	o-xylene	60	41000	17000*	
	MTBE (Methyl Tertiary Butyl Ether)	LOD ⁽³⁾	LOD ⁽³⁾	LOD ⁽³⁾	

LQM/CIEH S4ULs for Human Health Risk Assessment (3rd edition, 2015) used unless stated:

- 1) Category 4 Screening Levels (March 2014)
- 2) CL:AIRE Soil GAC for Human Health Assessment (January 2010)
- 3) In-house screening criteria used as no GAC methodology currently exists
- 4) Hazardous waste thresholds. This limit only applies to imported material, not to in-situ soil.

Assumed 1% SOM (most conservative) for those values dependent upon SOM. ND = Not Detected. LOD = Limit of Detection

*Exceeds vapour saturation limit

**Exceeds solubility saturation limit

When the above has been completed and prior to occupation, this information will be compiled in a validation / completion report which will be submitted to and approved in writing by the local planning authority. Further details on the successful installation of cover systems are contained in Appendix 4.

Ground Gas Protection Validation

The following plan details the required actions to demonstrate the successful installation of ground gas protection on the site. In accordance with BS8485+A1 (2019), the verification shall include, as a minimum, the following:

- Objectives of the verification.
- A brief overview of the site conditions and summary of the ground gas regime.
- A description of the installation, including gas-resistant membrane manufacturer and type used (including sealing / jointing tape and pre-formed components e.g. top hats, corners). The manufacturer specification / datasheet shall be included.
- Installer and verifier and credentials of such organisations, i.e. level of competency of installer – NVQ Level 2 or general groundworker.
- Detailed description of any deviations from the specification provided in this report, with explanation and justification of such deviations.
- As-built construction drawings and product specifications of components used.
- A description of the verification approach – in this case visual inspection, including pick testing, at a rate of one per plot.
- Verification evidence – in this case photographic evidence of each verified plot at the frequency outlined above.
- Any record of relevant communications with regulatory bodies.
- Verification conclusions, including any future monitoring or management requirements (anticipated none in this case due to passive approach), and limitations of the measures installed.

When the above has been completed and prior to occupation, this information will be compiled in a validation / completion report which will be submitted to and approved in writing by the local planning authority / insurer.

Validation Report

The Validation Report is to be submitted to the Manchester City Council as part of the discharge of planning conditions.

Yours sincerely,

Agnieszka Stefanowicz MEarthSci FGS

Geo-Environmental Engineer

Enc.

Appendix 1 – Site Location Plan

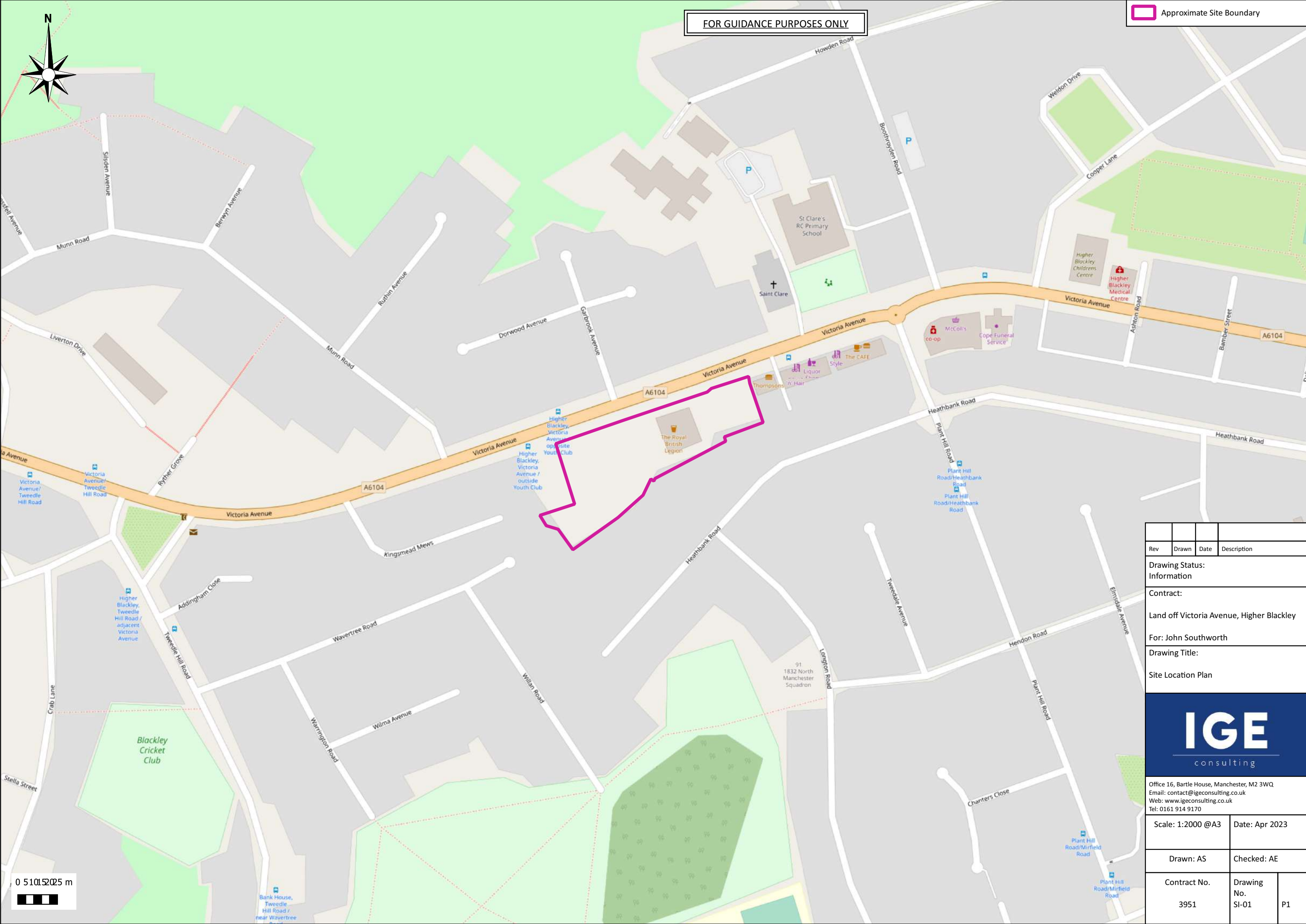
Appendix 2 – Exploratory Hole Location, Exploratory Hole Logs and Site Works Plan

Appendix 3 – Good Practice Gas Membrane Installation, Warning Poster and Inspection Record Sheet

Appendix 4 – Clean Cover System Guidance

Appendix 5 – Previous Site Investigation Chemical Screening Sheets and Ground Gas Monitoring Results

APPENDIX 1



FOR GUIDANCE PURPOSES ONLY

Approximate Site Boundary

Rev	Drawn	Date	Description
Drawing Status: Information			
Contract: Land off Victoria Avenue, Higher Blackley			
For: John Southworth			
Drawing Title: Site Location Plan			
IGE consulting			
Office 16, Bartle House, Manchester, M2 3WQ Email: contact@igeconsulting.co.uk Web: www.igeconsulting.co.uk Tel: 0161 914 9170			
Scale: 1:2000 @A3		Date: Apr 2023	
Drawn: AS		Checked: AE	
Contract No. 3951		Drawing No. SI-01	P1

APPENDIX 2



FOR GUIDANCE PURPOSES ONLY

PROPOSED JUNCTION BELL MOUTH LEVELS
TO CONFORM WITH EXISTING VICTORIA
AVENUE CHANNEL LEVELS

Approximate Site Boundary

Site Features (Pre-Works)

Electricity Sub-Station

Former Club Buildings

Club and Community Centre Buildings

Hardstanding

Stockpiles

Previous SI

E3P Cable Percussive Boreholes

E3P Dynamic Sample Boreholes

Trial Pits Series 100

Trial Pits Series 200

Trial Pits Series 300

IGE SI

Trial Pits

Cable Percussive Boreholes

Rev	Drawn	Date	Description
Drawing Status: Information			
Contract: Land off Victoria Avenue, Higher Blackley			
For: John Southworth			
Drawing Title: Exploratory Hole Location and Site Works Plan			
IGE consulting			
Office 16, Bartle House, Manchester, M2 3WQ Email: contact@igeconsulting.co.uk Web: www.igeconsulting.co.uk Tel: 0161 914 9170			
Scale: 1:400 @A3		Date: Apr 2023	
Drawn: AS		Checked: AE	
Contract No. 3951		Drawing No. SI-02	P1



IGE consulting		Office 11, Bartle House, Oxford Court Manchester M2 3WQ email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk tel: 0161 914 9170		Borehole Log ver. 0.5			Borehole No. BH01 Sheet 1 of 2		
Project Name: Victoria Avenue				Co-ords: 385324E - 404142N		Project No.: 3951			
Location: Blackley, Manchester				Level (mAOD): 102.02		Rev.: 1.0			
Client: John Southworth Builders Ltd				Dates: 16/03/2023 - 20/03/2023		Logged By: LM			
				Weather: Heavy showers		Checked By:			
Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (mbgl)	Level (mAOD)		Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 0.40	B	N=18 (2,3/4,4,5,5)	1.60	100.42		Soft dark brown mottled black sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse of mudstone, sandstone, concrete and brick fragments. MADE GROUND	1
		0.50	D						
		0.70 - 1.00	B						
		1.10	D						
		1.20 - 1.65	D						
		1.20	SPT	N=12 (2,2/3,3,3,3)	1.90	100.12	Light reddish brown slightly gravelly very silty fine to coarse SAND. Gravel is angular to subangular fine to medium of sandstone and mudstone. GLACIAL TILL	2	
		1.60 - 1.80	B						
		1.90	D						
		2.00 - 2.45	D						
		2.00 - 2.50	B						
		2.00	SPT	N=12 (2,2/3,2,3,4)	5.00	97.02	Soft locally firm dark greyish brown mottled brownish grey sandy silty CLAY locally interbedded with silty fine to medium SAND. GLACIAL TILL	3	
		2.80	D						
		3.00 - 3.45	D						
		3.00	SPT						
		3.70	D						
		4.00 - 4.45	U	N=16 (2,2/3,4,4,5)					4
		4.50	D						
4.70 - 4.90	B								
5.00 - 5.45	D								
5.00 - 5.50	B								
5.00	SPT	N=15 (2,3/4,3,4,4)					5		
6.00	D								
6.50 - 6.95	D								
6.50 - 7.00	B								
6.50	SPT								
7.50	D	N=9 (1,0/1,2,3,3)					6		
8.00 - 8.45	D								
8.00 - 8.50	B								
8.00	SPT								
9.00	D								
9.50 - 10.00	B						7		
9.50 - 9.95	D								
9.50	SPT								
									8
									9
									10
Remarks:				Continued on next sheet					
				Casing Details			Chiselling Details		
				Depth Top (m)	Depth Base (m)	Diameter (mm)	Depth Top (m)	Depth Base (m)	Duration (hrs)
					15.00	150			
				Water Strike					
				Depth Strike (m)	Time Elapsed (min)	Water Level (m)			
SPT Energy Ratio:									

IGE consulting		Office 11, Bartle House, Oxford Court Manchester M2 3WQ email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk tel: 0161 914 9170			Borehole Log ver. 0.5			Borehole No. BH01 Sheet 2 of 2		
Project Name: Victoria Avenue					Co-ords: 385324E - 404142N		Project No.: 3951			
Location: Blackley, Manchester					Level (mAOD): 102.02		Rev.: 1.0			
Client: John Southworth Builders Ltd					Dates: 16/03/2023 - 20/03/2023		Logged By: LM			
					Weather: Heavy showers		Checked By:			
Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (mbgl)	Level (mAOD)		Stratum Description		
		Depth (m)	Type	Results						
		10.50	D	N=19 (3,4/4,4,5,6)	10.30	91.72		Medium dense dark brown mottled dark grey very gravelly very silty fine to coarse SAND. Gravel is angular to subrounded fine to coarse of mudstone and sandstone. GLACIAL TILL	11	
		11.00 - 11.45	U							
		11.50	D							
		12.00 - 12.40	B							
		12.50 - 12.95	D	N=16 (2,3/3,4,4,5)	17.00	85.02		Medium dense dark greyish brown very gravelly very silty fine to coarse SAND. Gravel is angular fine of mudstone and sandstone. GLACIAL TILL	17	
		12.50 - 13.00	B							
		12.50	SPT							
		13.50	D							
		14.00 - 14.45	D	N=18 (3,4/4,4,5,5)	19.50	82.52		Stiff dark greyish brown slightly sandy CLAY. GLACIAL TILL	19	
		14.00 - 14.50	B							
		14.00	SPT							
		15.00	D							
15.50 - 15.95	U	N=19 (3,4/5,4,5,5)	20.00	82.02						
16.00	D									
16.50 - 16.80	B									
17.00 - 17.40	D									
17.00 - 17.50	B									
17.00	SPT									
18.00	D									
18.50 - 18.95	D									
18.50 - 19.00	B									
18.50	SPT									
19.50	D									
19.50 - 19.95	D									
19.50 - 20.00	B									
19.50	SPT									
Remarks:					Borehole terminated at 20.00m.					
					Casing Details			Chiselling Details		
					Depth Top (m)	Depth Base (m)	Diameter (mm)	Depth Top (m)	Depth Base (m)	Duration (hrs)
						15.00	150			
					Water Strike					
					Depth Strike (m)	Time Elapsed (min)	Water Level (m)			
SPT Energy Ratio:										



ver. 0.5

Sheet 1 of 2

Project Name:	Victoria Avenue	Co-ords:	385246E - 404108N	Project No.:	3951
Location:	Blackley, Manchester	Level (mAOD):	102.23	Rev.:	1.0
		Dates:	13/04/2023	Logged By:	LM
Client:	John Southworth Builders Ltd	Weather:	Heavy showers	Checked By:	

Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (mbgl)	Level (mAOD)		Stratum Description		
		Depth (m)	Type	Results						
		0.10 - 0.60	B		0.80	101.43		Soft dark reddish brown sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse of mudstone, sandstone, glass, plastic, timber fragments, concrete and brick fragments. MADE GROUND	1	
		0.70	D							
		0.80 - 1.00	B							
		1.10	D	N=9 (2,2/2,2,3,2)	1.20	101.03		Loose becoming medium dense dark brown gravelly very silty fine to coarse SAND. Gravel is angular fine of mudstone and sandstone. GLACIAL TILL	2	
		1.20 - 1.65	D							
		1.20	SPT							
		1.80	D	N=11 (2,2/3,2,3,3)						
		2.00 - 2.45	D							
		2.00 - 3.00	B							
		2.00	SPT	N=11 (1,2/2,3,3,3)						
		3.00 - 3.45	D							
		3.00 - 3.50	B							
		3.00	SPT	N=11 (1,1/2,3,3,3)						
		3.80	D							
		4.00 - 4.45	D							
4.00 - 4.50	B	N=11 (1,1/2,3,3,3)								
4.00	SPT									
4.80	D									
5.00 - 5.45	D	N=9 (1,1/2,3,2,2)								
5.00	SPT									
5.50 - 6.00	B									
5.50							Firm dark greyish brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse of mudstone and sandstone. GLACIAL TILL	6		
6.40	D									
6.50 - 6.95	U									
7.00	D							7		
7.50 - 7.90	B									
8.00 - 8.45	D									
8.00 - 8.50	B	N=14 (2,2/3,4,3,4)		8.00	94.23		Medium dense dark greyish brown gravelly very silty fine to coarse SAND. Gravel is angular to subrounded fine to medium of mudstone and sandstone. GLACIAL TILL	8		
8.00	SPT									
9.00	D									
9.50 - 9.95	D	N=12 (1,1/2,2,3,5)						9		
9.50	SPT									
Continued on next sheet										10

Continued on next sheet

Remarks:	Casing Details			Chiselling Details		
	Depth Top (m)	Depth Base (m)	Diameter (mm)	Depth Top (m)	Depth Base (m)	Duration (hrs)
		15.00	150			
	Water Strike					
	Depth Strike (m)	Time Elapsed (min)	Water Level (m)			
SPT Energy Ratio:						

IGEconsulting Office 11, Bartle House, Oxford Court Manchester M2 3WQ email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk tel: 0161 914 9170		Borehole Log ver. 0.5			Borehole No. BH02 Sheet 2 of 2				
Project Name: Victoria Avenue				Co-ords: 385246E - 404108N		Project No.: 3951			
Location: Blackley, Manchester				Level (mAOD): 102.23		Rev.: 1.0			
Client: John Southworth Builders Ltd				Dates: 13/04/2023		Logged By: LM			
				Weather: Heavy showers		Checked By:			
Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (mbgl)	Level (mAOD)	Stratum Description		
		Depth (m)	Type	Results					
		10.50	D	N=11 (0,1/2,2,3,4)	11.80	90.43	Medium dense dark greyish brown gravelly very silty fine to coarse SAND. Gravel is angular to subrounded fine to medium of mudstone and sandstone. GLACIAL TILL	11	
		11.00 - 11.45 11.00	D SPT						
		12.00	D	N=18 (2,4/4,5,6,3)	13.50	88.73	Firm dark greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone. GLACIAL TILL	12	
		12.50 - 12.95 12.50 - 13.00 12.50	D B SPT						
		13.50	D	N=13 (2,2/2,3,4,4)	15.00	87.23	Medium dense dark greyish brown gravelly very silty fine to coarse SAND. Gravel is angular to subrounded fine to medium of mudstone and sandstone. GLACIAL TILL	13	
		14.00 - 14.45 14.00 - 14.50 14.00	D B SPT						
		15.00	D	N=15 (2,3/3,4,4,4)	18.50	83.73	Firm dark greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone. GLACIAL TILL	14	
		15.50 - 15.95 15.50 - 16.00 15.50	D B SPT						
		16.50	D	N=18 (2,3/4,4,5,5)	19.00	83.23	Medium dense dark greyish brown gravelly very silty fine to coarse SAND. Gravel is angular to subrounded fine to medium of mudstone and sandstone. GLACIAL TILL	15	
		17.00 - 17.45	U						
		17.50	D	N=18 (2,3/4,4,5,5)	18.50	83.73	Firm dark greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone. GLACIAL TILL	16	
		18.00 - 18.40	B						
18.50 - 18.95 18.50	D SPT	N=18 (2,3/4,4,5,5)	19.00	83.23	Medium dense dark greyish brown gravelly very silty fine to coarse SAND. Gravel is angular to subrounded fine to medium of mudstone and sandstone. GLACIAL TILL	17			
18.95 19.00 - 19.50	D B								
		20.00	D		20.00	82.23	Borehole terminated at 20.00m.		18
Remarks:		Casing Details			Chiselling Details				
		Depth Top (m)	Depth Base (m)	Diameter (mm)	Depth Top (m)	Depth Base (m)	Duration (hrs)		
			15.00	150					
		Water Strike							
		Depth Strike (m)	Time Elapsed (min)	Water Level (m)					
SPT Energy Ratio:									

IGEconsulting Office 11, Bartle House, Oxford Court Manchester M2 3WQ email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk tel: 0161 914 9170		Borehole Log ver. 0.5			Borehole No. BH03 Sheet 1 of 2				
Project Name: Victoria Avenue				Co-ords: 385274E - 404103N		Project No.: 3951			
Location: Blackley, Manchester				Level (mAOD): 102.01		Rev.: 1.0			
Client: John Southworth Builders Ltd				Dates: 14/03/2023 - 16/03/2023		Logged By:			
				Weather: Heavy showers		Checked By:			
Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (mbgl)	Level (mAOD)	Stratum Description		
		Depth (m)	Type	Results					
		0.40 - 0.80	B	N=10 (2,3/3,2,3,2)	0.20	101.81	Dark reddish brown very sandy clayey angular to subangular fine to coarse GRAVEL of concrete, brick fragments, limestone and plastic. MADE GROUND	1	
		1.00	D						
		1.20 - 1.65	D						
		1.20 - 1.70	B						
		1.20	SPT	N=4 (1,1/1,1,1,1)	2.50	99.51	Firm dark red sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse of mudstone and sandstone with rare brick fragments. MADE GROUND		
		1.90	D						
		2.00 - 2.45	D						
		2.00 - 2.50	B						
		2.00	SPT	N=8 (1,1/2,1,2,3)	4.00	98.01	Firm dark red sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse of mudstone and sandstone. GLACIAL TILL		
		2.80	D						
3.00 - 3.45	D								
3.00 - 3.50	B								
3.00	SPT	N=13 (2,2/3,3,3,4)	7.50	94.51	Firm dark greyish brown slightly sandy slightly gravelly silty CLAY. GLACIAL TILL				
3.80	D								
4.00 - 4.45	D								
4.00 - 4.50	B								
4.00	SPT	N=4 (2,2/1,1,1,1)	9.00	93.01	Medium dense dark greyish brown gravelly silty fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of sandstone and mudstone. GLACIAL TILL				
4.80	D								
5.00 - 5.45	D								
5.00 - 5.50	B								
5.00	SPT	N=14 (2,2/3,3,4,4)	9.00	93.01	Firm dark greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone. GLACIAL TILL				
6.00	D								
6.50 - 6.95	U								
7.00	D								
7.50	D	N=11 (2,2/2,2,4,3)	9.00	93.01	Firm dark greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone. GLACIAL TILL				
8.00 - 8.45	D								
8.00 - 8.50	B								
8.00	SPT								
9.00	D								
9.50 - 10.00	B								
9.50 - 9.95	D								
9.50	SPT								
Continued on next sheet								10	
Remarks:				Casing Details			Chiselling Details		
				Depth Top (m)	Depth Base (m)	Diameter (mm)	Depth Top (m)	Depth Base (m)	Duration (hrs)
					15.00	150			
				Water Strike					
				Depth Strike (m)	Time Elapsed (min)	Water Level (m)			
SPT Energy Ratio:									

IGE consulting		Office 11, Bartle House, Oxford Court Manchester M2 3WQ email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk tel: 0161 914 9170			Borehole Log ver. 0.5			Borehole No. BH03 Sheet 2 of 2	
Project Name: Victoria Avenue					Co-ords: 385274E - 404103N		Project No.: 3951		
Location: Blackley, Manchester					Level (mAOD): 102.01		Rev.: 1.0		
Client: John Southworth Builders Ltd					Dates: 14/03/2023 - 16/03/2023		Logged By:		
					Weather: Heavy showers		Checked By:		
Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (mbgl)	Level (mAOD)		Stratum Description	
		Depth (m)	Type	Results					
		10.50	D	N=12 (1,1/2,3,3,4)	11.00	91.01		Firm dark greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone. GLACIAL TILL	11
		11.00 - 11.45 11.00 - 11.50 11.00	D B SPT					Medium dense dark greyish brown gravelly silty fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of sandstone and mudstone. GLACIAL TILL	
		12.00	D	N=16 (2,3/3,4,5,4)	12.00	90.01		Firm dark greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone. GLACIAL TILL	12
		12.50 - 12.95 12.50 - 13.00 12.50	D B SPT						
		13.50	D	N=15 (2,3/3,4,4,4)	13.50	89.01			13
		14.00 - 14.45	U						
		14.50	D	N=12 (1,3/2,3,3,4)	14.50	88.01			14
		15.00 - 15.40	B						
		15.50 - 15.95 15.50 - 16.00 15.50	D B SPT		15.50	87.01			15
		16.50	D						
		17.00 - 17.45 17.00 - 17.50 17.00	D B SPT	N=16 (3,3/3,4,4,5)	17.00	85.01		Medium dense dark greyish brown gravelly silty fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of sandstone and mudstone. GLACIAL TILL	17
		18.00	D						
18.50 - 18.95 18.50 - 19.00 18.50	D B SPT	N=12 (1,3/2,3,3,4)	18.50	84.01			18		
19.50 19.50 - 19.95 19.50 - 20.00 19.50	D D B SPT	N=18 (2,3/4,4,5,5)							
				20.00	82.01		Firm dark greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone. GLACIAL TILL	20	
Borehole terminated at 20.00m.									
Remarks:		Casing Details			Chiselling Details				
		Depth Top (m)	Depth Base (m)	Diameter (mm)	Depth Top (m)	Depth Base (m)	Duration (hrs)		
			15.00	150					
		Water Strike							
		Depth Strike (m)	Time Elapsed (min)	Water Level (m)					
SPT Energy Ratio:									



Trial Pit No.
TP23-04
Sheet 1 of 1

ver. 1.1

Project No.
3951

Logged By
AS

Checked By

- 1
- 2
- 3
- 4
- 5

Remarks:



Image 1. TP23-04 Pit.



Image 1. TP23-05 Pit.

APPENDIX 3

WARNING

GAS BARRIER INSTALLED ON THIS SITE



KEEP OFF AND DO NOT PUNCTURE

GROUND GAS RESISTANT MEMBRANE INSPECTION RECORD



Office 16, Bartle House
Oxford Court
Manchester
M2 3WQ

Tel: 0161 914 9171
Email: contact@igeconsulting.co.uk
Web: www.igeconsulting.co.uk

Project:	
Project No:	
Plot No. Inspected:	
Date of inspection:	
Inspected by:	
Inspection Method:	

INSPECTED ITEM	YES/NO	COMMENTS	PHOTOGRAPHED YES / NO
Identification Identify that the correct membrane has been used, including sealing / jointing tape and pre-formed components e.g. tophats, corners.			
General Condition Inspect the general condition of the membrane for rips, tears and punctures.			
Jointing Check that all jointing has been carried out to the manufacturer's specification.			
Installation Check that the membrane has been installed correctly across cavities, including correct jointing in these areas.			
Top Hat Installation Check that top hats have been correctly installed around service entries, including jubilee clip around pipe and correct lapping and jointing to membrane at base.			
Vent Installation Check that vents have been installed around the perimeter of the building in sufficient number and in the correct locations, including inspecting the condition i.e. not blocked or otherwise restricted.			
Pressure Relief / Passive Venting Check the presence of a vented void / pressure relief pathway, including measuring that this is of a sufficient depth and not been filled or otherwise compromised. Check that internal sleeper walls are also vented to provide adequate flow-through within the void so that none of the walls are blocking off unvented sections within the void.			

This Plot has PASSED / FAILED inspection.

Additional inspection visit IS / IS NOT required for these plots.

Engineer:

Signed:

PHOTOGRAPHS	
Figure 1 –	Figure 2 –
Figure 3 –	Figure 4 –
Figure 5 –	Figure 6 –

GOOD PRACTICE GROUND GAS RESISTANT MEMBRANE INSTALLATION PHOTOGRAPHS



Figure 1 – Membrane neatly installed and in good condition.



Figure 2 – Air bricks installed at 2m centres.



Figure 3 – Correct auto-welding.



Figure 4 – Service penetrations sealed using detailing strip.



Figure 5 – Corners installed using detailing strip.

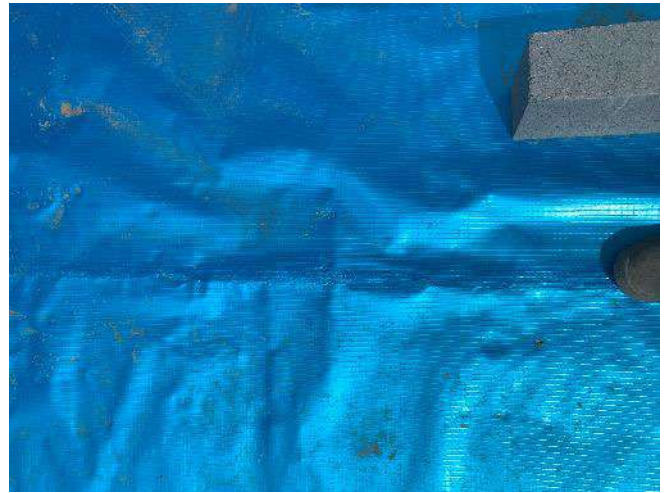


Figure 6 – Correct auto-welding.



Figure 7 – Membrane kept free of stones, debris and equipment to ensure it stays intact. No holes, tears or punctures are present.



Figure 8 – Sufficient overlap of cavity.



Figure 9 – Small hole noted and correctly patched using detailing strip.



Figure 10 – Correct jointing with double sided tape.



Figure 11 – Service penetration correctly sealed using a pre-formed top hat, double sided tape and jubilee clip.



Figure 12 – Corner folded into place.



Figure 13 – Corners formed correctly using double sided tape.



Figure 14 – Small hole noted and correctly patched using double sided tape.

APPENDIX 4

EXAMPLE INSTALLATION OF CLEAN COVER SYSTEM

The following example shows the clean cover system installation in line with the following requirements:

- A 600mm clean cover system comprising:
 - A minimum of 150mm topsoil, underlain by
 - 300mm subsoil, underlain by
 - 150mm gravel break layer
 - A hi-viz geotextile marker

It should be noted that most cover systems require **either** a gravel break layer **or** a hi-viz geotextile marker, but the below example uses both:

Figure 1: First, the gardens are dug out to 600mm below FFL and lined with a hi-viz geotextile marker:



Figure 2: The geotextile is overlain by a 150mm clean stone break layer.



Figure 3: The break layer is overlain by 300mm sub-soil, seen here before spreading across the garden:



Figure 4: The sub-soil is overlain by 150mm topsoil to FFL:



Figure 5: The gardens are finished with turf. The overall cover system depth is 600mm:



EXAMPLE CLEAN COVER SYSTEM VALIDATION

The following example shows validation of a clean cover system in line with the following requirements:

- A 600mm clean cover system comprising:
 - A minimum of 150mm topsoil, underlain by
 - 450mm subsoil

Best practice requires three photos as follows:



Photograph 1 – Identifies the plot number and shows the validation dig location in relation to the plot.

Photograph 2 – Shows the validation depth clearly, using a staff and a marker which crosses the hole. Shows the topsoil and subsoil, and the base of the hole.

Photograph 3 – Shows the validation hole in context. The plot being validated can be seen, along with nearby plots.

The validation should be written up into a Verification Log, shown below:



Bartle House, Manchester, M2 3WQ
email: contact@igeconsulting.co.uk
web: www.igeconsulting.co.uk

Verification Log

Project Name:

Project Number:

Location:

Client:

Remediation Requirements:

Validation Requirements:

Plot Number:

Grid reference:

Inspection date:

Engineer:

Photographs:

Photographs shows

This plot has PASSED / FAILED* verification (*delete as appropriate*)

*Proposed further remedial works (if FAILED):

An additional inspection IS / IS NOT required for this plot (*delete as appropriate*)

APPENDIX 5



Project: Victoria Avenue, Higher Blackley

Job No: 3951

Lab Sample Number		2586987	2586988	2586989	2586990	2586991	2586992	2586993	2586994	2586995	Statistical Analysis					GAC - S4UL unless stated				C4SL			
Sample Reference		TP301	TP302	TP303	TP304	TP304	TP305	TP306	TP307	TP310	Statistical Analysis					Statistical Results				C4SL			
Sample Number		None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	Statistical Analysis					Statistical Results				C4SL			
Depth (m)		0.50	0.60	0.40	0.50	0.50	0.40	0.50	1.00	0.70	Statistical Analysis					Statistical Results				C4SL			
Date Sampled		14/02/2023	14/02/2023	14/02/2023	14/02/2023	14/02/2023	14/02/2023	14/02/2023	14/02/2023	14/02/2023	Count	Standard Deviation	Minimum	Maximum	Average	Maximum	1%Residential with Home Grown Produce	Pass/ Fail	Exceedances	Residential with home grown produce	Pass/ Fail	Exceedances	
Analytical Parameter (Soil Analysis)		Units	LoD																				
Stone Content		%	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	9	0.00	0.1	0.1	0.1	0.1							
Moisture Content		%	0.01	17	16	15	10	13	12	10	18	9	3.17	10.00	16.00	13.44	18.00						
Total mass of sample received		kg	0.001	0.3	0.3	0.3	0.3	0.3	0.3	0.3	9	0.00	0.300	0.300	0.300	0.300							
Asbestos																							
Admission to Soil Screen		Type	N/A	Not-detected	-	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	0	-	-	-	-	-							
General Inorganics																							
pH - Automated		pH Units	N/A	8.4	7	8.5	10.1	8.8	8.7	8.4	10	7.8	9	0.97	7.00	10.10	8.83	1.00	69	Pass	0		
Total Cyanide		mg/kg	0.005	3300	350	950	1500	1900	1300	1000	1300	430	9	0.00	1.00	1.00	1.00						
Total Sulphate as SO4		mg/kg	2.50	0.86	0.13	0.062	0.19	0.4	0.24	0.18	0.16	0.042	9	0.19	0.04	0.68	0.23						
Water Soluble Sulphate as SO4 10hr extraction (2:1)		mg/kg	0.00120	1300	270	120	370	790	470	330	85	9	37.4733	85.0000	1300.0000	666.1111							
Water Soluble SO4 10hr extraction (2:1 Leachate Equivalent)		mol	1.25	660	133	61.8	187	387	238	184	165	42.4	9	191.67	42.40	660.000	229.58						
Sulphate		mg/kg	0.005	2700	180	500	850	670	750	680	340	9	26.54	100	91.00	50.89							
Total Sulphur		%	0.1	2.4	0.5	1.6	1	1.5	1.8	1.3	2.2	9	740.283	160.000	2700.000	881.111							
Total Organic Carbon (TOC) - Automated		%	0.1	2.4	0.5	1.6	1	1.5	1.8	1.3	2.2	9	0.88	0.50	2.40	1.84							
Total Phenols		mg/kg	1	1	1	1	1	1	1	1	1	9	0.00	1.00	1.00	1.00							
Total Phenols (monohydric)		mg/kg	1	1	1	1	1	1	1	1	1	9	0.00	1.00	1.00	1.00							
Speciated PAHs																							
Naphthalene		mg/kg	0.05	0.09	0.05	0.2	0.8	0.27	0.74	0.29	0.16	0.05	9	0.28	0.05	0.80	0.29	0.80	2.30	Pass	0		
Acenaphthylene		mg/kg	0.05	0.08	0.05	0.08	0.15	0.06	0.13	0.06	0.05	0.3	9	0.07	0.05	0.26	0.10	0.26	0.70	Pass	0		
Acenaphthene		mg/kg	0.05	0.16	0.05	0.59	1.1	1.5	1.3	2	0.16	0.15	9	0.72	0.05	2.00	0.78	2.00	218	Pass	0		
Fluorene		mg/kg	0.05	0.15	0.05	0.67	1.1	1.5	1.3	2	0.16	0.15	9	0.56	0.05	1.50	0.62	1.50	170	Pass	0		
Phenanthrene		mg/kg	0.05	1.2	0.12	0.4	9.5	9.8	9.8	17	1.2	0.08	1	5.85	0.12	17.00	5.98	17.00	59	Pass	0		
Anthracene		mg/kg	0.05	0.3	0.05	1.7	2.6	1.7	2.7	4.2	0.29	0.24	9	1.44	0.05	4.20	1.53	4.20	2400	Pass	0		
Fluorethene		mg/kg	0.05	2.2	0.22	9	12	7.8	20	29	1.5	0.9	9	6.68	0.22	28.00	9.36	28.00	290	Pass	0		
Pyrene		mg/kg	0.05	2.2	0.21	8.1	11	7	18	26	2.5	1.4	9	8.66	0.21	26.00	8.49	26.00	620	Pass	0		
Benzo[a]fluoranthene		mg/kg	0.05	1	0.08	0.5	3.2	2.7	7.6	9.7	1.2	0.72	9	3.35	0.06	9.70	3.51	9.70	15	Pass	0		
Chrysene		mg/kg	0.05	1.5	0.08	4.6	6.6	2.6	30	16	1.5	0.94	9	4.71	0.08	14.00	4.58	14.00	2.60	Fail	4		
Benzo[b]fluoranthene		mg/kg	0.05	0.68	0.05	0.3	1.2	0.8	1.7	0.8	0.3	0.3	9	1.47	0.05	4.80	1.58	4.80	77	Pass	0		
Benzo[a]pyrene		mg/kg	0.05	1.4	0.08	2.6	5.3	2.1	15	12	1.4	0.77	9	3.94	0.08	12.00	3.92	12.00	2.30	Fail	5	8.00	
Indeno[1,2,3-cd]pyrene		mg/kg	0.05	0.07	0.05	0.4	1.1	0.73	1.4	0.37	0.14	0.17	9	1.74	0.05	5.40	1.76	5.40	27	Pass	0		
Dibenz[a,h]anthracene		mg/kg	0.05	0.15	0.05	0.4	0.63	0.05	0.99	1.4	0.05	0.05	9	0.49	0.05	1.40	0.42	1.40	0.44	Fail	4		
Benzo[ghi]perylene		mg/kg	0.05	0.73	0.05	1.8	2.8	1.3	4.2	6.3	0.91	0.38	9	2.05	0.05	6.30	2.05	6.30	320	Pass	0		
Total PAH		mg/kg	0.8	13.4	0.85	47.1	68.4	41.4	100	148	15	8.63	9	48.50	0.85	148.00	48.98						
Speciated Total EPA-16 PAHs		mg/kg	0.8	13.4	0.85	47.1	68.4	41.4	100	148	15	8.63	9	48.50	0.85	148.00	48.98						
Heavy Metals / Metalloids																							
Arsenic (soil regia extractable)		mg/kg	1	11	7.5	19	13	11	14	12	6.2	34	9	5.11	6.20	24.00	12.08	24.00	37	Pass	0		
Cadmium (soil regia extractable)		mg/kg	0.2	0.5	0.2	0.4	0.6	0.2	0.2	0.7	0.5	0.2	9	0.20	0.20	0.70	0.39	0.70	11	Pass	0	22	
Chromium (hexavalent)		mg/kg	1.2	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	9	0.00	1.80	1.80	1.80	6	Pass	0	21	Pass	0
Chromium (soil regia extractable)		mg/kg	1	15	12	17	16	15	15	17	15	15	9	2.92	12.00	22.00	15.67	22.00	919	Pass	0		
Copper (soil regia extractable)		mg/kg	1	26	21	31	41	31	40	38	15	36	9	8.92	15.00	41.00	31.00	41.00	2400	Pass	0		
Lead (soil regia extractable)		mg/kg	1	41	13	26	120	71	130	27	13	30	9	44.10	13.00	130.00	74.33	130.00	200	Pass	0	210	
Mercury (soil regia extractable)		mg/kg	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	9	0.10	0.30	0.60	0.33	0.60	49	Pass	0		
Nickel (soil regia extractable)		mg/kg	1	15	19	16	16	17	15	19	12	19	9	2.35	12.00	19.00	16.44	19.00	130	Pass	0		
Selenium (soil regia extractable)		mg/kg	1	1	1	1	1	1	1	1	1	1	9	1.74	0.05	5.40	1.76	5.40	27	Pass	0		
Zinc (soil regia extractable)		mg/kg	1	120	45	80	88	84	75	250	82	49	9	61.18	45.00	250.00	98.11	250.00	3700	Pass	0		
Petroleum Hydrocarbons																							
Petroleum Range Organics (C8 - C16)		mg/kg	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	9	0.00	0.10	0.10	0.10						
TPH (C8 - C8)		mg/kg	1	1	1	1	1	1	1	1	1	1	9	0.00	1.00	1.00	1.00						
TPH (C8 - C8)		mg/kg	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	9	0.00	0.10	0.10	0.10						
TPH (C9 - C10)		mg/kg	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	9	0.00	0.10	0.10	0.10						
TPH (C10 - C12)		mg/kg	2	2	2	2	2	2	2	2	2	2	9	0.23	2.00	2.70	2.08						
TPH (C12 - C16)		mg/kg	1	4	4	4	4	4	4	4	4	4	9	0.44	4.00	4.00	4.00						
TPH (C16 - C21)		mg/kg	1	19	1	15	36	24	40	40	30	1	9	15.08	1.00	40.00	22.78						
TPH (C21 - C35)		mg/kg	1	140	1	49	97	41	85	90	160	1	9	55.83	1.00	160.00	73.78						
TPH (C35 - C40)		mg/kg	1	95	19	16	13	13	21	60	10	10	9	28.30	1.00	60.00	32.33						
TPH (C35 - C40)		mg/kg	10	250	10	86	170	84	150	170	280	10	9	92.60	10.00	280.00	132.22						
VOCs - All below detection limit except the following:																							
Chloromethane		µg/L	1	5	-	-	5	-	5	5	-	-	4	0.00	5.00	5.00	5.00	-					
Chloroethane		µg/L	1	5	-	-	5	-	5	5	-	-	4	0.00	5.00	5.00	5.00	-					
Bromomethane		µg/L	1	5	-	-	5	-	5	5	-	-	4	0.00	5.00	5.00	5.00	-					
Vinyl Chloride		µg/L	1	5	-	-	5	-	5	5	-	-	4	0.00	5.00	5.00	5.00	-					

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Project: Victoria Avenue, Higher Blackley

Job No: 3951

Lab Sample Number			2586940	2586941	2586942	2586943	2586944	2586945	2586946	2586947	2586948	2586949	2586950	2586951	Statistical Analysis					GAC - S4UL unless stated				C4SL							
Sample Reference			SP101	SP102	SP103	SP201	SP202	SP203	SP205	SP301	SP302	SP401	SP402	SP403	Statistical Results					1% Residential with Home Grown Produce	Pass/ Fail	Exceedances	Residential with home grown produce	Pass/ Fail	Exceedances						
Sample Number			None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	Count	Standard Deviation	Minimum	Maximum	Average							Maximum					
Depth (m)			None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied																	
Date Sampled			14/02/2023	14/02/2023	14/02/2023	14/02/2023	14/02/2023	14/02/2023	14/02/2023	14/02/2023	14/02/2023	14/02/2023	14/02/2023	14/02/2023																	
Analytical Parameter (Soil Analysis)			Units	LoD																											
Stone Content			%	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	12	0.00	0.1	0.1	0.1	0.1											
Moisture Content			%	0.01	15	13	14	19	19	19	14	9.9	14	12	12	3.33	9.90	19.00	14.91	19.00											
Total mass of sample received			kg	0.001	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	12	0.00	0.300	0.300	0.300	0.300											
Asbestos																															
Asbestos in Soil Screen			Type	N/A	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	0	-	-	-	-												
General Inorganics																															
pH - Automated			pH Units	N/A	9.5	9	8.6	8.3	8.1	8.3	8.4	9.8	10.8	9	9.8	9.2	12	0.80	8.10	10.80	9.07										
Total Cyanide			mg/kg	1	1	1	1	1	1	1	1	1	1	1	1	1	12	0.00	1.00	1.00	1.00										
Total Sulphate as SO4			%	0.005	1100	800	720	430	500	380	330	5100	2900	1800	1600	1200	12	1382.629	330.000	5100.000	1405.000										
Water Soluble Sulphate as SO4 16hr extraction (2:1)			mg/kg	2.50	0.18	0.16	0.056	0.14	0.11	0.09	0.09	0.87	0.6	0.45	0.3	0.21	12	0.25	0.06	0.87	0.27										
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)			g/l	0.00125	350	320	110	280	220	180	1700	1200	910	590	420	12	489.30068	110.00000	1700.00000	538.33333											
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)			mg/l	1.25	176	161	56.2	138	110	89.8	90.4	869	597	455	296	210	12	248.34	56.20	869.00	270.70										
Sulphide			mg/kg	1	28	13	7.2	1	3.2	2.1	2.2	1.5	11	10	38	12	11.46	1.00	38.00	10.60											
Total Sulphur			%	0.005	610	410	330	210	220	200	200	2100	1200	880	770	650	12	557.378	200.000	2100.000	648.333										
Total Organic Carbon (TOC) - Automated			%	0.1	1.4	1.2	1	1	0.9	1	0.9	1.1	1	1.5	1.3	1.2	12	0.20	0.90	1.50	1.13										
Total Phenols																															
Total Phenols (monohydric)			mg/kg	1	1	1	1	1	1	1	1	1	1	1	1																
Speciated PAHs																															
Naphthalene			mg/kg	0.05	3.9	0.24	0.05	0.05	0.05	0.05	0.05	0.25	0.36	0.44	0.36	12	1.08	0.05	3.90	0.49											
Acenaphthylene			mg/kg	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.09	0.1	0.14	0.05	12	0.03	0.05	0.14	0.07	0.14											
Acenaphthene			mg/kg	0.05	6.3	0.73	0.3	0.05	0.05	0.14	0.13	0.16	0.37	1.6	0.86	0.93	12	1.74	0.05	6.30	0.97										
Fluorene			mg/kg	0.05	4.5	0.53	0.24	0.05	0.05	0.1	0.13	0.05	0.35	1.2	0.66	0.66	12	1.24	0.05	4.50	0.71										
Phenanthrene			mg/kg	0.05	28	5	2	0.05	0.14	0.67	0.71	1.2	2.9	5.8	12	7.78	0.05	28.00	5.20	28.00											
Anthracene			mg/kg	0.05	7.3	1.2	0.52	0.05	0.15	0.05	0.27	0.76	1.5	1.5	12	2.02	0.05	7.30	1.30	7.30											
Fluoranthene			mg/kg	0.05	30	6.5	0.78	0.08	0.13	0.78	0.88	2.3	8.9	11	12	8.52	0.08	30.00	6.75	30.00											
Pyrene			mg/kg	0.05	25	6.2	3.5	0.1	0.13	0.71	0.61	2.6	3.9	13	8.5	10	12	7.26	0.10	25.00	6.19										
Benzo(a)anthracene			mg/kg	0.05	13	3.1	1.8	0.05	0.34	0.05	1.3	1.7	5.2	4	4.4	12	3.85	0.05	13.00	2.92											
Chrysene			mg/kg	0.05	11	2.7	1.5	0.05	0.36	0.05	1.2	1.8	5.7	3.9	4.07	12	3.22	0.05	11.00	2.75											
Benzo(b)fluoranthene			mg/kg	0.05	-	3.2	-	-	0.05	0.32	0.05	1.2	2.1	5.2	4.6	0.5	9	2.04	0.05	5.20	1.86										
Benzo(k)fluoranthene			mg/kg	0.05	-	1	-	-	0.05	0.15	0.05	0.57	0.67	1.6	0.05	9	0.90	0.05	2.70	0.76											
Benzo(a)pyrene			mg/kg	0.05	10	2.7	1.8	0.05	0.05	0.3	0.25	1.1	1.8	5.1	4	12	2.90	0.05	10.00	2.60											
Indeno(1,2,3-cd)pyrene			mg/kg	0.05	4.6	1.5	0.82	0.05	0.05	0.18	0.05	0.64	0.94	2.4	2.1	2.1	12	1.35	0.05	4.60	1.29										
Dibenz(a,h)anthracene			mg/kg	0.05	0.05	0.33	0.23	0.05	0.05	0.05	0.05	0.13	0.2	0.67	0.56	0.5	12	0.23	0.05	0.67	0.24										
Benzo(ghi)perylene			mg/kg	0.05	5.3	1.5	0.98	0.05	0.05	0.22	0.05	0.68	1	2.8	2.3	12	1.55	0.05	5.30	1.44											
Total PAH																															
Speciated Total EPA-16 PAHs			mg/kg	0.8	166	36.5	19.5	0.8	0.8	4.4	2.51	13.7	22.7	71.3	49.7	48.3	12	46.74	0.80	166.00	36.35										
Heavy Metals / Metalloids																															
Arsenic (aquia regia extractable)			mg/kg	1	12	9.5	10	8.2	7.4	10	8.4	11	8.1	12	13	11	12	1.79	7.40	13.00	10.05										
Cadmium (aquia regia extractable)			mg/kg	0.2	0.5	0.4	0.9	0.2	0.2	0.2	0.2	0.2	0.4	0.2	0.2	0.2	12	0.21	0.20	0.90	0.32										
Chromium (hexavalent)			mg/kg	1.2	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	12	0.00	1.80	1.80	1.80										
Chromium (aquia regia extractable)			mg/kg	1	17	14	17	29	29	28	30	16	17	15	16	17	12	6.42	14.00	30.00	20.42										
Copper (aquia regia extractable)			mg/kg	1	360	37	36	25	24	36	24	33	54	40	35	12	94.85	24.00	360.00	60.08											
Lead (aquia regia extractable)			mg/kg	1	130	91	95	20	17	28	26	42	110	110	91	12	45.53	17.00	140.00	74.92											
Mercury (aquia regia extractable)			mg/kg	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	12	0.00	0.30	0.30	0.30											
Nickel (aquia regia extractable)			mg/kg	1	18	15	16	35	34	32	34	13	14	15	15	14	12	9.33	13.00	35.00	21.25										
Selenium (aquia regia extractable)			mg/kg	1	1	1	1	1	1	1	1	1	1	1	1	12	0.00	1.00	1.00	1.00											
Zinc (aquia regia extractable)			mg/kg	1	180	77	77	56	57	59	57	100	76	88	70	64	12	34.28	56.00	180.00	80.08										
Petroleum Hydrocarbons																															
Petroleum Range Organics (C6 - C10)			mg/kg	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	12	0.00	0.10	0.10	0.10											
TPH (C5 - C6)			mg/kg	1	1	1	1	1	1	1	1	1	1	1	1	12	0.00	1.00	1.00	1.00											
TPH (C6 - C8)			mg/kg	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	12	0.00	0.10	0.10	0.10											
TPH (C8 - C10)			mg/kg	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	12	0.00	0.10	0.10	0.10											
TPH (C10 - C12)			mg/kg	2	5.1	2	2	2	2	2	2	2	2	2	3	12	0.90	2.00	5.10	2.41											
TPH (C12 - C16)			mg/kg	4	20	4	4.4	4	4	4	4	53	17	5.2	4	11	12	14.31	4.00	53.00	11.22										
TPH (C16 - C21)			mg/kg	1	45	16	12	1	1	1	80	59	33	23	24	12	25.59	1.00	80.00	24.67											
TPH (C21 - C35)			mg/kg	1	58	23	22	1	1	1	140	470	51	41	38	12	131.71	1.00	470.00	70.58											
TPH (C35 - C40)			mg/kg	10	10	10	10	10	10	10	39	110	10	10	10	12	29.32	10.00	110.00	20.75											
TPH (C5 - C40)			mg/kg	10	130	39	41	10	10	10	320	650	89	64	76	12	187.87	10.00	650.00	120.75											
GAC used: LQM/CIEH Suitable 4 Use Levels for Human Health Risk Assessment (3rd edition, 2015)																															
Category 4 Screening Levels (March 2014) used for Arsenic																															
In-house methodology used for Cyanide - no GAC currently available																															
Exceeded GAC & C4SL																															
Exceeded GAC but not C4SL																															
Recorded below laboratory detection limit																															
This spreadsheet has been developed by IGE Consulting Ltd																															

TABLE 2.1 SUMMARY OF GROUND GAS MONITORING RESULTS

WELL	DATE	CH ₄ INITIAL (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ GSV (l/hr)	CO ₂ INITIAL (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ GSV (l/hr)	O ₂ (%V/V)	ATMOS (mb)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)	
WS101	05/06/2019	0.1	0.1	0.00013	1.6	1.6	0.00208	19.3	990	Rising	0.13	0.50 – 4.00	3.56	dry	
	19/06/2019	0.1	0.1	0.00026	1.4	1.4	0.00364	19.6	998	Falling	0.26		3.55	dry	
	26/06/2019	Access to site impaired.													
	30/07/2019	0.1	0.1	0.00396	2.2	2.2	0.08712	18.6	993	Falling	3.96		3.55	dry	
	19/08/2019	0.1	0.1	0.0027	1.9	1.9	0.0513	18.9	997	Rising	2.7		3.55	dry	
	29/08/2019	0.1	0.1	0.00234	1.7	1.7	0.03978	19.0	992	Rising	2.34		3.54	dry	
	20/09/2019	0.1	0.1	0.00194	1.8	1.8	0.03492	18.8	1001	Falling	1.94		3.55	dry	
	25/10/2019	Access to site impaired.													
	20/11/2019	0.1	0.1	0.0023	1.8	1.8	0.0414	19.1	998	Falling	2.3		3.54	dry	
WS102	05/06/2019	0.1	0.1	0.00128	0.8	0.8	0.01024	19.2	990	Rising	1.28	0.50 – 2.00	1.65	1.23	
	19/06/2019	0.1	0.1	0.00098	0.6	0.6	0.00588	19.5	998	Falling	0.98		1.65	1.26	
	26/06/2019	Access to site impaired.													
	30/07/2019	0.1	0.1	0.00013	1.3	1.3	0.00169	11.7	993	Falling	0.13		1.63	1.18	
	19/08/2019	0.1	0.1	0.00026	1.1	1.1	0.00286	12.9	997	Rising	0.26		1.64	1.22	
	29/08/2019	0.1	0.1	0.00052	1.2	1.2	0.00624	12.0	992	Rising	0.52		1.65	1.20	
	20/09/2019	0.1	0.1	0.00089	1.0	1.0	0.0089	13.1	1001	Falling	0.89		1.65	1.24	
	25/10/2019	0.1	0.1	-0.00013	2.1	2.1	-0.00273	15.0	997	Falling	-0.13		1.59	0.90	
	20/11/2019	0.1	0.1	-0.00026	1.9	1.9	-0.00494	14.6	998	Falling	-0.26		1.59	1.02	



WELL	DATE	CH ₄ INITIAL (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ GSV (l/hr)	CO ₂ INITIAL (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ GSV (l/hr)	O ₂ (%V/V)	ATMOS (mb)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)	
WS103	05/06/2019	2.2	2.2	0.01936	3.6	3.6	0.03168	15.2	990	Rising	0.88	0.50 – 4.50	4.32	1.52	
	19/06/2019	1.9	1.9	0.00988	3.5	3.5	0.0182	15.8	998	Falling	0.52		4.31	1.50	
	26/06/2019	Access to site impaired.													
	30/07/2019	0.1	0.1	0.0001	0.6	0.6	0.0006	20.1	993	Falling	0.1		4.40	0.88	
	19/08/2019	0.1	0.1	0.00013	1.3	1.3	0.00169	19.3	997	Rising	0.13		4.38	1.02	
	29/08/2019	0.1	0.1	0.00026	1.1	1.1	0.00286	19.5	992	Rising	0.26		4.37	1.09	
	20/09/2019	0.1	0.1	0.00052	1.2	1.2	0.00624	19.3	1001	Falling	0.52		4.37	1.10	
	25/10/2019	0.1	0.1	-0.00228	1.4	1.4	-0.03192	18.7	997	Falling	-2.28		4.30	1.30	
	20/11/2019	0.1	0.1	-0.0016	1.1	1.1	-0.0176	19.1	998	Falling	-1.6		4.30	1.36	
WS105A	05/06/2019	0.1	0.1	0.00013	2.3	2.3	0.00299	17.5	990	Rising	0.13	0.50 – 1.40	1.6	dry	
	19/06/2019	0.1	0.1	0.00026	2.0	2.0	0.0052	18.2	998	Falling	0.26		1.6	dry	
	26/06/2019	0.1	0.1	0.00144	1.3	1.3	0.01872	18.5	1017	Rising	1.44		1.6	1.55	
	30/07/2019	0.1	0.1	0.00095	6.7	6.7	0.06365	14.2	993	Falling	0.95		1.6	1.56	
	19/08/2019	0.1	0.1	0.00102	5.4	5.4	0.05508	15.3	997	Rising	1.02		1.6	1.57	
	29/08/2019	0.1	0.1	0.00098	5.1	5.1	0.04998	15.8	992	Rising	0.98		1.6	1.54	
	20/09/2019	0.1	0.1	0.00135	5.3	5.3	0.07155	15.2	1001	Falling	1.35		1.6	1.48	
	25/10/2019	Access to site impaired.													
	20/11/2019	Access to site impaired.													

