

Solum House
Unit 1 Elliott Court
St. Johns Road
Meadowfield
Durham, DH7 8PN

Tel: (0191) 378 6380

e-mail: admin@arc-environmental.com
www.arc-environmental.com



PHASE 1: DESK TOP STUDY AND COAL MINING RISK

ASSESSMENT REPORT

FAIRBRIAR HATBOX LIMITED / SCARBOROUGH DEVELOPMENT GROUP

BOWLERS YARD

LAND OFF POLLARD STREET

MANCHESTER

M4 7BB

Project No: 18-831

Prepared By:

Michaela Petrova

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Date: 10/12/2019

Approved By:

Matt Bradford

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Date: 10/12/2019

The information and/or advice contained in this Phase 1: Desk Top Study Report and Coal Mining Risk Assessment is based solely on, and is limited to, the boundaries of the site, the immediate area around the site, and the historical use(s) unless otherwise stated. This 'Report' has been prepared to collate information relating to the physical, environmental and industrial setting of the site, and to highlight, where possible, the likely problems that might be encountered when considering the future development of this site for the proposed end use. All comments, opinions, diagrams, cross sections and/or sketches contained within the report, and/or any configuration of the findings is conjectural and given for guidance only and confirmation of the anticipated ground conditions should be considered before development proceeds. Agreement for the use or copying of this report by any Third Party must be obtained in writing from Arc Environmental Limited (ARC). If a change in the proposed land use is envisaged, then a reassessment of the site should be carried out.

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Arc Environmental Limited (ARC) were instructed by GHD on behalf of Fairbriar Hatbox Limited / Scarborough Development Group to undertake a Phase 1: Desk Top Study and Coal Mining Risk Assessment Report for land located east of Munday Street in Manchester where proposals have been made for a multi-storey building with residential end use.

The primary objectives of this report are to assess the geological, geotechnical and potential ground contamination conditions on and beneath the surface of this site. A Preliminary Conceptual Site Model (CSM) has been developed to define the scope and extent of any further investigation works deemed necessary, prior to commencing with any future redevelopment works. A site walkover (reconnaissance) survey was completed as part of this report with site photographs included within Appendix I, and all relevant observations noted in Section 2.1 below.

2.0 Physical Setting

2.1 Site Details / Reconnaissance (Walkover) Survey:-

Table 2.1

Site Name & Address:	Bowlers Yard, Munday Street, Manchester, M4 7BB.
National Grid Reference:	385610, 398330 (representative of the central part of the site).
Description of Location:	The site is located to the east of Munday Street approximately 1.55km east of Manchester City Centre.
Site Boundaries:	N = The East Manchester Metrolink, W = Munday Street, S = Pollard Street and E = Parking space / hardstanding surface.
Site Shape & Development Details:	The site is generally triangular in shape, occupying a total area of c.0.09 Hectares (Ha). The proposed plan shows the construction of a multi-storey apartment block.
General Topography:	The site is relatively level.
Site surfacing:	The site surface is mixed tarmac and limestone gravel with occasional grass cover.
Above Ground Structures:	In accordance with the reconnaissance (walkover) survey the site is currently unoccupied.
Sub-surface Structures & Services:	QS Zero Dig Underground Utility Survey was obtained, a copy of which is attached in Appendix II, shows an assumed water pipe on the south-western portion of the site and an unknown metallic utility on the north-central portion of the site. In addition to this, some anomalies were detected across the site which could be indicative of possible utilities. Therefore, services are anticipated below the site.
Additional Comments:	From the reconnaissance (walkover) survey, the site is currently fenced off and the access can be obtained off Munday Street via a locked gate. Some demolition rubble (i.e. bricks, wood, broken glass, etc.) was noted on site as well as an area of tarmac surfacing along the northern site boundary.
Summary of Site History:	The historical Ordnance Survey (OS) maps show the site has undergone several development phases. From as early as c.1848 the majority of the site is recorded to be occupied by terraced houses and some further residential development was recorded dated c.1891. These buildings were demolished by c.1908 and subsequently followed by new development phase including terraced houses with car parking / open space area in the central portion of the site. These buildings were demolished by c.1978 and the site was recorded as unoccupied land. The site has been recorded unchanged until 2019 (present day).

3.0 Environmental Setting

The geological and mining assessment for this site has been based on geological plans published by the British Geological Survey (BGS) and previous on site investigation works by Arc Environmental. The following documents have been reviewed as part of this study:

- BGS Sheet 85, Manchester, Solid & Drift Editions, 1:50,000 & 1:63 360 scale, 2010 & 1970.
- BGS Digital Mapping (Geoindex Onshore).
- ArcGIS Mapping.
- BGS Geology of Britain Viewer.
- Coal Authority Online Interactive Map Viewer.
- Phase 2: Ground Investigation Report by ARC Environmental, ref.: 13-898, Proposed Development, Milliners Wharf, Munday Street, Manchester M4 7BB, March 2014

3.1 Site Geology:-

3.1.1 Made Ground:-

In accordance with published British Geological Survey (BGS) maps the site does not contain any made ground deposits.

However, Ordnance Survey (OS) historical plans show several phases of development on the site associated with former terraced houses on site before c.1848 subsequently demolished, followed by new development phase including new residential properties / terraced houses which were also subsequently demolished. Therefore, made ground deposits are anticipated across the site.

In addition to the above, the previous intrusive site investigation recorded made ground to depth of at least c.2.40m below ground level (bgl).

Considering the information above, significant thicknesses of made ground deposits are anticipated across the site.

3.1.2 Superficial Deposits:-

Based on published BGS maps, the site is shown to be underlain by significant thicknesses of Glacial Till deposits.

The previous site investigations encountered sandy gravelly clay to a depth of at least c.3.90m. Furthermore, RBH1 located c.40m north to the site recorded Glacial Till deposits comprising firm sandy gravelly clay underlain by sand and gravel to a depth of at least c.20m bgl.

3.1.3 Solid Geology:-

According to published BGS maps the site is underlain by the Collyhurst Sandstone Formation of Permian age. These deposits comprise mainly sandstone.

RBH1 recorded sandstone with some mudstone bands from a depth of c.20m bgl.

3.0 Environmental Setting (Cont'd)

3.2 Coal Mining Risk Assessment & Mineral Extraction:-

3.2.1 Coal Mining Risk Assessment:-

In accordance with published BGS maps the site is underlain by the Collyhurst Sandstone Formation of Permian age.

The Coal Authority Interactive Map viewer records the site to lie within a Coal Mining Reporting Area and out-with defined Development High Risk Area or Surface Mining (Past and Current) area. There are no mine entries recorded within c.100m of the site boundary.

According to The Coal Authority Coal Mining Report the shallowest recorded worked coal seam below the site is named the Bradford Four Feet which lies at a depth of c.374m bgl with an extraction thickness of c.0.12m which is deemed not to pose a risk of future surface instability associated with the past coal mining activities.

Published BGS maps show the Openshaw (OP) Coal to subcrop c.1km north-east to the site dipping south-west below the site. From the generalised vertical section this coal seam is anticipated to be impersistent and lie at significant depth below the site deemed not to pose a risk of future surface instability.

In addition to the above, the previous intrusive site investigation did not record any coal seam to a maximum depth of c.25m bgl in RBH1 located c.40m north to the site.

When considering the information above, the site is deemed not to be at risk of future surface instability issues arising from the past shallow coal mining activities and as a result, no further assessment or intrusive investigation works are required with regards to historical coal mining activities.

3.2.2 Surface Mineral Extraction:-

In accordance with OS maps dating from as early as c.1848 there have not been any open or infilled extraction features (clay pits, sandstone quarries or the like) on site or within an influencing distance from the site boundaries).

3.3 Site Hydrogeology:-

Table 3.1

<u>STRATA</u>	<u>Aquifer / Soil Leachability EA Classification</u>	<u>Comments</u>
Groundwater Vulnerability:	Soils of high leaching potential (U).	Soil information for restored mineral workings and urban areas is based on fewer observations than elsewhere. A worst case vulnerability classification (H) assumed, until proved otherwise.
Drift Geology:	Secondary Undifferentiated.	This has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
Solid Geology:	Principal Aquifer.	These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

3.0 Environmental Setting (Cont'd)

3.3 Site Hydrogeology (Cont'd):-

- The site is not recorded as being within a Source Protection Zone (SPZ), and there are no SPZ's within c.1km of the site boundary.
- There are no Water Abstractions recorded on site or within c.500m of the site boundary.

3.4 Site Hydrology:-

Table 3.2

<u>SURFACE WATER FEATURE</u>	<u>Location</u>	<u>Comments</u>
GQA Classified River	One recorded within c.250m.	Ashton Canal located c.40m north-west with designated GQA River Quality Grade C.
Unclassified Watercourse(s), Canals, Ponds, Lakes & Other Bodies of Water.	None recorded within c.250m.	~
<u>SURFACE WATER FEATURE</u>	<u>Location</u>	<u>Comments</u>
Flooding from Rivers or Sea	None recorded on the site. The site lies within a Zone I Flood area (very low risk).	Although the site does not fall within the designated Flood Zone II & III, it is recommended that further consultation with the LA and EA should be made with respect to the potential for flood events in this area and to establish local knowledge of periodic flooding, standing water or poor drainage problems.
Surface Water Flooding – Pluvial (Envirocheck & Reconnaissance survey)	~	The Envirocheck report records the whole of the site to lie out-with any areas at risk from surface water flooding. Appropriate surface water management will need to be adopted to deal with the future management of positively drained surface water. At the time of the reconnaissance survey (walkover), there was no evidence of surface flooding.
Groundwater Flooding at Surface (BGS):	~	The site is shown to lie out-with areas where there is potential for groundwater flooding to occur.
<u>RAINFALL</u>	<u>Measurements (mm)</u>	<u>Comments</u>
Annual	867.1	Based on 'station average' records from Woodford, dated from 1981-2010.
Precipitation, Min (Feb)	51.5	
Precipitation, Max (Dec)	98.8	

3.5 Radon Assessment:-

The site is recorded to lie within a lower probability radon area, with less than 1% of homes are estimated to be at or above the action level, in accordance with the BGS, National Geoscience Information Service, and their assessment suggests that no radon protective measures are necessary in the construction of new dwellings or extensions.

This corresponds with the BRE Digest, BR211 (2015) Radon: Guidance on Protective Measures for New Buildings, where the site is situated within a clear grid square (1km), where no radon protective measures are recommended.

3.0 Environmental Setting (Cont'd)

3.6 Site Ecology:-

At this stage, and from the site reconnaissance (walkover) survey undertaken, it is not felt that the site is affected by the presence of invasive weed species (i.e. Japanese Knotweed). However, a detailed Japanese Knotweed survey has not been carried out.

A detailed assessment and site awareness during future investigation works and during the construction phase for any potential invasive weed species would be considered prudent.

Table 3.3

FEATURES	Location	Comments
Local Nature Reserves	None recorded within c.250m.	~
Areas of Adopted Green Belt	None recorded within c.250m.	~
Special Protection Areas	None recorded within c.250m.	~
Nitrate Vulnerable Zone	None recorded within c.250m.	~
Other	None recorded within c.250m.	~

3.7 Estimated Soil Chemistry:-

Data provided by the BGS in relation to estimated soil chemistry for a number of key metals and metalloid elements are summarised in Table 3.4 below. Note; the references to the anticipated background concentrations of contaminants, sourced from the BGS, should not be relied upon. They are not site-specific and do not represent the condition of the ground at the proposed development site.

Table 3.4

Element	Location	Estimated Soil Concentrations (mg/kg)
Arsenic	On site	25-35
Cadmium	On site	<1.8
Chromium (total)	On site	60-90
Lead	On site	100-200
Nickel	On site	30-45

4.0 Industrial Setting

4.1 Site History:-

Copies of old survey plans covering the site area & adjacent land are included in Appendix V and a summary of the site history based on these plans is provided in Table 4.1 below and on the following page.

Table 4.1

Date	Site	Adjacent Areas
c.1848 – c.1890.	The majority of the site is shown to be occupied by terraced houses .	An existing Munday Street and Pollard Street are recorded to the west and to the south, respectively. North-eastern area between c.50m and c.250m is recorded to be occupied by several industrial units including Pollard Street Iron Works recorded to the immediate east, Piercy Street Sizing Works , Piercy Street Foundry (iron) , Wellington Mills (cotton) , Phoenix Mills (cotton) , Rhodes Mill (cotton) , Cotton Mill , Hope Mills (cotton) , Beswick Street Mill and Hope Mills Gas Works . Further two cotton mills (Ancoat's Mill and Ancoat's Bank Mill) were recorded c.200m south west to the site. Soho Chemical Works , Soho Iron Works and Lowe Street Mill (cotton) were recorded c.80m south-west and west to the site. Manchester Flint Glass Works were recorded c.210m north west to the site.

Significant features / potential contamination sources highlighted in **bold**.

4.0 Industrial Setting (Cont'd)

4.1 Site History (Cont'd):-

Table 4.1 (Cont'd)

Date	Site	Adjacent Areas
c.1891 – c.1907.	Further terraced houses with associated infrastructure are recorded on the southern portion of the site.	A fire station and further residential dwellings are recorded c.20m to the west. A tramway is recorded on the Pollard Street. Ancoats Hospital is recorded c.100m north-west. The previously recorded Hope Mills (cotton) is now recorded as Ancoats Works (engineering) , Victoria Mills (cotton) are recorded c.80m north. Previously recorded Ancoat's Mill c.200m west is now shown as disused and previously recorded Soho Chemical Works c.80m south-west are now recorded as Vulcan Works (iron) . Previously recorded Piercy Street Sizing Works c.100m north-west are now recorded as Machine Works . A Wire Works were recorded c.250 north-west to the site. A hospital was recorded c.125m north-west to the site. A brewery is recorded c.50m south-east.
c.1908 – c.1947.	The site has undergone phases of demolition and construction and is shown to be a part of Granville Place. The site is occupied along the southern and western boundary by terraced houses , the remaining portion of the site is part of the open space / car parking / back gardens .	The previously recorded Cotton Mill at Ruthers Street c.80m north-east is recorded as disused. Previously recorded Cotton Mills and Vulcan Works (iron) c.80m south-west is now converted to a complex of Vulcan Works (iron) which later in this period changed its use to textile machinery Vulcan Works . A further Chain and Toy Balloon Works are recorded c.230m west and a Glass Works are recorded c.100m south.
c.1948 – c.1950.	The site is shown to remain unchanged.	Land reshaping / landscaping was recorded to the immediate north of site. A tank is recorded c.30m north-east to the site. A Chair Frame Factory is recorded c.20m west to the site. The previously recorded Machine Works c.100m north-west are now recorded as Mill Street Works (textile engineering) . Residential area c.100m east to the site undergone some demolition and construction phases. Previously recorded works c.120m north are now recorded as Oil and Tallow Works . A tank is recorded c.20m north-east to the site and the previously recorded brewery is no longer recorded.
c.1951 – c.1977.	The site is shown to remain unchanged.	Previously recorded Chain Works c.230m north-west are now recorded as Engineering Works , York Mill (cotton waste and bags etc.) and Laundry are recorded c.220mnorth-west.
c.1978 – c.1999.	The site has undergone demolition phase and is shown as unoccupied space.	The previously recorded York Mill (cotton waste and bags etc.) , Engineering Works and Laundry c.230m north-west are no longer present. Previously recorded Chemical Works and Engineering Works c.240m north-west are no longer present. Cotton Mills and Chair Frame Factory previously recorded c.20m to c.50m west are now no longer present and Glass Works previously recorded c.100m south are no longer present too. Victoria Mills previously recorded c.30m to c.80m north-east to north are now converted into Victoria Industrial Estate which undergone some building reshaping / demolition towards the end of this period.
c.2000 – c.2006.	The site is shown to remain unoccupied.	A large portion of the Victoria Industrial Estate was demolished. The warehouses recorded c.200m south-west undergone phases of demolition and new development. The previously recorded hospital c.125m north-west is no longer present. The previously recorded tank c.20m north-east is no longer present.

Significant features / potential contamination sources highlighted in **bold**.

4.0 Industrial Setting (Cont'd)

4.1 Site History (Cont'd):-

In accordance with published OS maps the site remains unchanged from c.2006 until c.2019 (present day). The East Manchester Metrolink rail is now recorded to the immediate north of the site boundary with associated metro station located c.80m west to the site. A new residential area is recorded c.20m north to the site comprising two multi-storey buildings and Milliners Wharf residential apartments.

From the reconnaissance (walkover) survey, the site is currently fenced off and the access can be obtained off Munday Street via a locked gate. Some demolition rubble (i.e. bricks, wood, broken glass, etc.) was noted on site as well as an area of tarmac surfacing along the northern site boundary.

4.2 Landfill & Waste:-

The information relating to Landfill and Waste has been obtained from the Envirocheck report (attached in Appendix V);

- There are no active BGS Recorded Landfill Sites, Historical Landfill Sites, Registered Landfill Sites or Local Authority Recorded Landfill Sites located within c.250m of the site boundary.
- There are no Licensed Waste Management Facilities recorded within c.250m of the site boundary.
- There are three Potentially Infilled Lands (water related) recorded within c.250m of the site boundary with the date of mapping c.1923 and c.1956. The infillings are not considered to represent a potential ground gas / hazardous gas generation due to the age of infilling.
- Made ground deposits were recorded to a depth of c.2.40m comprising firm brown sandy gravelly clay with fragments of brick, sandstone and limestone. Made ground also comprised of some 'ashy' soils and concrete rubble.

Considering the information reviewed and from the previous site investigation carried out by Arc Environmental, it is deemed that the site is not at risk of generating hazardous ground gases, therefore no gas monitoring wells are required for this site.

4.3 Statutory Requirements / Authorisations

Table 4.2

TYPE	Location	Comments
Local Authority Pollution Prevention and Controls	None recorded within c.250m.	~
Registered Radioactive Substances	None recorded within c.250m.	~
Prosecutions Relating to Authorised Processes	None recorded within c.250m.	~
Enforcement and Prohibition Notices	None recorded within c.250m.	~
Planning Hazardous Substances Consents / Enforcements	None recorded within c.250m.	~
COMAH/NIHHS Sites	None recorded within c.250m.	~
Contemporary Trade Entries	Seventeen recorded within c.250m.	Three entries are recorded as active and the remaining fourteen as inactive. The closest active entry is recorded c.185m north (soft furnishing – manufacturers). None of the recorded entries are considered to be attributable to this site.
Fuel Station Entries	None recorded within c.250m.	~

4.0 Industrial Setting (Cont'd)

4.4 Pollution Incidents and Discharge Consents

Table 4.3

TYPE	Location	Comments
Discharge Consents	One recorded within c.250m.	Discharge of Other Matter-Surface Water with receiving water Manchester & Ashton Canal. Authorisation for the discharge was revoked 01/07/1991.
Water Industry Act Referrals	None recorded within c.250m.	~
Prosecutions Relating to Controlled Waters	None recorded within c.250m.	~
Pollution Incidents to Controlled Waters	Four recorded within c.250m.	The nearest pollution incident was recorded c.70m north to the site and was classified as Category 3 – Minor Incident to freshwater stream/river. The catchment area is Ashton Canal and the pollutant is unknown. The incident is dated 24/05/1996.
Substantiated Pollution Incident Register	None recorded within c.250m.	~

5.0 Conceptual Site Model (CSM)

The Conceptual Site Model (CSM) is one of the primary planning tools that can be used to support the decision-making process of managing contaminated land and groundwater on any given site and allows a better understanding of what needs to be done to achieve risk management, and from this appropriate remediation techniques, if required for those risk management goals can be chosen.

This can be done by undertaking a *source-pathway-receptor* analysis of the site. The anticipated *sources*, *pathways* and *receptors* for this site are summarised in Table 5.1 below.

Table 5.1

<u>Sources (S)</u>	
S1	Made ground deposits recorded to depth of at least c.2.40m associated with historical activity on site.

<u>Pathways (P)</u>	
P1	Ingestion & Dermal Contact.
P2	Air – inhalation of vapours (indoor & outdoors) and contact with dust.
P3	Consumption of home-grown produce and attached soil.
P4	Migration through existing services.
P5	Direct contact with building materials.
P6	Surface run off and leachate migration.

<u>Receptors (R)</u>	
R1	Human health (Future end users and construction workers).
R2	Groundwater within the Secondary Undifferentiated Aquifer within the drift deposits, Principal Aquifer within solid geology and the Ashton Canal c.40m north-west.
R3	Adjacent sites.
R4	Building materials & protection of water pipes.*
R5	Flora and fauna.*

* = Not included in the Human Health & Controlled Waters Risk Assessment

A graphical representation of the CSM has been produced for this site and can be seen attached in Appendix VI, which also sets out the critical pollutant linkages of concern for this particular site, with regard to contamination as above.

5.0 Conceptual Site Model (CSM) (Cont'd)

5.1 Geotechnical Considerations:-

The following potential geotechnical issues and hazards have been identified for this site, and these issues should be considered before future development of the site is to take place;

- Actual thickness, origin, variability and condition of the made ground present below the site.
- Geotechnical parameters of drift deposits below the site.
- Stability of excavations.
- Control of surface drainage.
- The presence of buried services.
- Possibly buried foundation remains and / or cellar rooms.

To determine the geotechnical considerations above with more certainty, it is recommended that a programme of intrusive geotechnical investigation works is undertaken on this site with associated geotechnical testing, to aid in assessing the extent of any potential issues prior to commencing with any development in the future. Following this work detailed foundation proposals for the proposed development can then be prepared.

The information reviewed indicates that the site can be considered as being located within a
LOW to MODERATE geotechnical risk setting.

5.2 Sources of Contamination and Probable Contaminants:-

The historical Ordnance Survey maps, the Landmark Envirocheck Report and other environmental information show several development and demolition phases on site since c.1848. The development phases include residential properties dated as early as c.1848. Such buildings used to have basements / cellars, remains of which could potentially be present within the made ground deposits. In addition to this, if the remains of the former buildings are present within the made ground on the site then potential asbestos containing materials may be encountered during the future site works which may pose a risk to human health (i.e. workers).

However, according to the findings from Phase 2: Ground Investigation Report, ref.:13-898, from the results of the contamination screening including generic contaminants (inorganic metalloids), speciated PAH's, TPH's, BTEX (organic contaminants) and asbestos screening the Level 1 Risk Assessments was carried out which concluded that the made ground materials present on this site do not represent a significant risk to the end users.

Note, that the above conclusion was made based on the contamination results being assessed against a CLEA Risk Assessment Model for Human Health for *Commercial* end use category. Considering the proposed development has been classified as *Residential* end use, a re-assessment of the obtained results, dated March 2014, will need to be carried out as part of the Phase 2 Ground Investigation Report using CLEA Risk Assessment Model for Human Health for *Residential without home-grown produce* end use category.

Soils – Human Health:

Considering the information reviewed, it is felt that no further contamination testing is needed in relation to human health.

The information reviewed indicates that the site can be considered as being located within a
NEGLIGIBLE ground contamination risk setting for Human Health.

5.0 Conceptual Site Model (CSM) (Cont'd)

5.2 Sources of Contamination and Probable Contaminants (Cont'd):-

Groundwater / Leachate – Controlled Waters:

The following issues have been taken into consideration when assessing the risks towards groundwater / controlled waters;

- The site is not recorded as being within a Source Protection Zone (SPZ), and there are no SPZ's within c.1km of the site boundary.
- There are no Water Abstractions recorded on site or within c.500m of the site boundary.
- Groundwater beneath the site has been classified as Secondary Undifferentiated Aquifer within drift geology and Principal Aquifer within solid geology.

The information reviewed indicates that the site can be considered as being located within a **LOW** ground contamination risk setting for Controlled Waters.

6.0 Recommendations for Ground Investigation Works

The conclusions contained within this report have been based on a review of geological plans, historical plans and available environmental data relating to the site and nearby adjacent land and forms the basis of a preliminary risk assessment. The primary benefits of undertaking this report are as follows;

- (i) Identify the geotechnical and / or geo-environmental characteristics of the ground in sufficient detail to enable economic design of the proposed development, construction or remedial works.
- (ii) Minimise the risk of unforeseen ground conditions which might cause increased costs and / or programme (construction) delays at a later date.

Therefore, it is recommended that a phased programme of Ground Investigation (intrusive investigation) works are completed for this site to provide an assessment of the geotechnical and contamination characteristics of the site. These intrusive investigation works should be completed prior to commencing with any future development works and should include for the following or a similar scope of investigation works;

- Completion of series of deep boreholes (to a depth of c.25m depth) to aid foundation design.
- Appropriate geotechnical laboratory testing.
- Re-assessment of contamination test results based on a residential end-use.
- Completion of interpretative Ground Investigation Report.

The samples of soil collected should be forwarded to UKAS and MCERTS accredited laboratory to undertake the recommended testing.

END OF REPORT

GENERAL REFERENCES

- British Geological Survey: Maps, Reports, Memoirs, etc.
 - BGS Sheet 85, Manchester, Solid & Drift Editions, 1:50,000 & 1:63 360 scale, 2010 & 1970.
 - BGS Digital Mapping (Geoindex Onshore).
 - ArcGIS Mapping.
 - BGS Geology of Britain Viewer.
 - Coal Authority Online Interactive Map Viewer.
 - Phase 2: Ground Investigation Report by ARC Environmental, ref.: 13-898, Proposed Development, Milliners Wharf, Munday Street, Manchester M4 7BB, March 2014
 - RBH1 rotary borehole (report ref.: 13-898).
- Landmark Information Group Envirocheck Report, Reference: 192276069_1_1.
- Coal Authority Consultants Mining Report (ref. 51002002873001).
- DoE, DEFRA & EA - Contaminated Land Reports.

CLR 1: A framework for assessing the impact of contaminated land on groundwater and surface water. Report by Aspinwall & Co. Volumes 1 & 2. DoE, 1994.

CLR 2: Guidance on preliminary site inspection of contaminated land. Report by Applied Environmental Research Centre Ltd. Volume 1. DOE, 1994.

CLR 3: Documentary research on industrial sites. Report by RPS Group plc. DoE, 1994.

CLR 4: Sampling strategies for contaminated land. Report by The Centre for Research into the Built Environment, The Nottingham Trent University. DoE, 1994.

CLR 5: Information systems for land contamination. Report by Meta Generics Ltd. DoE, 1994.

CLR 6: Prioritisation & categorisation procedure for sites which may be contaminated. Report by M J Carter Associates. DoE, 1995.

CLR11: Model Procedures for the Management of Land Contamination. DEFRA/EA, 2004.

Science Report Final SC050021/SR2: Human Health Toxicological Assessment of Contaminants in Soils, 2009.

Science Report Final SC50021/SR3: Updated Technical Background to the CLEA Model, 2009.

Science Report SC050021/SR4: CLEA software (version 1.06) handbook, 2009.
- BS10175:2011+A2:2017: Investigation of Potentially Contaminated Sites – Code of Practice.
- BS8576:2013: Guidance on Investigations for Ground Gas, Permanent Gases and Volatile Organic Compounds (VOCs).
- BS5930:2015: Code of Practice for Site Investigations.
- BRE Digest BR211 (2015): Radon: Guidance on Protective Measures for New Buildings.
- Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D66, 2008 (NHBC, EA, CIEH).
- Methane and Associated Hazards to Construction - CIRIA Reports 149,150,151 & 152.
- Assessing Risks Posed by Hazardous Ground Gases to Buildings, CIRIA C665, 2007.
- BS8485: 2015: Code of Practise for the Characterization and Remediation from Ground Gas in Affected Developments.
- CIRIA Report C624 'Development and flood risk – guidance for the construction industry' and Planning Policy Statement 25 (PPS25).
- CIRIA Report C733 'Asbestos in Soil and Made Ground: a guide to understanding and managing risks'.

APPENDIX I

Location Plan

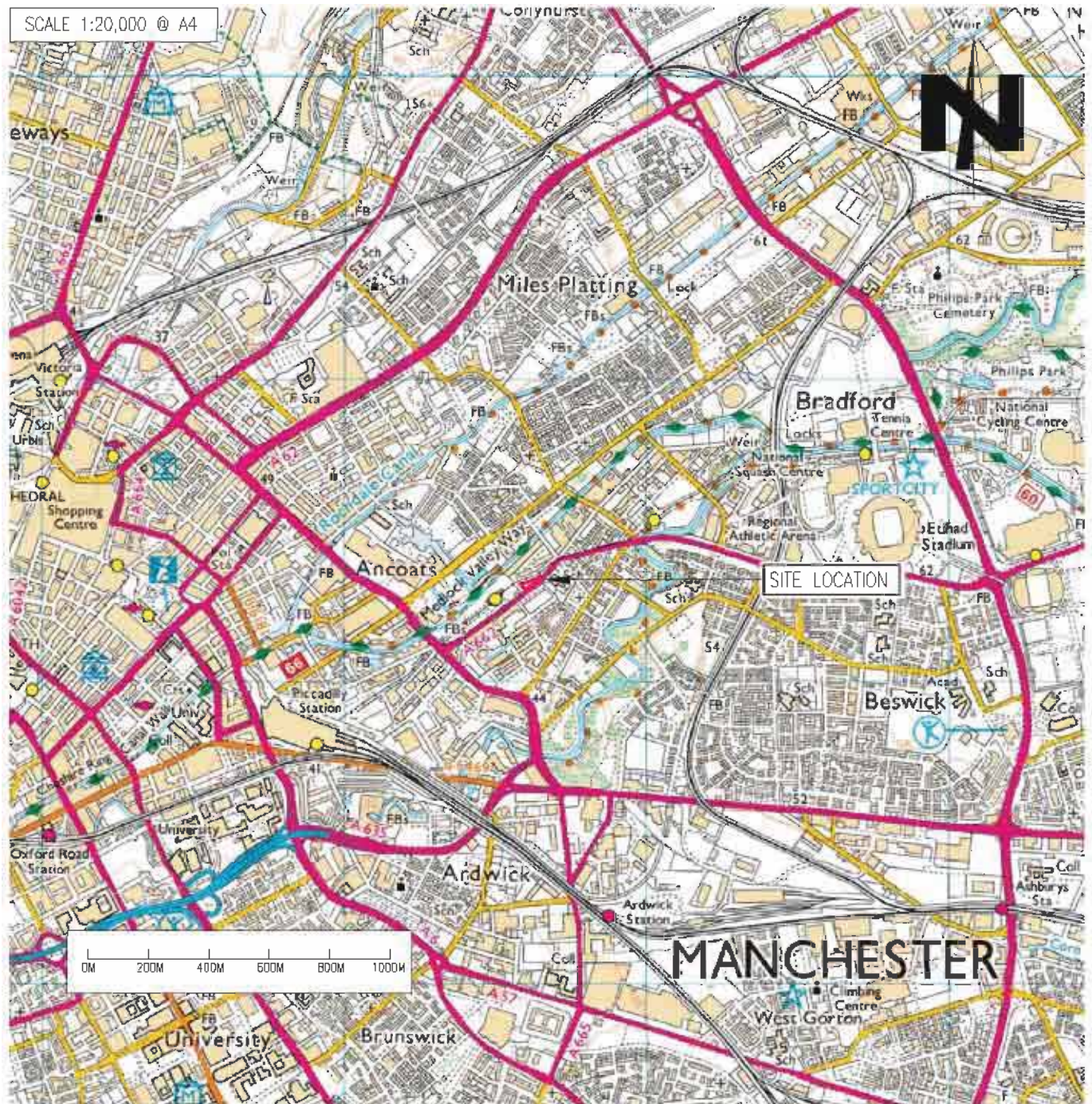
Aerial Photograph

Existing Site Layout Plan

Proposed Development Layout Plan

Site Observations – Site Photographic Record Sheet

SCALE 1:20,000 @ A4



Client:

**FAIRBRIAR HATBOX LIMITED /
SCARBOROUGH DEVELOPMENT GROUP**

Project Title:

Bowlers Yard
Land off Pollard Street
Manchester, M4 7BB

Drawing Title:

Location Plan

Job Reference:

18-831

Drawing Number:

-

Revision:

-

Drawn by:

P.D

Date:

28.01.19

Scale of A4:

As Shown

Checked by:

M.P

Approved by:

M.P

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rev.

date

amendments

drawn

photo

ARC ENVIRONMENTAL LTD

Solum House
Unit 1 Elliott Court
St. John's Road
Meadowfield
Durham
DH7 8PN

Tel: (0191) 378 6380

Fax: (0191) 378 0494

e-mail: admin@arc-environmental.com

web: www.arc-environmental.com





ARC ENVIRONMENTAL LTD

Solum House
Unit 1 Elliott Court
St. John's Road
Meadowfield
Durham, DH7 8PN
Tel: (0191) 378 6380
Fax: (0191) 378 0494
e-mail: admin@arc-environmental.com
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LEGEND	APPROXIMATE
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rev.	date	amendments	drawn	checked

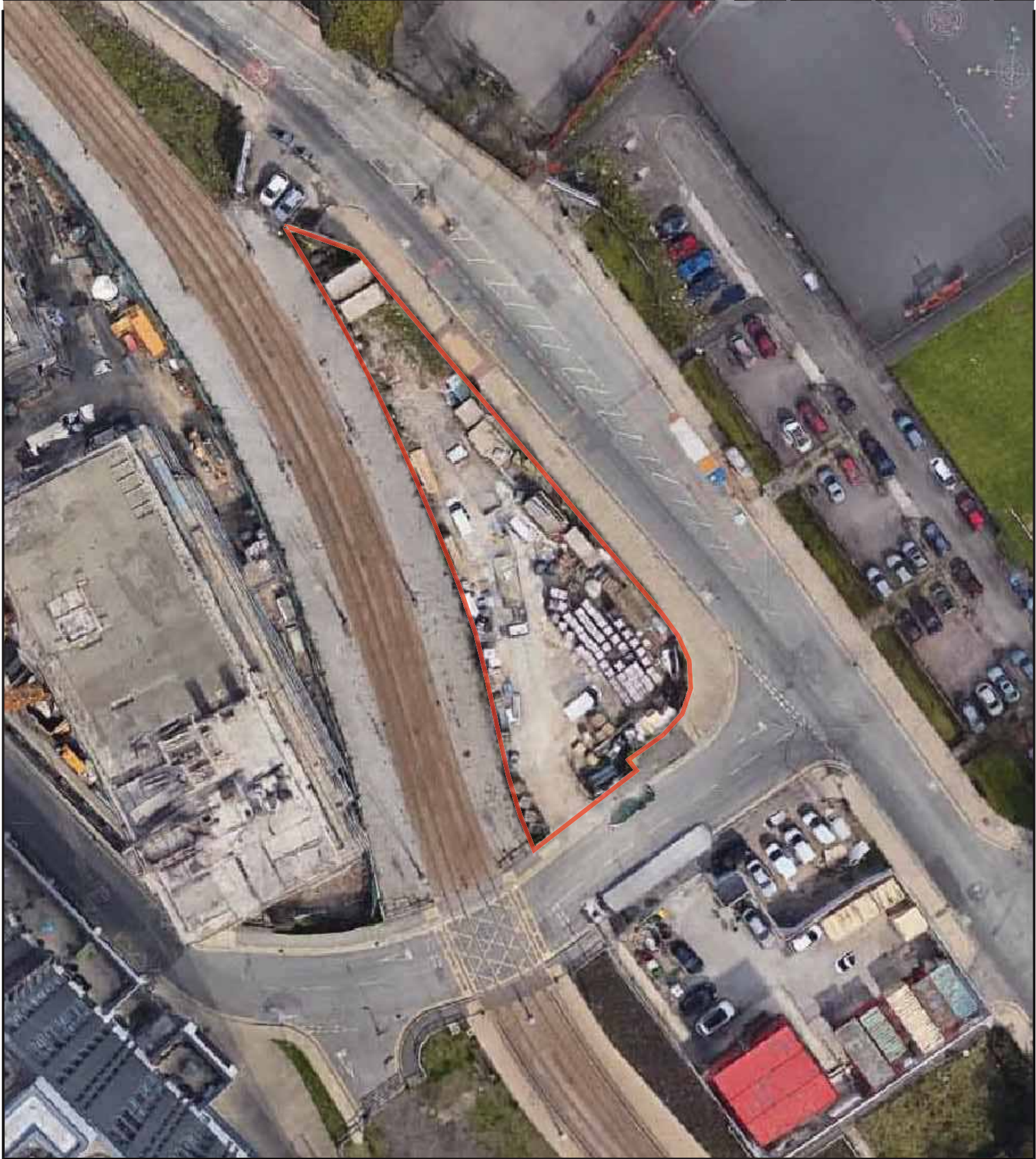
Client: **FAIRBRIAR HATBOX LIMITED /
SCARBOROUGH DEVELOPMENT GROUP**

Project Title:
Bowlers Yard
Land off Pollard Street
Manchester, M4 7BB

Drawing Title:
Aerial Photograph

Scale at A3: | Date: | Drawn by: | Approved by:
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Job Ref: | Drg no: | Rev:
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Solum House
Unit 1 Elliott Court
St. John's Road
Meadowfield
Durham, DH7 8PN
Tel: (0191) 378 6380
Fax: (0191) 378 0494
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LEGEND	
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Client:

ent: **FAIRBRIAR HATBOX LIMITED /
SCARBOROUGH DEVELOPMENT GROUP**

Project Title: Bowlers Yar

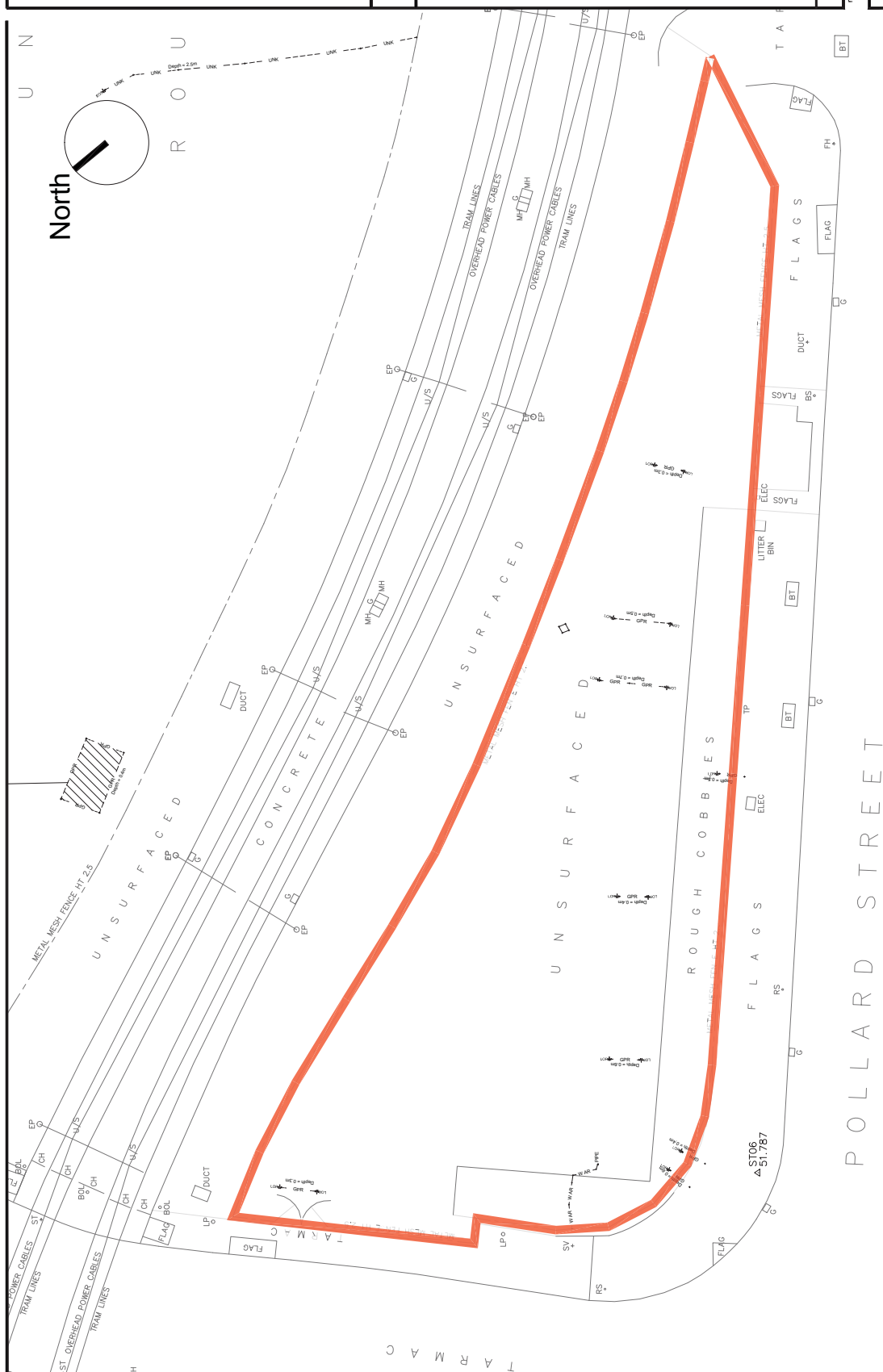
Land off Pollard Street
Manchester, M4 7BB

Drawing Title:

Existing Site Layout Plan

Scale at A3:	Date:	Drawn by:	Approved by:
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Job Ref: 18-831 Drg no: — Rev: —





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ARC ENVIRONMENTAL LTD

Solum House
Unit 1 Elliott Court
St. John's Road
Meadowfield
Durham, DH7 8PN
Tel: (0191) 378 6380
Fax: (0191) 378 0494
e-mail: admin@arc-environmental.com
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rev.	date	amendments	drawn checked

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SCARBOROUGH DEVELOPMENT GROUP

Project Title:
Bowlers Yard
Land off Pollard Street
Manchester, M4 7BB

Drawing Title:
Site Photographic Record Sheet

Scale at A3: | Date: | Drawn by: | Approved by:
NIS @ A3 28.01.19 P.D M.P

Job Ref: | Drg no: | Rev:
18-831 — —

APPENDIX II

QS Zero Dig Underground Utility Survey Plan

Survey Notes:

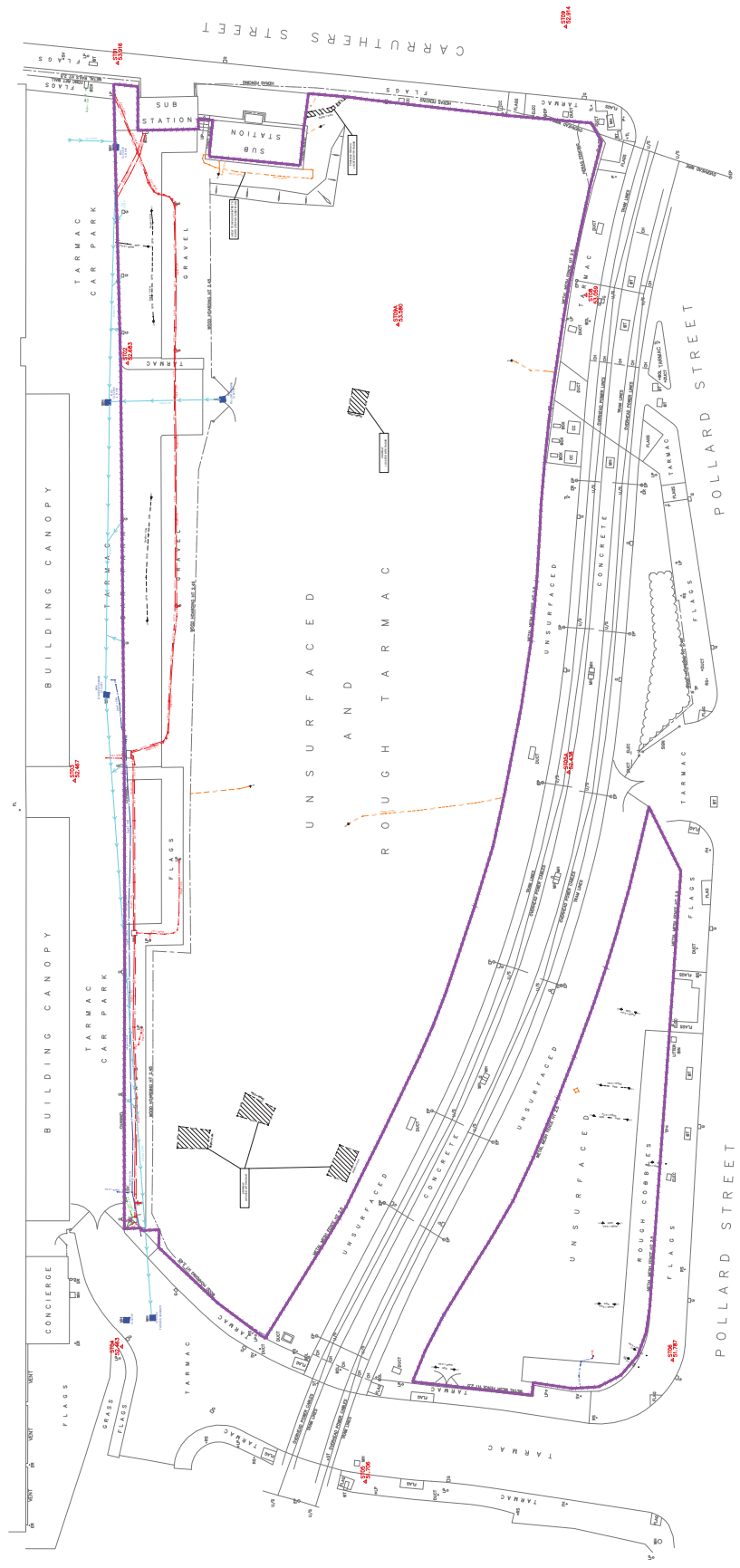



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 TS27 4SL
 T: 0191 646 9700
 E: info@quicksurvey.co.uk

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APPENDIX III

Coal Authority Consultants Coal Mining Report



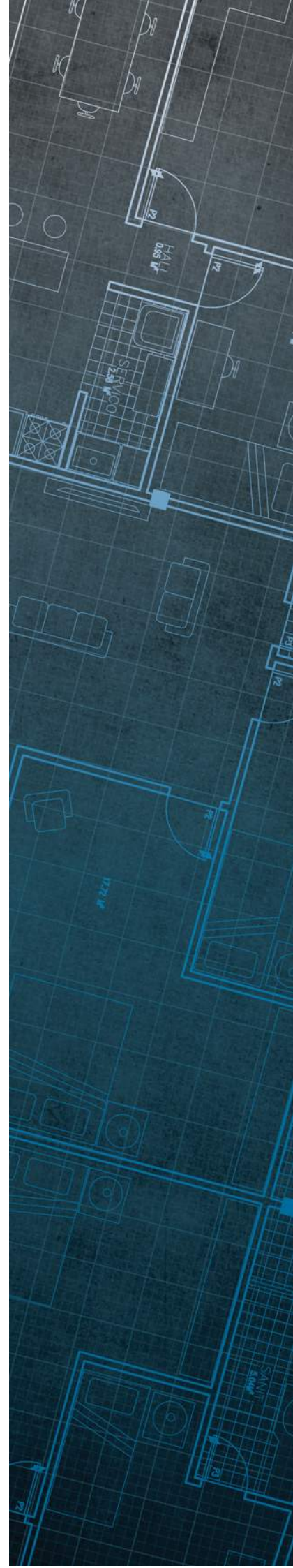
The Coal
Authority

Consultants Coal Mining Report

2 Munday Street
Manchester
M4 7BB

Date of enquiry:	28 January 2019
Date enquiry received:	28 January 2019
Issue date:	28 January 2019

Our reference:	51002002873001
Your reference:	18-831 MP



Consultants

Coal Mining Report

This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

ARC ENVIRONMENTAL LTD

Enquiry address

2 Munday Street
Manchester
M4 7BB

How to contact us

0345 762 6848 (UK)
+44 (0)1623 637 000 (International)

200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

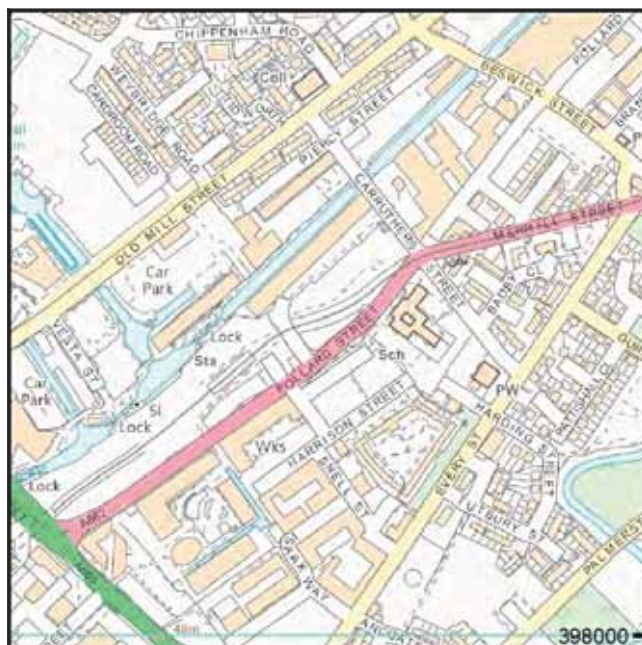
www.groundstability.com

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 /thecoalauthority



Approximate position of property



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Section 1 – Mining activity and geology

Past underground mining

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	BRADFORD FOUR FEET	Coal	35D3	321	South	12.0	South-West	120	1900
unnamed	BRADFORD FOUR FEET	Coal	35CT	374	Beneath Property	18.4	South-West	120	1900
unnamed	PARKER	Coal	35BO	708	North-East	18.0	South-West	80	1935
unnamed	PARKER	Coal	35BV	732	East	18.4	South-West	80	1935
unnamed	ROGER	Coal	35B1	983	East	17.5	South-West	180	1958
unnamed	CROMBOUK E	Coal	359E	1063	East	16.5	South-West	120	1932
unnamed	CROMBOUK E	Coal	359K	1064	East	13.3	South-West	120	1947
unnamed	ROGER	Coal	35B0	1088	East	19.0	South-West	180	1961
unnamed	ROGER	Coal	35B3	1093	East	15.9	South-West	180	1958

Probable unrecorded shallow workings

None.

Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

Mine entries

None recorded within 100 metres of the enquiry boundary.

Abandoned mine plan catalogue numbers

The following abandoned mine plan catalogue numbers intersect with some, or all, of the enquiry boundary:

11471	NW643	NW645
NW1167	2655	NW644

Please contact us on 0345 762 6848 to determine the exact abandoned mine plans you require based on your needs.

Outcrops

No outcrops recorded.

Geological faults, fissures and breaklines

No faults, fissures or breaklines recorded.

Opencast mines

None recorded within 500 metres of the enquiry boundary.

Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

Section 2 – Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

Site investigations

None recorded within 50 metres of the enquiry boundary.

Remediated sites

None recorded within 50 metres of the enquiry boundary.

Coal mining subsidence

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

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

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

Mine gas

None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining

None recorded.

Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

Court orders

None recorded.

Section 46 notices

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

Withdrawal of support notices

The property is in an area where a notice to withdraw support was given in 1955.

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

Payments to owners of former copyhold land

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

Section 4 – Further information

The following potential risks have been identified and as part of your risk assessment should be investigated further.

Development advice

The site is within an area of historical coal mining activity. Should you require advice and/or support on understanding the mining legacy, its risks to your development or what next steps you need to take, please contact us.

For further information on specific site or ground investigations in relation to any issues raised in Section 4, please call us on 0345 762 6848 or email us at groundstability@coal.gov.uk.

Section 5 – Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **call us on 0345 762 6848** or **email us at groundstability@coal.gov.uk**.

Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

Opencast mines

Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

Coal Authority managed tips

Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

Site investigations

Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

Remediated sites

Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

Coal mining subsidence

Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

Mine gas

Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission.

Mine water treatment schemes

Locations where the Coal Authority has constructed or operates assets that remove pollutants from mine water prior to the treated mine water being discharged into the receiving water body.

These schemes are part of the UK's strategy to meet the requirements of the Water Framework Directive. Schemes fall into 2 basic categories: Remedial – mitigating the impact of existing pollution or Preventative – preventing a future pollution incident.

Mine water treatment schemes generally consist of one or more primary settlement lagoons and one or more reed beds for secondary treatment. A small number are more specialised process treatment plants.

Future underground mining

Details of all planned underground mining relative to the enquiry boundary. Only those future workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination will be included.

Coal mining licensing

Details of all licenses issued by the Coal Authority either within or within 200 metres of the enquiry boundary in relation to the under taking of surface coal mining, underground coal mining or underground coal gasification.

Court orders

Orders in respect of the working of coal under the Mines (Working Facilities and Support) Acts of 1923 and 1966 or any statutory modification or amendment thereof.

Section 46 notices

Notice of proposals relating to underground coal mining operations that have been given under section 46 of the Coal Mining Subsidence Act 1991.

Withdrawal of support notices

Published notices of entitlement to withdraw support and the date of the notice. Details of any revocation notice withdrawing the entitlement to withdraw support given under Section 41 of the Coal Industry Act 1994.

Payment to owners of former copyhold land

Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.

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Approximate position of the enquiry boundary shown



APPENDIX IV

**Phase 2: Ground Investigation Report by ARC Environmental, ref.: 13-898,
Proposed Development, Milliners Wharf, Munday Street, Manchester
M4 7BB, March 2014**

Solum House
Unit 1 Elliott Court
St Johns Road
Meadowfield
Durham
DH7 8PN

Tel: (0191) 378 6380

Fax: (0191) 378 0494

e-mail: admin@arc-environmental.com

www.arc-environmental.com



PHASE 2: GROUND INVESTIGATION REPORT

VICTORIA MILLS DEVELOPMENT LTD

PROPOSED DEVELOPMENT

MILLINERS WHARF

MUNDAY STREET

MANCHESTER

M4 7BB

Project No: 13-898

Prepared By:

Matt Bradford

Date:

5th March 2014

Revision 1

A handwritten signature in dark ink, appearing to read 'Matt Bradford', written over a faint circular stamp.

25th March 2014

Approved By:

Kevin Moir

Date:

5th March 2014

A handwritten signature in dark ink, appearing to read 'Kevin Moir', written over a faint circular stamp.

25th March 2014

The information and/or advice contained in this Phase 2 Ground Investigation Report is based solely on, and is limited to, the boundaries of the site, the immediate area around the site, and the historical use(s) unless otherwise stated. This 'Report' has been prepared in order to collate information relating to the physical, environmental and industrial setting of the site, and to highlight, where possible, the likely problems that might be encountered when considering the future development of this site for the proposed end use. All comments, opinions, diagrams, cross sections and/or sketches contained within the report, and/or any configuration of the findings is conjectural and given for guidance only and confirmation of the anticipated ground conditions should be considered before development proceeds. Agreement for the use or copying of this report by any Third Party must be obtained in writing from Arc Environmental Limited (ARC). If a change in the proposed land use is envisaged, then a reassessment of the site should be carried out.

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GENERAL REFERENCES	Page 32



APPENDICES

Appendix I	Location Plan, Aerial Photograph, Existing & Proposed Site Layout Plans
Appendix II	Trial Pit and Borehole Location Plan and Trial Pit and Borehole Record Sheets
Appendix III	Gas and Water Monitoring Certificate
Appendix IV	Laboratory Results (Geotechnical & Ground Contamination)
Appendix V	Ground Contamination Risk Assessment Data: Methodology, Notes for Off-Site Disposal, CL:AIRE Statistical Analysis Sheets and Revised Conceptual Site Model (CSM)

1.0 Introduction

March 2014

As requested by BSCP Ltd on behalf of Victoria Mills Development Ltd and in conjunction with the Phase 1: Desk Top Study Report, completed for this site by Betts Associates Geo Environmental. (ref 12CHE061/DS, October 2012), Phase 2: Ground Investigation works have been carried out for a proposed development at Milliners Wharf on Munday Street in Manchester.

The recent construction of the East Manchester Metrolink has split the site into two separate sites, with two 8 / 9 storey residential apartment blocks proposed on the northern site and a single storey commercial building proposed on the southern site. For the purposes of this report the two portions of the site have been called Site A and Site B as detailed below (and on the attached plan in Appendix I);

- Site A - Larger northern site where two 8 / 9 storey residential apartment blocks are proposed (Buildings A & B)
- Site B – Smaller southern site where a single storey commercial building is proposed (Building C)

This Phase 2 intrusive investigation has been designed to provide an up to date and robust assessment of the ground contamination issues across both sites, for potential risks to Human Health and Controlled Waters, in addition to the potential geotechnical issues associated with the proposed development works, as highlighted from the results of the desk top study data.

The intrusive investigation works undertaken by Arc Environmental Limited comprised 7 no. windowless sampling boreholes (BH's 1 - 7) incorporating 3 no. combined gas and water monitoring wells, 12 no. mechanically excavated trial pits (TP's 1 – 12), 7 no. cable percussive boreholes (SA1, 2, 2A, 2B, 3, 3A & 4) and 3 no. rotary boreholes (RBH's 1 – 3). All of the investigation locations can be seen on the Trial Pit and Borehole Location Plan attached in Appendix II and this plan should be used for orientating purposes only, as the positions shown are approximate and the plan is not to a standard scale.

A summary of the investigation positions relevant to each site is given below;

- Site A – WS's 1 - 3 & 5 - 7, TP's 4 - 12, SA's 1 - 4 and RBH's 1 - 3.
- Site B – WS 4 & TP's 1 - 3.

2.0 Site Details

Table 2.1

Site Name & Address:	Milliners Wharf, Manchester.
National Grid Reference:	385628, 398375 – representative for the central part of the site.
Description of Location:	The site is located to the east of Manchester City Centre, adjacent to Pollard Street and in between Carruthers Street and Munday Street.
General Site Boundaries:	N = Existing Milliners Wharf comprising residential flats, W = Munday Street, S = Pollard Street & E = Carruthers Street. The East Manchester Metrolink splits the site in two running roughly east / west.
Site Setting:	The site is in a generally urban setting to the east of Manchester City Centre.
Adjacent Site Uses:	Residential and Commercial.
Ground Levels & General Topography:	The sites are generally level.
Site Surface(s):	The sites comprise unsurfaced and rough site surfacing with areas of concrete and tarmac hardstanding.
Above Ground Structures:	There are currently no above ground structures on either site.
Sub-surface Structures:	Buried cellar and basement features are present across both sites. Current and relic services are present below the proposed development also.

3.0 Scope of Works

The information contained in this report is limited to the boundary of Sites A & B as indicated on the Existing Site Layout Plan shown in Appendix I, in addition to those areas accessible during the ground investigation. The investigation positions have been located across both Sites A & B and when considering the full scope of the development any features and / or issues not specifically mentioned in this report cannot be assumed to have been covered.

Table 3.1

Client:	The Scarborough Group.
Project type:	It is proposed to construct two residential apartment blocks on Site A and an industrial unit on Site B.
Site Location plan:	See Appendix I.
Layout plan (existing):	See Appendix I.
Layout plan (proposed):	See Appendix I.
Intrusive Investigation Works:	7 no. windowless sampling boreholes (BH's 1 - 7). 3 no. combined ground gas and water monitoring installations (BH's 1, 3 & 7). 12 no. mechanically excavated trial pits (TP's 1 - 12). 7 no. cable percussive boreholes (SA 1, 2, 2A, 2B, 3, 3B & 4). 3 no. rotary boreholes (RBH's 1 - 3)
Laboratory Testing:	Geotechnical and Ground Contamination.
CLEA Classification:	Site A is being assessed as CLEA standard end use <i>Residential</i> . Site A is being assessed as CLEA standard end use <i>Commercial</i> .
Reporting:	Factual & Interpretative.

4.0 Ground Conditions

For an accurate description of the ground conditions encountered at each investigation position, reference should be made to the borehole and trial pit record sheets attached in Appendix II. It should be noted that there is always the possibility of variation in the ground conditions around and between the investigation locations.

4.1 Soil Profile:-

4.1.1 Site A:-

A summary of the soil profile on Site A can be seen in Table 4.1 below and continued on the following page.

Table 4.1 – Site A

BGL = Below ground level.

Type of Strata	Depths Recorded (BGL)	Description & General Comments
MADE GROUND (Variable)	From Ground Level to c.0.70m and c.3.70m	Tarmac, concrete, dolomitic limestone hardcore, sandy gravel, soft and firm sandy gravelly clay, clayey silty gravelly sand, loose sandy gravel, soft silty clay, firm sandy clay, clayey sandy gravel and clayey gravelly sand was encountered across Site A. Gravel was fine to coarse with many cobbles comprising brick, limestone, coal, concrete, ash, sandstone. Some glass, pottery, plastic, clothes, rag, metal and rope also noted. Relic brick walls were encountered in several positions across Site A with relic concrete sub floors encountered in TP7 at c.3.20m, TP10 at 1.20m, SA2 at 0.70m, SA2A at 1.90m and SA3 at 1.90m.

4.0 Ground Conditions (Cont'd)

4.1 Soil Profile (Cont'd):-

4.1.1 Site A (Cont'd):-

Table 4.1 – Site A (Cont'd)

BGL = Below ground level.

Type of Strata	Depths Recorded (BGL)	Description & General Comments
DRIFT GEOLOGY: (Glacial Till)	From c.0.70m and c.3.70m to c.18.10m and c.20.20m	Soft to and stiff (low to high strength) sandy gravelly CLAY, slightly laminated CLAY, silty CLAY was encountered below the made ground materials underlain by very dense SAND and GRAVEL and gravelly SAND from a depth of between c.13.50m and c.16.00m. Gravel is fine to coarse of sandstone and some coal. Cobbles noted. Some fine sand and gravel horizons were noted throughout the clay deposits.
SOLID GEOLOGY: (Collyhurst Sandstone Formation / Halesowen Formation)	From c.18.10m and c.20.20m to c.>25.20m	SANDSTONE with some mudstone bands and MUDSTONE with some sandstone bands were encountered below Site A.

As anticipated from historic land uses highlighted in the Phase 1: Desk Top Study Report, made ground was encountered up to a depth of c.3.70m across Site A. There were no visual or olfactory evidence of significant or 'gross' contamination (fuel, oils or asbestos) noted on or below the site during the ground investigation works. However, ash was noted within the made ground deposits across Site A.

4.1.2 Site B:-

A summary of the soil profile on Site B can be seen in Table 4.2 below.

Table 4.2 – Site B

BGL = Below ground level.

Type of Strata	Depths Recorded (BGL)	Description & General Comments
MADE GROUND (Variable)	From Ground Level to c.1.30m and c.>2.40m	Dolomitic limestone hardcore, concrete and soft and firm sandy gravelly clay was encountered across Site B. Gravel was fine to coarse with cobbles comprising brick, ash, pottery, concrete, sandstone and limestone. Some plastic also noted. Relic brick walls were encountered in TP1 with a relic concrete sub floor encountered in TP1 at c.2.40m. A c.300mm diameter pot lined 'well' feature was encountered in the side of the base wall of TP1 extending to c.4.20m and noted as dry.
DRIFT GEOLOGY: (Glacial Till)	From c.1.30m and c.1.70m to c.>3.90m	Firm and stiff (high strength) sandy gravelly CLAY. Gravel is fine to coarse of sandstone mudstone and some coal. Cobbles noted.
SOLID GEOLOGY: (Collyhurst Sandstone Formation / Halesowen Formation)	Not encountered during these intrusive works below Site B	From deep boreholes undertaken on Site A, sandstone / mudstone is anticipated to lie at a depth in excess of c.20.00m below the site.

As anticipated from historic land uses highlighted in the Phase 1: Desk Top Study Report, made ground was encountered up to a depth in excess of c.2.40m across Site B. There were no visual or olfactory evidence of significant or 'gross' contamination (fuel, oils or asbestos) noted on or below the site during the ground investigation works. However, ash was noted within the made ground deposits across Site B.

4.0 Ground Conditions (Cont'd)

4.2 Groundwater:-

During the investigation works, slight water ingresses were noted across both Sites with standing water recorded within TP10 at a depth of c.1.00. This water is likely to be trapped surface water within the made ground deposits rather than part of a shallow continuous groundwater table below the site. However, given the water ingresses noted below both Sites, groundwater should be taken into account when considering the construction process for the proposed development.

As such it would be prudent to allow for the introduction of temporary groundwater control techniques (i.e. sump pumping), in order to take care of any ingresses of groundwater, during the construction period, especially during the wetter periods of the year.

In order to carry out a programme of ground gas and water monitoring, combined monitoring wells were installed at the locations of BH's 1, 3 & 7, the results of which are discussed further in Section 5.2.

5.0 Insitu Testing & Sampling

5.1 Insitu Standard Penetration Tests:-

Insitu standard penetration tests (SPT's) were carried out on the made ground, drift and solid deposits encountered within the boreholes on Site A, in order to determine their relative strength using a normal split spoon sampler or a standard 60° cone penetrometer. The results are shown as blows on the graphic borehole record sheets, adjacent to the appropriate sample level and are also summarised in Table 5.1 below.

Table 5.1

Strata	Range of 'N' Values	Result Details
MADE GROUND:	1 - 8	Very loose and loose deposits.
DRIFT GEOLOGY: (Glacial Till)	8 - 50 Blows	Firm and stiff / very dense deposits
SOLID GEOLOGY: (Collyhurst Sandstone Formation / Halesowen Formation)	50 Blows	Weak deposits

SPT 'N' values of between 1 and 8 was recorded within the made ground deposits encountered across Site A, indicating very loose and loose deposits whilst SPT 'N' values ranging from 8 to 50 were recorded within the natural glacial till deposits, indicating firm and stiff / very dense deposits. 50 blows for limited penetration were recorded within the initial solid geology comprising sandstone indicating weak deposits.

5.2 Insitu Gas & Water Monitoring:-

Ground gas & water monitoring standpipes were installed within BH's 1, 3 & 7, primarily to check for the possible presence of hazardous ground gases, and to monitor any shallow water levels. A standard 50mm diameter HDPE standpipe, with gravel and geo-wrap surround, bentonite seal, gas valve cap and security cover, was installed within each borehole, and ground gas and water levels were allowed to reach equilibrium, prior to the first monitoring visit.

5.0 Insitu Testing & Sampling (Cont'd)

5.2 Insitu Gas & Water Monitoring (Cont'd):-

Monitoring was undertaken using a Gas Data GFM 430 / 435 series soil gas analyser, with integral flow meter, and a Geotechnical Instruments electronic dipmeter.

Based on the Phase 1: Desk Top Study Report and findings of the intrusive investigation works, in accordance with CIRIA Report C665, November 2007, Report Edition No. 04, March 2007 and BS8485:2007: Code of practice for the characterization and remediation from ground gas affected developments, it is felt that an adequate risk assessment can be undertaken based on the following limiting factors:

- The development has been considered as **moderate sensitivity** i.e. Flats type development (Tables 5.5a & 5.5b – Typical/Idealised frequency and period of monitoring, after Wilson et al, 2005).
- The risk associated with the generation potential of a source is considered as **low** (assessment based on the results of the Phase 1: Desk Top Study report combined with findings of intrusive works).
- Monitoring over a **minimum** of **three months** with **six recorded** readings (Tables 5.5a & 5.5b – Typical /idealised frequency and period of monitoring after Wilson et al, 2005).
- **Negligible** flow rates are recorded during the monitoring period (Table 8.5 – Modified Wilson & Card classification).

A summary of the results for the visits undertaken to date, compared with the 'inert' background gas levels is presented in Table 5.2 below, whilst copies of the monitoring certificate is attached in Appendix III. A further 4 no. monitoring visits have been scheduled and the results along with the final recommendations will be issued as an addendum report.

Table 5.2

Table 3.2

<u>Position</u>	<u>Date</u>	<u>Atmospheric Pressure (mbar)</u>	<u>Water (m bgl)</u>	<u>CH₄ (%v/v)</u>	<u>LEL (%v/v)</u>	<u>CO₂ (%v/v)</u>	<u>O₂ (%v/v)</u>	<u>Flow Rate (l/hr)</u>	
Background		~	~	0	0	0	21.0	<0.1	
BH1	17/02/14	998	1.03	0.0	0.0	0.1	20.0	<0.1	
BH3		997	Falling	3.50	0.0	0.0	0.1	19.8	<0.1
BH7		997		0.31	0.0	0.0	0.0	19.0	<0.1
BH1	25/02/14	987	1.13	0.0	0.0	0.1	20.0	<0.1	
BH3		986	Falling	3.45	0.0	0.0	0.0	20.1	<0.1
BH7		987		0.48	0.0	0.0	0.1	20.2	<0.1
4 no. outstanding visits to be completed – results to follow as Addendum Letter Report.									

Elevated levels shown **Bold**.

As can be seen from the results undertaken, no levels of Methane (CH₄) or have been recorded during the monitoring period completed to date. However, detectible concentrations of Carbon Dioxide (CO₂) have been recorded (to date), up to a maximum recorded level of 0.1% v/v, with associated depleted oxygen (O₂) concentrations (minimum 19.0% v/v). A negligible flow rate of <0.1l/hr has been recorded during the monitoring period undertaken to date. The two visits to date were noted at low and falling atmospheric pressures.

Based on the results undertaken to date, in accordance with CIRIA Report C665, a preliminary risk assessment has been completed for this site, by converting the results in Table 5.2 above to a gas screening value (GSV), calculated by multiplying the typical maximum gas concentrations with the recorded maximum positive flow rates (after Wilson & Card).

5.0 Insitu Testing (Cont'd)

5.2 Insitu Gas & Water Monitoring (Cont'd):-

Using the maximum values recorded, as no increased levels of Methane have been recorded to date, the gas screening value (GSV) for Carbon Dioxide only has been calculated, the results of which are shown below:

$$\text{Carbon Dioxide GSV} = 0.001 (0.1\%) \times 0.1 = 0.0001 \text{ l/hr}$$

When considering the gas screening value (GSV) for Carbon Dioxide, the GSV of 0.0001 l/hr falls below the lower target concentration of 0.07 l/hr and as such equates to a Characteristic Situation 1 (CS1), in accordance with Table 8.5 in CIRIA C665. Consequently, at this stage, based upon the results of this preliminary assessment, gas protective measures are unlikely to be required for the proposed developments on both Sites A and B.

However, as previously highlighted, a further four monitoring visits have been scheduled for this site and the final results along with the final recommendations will be issued as an addendum Letter Report.

From the results of the subsequent monitoring visits, water levels ranging from c.0.31m to c.3.50m have been recorded. Given the lack of standing water during the intrusive site works, it is felt that the water levels observed are anticipated to be trapped surface water within the monitoring boreholes rather than a continuous shallow water surface (water table). However, it would be prudent to allow for the introduction of temporary groundwater control measures, i.e. pumping equipment, in order to take care of any water ingresses, particularly during the wetter periods of the year.

5.3 In-situ Hand Shear Vane Tests:-

Insitu hand vane tests were carried out using a portable insitu hand vane tester on the natural clay soil deposits encountered across both Site A and B. The hand vane tester takes direct readings of shear strength. Three vane sizes allow for the direct determination of undrained shear strength of extremely low to high strength clays. The peak vane value is determined by a calibrated scale ring built into the head assembly. The cross handle is used both to push the vane to the desired test depth and apply the shearing torque.

5.3.1 Site A:-

The results of the insitu hand vane tests undertaken across Site A are summarised in Table 5.4 below and can also be found adjacent to the appropriate sample level, on the graphic record sheets.

Table 5.4

<u>Strata</u>	<u>Range of Shear Strength Values</u>	<u>Strength</u>
DRIFT GEOLOGY: (Glacial Till)	30kN/m ² to 130kN/m ²	Low to high strength (Soft to stiff)

As can be seen from the results of the tests carried out in the natural clay deposits across Site A, shear strength values of 30kN/m² to 130 kN/m² were recorded, indicating low to high strength (soft to stiff) deposits.

5.3.2 Site B:-

The results of the insitu hand vane tests undertaken across Site B are summarised in Table 5.5 on the following page and can also be found adjacent to the appropriate sample level, on the graphic record sheets.

5.0 Insitu Testing (Cont'd)

5.3 In-situ Hand Shear Vane Tests (Cont'd):-

5.3.2 Site B (Cont'd):-

Table 5.5

<u>Strata</u>	<u>Range of Shear Strength Values</u>	<u>Strength</u>
DRIFT GEOLOGY: (Glacial Till)	20kN/m ² to 130kN/m ²	Low to high strength (Soft to stiff)

As can be seen from the results of the tests carried out in the natural clay deposits across Site B, shear strength values of 20kN/m² to 130 kN/m² were recorded, indicating low to high strength (soft to stiff) deposits.

5.4 Determination of Insitu Equivalent CBR Tests:-

Insitu equivalent CBR tests were carried out using a MEXE Cone Penetrometer, in accordance with the manufacturer's instructions, in order to estimate the insitu CBR values of the initial made ground deposits, noted within the trial pits. In each case a series of tests were carried out and an average of the results noted can be seen on the graphic trial pit record sheets, adjacent to the appropriate sample level.

From the results of the tests completed across Site A, CBR values of 0.8% to 2.1% were recorded with an average or typical value across the site of 1.5%. Therefore, where the initial made ground deposits are to be used as an undisturbed subgrade, it is felt that a characteristic design CBR value of 1.5% can be taken across Site A.

From the results of the tests completed across Site B, CBR values of 0.9% to 1.2% were recorded with an average value across the site of 1.0%. Therefore, where the initial made ground deposits are to be used as an undisturbed subgrade, it is felt that a characteristic design CBR value of 1.0% can be taken across Site B.

However, it should be noted that the achievable CBR value for the made ground strata across both Site A & B, may improve under compaction/proof rolling, prior to emplacement of the stone sub-base, which will also help to identify any soft spots that may require re-compaction or digging out and replaced with additional compacted sub-base.

6.0 Laboratory Testing

All geotechnical testing is currently being carried out in accordance with BS1377:1990: Parts 1-9 by Professional Soils Laboratory Limited (PSL) of Doncaster, South Yorkshire (UKAS accredited). Ground contamination was undertaken by Chemtech Environmental of Consett, Co. Durham (UKAS & MCERTS accredited).

6.1 Determination of pH & SO₄:-

6.1.1 Site A:-

Representative samples (29 no.) of the made ground and natural deposits recovered from across Site A, were tested in order to determine their pH value and Soluble Sulphate (SO₄) levels. The results are shown in Table 6.1 on the following page and are also contained in the Chemtech Analytical Reports nos. 50181(2) & 50424, copies of which are attached in Appendix IV.

6.0 Laboratory Testing (Cont'd)

6.1 Determination of pH & SO₄ (Cont'd):-

6.1.1 Site A (Cont'd):-

Table 6.1

Position	Strata	Depth (m)	pH value	SO ₄ (mg/l)	Design SO ₄ Class	ACEC Class
TP4	MG	1.00	8.0	184	DS-1	AC-1
TP5	MG	0.50	7.9	1113	DS-2	AC-2
TP5	MG	1.50	8.2	532	DS-2	AC-2
TP6	MG	0.70	7.9	538	DS-2	AC-2
TP7	MG	0.70	7.7	1070	DS-2	AC-2
TP7	MG	2.00	7.8	2133	DS-2	AC-2
TP8	MG	0.50	7.2	821	DS-2	AC-2
TP9	MG	0.50	7.6	1165	DS-2	AC-2
TP9	MG	1.50	7.6	363	DS-1	AC-1
TP10	MG	0.50	8.1	159	DS-1	AC-1
TP11	MG	0.50	8.1	200	DS-1	AC-1
TP11	MG	2.00	7.9	738	DS-2	AC-2
TP12	MG	0.60	9.9	540	DS-2	AC-2
BH1	NS	3.50	8.0	103	DS-1	AC-1
BH2	NS	4.00	8.5	<10	DS-1	AC-1
BH5	NS	3.50	8.4	30	DS-1	AC-1
BH6	NS	3.00	8.0	122	DS-1	AC-1
BH7	NS	2.50	8.1	68	DS-1	AC-1
SA1	NS	5.50	8.2	63	DS-1	AC-1
SA1	NS	9.50	8.3	30	DS-1	AC-1
SA1	NS	14.50	8.1	45	DS-1	AC-1
SA2B	NS	5.00	8.2	62	DS-1	AC-1
SA2B	NS	8.50	8.2	56	DS-1	AC-1
SA2B	NS	11.00	8.2	51	DS-1	AC-1
SA3A	NS	5.00	8.2	19	DS-1	AC-1
SA3A	NS	8.50	8.3	19	DS-1	AC-1
SA4	NS	5.00	8.2	50	DS-1	AC-1
SA4	NS	8.00	8.2	27	DS-1	AC-1
SA4	NS	11.50	8.3	25	DS-1	AC-1

ACEC = Aggressive Chemical Environment for Concrete Site Classification. MG=Made Ground, NS=Natural Strata.

From these results it can be seen that the samples tested across Site A range in pH from 7.2 to 9.9 and the amount of Soluble Sulphate present falls between <10mg/l to 2133mg/l.

In accordance with BRE Special Digest 1: 2005 (3rd Edition) for brownfield locations, Site A can be given a classification of Class DS-2. When considering the nature of the materials tested and assuming mobile groundwater, the assessment of the Aggressive Chemical Environment for Concrete (ACEC) for Site A overall is AC-2.

6.1.2 Site B:-

Representative samples (5 no.) of the made ground and natural deposits recovered from across Site B, were tested in order to determine their pH value and Soluble Sulphate (SO₄) levels. The results are shown in Table 6.2 on the following page and are also contained in the Chemtech Analytical Reports nos. 50181(2) & 50424, copies of which are attached in Appendix IV.

6.0 Laboratory Testing (Cont'd)

6.1 Determination of pH & SO₄ (Cont'd):-

6.1.2 Site B (Cont'd):-

Table 6.1

Position	Strata	Depth (m)	pH value	SO ₄ (mg/l)	Design SO ₄ Class	ACEC Class
TP1	MG	0.50	8.2	28	DS-1	AC-1
TP1	MG	2.00	8.2	22	DS-1	AC-1
TP2	MG	0.50	8.0	51	DS-1	AC-1
TP3	MG	0.50	7.7	75	DS-1	AC-1
BH4	NS	2.50	8.3	78	DS-1	AC-1

From these results it can be seen that the samples tested across Site B range in pH from 7.7 to 8.3 and the amount of Soluble Sulphate present falls between 22mg/l to 78mg/l.

In accordance with BRE Special Digest 1: 2005 (3rd Edition) for brownfield locations, Site B can be given a classification of Class DS-1. When considering the nature of the materials tested and assuming mobile groundwater, the assessment of the Aggressive Chemical Environment for Concrete (ACEC) for Site B overall is AC-1.

6.2 Determination of Liquid & Plastic Limits:-

Representative samples (16 no.) of the natural clay deposits encountered across both sites were tested in order to determine their liquid and plastic limits, so these materials might be classified. The results can be seen in Table 6.2 below and are also attached in Appendix IV.

Table 6.2

Position	Depth (m)	M/C (%)	LL	PL	PI	Class	% Passing 425µm Sieve
BH1	2.50	21	43	21	22	CI	100
BH2	3.50	19	40	20	20	CI	97
BH3	4.00	29	45	22	23	CI	86
BH4	1.50	29	51	25	26	CH	87
BH6	2.00	22	47	23	24	CI	95
BH7	1.00	28	48	25	23	CI	100
BH7	4.00	20	34	17	17	CL	96
SA1	4.50-5.00	20	38	19	19	CI	96
SA2B	3.00-3.50	19	32	17	15	CL	95
SA2B	8.00	26	30	16	14	CL	87
SA2B	12.00-12.50	19	34	17	17	CL	96
SA2A	3.00-3.50	19	36	18	18	CI	86
SA2A	7.00	20	31	16	15	CL	96
SA2A	11.50	17	36	17	19	CI	97
SA4	6.00-6.50	19	34	17	17	CL	88
SA4	11.00	17	32	16	16	CL	95

M/C = Moisture Content, LL = Liquid Limit, PL = Plastic Limit, PI = Plasticity Index, NP= Non Plastic

From the results displayed in Table 6.2 above, it can be seen that the samples are of an inorganic nature, and when plotted on the plasticity chart, the results fall within the low, intermediate and high plasticity range and from the resulting plasticity indices, are of a low to moderate volume change potential, when taking into account the amount passing the 425µm sieve.

6.0 Laboratory Testing (Cont'd)

6.2 Determination of Liquid & Plastic Limits (Cont'd):-

Therefore, it can be seen that some of these materials may undergo changes in volume, if large changes in their natural moisture content were to occur due to seasonal variations or the like, and if new foundations are to be based within these materials, it is recommended that they are taken down to a minimum depth of 0.90m below finished ground levels.

An increase in this minimum depth may be required, if made ground is encountered or there is an increase in the depth to competent strata, and also if the proposed development is within close proximity to existing or envisaged vegetation, then an increase in the minimum foundation depth may also be required, even if trees are to be removed, in order to ensure no additional future shrinkage and swelling of these materials occurs. Reference should be made to BS5837: 2012, "Trees in Relation to Construction".

6.3 Undrained Shear Strength (Triaxial):-

In total 13 no. undisturbed samples of the natural clay deposits recovered during the investigation from across Site A were dispatched to the laboratory for examination and subsequent testing. The samples were tested at varying lateral pressures (reflecting insitu overburden pressure), in order to obtain their undrained shear strength (cohesion). The results obtained are shown in Table 6.3 below, along with the value of moisture contents (as received) and bulk densities, the angle of shearing resistance has been taken as zero, assuming fully saturated conditions.

Table 6.3

<u>Location</u>	<u>Depth(m)</u>	<u>M/C (%)</u>	<u>Bulk Density (Mg/m³)</u>	<u>Cu (kN/m²)</u>
SA1	3.00-3.45	17	2.16	160
SA1	6.00-6.45	16	2.15	111
SA1	9.00-9.45	15	2.11	151
SA1	12.00-12.45	16	2.19	120
SA1	15.00-15.45	26	2.05	117
SA2B	4.50-4.95	19	2.13	97
SA2B	7.50-7.95	15	2.18	116
SA2B	10.50-10.95	18	2.15	128
SA3A	4.50-4.95	21	2.08	68
SA3A	10.50-10.95	16	2.16	114
SA4	4.50-4.95	28	1.99	71
SA4	7.50-7.95	17	2.15	78
SA4	10.50-10.95	17	2.30	92

The undrained shear strength of the clays tested ranges from 68kN/m² to 160kN/m² and are classed as medium to high strength materials. These laboratory results/descriptions generally correspond with the field descriptions of these materials.

6.4 One Dimensional Consolidation Tests:-

Six representative samples of the natural clay deposits encountered across Site A were tested, in order to determine their one dimensional consolidation properties, using conventional front loading oedometers, with a five loading increment regime applied, to aid in subsequent settlement estimations and for classification.

6.0 Laboratory Testing (Cont'd)

6.4 One Dimensional Consolidation Tests (Cont'd):-

The tests were carried out in order to determine the initial and subsequent void ratio (e_o), coefficient of volume compressibility (m_v), and coefficient of consolidation (c_v), so that an assessment to the overall compressibility of these materials could be carried out. The results obtained can be seen on the one dimensional consolidation properties result sheets, attached in Appendix IV.

The results of the tests indicate that the m_v value, the void ratio change from effective original overburden pressure + 100 kN/m² additional imposed loading, range from 0.080 – 0.153 m²/MN. These results suggest low to medium compressibility for the natural clay deposits encountered. The C_v values recorded ranged between 1.36 – 24.71²/year. The results indicate low to medium plasticity, and correspond with the plasticity indices recorded in section 6.2.

6.5 Contamination Screening:-

Representative samples of the made ground encountered within the excavations from both Sites A & B, were passed onto Chemtech Environmental Ltd of Consett, Co. Durham so that generic and targeted soil contamination screening could be carried out. The results of all the testing can be found in the Chemtech Analytical Report. 50181(2) a copy of which can be found in Appendix IV.

Representative samples were screened using a standard generic contamination suite (based on the current CLEA SGV listed analytes with historical additions) which is used to assess typical made ground (disturbed natural strata mixed with anthropogenic debris) of an unknown source. In addition, a variety of additional targeted 'organic' soils and leachate screening was carried out based upon the historic uses of the site.

The total analysis carried out for both Sites is summarised below;

6.5.1 Soils:-

- 17 no. soil samples screened for a generic (metals and non organics) soil suite which includes the following determinands; Arsenic, Cadmium, Chromium (III & VI), Copper, Lead, Mercury, Nickel, Selenium, Zinc, Cyanide, pH, and Total Organic Carbon (TOC).
- 17 no. soil samples screened for Speciated Polycyclic Aromatic Hydrocarbons (PAH's) – based on the current USEPA 16 PAH's + Benzo(j)fluoranthene.
- 6 no. soil samples screened for Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOC's).
- 12 no. soil samples screened for Speciated Total Petroleum Hydrocarbons (TPH's - full Ali & Aro EC split), Benzene, Toluene, Ethylbenzene, m, p & o-Xylene (BTEX), Methyl tert-butyl ether (MTBE) and Phenols.
- 6 no. soil samples screened for Organochlorine & Organophosphate Pesticides (total)
- 2 no. soil samples screened for Polychlorinated Bi-Phenyls (PCB's).
- 17 no. soil samples screened for the presence of asbestos.

6.0 Laboratory Testing (Cont'd)

6.5 Contamination Screening:-

6.5.2 Leachate:-

- 5 no. soil samples were screened for a generic (metals and non organics) leachate suite which includes the following determinands; Arsenic, Boron, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Zinc, Cyanide, Sulphate, Sulphide, pH, and Total Organic Carbon (TOC).
- 5 no. soil samples were screened for Speciated Polycyclic Aromatic Hydrocarbons (PAH's) – based on the current USEPA 16 PAH's + Benzo(j)fluoranthene.
- 2 no. soil samples were screened for Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOC's).
- 5 no. soil samples were screened for Speciated Total Petroleum Hydrocarbons (TPH's - full Ali & Aro EC split), Benzene, Toluene, Ethylbenzene, m, p & o-Xylene (BTEX), Methyl tert-butyl ether (MTBE) and Phenols.
- 2 no. soil samples were screened for Organochlorine & Organophosphate Pesticides (total).

The contamination results have been used to carry out a preliminary Level 1 Quantitative Human Health & Groundwater Risk Assessment for the ground contamination present across both Sites, and are discussed in further detail in Section 7.0.

7.0 Level 1 Ground Contamination Risk Assessment

7.1 Methodology:-

Following completion of the contamination screening undertaken on various samples from across both Sites, a Level 1 quantitative ground contamination risk assessment has been undertaken for both Sites A & B, generally in accordance with CLR11: Model Procedures for the Management of Land Contamination. A detailed description of the Assessment Framework and Methodology used by ARC for these risk assessments can be found in Appendix V.

This quantitative ground contamination risk assessment uses the current UK practice for assessing the risks from land contamination, which is based on the established *source-pathway-receptor* pollutant linkage methodology and 'suitable for use' approach (Part IIA, EPA 1990 - inserted through Section 57 EA 1995).

Based on the Conceptual Site Model (CSM) for Sites A & B (described further in the following Section 7.2), a site specific screening strategy for both sites has been developed (see Section 7.3) and the risks from potential contaminants have been assessed for Human Health and Controlled Waters. The results of the risk assessment can be found in Sections 7.4, 7.5 & 7.6 (Human Health) and 7.7 (Controlled Waters). Comments regarding off-site disposal can also be found in Appendix V.

7.2 Conceptual Site Model (CSM):-

Following the results of the intrusive investigation works, a Conceptual Site Model (CSM) has been developed for both Sites, and is represented graphically in Appendix V. In addition, Table 7.1 on the following page summarises the various contaminant sources, plausible migration pathways and potentially sensitive receptors identified for both sites, assuming no remediation, additional protection measures and/or removal of the sources of contamination takes place.

7.0 Level 1 Ground Contamination Risk Assessment (Cont'd)

7.2 Conceptual Site Model (CSM) (Cont'd):-

Table 7.1

* = Not included as part of Level 1 Human Health or Controlled Waters risk assessment

	Sources (S)		Pathways (P)		Receptors (R)
S1	Made ground comprising disturbed natural strata and demolition fill with anthropogenic debris up to a depth of c.3.70m across Site A and in excess of c.2.40m across Site B.	P1	Ingestion	R1	Human Health (future site users)
		P2	Inhalation of indoor / outdoor air	R2	Deep groundwater (Secondary A)
S2	The historic and current adjacent electric sub-station adjacent to the north eastern margin of the site.	P3	Dermal contact	R3	Building materials *
		P4	Migration through existing services	R4	Adjacent sites
S3	Historic uses of the sites as a mill.	P5	Direct contact with building materials	R5	Flora and fauna*
S4	Potential for ground gas generation from made ground on the site.	P6	Infiltration and surface runoff	R6	Surface water (Canal) present c.38m north of the site

7.2.1 Sources:-

Both Sites are covered by a layer of made ground (ground level up to c.3.70m in thickness across Site A and in excess of c.2.40m across Site B) which represents a potential source of ground contamination for the Sites. The made ground generally comprises disturbed natural strata and demolition fill with anthropogenic debris. There was no visual or olfactory evidence of any contamination such as fuels, asbestos or the like. Owing to the historical use of the site as a mill, representative and targeted samples of the materials encountered have been assessed using appropriate soil screening suites including Pesticides, VOC's and SVOC's together with PCB's owing to the presence of current and historic sub stations.

The site is also deemed to be at a low risk from hazardous ground gas production from on site made ground although based upon the results of the preliminary gas monitoring assessment, gas protective measures are unlikely to be required for the proposed development.

7.2.2 Pathways:-

When considering the proposed end use (*Residential – Site A & Commercial – Site B*), and without considering treatment, removal or protection measures, there are some potential plausible pathways available for direct contact, dermal contact, ingestion, inhalation, wind (dust / particulate), volatilization, and vertical and lateral transportation below both Sites.

Within the CLEA Risk Assessment Model for Human Health, there are 3 exposure mediums considered for on site receptors, comprising ingestion of soil containing contaminants, inhalation of contaminated dust/vapours and dermal contact, with up to 10 no. exposure pathways considered, as shown below.

- 1. Ingestion of soil and indoor dust 2. Consumption of homegrown produce and attached soil 3. Dermal contact (indoor) 4. Dermal contact (outdoor) 5. Inhalation of dust (indoor) 6. Inhalation of dust (outdoor) 7. Inhalation of vapour (indoor) 8. Inhalation of vapour (outdoor) 9. Oral background intake 10. Inhalation background intake.

Where the future site has hard cover and below new structures, the majority of these pathways will not be available. When considering the potential pathways for leachate migration, where either hard cover and/or future surface water drainage systems are present, the potential effects of surface infiltration or contaminated surface water runoff will be greatly reduced.

7.0 Level 1 Ground Contamination Risk Assessment (Cont'd)

7.2 Conceptual Site Model (CSM) (Cont'd):-

7.2.2 Pathways (Cont'd):-

Similarly, when considering the construction work force, exposure pathways through direct contact, ingestion and dust inhalation will be available during part of the construction process, and therefore adequate PPE should be provided to protect the work force during this period.

7.2.3 Receptors:-

Within the CLEA Risk Assessment Model for Human Health, the potential receptors are assessed initially on site end use, followed by a delineation of age category (i.e. child or adult), with default settings for *Residential* and *Allotment* end uses based on a child aged 0 to 6 years, whilst *Commercial* end uses are based upon a working exposure period of up to 49 years (i.e. 16 to 65).

Key generic assumptions for *Residential* and *Commercial* end use are also based upon a typical residential property, consisting of a two-storey small terraced house, with private garden, and a typical commercial or light industrial property, consisting of a three-storey office building (pre-1970), respectively. No building is anticipated for *Allotment* end uses.

Within the published CLEA Risk Assessment Model for Human Health (Science Reports SC50021/SR2 & SC050021/SR3) there are 3 no. generic end use categories presently in use, as follows;

- 1) *Residential*, 2) *Allotments*, 3) *Commercial*

Therefore, for this Level 1 Risk Assessment, the best fit end use category for Site A has been taken as:

- 1) *Residential*

Whilst the best fit end use category for Site B has been taken as:

- 3) *Commercial*

For Controlled Waters and assuming a worst case scenario, the primary receptors for the Level 1 Risk Assessment are deep groundwater (Secondary A), although this is generally considered to be a low level of risk.

7.3 Screening Strategy:-

From the results of the intrusive works, the historic uses of the sites as a mill and the historic and current sub stations, samples of the made ground encountered across both Sites have been randomly chosen for screening, using a generic soil and leachate suite, to reflect the more homogeneous nature of the potential contaminants within the general matrix of the made ground / fill encountered.

There was no visual, olfactory or analytical evidence of significant heavy or gross contamination, such as waste oils, fuels, etc. or the like found across either Site. However, when considering the presence of ashy materials noted in the made ground encountered together with the history of the site, a variety of additional targeted 'organic' soils and leachate screening was also undertaken. There was no evidence of asbestos or asbestos containing materials (ACM's) within the made ground encountered across both Sites. However, it was felt prudent to undertake targeted screening for ACM's due to the historical uses of the site.

7.0 Level 1 Ground Contamination Risk Assessment (Cont'd)

7.4 Level 1 Human Health Risk Assessment (Soils) Generic Screening:-

The generic soil screening results from across Site A and B have been subjected to statistical analysis utilising the contaminated land statistical analysis sheets developed by CL:AIRE, (Contaminated Land: Applications in Real Environments) and a copy of the calculation sheet and the statistical methodology can be found in Appendix V.

7.4.1 Human Health - Generic Contaminants - Site A:-

The results of the analysis and risk assessment for Site A have been summarised in Table 7.2 below and have identified the following;

Table 7.2 – Generic Contaminants – Site A

Bold = Elevated result

Analyte	Critical Conc. (C _C) mg/kg	No. of Samples Screened	Max. Conc. (C _M) recorded mg/kg	Statistical Upper Confidence Limit (UCL _{0.95}) mg/kg	Has UCL _{0.95} exceeded C _C	No. of Samples > C _C	Is C _M an outlier (statistical hot spot)
Arsenic	32 ⁽¹⁾	13	35	24.1	NO	1	NO
Cadmium	10 ⁽¹⁾	13	1.8	1.1	NO	0	NO
Chromium III	3000 ⁽³⁾	13	301	184.4	NO	0	YES
Chromium VI	4.3 ⁽³⁾	13	<1	0.5	NO	0	NO
Copper	2330 ⁽³⁾	13	626	331.5	NO	0	YES
Lead	276 ⁽²⁾	13	503	381.7	YES	9	NO
Mercury	170 ⁽¹⁾	13	0.7	0.5	NO	0	NO
Nickel	130 ⁽¹⁾	13	127	74.6	NO	0	YES
Selenium	350 ⁽¹⁾	13	1.5	1.1	NO	0	NO
Zinc	3750 ⁽³⁾	13	542	384.2	NO	0	NO
Cyanide	34 ⁽²⁾	13	<2	1.0	NO	0	NO

⁽¹⁾ = CLEA SGV Values (Residential – Version 1.06), ⁽²⁾ = ATRISK^{SOIL} SSV (2011), ⁽³⁾ = LQM CIEH Generic Assessment Criteria Values, 2nd Edition (2009)

- The maximum concentration (C_M) value for Arsenic exceeds the chosen Critical Concentration (C_C) value for Site A. However, this does not represent a statistical outlier nor does the statistical upper confidence limit (UCL_{0.95}) value exceed the chosen C_C value for this site, and as such it is felt the UCL_{0.95} value can be taken as representative of the sample population as a whole.
- The C_M value for Lead exceeds the chosen C_C value for the site.
- None of the remaining C_M values for the analytes screened exceed the chosen C_C values for this site.
- The UCL_{0.95} values for Lead also exceeds the C_C value for this site.
- None of the remaining UCL_{0.95} values exceed the chosen C_C values for the site.
- The C_M value recorded for Chromium III, Copper and Nickel are recorded as statistical outliers. However, since neither the C_M value nor the calculated UCL_{0.95} value exceeds the C_C value, it is felt that these analytes do not represent a significant risk to future end users on Site A.
- None of the maximum concentrations recorded for the remaining analytes represent statistical 'hot spots', and therefore the UCL_{0.95} values calculated can be taken as representative of Zone A as a whole.
- Therefore, there is a requirement for either removal, treatment, protection measures and/or further risk assessment (DQRA), in order to protect the future end users with regard to Lead contamination.

7.0 Level 1 Ground Contamination Risk Assessment (Cont'd)

7.4 Level 1 Human Health Risk Assessment (Soils) Generic Screening (Cont'd):-

7.4.2 Human Health - Generic Contaminants - Site B:-

The results of the analysis and risk assessment for Site B have been summarised in Table 7.3 below and have identified the following;

Table 7.3 – Generic Contaminants – Site B

Bold = Elevated result

Analyte	Critical Conc. (C _C) mg/kg	No. of Samples Screened	Max. Conc. (C _M) recorded mg/kg	Statistical Upper Confidence Limit (UCL _{0.95}) mg/kg	Has UCL _{0.95} exceeded C _C	No. of Samples > C _C	Is C _M an outlier (statistical hot spot)
Arsenic	640 ⁽¹⁾	4	25	25.5	NO	0	NO
Cadmium	230 ⁽¹⁾	4	<0.2	0.1	NO	0	NO
Chromium III	30400 ⁽⁴⁾	4	119	117.3	NO	0	NO
Chromium VI	35 ⁽⁴⁾	4	<1	0.5	NO	0	NO
Copper	71700 ⁽⁴⁾	4	67	65.6	NO	0	NO
Lead	750 ⁽²⁾	4	252	229.3	NO	0	NO
Mercury	3600 ⁽¹⁾	4	0.7	0.7	NO	0	NO
Nickel	1800 ⁽¹⁾	4	45	44.6	NO	0	NO
Selenium	13000 ⁽¹⁾	4	1.1	1.1	NO	0	YES
Zinc	665000 ⁽⁴⁾	4	89	88.8	NO	0	NO
Cyanide	34 ⁽³⁾	4	<2	1.0	NO	0	NO

⁽¹⁾ = CLEA SGV Values (Commercial – Version 1.06), ⁽²⁾ = ATRISK^{SOIL} SSV (2011), ⁽³⁾ = LQM CIEH Generic Assessment Criteria Values, 2nd Edition (2009), ⁽⁴⁾ CLEA SGV (Commercial – Version 1.0 Beta)

- None of the C_M values nor the UCL_{0.95} values exceed the C_C values for Site B.
- The C_M value recorded for Selenium is recorded as a statistical outlier. However, since neither the C_M value nor the calculated UCL_{0.95} value exceeds the C_C value, it is felt that this analyte does not represent a significant risk to future end users.
- None of the maximum concentrations recorded for the remaining analytes represent statistical 'hot spots', and therefore the UCL_{0.95} values calculated can be taken as representative of Zone B as a whole.
- Therefore, it can be seen that there is no potential risk to the end users on Site B from the contaminants screened and there will be no requirement for removal, treatment, protection measures and/or further risk assessment (DQRA), in order to protect the future end users (i.e. no risk to human health) from the generic made ground encountered.

7.5 Level 1 Human Health Risk Assessment (Soils) Organic Screening:-

The organic soil screening results from the Sites A and B have been subjected to statistical analysis utilising the contaminated land statistical analysis sheets developed by CL:AIRE, and a copy of the calculation sheets and the statistical methodology can be found in Appendix V. Due to the nature of the potential contaminants present several of the suites of screening results from Sites A and B were not suitable for statistical analysis and therefore the maximum concentrations recorded have been assessed against the chosen C_C values for the site. For Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOC's) and pesticides, only the results above the detection limit have been included.

7.0 Level 1 Ground Contamination Risk Assessment (Cont'd)

7.5 Level 1 Human Health Risk Assessment (Soils) Organic Screening (Cont'd):-

7.5.1 Human Health – Organic Contaminants – Site A:-

The results of the analysis and risk assessment for Site A have been summarised in Tables 7.3 and 7.4 below and on the following page and have identified the following;

Table 7.3 – Organic Contaminants – Site A

Bold = Elevated result

Analyte	Critical Conc. (C _C) mg/kg	No. of Samples Screened	Max. Conc. (C _M) recorded mg/kg	Statistical Upper Confidence Limit (UCL _{0.95}) mg/kg	Has UCL _{0.95} exceeded C _C	No. of Samples > C _C	Is C _M an outlier (statistical hot spot)
Acenaphthene	1000 ⁽¹⁾	13	25.3	11.4	NO	0	NO
Acenaphthylene	850 ⁽¹⁾	13	0.3	0.2	NO	0	NO
Anthracene	9200 ⁽¹⁾	13	29.1	13.1	NO	0	NO
Benzo(a)anthracene	5.9 ⁽¹⁾	13	32.4	15.4	YES	2	NO
Benzo(a)pyrene	1.0 ⁽¹⁾	13	26.3	13.2	YES	11	NO
Benzo(b)fluoranthene	7.0 ⁽¹⁾	13	33.0	16.7	YES	2	NO
Benzo(ghi)perylene	47 ⁽¹⁾	13	19.7	9.9	NO	0	NO
Benzo(k)fluoranthene	10 ⁽¹⁾	13	12.9	6.6	YES	1	NO
Chrysene	9.3 ⁽¹⁾	13	34.9	16.9	YES	2	NO
Dibenz(ah)anthracene	0.9 ⁽¹⁾	13	3.9	2.0	YES	3	NO
Fluoranthene	670 ⁽¹⁾	13	90.4	42.5	NO	0	NO
Fluorene	780 ⁽¹⁾	13	16.1	7.4	NO	0	NO
Indeno(123cd)pyrene	4.2 ⁽¹⁾	13	19.3	9.3	YES	2	NO
Naphthalene	8.7 ⁽¹⁾	13	15.6	7.3	YES	1	NO
Phenanthrene	380 ⁽¹⁾	13	118.8	54.5	NO	0	NO
Pyrene	1600 ⁽¹⁾	13	75.9	36.2	NO	0	NO
TPH Aliphatic (EC5-EC6)	110 ⁽¹⁾	8	<0.1	0.1	NO	0	NO
TPH Aliphatic (EC6-EC8)	370 ⁽¹⁾	8	<0.1	0.1	NO	0	NO
TPH Aliphatic (EC8-EC10)	110 ⁽¹⁾	8	0.3	0.3	NO	0	NO
TPH Aliphatic (EC10-EC12)	540 ⁽¹⁾	8	3	2.4	NO	0	NO
TPH Aliphatic (EC12-EC16)	3000 ⁽¹⁾	8	20	15.9	NO	0	NO
TPH Aliphatic (EC16-EC35)	76000 ⁽¹⁾	8	501	380.3	NO	0	NO
TPH Aliphatic (EC35-EC44)	76000 ⁽¹⁾	8	75	45.5	NO	0	NO
TPH Aromatic (EC5-EC7)	280 ⁽¹⁾	8	<0.1	0.1	NO	0	YES
TPH Aromatic (EC7-EC8)	611 ⁽¹⁾	8	<0.1	0.1	NO	0	YES
TPH Aromatic (EC8-EC10)	151 ⁽¹⁾	8	<0.1	0.1	NO	0	YES
TPH Aromatic (EC10-EC12)	346 ⁽¹⁾	8	16	11.1	NO	0	YES
TPH Aromatic (EC12-EC16)	593 ⁽¹⁾	8	26	17.7	NO	0	YES
TPH Aromatic (EC16-EC21)	770 ⁽¹⁾	8	330	225.2	NO	0	YES
TPH Aromatic (EC21-EC35)	1230 ⁽¹⁾	8	169	117.3	NO	0	NO
TPH Aromatic (EC35-EC44)	1230 ⁽¹⁾	8	20	13.9	NO	0	YES

(1) = LQM CIEH Generic Assessment Criteria Values, 2nd Edition (2009) for Commercial 6% SOM

- The C_M values for Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenz(ah)anthracene, Indeno(123cd)pyrene and Naphthalene exceed the chosen C_C values for Site A.
- The C_M values for the remainder of the PAH's and all of the TPH's fall below the chosen C_C values for the site.

7.0 Level 1 Ground Contamination Risk Assessment (Cont'd)

7.5 Level 1 Human Health Risk Assessment (Soils) Organic Screening (Cont'd):-

7.5.1 Human Health – Organic Contaminants – Site A (Cont'd):-

- The $UCL_{0.95}$ values for Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Chrysene, Dibenz(ah)anthracene and Indeno(123cd)pyrene also exceed the C_C values for Site A.
- The C_M values recorded for Benzo(k)fluoranthene, Naphthalene TPH Aromatic (EC5-EC7), TPH Aromatic (EC7-EC8), TPH Aromatic (EC8-EC10), TPH Aromatic (EC10-EC12), TPH Aromatic (EC12-EC16), TPH Aromatic (EC16-EC21) and TPH Aromatic (EC35-EC44) are recorded as statistical outliers. However, since neither the C_M values nor the calculated $UCL_{0.95}$ values exceed the C_C values, it is felt that these analytes do not represent a significant risk to future end users.
- The $UCL_{0.95}$ values for the remainder of the PAH's and TPH's do not exceed the chosen C_C values for this site.
- None of the maximum concentrations recorded for the remaining analytes represent statistical 'hot spots', and therefore the $UCL_{0.95}$ values calculated can be taken as representative of Zone A as a whole.

Table 7.4 – Organic Contaminants – Site A

Bold = Elevated result

Analyte	Critical Conc. (C_C) mg/kg	No. of Samples Screened	Max. Conc. (C_M) recorded	Has C_M exceeded C_C	No. of Samples > C_C
2-Methylphenol	3100 ⁽¹⁾	4	0.3	NO	0
2-Methylnaphthalene	8.7 ^(#)	4	0.3	NO	0
Dibenzofuran	7.8 ⁽²⁾	4	0.4	NO	0
Azobenzene	5.1 ⁽²⁾	4	1.5	NO	0
Benzenes	0.33 ⁽³⁾	8	<0.01	NO	0
Toluene	610 ⁽³⁾	8	<0.01	NO	0
Ethylbenzene	350 ⁽³⁾	8	0.01	NO	0
m & p-Xylene	230 ⁽³⁾	8	0.01	NO	0
o-Xylene	250 ⁽³⁾	8	<0.01	NO	0

⁽¹⁾ = ATRISK^{SOIL} SSV (2009). ⁽²⁾ = USEPA Region 9 (November 2013), ⁽³⁾ = SGV values (2nd Edition, 2009) for Residential ^(#) = LQM CIEH Generic Assessment Criteria Value for Naphthalene used

- The C_M values for all of the BTEX, VOC, SVOC and pesticides analytes fall below the chosen C_C values for Site A.

From the above risk assessment, there is a requirement for either removal, treatment, protection measures and/or further risk assessment (DQRA), in order to protect the future end users with regard to PAH contamination across Site A.

7.5.2 Human Health – Organic Contaminants – Site B:-

The results of the analysis and risk assessment for Site B have been summarised in Tables 7.5 and 7.6 on the following pages and have identified the following;

- None of the C_M values nor the $UCL_{0.95}$ values exceed the C_C values for Site B.
- The C_M value recorded for Acenaphthylene, TPH Aliphatic (EC10-EC12) and TPH Aliphatic (EC12-EC16), are recorded as statistical outliers. However, since neither the C_M value nor the calculated $UCL_{0.95}$ value exceeds the C_C values, it is felt that these analytes do not represent a significant risk to future end users.

7.0 Level 1 Ground Contamination Risk Assessment (Cont'd)

7.5 Level 1 Human Health Risk Assessment (Soils) Organic Screening (Cont'd):-

7.5.2 Human Health – Organic Contaminants – Site B (Cont'd):-

Table 7.5 – Organic Contaminants – Site B

Bold = Elevated result

Analyte	Critical Conc. (C _C) mg/kg	No. of Samples Screened	Max. Conc. (C _M) recorded mg/kg	Statistical Upper Confidence Limit (UCL _{0.95}) mg/kg	Has UCL _{0.95} exceeded C _C	No. of Samples > C _C	Is C _M an outlier (statistical hot spot)
Acenaphthene	100000 ⁽¹⁾	4	0.09	0.1	NO	0	NO
Acenaphthylene	10000 ⁽¹⁾	4	0.03	0.1	NO	0	YES
Anthracene	5400 ⁽¹⁾	4	0.13	0.1	NO	0	NO
Benzo(a)anthracene	97 ⁽¹⁾	4	0.45	0.5	NO	0	NO
Benzo(a)pyrene	14 ⁽¹⁾	4	0.54	0.6	NO	0	NO
Benzo(b)fluoranthene	100 ⁽¹⁾	4	0.74	0.8	NO	0	NO
Benzo(ghi)perylene	650 ⁽¹⁾	4	0.42	0.4	NO	0	NO
Benzo(k)fluoranthene	140 ⁽¹⁾	4	0.29	0.3	NO	0	NO
Chrysene	140 ⁽¹⁾	4	0.60	0.6	NO	0	NO
Dibenz(ah)anthracene	13 ⁽¹⁾	4	0.02	0.1	NO	0	NO
Fluoranthene	23000 ⁽¹⁾	4	1.19	1.1	NO	0	NO
Fluorene	71000 ⁽¹⁾	4	0.07	0.1	NO	0	NO
Indeno(123cd)pyrene	62 ⁽¹⁾	4	0.28	0.3	NO	0	NO
Naphthalene	100 ⁽¹⁾	4	0.07	0.1	NO	0	NO
Phenanthrene	23000 ⁽¹⁾	4	0.81	0.7	NO	0	NO
Pyrene	54000 ⁽¹⁾	4	1.15	1.1	NO	0	NO
TPH Aliphatic (EC5-EC6)	130000 ⁽¹⁾	4	0.1	0.1	NO	0	NO
TPH Aliphatic (EC6-EC8)	42000 ⁽¹⁾	4	0.1	0.1	NO	0	NO
TPH Aliphatic (EC8-EC10)	12000 ⁽¹⁾	4	0.4	0.5	NO	0	NO
TPH Aliphatic (EC10-EC12)	49000 ⁽¹⁾	4	4	5.2	NO	0	YES
TPH Aliphatic (EC12-EC16)	91000 ⁽¹⁾	4	2	2.5	NO	0	YES
TPH Aliphatic (EC16-EC35)	1800000 ⁽¹⁾	4	8	8.0	NO	0	NO
TPH Aliphatic (EC35-EC44)	1800000 ⁽¹⁾	4	<1	0.5	NO	0	NO
TPH Aromatic (EC5-EC7)	90000 ⁽¹⁾	4	<0.01	0.1	NO	0	NO
TPH Aromatic (EC7-EC8)	190000 ⁽¹⁾	4	<0.01	0.1	NO	0	NO
TPH Aromatic (EC8-EC10)	18000 ⁽¹⁾	4	0.14	0.1	NO	0	NO
TPH Aromatic (EC10-EC12)	34500 ⁽¹⁾	4	<1	0.5	NO	0	NO
TPH Aromatic (EC12-EC16)	37800 ⁽¹⁾	4	<1	0.5	NO	0	NO
TPH Aromatic (EC16-EC21)	28000 ⁽¹⁾	4	3	2.9	NO	0	NO
TPH Aromatic (EC21-EC35)	28000 ⁽¹⁾	4	3	2.9	NO	0	NO
TPH Aromatic (EC35-EC44)	28000 ⁽¹⁾	4	<1	0.5	NO	0	NO

(1) = LQM CIEH Generic Assessment Criteria Values, 2nd Edition (2009) for Commercial 6% SOM

- None of the maximum concentrations recorded for the remaining analytes represent statistical 'hot spots', and therefore the UCL_{0.95} values calculated can be taken as representative of Zone B as a whole.
- Therefore, it can be seen that there is no potential risk to the end users on Site B from the contaminants screened and there will be no requirement for removal, treatment, protection measures and/or further risk assessment (DQRA), in order to protect the future end users (i.e. no risk to human health) from the generic made ground encountered.

7.0 Level 1 Ground Contamination Risk Assessment (Cont'd)

7.5 Level 1 Human Health Risk Assessment (Soils) Organic Screening (Cont'd):-

7.5.2 Human Health – Organic Contaminants – Site B (Cont'd):-

Table 7.6 – Organic Contaminants – Site B

Bold = Elevated result

<u>Analyte</u>	<u>Critical Conc. (C_C) mg/kg</u>	<u>No. of Samples Screened</u>	<u>Max. Conc. (C_M) recorded</u>	<u>Has C_M exceeded C_C</u>	<u>No. of Samples > C_C</u>
Benzene	95 ⁽¹⁾	4	<0.01	NO	0
Toluene	4400 ⁽¹⁾	4	<0.01	NO	0
Ethylbenzene	2800 ⁽¹⁾	4	0.03	NO	0
m & p-Xylene	3200 ⁽¹⁾	4	0.09	NO	0
o-Xylene	2600 ⁽¹⁾	4	0.02	NO	0

⁽¹⁾ = SGV values (2nd Edition, 2009) for *Commercial*

- The C_M values for all of the BTEX, VOC, SVOC and pesticides analytes fall below the chosen C_C values for Site A.

Therefore, it can be seen that there is no potential risk to the end users on Site B from the contaminants screened and there will be no requirement for removal, treatment, protection measures and/or further risk assessment (DQRA), in order to protect the future end users (i.e. no risk to human health) from the generic made ground encountered.

7.5.3 Human Health – Targeted PCB Screening:-

Due to the presence of an historic and adjacent current electric sub-station on Site A it was deemed prudent to complete screening for Polychlorinated biphenyls (PCB's) across Site A.

A summary of the results for the Level 1 Risk Assessment for PCB's has been compiled in Table 7.7 below.

Table 7.7 – Targeted PCB Screening – Site A

<u>Analyte</u>	<u>Critical Conc. (C_C) mg/kg</u>	<u>No. of Samples Screened</u>	<u>Max. Conc. (C_M) recorded</u>	<u>No. of Samples > C_C</u>
PCB Congener 28	0.01 ⁽¹⁾	2	<0.01	0
PCB Congener 52	0.01 ⁽¹⁾	2	<0.01	0
PCB Congener 101	0.01 ⁽¹⁾	2	<0.01	0
PCB Congener 118	0.01 ⁽¹⁾	2	<0.01	0
PCB Congener 138	0.01 ⁽¹⁾	2	<0.01	0
PCB Congener 153	0.01 ⁽¹⁾	2	<0.01	0
PCB Congener 180	0.01 ⁽¹⁾	2	<0.01	0

⁽¹⁾ = Detection Limit.

The results have identified the following:

- None of the C_M values recorded for any of the PCB's exceed the C_C values chosen for Site A.
- From these results it can be seen that the made ground in the proximity of the historic and current electric sub-station does not represent a risk with respect to the presence of PCB's.

7.0 Level 1 Ground Contamination Risk Assessment (Cont'd)

7.6 Level 1 Human Health Risk Assessment (Soils) Asbestos Screening:-

Due to the site history and presence of demolition fill encountered within the made ground across both Sites A & B, asbestos screening was undertaken on samples for laboratory analysis. It should be noted that asbestos containing materials (ACM's) were not visually identified at any locations across either Site during the fieldworks stage.

7.6.1 Human Health – Asbestos Screening – Site A:-

The results of the screening completed on the samples recovered from Site A are contained in Table 7.8 below.

Table 7.8 - Asbestos Screening – Site A

Position	Depth (m)	Chrysotile (white)	Amosite (brown)	Crocidolite (blue)	Anthophyllite	Actinolite	Tremolite	Asbestos Detected
TP4	1.00	YES	NAD	NAD	NAD	NAD	NAD	YES
TP5	0.50	YES	NAD	NAD	NAD	NAD	NAD	YES
TP5	1.50	NAD	NAD	NAD	NAD	NAD	NAD	NO
TP6	0.70	NAD	NAD	NAD	NAD	NAD	NAD	NO
TP7	0.70	NAD	YES	NAD	NAD	NAD	NAD	YES
TP7	2.00	NAD	NAD	NAD	NAD	NAD	NAD	NO
TP8	0.50	NAD	NAD	NAD	NAD	NAD	NAD	NO
TP9	0.50	NAD	NAD	NAD	NAD	NAD	NAD	NO
TP9	1.50	YES	YES	NAD	NAD	NAD	NAD	YES
TP10	0.50	NAD	NAD	NAD	NAD	NAD	NAD	NO
TP11	0.50	NAD	NAD	NAD	NAD	NAD	NAD	NO
TP11	2.00	YES	NAD	NAD	NAD	NAD	NAD	YES
TP12	0.60	YES	NAD	NAD	NAD	NAD	NAD	YES

NAD = No Asbestos Detected

The results have identified the following:

- The results of the Asbestos screening undertaken on the made ground on Site A has detected Chrysotile (white) and Amosite (brown).

Therefore, it is felt that adequate protection measures should still be incorporated in to the design of any future redevelopment works across Site A to negate the risks posed towards Human Health, if the made ground deposits are to remain on site.

7.6.2 Human Health – Asbestos Screening – Site B:-

The results of the screening completed on the samples recovered from Site B are contained in Table 7.9 below.

Table 7.9 – Asbestos Screening – Site B

Position	Depth (m)	Chrysotile (white)	Amosite (brown)	Crocidolite (blue)	Anthophyllite	Actinolite	Tremolite	Asbestos Detected
TP1	0.50	NAD	NAD	NAD	NAD	NAD	NAD	NO
TP1	2.00	NAD	NAD	NAD	NAD	NAD	NAD	NO
TP2	0.50	NAD	NAD	NAD	NAD	NAD	NAD	NO
TP3	0.50	NAD	NAD	NAD	NAD	NAD	NAD	NO

NAD = No Asbestos Detected

7.0 Level 1 Ground Contamination Risk Assessment (Cont'd)

7.6 Level 1 Human Health Risk Assessment (Soils) Asbestos Screening:-

7.6.2 Human Health – Asbestos Screening – Site B (Cont'd):-

The results have identified the following;

- The results have confirmed that no asbestos fibres were detected within the samples of made ground tested across Site B

Therefore, there is deemed to be no requirement to protect the future end users with regard to asbestos across Site B.

7.7 Level 1 Risk Assessment (Leachate):-

Based on the results of the soils screening carried out on the various samples chosen, leachate screening has also been carried out on five samples from Site A and the results have been used to complete a Level 1 Risk Assessment for the potential impact on controlled waters. The results have been assessed against appropriate EQS Freshwater and Drinking Water Standards and are summarised in Table 7.10 below and on the following page. For Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOC's) and pesticides, only the results above the detection limit have been included.

Table 7.10 Leachate Screening Site A

Analyte	Critical Conc. (C _C) µg/l	No. of Samples Screened	Max. Conc. (C _M) recorded	Has C _M exceeded C _C	No. of Samples > C _C
Arsenic	50 ⁽¹⁾	5	5.51	NO	0
Boron	1000 ⁽²⁾	5	76	NO	0
Cadmium	5 ⁽²⁾	5	<0.07	NO	0
Chromium	50 ⁽²⁾	5	11.8	NO	0
Copper	2000 ⁽²⁾	5	8.9	NO	0
Lead	25 ⁽²⁾	5	8.2	NO	0
Mercury	1 ⁽²⁾	5	<0.008	NO	0
Nickel	20 ⁽²⁾	5	3.0	NO	0
Selenium	10 ⁽²⁾	5	0.7	NO	0
Zinc	5000 ⁽²⁾	5	5	NO	0
Sulphate	250mg/l ⁽¹⁾	5	173	NO	0
Cyanide	50 ⁽²⁾	5	<20	NO	0
Acenaphthene	0.1 ⁽²⁾	5	<0.1	NO	0
Acenaphthylene	0.1 ⁽²⁾	5	<0.1	NO	0
Anthracene	0.1 ⁽²⁾	5	<0.1	NO	0
Benzo(a)anthracene	0.1 ⁽²⁾	5	<0.1	NO	0
Benzo(a)pyrene	0.1 ⁽²⁾	5	<0.1	NO	0
Benzo(b)fluoranthene	0.1 ⁽²⁾	5	<0.1	NO	0
Benzo(ghi)perylene	0.1 ⁽²⁾	5	<0.1	NO	0
Benzo(k)fluoranthene	0.1 ⁽²⁾	5	<0.1	NO	0
Chrysene	0.1 ⁽²⁾	5	<0.1	NO	0
Dibenz(ah)anthracene	0.1 ⁽²⁾	5	<0.1	NO	0
Fluoranthene	0.1 ⁽²⁾	5	<0.1	NO	0
Fluorene	0.1 ⁽²⁾	5	<0.1	NO	0
Indeno(123cd)pyrene	0.1 ⁽²⁾	5	<0.1	NO	0
Naphthalene	10 ⁽¹⁾	5	1.2	NO	0
Phenanthrene	0.1 ⁽²⁾	5	<0.1	NO	0
Pyrene	0.1 ⁽²⁾	5	<0.1	NO	0

⁽¹⁾ = EQS UK freshwater, ⁽²⁾ = EQS Drinking water, ⁽³⁾ = Detection Limit,

7.0 Level 1 Ground Contamination Risk Assessment (Cont'd)

7.7 Level 1 Risk Assessment (Leachate):-

Table 7.10 Leachate Screening Site A (Cont'd)

Analyte	Critical Conc. (C _c) µg/l	No. of Samples Screened	Max. Conc. (C _M) recorded	Has C _M exceeded C _c	No. of Samples > C _c
Benzene	30 ⁽¹⁾	5	<1	NO	0
Toluene	50 ⁽¹⁾	5	<1	NO	0
Ethylbenzene	200 ⁽¹⁾	5	<1	NO	0
m & p-Xylene	30 ⁽¹⁾	5	<1	NO	0
o-Xylene	30 ⁽¹⁾	5	<1	NO	0
TPH Aliphatic EC5-EC6	10 ⁽¹⁾	5	<1	NO	0
TPH Aliphatic EC6-EC8	10 ⁽¹⁾	5	<1	NO	0
TPH Aliphatic EC8-EC10	10 ⁽¹⁾	5	<1	NO	0
TPH Aliphatic EC10-EC12	10 ⁽¹⁾	5	<1	NO	0
TPH Aliphatic EC12-EC16	10 ⁽¹⁾	5	<1	NO	0
TPH Aliphatic EC16-EC35	10 ⁽¹⁾	5	5	NO	0
TPH Aliphatic EC35-EC44	10 ⁽¹⁾	5	<1	NO	0
TPH Aromatic EC5-EC7	10 ⁽¹⁾	5	<1	NO	0
TPH Aromatic EC7-EC8	10 ⁽¹⁾	5	<1	NO	0
TPH Aromatic EC8-EC10	10 ⁽¹⁾	5	<1	NO	0
TPH Aromatic EC10-EC12	10 ⁽¹⁾	5	<1	NO	0
TPH Aromatic EC12-EC16	10 ⁽¹⁾	5	<1	NO	0
TPH Aromatic EC16-EC21	10 ⁽¹⁾	5	<1	NO	0
TPH Aromatic EC21-EC35	10 ⁽¹⁾	5	<1	NO	0
TPH Aromatic EC35-EC44	10 ⁽¹⁾	5	<1	NO	0

⁽¹⁾ = EQS UK freshwater, ⁽²⁾ = EQS Drinking water, ⁽³⁾ = Detection Limit,

The results have identified the following:

- None of the generic analytes, speciated PAH's or TPH's, BTEX, VOC, SVOC and pesticides analytes screened exceed the chosen C_c values for this site.
- When considering these results, the made ground materials below Site A do not represent a significant risk to controlled waters.

8.0 Conclusions & Recommendations

8.1 Ground Conditions:-

8.1.1 Site A:-

Made ground comprising tarmac, concrete, dolomitic limestone hardcore, sandy gravel, soft and firm sandy gravelly clay, clayey silty gravelly sand, loose sandy gravel, soft silty clay, firm sandy clay, clayey sandy gravel and clayey gravelly sand was encountered across Site A to a maximum depth of c.3.70m. Gravel was fine to coarse with many cobbles comprising brick, limestone, coal, concrete, ash, sandstone. Some glass, pottery, plastic, clothes, rag, metal and rope also noted. Relic brick walls were encountered in several positions across Site A with relic concrete sub floors encountered in TP7 at c.3.20m, TP10 at 1.20m, SA2 at 0.70m, SA2A at 1.90m and SA3 at 1.90m.

8.0 Conclusions & Recommendations (Cont'd)

8.1 Ground Conditions (Cont'd):-

8.1.1 Site A (Cont'd):-

Natural deposits comprising soft to and stiff (low to high strength) sandy gravelly clay, slightly laminated clay, silty clay was encountered below the made ground materials underlain by very dense sand and gravel and gravelly sand from a depth of between c.13.50m and c.16.00m. Gravel is fine to coarse of sandstone and some coal and cobbles noted. Some fine sand and gravel horizons were noted throughout the clay deposits.

Solid deposits comprising sandstone and mudstone were encountered below Site A from a depth of between c.18.10m and c.20.20m to c.>25.20m.

8.1.2 Site B:-

Made ground comprising dolomitic limestone hardcore, concrete and soft and firm sandy gravelly clay was encountered across Site B to a depth in excess of c.2.40m. Gravel was fine to coarse with cobbles comprising brick, ash, pottery, concrete, sandstone and limestone. Some plastic was also noted. Relic brick walls were encountered in TP1 with a relic concrete sub floor encountered in TP1 at c.2.40m. A c.300mm diameter pot lined 'well' feature was encountered in the side of the base wall of TP1 extending to c.4.20m, which was noted as dry.

Natural deposits comprising firm and stiff (high strength) sandy gravelly clay was encountered from a depth of c.1.30m and c.1.70m to a depth in excess of c.3.90m. Gravel is fine to coarse of sandstone mudstone and some coal and cobbles noted.

Solid deposits were not encountered below Site B. However, from the deep boreholes undertaken across Site A sandstone and mudstone is anticipated to lie at a depth in excess of c.20.00m below Site B.

8.2 Groundwater:-

Ingresses of water were recorded within several of the excavations across both Sites. It is anticipated that this is trapped surface water and not part of a continuous groundwater table. Some further unrecorded local pockets of trapped surface water may also be present, particularly after periods of heavy rain, and this should also be taken into account when considering the construction process for the proposed development.

In order to take care of any localised ingresses of surface water, during the construction period, it would be prudent to allow for the introduction of temporary groundwater control techniques (i.e. sump pumping), especially during the wetter periods of the year.

From the results of the subsequent monitoring visit, water levels ranged from c.0.31m to c.3.50m. It is therefore considered prudent to allow for the introduction of temporary groundwater control techniques (i.e. pumping equipment), in order to take care of any ingresses of groundwater which may occur, during the construction period, especially if construction takes place during the wetter periods of the year.

8.0 Conclusions & Recommendations (Cont'd)

8.3 Foundation Options:-

8.3.1 Site A:-

Given the nature of the proposed development on Site A comprising multi-storey residential apartment blocks and the anticipated high loadings required, the preferred foundation option for the proposed development is bored / continuous flight auger piles. Due to the numerous types of pile, and methods of installation, the information contained within this report will need to be passed onto specialist piling contractors, so they can design and price a suitable scheme.

Obstructions within the made ground and drift deposits should be anticipated during piling. For example, relic concrete sub floors and relic foundations were encountered across Site A.

There may be a requirement for pre-auguring or local excavation and removal of obstructions and this will need to be considered as part of any piling scheme.

Due to the thicknesses of made ground encountered, consideration should be given to the effects of negative skin friction on piled foundations where they come into contact with the remaining made ground.

Where any made ground materials are utilised as an undisturbed sub-grade for the design and construction of any new areas of hardstanding, car parking, access roads and/or ground bearing floor slabs, it is felt that a characteristic design CBR value of 1.5% should not be exceeded across Site A.

8.3.2 Site B:-

With regards to new foundations across Site B, it can be seen that in and around the areas of the proposed development, made ground was recorded to a depth in excess of c.2.40m below existing ground levels, before natural drift deposits were recorded.

Conventional shallow strip or pad foundations located on firm and stiff natural sandy gravelly clay should provide a competent bearing horizon to carry the foundations of the proposed commercial unit where a maximum allowable bearing pressure of 175kN/m² should not be exceeded.

Deeper foundations will be required where localised deep made ground is encountered. In this instance, foundations should be taken down through the made ground and based wholly within the firm and stiff natural clay. Excavation depths in the order of c.1.30m to c.2.40m are anticipated from current ground levels.

Where any made ground materials are utilised as an undisturbed sub-grade for the design and construction of any new areas of hardstanding, car parking, access roads and/or ground bearing floor slabs, it is felt that a characteristic design CBR value of 1.0% should not be exceeded across Site B.

During the construction phase, it may also be beneficial for a suitably qualified Geotechnical Engineer / Engineering Geologist to attend site and confirm the correct founding strata has been achieved within all foundation excavations, as localised variations in the type and nature of the upper ground conditions have been duly noted.

8.0 Conclusions & Recommendations (Cont'd)

8.4 Ground Gas Monitoring: -

From the results of the gas monitoring visits completed to date, a preliminary gas screening value (GSV) for Carbon Dioxide has been calculated for this site as 0.0001 l/hr, which equates to a Characteristic Situation 1 (CS1), in accordance with CIRIA C665. Consequently, based upon the results of this preliminary assessment, gas protective measures are unlikely to be required within the proposed development.

However, a further four visits have been scheduled and the results along with the final recommendations will be issued as an Addendum Letter Report.

8.5 Ground Contamination:-

8.5.1 Site A:-

From the results of the contamination screening and the Level 1 Risk Assessments (Section 7.0) undertaken and due to Site A being developed for residential end-use, elevated Lead, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Chrysene, Dibenz(ah)anthracene and Indeno(123cd)pyrene was recorded within the made ground materials across Site A and could represent a potential future risk to end users. In addition, asbestos fibres, which were not visually identifiable within the made ground, was recorded across Site A also.

Subsequently, removal, protection or further Risk Assessment (DQRA) is required for this site, with potential remedial measures available being discussed further in Section 8.6.

When considering the results of the leachate screening, the contaminants in the samples screened are not considered to be sufficiently mobile to represent a significant risk to controlled waters or adjacent sites, and as such no additional protection or treatment measures are considered necessary.

At this stage, when considering the risk to building materials, it is recommended that a concrete design class of DS-2 and ACEC class of AC-2 is used for all foundations and buried concrete.

If during future redevelopment works, any excavated materials are to be removed from this site as a waste and disposed of at a landfill, reference should be made to the notes on off-site disposal within Appendix V, particularly when assessing the likely classification of these materials prior to disposal.

8.5.2 Site B:-

From the results of the contamination screening and the Level 1 Risk Assessments (Section 7.0), it can be seen that the made ground materials present on Site B do not represent a significant risk to the end users, and will not require any removal, treatment or protection measures to be installed, for a commercial setting.

When considering the results of the targeted asbestos screening, no asbestos fibres or fragments were identified within the made ground samples screened from across the site as part of these ground investigation works.

When considering the risk to building materials, it is recommended that a concrete design class of DS-1 and ACEC class of AC-1 is used for all foundations and buried concrete.

8.0 Conclusions & Recommendations (Cont'd)

8.5 Ground Contamination (Cont'd):-

8.5.2 Site B (Cont'd):-

If during future redevelopment works, any excavated materials are to be removed from this site as a waste and disposed of at a landfill, reference should be made to the notes on off-site disposal within Appendix V, particularly when assessing the likely classification of these materials prior to disposal.

8.6 Remediation Strategy: -

From the results of the Level 1 Risk Assessment, it can be seen that elevated levels of Lead, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Chrysene, Dibenzo(ah)anthracene and Indeno(123cd)pyrene contamination and asbestos have been recorded for the made ground materials below Site A, which are considered to represent a risk to human health. Subsequently, remediation works will be required across Site A in order to address the current potential risks posed to human health.

Where future buildings and areas of hardstanding are proposed then the source-pathway-receptor model will not exist and there is not considered to be health risk to the future end users. However, in areas of future soft landscaping (i.e. gardens, grass verges, etc) there is the potential for ingestion, dermal contact and inhalation of fugitive dust and vapours etc.

The following remediation option is felt to be the most viable option for Site A:

1. The introduction of an engineered clean cover system within all areas of proposed soft landscaping, to provide a safe and permanent barrier between the levels of contamination recorded and the proposed end users (i.e. residents). Given the levels of PAH's and asbestos, with the soft landscaped areas to be managed as part of the apartment development, an engineered clean cover system with no dig / visible barrier is deemed appropriate (i.e. visqueen / compact coarse stone). To ensure adequate protection, a thickness of c.600mm is recommended for Site A, to act as a break in the pollutant linkage between the receptor and the source of contamination (i.e. made ground).

This Remediation Strategy will need to be approved by the Local Authorities and subsequent remedial works that are completed across the site will require confirmatory validation testing and photographic evidence.

The remediation work should be validated by a suitably qualified Geo-environmental Engineer to ensure that all works are being completed in strict accordance with this Remediation Strategy.

From the results of the Risk Assessment undertaken, there is deemed to be no requirement to undertake remediation works across Site B.

8.7 General Comments:-

When considering the risks to the construction workforce, suitable PPE should be adopted to provide protection against the levels of potential contaminants recorded during these investigation works. Similarly, the results can also be used by the Main Contractor / Project Coordinator, when devising an adequate Site Health & Safety Plan, in accordance with current CDM Regulations.

For deeper excavations, drainage, service runs or the like that may pass close to or beneath any proposed new foundations, these should be undertaken with care and completed prior to the preparation of any new foundations, so as not to allow any loose or granular material to move or 'flow', thus causing settlement to occur to any new foundations based at a higher level.

8.0 Conclusions & Recommendations (Cont'd)

8.7 General Comments (Cont'd):-

It is also recommended for any new developments, adequate surface drainage should be designed and installed by a competent contractor, in order to prevent surface water 'ponding' or collection, during and post construction, particularly where the existing surface drainage system is disrupted or damaged.

An "observational technique" can be applied to the design and construction on this site, and where ground conditions seem to vary from that indicated from the Conceptual Site Model derived from works to date, then advice from a suitably qualified Engineering Geologist/Geotechnical Engineer should be sought.

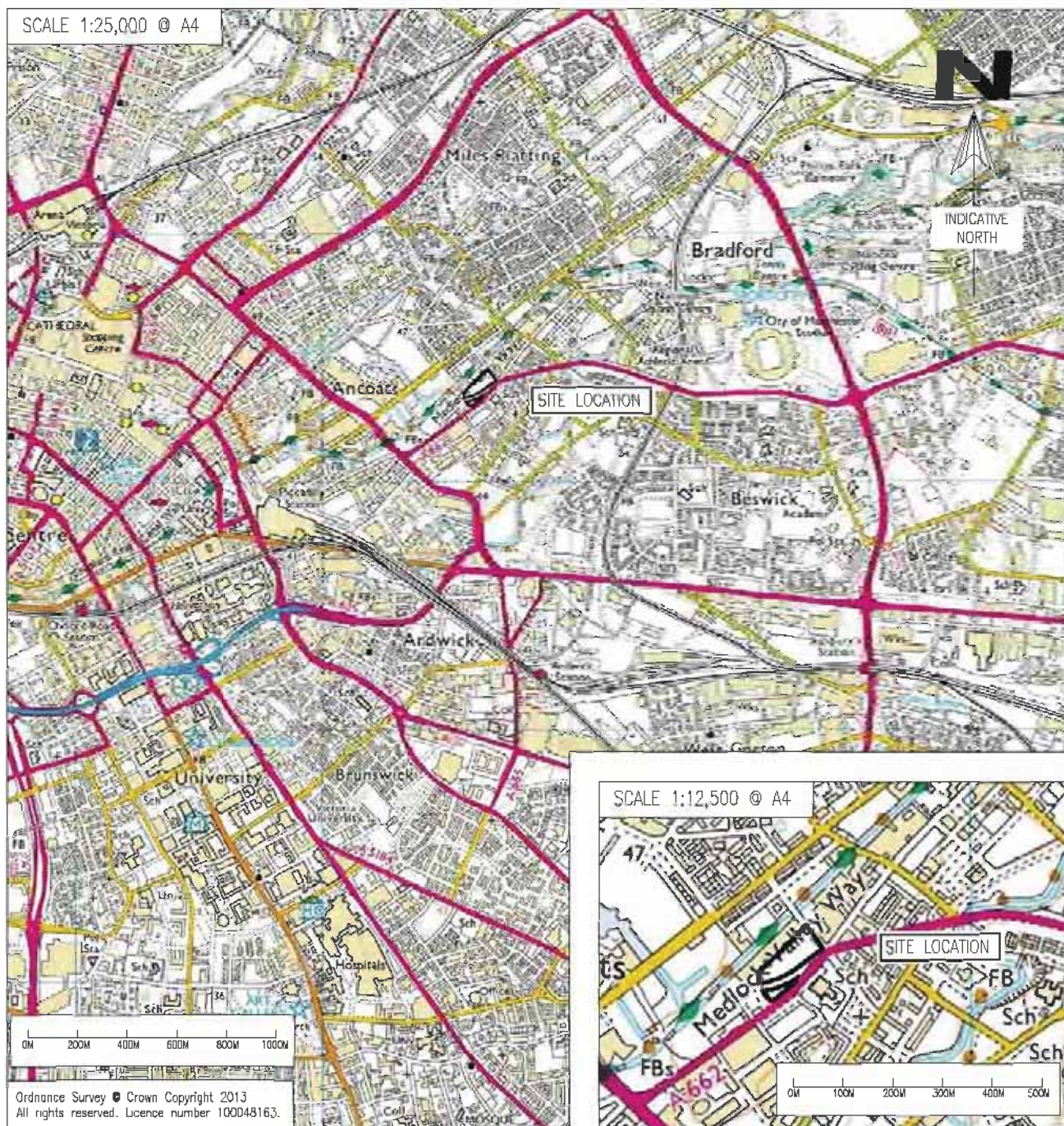
END OF REPORT

GENERAL REFERENCES

- Phase 1: Desk Top Study Report, completed for this site by Betts Associates Geo Environmental. (ref 12CHE061/DS, October 2012)
- DoE. - Contaminated Land Reports, CLR 1-6 1994 & 1995, CLR 7-10 2002, CLR 11 2004.
- BS5930:1999: Code of Practice for Site Investigations.
- BS EN 1997-1: 2004: Eurocode 7 - Geotechnical design. Part 1: General rules. British Standards Institution
- BS EN 1997-2: 2007: Eurocode 7 - Geotechnical design. Part 2: Ground investigation and testing British Standards Institution
- BS EN ISO 9001: 2000: Quality Management Systems - requirements. British Standards Institution
- BS EN ISO 14689-1: 2003: Geotechnical investigation and testing - Identification and classification of rock. Identification and description. British Standards Institution. Amended 2007 (Partially supersedes BS 5930:1999)
- BS EN ISO 22476-3: 2005: Geotechnical investigation and testing. Field testing. Standard penetration test. British Standards Institution
- BS EN ISO 14688-1: 2002: Geotechnical investigation and testing. Identification and classification of soil. Identification and description.
- BS EN ISO 14688-2: 2004: Geotechnical investigation and testing. Identification and classification of soil. Principles for a classification.
- BS10175+A1:2013: British Standard Investigation of Potentially Contaminated Sites.
- BS5837: Trees in Relation to Design, Demolition and Construction (2012).
- Methane and Associated Hazards to Construction - CIRIA Reports 149,150,151 & 152.
- Assessing Risks Posed by Hazardous Ground Gases to Buildings, CIRIA C665, 2007
- BS8485: 2007: Code of Practice for the Characterization and Remediation from Ground Gas in Affected Developments.
- Concrete in Aggressive Ground. BRE Special Digest 1: 2005.
- BS1377: 1990: Parts 1 – 9. Methods of Test for Soils for Civil Engineering Purposes.
- BS8576:2013 Guidance on Investigating for Ground Gas. Permanent Gases and Volatile Organic Compounds (VOCs).

APPENDIX I

**Location Plan
Aerial Photograph
Existing & Proposed Site Layout Plans**



Client:

BSCP LTD

Project Title:

Proposed Development

Milliners Wharf, Munday Street

Manchester, M4 7BB

Drawing Title:

Location Plan

Job Reference:

14-898

Drawing Number:

-

Revision:

-

Drawn by:

P.D

Date:

05.03.14

Scale at A4:

As Shown

Checked by:

M.P.B

Approved by:

M.P.B

The contractor shall check all dimensions on site before commencement of any works. No dimensions to be scaled off this drawing.

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ARC ENVIRONMENTAL LTD

Solum House
Unit 1 Elliott Court
St John's Road
Meadowfield
Durham
DH7 8PN

Tel: (0191) 378 6380

Fax: (0191) 378 0494

e-mail: admin@arc-environmental.com

web: www.arc-environmental.com





ARC ENVIRONMENTAL LTD

Solum House
Unit 1 Elliott Court
St. John's Road
Meadowfield
Dunham, DH7 8PN
Tel: (0191) 378 6390
Fax: (0191) 378 0494
e-mail: admin@arc-environmental.com
web: www.arc-environmental.com

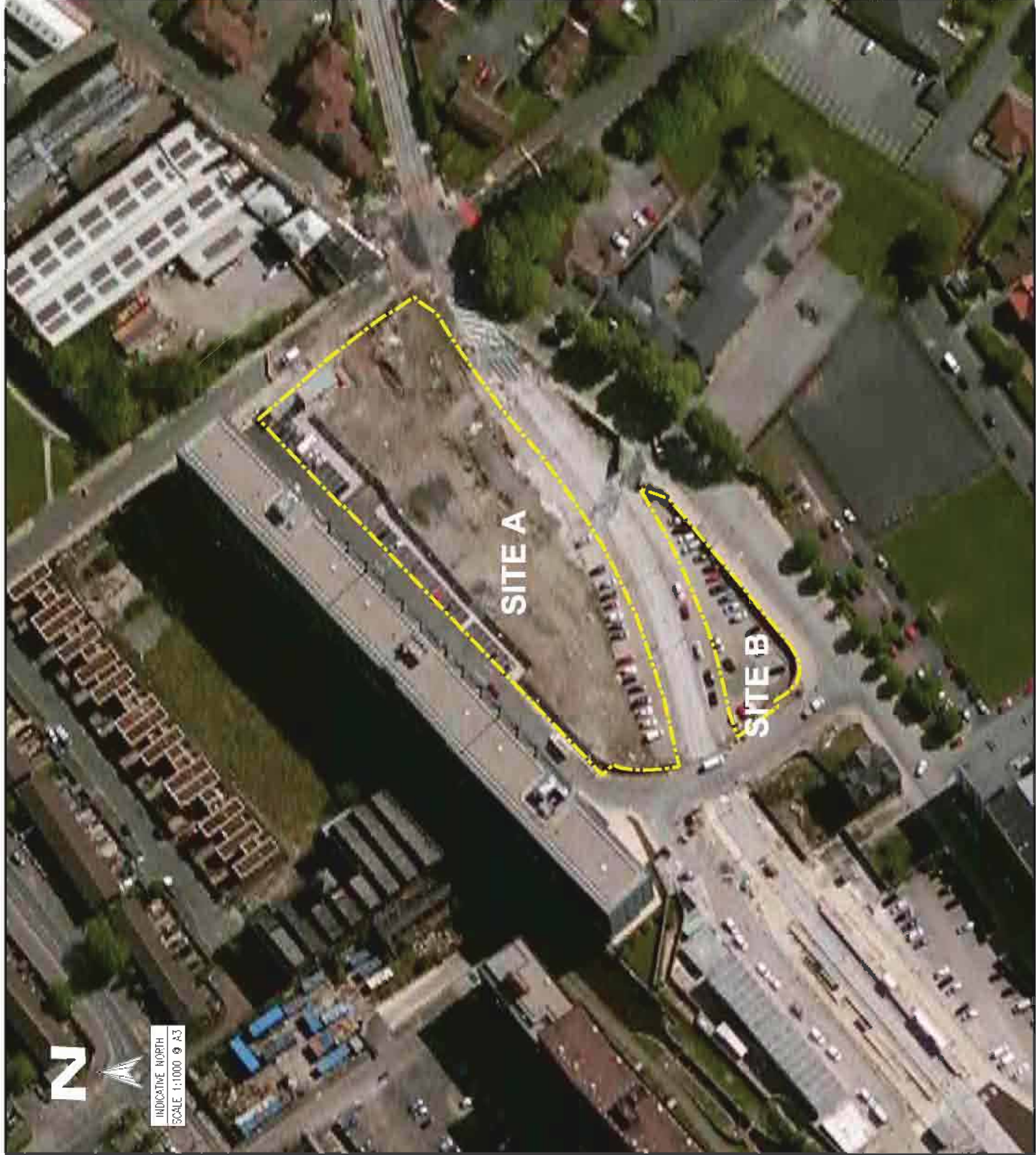
The contractor shall check all dimensions on site before commencement of any works. No dimensions to be scaled off this drawing.

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LEGEND	APPROXIMATE SITE BOUNDARY

Rev.	date	amendments	Drawn: chsl

Client:			
Project:	Proposed Development		
Milliners Wharf, Munday Street			
Manchester, M4 7BB			
Drawing Title:	Aerial Photograph		
Scale:	1:1000	Date:	
Job Ref:	13-898	Org no:	
		Rev:	



N

INDICATIVE NORTH
SCALE 1:1000 @ A3

2000 2001



ARC ENVIRONMENTAL LTD

Solum House
Unit 1 Elliott Court
St. John's Road
Meadowfield
Durham, DH7 8PN
Tel: (0191) 378 6390
Fax: (0191) 378 0494
e-mail: admin@arc-environmental.com
web: www.arc-environmental.com

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LEGEND	APPROXIMATE SITE BOUNDARY

rev.	date	amendments	drawn	checked

Client:

BSCP LTD

Project Title:

Proposed Development

Milliners Wharf, Munday Street

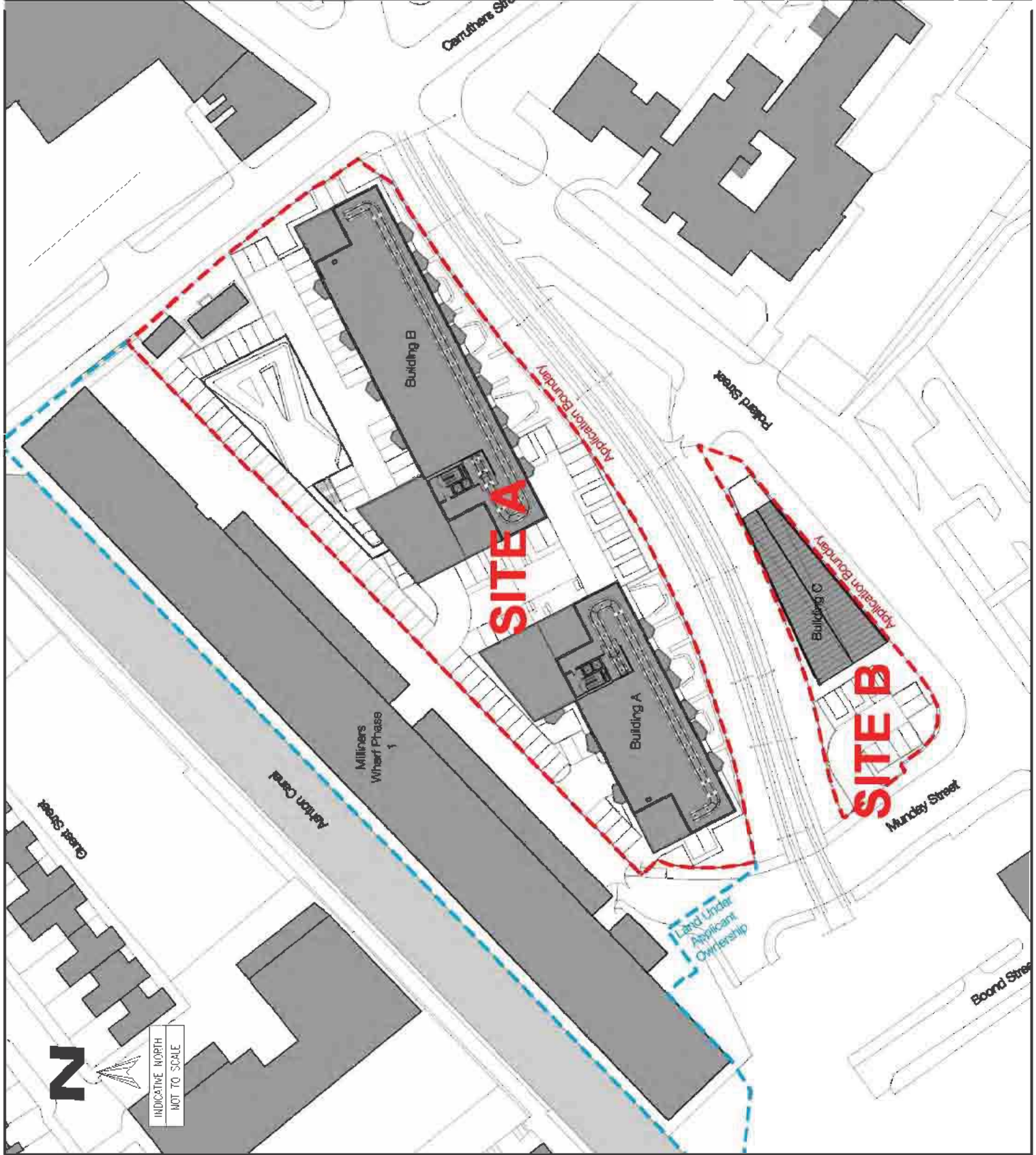
Manchester, M4 7BB

Drawing Title:

Proposed Development Layout Plan

Scale of A3: 1 Date: 05/02/14 Drawn by: P.D. Approved by: M.P.B.
M5 & A3

Job Ref: 13-898
Orig no: - Rev: -



APPENDIX II

**Trial Pit and Borehole Location Plan
Trial Pit and Borehole Record Sheets**



Solum House
Unit 1 Elliott Court
St. John's Road
Meadowfield
Durham, DH7 8PN
Tel: (0191) 378 6380
Fax: (0191) 378 0499
e-mail: admin@arc-environment.co.uk
web: www.arc-environment.co.uk

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12-200		APPROXIMATE SPE. RES. VALUE
		WALNUTS SAMPLE BIRCHHOLE POSITION
		ORCH. FERTILIZER BIRCHHOLE POSITION
		ORCH. BIRCHHOLE POSITION
		MICHAEL'S LEGGINGS TRAIL PIT POSITION

BSCP LTD

Proj. H-21 T 114

Prigogine, I. 114

Millions. What? Millions? So?

Munich, M4 7EE

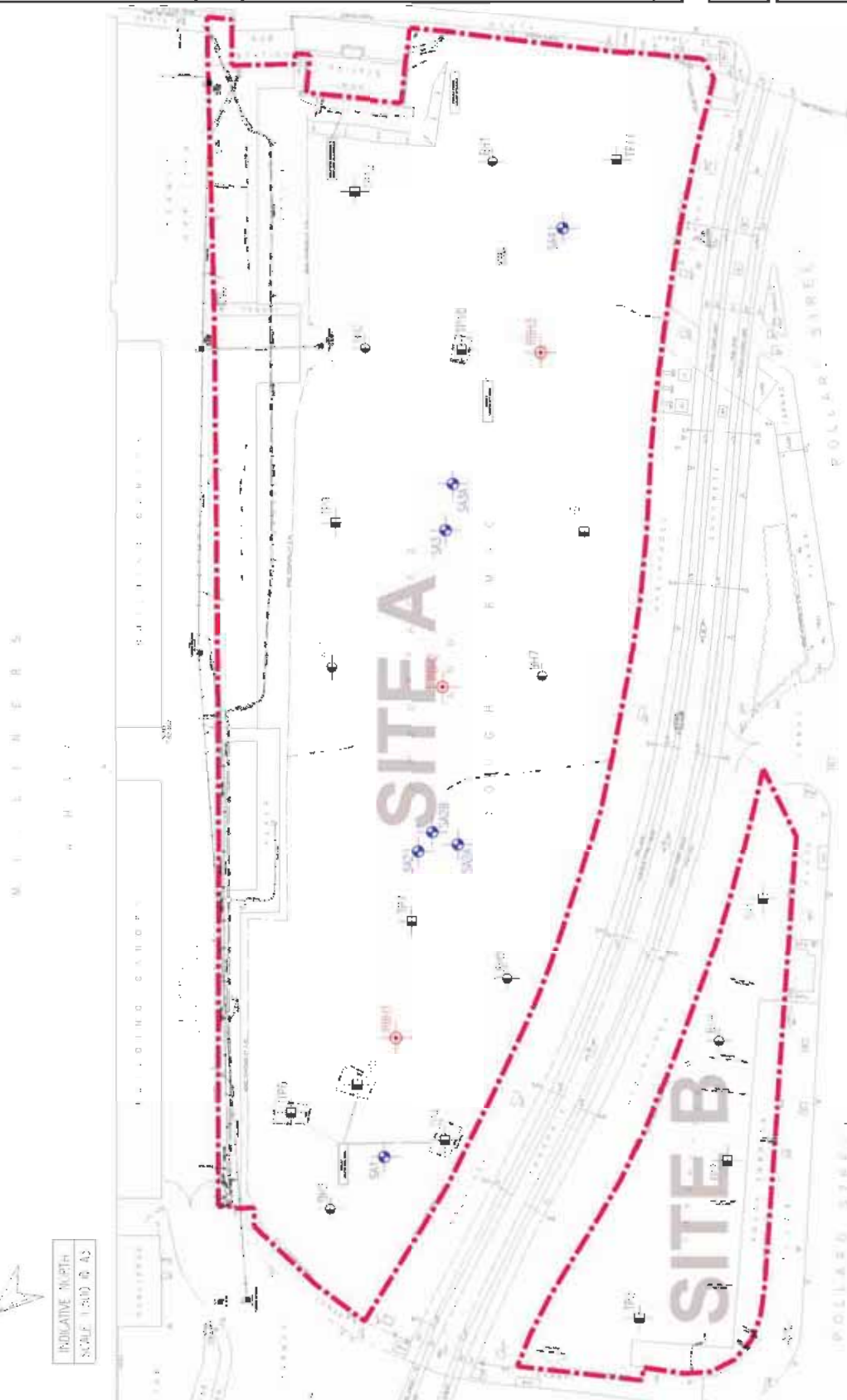
Growing Time:

... Primary High Landing: Place 100 g of seed

Seedling no.	Age	Date	Grower by	Approved by:
10000	100	10/10/10	10	1000

Doc Ref:	Orig. no:	Rev:
----------	-----------	------

100



INSTALLATION NOTES

CLIMBER, INC. AND COMPANY
PO BOX 10000
CHICAGO, IL 60680



Solum House
Unit 1 Elliot Court
St. John's Road
Meadowfield
Durham, DH7 8PN
Tel: (0191) 378 6380
Fax: (0191) 378 0484
e-mail: admin@arc-environmental.com
web: www.arc-environmental.com

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LEGEND	
	APPROXIMATE SITE BOUNDARY
	WINDOWLESS SAMPLING BOREHOLE POSITION
	CABLE PERCUSSION BOREHOLE POSITION
	ROTARY BOREHOLE POSITION
	MECHANICALLY EXCAVATED TRIAL PIT POSITION

Client,

BSCP LTD

Project Title:

Project Title;
Proposed Development

Milliners Wharf, Munday Street

Manchester, M4 7BB

Drawing Title:

Exploratory Hole Location Plan (Proposed Layout)

Scale at A3:	Date:	Drawn by:	Approved by:
1:500 @ A3	05.02.14	P.D	M.P.B

Job Ref:	Dmg nos	Rev:
----------	---------	------

13-898





Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project Milliners Wharf, Manchester				BOREHOLE No BH1
Job No 13-898	Date 12-02-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.20	D					(0.90)	Brown and grey sandy gravel. Gravel is fine to coarse comprising fragments of brick limestone and coal. Cobbles. Becoming clayey in places (MADE GROUND).		
0.50	D					0.90			
1.00	D						Soft and firm brown sandy gravelly clay. Gravel is fine to coarse comprising brick limestone and coal. Cobbles (MADE GROUND).		
1.00-1.45	SPT	N=6							
1.00	V	40kN/m ²							
1.50	D					(1.50)			
1.50	V	37kN/m ²							
2.00	D					2.40			
2.00-2.45	SPT	N=6							
2.00	V	28kN/m ²							
2.50	D					(0.60)	Stiff (high strength) brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone. Cobbles (GLACIAL TILL).		
2.50	V	130kN/m ²				3.00			
3.00	D					(0.90)	Stiff (high strength) brown and grey slightly laminated CLAY (GLACIAL TILL).		
3.00	V	85kN/m ²							
3.50	D					3.90			
3.50	V	120kN/m ²							
3.90	D						Borehole terminated at 3.90m.		
3.90	V	110kN/m ²							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Upon completion, borehole recorded as dry.
All dimensions in metres Scale 1:31.25			Client BSCP			Method/ Plant Used Windowless Sampling			Logged By JH		

AGS3 UK BH BHS 13-898.GPJ AGS3 ALL.GDT 2/24/14



Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project Milliners Wharf, Manchester				BOREHOLE No BH2	
Job No 13-898	Date 12-02-14	Ground Level (m)	Co-Ordinates ()		
Contractor Arc Environmental Ltd				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.20	D					(0.40)	Brown and grey sandy gravel. Gravel is fine to coarse comprising fragments of brick limestone and coal. Cobbles. Becoming clayey in places (MADE GROUND).		
0.50	D					(0.60)	Brown sandy gravel. Gravel is fine to coarse comprising fragments of ash brick coal and some glass. Cobbles (MADE GROUND).		
1.00 1.00-1.45	D SPT	N=1				1.00	Very soft dark grey and black silty clay (MADE GROUND).		
1.50 1.50	D V	18kN/m ²	↓			(1.50)			
2.00 2.00	D V	20kN/m ²				2.50			
2.50 2.50	D V	19kN/m ²				(0.80)	Black clayey silty gravelly sand. Gravel is fine to coarse of coal and ash. Wet (MADE GROUND).		
3.00 3.00-3.45	D SPT	N=8				3.30			
3.50 3.50	D V	80kN/m ²				(0.30) 3.60	Stiff (high strength) brown sandy gravelly CLAY. Gravel is fine to coarse of sandstone (GLACIAL TILL).		
						(0.40)	Stiff (high strength) brown silty sandy CLAY (GLACIAL TILL).		
4.00	V	82kN/m ²				4.00	Borehole terminated at 4.00m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Upon completion, water recorded at 1.80m.
All dimensions in metres Scale 1:31.25			Client BSCP			Method/ Plant Used Windowless Sampling			Logged By JH		

AGS3 UK BH BHS 13-898.GPJ AGS3_ALL.GDT 2/24/14



Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project Milliners Wharf, Manchester				BOREHOLE No BH3	
Job No 13-898	Date 12-02-14	Ground Level (m)	Co-Ordinates ()		
Contractor Arc Environmental Ltd				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.20	D						Firm brown sandy gravelly clay. Gravel is fine to coarse comprising fragments of brick limestone and coal. Cobbles (MADE GROUND).		
0.50	D					(1.00)			
1.00	D					1.00			
1.00-1.45	SPT	N=4					Loose dark brown and black sandy gravel. Gravel is fine to coarse comprising fragments of coal brick concrete sandstone and ash. Cobbles. Becoming clayey in places (MADE GROUND).		
1.00	V	48kN/m ²				(0.90)			
1.50	D					1.90			
2.00	D						Soft brown silty clay with some fine to coarse gravel comprising fragments of ash sandstone brick coal and pottery (MADE GROUND).		
2.00-2.45	SPT	N=1				(1.80)			
2.50	D								
3.00	D								
3.00-3.45	SPT	N=1							
3.00	V	37kN/m ²				3.70			
3.50	D						Firm (medium strength) brown and grey silty CLAY (GLACIAL TILL).		
3.50	V	20kN/m ²				(0.30)			
4.00	D					4.00			
4.00	V	37kN/m ²					Borehole terminated at 4.00m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Upon completion, borehole recorded as dry.
All dimensions in metres Scale 1:31.25			Client BSCP			Method/ Plant Used Windowless Sampling			Logged By JH		

AGS3 UK BH BHS 13-898.GPJ AGS3 ALL.GDT 2/24/14



Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project Milliners Wharf, Manchester				BOREHOLE No BH4	
Job No 13-898	Date 12-02-14	Ground Level (m)	Co-Ordinates ()		
Contractor Arc Environmental Ltd				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.50 0.50	D V	48kN/m ²				(1.30)	Firm brown sandy gravelly clay. Gravel is fine to coarse comprising fragments of brick sandstone and limestone. Cobbles (MADE GROUND).		
1.00 1.00	D V	46kN/m ²				1.30			
1.50 1.50	D V	95kN/m ²					Stiff (high strength) brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and some coal. Cobbles (GLACIAL TILL).		
2.00 2.00	D V	130kN/m ²							
2.50 2.50	D V	130kN/m ²				(2.60)			
3.00 3.00	D V	130kN/m ²							
3.50 3.50	D V	130kN/m ²				3.90			
3.90 3.90	D V	130kN/m ²					Borehole terminated at 3.90m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Upon completion, borehole recorded as dry.
All dimensions in metres Scale 1:31.25			Client BSCP			Method/ Plant Used Windowless Sampling				Logged By JH	

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Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project Milliners Wharf, Manchester				BOREHOLE No BH5	
Job No 13-898	Date 12-02-14	Ground Level (m)	Co-Ordinates ()		
Contractor Arc Environmental Ltd				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.20	D						Black and dark brown sandy gravel. Gravel is fine to coarse comprising fragments of sandstone brick ash and limestone. Cobbles (MADE GROUND).		
0.50	D					(1.10)			
1.00	D					1.10			
1.00-1.45	SPT	N=5				(0.30)	Firm dark grey sandy clay (MADE GROUND).		
						1.40			
1.50	D						Stiff (high strength) brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and coal. Cobbles (GLACIAL TILL).		
1.50	V	100kN/m ²							
2.00	D						Becoming soft (low strength).		
2.00	V	97kN/m ²							
2.50	D								
2.50	V	120kN/m ²				(2.60)			
3.00	D								
3.00	V	118kN/m ²							
3.50	D								
3.50	V	40kN/m ²							
4.00	D					4.00	Borehole terminated at 4.00m.		
4.00	V	40kN/m ²							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Upon completion, borehole recorded as dry.

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Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project Milliners Wharf, Manchester				BOREHOLE No BH6
Job No 13-898	Date 12-02-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.20	D						Loose brown clayey sandy gravel. Gravel is fine to coarse comprising fragments of brick limestone and coal. Cobbles (MADE GROUND).		
0.50	D								
1.00	D					(1.60)			
1.00-1.45	SPT	N=6							
1.50	D					1.60	Stiff (high strength) brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and some coal. Cobbles (GLACIAL TILL).		
2.00	D								
2.00	V	120kN/m ²							
2.50	D								
2.50	V	113kN/m ²				(2.40)			
3.00	D								
3.00	V	124kN/m ²							
3.50	D						Borehole terminated at 4.00m.		
3.50	V	128kN/m ²				4.00			
4.00	D								
4.00	V	103kN/m ²							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Upon completion, borehole recorded as dry.
All dimensions in metres Scale 1:31.25			Client BSCP			Method/ Plant Used Windowless Sampling					Logged By JH

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Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project Milliners Wharf, Manchester				BOREHOLE No BH7	
Job No 13-898	Date 12-02-14	Ground Level (m)	Co-Ordinates ()		
Contractor Arc Environmental Ltd				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.20	D					0.05 (0.40)	Tarmac (MADE GROUND). Brown sandy gravel. Gravel is fine to coarse comprising fragments of brick limestone and coal. Cobbles (MADE GROUND).		
0.50	D					0.45 (0.25) 0.70	Firm brown sandy gravelly clay. Gravel is fine to coarse of brick and coal. Cobbles (MADE GROUND).		
1.00 1.00	D V	85kN/m ²				(3.30)	Stiff (high strength) dark grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and some coal. Becoming laminated in places (GLACIAL TILL).		
1.50 1.50	D V	100kN/m ²							
2.00 2.00	D V	116kN/m ²							
2.50 2.50	D V	125kN/m ²							
3.00 3.00	D V	120kN/m ²							
3.50 3.50	D V	106kN/m ²							
4.00 4.00	D V	80kN/m ²				4.00	Borehole terminated at 4.00m.		

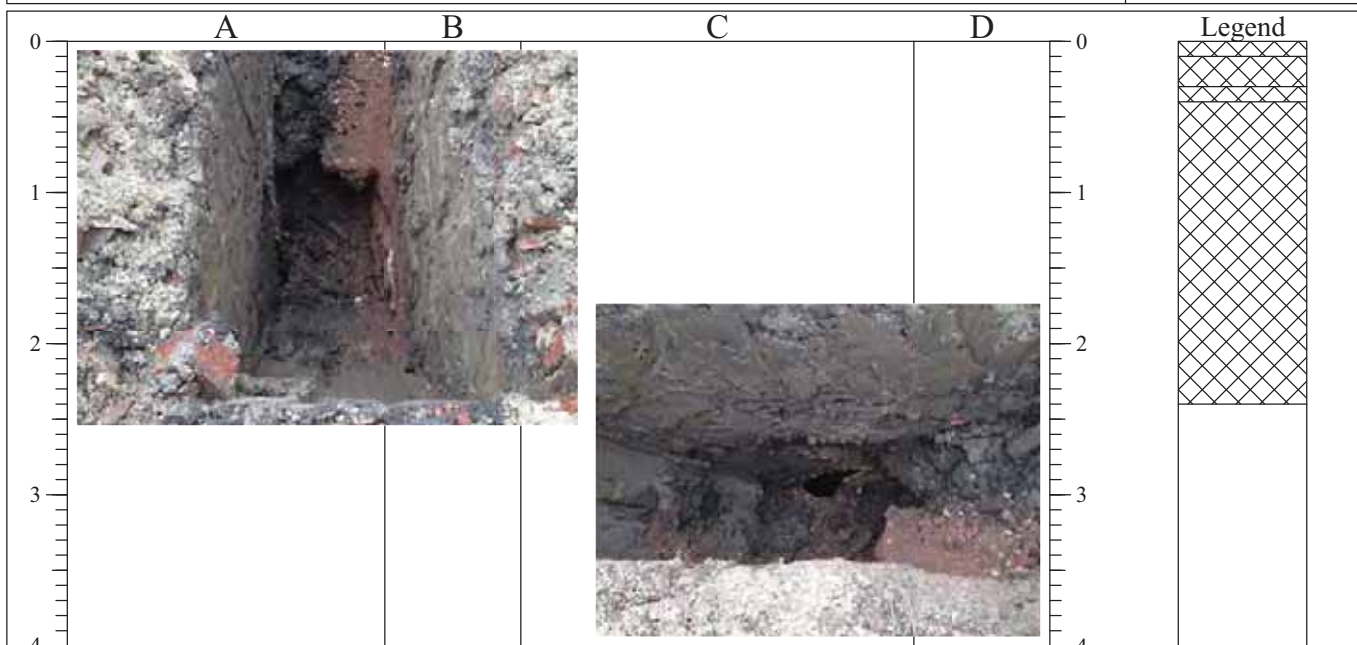
Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Upon completion, borehole recorded as dry.
All dimensions in metres Scale 1:31.25			Client BSCP			Method/ Plant Used Windowless Sampling				Logged By JH	



Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

TRIAL PIT LOG

Project Milliners Wharf, Manchester				TRIAL PIT No TP1
Job No 13-898	Date 28-01-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.10		Dolomitic limestone gravel hardcore (MADE GROUND).			
0.10-0.30		Concrete (MADE GROUND).			
0.30-0.40		Loose reddish brown brick gravel. Cobbles noted (MADE GROUND).			
0.40-2.40		Soft brown and black sandy gravelly clay. Gravel is fine to coarse comprising fragments of brick pot and some ash (MADE GROUND).	0.50	CBR	1.2
			0.50	J/D	
			0.50	V	25kN/m ²
			1.00	V	30kN/m ²
			1.50	V	32kN/m ²
			2.00	J/D	
			2.00	V	29kN/m ²
2.40		Trial pit terminated at 2.40m due to refusal on concrete in base of pit. Relic brick walls in ends of pit with a c.300mm diameter pot lined 'well' like feature in base / side of pit extending to c.4.20m BGL. Noted as dry.			



GENERAL REMARKS

WATER: Upon completion, trial pit recorded as dry and open.

All dimensions in metres
Scale 1:50

Client BSCP

Method/
Plant Used

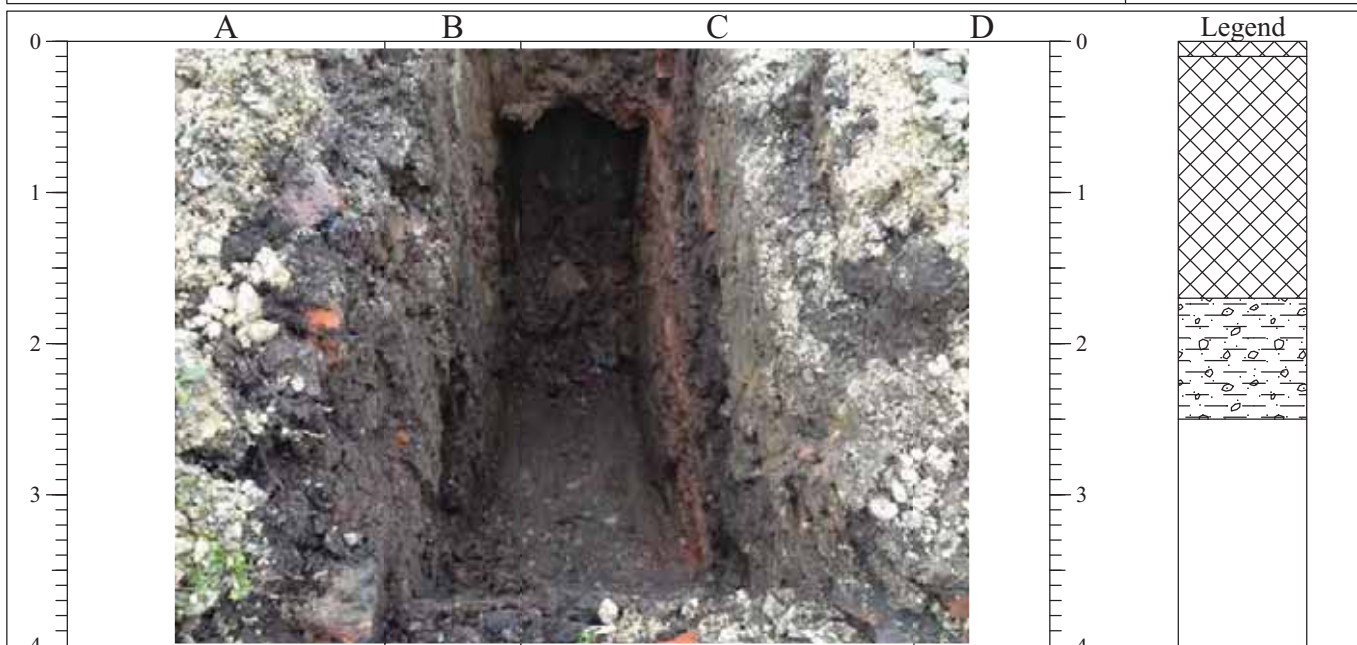
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Telephone: 0191 378 6380
Fax: 0191 378 0494

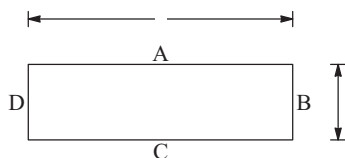
TRIAL PIT LOG

Project Milliners Wharf, Manchester				TRIAL PIT No TP2
Job No 13-898	Date 28-01-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.10		Dolomitic limestone gravel hardcore (MADE GROUND).			
0.10-1.70		Soft becoming firm in places brown sandy gravelly clay. Gravel is fine to coarse comprising fragments of brick pot concrete and ash. Cobbles noted. Becoming very sandy and very gravelly in places (MADE GROUND).	0.50	J/D	
			0.50	V	30kN/m ²
			1.00	V	25kN/m ²
1.70-2.50		Stiff (high strength) brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles (GLACIAL TILL). c.200mm diameter pot drain at 1.80m.	2.00	B	
1.80			2.00	V	120kN/m ²
2.50		Trial pit terminated at 2.50m.	2.50	V	120kN/m ²

Shoring/Support:
Stability:



GENERAL
REMARKS

WATER: Upon completion, trial pit recorded as dry and open.

All dimensions in metres
Scale 1:50

Client BSCP

Method/
Plant Used

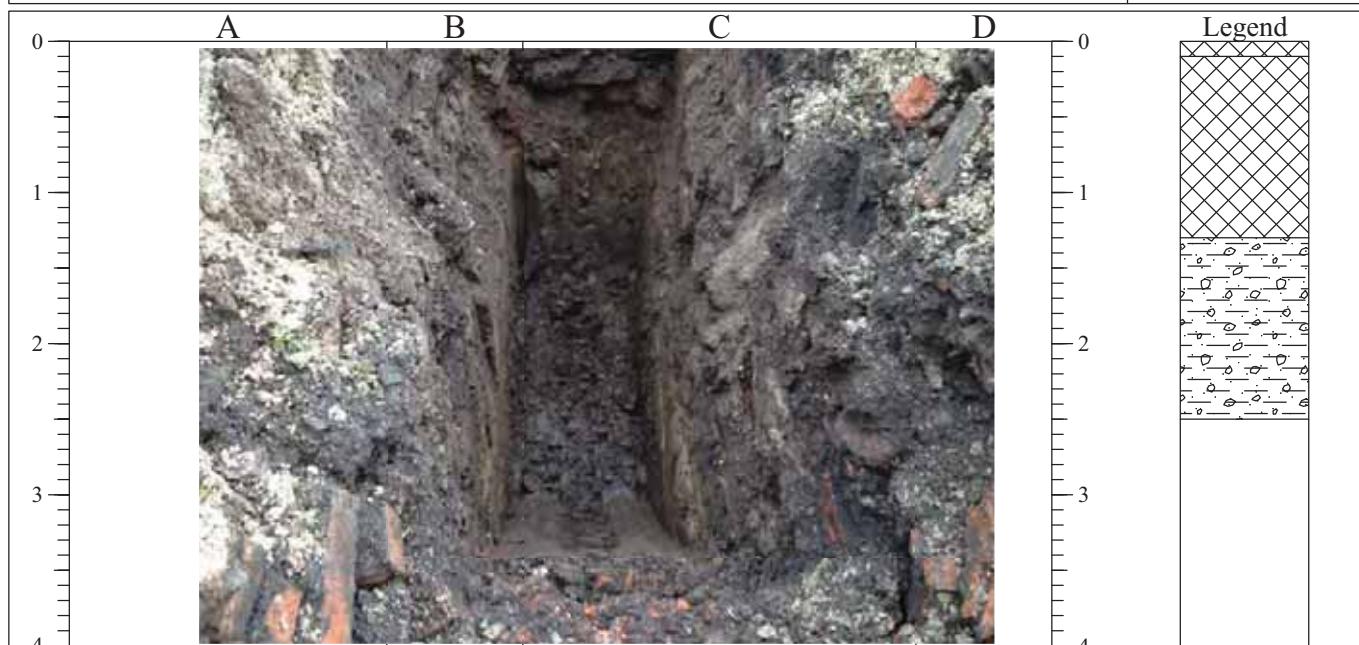
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Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

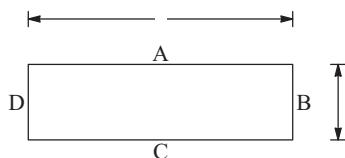
TRIAL PIT LOG

Project Milliners Wharf, Manchester				TRIAL PIT No TP3
Job No 13-898	Date 28-01-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.10		Dolomitic limestone gravel hardcore (MADE GROUND).			
0.10-1.30		Soft black and brown sandy gravelly clay. Gravel is fine to coarse comprising fragments of brick concrete and some ash. Some plastic also noted. Cobbles. Becoming clayey sandy gravel / clayey gravelly sand in places (MADE GROUND).	0.50	CBR	0.9
			0.50	J/D	
			0.50	V	20kN/m ²
1.30-2.50		Firm (high strength) light brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles	1.50	B	
			1.50	V	82kN/m ²
1.80		Becoming stiff (high strength) and dark brown and grey from 1.80m.	2.00	V	120kN/m ²
2.50		Trial pit terminated at 2.50m. Relic brick walls in ends of pit.	2.50	B	
			2.50	V	120kN/m ²

Shoring/Support:
Stability:



GENERAL REMARKS

WATER: Upon completion, trial pit recorded as dry and open.

All dimensions in metres
Scale 1:50

Client BSCP

Method/
Plant Used

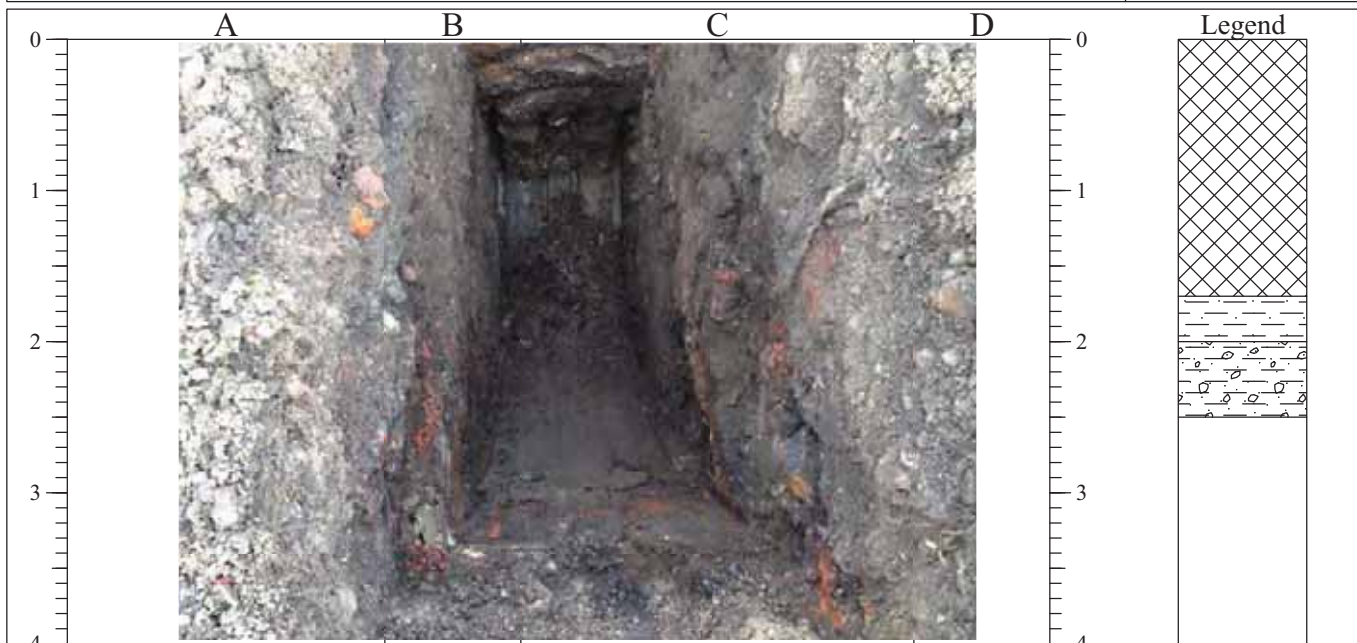
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Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

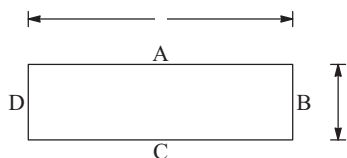
TRIAL PIT LOG

Project Milliners Wharf, Manchester				TRIAL PIT No TP4
Job No 13-898	Date 28-01-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-1.70		Black brown and grey sandy gravel / gravelly sand. Gravel is fine to coarse comprising fragments of brick concrete pot and ash. Cobbles. Becoming clayey in places (MADE GROUND).	1.00	J/D	
1.70-2.00		Soft (low strength) grey sandy CLAY (GLACIAL TILL).			
2.00-2.50		Stiff (high strength) brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles (GLACIAL TILL).	2.00	V	30kN/m ²
2.50		Trial pit terminated at 2.50m.	2.50	B	
			2.50	V	120kN/m ²

Shoring/Support:
Stability:



GENERAL
REMARKS

WATER: Upon completion, trial pit recorded as dry and open.

All dimensions in metres
Scale 1:50

Client BSCP

Method/
Plant Used

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Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

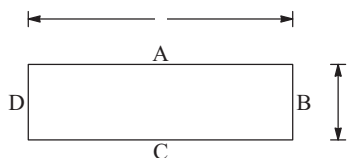
TRIAL PIT LOG

Project Milliners Wharf, Manchester				TRIAL PIT No TP5
Job No 13-898	Date 28-01-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-2.70		Black brown and grey sandy gravel / gravelly sand. Gravel is fine to coarse comprising fragments of brick sandstone concrete pot and ash. Cobbles and boulders. Becoming clayey in places (MADE GROUND).	0.50 0.50	CBR J/D	2
2.70-3.00		Stiff (high strength) brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles (GLACIAL TILL).	1.50	J/D	
3.00		Trial pit terminated at 3.00m. Relic brick walls across pit.	3.00 3.00	B V	120kN/m ²

Shoring/Support:
Stability:



GENERAL
REMARKS

WATER: Upon completion, trial pit recorded as dry with slight wall collapse from surface.

All dimensions in metres
Scale 1:50

Client BSCP

Method/
Plant Used

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Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

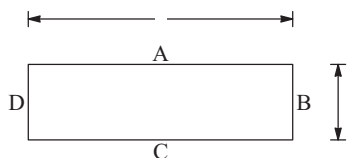
TRIAL PIT LOG

Project Milliners Wharf, Manchester				TRIAL PIT No TP6
Job No 13-898	Date 28-01-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-1.50		Black brown and grey sandy gravel / gravelly sand. Gravel is fine to coarse comprising fragments of brick sandstone concrete pot and ash. Cobbles and boulders. Becoming clayey in places (MADE GROUND).	0.70	J/D	
1.50-2.50		Firm (high strength) light brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles (GLACIAL TILL).	1.50	V	80kN/m ²
2.00		Becoming stiff (high strength) and dark brown and grey from 2.00m.	2.00	B	
			2.00	V	120kN/m ²
2.50		Trial pit terminated at 2.50m.	2.50	V	120kN/m ²

Shoring/Support:
Stability:



GENERAL REMARKS

WATER: Upon completion, trial pit recorded as dry and open.

All dimensions in metres
Scale 1:50

Client BSCP

Method/
Plant Used

Logged By
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Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

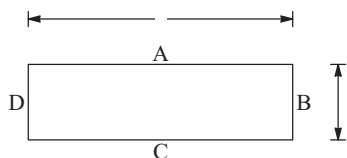
TRIAL PIT LOG

Project Milliners Wharf, Manchester				TRIAL PIT No TP7
Job No 13-898	Date 28-01-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-3.20		Black brown and grey sandy gravel / gravelly sand. Gravel is fine to coarse comprising fragments of brick sandstone concrete pot and ash. Clothes rag metal and plastic noted. Cobbles and boulders. Becoming clayey in places (MADE GROUND).	0.50 0.70	CBR J/D	0.8
3.20		Trial pit terminated at 3.20m due to refusal on possible concrete floor and owing to collapse of side walls.	2.00	J/D	

Shoring/Support:
Stability:



GENERAL
REMARKS

WATER: Upon completion, trial pit recorded as dry with slight wall collapse from surface.

All dimensions in metres
Scale 1:50

Client BSCP

Method/
Plant Used

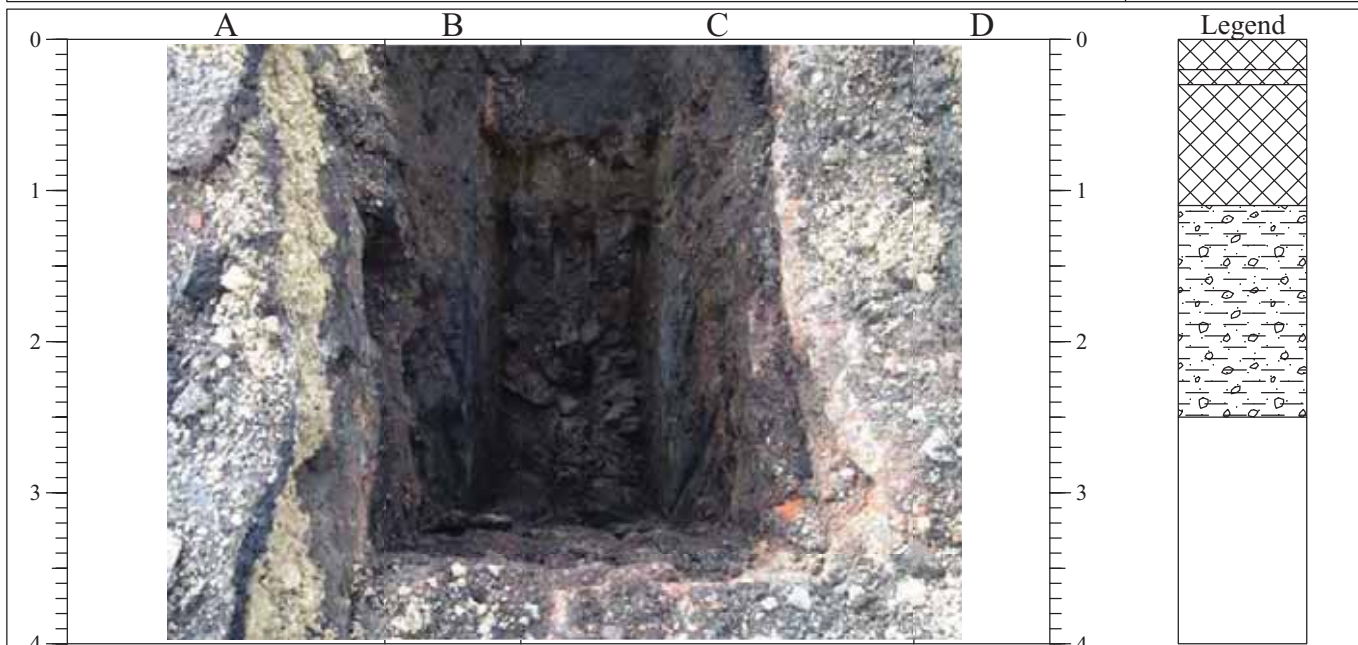
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Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

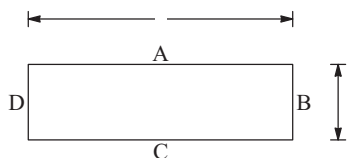
TRIAL PIT LOG

Project Milliners Wharf, Manchester				TRIAL PIT No TP8
Job No 13-898	Date 28-01-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.20		Tarmac underlain by dolomitic limestone fill (MADE GROUND).			
0.20-0.30		Concrete (MADE GROUND).			
0.30-1.10		Black brown and grey sandy gravel / gravelly sand. Gravel is fine to coarse comprising fragments of brick sandstone concrete pot and ash. Cobbles. Becoming clayey in places (MADE GROUND).	0.50	J/D	
1.10-2.50		Stiff (high strength) black and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles (GLACIAL TILL). Becoming light brown and grey.	1.50	B	
1.40			1.50	V	120kN/m ²
1.90		Becoming dark brown and grey.	2.00	V	120kN/m ²
2.50		Trial pit terminated at 2.50m.	2.50	B	
			2.50	V	120kN/m ²

Shoring/Support:
Stability:



GENERAL
REMARKS

WATER: Upon completion, trial pit recorded as dry and open.

All dimensions in metres
Scale 1:50

Client BSCP

Method/
Plant Used

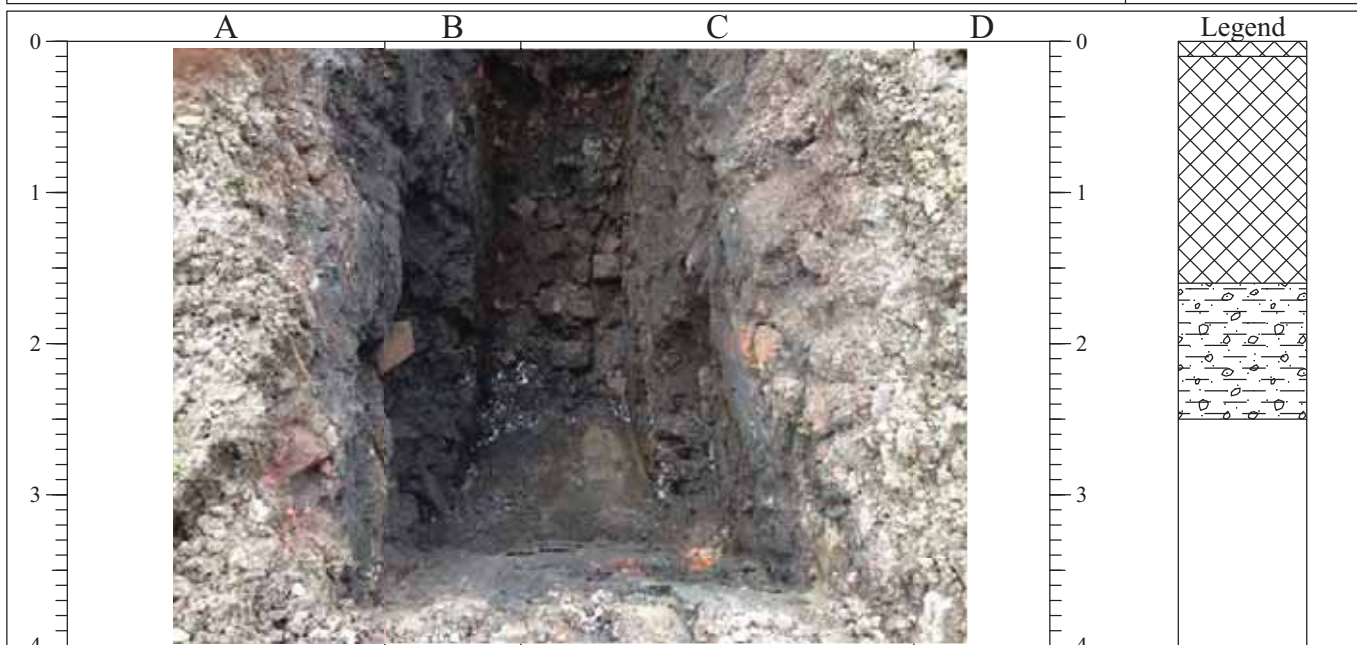
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Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

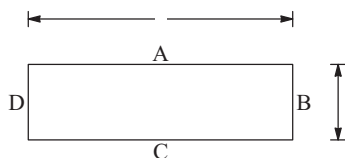
TRIAL PIT LOG

Project Milliners Wharf, Manchester				TRIAL PIT No TP9
Job No 13-898	Date 28-01-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.10		Dolomitic limestone gravel hardcore (MADE GROUND).			
0.10-1.60		Black brown and grey sandy gravel / gravelly sand. Gravel is fine to coarse comprising fragments of brick concrete pot and ash. Cobbles. Becoming clayey in places (MADE GROUND).	0.50	CBR	1.3
			0.50	J/D	
1.60-2.50		Firm (high strength) light brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles (GLACIAL TILL).	1.50	J/D	
1.90		Becoming stiff (high strength) and dark brown and grey from 1.90m.	2.00	B	
			2.00	V	120kN/m ²
2.50		Trial pit terminated at 2.50m.	2.50	V	120kN/m ²

Shoring/Support:
Stability:



GENERAL
REMARKS

WATER: Upon completion, slight water ingress from 1.60m.

All dimensions in metres
Scale 1:50

Client BSCP

Method/
Plant Used

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Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

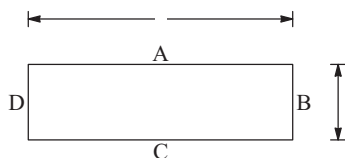
TRIAL PIT LOG

Project Milliners Wharf, Manchester				TRIAL PIT No TP10
Job No 13-898	Date 28-01-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.30		Dolomitic limestone gravel hardcore (MADE GROUND).			
0.30-1.20		Brown and black sandy gravel. Gravel is fine to coarse comprising fragments of brick. Metal noted (MADE GROUND).	0.50	J/D	
0.80		Defunct water pipe in plastic duct across pit.	1.00	W	
1.20		Trial pit terminated at 1.20m due to relic concrete floor. Relic brick walls in ends and side of pit.			

Shoring/Support:
Stability:



GENERAL
REMARKS

WATER: Upon completion, standing water level recorded at 1.00m.

All dimensions in metres
Scale 1:50

Client BSCP

Method/
Plant Used

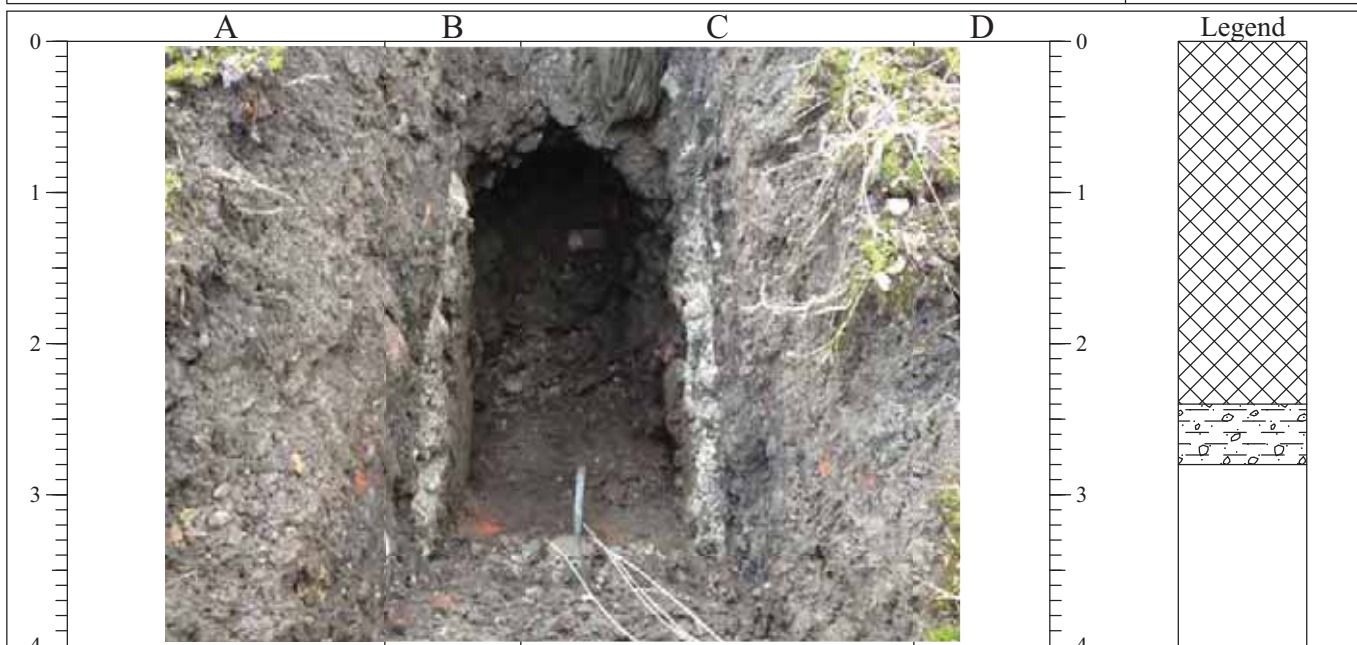
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Telephone: 0191 378 6380
Fax: 0191 378 0494

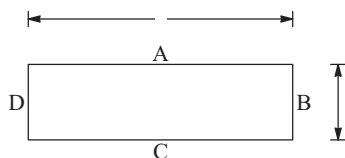
TRIAL PIT LOG

Project Milliners Wharf, Manchester				TRIAL PIT No TP11
Job No 13-898	Date 28-01-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-2.40		Black clayey sandy gravel / clayey gravelly sand. Gravel is fine to coarse comprising fragments of brick concrete and some ash. Some rope plastic and dolomitic limestone gravel noted (MADE GROUND).	0.50 0.50	CBR J/D	2.1
2.40-2.80		Stiff (high strength) dark brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles (GLACIAL TILL).	2.00	J/D	
2.80		Trial pit terminated at 2.80m.	2.60 2.70	B V	120kN/m ²

Shoring/Support:
Stability:



GENERAL
REMARKS

WATER: Upon completion, slight water ingress from 1.20m with slight wall collapse from surface.

All dimensions in metres
Scale 1:50

Client BSCP

Method/
Plant Used

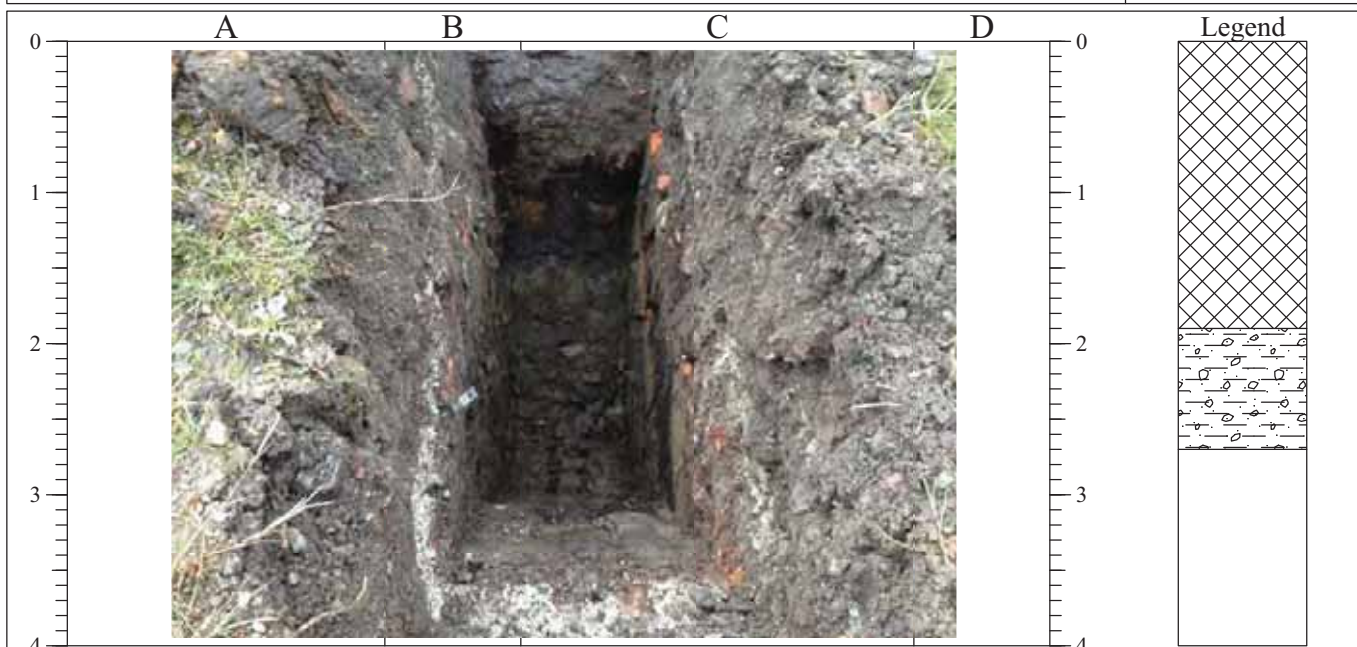
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Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

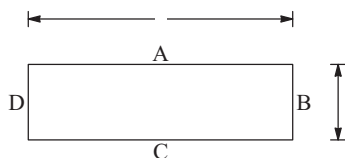
TRIAL PIT LOG

Project Milliners Wharf, Manchester				TRIAL PIT No TP12
Job No 13-898	Date 28-01-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-1.90		Black clayey sandy gravel / clayey gravelly sand. Gravel is fine to coarse comprising fragments of brick concrete and some ash (MADE GROUND).	0.60	J/D	
1.90-2.70		Stiff (high strength) dark brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles (GLACIAL TILL).	2.00	V	120kN/m ²
			2.20	B	
			2.50	V	120kN/m ²
2.70		Trial pit terminated at 2.70m.			

Shoring/Support:
Stability:



GENERAL
REMARKS

WATER: Upon completion, trial pit recorded as dry and open.

All dimensions in metres
Scale 1:50

Client BSCP

Method/
Plant Used

Logged By
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Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project Milliners Wharf, Manchester				BOREHOLE No SA1
Job No 13-898	Date 03-02-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 2

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.20	D						Black brown and grey sandy gravel / gravelly sand. Gravel is fine to coarse comprising fragments of brick concrete pot and ash. Cobbles. Becoming clayey in places (MADE GROUND).		
1.00	D					(2.40)			
1.50-1.95	SPT	N=5				2.40			
2.40	D						Firm brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles. Some fine sand and gravel bands (GLACIAL TILL).		
3.00-3.45	U100	60 Blows							
3.50	D								
4.20	D								
4.50-5.00	B								
4.50-4.95	SPT	N=16							
5.50	D								
6.00-6.45	U100	39 Blows							
6.50	D								
7.20	D								
7.50-7.95	SPT	N=15				(10.90)			
8.50	D								
9.00-9.45	U100	45 Blows							
9.50	D								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS	
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To		
03-02-14	00.00		11.00	150								
All dimensions in metres Scale 1:62.5		Client BSCP				Method/ Plant Used Cable Percussive					Logged By MH	

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Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project Milliners Wharf, Manchester				BOREHOLE No SA1	
Job No 13-898	Date 03-02-14	Ground Level (m)	Co-Ordinates ()		
Contractor Arc Environmental Ltd				Sheet 2 of 2	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
10.20 10.50- 10.95	D SPT	N=14					Firm brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles. Some fine sand and gravel bands (GLACIAL TILL). <i>(continued)</i>		
11.50 12.00- 12.45 12.50- 13.00	D U100 B	51 Blows				13.30			
13.50- 13.95	SPT	N=22				13.50	Grey fine to coarse SAND (GLACIAL TILL).		
14.50 15.00- 15.45 15.50	D U100 D	100 Blows				(2.50) 16.00	Firm brown laminated sandy gravelly CLAY. Gravel is fine to coarse of sandstone. Cobbles (GLACIAL TILL).		
16.00 16.50- 16.95	D CPT	N=22				(1.00) 17.00	Dense light brown gravelly SAND. Possible highly weathered sandstone (GLACIAL TILL).		
17.00- 17.03	CPT	50 Blows				17.03	Very dense brown SAND and GRAVEL (GLACIAL TILL). Borehole terminated at 17.03m due to refusal on very dense deposits. Standing time for 3 hours to source water feed during drilling from 16.00m. Chiselling for 1 hour from 16.80m to 17.00m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Slight water seepage from 2.30m. Upon completion, borehole recorded as dry.
All dimensions in metres Scale 1:62.5			Client BSCP			Method/ Plant Used Cable Percussive			Logged By MH		



Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project Milliners Wharf, Manchester				BOREHOLE No SA2	
Job No 13-898	Date 05-02-14	Ground Level (m)	Co-Ordinates ()		
Contractor Arc Environmental Ltd				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
						(0.70) 0.70	Black brown and grey sandy gravel / gravelly sand. Gravel is fine to coarse comprising fragments of brick concrete pot and ash. Cobbles. Becoming clayey in places (MADE GROUND).		
						1.00	Concrete (MADE GROUND).		
							Borehole terminated at 1.00m due to refusal on concrete sub base. Chiselling for 1 hour from 0.70m to 1.00m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Upon completion, borehole recorded as dry.
All dimensions in metres Scale 1:62.5			Client BSCP			Method/ Plant Used Cable Percussive			Logged By MH		

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Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project Milliners Wharf, Manchester				BOREHOLE No SA2A	
Job No 13-898	Date 05-02-14	Ground Level (m)	Co-Ordinates ()		
Contractor Arc Environmental Ltd				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.30	D					(1.90)	Black brown and grey sandy gravel / gravelly sand. Gravel is fine to coarse comprising fragments of brick concrete pot and ash. Cobbles. Becoming clayey in places (MADE GROUND).		
						1.90			
						2.30	Concrete (MADE GROUND).		
							Borehole terminated at 2.30m due to refusal on concrete sub base. Chiselling for 1 hour from 0.60m to 0.70m. Chiselling for 2 hours from 1.90m. Standing time for 2 hours to collect 8 inch equipment to break through concrete.		

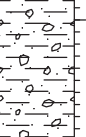
Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Upon completion, borehole recorded as dry.
All dimensions in metres Scale 1:62.5			Client BSCP			Method/ Plant Used Cable Percussive			Logged By MH		



Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project Milliners Wharf, Manchester				BOREHOLE No SA2B	
Job No 13-898	Date 06-02-14	Ground Level (m)	Co-Ordinates ()		
Contractor Arc Environmental Ltd				Sheet 1 of 2	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.00-2.00	B					(2.70) 2.70	Black brown and grey sandy gravel / gravelly sand. Gravel is fine to coarse comprising fragments of brick concrete pot and ash. Cobbles. Becoming clayey in places (MADE GROUND).		
3.00-3.50 3.00-3.45	B SPT	N=8					Firm brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles. Some fine sand and gravel bands (GLACIAL TILL).		
4.00	D								
4.50-4.95	U100	40 Blows							
5.00	D								
6.00-6.45	SPT	N=15							
7.00	D								
7.50-7.95	U100	50 Blows							
8.00	D								
8.50	D								
9.00-9.45	SPT	N=21				(12.60)			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
06-02-14	00.00		15.50	150							WATER: Slight water seepage from 2.70m. Upon completion, borehole recorded as dry.
All dimensions in metres Scale 1:62.5			Client BSCP			Method/ Plant Used Cable Percussive			Logged By MH		



Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project Milliners Wharf, Manchester				BOREHOLE No SA2B
Job No 13-898	Date 06-02-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 2 of 2

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
10.00	D						Firm brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles. Some fine sand and gravel bands (GLACIAL TILL). <i>(continued)</i>		
10.50-10.95	U100	69 Blows							
11.00	D								
11.50	D								
12.00-12.50	B								
12.00-12.45	SPT	N=20							
13.00	D								
13.50-13.95	U100	50 Blows							
14.00	D								
15.00-15.45	SPT	N=30				15.30			
15.50-15.70	SPT	50 Blows				15.70	Very dense brown SAND and GRAVEL (GLACIAL TILL).		
							Borehole terminated at 15.70m due to refusal on very dense deposits. Dayworks for 2.5 hours whilst installing 8 inch equipment through the made ground deposits. Chiselling for 2 hours from 15.30m to 15.70m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Slight water seepage from 2.70m. Upon completion, borehole recorded as dry.
All dimensions in metres Scale 1:62.5			Client BSCP			Method/ Plant Used Cable Percussive			Logged By MH		

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Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project Milliners Wharf, Manchester				BOREHOLE No SA3	
Job No 13-898	Date 11-02-14	Ground Level (m)	Co-Ordinates ()		
Contractor Arc Environmental Ltd				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
						(1.90) 1.90 2.00	Black brown and grey sandy gravel / gravelly sand. Gravel is fine to coarse comprising fragments of brick concrete pot and ash. Cobbles. Becoming clayey in places (MADE GROUND). Concrete (MADE GROUND). Borehole terminated at 2.30m due to refusal on concrete sub base. Chiselling for 1 hour at 2.00m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Upon completion, borehole recorded as dry.
All dimensions in metres Scale 1:62.5			Client BSCP			Method/ Plant Used Cable Percussive			Logged By MH		

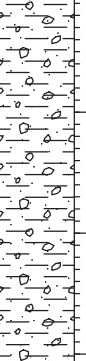
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Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project Milliners Wharf, Manchester				BOREHOLE No SA3A
Job No 13-898	Date 12-02-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 2

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.00-1.50	B					(2.50)	Black brown and grey sandy gravel / gravelly sand. Gravel is fine to coarse comprising fragments of brick concrete pot and ash. Cobbles. Becoming clayey in places (MADE GROUND).		
1.80-2.50	B					2.50			
3.00-3.50 3.00-3.45	B SPT	N=8					Firm brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles. Some fine sand and gravel bands (GLACIAL TILL).		
4.00	D								
4.50-4.95	U100	26 Blows							
5.00	D								
5.50	D								
6.00-6.45	SPT	N=16							
7.00	D								
7.50-7.95	U100	31 Blows				(10.50)			
8.00	D								
8.50	D								
9.00-9.45	SPT	N=15							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
12-02-14	00.00		13.30	150							
All dimensions in metres Scale 1:62.5		Client BSCP				Method/ Plant Used Cable Percussive					Logged By MH

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Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project Milliners Wharf, Manchester				BOREHOLE No SA3A
Job No 13-898	Date 12-02-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 2 of 2

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
10.50-10.95	U100	56 Blows					Firm brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles. Some fine sand and gravel bands (GLACIAL TILL). <i>(continued)</i>		
11.00	D								
11.50	D								
12.00-12.45	SPT	N=20							
12.50	D					13.00			
						13.36	Very dense brown SAND and GRAVEL (GLACIAL TILL).		
13.30-13.36	SPT	50 Blows					Borehole terminated at 13.36m due to refusal on very dense deposits. Dayworks for 2.5 hours whilst installing 8 inch equipment through the made ground deposits. Chiselling for 2 hours from 13.00m to 13.30m.		

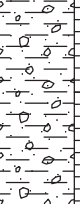
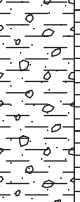
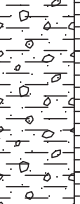
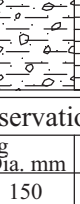
Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											WATER: Slight water seepage from 2.50m. Upon completion, borehole recorded as dry.
All dimensions in metres Scale 1:62.5			Client BSCP			Method/ Plant Used Cable Percussive			Logged By MH		



Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project Milliners Wharf, Manchester				BOREHOLE No SA4
Job No 13-898	Date 13-02-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 2

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.50-1.50	B					(2.60)	Black brown and grey sandy gravel / gravelly sand. Gravel is fine to coarse comprising fragments of brick concrete pot and ash. Cobbles. Becoming clayey in places (MADE GROUND).		
2.50-3.00	B					2.60	Firm brown silty sandy CLAY (GLACIAL TILL).		
3.00-3.45	SPT	N=8				(1.60)			
4.00	D					4.20	Firm brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles. Some fine sand and gravel bands (GLACIAL TILL).		
4.20	D								
4.50-4.95	U100	37 Blows							
5.00	D								
5.50	D								
6.00-6.50	B								
6.00-6.45	SPT	N=15							
7.00	D								
7.50-7.95	U100	57 Blows							
8.00	D								
8.50	D					(8.80)			
9.00-9.45	SPT	N=17							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
13-02-14	00.00		13.00	150							WATER: Slight water seepage from 2.60m. Upon completion, borehole recorded as dry.
All dimensions in metres Scale 1:62.5			Client BSCP			Method/ Plant Used Cable Percussive			Logged By MH		



Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

BOREHOLE LOG

Project Milliners Wharf, Manchester				BOREHOLE No SA4	
Job No 13-898	Date 13-02-14	Ground Level (m)	Co-Ordinates ()		
Contractor Arc Environmental Ltd				Sheet 2 of 2	

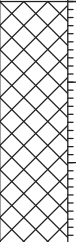
SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
10.00	D						Firm brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles. Some fine sand and gravel bands (GLACIAL TILL). <i>(continued)</i>		
10.50-10.95	U100	58 Blows							
11.00	D								
11.50	D								
12.00-12.45	SPT	N=17							
13.00-13.05	SPT	50 Blows				13.00 13.05	Very dense brown SAND and GRAVEL (GLACIAL TILL). Borehole terminated at 13.36m due to refusal on very dense deposits. Chiselling for 2 hours from 13.00m to 13.05m.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
All dimensions in metres Scale 1:62.5			Client BSCP			Method/ Plant Used Cable Percussive			Logged By MH		



DRILLHOLE LOG

Project Milliners Wharf, Manchester				DRILLHOLE No RBH1
Job No 13-898	Date 26-02-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1

RUN DETAILS			STRATA			DESCRIPTION		Geology	Instrument/ Backfill
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend (Thick- ness)	Discontinuities	Detail	Main		
					(3.00)			Black brown and grey sandy gravel / gravelly sand. Gravel is fine to coarse comprising fragments of brick concrete pot and ash. Cobbles. Becoming clayey in places (MADE GROUND). Relic Concrete floor from 0.80m to 1.10m.	
					(11.20)			Firm brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles. Some fine sand and gravel bands (GLACIAL TILL).	
26-02	(SPT)	(50/180mm)			14.20				

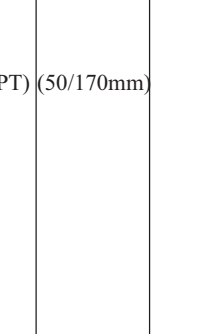
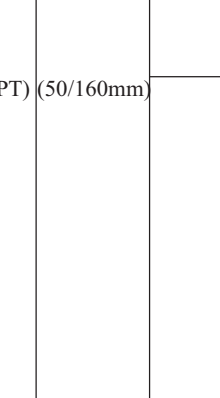
Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Water Strike	Standing	From	To	Type	Returns	
26-02-14	00.00		20.20	115			0 14.2	14.2 20.2	Air Mist Air Mist	100 50	All descriptions based on drillers interpretations on cuttings brought to surface and drilling rates maintained.
All dimensions in metres Scale 1:93.75		Client BSCP				Method/ Plant Used Open Hole Rotary				Logged By Welltherm	

AGS3 UK DH RBHS 13-898.GPJ AGS3 ALL.GDT 2/28/14



DRILLHOLE LOG

Project Milliners Wharf, Manchester				DRILLHOLE No RBH1
Job No 13-898	Date 26-02-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 2

RUN DETAILS			STRATA						
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION			Instrument/ Backfill
						Discontinuities	Main		
26-02	(SPT)	(50/170mm)			(6.00)		Grey fine to coarse SAND and GRAVEL. Many cobbles (GLACIAL TILL). <i>(continued)</i>		
26-02	(SPT)	(50/160mm)			(5.00)		Reddish brown SANDSTONE with some mudstone bands (COLLYHURST SANDSTONE FORMATION).		
					25.20		Borehole terminated at 25.20m in solid deposits.		

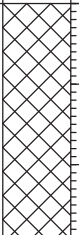
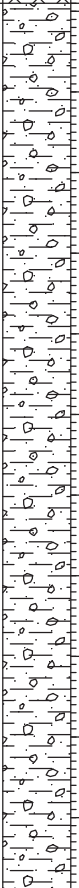
Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Strike	Water Standing	From	To	Type	Returns	
							20.2	25.2	Air Mist	100	
All dimensions in metres Scale 1:93.75		Client BSCP				Method/ Plant Used Open Hole Rotary					Logged By Welltherm

AGS3 UK DH RBHS 13-898.GPJ AGS3 ALL.GDT 2/28/14



DRILLHOLE LOG

Project Milliners Wharf, Manchester				DRILLHOLE No RBH2
Job No 13-898	Date 26-02-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1

RUN DETAILS			STRATA				Geology	Instrument/ Backfill	
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION			
						Discontinuities			Detail
26-02	(SPT)	(50/200mm)			(2.90) 2.90		Black brown and grey sandy gravel / gravelly sand. Gravel is fine to coarse comprising fragments of brick concrete pot and ash. Cobbles. Becoming clayey in places (MADE GROUND).		
					(11.00) 13.90		Firm brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles. Some fine sand and gravel bands (GLACIAL TILL).		
							Grey fine to coarse SAND and GRAVEL. Many cobbles (GLACIAL TILL).		

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Strike	Water Standing	From	To	Type	Returns	
26-02-14	00.00		18.10	115			0 13.9	13.9 18.1	Air Mist Air Mist	100 50	
											All descriptions based on drillers interpretations on cuttings brought to surface and drilling rates maintained.
All dimensions in metres Scale 1:93.75		Client BSCP				Method/ Plant Used Open Hole Rotary					Logged By Welltherm

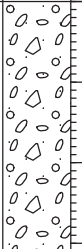
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Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

DRILLHOLE LOG

Project Milliners Wharf, Manchester				DRILLHOLE No RBH2
Job No 13-898	Date 26-02-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 2 of 2

RUN DETAILS			STRATA						Geology	Instrument/ Backfill
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION				
						Discontinuities	Detail	Main		
26-02	(SPT)	(50/150mm)			(4.20) <					

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Water Strike	Water Standing	From	To	Type	Returns	
							18.1	23.1	Air Mist	100	All descriptions based on drillers interpretations on cuttings brought to surface and drilling rates maintained.
All dimensions in metres Scale 1:93.75			Client BSCP			Method/ Plant Used Open Hole Rotary			Logged By Welltherm		

AGS3 UK DH RBHS 13-898.GPJ AGS3 ALL.GDT 2/28/14



Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

DRILLHOLE LOG

Project Milliners Wharf, Manchester				DRILLHOLE No RBH3
Job No 13-898	Date 25-02-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1

RUN DETAILS			STRATA						of 2	
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION			Geology	Instrument/ Backfill
						Discontinuities	Detail	Main		
26-02	(SPT)	(50/150mm)			0.30			Tarmac over concrete (MADE GROUND).		
					(2.60)			Black brown and grey sandy gravel / gravelly sand. Gravel is fine to coarse comprising fragments of brick concrete pot and ash. Cobbles. Becoming clayey in places (MADE GROUND).		
					2.90					
					(10.60)			Firm brown and grey sandy gravelly CLAY. Gravel is fine to coarse of sandstone and mudstone. Cobbles. Some fine sand and gravel bands (GLACIAL TILL).		
					13.50			Grey fine to coarse SAND and GRAVEL. Many cobbles (GLACIAL TILL).		

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Water Strike	Water Standing	From	To	Type	Returns	
26-02-14	00.00		19.80	115			0 13.5	13.5 19.8	Air Mist Air Mist	100 50	All descriptions based on drillers interpretations on cuttings brought to surface and drilling rates maintained.
All dimensions in metres Scale 1:93.75			Client BSCP			Method/ Plant Used Open Hole Rotary			Logged By Welltherm		

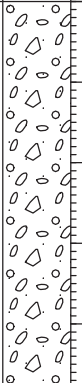
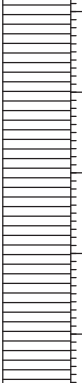
AGS3 UK DH RBHS 13-898.GPJ AGS3 ALL.GDT 2/28/14



Arc Environmental Ltd
Solum House, Unit 1 Elliott Court, St Johns Road,
Meadowfield, Durham DH7 8PN
Telephone: 0191 378 6380
Fax: 0191 378 0494

DRILLHOLE LOG

Project Milliners Wharf, Manchester				DRILLHOLE No RBH3
Job No 13-898	Date 25-02-14	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 2 of 2

RUN DETAILS			STRATA						Geology	Instrument/ Backfill
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION				
						Discontinuities	Detail	Main		
26-02	(SPT)	(50/200mm)			(6.30)			Grey fine to coarse SAND and GRAVEL. Many cobbles (GLACIAL TILL). (continued)		
26-02	(SPT)	(50/210mm)			(5.00)			Reddish brown MUDSTONE with some sandstone bands (HALESOWEN FORMATION).		
					24.80			Borehole terminated at 24.80m in solid deposits.		

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Water Strike	Water Standing	From	To	Type	Returns	
							19.8	24.8	Air Mist	100	All descriptions based on drillers interpretations on cuttings brought to surface and drilling rates maintained.
All dimensions in metres Scale 1:93.75			Client BSCP			Method/ Plant Used Open Hole Rotary			Logged By Welltherm		

AGS3 UK DH RBHS 13-898.GPJ AGS3 ALL.GDT 2/28/14

APPENDIX III

Gas and Water Monitoring Certificate

Arc Environmental Ground Gas & Groundwater Monitoring Certificate



Site:	Milliners Wharf, Manchester
Ref:	13-898

Visit	Date	Time	Equipment	Weather	Initials	Comments	Borehole	Gas Flow (l/hr)	Atmospheric Pressure (mb)	Falling Y/N	Methane (% v/v)		Methane (% LEL)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Hydrocarbons (GFM 435 only)		Other Gases (PPM)			Depth to Water (m bgl)
											Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	Hex %	PID Cf	PID (Isobutylene)	H ₂ S	CO	
1	17/02/2014	8.30am	GFM435	Drizzle, Overcast	AL		1	<0.1	998	Y		0.0	0.0			0.1		20.0						1.03
							3	<0.1	997	Y		0.0	0.0			0.1		19.8						3.50
							7	<0.1	997	Y		0.0	0.0			0.0		20.0						0.31
2	25/02/2014	8.15am	GFM435	Dry, Bright	MPB		1	<0.1	987	Y		0.0	0.0			0.1		20.0						1.13
							3	<0.1	986	Y		0.0	0.0			0.0		20.1						3.45
							7	<0.1	987	Y		0.0	0.0			0.1		20.2						0.48
3																								
4																								
5																								
6																								

Notes:
Detection limits - Methane = 0.0%, Carbon Dioxide = 0.0%, LEL = 0.0%, Oxygen = 0.0%, Flow = 0.1lhr
Monitoring order is from **Left to Right** across table
Monitoring should be for **Not Less** than 3 minutes. However, if high concentrations of gases initially recorded, monitoring should be for up to 10 minutes
N/A = Not applicable
= Off the scale
Cf = PID compensation Factor (1-10) - Must be used to multiply the PID reading to give an accurate measure of the total hydrocarbons in the borehole when methane is present
Hex = Hexene (Valid and in range up to 2.000%) - Recorded when abnormally high methane is present.
PID = Photo Ionisation Detector (Calibrated to Isobutylene)

APPENDIX IV

Laboratory Results (Geotechnical & Ground Contamination)



LABORATORY REPORT



4043

Contract Number: PSL14/0950

Client's Reference:

Report Date: 24 March 2014

Client Name: Arc Environmental
Solum House
Unit 1 Elliott Court
St Johns Road, Meadowfield
Durham
DH7 8PN

For the attention of: Matt Bradford

Contract Title: Milliners Wharf, Manchester

Date Received: 26/2/2014

Date Commenced: 26/2/2014

Date Completed: 24/3/2014

Notes: Observations and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson
(Director)

A Watkins
(Director)

M Beastall
(Laboratory Manager)

D Lambe
(Senior Technician)

S Royle
(Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
BH1		B	2.50	Brown mottled grey sandy CLAY.
BH2		B	3.50	Brown slightly gravelly sandy CLAY.
BH3		B	4.00	Brown gravelly sandy CLAY.
BH4		B	1.50	Brown gravelly sandy CLAY.
BH6		B	2.00	Brown mottled grey slightly gravelly sandy CLAY.
BH7		B	1.00	Brown sandy CLAY.
BH7		B	4.00	Brown slightly gravelly very sandy CLAY.
SA1		U	3.00-3.45	Very stiff brown slightly gravelly sandy CLAY.
SA1		B	4.50-5.00	Brown slightly gravelly sandy CLAY.
SA1		U	6.00-6.45	Stiff brown slightly gravelly sandy CLAY.
SA1		U	9.00-9.45	Very stiff brown slightly gravelly sandy CLAY.
SA1		U	12.00-12.45	Stiff brown slightly gravelly sandy CLAY.
SA1		U	15.00-15.45	Stiff brown sandy CLAY.
SA2B		B	3.00-3.50	Brown slightly gravelly very sandy CLAY.
SA2B		U	4.50-4.95	Stiff brown slightly gravelly sandy CLAY.
SA2B		U	7.50-7.95	Stiff brown slightly gravelly sandy CLAY.
SA2B		D	8.00	Brown gravelly very sandy CLAY.
SA2B		U	10.50-10.95	Stiff brown slightly gravelly sandy CLAY.
SA2B		B	12.00-12.50	Brown slightly gravelly very sandy CLAY.



Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	23/03/14		24/03/14		24/03/14
MILLINERS WHARF, MANCHESTER.				Contract No:	PSL14/0950
				Client Ref:	13-898

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
SA3A		B	3.00-3.50	Brown gravelly very sandy CLAY.
SA3A		U	4.50-4.95	Firm brown slightly gravelly sandy CLAY.
SA3A		D	7.00	Brown slightly gravelly very sandy CLAY.
SA3A		U	10.50-10.95	Stiff brown slightly gravelly sandy CLAY.
SA3A		D	11.50	Brown slightly gravelly very sandy CLAY.
SA4		U	4.50-4.95	Firm brown sandy CLAY.
SA4		B	6.00-6.50	Brown gravelly very sandy CLAY.
SA4		U	7.50-7.95	Stiff brown slightly gravelly sandy CLAY.
SA4		U	10.50-10.95	Stiff brown slightly gravelly sandy CLAY.
SA4		D	11.00	Brown slightly gravelly very sandy CLAY.



Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	23/03/14		24/03/14		24/03/14
MILLINERS WHARF, MANCHESTER.				Contract No:	PSL14/0950
				Client Ref:	13-898

SUMMARY OF SOIL CLASSIFICATION TESTS

(B.S. 1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Depth (m)	Moisture Content % Clause 3.2	Bulk Density Mg/m ³ Clause 7.2	Dry Density Mg/m ³ Clause 7.2	Particle Density Mg/m ³ Clause 8.	Liquid Limit % Clause 4.3/4.4	Plastic Limit % Clause 5.	Plasticity Index % Clause 5.4	% Passing .425mm	Remarks
BH1		B	2.50	21				43	21	22	100	Intermediate plasticity CL.
BH2		B	3.50	19				40	20	20	97	Intermediate plasticity CL.
BH3		B	4.00	29				45	22	23	86	Intermediate plasticity CL.
BH4		B	1.50	29				51	25	26	87	High plasticity CH.
BH6		B	2.00	22				47	23	24	95	Intermediate plasticity CL.
BH7		B	1.00	28				48	25	23	100	Intermediate plasticity CL.
BH7		B	4.00	20				34	17	17	96	Low plasticity CL.
SA1		B	4.50-5.00	20				38	19	19	96	Intermediate plasticity CL.
SA2B		B	3.00-3.50	19				32	17	15	95	Low plasticity CL.
SA2B		D	8.00	26				30	16	14	87	Low plasticity CL.
SA2B		B	12.00-12.50	19				34	17	17	96	Low plasticity CL.
SA3A		B	3.00-3.50	19				36	18	18	86	Intermediate plasticity CL.
SA3A		D	7.00	20				31	16	15	96	Low plasticity CL.
SA3A		D	11.50	17				36	17	19	97	Intermediate plasticity CL.
SA4		B	6.00-6.50	19				34	17	17	88	Low plasticity CL.
SA4		D	11.00	17				32	16	16	95	Low plasticity CL.

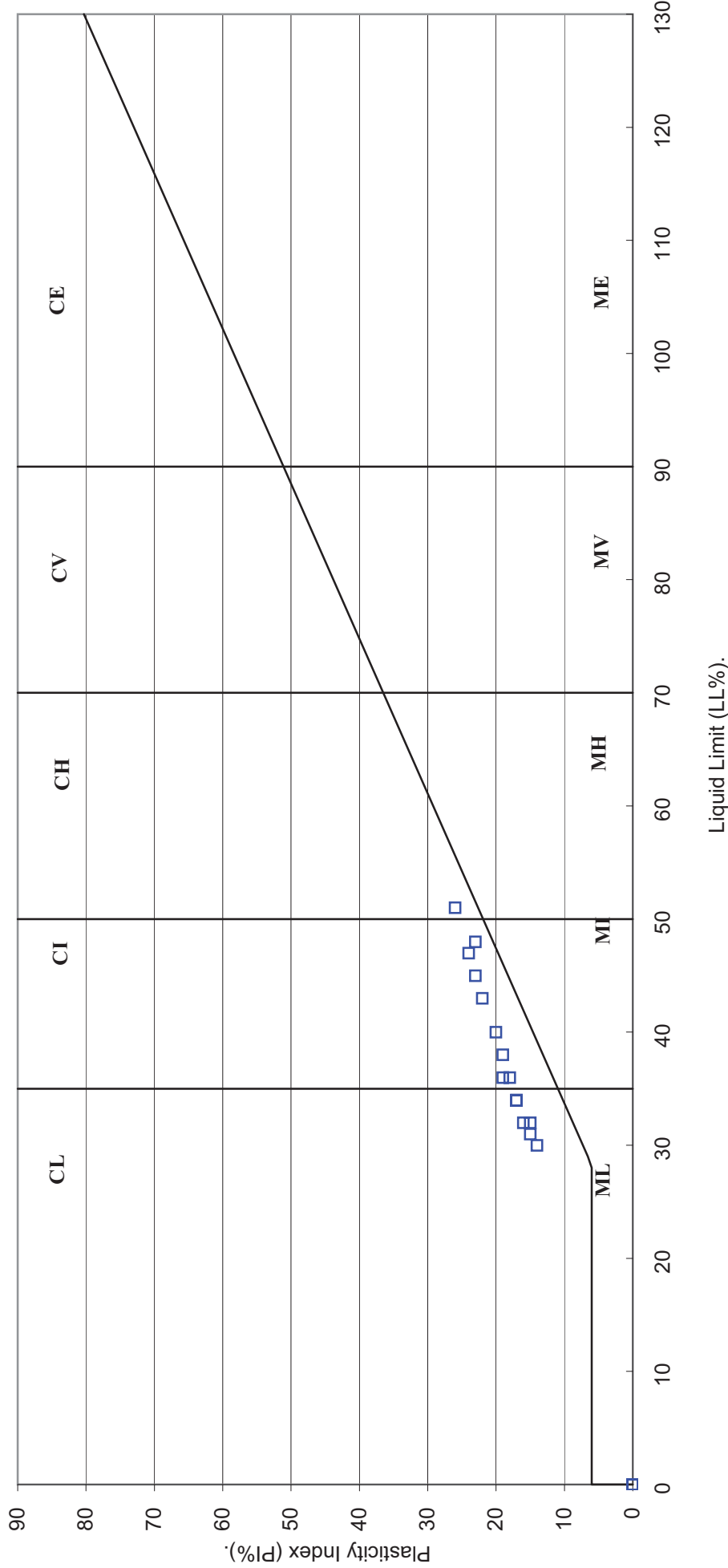


PSL
Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	24/03/14		24/03/14		24/03/14
MILLINERS WHARF, MANCHESTER.				Contract No:	PSL14/0950
				Client Ref:	13-898

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



Compiled by	Date	Checked by	Date	Approved by	Date
	24/03/14		24/03/14		24/03/14
MILLINERS WHARF, MANCHESTER.				Contract No:	PSL14/0950
				Client Ref:	13-898

One Dimensional Consolidation Properties

BS 1377: Part 5: 1990

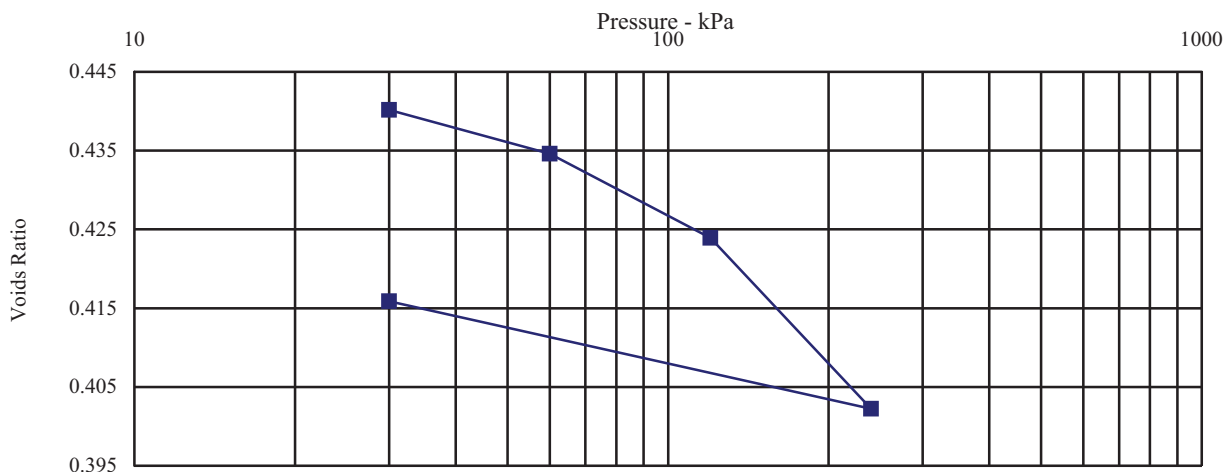
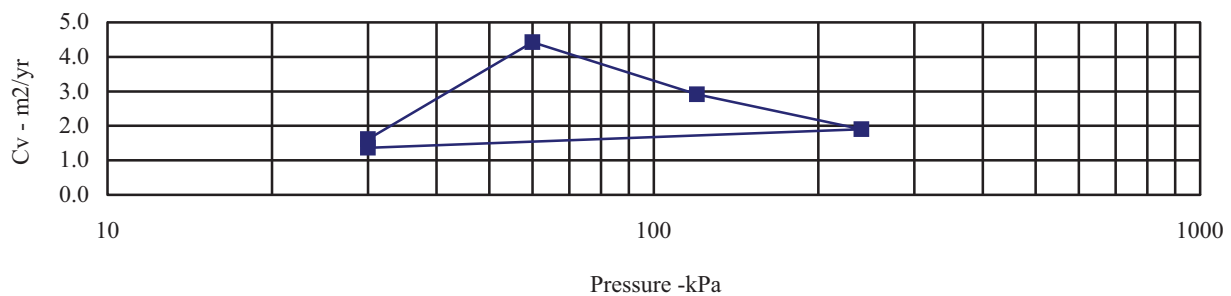
Hole Number: SA1

Depth (m): 3.00-3.45

Sample Number:

Sample Type: U

Initial Conditions		Pressure Range			Mv	Cv	Specimen location	
Moisture Content (%):	19	kPa			m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	2.15	0	-	30	0.767	1.610	Method used to	
Dry Density (Mg/m3):	1.80	30	-	60	0.129	4.426	determine CV:	t90
Voids Ratio:	0.474	60	-	120	0.124	2.917	Nominal temperature	
Degree of saturation:	108.2	120	-	240	0.127	1.906	during test ' C:	20
Height (mm):	19.85	240	-	30	0.046	1.364	Remarks:	
Diameter (mm)		See summary of soils description.						
Particle Density (Mg/m3):								
Assumed								



Checked by	Date	Approved by	Date
<i>H. bus</i>	24/03/14	<i>H. bus</i>	24/03/14



MILLINERS WHARF,
MANCHESTER.

Contract No.

PSL14/0950

Page of

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

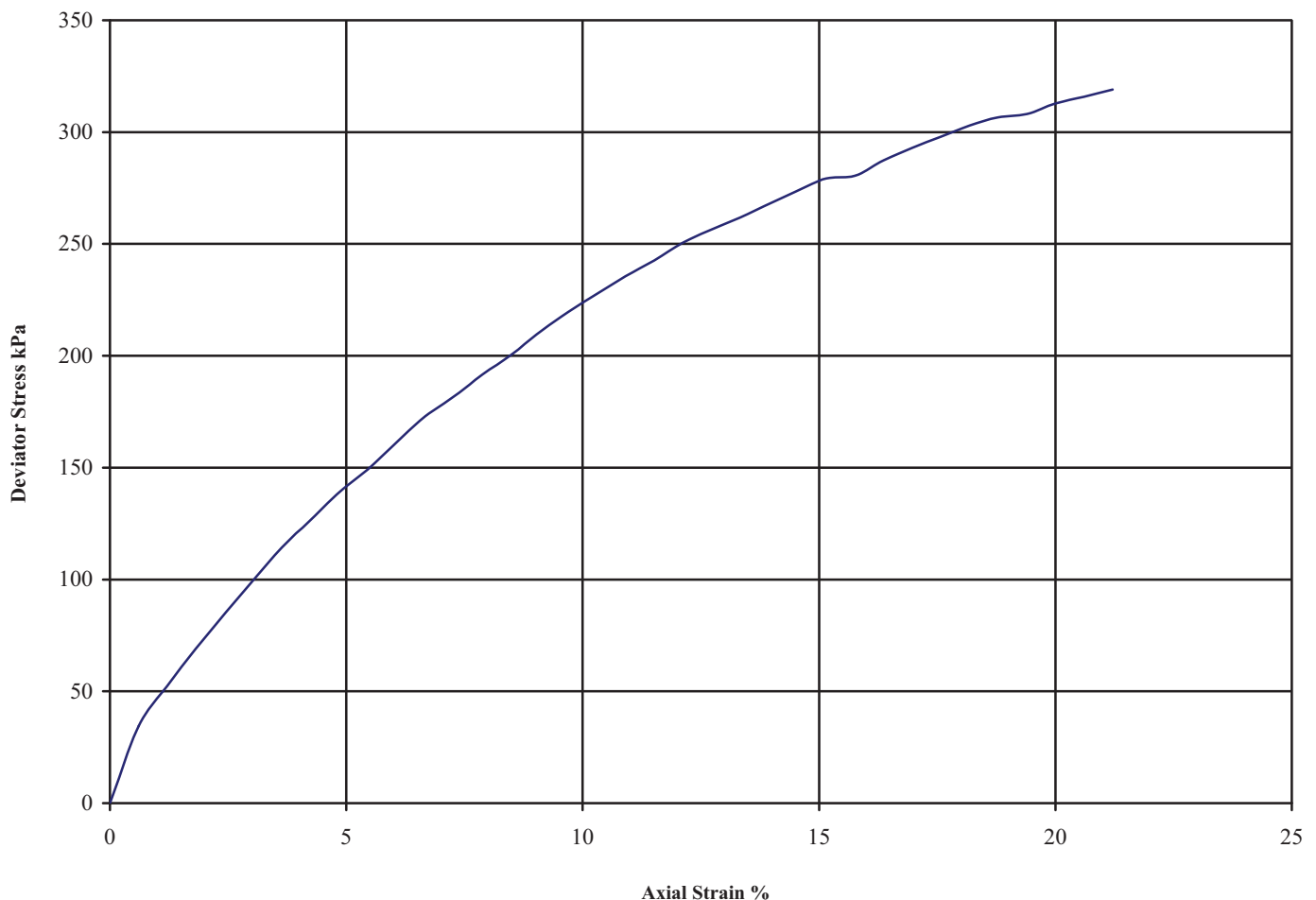
B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: SA1

Depth (m): 3.00-3.45

Sample Number:

Sample Type: U



Diameter (mm):		102.0	Height (mm):		165.0	Test:	100 mm Single Stage.		Undisturbed			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Remarks			
									Sample taken from top of tube			
									Rate of strain = 2.4 %/min			
									Latex Membrane used 0.2 mm thickness, Correction applied 0.33 kPa			
A	17	2.16	1.84	60	319	160	21.2	Compound	See summary of soil descriptions.			
									Checked	Date	Approved	Date
									<i>H. S.</i>	24/03/14	<i>H. S.</i>	24/03/14
PSL Professional Soils Laboratory				MILLINERS WHARF, MANCHESTER.					Contract No: PSL14/0950			

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

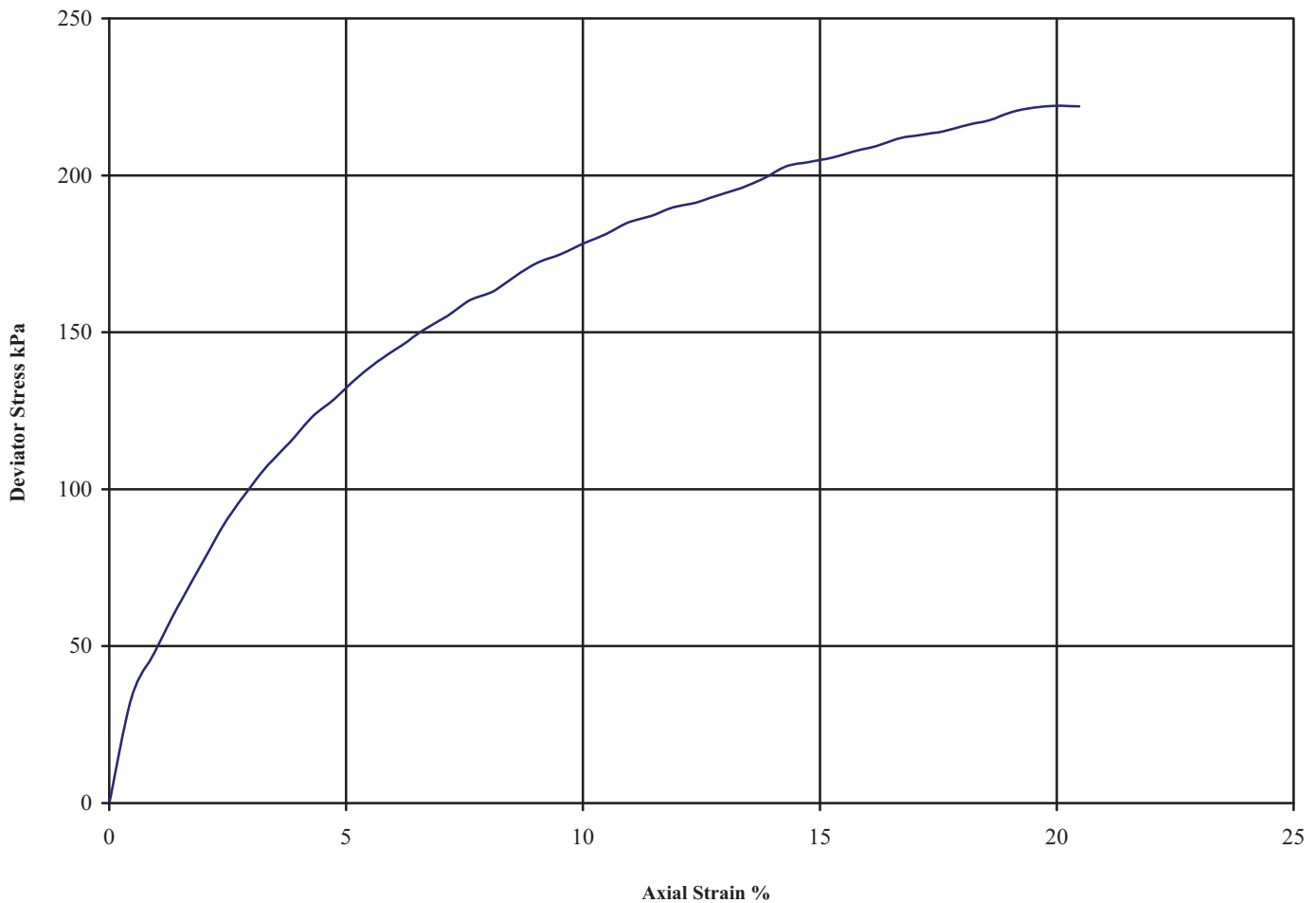
B.S. 1377 : Part 7 : Clause 8 : 1990

Hole Number: SA1

Depth (m): 6.00-6.45

Sample Number:

Sample Type: U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage.		Undisturbed			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max.	Shear	Failure Strain (%)	Mode of Failure	Remarks			
					Deviator Stress (kPa)	Cu (kPa)			Sample taken from top of tube			
					θ_3	$(\theta_1 - \theta_3)_f$			$\frac{1}{2}(\theta_1 - \theta_3)_f$	Rate of strain = 1.9 %/min		
										Latex Membrane used 0.2 mm thickness, Correction applied 0.33 kPa		
A	16	2.15	1.85	120	222	111	20.0	Compound	See summary of soil descriptions.			
									Checked	Date	Approved	Date
										24/03/14		24/03/14
PSL Professional Soils Laboratory				MILLINERS WHARF, MANCHESTER.					Contract No: PSL14/0950			

One Dimensional Consolidation Properties

BS 1377: Part 5: 1990

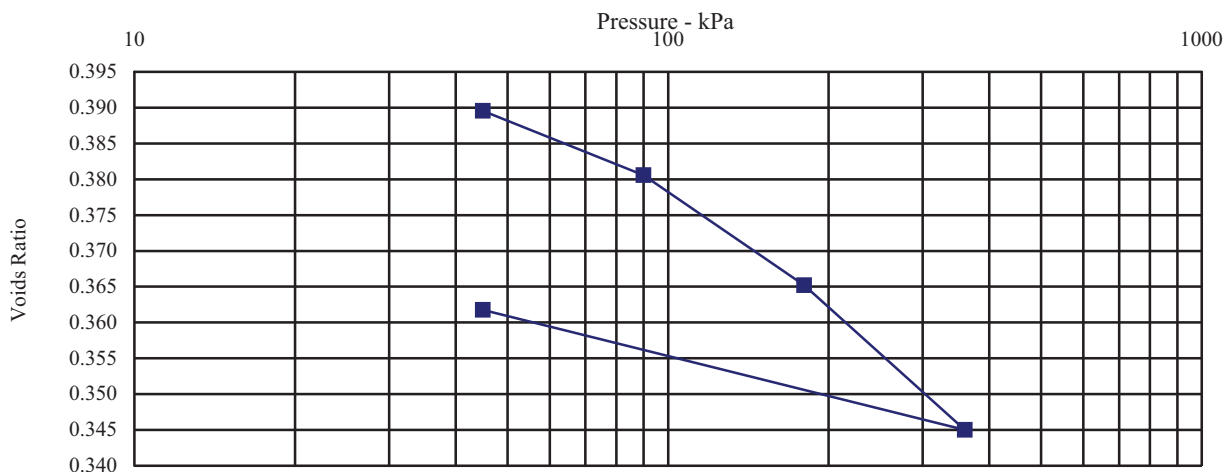
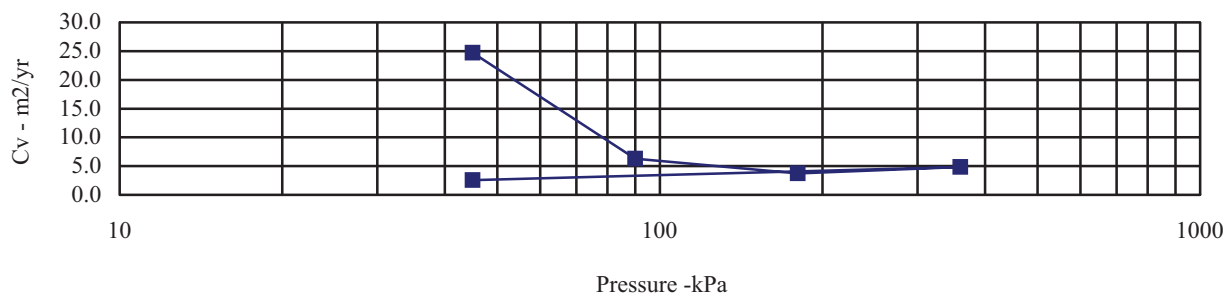
Hole Number: SA1

Depth (m): 9.00-9.45

Sample Number:

Sample Type: U

Initial Conditions		Pressure Range			Mv	Cv	Specimen location	
Moisture Content (%):	15	kPa			m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	2.19	0	-	45	0.051	24.709	Method used to	
Dry Density (Mg/m3):	1.90	45	-	90	0.143	6.298	determine CV:	t90
Voids Ratio:	0.393	90	-	180	0.124	3.734	Nominal temperature	
Degree of saturation:	101.9	180	-	360	0.082	4.851	during test 'C':	20
Height (mm):	20.04	360	-	45	0.040	2.551	Remarks:	
Diameter (mm)		See summary of soils description.						
Particle Density (Mg/m3):								
Assumed								



Checked by	Date	Approved by	Date
<i>H. bus</i>	24/03/14	<i>H. bus</i>	24/03/14



MILLINERS WHARF,
MANCHESTER.

Contract No.

PSL14/0950

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Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

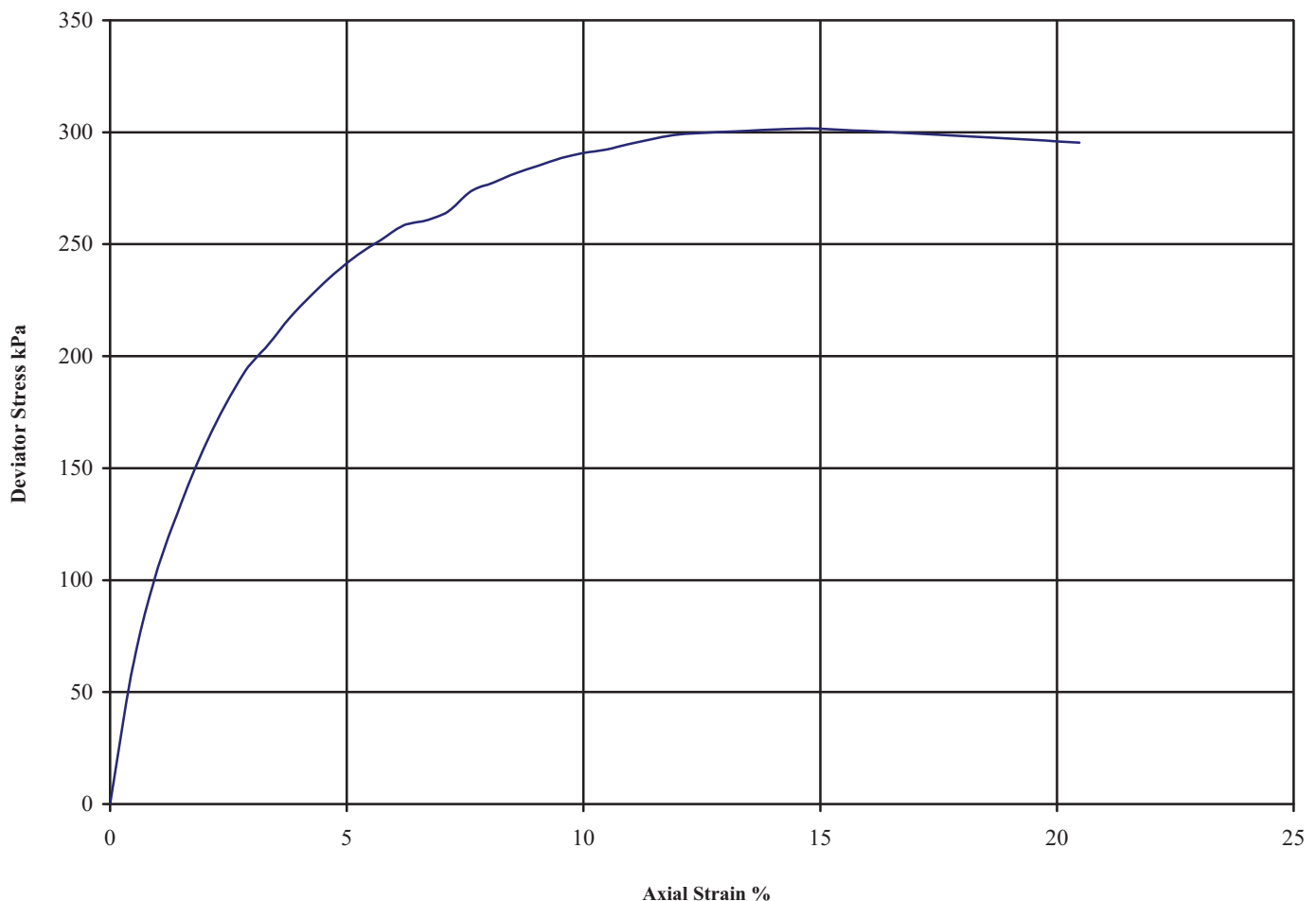
B.S. 1377 : Part 7 : Clause 8 : 1990

Hole Number: SA1

Depth (m): 9.00-9.45

Sample Number:

Sample Type: U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage.		Undisturbed			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Remarks			
									Sample taken from top of tube			
									Rate of strain = 1.9 %/min			
									Latex Membrane used 0.2 mm thickness, Correction applied 0.34 kPa			
A	15	2.11	1.84	180	302	151	14.8	Compound	See summary of soil descriptions.			
									Checked	Date	Approved	Date
									<i>H. S.</i>	24/03/14	<i>H. S.</i>	24/03/14
PSL Professional Soils Laboratory				MILLINERS WHARF, MANCHESTER.					Contract No: PSL14/0950			

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

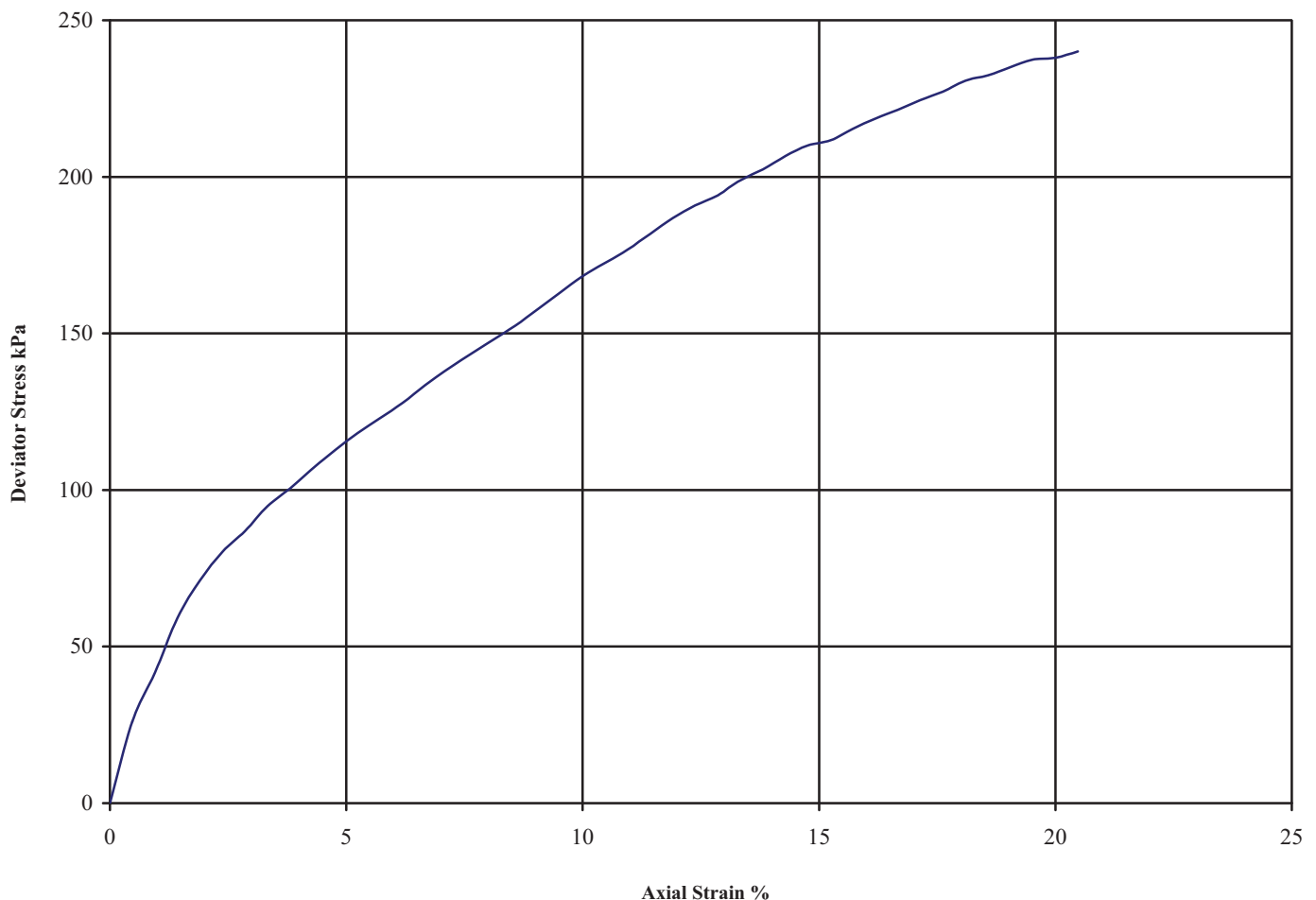
B.S. 1377 : Part 7 : Clause 8 : 1990

Hole Number: SA1

Depth (m): 12.00-12.45

Sample Number:

Sample Type: U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage.		Undisturbed			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Remarks			
									Sample taken from top of tube			
									Rate of strain = 1.9 %/min			
									Latex Membrane used 0.2 mm thickness, Correction applied 0.33 kPa			
A	16	2.19	1.88	240	240	120	20.5	Plastic	See summary of soil descriptions.			
									Checked	Date	Approved	Date
										24/03/14		24/03/14
PSL Professional Soils Laboratory				MILLINERS WHARF, MANCHESTER.					Contract No: PSL14/0950			

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

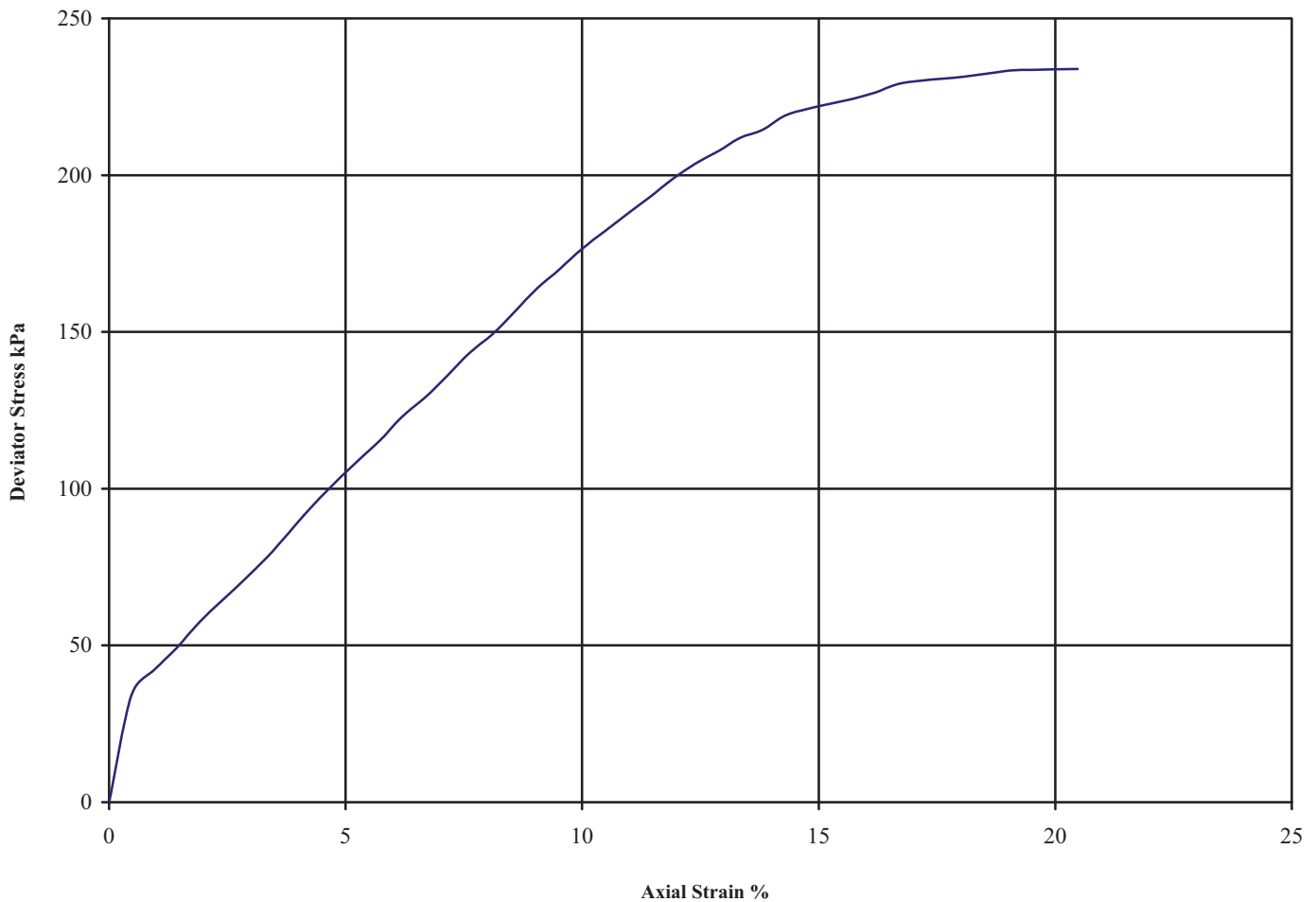
B.S. 1377 : Part 7 : Clause 8 : 1990

Hole Number: SA1

Depth (m): 15.00-15.45

Sample Number:

Sample Type: U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage.		Undisturbed			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max.	Shear	Failure Strain (%)	Mode of Failure	Remarks			
					Deviator Stress (kPa)	Cu (kPa)			Sample taken from top of tube			
									Rate of strain = 1.9 %/min			
									Latex Membrane used 0.2 mm thickness,			
A	26	2.05	1.63	300	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$	20.5	Plastic	Correction applied 0.33 kPa			
									See summary of soil descriptions.			
									Checked	Date	Approved	Date
										24/03/14		24/03/14
PSL Professional Soils Laboratory				MILLINERS WHARF, MANCHESTER.					Contract No: PSL14/0950			

One Dimensional Consolidation Properties

BS 1377: Part 5: 1990

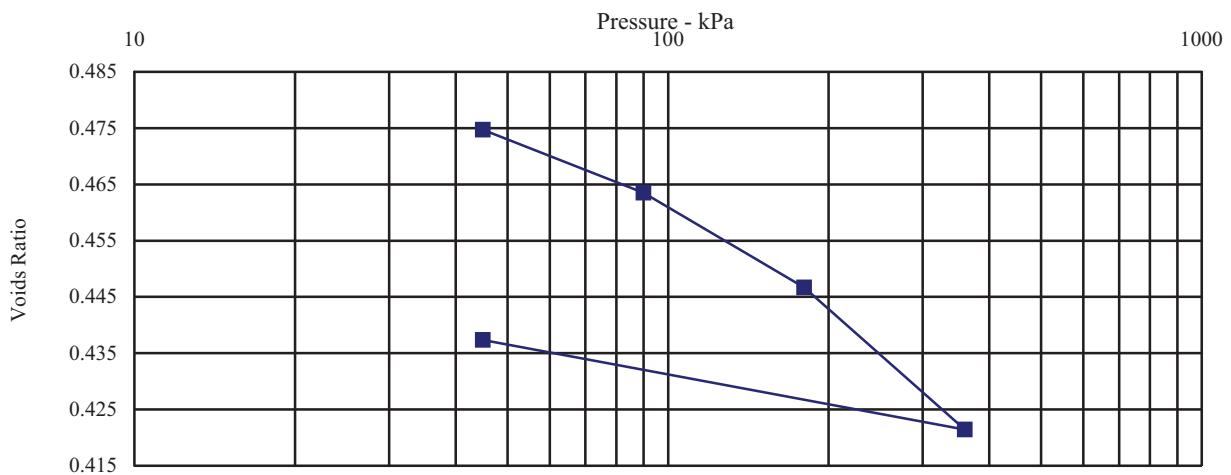
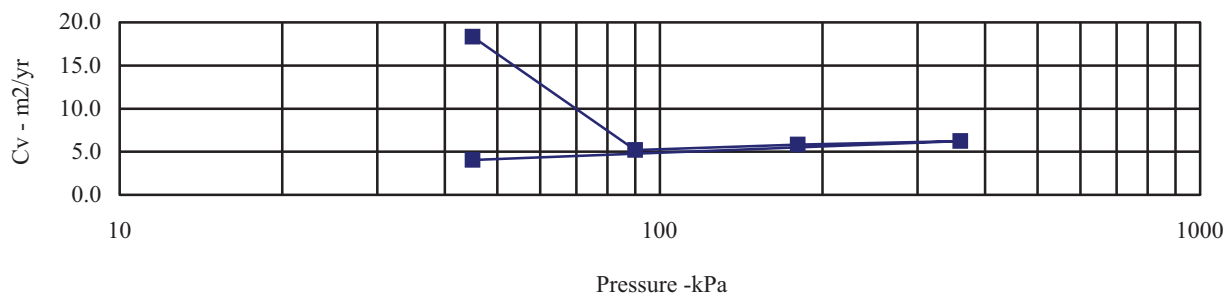
Hole Number: SA2B

Depth (m): 4.50-4.95

Sample Number:

Sample Type: U

Initial Conditions		Pressure Range			Mv	Cv	Specimen location	
Moisture Content (%):	18	kPa			m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	2.11	0	-	45	0.100	18.329	Method used to	
Dry Density (Mg/m3):	1.79	45	-	90	0.169	5.203	determine CV:	t90
Voids Ratio:	0.481	90	-	180	0.128	5.844	Nominal temperature	
Degree of saturation:	99.1	180	-	360	0.097	6.252	during test ' C:	20
Height (mm):	20.36	360	-	45	0.036	4.043	Remarks:	
Diameter (mm)	75.21	See summary of soils description.						
Particle Density (Mg/m3):	2.65							
Assumed								



Checked by	Date	Approved by	Date
<i>H. B. S.</i>	24/03/14	<i>H. B. S.</i>	24/03/14



MILLINERS WHARF,
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Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

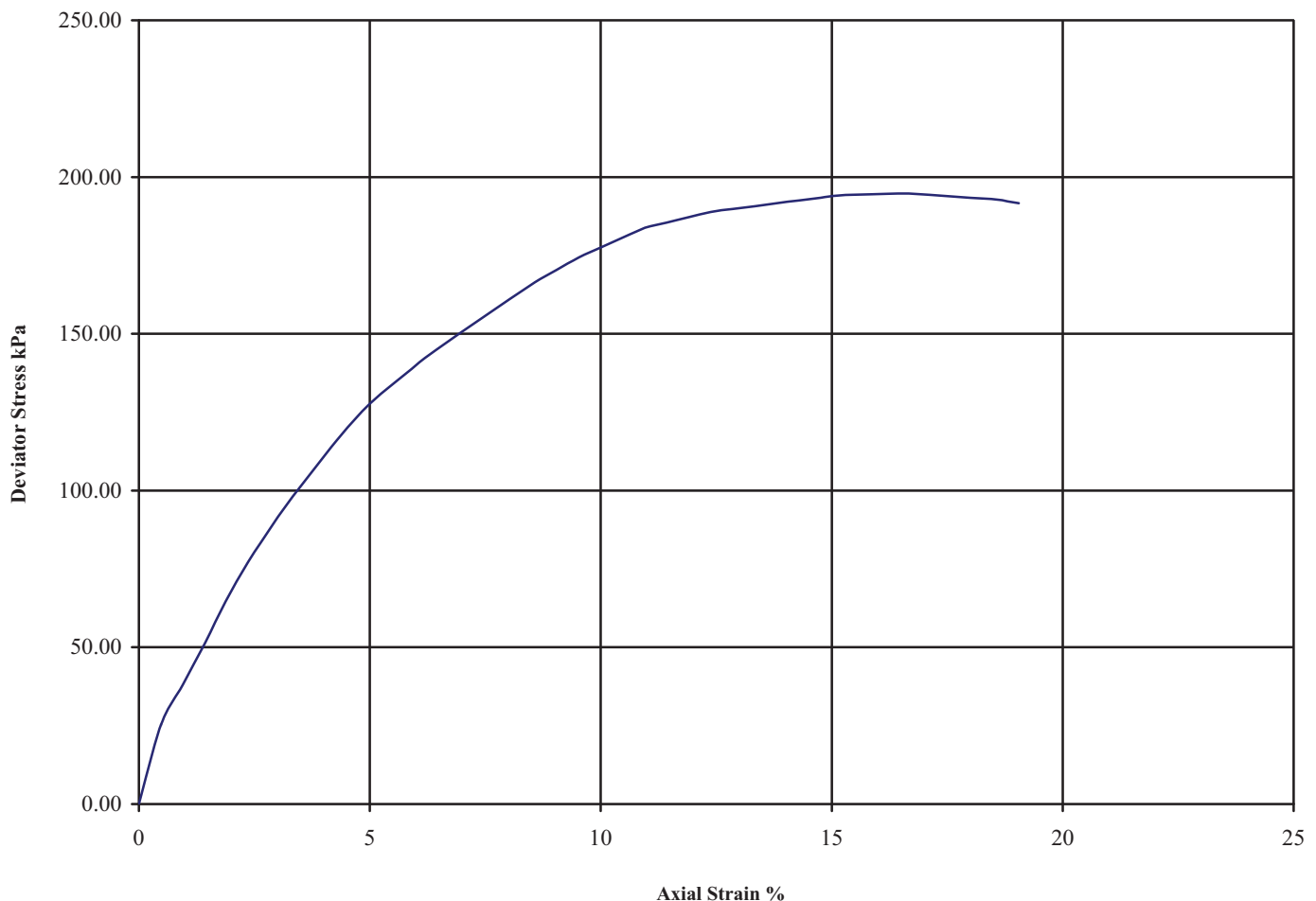
B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: SA2B

Depth (m): 4.50-4.95

Sample Number:

Sample Type: U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage.		Undisturbed			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Remarks			
									Sample taken from top of tube			
									Rate of strain = 1.9 %/min			
									Latex Membrane used 0.2 mm thickness,			
A	19	2.13	1.79	90	195	97	16.7	Plastic	Correction applied 0.34 kPa			
									See summary of soil descriptions.			
									Checked	Date	Approved	Date
										24/03/14		24/03/14
PSL Professional Soils Laboratory				MILLINERS WHARF, MANCHESTER.					Contract No: PSL14/0950			

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

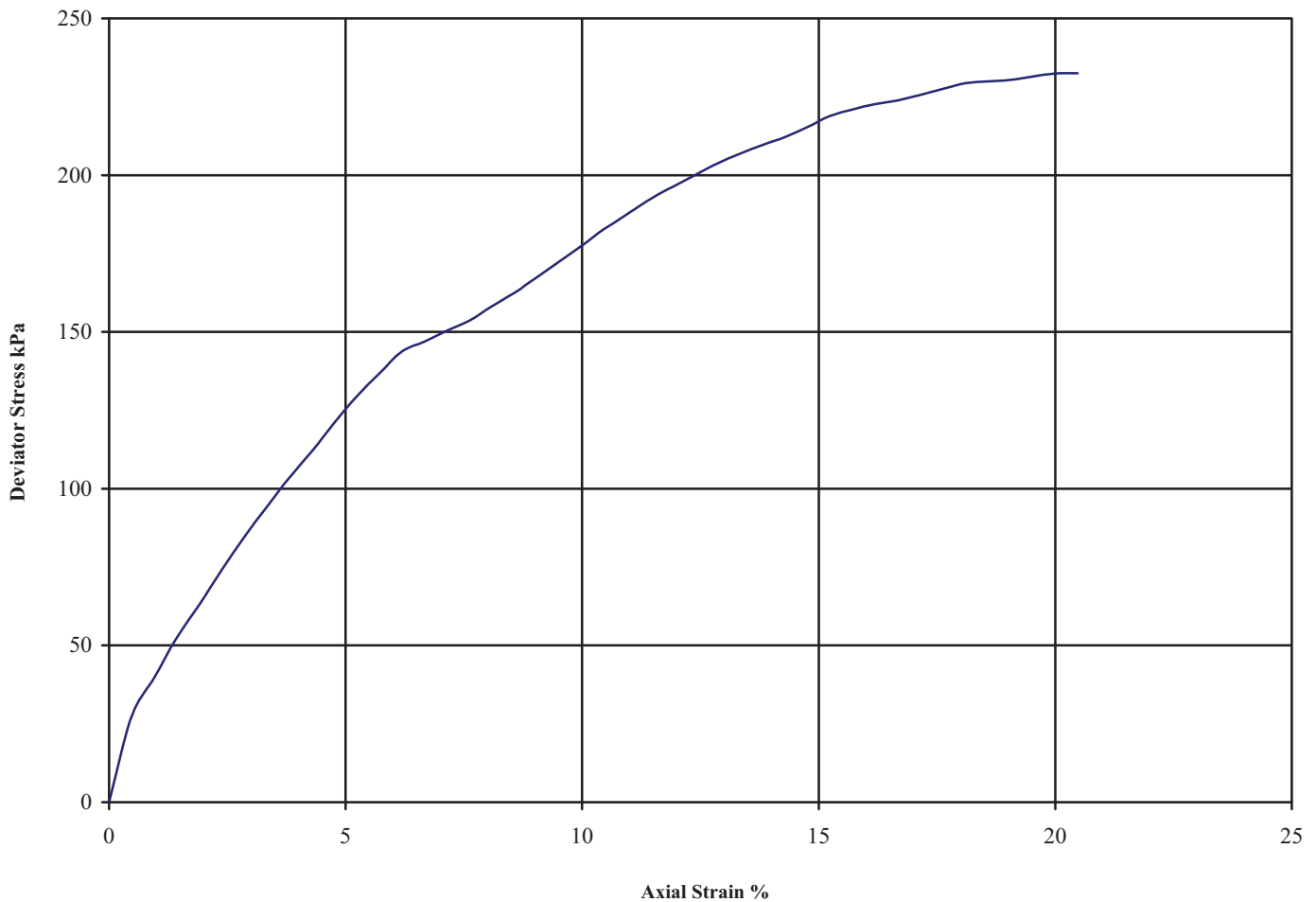
B.S. 1377 : Part 7 : Clause 8 : 1990

Hole Number: SA2B

Depth (m): 7.50-7.95

Sample Number:

Sample Type: U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage.		Undisturbed			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max.	Shear	Failure Strain (%)	Mode of Failure	Remarks			
					Deviator Stress (kPa)	Cu (kPa)			Sample taken from top of tube			
									Rate of strain = 1.9 %/min			
									Latex Membrane used 0.2 mm thickness,			
A	15	2.18	1.90	150	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$	20.5	Plastic	Correction applied 0.33 kPa			
									See summary of soil descriptions.			
									Checked	Date	Approved	Date
										24/03/14		24/03/14
PSL Professional Soils Laboratory				MILLINERS WHARF, MANCHESTER.					Contract No: PSL14/0950			

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

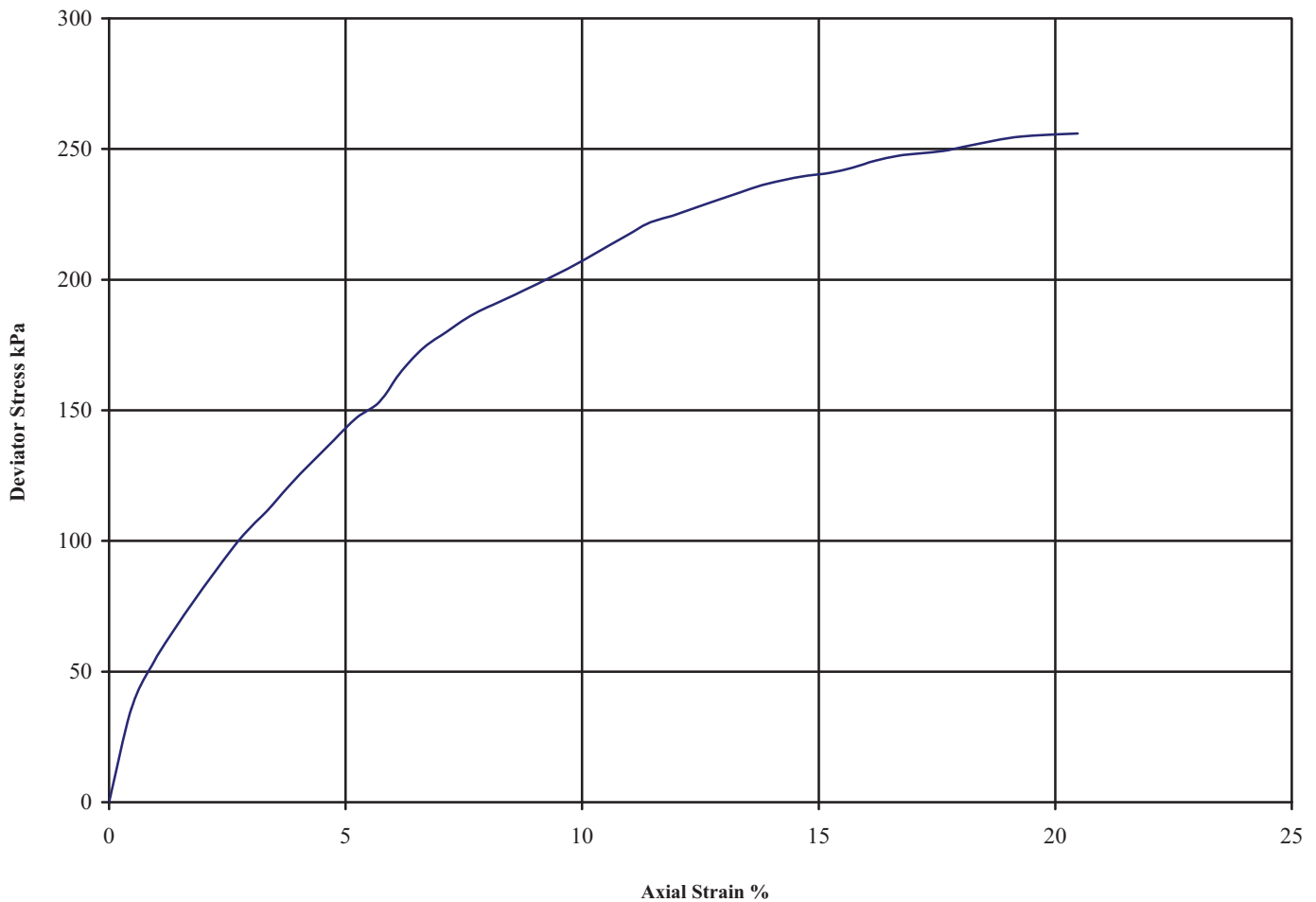
B.S. 1377 : Part 7 : Clause 8 : 1990

Hole Number: SA2B

Depth (m): 10.50-10.95

Sample Number:

Sample Type: U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage.		Undisturbed			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max.	Shear	Failure Strain (%)	Mode of Failure	Remarks			
					Deviator Stress (kPa)	Cu (kPa)			Sample taken from top of tube			
									Rate of strain = 1.9 %/min			
									Latex Membrane used 0.2 mm thickness,			
A	18	2.15	1.82	210	$(\theta_1-\theta_3)_f$	$\frac{1}{2}(\theta_1-\theta_3)_f$	20.5	Compound	Correction applied 0.33 kPa			
									See summary of soil descriptions.			
									Checked	Date	Approved	Date
										24/03/14		24/03/14
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Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

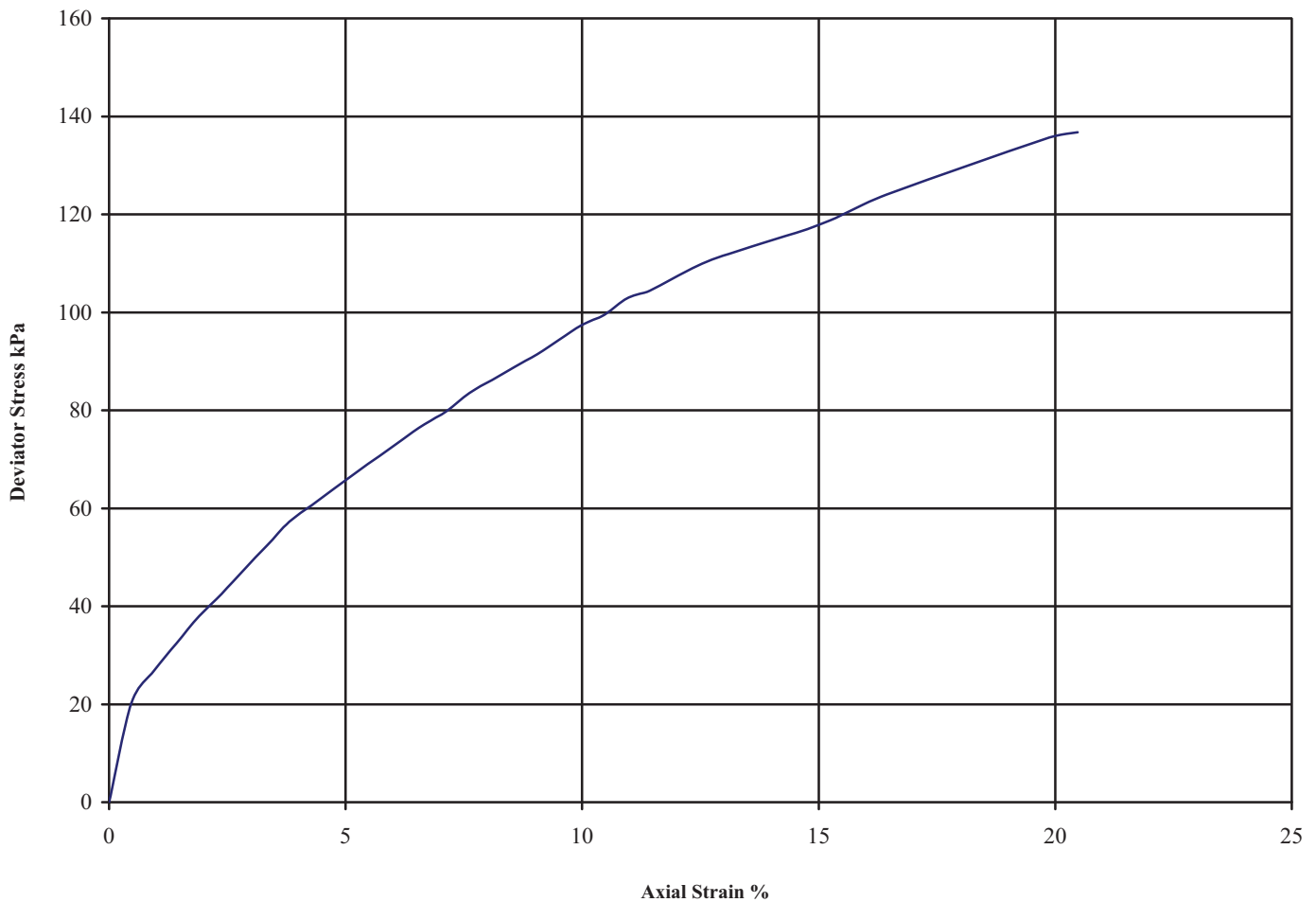
B.S. 1377 : Part 7 : Clause 8 : 1990

Hole Number: SA3A

Depth (m): 4.50-4.95

Sample Number:

Sample Type: U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage.		Undisturbed			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max.	Shear	Failure Strain (%)	Mode of Failure	Remarks			
					Deviator Stress (kPa)	Cu (kPa)			Sample taken from top of tube			
									Rate of strain = 1.9 %/min			
									Latex Membrane used 0.2 mm thickness,			
A	21	2.08	1.71	90	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			Correction applied 0.33 kPa			
									See summary of soil descriptions.			
									Checked	Date	Approved	Date
										24/03/14		24/03/14
PSL Professional Soils Laboratory				MILLINERS WHARF, MANCHESTER.					Contract No: PSL14/0950			

One Dimensional Consolidation Properties

BS 1377: Part 5: 1990

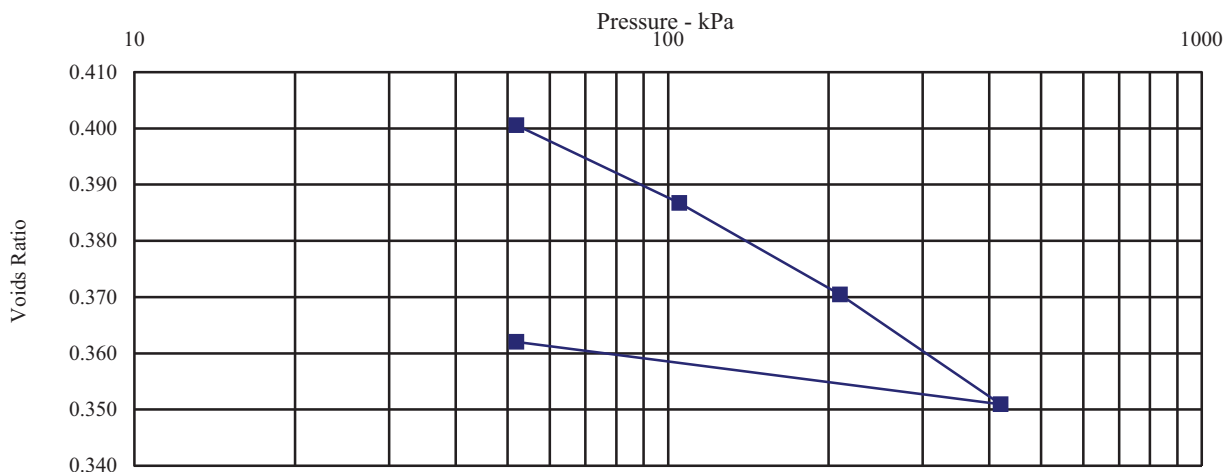
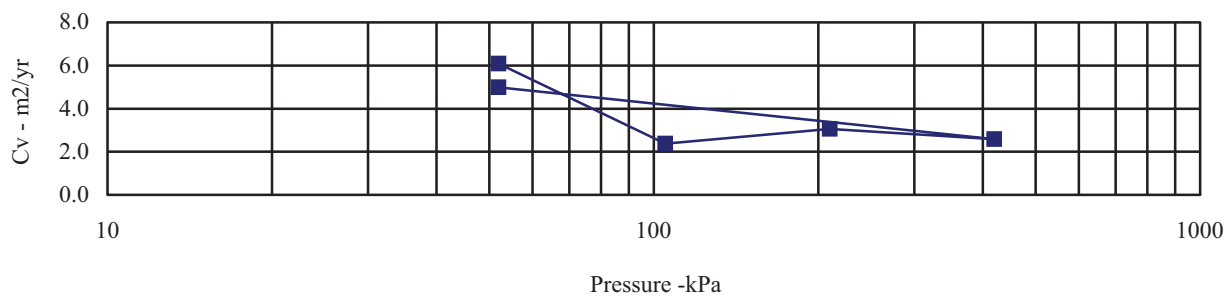
Hole Number: SA3A

Depth (m): 10.50-10.95

Sample Number:

Sample Type: U

Initial Conditions		Pressure Range			Mv	Cv	Specimen location	
Moisture Content (%):	16	kPa			m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	2.18	0	-	52	0.114	6.085	Method used to	
Dry Density (Mg/m3):	1.88	52	-	105	0.187	2.369	determine CV:	t90
Voids Ratio:	0.409	105	-	210	0.112	3.058	Nominal temperature	
Degree of saturation:	101.7	210	-	420	0.068	2.585	during test ' C:	20
Height (mm):	19.93	420	-	52	0.022	4.982	Remarks:	
Diameter (mm)	75.23	See summary of soils description.						
Particle Density (Mg/m3):	2.65							
Assumed								



Checked by	Date	Approved by	Date
<i>H. B. S.</i>	24/03/14	<i>H. B. S.</i>	24/03/14



MILLINERS WHARF,
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PSL14/0950

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Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

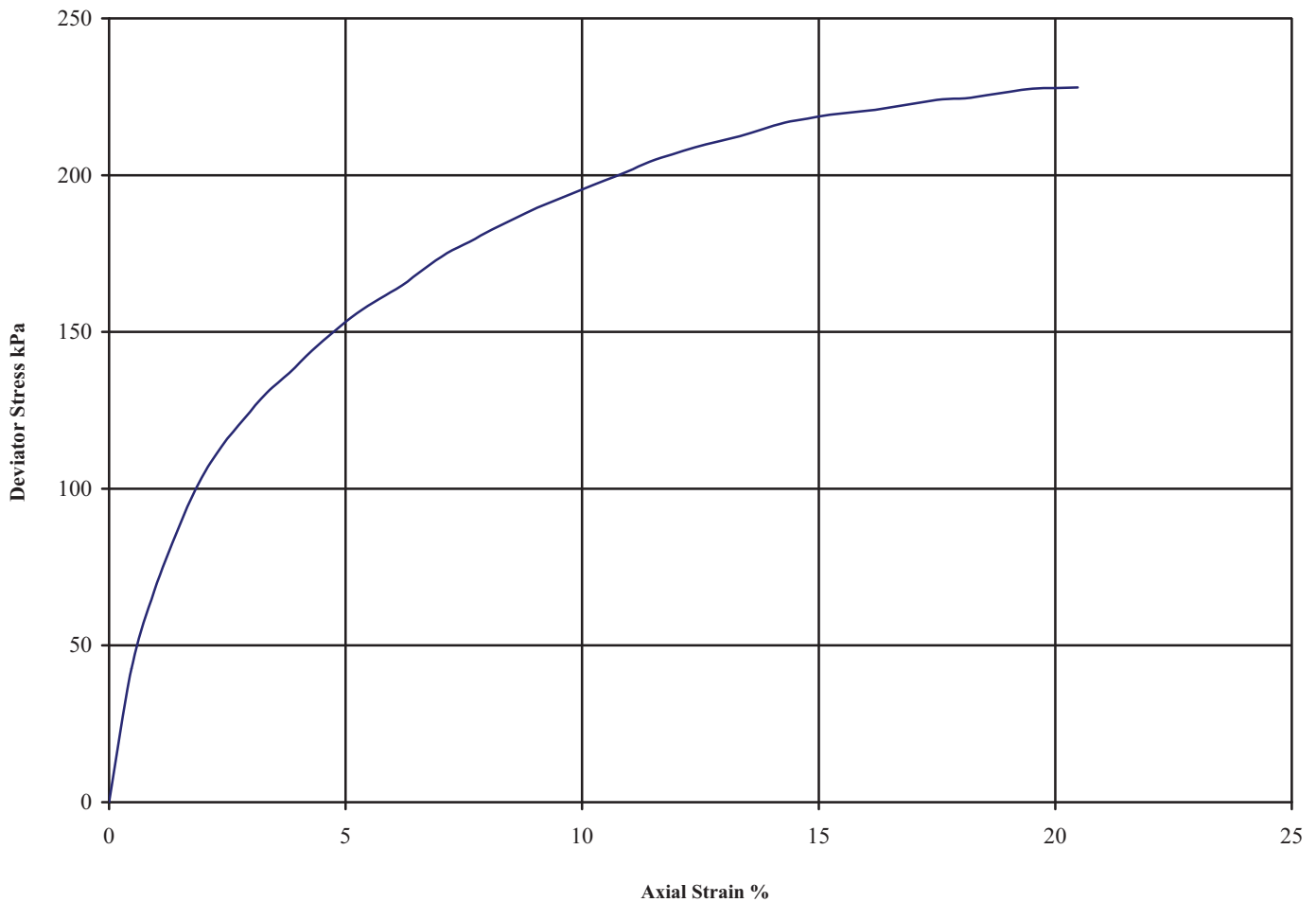
B.S. 1377 : Part 7 : Clause 8 : 1990

Hole Number: SA3A

Depth (m): 10.50-10.95

Sample Number:

Sample Type: U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage.		Undisturbed			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max.	Shear	Failure Strain (%)	Mode of Failure	Remarks			
					Deviator Stress (kPa)	Cu (kPa)			Sample taken from top of tube			
									Rate of strain = 1.9 %/min			
									Latex Membrane used 0.2 mm thickness,			
A	16	2.16	1.87	210	228	114	20.5	Compound	Correction applied 0.33 kPa			
									See summary of soil descriptions.			
									Checked	Date	Approved	Date
										24/03/14		24/03/14
PSL Professional Soils Laboratory				MILLINERS WHARF, MANCHESTER.					Contract No: PSL14/0950			

One Dimensional Consolidation Properties

BS 1377: Part 5: 1990

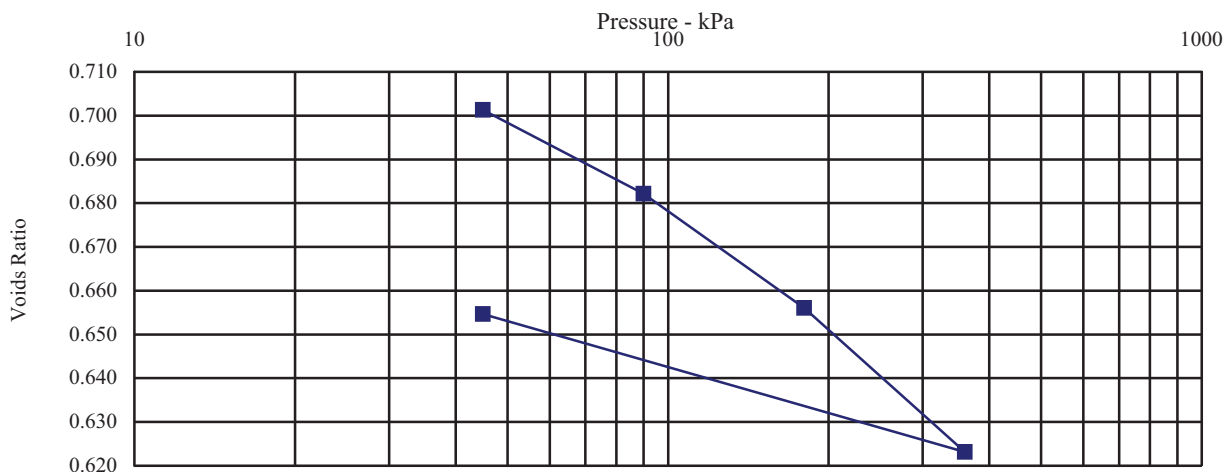
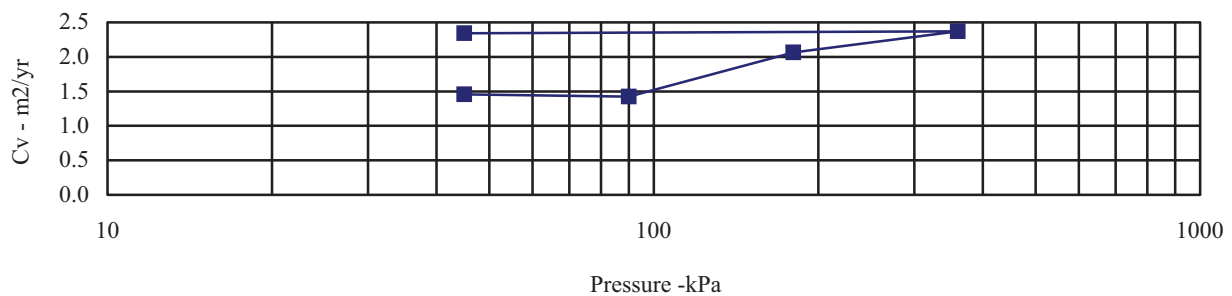
Hole Number: SA4

Depth (m): 4.50-4.95

Sample Number:

Sample Type: U

Initial Conditions		Pressure Range			Mv	Cv	Specimen location	
Moisture Content (%):	28	kPa			m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	1.99	0	-	45	0.131	1.457	Method used to	
Dry Density (Mg/m3):	1.55	45	-	90	0.250	1.422	determine CV:	t90
Voids Ratio:	0.711	90	-	180	0.173	2.066	Nominal temperature	
Degree of saturation:	105.8	180	-	360	0.110	2.371	during test ' C:	20
Height (mm):	19.83	360	-	45	0.062	2.342	Remarks:	
Diameter (mm)	75.26	See summary of soils description.						
Particle Density (Mg/m3):	2.65							
Assumed								



Checked by	Date	Approved by	Date
<i>H. B. S.</i>	24/03/14	<i>H. B. S.</i>	24/03/14



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MANCHESTER.

Contract No.

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Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

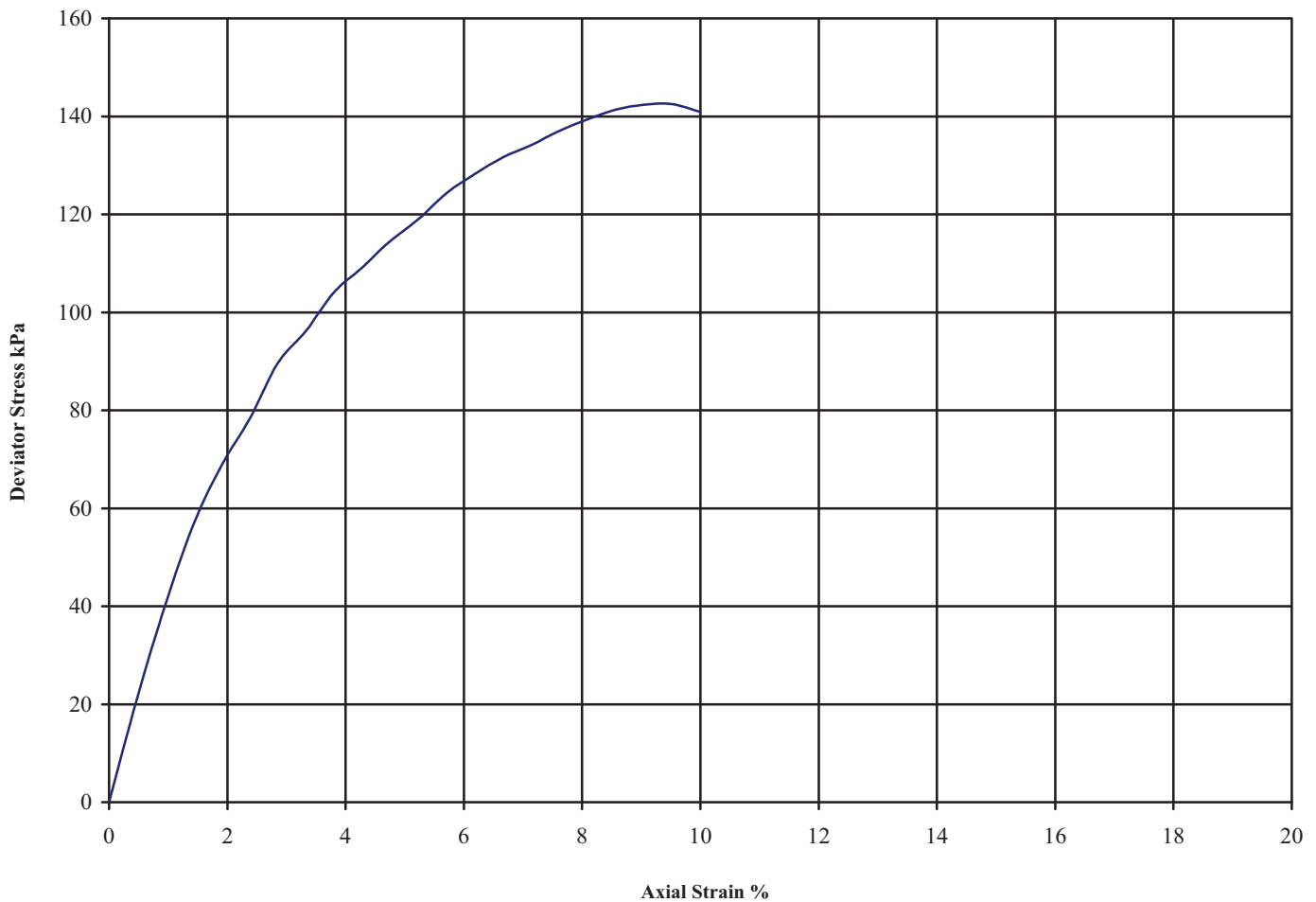
B.S. 1377 : Part 7 : Clause 8 : 1990

Hole Number: SA4

Depth (m): 4.50-4.95

Sample Number:

Sample Type: U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage.		Undisturbed			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max.	Shear	Failure Strain (%)	Mode of Failure	Remarks			
					Deviator Stress (kPa)	Cu (kPa)			Sample taken from top of tube			
									Rate of strain = 1.9 %/min			
									Latex Membrane used 0.2 mm thickness,			
									Correction applied 0.35 kPa			
A	28	1.99	1.56	90	143	71	9.5	Brittle	See summary of soil descriptions.			
									Checked	Date	Approved	Date
										24/03/14		24/03/14
PSL Professional Soils Laboratory				MILLINERS WHARF, MANCHESTER.					Contract No: PSL14/0950			

One Dimensional Consolidation Properties

BS 1377: Part 5: 1990

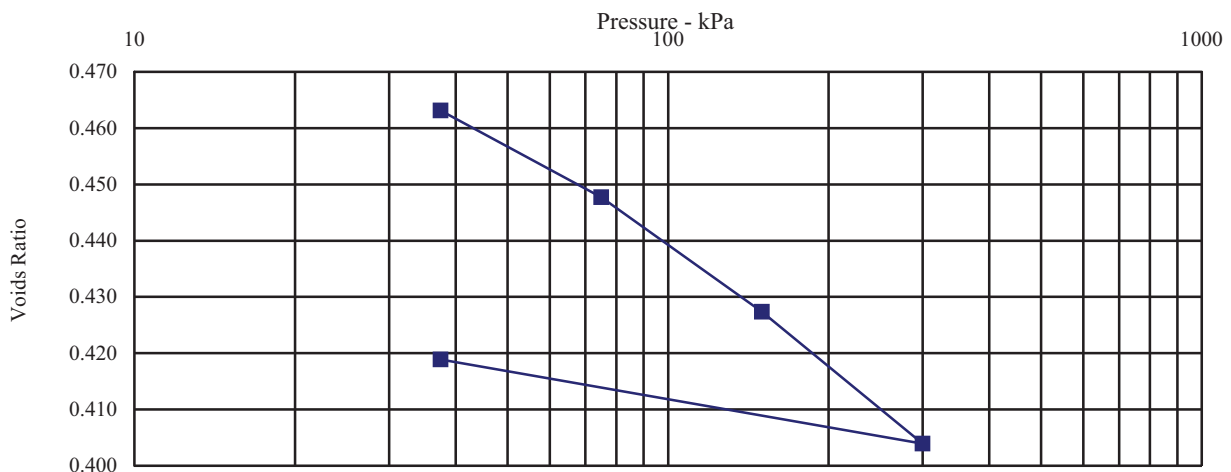
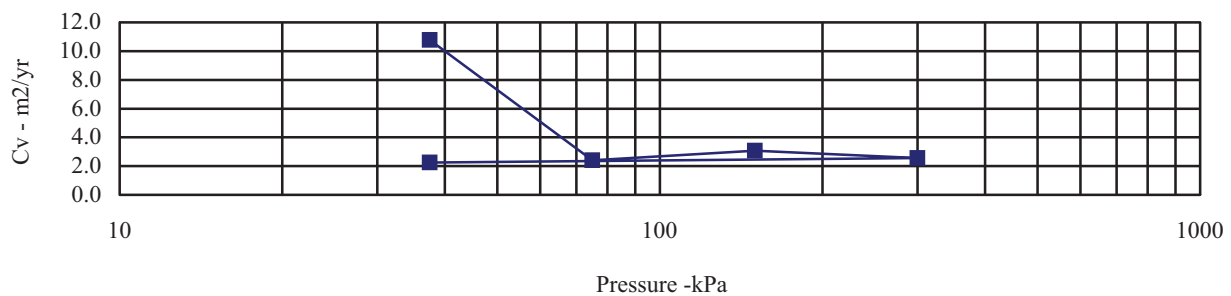
Hole Number: SA4

Depth (m): 7.50-7.95

Sample Number:

Sample Type: U

Initial Conditions		Pressure Range			Mv	Cv	Specimen location	
Moisture Content (%):	18	kPa			m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	2.12	0	-	37.5	0.208	10.786	Method used to	
Dry Density (Mg/m3):	1.80	37.5	-	75	0.280	2.399	determine CV:	t90
Voids Ratio:	0.475	75	-	150	0.188	3.069	Nominal temperature	
Degree of saturation:	100.2	150	-	300	0.109	2.551	during test ' C:	20
Height (mm):	20.04	300	-	37.5	0.041	2.244	Remarks: See summary of soils description.	
Diameter (mm)								
Particle Density (Mg/m3):								
Assumed								



Checked by	Date	Approved by	Date
<i>H. be</i>	24/03/14	<i>H. be</i>	24/03/14



MILLINERS WHARF,
MANCHESTER.

Contract No.

PSL14/0950

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Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

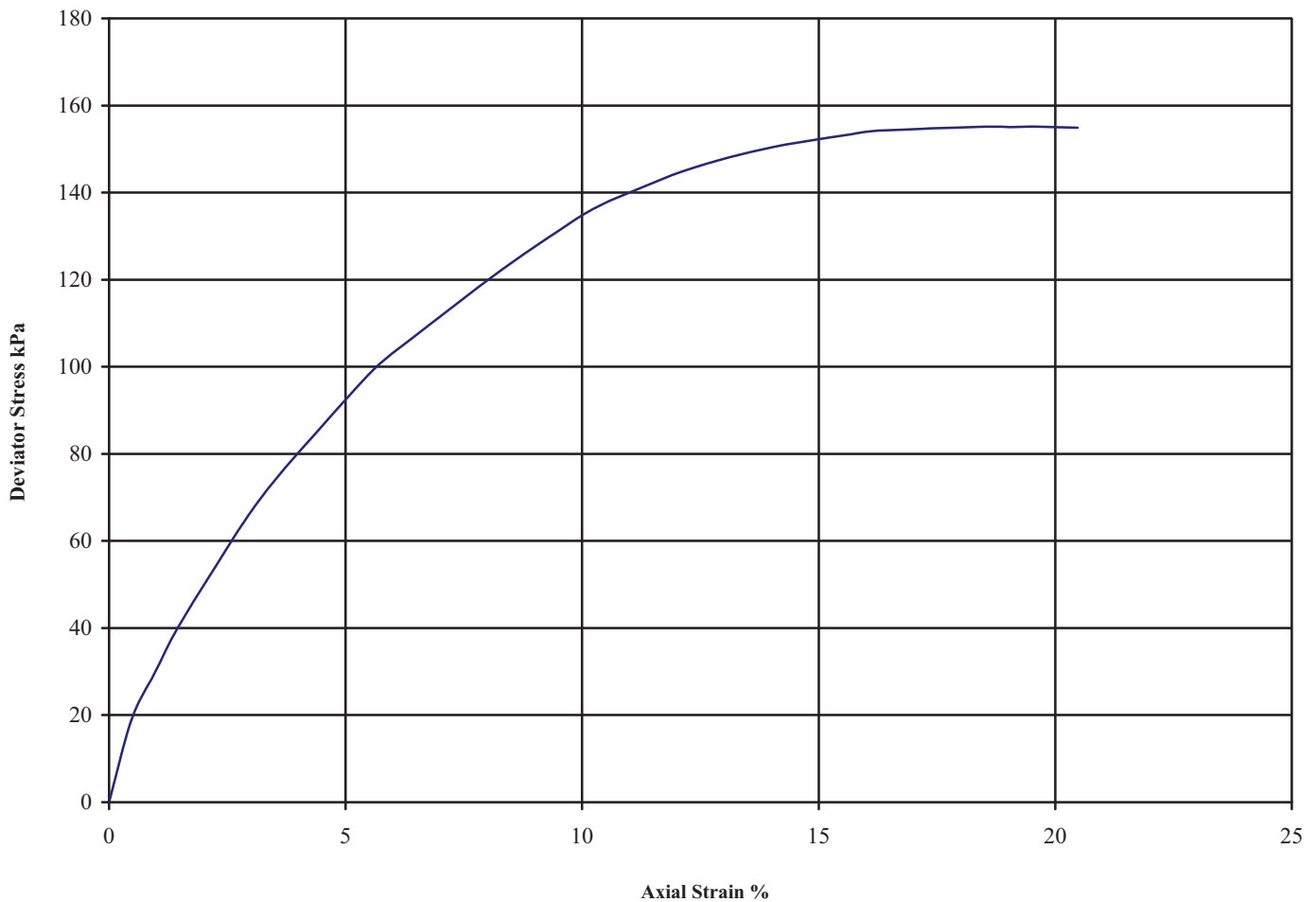
B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: SA4

Depth (m): 7.50-7.95

Sample Number:

Sample Type: U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage.		Undisturbed			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Remarks			
									Sample taken from top of tube			
									Rate of strain = 1.9 %/min			
									Latex Membrane used 0.2 mm thickness,			
A	17	2.15	1.84	150	155	78	19.5	Plastic	Correction applied 0.33 kPa			
									See summary of soil descriptions.			
									Checked	Date	Approved	Date
										25/03/14		25/03/14
PSL Professional Soils Laboratory				MILLINERS WHARF, MANCHESTER.					Contract No: PSL14/0950			

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

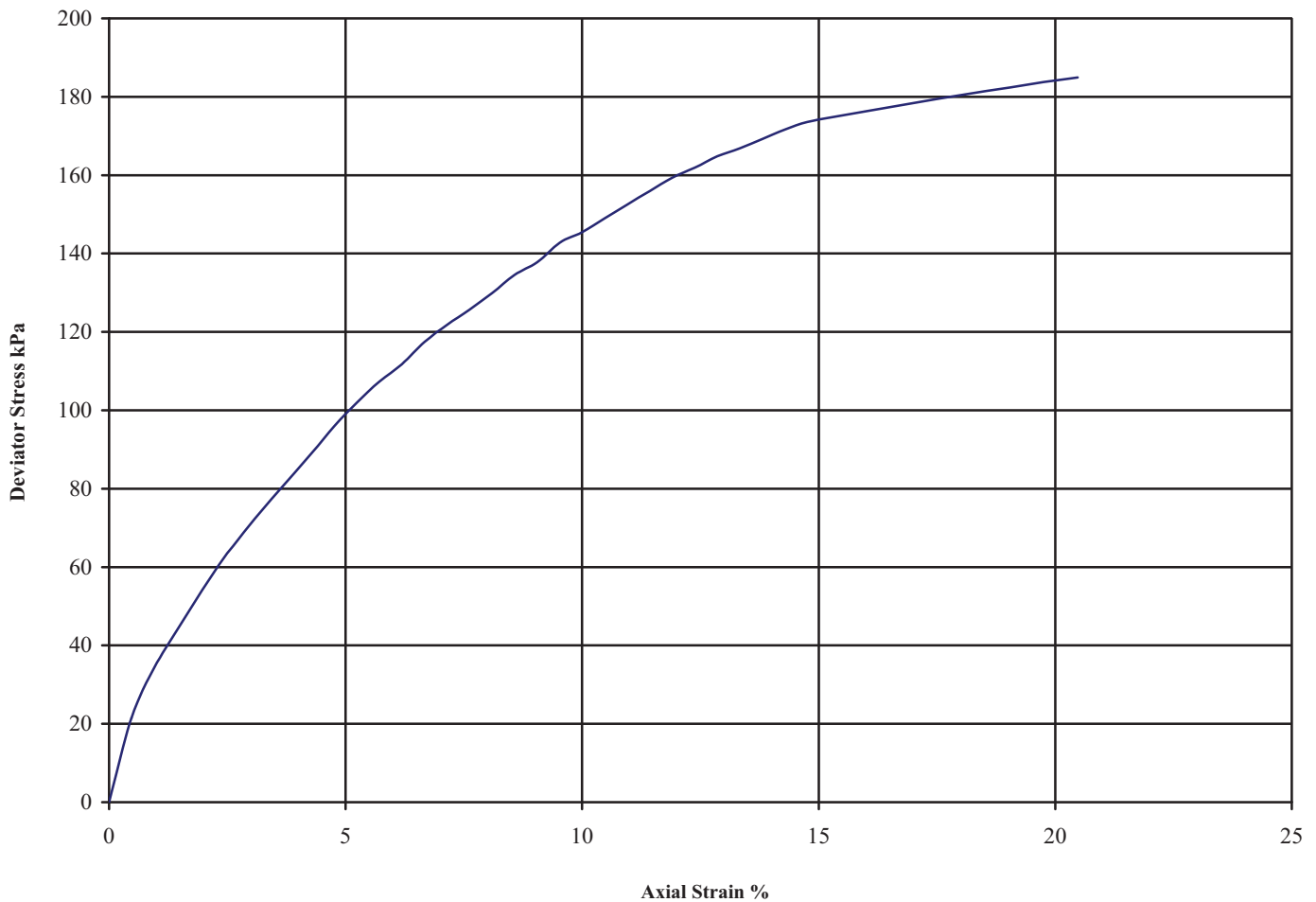
B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: SA4

Depth (m): 10.50-10.95

Sample Number:

Sample Type: U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage.		Undisturbed			
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Remarks			
									Sample taken from top of tube			
									Rate of strain = 1.9 %/min			
									Latex Membrane used 0.2 mm thickness, Correction applied 0.33 kPa			
A	17	2.30	1.97	210	185	92	20.5	Plastic	See summary of soil descriptions.			
									Checked	Date	Approved	Date
										24/03/14		24/03/14
PSL Professional Soils Laboratory				MILLINERS WHARF, MANCHESTER.					Contract No: PSL14/0950			



ANALYTICAL TEST REPORT

Contract no: 50424
Contract name: Milliners Wharf, Manchester
Client reference: 13-898
Clients name: ARC Environmental
Clients address: Solum House
Unit 1 Elliott Court
St Johns Road, Meadowfield
DH7 8PN

Samples received: 21 February 2014

Analysis started: 21 February 2014

Analysis completed 27 February 2014

Report issued: 28 February 2014

Notes: Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
This report shall not be reproduced except in full, without prior written approval.
Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

Key: U UKAS accredited test
M MCERTS & UKAS accredited test
\$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing

Approved by:

Karan Campbell
Director


John Campbell
Director

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
50424-1	BH 01	3.50	Clay	-	-	15.8
50424-2	BH 02	4.00	Clay	-	-	15.3
50424-3	BH 04	2.50	Clay	-	-	13.8
50424-4	BH 05	3.50	Clay	-	-	14.4
50424-5	BH 06	3.00	Clay	-	-	18.5
50424-6	BH 07	2.50	Clay	-	-	17.1
50424-7	SA 1	5.50	Clay	-	-	15.9
50424-8	SA 1	9.50	Clay with Gravel	-	-	22.4
50424-9	SA 1	14.50	Clay	-	-	21.7
50424-10	SA 2B	5.00	Clay	-	-	13.4
50424-11	SA 2B	8.50	Clay	-	-	20.0
50424-12	SA 2B	11.00	Clay	-	-	17.7
50424-13	SA 3A	5.00	Clay	-	-	16.9
50424-14	SA 3A	8.50	Clay	-	-	15.3
50424-15	SA 4	5.00	Clay	-	-	14.4
50424-16	SA 4	8.00	Clay	-	-	13.2
50424-17	SA 4	11.50	Clay	-	-	14.3

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SOILS

Lab number			50424-1	50424-2	50424-3	50424-4	50424-5	50424-6
Sample id			BH 01	BH 02	BH 04	BH 05	BH 06	BH 07
Depth (m)			3.50	4.00	2.50	3.50	3.00	2.50
Date sampled			12/02/2014	12/02/2014	12/02/2014	12/02/2014	12/02/2014	12/02/2014
Test	Method	Units						
pH	CE004 ^M	units	8.0	8.5	8.3	8.4	8.0	8.1
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	103	<10	78	30	122	68

Chemtech Environmental Limited

SOILS

Lab number			50424-7	50424-8	50424-9	50424-10	50424-11	50424-12
Sample id			SA 1	SA 1	SA 1	SA 2B	SA 2B	SA 2B
Depth (m)			5.50	9.50	14.50	5.00	8.50	11.00
Date sampled			12/02/2014	12/02/2014	12/02/2014	12/02/2014	12/02/2014	12/02/2014
Test	Method	Units						
pH	CE004 ^M	units	8.2	8.3	8.1	8.2	8.2	8.2
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	63	30	45	62	56	51

Chemtech Environmental Limited

SOILS

Lab number			50424-13	50424-14	50424-15	50424-16	50424-17
Sample id			SA 3A	SA 3A	SA 4	SA 4	SA 4
Depth (m)			5.00	8.50	5.00	8.00	11.50
Date sampled			12/02/2014	12/02/2014	12/02/2014	12/02/2014	12/02/2014
Test	Method	Units					
pH	CE004 ^M	units	8.2	8.3	8.2	8.2	8.3
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	19	19	50	27	25

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	Wet	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	M	10	mg/l SO ₄

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

- N No (not deviating sample)
- Y Yes (deviating sample)
- A Sampling date not provided
- B Sampling time not provided (waters only)
- C Sample exceeded holding time(s)
- D Sample not received in appropriate containers
- E Headspace present in sample container
- F Sample not chemically fixed (where appropriate)
- G Sample not cooled
- H Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
50424-1	BH 01	3.50	N	
50424-2	BH 02	4.00	N	
50424-3	BH 04	2.50	N	
50424-4	BH 05	3.50	N	
50424-5	BH 06	3.00	N	
50424-6	BH 07	2.50	N	
50424-7	SA 1	5.50	N	
50424-8	SA 1	9.50	N	
50424-9	SA 1	14.50	N	
50424-10	SA 2B	5.00	N	
50424-11	SA 2B	8.50	N	
50424-12	SA 2B	11.00	N	
50424-13	SA 3A	5.00	N	
50424-14	SA 3A	8.50	N	
50424-15	SA 4	5.00	N	
50424-16	SA 4	8.00	N	
50424-17	SA 4	11.50	N	



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ANALYTICAL TEST REPORT

Contract no: 50181(2)

Contract name: Milliners Wharf, Manchester

Client reference: 13-898

Clients name: ARC Environmental

Clients address: Solum House
Unit 1 Elliott Court
St Johns Road, Meadowfield
DH7 8PN

Samples received: 29 January 2014

Analysis started: 29 January 2014

Analysis completed 13 February 2014

Report issued: 05 March 2014

This is a supplementary report to report number 50181(1) issued 13 February 2014.

Notes: Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
BTEX compounds are identified by retention time only and may include interference from co-eluting compounds.
This report shall not be reproduced except in full, without prior written approval.
Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

Key: U UKAS accredited test
M MCERTS & UKAS accredited test
\$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing
NAD No Asbestos Detected

Approved by:

Karan Campbell
Director

John Campbell
Director

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
50181-1	TP 1	0.50	Clay with Stones & Gravel	-	-	24.1
50181-2	TP 1	2.00	Clay with Stones & Gravel	-	-	20.9
50181-3	TP 2	0.50	Clay with Stones & Gravel	-	-	24.9
50181-4	TP 3	0.50	Clay with Stones, Gravel & Roots	-	-	21.8
50181-5	TP 4	1.00	Sand & Clay with Stones, Gravel & Brick	-	-	15.6
50181-6	TP 5	0.50	Sand with Stones & Gravel	-	-	12.5
50181-7	TP 5	1.50	Sand with Stones & Gravel	-	-	16.5
50181-8	TP 6	0.70	Sand with Stones & Gravel	-	-	15.4
50181-9	TP 7	0.70	Sandy Clay with Stones & Gravel	-	-	20.2
50181-10	TP 7	2.00	Sandy Loamy Clay with Stones & Gravel	-	-	18.0
50181-11	TP 8	0.50	Sand with Slag, Stones, Gravel & Wood	-	-	20.7
50181-12	TP 9	0.50	Sand with Stones & Gravel	-	-	15.2
50181-13	TP 9	1.50	Sandy Clay with Stones & Gravel	-	-	25.3
50181-14	TP 10	0.50	Sand with Stones, Brick & Gravel	-	-	14.5
50181-15	TP 11	0.50	Sandy Clay with Stones, Brick & Gravel	-	-	17.3
50181-16	TP 11	2.00	Clay with Stones & Gravel	-	-	16.5
50181-17	TP 12	0.60	Sandy Clay with Stones, Gravel & Stones	-	-	13.6

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SOILS

Lab number Sample id Depth (m) Date sampled			50181-1 TP 1 0.50 28/01/2014	50181-2 TP 1 2.00 28/01/2014	50181-3 TP 2 0.50 28/01/2014	50181-4 TP 3 0.50 28/01/2014	50181-5 TP 4 1.00 28/01/2014	50181-6 TP 5 0.50 28/01/2014
Test	Method	Units						
Arsenic (total)	CE054 ^M	mg/kg As	14	10	25	21	18	12
Cadmium (total)	CE054 ^M	mg/kg Cd	<0.2	<0.2	<0.2	<0.2	<0.2	0.6
Chromium (total)	CE054 ^M	mg/kg Cr	106	105	119	109	90	118
Chromium (III)	-	mg/kg CrIII	106	105	119	109	90	118
Chromium (VI)	CE050	mg/kg CrVI	<1	<1	<1	<1	<1	<1
Copper (total)	CE054 ^M	mg/kg Cu	41	33	52	67	76	48
Lead (total)	CE054 ^M	mg/kg Pb	45	34	252	114	163	182
Mercury (total)	CE054	mg/kg Hg	<0.5	<0.5	0.7	0.5	<0.5	<0.5
Nickel (total)	CE054 ^M	mg/kg Ni	45	35	33	40	47	19
Selenium (total)	CE054 ^M	mg/kg Se	1.0	1.0	1.0	1.1	1.0	0.6
Zinc (total)	CE054 ^M	mg/kg Zn	72	61	89	78	212	153
pH	CE004 ^M	units	8.2	8.2	8.0	7.7	8.0	7.9
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	28	22	51	75	184	1113
Cyanide (free)	CE077	mg/kg CN	<2	<2	<2	<2	<2	<2
Total Organic Carbon (TOC)	CE072 ^M	% w/w C	2.02	1.67	2.41	4.50	6.92	1.80
PAH								
Acenaphthene	CE087	mg/kg	<0.01	0.01	0.02	0.09	1.18	6.88
Acenaphthylene	CE087	mg/kg	<0.01	<0.01	<0.01	0.03	0.33	0.11
Anthracene	CE087	mg/kg	<0.01	<0.01	0.06	0.13	1.14	7.20
Benzo(a)anthracene	CE087	mg/kg	0.01	0.03	0.36	0.45	2.70	9.50
Benzo(a)pyrene	CE087	mg/kg	<0.01	0.02	0.42	0.54	3.55	9.74
Benzo(b)fluoranthene	CE087	mg/kg	<0.01	0.05	0.56	0.74	4.52	12.95
Benzo(ghi)perylene	CE087	mg/kg	<0.01	0.04	0.33	0.42	3.17	7.11
Benzo(k)fluoranthene	CE087	mg/kg	0.01	0.02	0.22	0.29	1.82	5.02
Chrysene	CE087	mg/kg	0.02	0.05	0.46	0.60	3.79	11.73
Dibenz(ah)anthracene	CE087	mg/kg	<0.01	<0.01	0.01	0.02	0.56	1.44
Fluoranthene	CE087	mg/kg	0.02	0.10	0.70	1.19	7.59	25.59
Fluorene	CE087	mg/kg	<0.01	<0.01	0.02	0.07	0.75	5.26
Indeno(123cd)pyrene	CE087	mg/kg	<0.01	0.03	0.22	0.28	2.19	5.74
Naphthalene	CE087	mg/kg	<0.01	<0.01	0.03	0.07	1.22	4.39
Phenanthrene	CE087	mg/kg	0.01	0.10	0.33	0.81	7.13	34.12
Pyrene	CE087	mg/kg	0.02	0.10	0.76	1.15	7.79	23.34
PAH (total of USEPA 16)	CE087	mg/kg	0.10	0.55	4.52	6.89	49.42	170.12
Benzo(j)fluoranthene	CE087	mg/kg	<0.01	<0.01	0.09	0.09	0.72	2.31
PAH (total of OIL 8)	CE087	mg/kg	0.04	0.19	2.35	3.02	19.83	58.43
BTEX & TPH								
Benzene	CE057 ^U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	-
Toluene	CE057 ^U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	-
Ethylbenzene	CE057 ^U	mg/kg	0.02	0.03	0.02	0.01	<0.01	-
m & p-Xylene	CE057 ^U	mg/kg	0.06	0.09	0.08	0.04	<0.01	-

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Lab number Sample id Depth (m) Date sampled			50181-1 TP 1 0.50 28/01/2014	50181-2 TP 1 2.00 28/01/2014	50181-3 TP 2 0.50 28/01/2014	50181-4 TP 3 0.50 28/01/2014	50181-5 TP 4 1.00 28/01/2014	50181-6 TP 5 0.50 28/01/2014
Test	Method	Units						
o-Xylene	CE057 ^U	mg/kg	0.01	0.02	0.02	<0.01	<0.01	-
TPH Aliphatic EC5-EC6	CE068	mg/kg	0.1	0.1	<0.1	<0.1	<0.1	-
TPH Aliphatic EC6-EC8	CE068	mg/kg	0.1	0.1	<0.1	<0.1	<0.1	-
TPH Aliphatic EC8-EC10	CE068	mg/kg	0.4	0.4	0.3	0.3	0.3	-
TPH Aliphatic EC10-EC12	CE068	mg/kg	<1	4	<1	<1	2	-
TPH Aliphatic EC12-EC16	CE068	mg/kg	<1	2	<1	<1	15	-
TPH Aliphatic EC16-EC35	CE068	mg/kg	6	2	2	8	209	-
TPH Aliphatic EC35-EC44	CE068	mg/kg	<1	<1	<1	<1	10	-
TPH Aromatic EC5-EC7	CE068	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	-
TPH Aromatic EC7-EC8	CE068	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	-
TPH Aromatic EC8-EC10	CE068	mg/kg	0.09	0.14	0.12	0.05	<0.01	-
TPH Aromatic EC10-EC12	CE068	mg/kg	<1	<1	<1	<1	1	-
TPH Aromatic EC12-EC16	CE068	mg/kg	<1	<1	<1	<1	2	-
TPH Aromatic EC16-EC21	CE068	mg/kg	<1	<1	2	3	24	-
TPH Aromatic EC21-EC35	CE068	mg/kg	<1	<1	2	3	20	-
TPH Aromatic EC35-EC44	CE068	mg/kg	<1	<1	<1	<1	3	-
Volatiles								
Dichlorodifluoromethane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Chloromethane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Vinyl chloride	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Bromomethane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Chloroethane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Trichlorofluoromethane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,1-Dichloroethene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Cis-1,2-Dichloroethene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,1-Dichloroethane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Trans-1,2-Dichloroethene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Chloroform	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,1,1-Trichloroethane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,2-Dichloroethane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Carbon tetrachloride	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Trichloroethene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,3-Dichloropropane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Dibromomethane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Bromodichloromethane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,1-Dichloro-1-propene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,3-Dichloropropene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,1,2-Trichloroethane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Dibromochloromethane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Tetrachloroethene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,2-Dibromoethane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01

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Lab number Sample id Depth (m) Date sampled			50181-1 TP 1 0.50 28/01/2014	50181-2 TP 1 2.00 28/01/2014	50181-3 TP 2 0.50 28/01/2014	50181-4 TP 3 0.50 28/01/2014	50181-5 TP 4 1.00 28/01/2014	50181-6 TP 5 0.50 28/01/2014
Test	Method	Units						
Chlorobenzene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,1,1,2-Tetrachloroethane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Styrene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Tribromomethane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,1,2,2-Tetrachloroethane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Isopropylbenzene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,2,3-Trichloropropane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Bromobenzene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
2-Chlorotoluene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Propylbenzene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
4-Chlorotoluene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,3,5-Trimethylbenzene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
tert-Butylbenzene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,2,4-Trimethylbenzene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,3-Dichlorobenzene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
sec-Butylbenzene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,4-Dichlorobenzene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
4-Isopropyltoluene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,2-Dichlorobenzene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Butylbenzene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,2-Dibromo-3-chloropropane	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,2,4-Trichlorobenzene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
1,2,3-Trichlorobenzene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Hexachloro-1,3-butadiene	CE066	mg/kg	<0.01	-	-	<0.01	-	<0.01
Semi-volatiles								
N-Nitrosodimethylamine	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
Phenol	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
Bis(2-chloroethyl)ether	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
2-Chlorophenol	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
1,3-Dichlorobenzene	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
1,4-Dichlorobenzene	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
2-Methylphenol	CE065	mg/kg	<0.1	-	-	<0.1	-	0.3
1,2-Dichlorobenzene	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
Bis(2-chloroisopropyl)ether	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
4-Methylphenol	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
N-Nitrosodi-n-propylamine	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
Hexachloroethane	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
Nitrobenzene	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
Isophorone	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
2,4-Dimethylphenol	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
2-Nitrophenol	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1

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SOILS

Lab number Sample id Depth (m) Date sampled			50181-1 TP 1 0.50 28/01/2014	50181-2 TP 1 2.00 28/01/2014	50181-3 TP 2 0.50 28/01/2014	50181-4 TP 3 0.50 28/01/2014	50181-5 TP 4 1.00 28/01/2014	50181-6 TP 5 0.50 28/01/2014
Test	Method	Units						
Bis(2-chloroethoxy)methane	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
2,4-Dichlorophenol	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
1,2,4-Trichlorobenzene	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
4-Chloroaniline	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
Hexachlorobutadiene	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
4-Chloro-3-methylphenol	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
2-Methylnaphthalene	CE065	mg/kg	<0.1	-	-	<0.1	-	0.3
Hexachlorocyclopentadiene	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
2,4,6-Trichlorophenol	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
2,4,5-Trichlorophenol	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
2-Chloronaphthalene	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
2-Nitroaniline	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
Dimethyl phthalate	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
2,6-Dinitrotoluene	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
3-Nitroaniline	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
2,4-Dinitrophenol	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
4-Nitrophenol	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
2,4-Dinitrotoluene	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
Dibenzofuran	CE065	mg/kg	<0.1	-	-	<0.1	-	0.4
Diethyl phthalate	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
4-Chlorophenylphenyl ether	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
4-Nitroaniline	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
2-Methyl-4,6-dinitrophenol	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
Azobenzene	CE065	mg/kg	<0.1	-	-	<0.1	-	1.5
4-Bromophenylphenyl ether	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
Hexachlorobenzene	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
Pentachlorophenol	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
Carbazole	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
Di-n-butyl phthalate	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
Butylbenzyl phthalate	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
Bis(2-ethylhexyl)phthalate	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
Di-n-octyl phthalate	CE065	mg/kg	<0.1	-	-	<0.1	-	<0.1
PCB								
PCB Congener 28	CE070	mg/kg	-	-	-	-	-	-
PCB Congener 52	CE070	mg/kg	-	-	-	-	-	-
PCB Congener 101	CE070	mg/kg	-	-	-	-	-	-
PCB Congener 118	CE070	mg/kg	-	-	-	-	-	-
PCB Congener 138	CE070	mg/kg	-	-	-	-	-	-
PCB Congener 153	CE070	mg/kg	-	-	-	-	-	-
PCB Congener 180	CE070	mg/kg	-	-	-	-	-	-

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SOILS

Lab number			50181-1	50181-2	50181-3	50181-4	50181-5	50181-6
Sample id			TP 1	TP 1	TP 2	TP 3	TP 4	TP 5
Depth (m)			0.50	2.00	0.50	0.50	1.00	0.50
Date sampled			28/01/2014	28/01/2014	28/01/2014	28/01/2014	28/01/2014	28/01/2014
Test	Method	Units						
Pesticides								
Organochlorine pesticides	CE065	mg/kg	-	-	<0.01	-	-	<0.01
Organophosphate pesticides	CE065	mg/kg	-	-	<0.01	-	-	<0.01
Subcontracted analysis								
Asbestos	\$	-	NAD	NAD	NAD	NAD	Chrysotile	Chrysotile

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SOILS

Lab number Sample id Depth (m) Date sampled			50181-7 TP 5 1.50 28/01/2014	50181-8 TP 6 0.70 28/01/2014	50181-9 TP 7 0.70 28/01/2014	50181-10 TP 7 2.00 28/01/2014	50181-11 TP 8 0.50 28/01/2014	50181-12 TP 9 0.50 28/01/2014
Test	Method	Units						
Arsenic (total)	CE054 ^M	mg/kg As	23	28	13	13	35	23
Cadmium (total)	CE054 ^M	mg/kg Cd	0.8	0.3	0.3	0.3	0.5	0.5
Chromium (total)	CE054 ^M	mg/kg Cr	116	129	107	83	78	85
Chromium (III)	-	mg/kg CrIII	116	129	107	83	78	85
Chromium (VI)	CE050	mg/kg CrVI	<1	<1	<1	<1	<1	<1
Copper (total)	CE054 ^M	mg/kg Cu	62	69	103	110	626	118
Lead (total)	CE054 ^M	mg/kg Pb	337	143	354	406	310	300
Mercury (total)	CE054	mg/kg Hg	0.7	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE054 ^M	mg/kg Ni	27	32	37	37	33	35
Selenium (total)	CE054 ^M	mg/kg Se	0.8	1.0	0.8	1.2	1.5	1.2
Zinc (total)	CE054 ^M	mg/kg Zn	140	296	170	158	542	243
pH	CE004 ^M	units	8.2	7.9	7.7	7.8	7.2	7.6
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	532	538	1070	2133	821	1165
Cyanide (free)	CE077	mg/kg CN	<2	<2	<2	<2	<2	<2
Total Organic Carbon (TOC)	CE072 ^M	% w/w C	3.33	4.29	2.58	7.28	23.92	10.00
PAH								
Acenaphthene	CE087	mg/kg	0.50	0.34	0.34	1.59	0.05	0.78
Acenaphthylene	CE087	mg/kg	0.12	0.10	0.11	0.22	0.05	0.08
Anthracene	CE087	mg/kg	0.97	0.46	0.55	3.19	0.12	1.19
Benzo(a)anthracene	CE087	mg/kg	2.49	1.10	1.65	4.78	0.22	3.66
Benzo(a)pyrene	CE087	mg/kg	2.83	1.35	2.09	4.95	0.18	4.52
Benzo(b)fluoranthene	CE087	mg/kg	3.70	1.78	2.75	6.81	0.31	5.87
Benzo(ghi)perylene	CE087	mg/kg	2.23	1.25	1.97	3.84	0.18	3.91
Benzo(k)fluoranthene	CE087	mg/kg	1.44	0.74	1.13	2.61	0.10	2.42
Chrysene	CE087	mg/kg	3.07	1.36	2.04	5.61	0.31	4.55
Dibenz(ah)anthracene	CE087	mg/kg	0.47	0.25	0.40	0.72	0.04	0.93
Fluoranthene	CE087	mg/kg	6.03	2.64	3.92	13.03	0.37	7.94
Fluorene	CE087	mg/kg	0.55	0.23	0.25	1.68	0.07	0.51
Indeno(123cd)pyrene	CE087	mg/kg	1.64	0.92	1.51	3.11	0.11	2.97
Naphthalene	CE087	mg/kg	0.27	0.22	0.36	0.64	0.37	2.23
Phenanthrene	CE087	mg/kg	4.39	2.03	2.42	12.49	0.77	5.95
Pyrene	CE087	mg/kg	6.18	2.55	3.54	11.15	0.40	8.09
PAH (total of USEPA 16)	CE087	mg/kg	36.86	17.33	25.04	76.42	3.65	55.59
Benzo(j)fluoranthene	CE087	mg/kg	0.27	0.11	0.35	0.91	0.02	1.10
PAH (total of OIL 8)	CE087	mg/kg	15.89	7.61	11.93	29.50	1.29	26.01
BTEX & TPH								
Benzene	CE057 ^U	mg/kg	-	<0.01	<0.01	-	<0.01	-
Toluene	CE057 ^U	mg/kg	-	<0.01	<0.01	-	<0.01	-
Ethylbenzene	CE057 ^U	mg/kg	-	<0.01	<0.01	-	<0.01	-
m & p-Xylene	CE057 ^U	mg/kg	-	<0.01	0.01	-	0.01	-

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SOILS

Lab number Sample id Depth (m) Date sampled			50181-7 TP 5 1.50 28/01/2014	50181-8 TP 6 0.70 28/01/2014	50181-9 TP 7 0.70 28/01/2014	50181-10 TP 7 2.00 28/01/2014	50181-11 TP 8 0.50 28/01/2014	50181-12 TP 9 0.50 28/01/2014
Test	Method	Units						
o-Xylene	CE057 ^U	mg/kg	-	<0.01	<0.01	-	<0.01	-
TPH Aliphatic EC5-EC6	CE068	mg/kg	-	<0.1	<0.1	-	<0.1	-
TPH Aliphatic EC6-EC8	CE068	mg/kg	-	<0.1	<0.1	-	<0.1	-
TPH Aliphatic EC8-EC10	CE068	mg/kg	-	0.2	0.3	-	<0.1	-
TPH Aliphatic EC10-EC12	CE068	mg/kg	-	<1	2	-	3	-
TPH Aliphatic EC12-EC16	CE068	mg/kg	-	3	1	-	20	-
TPH Aliphatic EC16-EC35	CE068	mg/kg	-	62	107	-	64	-
TPH Aliphatic EC35-EC44	CE068	mg/kg	-	<1	9	-	<1	-
TPH Aromatic EC5-EC7	CE068	mg/kg	-	<0.01	<0.01	-	<0.01	-
TPH Aromatic EC7-EC8	CE068	mg/kg	-	<0.01	<0.01	-	<0.01	-
TPH Aromatic EC8-EC10	CE068	mg/kg	-	<0.01	0.01	-	0.01	-
TPH Aromatic EC10-EC12	CE068	mg/kg	-	<1	<1	-	<1	-
TPH Aromatic EC12-EC16	CE068	mg/kg	-	<1	<1	-	<1	-
TPH Aromatic EC16-EC21	CE068	mg/kg	-	8	11	-	2	-
TPH Aromatic EC21-EC35	CE068	mg/kg	-	8	12	-	1	-
TPH Aromatic EC35-EC44	CE068	mg/kg	-	1	2	-	<1	-
Volatiles								
Dichlorodifluoromethane	CE066	mg/kg	-	-	-	-	<0.01	-
Chloromethane	CE066	mg/kg	-	-	-	-	<0.01	-
Vinyl chloride	CE066	mg/kg	-	-	-	-	<0.01	-
Bromomethane	CE066	mg/kg	-	-	-	-	<0.01	-
Chloroethane	CE066	mg/kg	-	-	-	-	<0.01	-
Trichlorofluoromethane	CE066	mg/kg	-	-	-	-	<0.01	-
1,1-Dichloroethene	CE066	mg/kg	-	-	-	-	<0.01	-
Cis-1,2-Dichloroethene	CE066	mg/kg	-	-	-	-	<0.01	-
1,1-Dichloroethane	CE066	mg/kg	-	-	-	-	<0.01	-
Trans-1,2-Dichloroethene	CE066	mg/kg	-	-	-	-	<0.01	-
Chloroform	CE066	mg/kg	-	-	-	-	<0.01	-
1,1,1-Trichloroethane	CE066	mg/kg	-	-	-	-	<0.01	-
1,2-Dichloroethane	CE066	mg/kg	-	-	-	-	<0.01	-
Carbon tetrachloride	CE066	mg/kg	-	-	-	-	<0.01	-
Trichloroethene	CE066	mg/kg	-	-	-	-	<0.01	-
1,3-Dichloropropane	CE066	mg/kg	-	-	-	-	<0.01	-
Dibromomethane	CE066	mg/kg	-	-	-	-	<0.01	-
Bromodichloromethane	CE066	mg/kg	-	-	-	-	<0.01	-
1,1-Dichloro-1-propene	CE066	mg/kg	-	-	-	-	<0.01	-
1,3-Dichloropropene	CE066	mg/kg	-	-	-	-	<0.01	-
1,1,2-Trichloroethane	CE066	mg/kg	-	-	-	-	<0.01	-
Dibromochloromethane	CE066	mg/kg	-	-	-	-	<0.01	-
Tetrachloroethene	CE066	mg/kg	-	-	-	-	<0.01	-
1,2-Dibromoethane	CE066	mg/kg	-	-	-	-	<0.01	-

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Lab number Sample id Depth (m) Date sampled			50181-7 TP 5 1.50 28/01/2014	50181-8 TP 6 0.70 28/01/2014	50181-9 TP 7 0.70 28/01/2014	50181-10 TP 7 2.00 28/01/2014	50181-11 TP 8 0.50 28/01/2014	50181-12 TP 9 0.50 28/01/2014
Test	Method	Units						
Chlorobenzene	CE066	mg/kg	-	-	-	-	<0.01	-
1,1,1,2-Tetrachloroethane	CE066	mg/kg	-	-	-	-	<0.01	-
Styrene	CE066	mg/kg	-	-	-	-	<0.01	-
Tribromomethane	CE066	mg/kg	-	-	-	-	<0.01	-
1,1,2,2-Tetrachloroethane	CE066	mg/kg	-	-	-	-	<0.01	-
Isopropylbenzene	CE066	mg/kg	-	-	-	-	<0.01	-
1,2,3-Trichloropropane	CE066	mg/kg	-	-	-	-	<0.01	-
Bromobenzene	CE066	mg/kg	-	-	-	-	<0.01	-
2-Chlorotoluene	CE066	mg/kg	-	-	-	-	<0.01	-
Propylbenzene	CE066	mg/kg	-	-	-	-	<0.01	-
4-Chlorotoluene	CE066	mg/kg	-	-	-	-	<0.01	-
1,3,5-Trimethylbenzene	CE066	mg/kg	-	-	-	-	<0.01	-
tert-Butylbenzene	CE066	mg/kg	-	-	-	-	<0.01	-
1,2,4-Trimethylbenzene	CE066	mg/kg	-	-	-	-	<0.01	-
1,3-Dichlorobenzene	CE066	mg/kg	-	-	-	-	<0.01	-
sec-Butylbenzene	CE066	mg/kg	-	-	-	-	<0.01	-
1,4-Dichlorobenzene	CE066	mg/kg	-	-	-	-	<0.01	-
4-Isopropyltoluene	CE066	mg/kg	-	-	-	-	<0.01	-
1,2-Dichlorobenzene	CE066	mg/kg	-	-	-	-	<0.01	-
Butylbenzene	CE066	mg/kg	-	-	-	-	<0.01	-
1,2-Dibromo-3-chloropropane	CE066	mg/kg	-	-	-	-	<0.01	-
1,2,4-Trichlorobenzene	CE066	mg/kg	-	-	-	-	<0.01	-
1,2,3-Trichlorobenzene	CE066	mg/kg	-	-	-	-	<0.01	-
Hexachloro-1,3-butadiene	CE066	mg/kg	-	-	-	-	<0.01	-
Semi-volatiles								
N-Nitrosodimethylamine	CE065	mg/kg	-	-	-	-	<0.1	-
Phenol	CE065	mg/kg	-	-	-	-	<0.1	-
Bis(2-chloroethyl)ether	CE065	mg/kg	-	-	-	-	<0.1	-
2-Chlorophenol	CE065	mg/kg	-	-	-	-	<0.1	-
1,3-Dichlorobenzene	CE065	mg/kg	-	-	-	-	<0.1	-
1,4-Dichlorobenzene	CE065	mg/kg	-	-	-	-	<0.1	-
2-Methylphenol	CE065	mg/kg	-	-	-	-	<0.1	-
1,2-Dichlorobenzene	CE065	mg/kg	-	-	-	-	<0.1	-
Bis(2-chloroisopropyl)ether	CE065	mg/kg	-	-	-	-	<0.1	-
4-Methylphenol	CE065	mg/kg	-	-	-	-	<0.1	-
N-Nitrosodi-n-propylamine	CE065	mg/kg	-	-	-	-	<0.1	-
Hexachloroethane	CE065	mg/kg	-	-	-	-	<0.1	-
Nitrobenzene	CE065	mg/kg	-	-	-	-	<0.1	-
Isophorone	CE065	mg/kg	-	-	-	-	<0.1	-
2,4-Dimethylphenol	CE065	mg/kg	-	-	-	-	<0.1	-
2-Nitrophenol	CE065	mg/kg	-	-	-	-	<0.1	-

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SOILS

Lab number Sample id Depth (m) Date sampled			50181-7 TP 5 1.50 28/01/2014	50181-8 TP 6 0.70 28/01/2014	50181-9 TP 7 0.70 28/01/2014	50181-10 TP 7 2.00 28/01/2014	50181-11 TP 8 0.50 28/01/2014	50181-12 TP 9 0.50 28/01/2014
Test	Method	Units						
Bis(2-chloroethoxy)methane	CE065	mg/kg	-	-	-	-	<0.1	-
2,4-Dichlorophenol	CE065	mg/kg	-	-	-	-	<0.1	-
1,2,4-Trichlorobenzene	CE065	mg/kg	-	-	-	-	<0.1	-
4-Chloroaniline	CE065	mg/kg	-	-	-	-	<0.1	-
Hexachlorobutadiene	CE065	mg/kg	-	-	-	-	<0.1	-
4-Chloro-3-methylphenol	CE065	mg/kg	-	-	-	-	<0.1	-
2-Methylnaphthalene	CE065	mg/kg	-	-	-	-	<0.1	-
Hexachlorocyclopentadiene	CE065	mg/kg	-	-	-	-	<0.1	-
2,4,6-Trichlorophenol	CE065	mg/kg	-	-	-	-	<0.1	-
2,4,5-Trichlorophenol	CE065	mg/kg	-	-	-	-	<0.1	-
2-Chloronaphthalene	CE065	mg/kg	-	-	-	-	<0.1	-
2-Nitroaniline	CE065	mg/kg	-	-	-	-	<0.1	-
Dimethyl phthalate	CE065	mg/kg	-	-	-	-	<0.1	-
2,6-Dinitrotoluene	CE065	mg/kg	-	-	-	-	<0.1	-
3-Nitroaniline	CE065	mg/kg	-	-	-	-	<0.1	-
2,4-Dinitrophenol	CE065	mg/kg	-	-	-	-	<0.1	-
4-Nitrophenol	CE065	mg/kg	-	-	-	-	<0.1	-
2,4-Dinitrotoluene	CE065	mg/kg	-	-	-	-	<0.1	-
Dibenzofuran	CE065	mg/kg	-	-	-	-	<0.1	-
Diethyl phthalate	CE065	mg/kg	-	-	-	-	<0.1	-
4-Chlorophenylphenyl ether	CE065	mg/kg	-	-	-	-	<0.1	-
4-Nitroaniline	CE065	mg/kg	-	-	-	-	<0.1	-
2-Methyl-4,6-dinitrophenol	CE065	mg/kg	-	-	-	-	<0.1	-
Azobenzene	CE065	mg/kg	-	-	-	-	1.0	-
4-Bromophenylphenyl ether	CE065	mg/kg	-	-	-	-	<0.1	-
Hexachlorobenzene	CE065	mg/kg	-	-	-	-	<0.1	-
Pentachlorophenol	CE065	mg/kg	-	-	-	-	<0.1	-
Carbazole	CE065	mg/kg	-	-	-	-	<0.1	-
Di-n-butyl phthalate	CE065	mg/kg	-	-	-	-	<0.1	-
Butylbenzyl phthalate	CE065	mg/kg	-	-	-	-	<0.1	-
Bis(2-ethylhexyl)phthalate	CE065	mg/kg	-	-	-	-	<0.1	-
Di-n-octyl phthalate	CE065	mg/kg	-	-	-	-	<0.1	-
PCB								
PCB Congener 28	CE070	mg/kg	-	-	<0.01	-	-	-
PCB Congener 52	CE070	mg/kg	-	-	<0.01	-	-	-
PCB Congener 101	CE070	mg/kg	-	-	<0.01	-	-	-
PCB Congener 118	CE070	mg/kg	-	-	<0.01	-	-	-
PCB Congener 138	CE070	mg/kg	-	-	<0.01	-	-	-
PCB Congener 153	CE070	mg/kg	-	-	<0.01	-	-	-
PCB Congener 180	CE070	mg/kg	-	-	<0.01	-	-	-

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SOILS

Lab number			50181-7	50181-8	50181-9	50181-10	50181-11	50181-12
Sample id			TP 5	TP 6	TP 7	TP 7	TP 8	TP 9
Depth (m)			1.50	0.70	0.70	2.00	0.50	0.50
Date sampled			28/01/2014	28/01/2014	28/01/2014	28/01/2014	28/01/2014	28/01/2014
Test	Method	Units						
Pesticides								
Organochlorine pesticides	CE065	mg/kg	-	<0.01	-	-	<0.01	-
Organophosphate pesticides	CE065	mg/kg	-	<0.01	-	-	<0.01	-
Subcontracted analysis								
Asbestos	\$	-	NAD	NAD	Amosite	NAD	NAD	NAD

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SOILS

Lab number Sample id Depth (m) Date sampled			50181-13 TP 9 1.50 28/01/2014	50181-14 TP 10 0.50 28/01/2014	50181-15 TP 11 0.50 28/01/2014	50181-16 TP 11 2.00 28/01/2014	50181-17 TP 12 0.60 28/01/2014
Test	Method	Units					
Arsenic (total)	CE054 ^M	mg/kg As	31	21	16	18	15
Cadmium (total)	CE054 ^M	mg/kg Cd	1.8	0.4	0.9	0.7	0.8
Chromium (total)	CE054 ^M	mg/kg Cr	75	99	301	80	108
Chromium (III)	-	mg/kg CrIII	75	99	301	80	108
Chromium (VI)	CE050	mg/kg CrVI	<1	<1	<1	<1	<1
Copper (total)	CE054 ^M	mg/kg Cu	191	176	135	145	113
Lead (total)	CE054 ^M	mg/kg Pb	499	503	416	354	237
Mercury (total)	CE054	mg/kg Hg	<0.5	0.6	<0.5	0.5	0.5
Nickel (total)	CE054 ^M	mg/kg Ni	59	29	127	26	24
Selenium (total)	CE054 ^M	mg/kg Se	1.2	0.8	0.8	0.8	0.7
Zinc (total)	CE054 ^M	mg/kg Zn	353	182	252	334	204
pH	CE004 ^M	units	7.6	8.1	8.1	7.9	9.9
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	363	159	200	738	540
Cyanide (free)	CE077	mg/kg CN	<2	<2	<2	<2	<2
Total Organic Carbon (TOC)	CE072 ^M	% w/w C	23.19	2.33	3.69	3.57	2.65
PAH							
Acenaphthene	CE087	mg/kg	0.52	25.34	0.86	0.12	0.81
Acenaphthylene	CE087	mg/kg	0.16	0.22	0.03	0.06	0.04
Anthracene	CE087	mg/kg	0.61	29.08	1.22	0.30	0.98
Benzo(a)anthracene	CE087	mg/kg	1.55	32.42	2.21	0.74	1.80
Benzo(a)pyrene	CE087	mg/kg	2.04	26.29	2.63	0.88	2.22
Benzo(b)fluoranthene	CE087	mg/kg	2.77	32.98	3.35	1.08	2.72
Benzo(ghi)perylene	CE087	mg/kg	1.62	19.74	1.63	0.57	1.47
Benzo(k)fluoranthene	CE087	mg/kg	0.95	12.93	1.38	0.48	1.16
Chrysene	CE087	mg/kg	2.10	34.93	2.80	1.04	2.47
Dibenz(ah)anthracene	CE087	mg/kg	0.05	3.96	0.42	0.13	0.38
Fluoranthene	CE087	mg/kg	2.90	90.41	7.17	2.00	5.13
Fluorene	CE087	mg/kg	0.30	16.06	0.62	0.14	0.61
Indeno(123cd)pyrene	CE087	mg/kg	1.17	19.25	1.39	0.46	1.22
Naphthalene	CE087	mg/kg	2.70	15.57	0.24	0.14	0.51
Phenanthrene	CE087	mg/kg	3.17	118.79	5.28	1.41	4.52
Pyrene	CE087	mg/kg	3.06	75.94	6.15	1.99	4.61
PAH (total of USEPA 16)	CE087	mg/kg	25.66	553.93	37.39	11.55	30.64
Benzo(j)fluoranthene	CE087	mg/kg	0.44	6.28	0.44	0.19	0.41
PAH (total of OIL 8)	CE087	mg/kg	11.06	169.05	14.63	5.00	12.37
BTEX & TPH							
Benzene	CE057 ^U	mg/kg	<0.01	<0.01	<0.01	-	<0.01
Toluene	CE057 ^U	mg/kg	<0.01	<0.01	<0.01	-	<0.01
Ethylbenzene	CE057 ^U	mg/kg	<0.01	<0.01	<0.01	-	<0.01
m & p-Xylene	CE057 ^U	mg/kg	<0.01	<0.01	<0.01	-	<0.01

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Lab number			50181-13	50181-14	50181-15	50181-16	50181-17
Sample id			TP 9	TP 10	TP 11	TP 11	TP 12
Depth (m)			1.50	0.50	0.50	2.00	0.60
Date sampled			28/01/2014	28/01/2014	28/01/2014	28/01/2014	28/01/2014
Test	Method	Units					
o-Xylene	CE057 ^U	mg/kg	<0.01	<0.01	<0.01	-	<0.01
TPH Aliphatic EC5-EC6	CE068	mg/kg	<0.1	<0.1	<0.1	-	<0.1
TPH Aliphatic EC6-EC8	CE068	mg/kg	<0.1	<0.1	<0.1	-	<0.1
TPH Aliphatic EC8-EC10	CE068	mg/kg	<0.1	<0.1	<0.1	-	<0.1
TPH Aliphatic EC10-EC12	CE068	mg/kg	3	<1	<1	-	2
TPH Aliphatic EC12-EC16	CE068	mg/kg	16	3	16	-	14
TPH Aliphatic EC16-EC35	CE068	mg/kg	397	436	326	-	501
TPH Aliphatic EC35-EC44	CE068	mg/kg	42	75	24	-	55
TPH Aromatic EC5-EC7	CE068	mg/kg	<0.01	<0.01	<0.01	-	<0.1
TPH Aromatic EC7-EC8	CE068	mg/kg	<0.01	<0.01	<0.01	-	<0.1
TPH Aromatic EC8-EC10	CE068	mg/kg	<0.01	<0.01	<0.01	-	<0.1
TPH Aromatic EC10-EC12	CE068	mg/kg	3	16	<1	-	<1
TPH Aromatic EC12-EC16	CE068	mg/kg	1	26	<1	-	<1
TPH Aromatic EC16-EC21	CE068	mg/kg	10	330	13	-	14
TPH Aromatic EC21-EC35	CE068	mg/kg	11	169	14	-	12
TPH Aromatic EC35-EC44	CE068	mg/kg	2	20	1	-	1
Volatiles							
Dichlorodifluoromethane	CE066	mg/kg	-	-	<0.01	-	<0.01
Chloromethane	CE066	mg/kg	-	-	<0.01	-	<0.01
Vinyl chloride	CE066	mg/kg	-	-	<0.01	-	<0.01
Bromomethane	CE066	mg/kg	-	-	<0.01	-	<0.01
Chloroethane	CE066	mg/kg	-	-	<0.01	-	<0.01
Trichlorofluoromethane	CE066	mg/kg	-	-	<0.01	-	<0.01
1,1-Dichloroethene	CE066	mg/kg	-	-	<0.01	-	<0.01
Cis-1,2-Dichloroethene	CE066	mg/kg	-	-	<0.01	-	<0.01
1,1-Dichloroethane	CE066	mg/kg	-	-	<0.01	-	<0.01
Trans-1,2-Dichloroethene	CE066	mg/kg	-	-	<0.01	-	<0.01
Chloroform	CE066	mg/kg	-	-	<0.01	-	<0.01
1,1,1-Trichloroethane	CE066	mg/kg	-	-	<0.01	-	<0.01
1,2-Dichloroethane	CE066	mg/kg	-	-	<0.01	-	<0.01
Carbon tetrachloride	CE066	mg/kg	-	-	<0.01	-	<0.01
Trichloroethene	CE066	mg/kg	-	-	<0.01	-	<0.01
1,3-Dichloropropane	CE066	mg/kg	-	-	<0.01	-	<0.01
Dibromomethane	CE066	mg/kg	-	-	<0.01	-	<0.01
Bromodichloromethane	CE066	mg/kg	-	-	<0.01	-	<0.01
1,1-Dichloro-1-propene	CE066	mg/kg	-	-	<0.01	-	<0.01
1,3-Dichloropropene	CE066	mg/kg	-	-	<0.01	-	<0.01
1,1,2-Trichloroethane	CE066	mg/kg	-	-	<0.01	-	<0.01
Dibromochloromethane	CE066	mg/kg	-	-	<0.01	-	<0.01
Tetrachloroethene	CE066	mg/kg	-	-	<0.01	-	<0.01
1,2-Dibromoethane	CE066	mg/kg	-	-	<0.01	-	<0.01

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Lab number Sample id Depth (m) Date sampled			50181-13 TP 9 1.50 28/01/2014	50181-14 TP 10 0.50 28/01/2014	50181-15 TP 11 0.50 28/01/2014	50181-16 TP 11 2.00 28/01/2014	50181-17 TP 12 0.60 28/01/2014
Test	Method	Units					
Chlorobenzene	CE066	mg/kg	-	-	<0.01	-	<0.01
1,1,1,2-Tetrachloroethane	CE066	mg/kg	-	-	<0.01	-	<0.01
Styrene	CE066	mg/kg	-	-	<0.01	-	<0.01
Tribromomethane	CE066	mg/kg	-	-	<0.01	-	<0.01
1,1,2,2-Tetrachloroethane	CE066	mg/kg	-	-	<0.01	-	<0.01
Isopropylbenzene	CE066	mg/kg	-	-	<0.01	-	<0.01
1,2,3-Trichloropropane	CE066	mg/kg	-	-	<0.01	-	<0.01
Bromobenzene	CE066	mg/kg	-	-	<0.01	-	<0.01
2-Chlorotoluene	CE066	mg/kg	-	-	<0.01	-	<0.01
Propylbenzene	CE066	mg/kg	-	-	<0.01	-	<0.01
4-Chlorotoluene	CE066	mg/kg	-	-	<0.01	-	<0.01
1,3,5-Trimethylbenzene	CE066	mg/kg	-	-	<0.01	-	<0.01
tert-Butylbenzene	CE066	mg/kg	-	-	<0.01	-	<0.01
1,2,4-Trimethylbenzene	CE066	mg/kg	-	-	<0.01	-	<0.01
1,3-Dichlorobenzene	CE066	mg/kg	-	-	<0.01	-	<0.01
sec-Butylbenzene	CE066	mg/kg	-	-	<0.01	-	<0.01
1,4-Dichlorobenzene	CE066	mg/kg	-	-	<0.01	-	<0.01
4-Isopropyltoluene	CE066	mg/kg	-	-	<0.01	-	<0.01
1,2-Dichlorobenzene	CE066	mg/kg	-	-	<0.01	-	<0.01
Butylbenzene	CE066	mg/kg	-	-	<0.01	-	<0.01
1,2-Dibromo-3-chloropropane	CE066	mg/kg	-	-	<0.01	-	<0.01
1,2,4-Trichlorobenzene	CE066	mg/kg	-	-	<0.01	-	<0.01
1,2,3-Trichlorobenzene	CE066	mg/kg	-	-	<0.01	-	<0.01
Hexachloro-1,3-butadiene	CE066	mg/kg	-	-	<0.01	-	<0.01
Semi-volatiles							
N-Nitrosodimethylamine	CE065	mg/kg	-	-	<0.1	-	<0.1
Phenol	CE065	mg/kg	-	-	<0.1	-	<0.1
Bis(2-chloroethyl)ether	CE065	mg/kg	-	-	<0.1	-	<0.1
2-Chlorophenol	CE065	mg/kg	-	-	<0.1	-	<0.1
1,3-Dichlorobenzene	CE065	mg/kg	-	-	<0.1	-	<0.1
1,4-Dichlorobenzene	CE065	mg/kg	-	-	<0.1	-	<0.1
2-Methylphenol	CE065	mg/kg	-	-	<0.1	-	<0.1
1,2-Dichlorobenzene	CE065	mg/kg	-	-	<0.1	-	<0.1
Bis(2-chloroisopropyl)ether	CE065	mg/kg	-	-	<0.1	-	<0.1
4-Methylphenol	CE065	mg/kg	-	-	<0.1	-	<0.1
N-Nitrosodi-n-propylamine	CE065	mg/kg	-	-	<0.1	-	<0.1
Hexachloroethane	CE065	mg/kg	-	-	<0.1	-	<0.1
Nitrobenzene	CE065	mg/kg	-	-	<0.1	-	<0.1
Isophorone	CE065	mg/kg	-	-	<0.1	-	<0.1
2,4-Dimethylphenol	CE065	mg/kg	-	-	<0.1	-	<0.1
2-Nitrophenol	CE065	mg/kg	-	-	<0.1	-	<0.1

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Lab number Sample id Depth (m) Date sampled			50181-13 TP 9 1.50 28/01/2014	50181-14 TP 10 0.50 28/01/2014	50181-15 TP 11 0.50 28/01/2014	50181-16 TP 11 2.00 28/01/2014	50181-17 TP 12 0.60 28/01/2014
Test	Method	Units					
Bis(2-chloroethoxy)methane	CE065	mg/kg	-	-	<0.1	-	<0.1
2,4-Dichlorophenol	CE065	mg/kg	-	-	<0.1	-	<0.1
1,2,4-Trichlorobenzene	CE065	mg/kg	-	-	<0.1	-	<0.1
4-Chloroaniline	CE065	mg/kg	-	-	<0.1	-	<0.1
Hexachlorobutadiene	CE065	mg/kg	-	-	<0.1	-	<0.1
4-Chloro-3-methylphenol	CE065	mg/kg	-	-	<0.1	-	<0.1
2-Methylnaphthalene	CE065	mg/kg	-	-	0.2	-	0.1
Hexachlorocyclopentadiene	CE065	mg/kg	-	-	<0.1	-	<0.1
2,4,6-Trichlorophenol	CE065	mg/kg	-	-	<0.1	-	<0.1
2,4,5-Trichlorophenol	CE065	mg/kg	-	-	<0.1	-	<0.1
2-Chloronaphthalene	CE065	mg/kg	-	-	<0.1	-	<0.1
2-Nitroaniline	CE065	mg/kg	-	-	<0.1	-	<0.1
Dimethyl phthalate	CE065	mg/kg	-	-	<0.1	-	<0.1
2,6-Dinitrotoluene	CE065	mg/kg	-	-	<0.1	-	<0.1
3-Nitroaniline	CE065	mg/kg	-	-	<0.1	-	<0.1
2,4-Dinitrophenol	CE065	mg/kg	-	-	<0.1	-	<0.1
4-Nitrophenol	CE065	mg/kg	-	-	<0.1	-	<0.1
2,4-Dinitrotoluene	CE065	mg/kg	-	-	<0.1	-	<0.1
Dibenzofuran	CE065	mg/kg	-	-	0.3	-	<0.1
Diethyl phthalate	CE065	mg/kg	-	-	<0.1	-	<0.1
4-Chlorophenylphenyl ether	CE065	mg/kg	-	-	<0.1	-	<0.1
4-Nitroaniline	CE065	mg/kg	-	-	<0.1	-	<0.1
2-Methyl-4,6-dinitrophenol	CE065	mg/kg	-	-	<0.1	-	<0.1
Azobenzene	CE065	mg/kg	-	-	1.0	-	1.0
4-Bromophenylphenyl ether	CE065	mg/kg	-	-	<0.1	-	<0.1
Hexachlorobenzene	CE065	mg/kg	-	-	<0.1	-	<0.1
Pentachlorophenol	CE065	mg/kg	-	-	<0.1	-	<0.1
Carbazole	CE065	mg/kg	-	-	<0.1	-	<0.1
Di-n-butyl phthalate	CE065	mg/kg	-	-	<0.1	-	<0.1
Butylbenzyl phthalate	CE065	mg/kg	-	-	<0.1	-	<0.1
Bis(2-ethylhexyl)phthalate	CE065	mg/kg	-	-	<0.1	-	<0.1
Di-n-octyl phthalate	CE065	mg/kg	-	-	<0.1	-	<0.1
PCB							
PCB Congener 28	CE070	mg/kg	-	-	-	-	<0.01
PCB Congener 52	CE070	mg/kg	-	-	-	-	<0.01
PCB Congener 101	CE070	mg/kg	-	-	-	-	<0.01
PCB Congener 118	CE070	mg/kg	-	-	-	-	<0.01
PCB Congener 138	CE070	mg/kg	-	-	-	-	<0.01
PCB Congener 153	CE070	mg/kg	-	-	-	-	<0.01
PCB Congener 180	CE070	mg/kg	-	-	-	-	<0.01

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SOILS

Lab number			50181-13	50181-14	50181-15	50181-16	50181-17
Sample id			TP 9	TP 10	TP 11	TP 11	TP 12
Depth (m)			1.50	0.50	0.50	2.00	0.60
Date sampled			28/01/2014	28/01/2014	28/01/2014	28/01/2014	28/01/2014
Test	Method	Units					
Pesticides							
Organochlorine pesticides	CE065	mg/kg	-	<0.01	-	-	<0.01
Organophosphate pesticides	CE065	mg/kg	-	<0.01	-	-	<0.01
Subcontracted analysis							
Asbestos	\$	-	Amosite, Chrysotile	NAD	NAD	Chrysotile	Chrysotile

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LEACHATES

Lab number Sample id Depth (m)			50181-6L TP 5 0.50	50181-11L TP 8 0.50	50181-12L TP 9 0.50	50181-14L TP 10 0.50	50181-15L TP 11 0.50
Test	Method	Units					
Arsenic (dissolved)	CE128 ^U	µg/l As	3.32	0.65	1.07	5.51	1.75
Boron (dissolved)	CE128 ^U	µg/l B	26	36	76	16	44
Cadmium (dissolved)	CE128 ^U	µg/l Cd	<0.07	<0.07	<0.07	<0.07	<0.07
Chromium (dissolved)	CE128 ^U	µg/l Cr	10.3	9.8	9.3	11.8	10
Copper (dissolved)	CE128 ^U	µg/l Cu	3.9	8.9	4.0	5.6	3.3
Lead (dissolved)	CE128 ^U	µg/l Pb	0.7	0.3	0.4	8.2	<0.2
Mercury (dissolved)	CE128 ^U	µg/l Hg	<0.008	<0.008	<0.008	<0.008	<0.008
Nickel (dissolved)	CE128 ^U	µg/l Ni	2.3	2.4	3.0	2.1	2.2
Selenium (dissolved)	CE128 ^U	µg/l Se	0.3	0.4	0.7	0.4	0.5
Zinc (dissolved)	CE128 ^U	µg/l Zn	2	4	4	5	<1
pH	CE004 ^U	units	8.1	8.0	7.9	8.5	8.2
Sulphate	CE049 ^U	mg/l SO ₄	173	127	29	33	23
Cyanide (free)	CE077	µg/l CN	<20	<20	<20	<20	<20
PAHs							
Acenaphthene	CE087	µg/l	-	<0.1	<0.1	<0.1	-
Acenaphthylene	CE087	µg/l	-	<0.1	<0.1	<0.1	-
Anthracene	CE087	µg/l	-	<0.1	<0.1	<0.1	-
Benzo(a)anthracene	CE087	µg/l	-	<0.1	<0.1	<0.1	-
Benzo(a)pyrene	CE087	µg/l	-	<0.1	<0.1	<0.1	-
Benzo(b)fluoranthene	CE087	µg/l	-	<0.1	<0.1	<0.1	-
Benzo(ghi)perylene	CE087	µg/l	-	<0.1	<0.1	<0.1	-
Benzo(k)fluoranthene	CE087	µg/l	-	<0.1	<0.1	<0.1	-
Chrysene	CE087	µg/l	-	<0.1	<0.1	<0.1	-
Dibenz(ah)anthracene	CE087	µg/l	-	<0.1	<0.1	<0.1	-
Fluoranthene	CE087	µg/l	-	<0.1	<0.1	<0.1	-
Fluorene	CE087	µg/l	-	<0.1	<0.1	<0.1	-
Indeno(123cd)pyrene	CE087	µg/l	-	<0.1	<0.1	<0.1	-
Naphthalene	CE087	µg/l	-	<0.1	<0.1	1.2	-
Phenanthrene	CE087	µg/l	-	<0.1	<0.1	<0.1	-
Pyrene	CE087	µg/l	-	<0.1	<0.1	<0.1	-
PAH (total of USEPA 16)	CE087	µg/l	-	<0.1	<0.1	<0.1	-
Benzo(j)fluoranthene	CE087	µg/l	-	<0.1	<0.1	<0.1	-
PAH (total of OIL 8)	CE087	µg/l	-	<0.1	<0.1	<0.1	-
BTEX & TPH							
MTBE	CE057 ^U	µg/l	<1	<1	<1	<1	<1
Benzene	CE057 ^U	µg/l	<1	<1	<1	<1	<1
Toluene	CE057 ^U	µg/l	<1	<1	<1	<1	<1
Ethylbenzene	CE057 ^U	µg/l	<1	<1	<1	<1	<1
m & p-Xylene	CE057 ^U	µg/l	<1	<1	<1	<1	<1
o-Xylene	CE057 ^U	µg/l	<1	<1	<1	<1	<1
TPH Aliphatic EC5-EC6	CE068	µg/l	<1	<1	<1	<1	<1

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LEACHATES

Lab number Sample id Depth (m)			50181-6L TP 5 0.50	50181-11L TP 8 0.50	50181-12L TP 9 0.50	50181-14L TP 10 0.50	50181-15L TP 11 0.50
Test	Method	Units					
TPH Aliphatic EC6-EC8	CE068	µg/l	<1	<1	<1	<1	<1
TPH Aliphatic EC8-EC10	CE068	µg/l	<1	<1	<1	<1	<1
TPH Aliphatic EC10-EC12	CE068	µg/l	<1	<1	<1	<1	<1
TPH Aliphatic EC12-EC16	CE068	µg/l	<1	<1	<1	<1	<1
TPH Aliphatic EC16-EC35	CE068	µg/l	<1	<1	<1	5	4
TPH Aliphatic EC35-EC44	CE068	µg/l	<1	<1	<1	<1	<1
TPH Aromatic EC5-EC7	CE068	µg/l	<1	<1	<1	<1	<1
TPH Aromatic EC7-EC8	CE068	µg/l	<1	<1	<1	<1	<1
TPH Aromatic EC8-EC10	CE068	µg/l	<1	<1	<1	<1	<1
TPH Aromatic EC10-EC12	CE068	µg/l	<1	<1	<1	<1	<1
TPH Aromatic EC12-EC16	CE068	µg/l	<1	<1	<1	<1	<1
TPH Aromatic EC16-EC21	CE068	µg/l	<1	<1	<1	<1	<1
TPH Aromatic EC21-EC35	CE068	µg/l	<1	<1	<1	<1	<1
TPH Aromatic EC35-EC44	CE068	µg/l	<1	<1	<1	<1	<1
Volatiles							
Dichlorodifluoromethane	CE066	µg/l	<1	-	-	-	<1
Chloromethane	CE066	µg/l	<1	-	-	-	<1
Vinyl chloride	CE066	µg/l	<1	-	-	-	<1
Bromomethane	CE066	µg/l	<1	-	-	-	<1
Chloroethane	CE066	µg/l	<1	-	-	-	<1
Trichlorofluoromethane	CE066	µg/l	<1	-	-	-	<1
1,1-Dichloroethene	CE066	µg/l	<1	-	-	-	<1
Cis-1,2-Dichloroethene	CE066	µg/l	<1	-	-	-	<1
1,1-Dichloroethane	CE066	µg/l	<1	-	-	-	<1
Trans-1,2-Dichloroethene	CE066	µg/l	<1	-	-	-	<1
Chloroform	CE066	µg/l	<1	-	-	-	<1
1,1,1-Trichloroethane	CE066	µg/l	<1	-	-	-	<1
1,2-Dichloroethane	CE066	µg/l	<1	-	-	-	<1
Carbon tetrachloride	CE066	µg/l	<1	-	-	-	<1
Trichloroethene	CE066	µg/l	<1	-	-	-	<1
1,3-Dichloropropane	CE066	µg/l	<1	-	-	-	<1
Dibromomethane	CE066	µg/l	<1	-	-	-	<1
Bromodichloromethane	CE066	µg/l	<1	-	-	-	<1
1,1-Dichloro-1-propene	CE066	µg/l	<1	-	-	-	<1
1,3-Dichloropropene	CE066	µg/l	<1	-	-	-	<1
1,1,2-Trichloroethane	CE066	µg/l	<1	-	-	-	<1
Dibromochloromethane	CE066	µg/l	<1	-	-	-	<1
Tetrachloroethene	CE066	µg/l	<1	-	-	-	<1
1,2-Dibromoethane	CE066	µg/l	<1	-	-	-	<1
Chlorobenzene	CE066	µg/l	<1	-	-	-	<1
1,1,1,2-Tetrachloroethane	CE066	µg/l	<1	-	-	-	<1

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LEACHATES

Lab number Sample id Depth (m)			50181-6L TP 5 0.50	50181-11L TP 8 0.50	50181-12L TP 9 0.50	50181-14L TP 10 0.50	50181-15L TP 11 0.50
Test	Method	Units					
Styrene	CE066	µg/l	<1	-	-	-	<1
Tribromomethane	CE066	µg/l	<1	-	-	-	<1
1,1,2,2-Tetrachloroethane	CE066	µg/l	<1	-	-	-	<1
Isopropylbenzene	CE066	µg/l	<1	-	-	-	<1
1,2,3-Trichloropropane	CE066	µg/l	<1	-	-	-	<1
Bromobenzene	CE066	µg/l	<1	-	-	-	<1
2-Chlorotoluene	CE066	µg/l	<1	-	-	-	<1
Propylbenzene	CE066	µg/l	<1	-	-	-	<1
4-Chlorotoluene	CE066	µg/l	<1	-	-	-	<1
1,3,5-Trimethylbenzene	CE066	µg/l	<1	-	-	-	<1
tert-Butylbenzene	CE066	µg/l	<1	-	-	-	<1
1,2,4-Trimethylbenzene	CE066	µg/l	<1	-	-	-	<1
1,3-Dichlorobenzene	CE066	µg/l	<1	-	-	-	<1
sec-Butylbenzene	CE066	µg/l	<1	-	-	-	<1
1,4-Dichlorobenzene	CE066	µg/l	<1	-	-	-	<1
4-Isopropyltoluene	CE066	µg/l	<1	-	-	-	<1
1,2-Dichlorobenzene	CE066	µg/l	<1	-	-	-	<1
Butylbenzene	CE066	µg/l	<1	-	-	-	<1
1,2-Dibromo-3-chloropropane	CE066	µg/l	<1	-	-	-	<1
1,2,4-Trichlorobenzene	CE066	µg/l	<1	-	-	-	<1
1,2,3-Trichlorobenzene	CE066	µg/l	<1	-	-	-	<1
Hexachloro-1,3-butadiene	CE066	µg/l	<1	-	-	-	<1
Semi-volatiles							
N-Nitrosodimethylamine	CE065	µg/l	<0.1	-	-	-	<0.1
Phenol	CE065	µg/l	<0.1	-	-	-	<0.1
Bis(2-chloroethyl)ether	CE065	µg/l	<0.1	-	-	-	<0.1
2-Chlorophenol	CE065	µg/l	<0.1	-	-	-	<0.1
1,3-Dichlorobenzene	CE065	µg/l	<0.1	-	-	-	<0.1
1,4-Dichlorobenzene	CE065	µg/l	<0.1	-	-	-	<0.1
2-Methylphenol	CE065	µg/l	<0.1	-	-	-	<0.1
1,2-Dichlorobenzene	CE065	µg/l	<0.1	-	-	-	<0.1
Bis(2-chloroisopropyl)ether	CE065	µg/l	<0.1	-	-	-	<0.1
4-Methylphenol	CE065	µg/l	<0.1	-	-	-	<0.1
N-Nitrosodi-n-propylamine	CE065	µg/l	<0.1	-	-	-	<0.1
Hexachloroethane	CE065	µg/l	<0.1	-	-	-	<0.1
Nitrobenzene	CE065	µg/l	<0.1	-	-	-	<0.1
Isophorone	CE065	µg/l	<0.1	-	-	-	<0.1
2,4-Dimethylphenol	CE065	µg/l	<0.1	-	-	-	<0.1
2-Nitrophenol	CE065	µg/l	<0.1	-	-	-	<0.1
Bis(2-chloroethoxy)methane	CE065	µg/l	<0.1	-	-	-	<0.1
2,4-Dichlorophenol	CE065	µg/l	<0.1	-	-	-	<0.1

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LEACHATES

Lab number Sample id Depth (m)			50181-6L TP 5 0.50	50181-11L TP 8 0.50	50181-12L TP 9 0.50	50181-14L TP 10 0.50	50181-15L TP 11 0.50
Test	Method	Units					
1,2,4-Trichlorobenzene	CE065	µg/l	<0.1	-	-	-	<0.1
4-Chloroaniline	CE065	µg/l	<0.1	-	-	-	<0.1
Hexachlorobutadiene	CE065	µg/l	<0.1	-	-	-	<0.1
4-Chloro-3-methylphenol	CE065	µg/l	<0.1	-	-	-	<0.1
2-Methylnaphthalene	CE065	µg/l	<0.1	-	-	-	<0.1
Hexachlorocyclopentadiene	CE065	µg/l	<0.1	-	-	-	<0.1
2,4,6-Trichlorophenol	CE065	µg/l	<0.1	-	-	-	<0.1
2,4,5-Trichlorophenol	CE065	µg/l	<0.1	-	-	-	<0.1
2-Chloronaphthalene	CE065	µg/l	<0.1	-	-	-	<0.1
2-Nitroaniline	CE065	µg/l	<0.1	-	-	-	<0.1
Dimethyl phthalate	CE065	µg/l	<0.1	-	-	-	<0.1
2,6-Dinitrotoluene	CE065	µg/l	<0.1	-	-	-	<0.1
3-Nitroaniline	CE065	µg/l	<0.1	-	-	-	<0.1
2,4-Dinitrophenol	CE065	µg/l	<0.1	-	-	-	<0.1
4-Nitrophenol	CE065	µg/l	<0.1	-	-	-	<0.1
2,4-Dinitrotoluene	CE065	µg/l	<0.1	-	-	-	<0.1
Dibenzofuran	CE065	µg/l	<0.1	-	-	-	<0.1
Diethyl phthalate	CE065	µg/l	<0.1	-	-	-	<0.1
4-Chlorophenylphenyl ether	CE065	µg/l	<0.1	-	-	-	<0.1
4-Nitroaniline	CE065	µg/l	<0.1	-	-	-	<0.1
2-Methyl-4,6-dinitrophenol	CE065	µg/l	<0.1	-	-	-	<0.1
Azobenzene	CE065	µg/l	<0.1	-	-	-	<0.1
4-Bromophenylphenyl ether	CE065	µg/l	<0.1	-	-	-	<0.1
Hexachlorobenzene	CE065	µg/l	<0.1	-	-	-	<0.1
Pentachlorophenol	CE065	µg/l	<0.1	-	-	-	<0.1
Carbazole	CE065	µg/l	<0.1	-	-	-	<0.1
Di-n-butyl phthalate	CE065	µg/l	<0.1	-	-	-	<0.1
Butylbenzyl phthalate	CE065	µg/l	<0.1	-	-	-	<0.1
Bis(2-ethylhexyl)phthalate	CE065	µg/l	<0.1	-	-	-	<0.1
Di-n-octyl phthalate	CE065	µg/l	<0.1	-	-	-	<0.1
Pesticides							
Organochlorine pesticides	CE065	µg/l	-	<0.1	-	<0.1	-
Organophosphate pesticides	CE065	µg/l	-	<0.1	-	<0.1	-

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE054	Arsenic (total)	Aqua regia digest, ICP-OES	Dry	M	1	mg/kg As
CE054	Cadmium (total)	Aqua regia digest, ICP-OES	Dry	M	0.2	mg/kg Cd
CE054	Chromium (total)	Aqua regia digest, ICP-OES	Dry	M	1	mg/kg Cr
-	Chromium (III)	Calculation: Cr (total) - Cr (VI)	Dry		1	mg/kg CrIII
CE050	Chromium (VI)	Acid extraction, Colorimetry	Dry		1	mg/kg CrVI
CE054	Copper (total)	Aqua regia digest, ICP-OES	Dry	M	1	mg/kg Cu
CE054	Lead (total)	Aqua regia digest, ICP-OES	Dry	M	1	mg/kg Pb
CE054	Mercury (total)	Aqua regia digest, ICP-OES	Dry		0.5	mg/kg Hg
CE054	Nickel (total)	Aqua regia digest, ICP-OES	Dry	M	1	mg/kg Ni
CE054	Selenium (total)	Aqua regia digest, ICP-OES	Dry	M	0.3	mg/kg Se
CE054	Zinc (total)	Aqua regia digest, ICP-OES	Dry	M	3	mg/kg Zn
CE004	pH	Based on BS 1377, pH Meter	Wet	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	M	10	mg/l SO ₄
CE077	Cyanide (free)	Extraction, Continuous Flow Colorimetry	Wet		2	mg/kg CN
CE072	Total Organic Carbon (TOC)	Removal of IC by acidification, Carbon Analyser	Dry	M	0.1	% w/w C
CE087	PAH (speciated)	Solvent extraction, GC-MS	Wet		0.01	mg/kg
CE057	BTEX	Headspace GC-FID	Wet	U	0.01	mg/kg
CE068	TPH Aliphatic/Aromatic fractions (C5-C10)	Headspace GC-FID	Wet		0.01-0.1	mg/kg
CE068	TPH Aliphatic/Aromatic fractions (C10-C44)	Solvent extraction, GC-FID	Wet		1	mg/kg
CE066	Volatile Organic Compounds	Headspace GC-MS	Wet		0.01	mg/kg
CE065	Semi-volatile Organic Compounds	Solvent extraction, GC-MS	Wet		0.1	mg/kg
CE070	PCB (ICES 7)	Solvent extraction, GC-MS	Wet		0.01	mg/kg
CE065	Organochlorine pesticides	Solvent extraction, GC-MS	Wet		0.01	mg/kg
CE065	Organophosphate pesticides	Solvent extraction, GC-MS	Wet		0.01	mg/kg
\$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-

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METHOD DETAILS

METHOD	LEACHATES	METHOD SUMMARY	STATUS	LOD	UNITS
CE128	Arsenic (dissolved)	ICP-MS	U	0.06	µg/l As
CE128	Boron (dissolved)	ICP-MS	U	6	µg/l B
CE128	Cadmium (dissolved)	ICP-MS	U	0.07	µg/l Cd
CE128	Chromium (dissolved)	ICP-MS	U	0.2	µg/l Cr
CE128	Copper (dissolved)	ICP-MS	U	0.4	µg/l Cu
CE128	Lead (dissolved)	ICP-MS	U	0.2	µg/l Pb
CE128	Mercury (dissolved)	ICP-MS	U	0.008	µg/l Hg
CE128	Nickel (dissolved)	ICP-MS	U	0.5	µg/l Ni
CE128	Selenium (dissolved)	ICP-MS	U	0.07	µg/l Se
CE128	Zinc (dissolved)	ICP-MS	U	1	µg/l Zn
CE004	pH	Based on BS 1377, pH Meter	U	-	units
CE049	Sulphate	Ion Chromatography	U	10	mg/l SO ₄
CE077	Cyanide (free)	Distillation, Colorimetry		20	µg/l CN
CE087	PAH (speciated)	Solvent extraction, GC-MS		0.1	µg/l
CE057	BTEX & MTBE	Headspace GC-FID	U	1	µg/l
CE068	TPH Aliphatic/Aromatic fractions (C5-C10)	Headspace GC-FID		1	µg/l
CE068	TPH Aliphatic/Aromatic fractions (C10-C44)	Solvent extraction, GC-FID		1	µg/l
CE066	Volatile Organic Compounds	Headspace GC-MS		1	µg/l
CE065	Semi-volatile Organic Compounds	Solvent extraction, GC-MS		0.1	µg/l
CE065	Organochlorine pesticides	Solvent extraction, GC-MS		0.1	µg/l
CE065	Organophosphate pesticides	Solvent extraction, GC-MS		0.1	µg/l

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DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

- N No (not deviating sample)
- Y Yes (deviating sample)
- A Sampling date not provided
- B Sampling time not provided (waters only)
- C Sample exceeded holding time(s)
- D Sample not received in appropriate containers
- E Headspace present in sample container
- F Sample not chemically fixed (where appropriate)
- G Sample not cooled
- H Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
50181-1	TP 1	0.50	N	
50181-2	TP 1	2.00	N	
50181-3	TP 2	0.50	N	
50181-4	TP 3	0.50	N	
50181-5	TP 4	1.00	N	
50181-6	TP 5	0.50	N	
50181-7	TP 5	1.50	N	
50181-8	TP 6	0.70	N	
50181-9	TP 7	0.70	N	
50181-10	TP 7	2.00	N	
50181-11	TP 8	0.50	N	
50181-12	TP 9	0.50	N	
50181-13	TP 9	1.50	N	
50181-14	TP 10	0.50	N	
50181-15	TP 11	0.50	N	
50181-16	TP 11	2.00	N	
50181-17	TP 12	0.60	N	

APPENDIX V

Ground Contamination Risk Assessment Data: Methodology

Notes for Off-Site Disposal

CL:AIRE Statistical Analysis Sheets

Conceptual Site Model (CSM)

Ground Contamination Risk Assessment

Assessment Framework:-

Ground contamination risk assessments are undertaken to identify potential risks from historical and recent land contamination on a given site and enable appropriate risk management actions to be undertaken in accordance with the regulatory context of the site and any future development. There are a range of technical approaches to the assessment of chemical contaminants in the UK, all of which broadly fit within a tiered/phased approach and the current UK approach is set out in the Defra and Environment Agency Publication: CLR 11: Model Procedures for the Management of Land Contamination (*Defra/EA 2004*).

ARC's approach to undertaking ground contamination risk assessments is based on the tiered/phased framework in accordance with CLR11, and for Human Health, the recently updated CLEA (Contaminated Land Exposure Assessment) framework and model for assessing potentially contaminated land in the UK. This framework and model is based primarily on the following publications and software: Science Reports SC050021/SR2 (EA 2008b Human Health toxicological assessment of contaminants in soil) and SC050021/SR3 (Updated technical background to CLEA model – replaces the previous guidance documents CLR9, CLR10 and Briefing notes 1 – 4); Science Report SC050021/SR4 (CLEA Software (version 1.06 beta) handbook) and the new CLEA software (replaces Science Report SC050021/H CLEA UK Handbook (draft) and the CLEA UK Software version 1.0 beta), along with the publication of a review of body weight and height data used within the Contaminated Land Exposure Assessment model (CLEA), Project no. SC050021/Technical Review 1.

At present, the SGV's (Soil Guidance Values) published as part of the previous CLEA UK Handbook (draft) and software (version 1.0 beta), have been withdrawn along with guidance documents CLR7 and CLR8, and replacement of the SGV values, using the updated model and software (version 1.06), is currently ongoing, and the new guidance documents for CLR7 & CLR8 have yet to be published. Currently, Defra and the EA have published TOX and SGV reports for the following select substances: Benzene, Toluene, Ethylbenzene, Xylenes, Arsenic, Cadmium, Mercury, Nickel, Selenium and Phenol. Although updated SGV values have been calculated for the aforementioned analytes, at present for the majority of the potential contaminants, relevant data is yet to be made available for the new model. According to Defra and the EA, the schedule for publication of the remaining reports will depend on various factors, and they anticipate publishing the remaining TOX and SGV reports for Cyanide, Lead, Dioxins, Dioxin-like Polychlorinated Biphenyls and Polycyclic Aromatic Hydrocarbons during the remainder of 2010.

When considering ground contamination risk assessments for Controlled Waters (groundwater and surface waters), ARC follows the EA guidance on Remedial Targets Methodology, Hydrogeological Risk Assessment for Land Contamination, 2006.

Methodology:-

During this transitional period, prior to the publication of all the new SGV values for the above mentioned analytes, ARC consider that the most appropriate methodology for completing a ground contamination risk assessment for soils on this site will be to utilise the recently published SGV values (Benzene, Toluene, Ethylbenzene, Xylenes, Arsenic, Cadmium, Chromium (III & VI), Mercury, Nickel, Selenium and Phenol), combined with the former CLEA model SGV's based on the CLEA UK software and other newly published and recognised GAC's (generic assessment criteria) for the remaining analytes. It is widely recognised by ground contamination risk assessment practitioners that the new CLEA model will generally result in higher SGV and GAC (generic assessment criteria) values for the standard end uses, and consequently continued use of the former CLEA model will result in a slightly more conservative assessment.

For general soil surface contamination, the new SGV value for inorganic Mercury can be compared with chemical analysis for total mercury content, as the concentrations of elemental and methylmercury compounds are likely to be very low, in accordance with Science Report SC050021 / Mercury SGV. In addition, the updated SGV values are based upon a Soil Organic Matter (SOM) content of 6%, in line with the most recent Defra and EA guidance. Once all the relevant data is available, a reassessment of the ground contamination present on this site can be carried out, if felt necessary, as this may result in a reduction in the scope of remediation works (if required). It should be noted that guidance document CLR11: Model Procedures for the Management of Land Contamination has not been withdrawn.

Ground Contamination Risk Assessment (Cont'd)

Methodology (Cont'd):-

ARC ground contamination risk assessments, in accordance with CLR11, are based on the established *source-pathway-receptor* pollutant linkage methodology and 'suitable for use' approach (Part IIA, EPA 1990 - inserted through Section 57 EA 1995), and adopts the tiered/phased approach beginning with a preliminary assessment (also referred to a desk top study). If potential pollutant linkages are identified from the preliminary assessment, for both Human Health and/or Controlled Waters, then Level 1 Quantitative Risk Assessments are appropriate guideline values. For soils these typically comprise soil guideline values (SGV's), generic assessment criteria (GAC) or site specific assessment criteria (SSAC) and for controlled waters, Environmental Quality Standards (EQS) or UK Drinking Water Standards.

Where any Level 1 criteria have been exceeded, various courses of action are available for recommendation, in order to try and 'break' the pollutant linkage by designing into the proposed development works and/or by recommending appropriate remediation works, i.e. removal of source, treatment of contaminants, installation of permanent barriers, etc. and/or by carrying out more detailed site specific quantitative risk assessment (DQRA, i.e. Level 2 or above). Completing further DQRA for any contaminants present, can take into account factors such as the introduction of physical barrier and the actual availability of plausible contaminant migration pathways, as well as site specific data such as the type, properties and characteristics (permeability, porosity, density, etc.) of the soil present on site, groundwater depth and flow, site specific exposure criteria and values, and contaminant retardation, attenuation, dilution and degradation. Similarly, when considering potential risks to off-site receptors, these are considered by assessing the potential risks to on-site receptors, as well as the potential mobility of any contaminants present within either the soils or water/groundwater below this site.

For the purpose of this report, preliminary and level 1 risk assessments consider two main categories of receptor, and these are as follows:

- On site Human Health – (CLEA Model).
- Controlled Waters – (groundwater) – (EA Remedial Targets Methodology).

When considering the risk to construction workforce, the results of the screening can be used by the Main Contractor/Project Coordinator, when devising an adequate Site Health & Safety Plan, in accordance with current CDM Regulations, and when assessing the level of PPE required on site. Similarly, when considering the risks to building materials, again the results of the contamination screening can be used to determine the level of protection that may be required, and reference should be made to the utilities suppliers for their comments.

Level 1 - Human Health:-

Level 1 human health related assessments are based upon the current CLEA Model, with site values assessed against published Soil Guidance Values (SGV's), and where these values are not available against the published CIEM (Chartered Institute of Environmental Health)/LQM Generic Assessment Criteria (GAC), Atkins ATRISKsoil® SSV values and USEPA Region 9 Screening Values (2009). For statistical analysis, the site is assessed to delineate any potentially differing areas of contamination (averaging areas), based on the results of the preliminary investigation as well as the result of any visual, olfactory or analytical evidence following completion of the intrusive investigation works. Following this geographical delineation of the site, where generic or pervasive contaminants are anticipated, for each 'averaging area' under consideration, the results are assessed using the established methods of statistical analysis given in the CL:AIRE Guidance on Comparing Soil Contamination Data with a Critical Concentration (C_c), May 2008. In this case, the results of the sample population are assessed to determine whether they represent a normal or non-normal distribution and the statistical upper confidence limit is (95% percentile – $UCL_{0.95}$) is calculated and then compared with the chosen Level 1 Critical Concentration (C_c) value for the site (i.e. the appropriate SGV, GAC or SSV).

In addition, further statistical analysis is undertaken to determine whether the maximum concentration(s) recorded represent statistical outliers, i.e. potential 'hot spots', and where necessary these are removed from the sampling populations and a reassessment of the averaging areas/potential hot spot areas identified.

Ground Contamination Risk Assessment (Cont'd)

Methodology (Cont'd):-

Level 1 - Human Health (Cont'd):-

Where targeted screening is undertaken, i.e. speciated PAH's for 'ashy' type materials, screening for suspected organic contamination, etc., the maximum site values recorded (C_M) at each location have been compared to the chosen Level 1 Critical Concentration (C_C), with no requirement for statistical analysis to be undertaken on for these samples.

Level 1 – Controlled Waters:-

The Level 1 controlled waters risk assessment has been carried out (in accordance with the guidance; Remedial Targets Methodology, Hydrogeological Risk Assessment for Land Contamination, Environment Agency, 2006) by comparing samples of leachate, with the chosen Level 1 Critical Concentration (C_C) value, based on an appropriate water quality standard (EQS, UK Drinking Water, etc.), and which is also taken as the Level 1 Leachate Remedial Target (LTC_1).

The number of samples chosen for screening is determined by assessing the potential risk of contamination reaching a sensitive receptor, i.e. shallow groundwater, nearby surface water feature, etc., based on the results of the preliminary investigation, as well as olfactory, visual, anecdotal and analytical evidence collected during the intrusive investigation works.

Where the potential risk is considered to be low between 0% and c.25% of the samples are targeted for screening, c.25% to c.50% where the risk is considered to be moderate and c.75% to 100% where the risk is considered to be high. This is to ensure that the potential risk is adequately assessed without carrying out unnecessary testing. When considering any 'hot spots' identified, samples are specifically targeted for screening on a sample by sample and analyte by analyte basis.

Notes for Off-Site Disposal

When considering the removal of any materials from this site as a waste, to be disposed of at a landfill, it can be seen that where the uncontaminated natural strata (excluding any 'topsoil' or 'peat' materials) can be kept separate from any made ground or contaminated natural strata, then these materials can be considered as 'inert' and taken to an Inert Landfill Site.

Where made ground or contaminated natural strata is to be removed off site as a 'waste', a preliminary classification assessment, regarding off-site disposal, can be made utilising the contamination soils screening undertaken as part of the Level 1 Risk Assessment for Human Health. If there is sufficient screening to classify these materials as Non-Hazardous, then they can be disposed of at a Non-Hazardous Landfill. If insufficient preliminary screening has been undertaken to carryout the classification assessment, then further preliminary soils screening should be undertaken, where required.

If the results of the preliminary classification assessment indicate that the materials to be removed from site as a 'waste' should be classified as Hazardous Waste, then prior to disposal, full WAC screening should be completed so that these materials can be classified as either Stable Non-Reactive Hazardous Waste or Hazardous Waste, and disposed of at a suitable waste disposal facility.

If possible, removal of materials from site as a 'waste' should be kept to a minimum, however, if materials have to be removed to accommodate finished ground levels etc., it is recommended that the volume to be disposed of is calculated, as the amount of additional screening required, including any full WAC screening, will be dependant upon the volume of material to be disposed of.

Client/client ref: BSCP Project ref: 13-898 Site ref: Milliners Wharf, Manchester SITE A Data description: Contamination Screening Results Contaminant(s): Generic Soils - Residential Test scenario: Planning		Arsenic (total) (mg/kg)	Cadmium (total) (mg/kg)	Chromium (III) (mg/kg)	Chromium (VI) (mg/kg)	Copper (total) (mg/kg)	Lead (total) (mg/kg)	Mercury (total) (mg/kg)	Nickel (total) (mg/kg)	Selenium (total) (mg/kg)	Zinc (total) (mg/kg)	Cyanide (free) (mg/kg)
Critical concentration, C_c		32	10	3000	4.3	2330	276	170	130	350	3750	34
Notes		SGV	SGV	LQM - 2009	LQM - 2009	LQM - 2009	ATRISK(SOIL) SSV - 2011	SGV	SGV	SGV	LQM - 2009	ATRISK(SOIL) SSV - 2011
		13	13	13	13	13	13	13	13	13	13	13
		20.4615385	0.61538462	113	0.5	151.692308	323.384615	0.35	40.9230769	0.95384615	249.153846	1
		7.28715062	0.42787489	59.0635251	0	148.753927	117.970716	0.16329932	27.8491817	0.25695455	111.671278	0
		0	1	0	13	0	0	9	0	0	0	13
Set non-detect values to:		Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit
Outliers?		No	No	Yes	No	Yes	No	No	Yes	No	No	No
Distribution		Normal	Non-normal	Non-normal	Single value	Non-normal	Normal	Non-normal	Non-normal	Normal	Non-normal	Single value
Statistical approach		Auto: One-sample t; Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: One-sample t; Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: One-sample t; Auto: Chebychev	Auto: Chebychev	Auto: Chebychev
Test scenario:		Evidence level required:				95%				Use Log-Normal distribution to test for outliers		
t statistic, t₀ (or k₀)		-5.709023583	-79.08085427	-176.2378136	N/A	-52.79860668	1.448220938	-3745.770577	-11.53252604	-4897.768118	-113.0324693	N/A
Upper confidence limit (on true mean concentration, μ)		24.0637055	1.13266014	184.40432	0.5	331.527036	381.69962	0.54741925	74.5910959	1.08086332	384.157838	1
Evidence level		100%	100%	100%	100%	100%	9%	100%	99%	100%	100%	100%
Base decision on:		evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level
Result		$\mu < C_c$	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$	$\mu \geq C_c$	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$	$\mu < C_c$
Select dataset		☉ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y
Back to data		Go to outlier test				Go to normality test				Show individual summary		

Client/client ref: BSCP Project ref: 13-898 Site ref: Milliners Wharf, Manchester SITE A Data description: Screening Results Contaminant(s): PAH's Test scenario: Planning Date: 28 February 2014	Critical concentration, C _c																	
	Acenaphthene (mg/kg)	1000	850	9200	5.9	1	7	47	10	9.3	0.9	670	780	4.2	8.7	380	1600	
		LQM - 2009 (6% SOM)	LQM - 2009 (6% SOM)	LQM - 2009 (6% SOM)	LQM - 2009 (6% SOM)	LQM - 2009 (6% SOM)	LQM - 2009 (6% SOM)	LQM - 2009 (6% SOM)	LQM - 2009 (6% SOM)	LQM - 2009 (6% SOM)	LQM - 2009 (6% SOM)	LQM - 2009 (6% SOM)	LQM - 2009 (6% SOM)	LQM - 2009 (6% SOM)	LQM - 2009 (6% SOM)	LQM - 2009 (6% SOM)	LQM - 2009 (6% SOM)	
	Notes																	
	Sample size, n																	
	Sample mean,																	
	Standard deviation, s																	
	Number of non-detects																	
	Set non-detect values to:																	
	Outliers?																	
Distribution																		
Statistical approach																		
Test scenario:																		
t statistic, t ₀ (or k ₀)	-518.2239076	-34880.78364	-4208.413821	-0.383969228	2.028596629	-0.302318286	-30.38985205	95 %	-8.027800454	-1.358543313	-0.519599118	-98.58424471	-634.6416745	-0.71235755	-5.554211049	-40.78513188	-284.8319293	
Upper confidence limit (on true mean concentration, μ)	11.4100795	0.16987302	13.1419667	15.3559989	13.1742831	16.7246441	9.94986	6.56102814	16.9628099	2.00641553	42.4691269	7.42133993	9.29058468	34.0000000	7.30531665	54.5233217	36.2102561	
Evidence level	100 %	100 %	100 %	13 %	0 %	8 %	100 %	100 %	98 %	65 %	21 %	100 %	100 %	34 %	97 %	100 %	100 %	
Base decision on:	2	1	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	
Result	μ < C _c	μ < C _c	μ < C _c	μ ≥ C _c	μ ≥ C _c	μ ≥ C _c	μ < C _c	μ < C _c	μ < C _c	μ ≈ ≥ C _c	μ ≥ C _c	μ < C _c	μ < C _c	μ ≥ C _c	μ < C _c	μ < C _c	μ < C _c	
Select dataset																		

Client/client ref: BSCP Project ref: Milliners Wharf, Manchester SITE A Site ref: 13-998 Data description: Contamination Screening Results Contaminant(s): Speciated TPH (All/Aro solids - Residential)	Critical concentration, C _c														
	Notes														
	Sample size, n														
	Sample mean, $\bar{x}$														
	Standard deviation, s														
	Number of non-detects														
	Set non-detect values to:														
	Outliers?														
	Distribution														
	Statistical approach														
Test scenario:															
t statistic, t ₀ (or k ₀)															
Upper confidence limit (on true mean concentration, μ)															
Evidence level															
Base decision on:															
Result															
Select dataset															

Milliners Wharf, Manchester SITE B

Client/client ref: BSCP Project ref: 13-898 Site ref: Milliners Wharf, Manchester - SITE B Data description: Contamination Screening Results Contaminant(s): Generic Soils - Commercial Test scenario: Planning	Critical concentration, C _c										
	Notes										
	Sample size, n										
	Sample mean, $\bar{x}$										
	Standard deviation, s										
	Number of non-detects										
	Set non-detect values to:										
	Outliers?										
	Distribution										
	Statistical approach										
Planning: is true mean lower than critical concentration ($\mu < C_c$)?											
Test scenario:											
t statistic, t ₀ (or k ₀)											
Upper confidence limit (on true mean concentration, μ)											
Evidence level											
Base decision on:											
Result											
Select dataset											
Back to data											
Go to outlier test											
Go to normality test											
Show individual summary											

Client/client ref: RSCP Project ID: 13-888 Sponsor: Milliners Wharf, Manchester 13-888 Data description: Contamination Results Contaminant(s): Generic Test scenario: Planning Date: 26 February 2014	Critical concentration, C_c														
	Notes														
	Sample size, n														
	Sample mean, $\bar{x}$														
	Standard deviation, s														
	Number of non-detects														
	Set non-detect values to:														
	Outliers?														
	Distribution														
	Statistical approach														
Test scenario:															
t statistic, t_0 (or k_0)															
Upper confidence limit (on true mean concentration, μ)															
Evidence level															
Base decision on:															
Result															
Select dataset															



Solum House
Unit 1 Elliott Court
St. John's Road
Meadowfield
Durnham, DH7 8PN
Tel: (0191) 378 6380
Fax: (0191) 378 0494
e-mail: admin@arc-environmental.com
web: www.arc-environmental.com

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BSCP LTD

PROJ: T114

References

William W. Mundy

Author's address: M4 7P8

1000

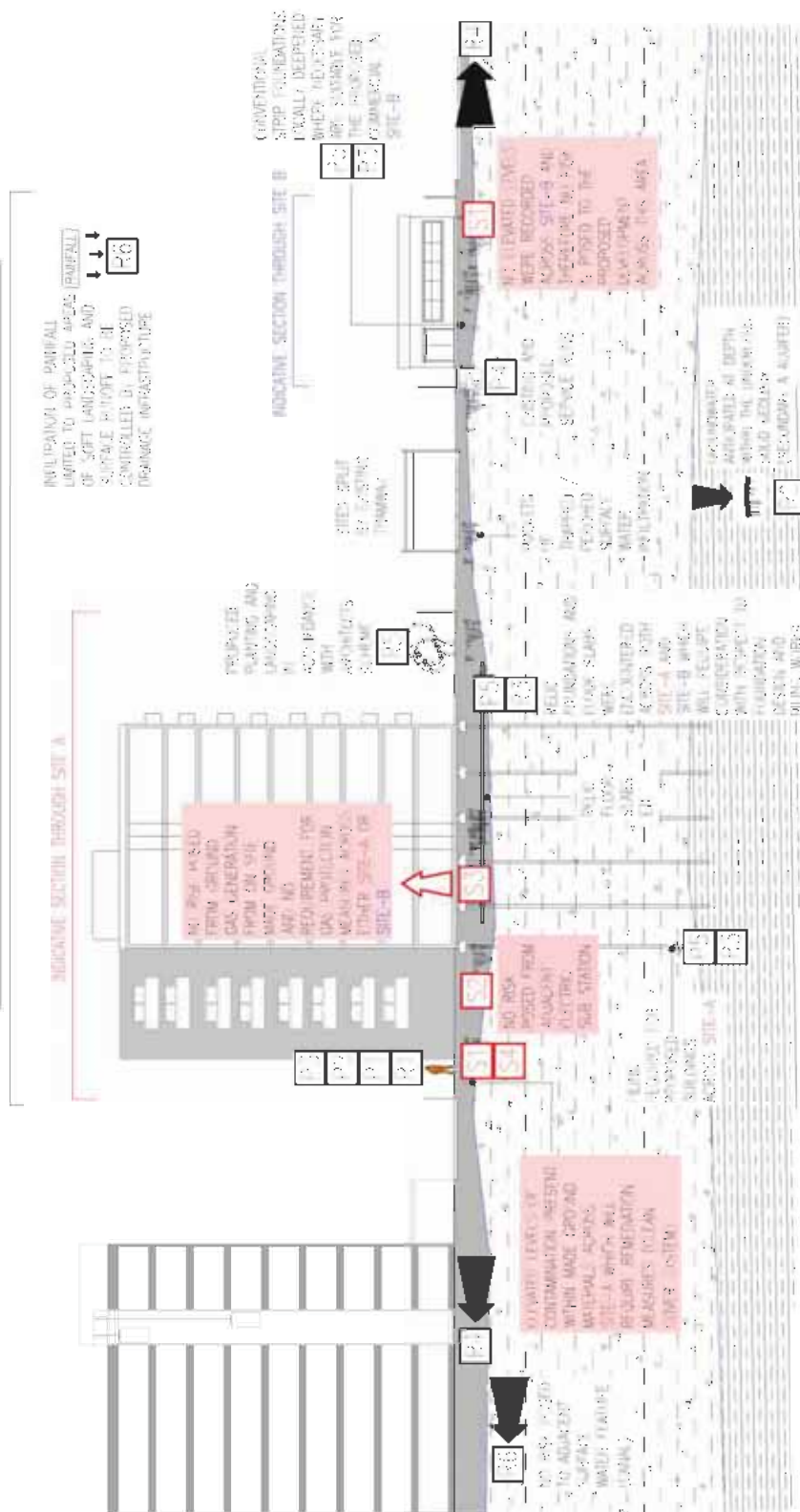
Computational Site Model

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5	2003	2003
6	2004	2004
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111	2109	2109
112	2110	2110
113	2111	2111
114	2112	2112
115	2113	2113
116	2114	

1000 R. G. Bailey

STRATA DETAILS		CSM SYMBOLS & EXPLANATIONS		CRITICAL POLLUTANT LINKAGES	
	SITE A MADE GROUND (UNBANKED) FROM GROUND LEVEL TO 0.070M AND 0.070M		UNSATURATED ANTICIPATED TO BE PRESENT AT DEPTH WITHIN THE SOLID GEOLGICAL (SECONDARY & QUATERNARY)	S	1. MADE GROUND COMPRISING DISTURBED NATURAL STRATA AND DEPOSITION FILL WITH ANTHROPOGENIC DEBRIS UP TO A DEPTH OF 0.270M ABOVE SITE A AND IN EXCESS OF 0.400M ABOVE SITE B 2. THE HISTORIC AND CURRENT AIRPORT ELECTRIC SUB-STATION ADJACENT TO THE UPPER EASTERN MARGIN OF THE SITE 3. POTENTIAL FOR GROUND OR GROUNDWATER FROM MADE GROUND OR THE SITE
	SOFT DEBRIS (CLAY, SILT) FROM 0.070M AND 0.070M TO 0.170M AND 0.170M		EXTENSIVE / PARTS OF HARDED / PAVED SURFACE WATER INFILTRATION		
	SOLID GEOLGICAL (GLOUcestERSHIRE) FORMATION / HALESOWEN FORMATIONS FROM 0.170M AND 0.170M TO 0.270M		POSSIBLE HAZARDOUS GROUND GAS CONCENTRATION FROM AN SITE (MPCOS)	PATHWAY	4. HISTORICAL SITE USAGE (FORMER MILLS)
	SITE B MADE GROUND (UNBANKED) FROM GROUND LEVEL TO 0.170M AND 0.070M		SITE SURFACING A Mixture OF HANDSANDING TYPICAL BUILDINGS, ETC) AND UNBANKED GROUND (SAND AND GRAVEL)		
	SOFT DEBRIS (CLAY, SILT) FROM 0.070M AND 0.070M TO 0.170M			P	1. INGESTION 2. INHALATION OF INDOOR / OUTDOOR AIR 3. DERMAL CONTACT 4. MIGRATION THROUGH EXISTING REPAIRS 5. DIRECT CONTACT WITH BUILDING MATERIALS 6. INFILTRATION AND SURFACE FLOODING
	SOLID GEOLGICAL (GLOUcestERSHIRE) FORMATION / HALESOWEN FORMATIONS NOT DISTURBED DURING THESE INFILTRATION WORKS BELOW SITE B - FROM DEEP HORIZONTAL UNIFORM IN GLOUcestERSHIRE / HALESOWEN IS ANTICIPATED TO BE AT A DEPTH IN EXCESS OF 0.270M BELOW THE SITE				
	SITE C MADE GROUND (UNBANKED) FROM GROUND LEVEL TO 0.070M AND 0.070M		UNSATURATED ANTICIPATED TO BE PRESENT AT DEPTH WITHIN THE SOLID GEOLGICAL (SECONDARY & QUATERNARY)	R	1. HUMAN HEALTH (FUTURE SITE USES) 2. DEEP UNSATURATED (SECONDARY & QUATERNARY) MATERIALS 3. ADJACENT SITE 4. FLOOD AND FLOODING 5. IMPROVED WATER (FUTURE) PRESENT 0.070M NORTH OF THE SITE
	SOLID GEOLGICAL (GLOUcestERSHIRE) FORMATION / HALESOWEN FORMATIONS NOT DISTURBED DURING THESE INFILTRATION WORKS BELOW SITE C - FROM DEEP HORIZONTAL UNIFORM IN GLOUcestERSHIRE / HALESOWEN IS ANTICIPATED TO BE AT A DEPTH IN EXCESS OF 0.270M BELOW THE SITE				

INDICATIVE SECTION THROUGH WHOLE SITE AREA USING AN APPROXIMATE NORTH THROUGH SOUTH ORIENTATION.



APPENDIX V

Envirocheck Report



Groundwater Vulnerability

General

- Specified Site
- Specified Buffer(s)
- Map ID
- Bearing Reference Point

Agency and Hydrological

Geological Classes

Major Aquifer
(Highly Permeable)

Minor Aquifer
(Variably Permeable)

Non Aquifer
(Negligibly Permeable)

Water or Sea

Drift Deposit

Soil Classes

High (H) 1, 2, 3, U

Intermediate (I) 1, 2

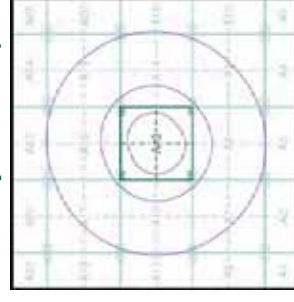
Low

High (H) 1, 2, 3, U

Intermediate (I) 1, 2

Low

Site Sensitivity Context Map - Slice A



Order Details

Order Number: 19276069_1_1
Customer Ref: 18-831 MP_
National Grid Reference: 385610, 398330
Slice: A
Site Area (Ha): 0.09
Search Buffer (m): 1000

Site Details

Bowlers Yard, MANCHESTER, M4 7BB



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirock.co.uk



Bedrock Aquifer Designation

General

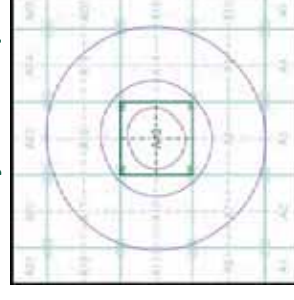
- Specified Site
- Specified Buffer(s)
- Map ID
- Bearing Reference Point

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landlip)

Site Sensitivity Context Map - Slice A

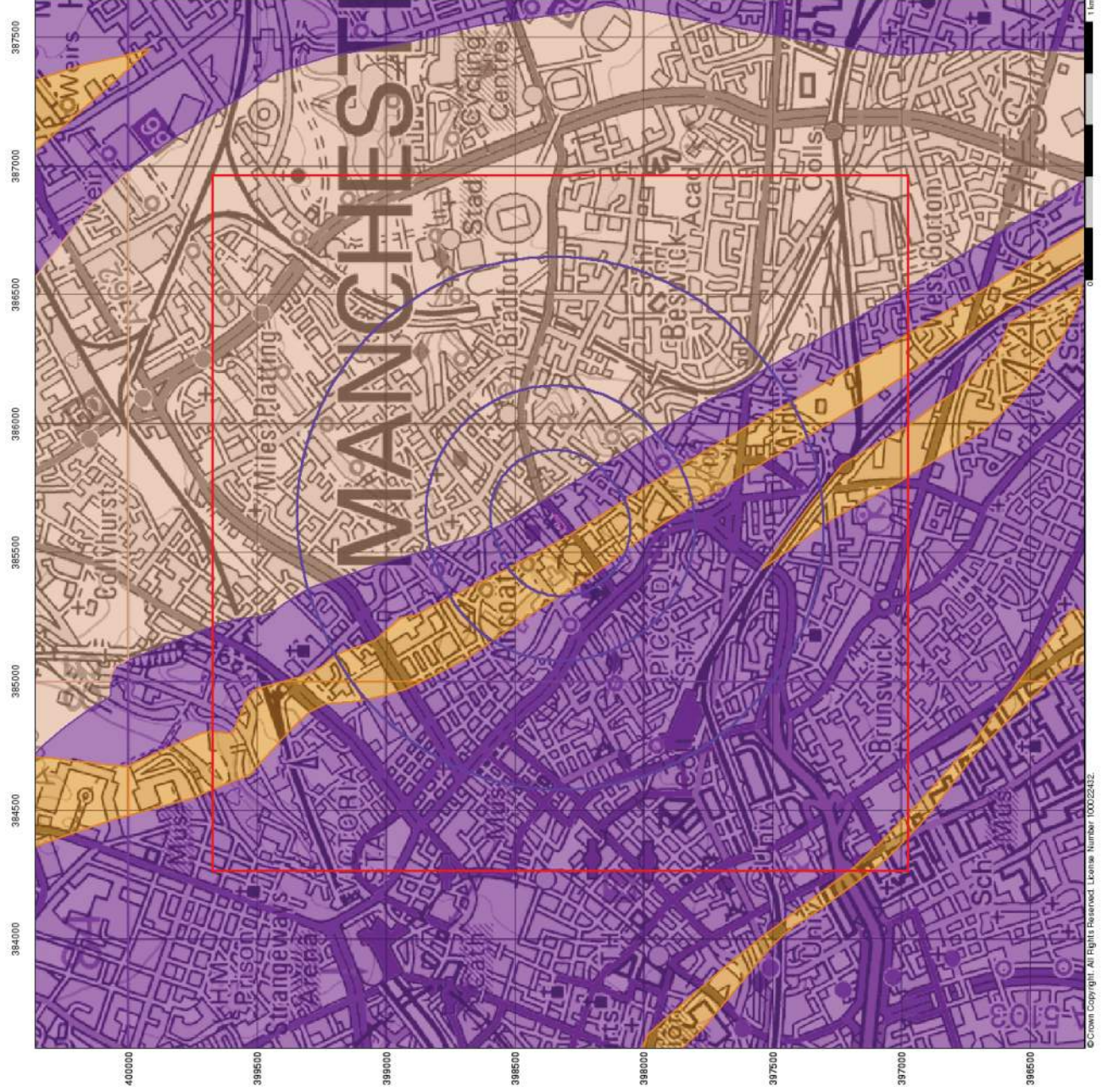


Order Details

Order Number: 19276069_1_1
Customer Ref: 18-831 MP_
National Grid Reference: 385610, 398330
Site: A
Site Area (Ha): 0.09
Search Buffer (m): 1000

Site Details

Bowlers Yard, MANCHESTER, M4 7BB



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.environrock.co.uk



Superficial Aquifer Designation

General

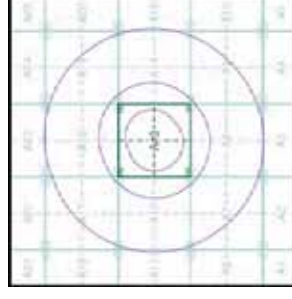
- Specified Site
- Specified Buffer(s)
- Map ID
- Bearing Reference Point

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landlip)

Site Sensitivity Context Map - Slice A

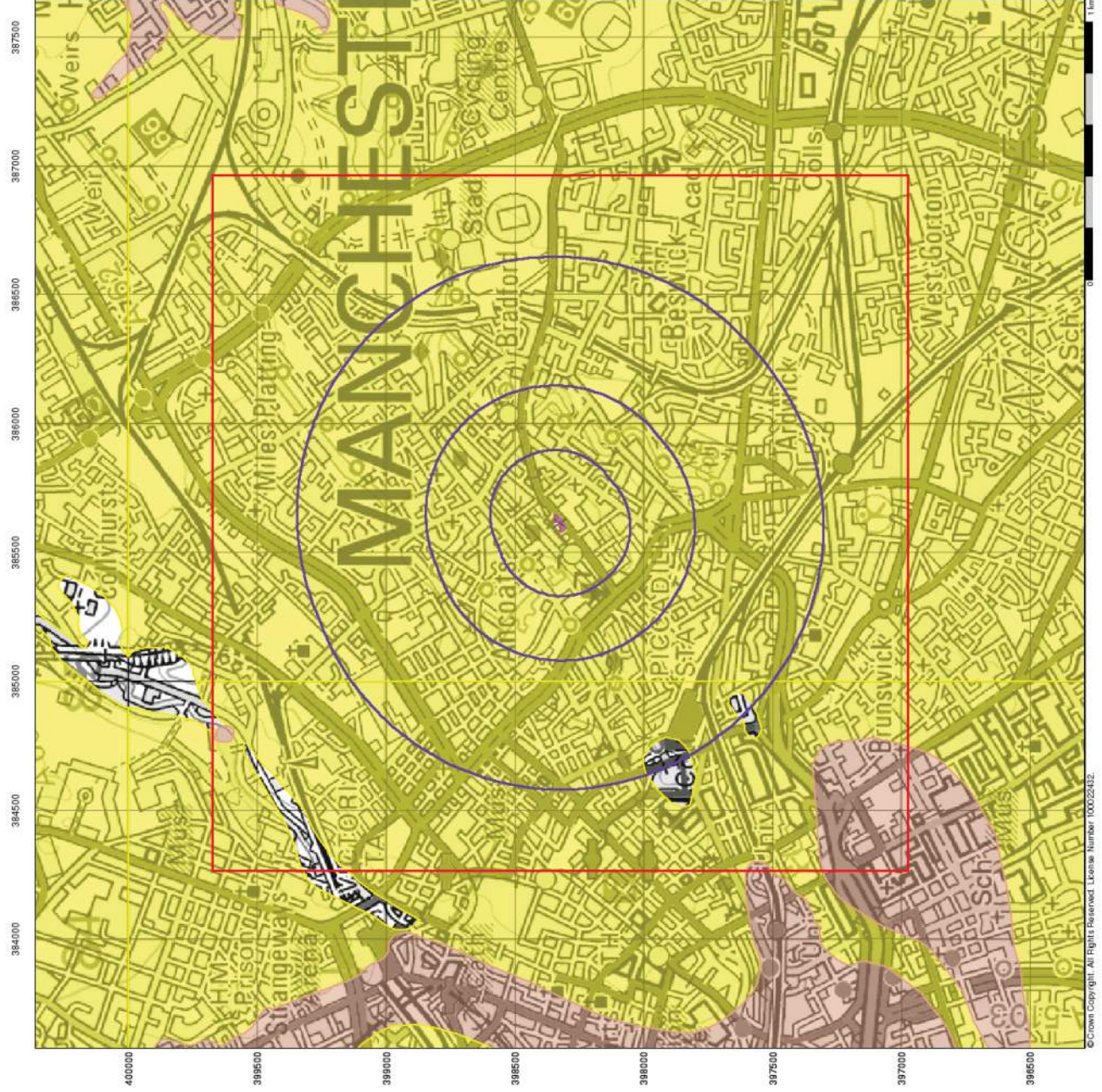


Order Details

Order Number: 192276069_1_1
Customer Ref: 18-831 MP_
National Grid Reference: 385610, 398330
Slice: A
Site Area (Ha): 0.09
Search Buffer (m): 1000

Site Details

Bowlers Yard, MANCHESTER, M4 7BB



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirock.co.uk



Source Protection Zones

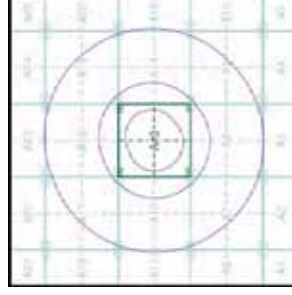
General

- Specified Site
- Specified Buffer(s)
- Map ID
- Bearing Reference Point

Agency and Hydrological

- Inner zone (Zone 1)
- Inner zone - subsurface activity only (Zone 1c)
- Outer zone (Zone 2)
- Outer zone - subsurface activity only (Zone 2c)
- Total catchment (Zone 3)
- Total catchment - subsurface activity only (Zone 3c)
- Special Interest (Zone 4)

Site Sensitivity Context Map - Slice A

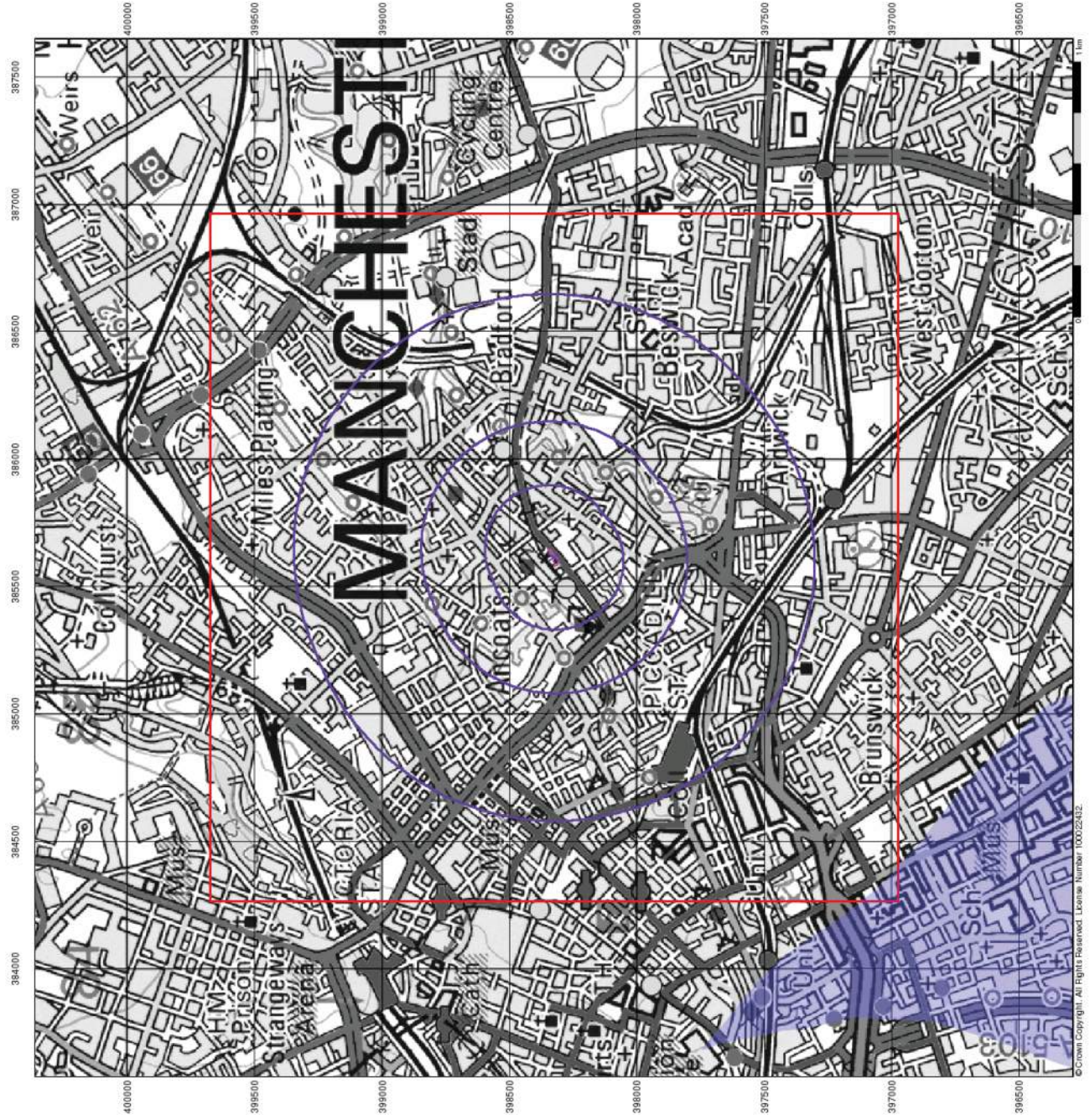


Order Details

Order Number: 19276069_1_1
Customer Ref: 18-831 MP_
National Grid Reference: 385610, 398330
Slice: A
Site Area (Ha): 0.09
Search Buffer (m): 1000

Site Details

Bowlers Yard, MANCHESTER, M4 7BB



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.environet.co.uk



Sensitive Land Uses

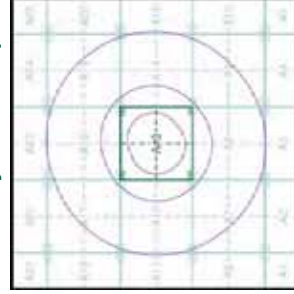
General

- Specified Site
- Specified Buffer(s)
- Map ID
- Bearing Reference Point

Sensitive Land Uses

- Ancient Woodland
- Area of Adopted Green Belt
- Area of Unadopted Green Belt
- Area of Outstanding Natural Beauty
- Environmentally Sensitive Area
- Forest Park
- Local Nature Reserve
- Marine Nature Reserve
- National Nature Reserve
- National Park
- Nitrate Sensitive Area
- Nitrate Vulnerable Zone
- Ramsar Site
- Site of Special Scientific Interest
- Special Area of Conservation
- Special Protection Area
- World Heritage Sites

Site Sensitivity Context Map - Slice A

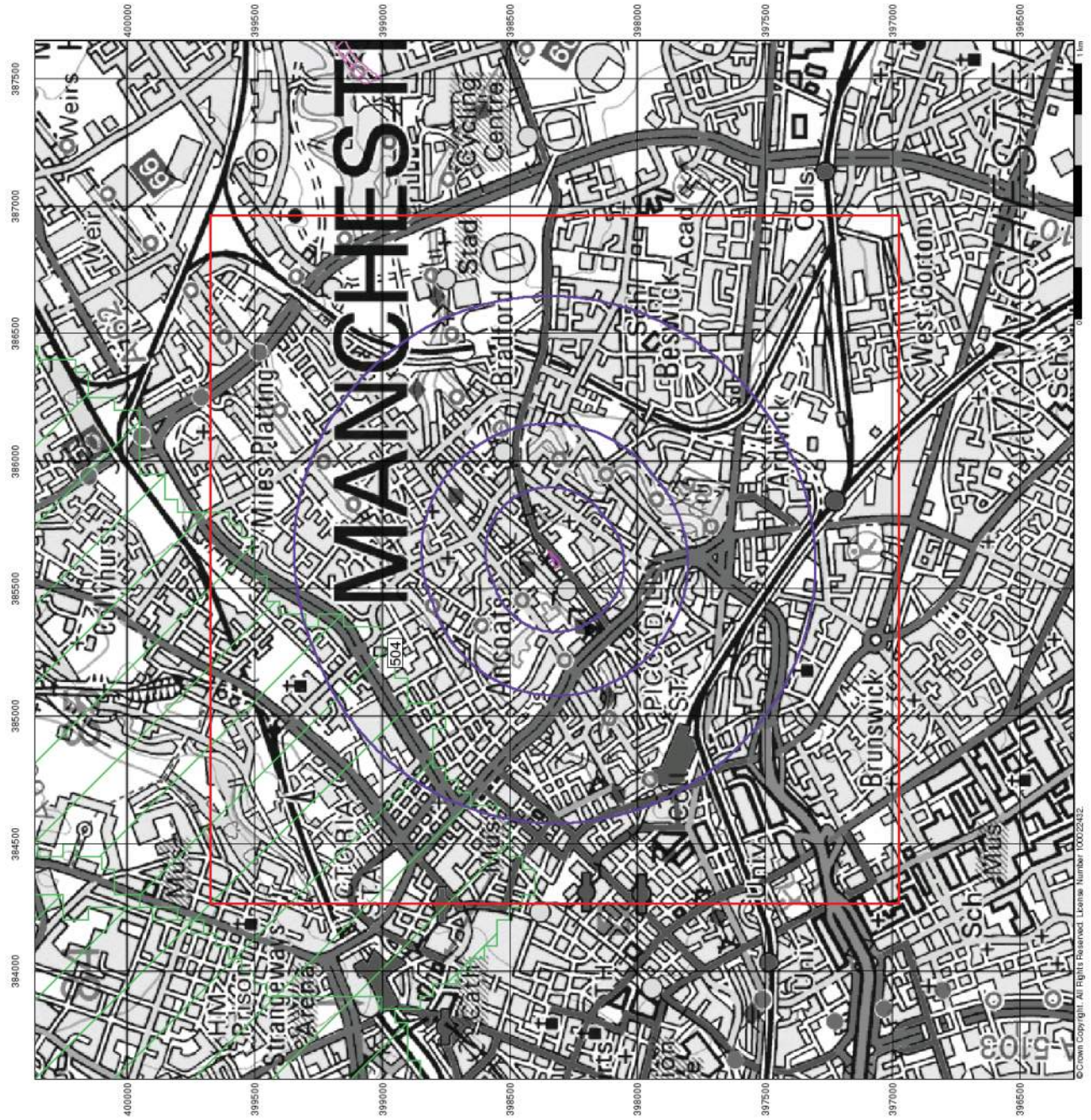


Order Details

Order Number: 19276069_1_1
Customer Ref: 18-831 MP_
National Grid Reference: 385610, 398330
Slice: A
Site Area (Ha): 0.09
Search Buffer (m): 1000

Site Details

Bowlers Yard, MANCHESTER, M4 7BB



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirock.co.uk



BGS Flood GFS Data

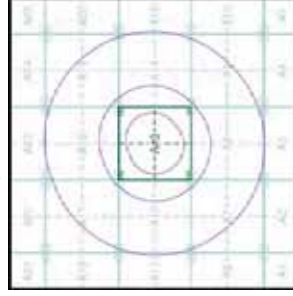
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice

Agency and Hydrological (Flood)

- Limited Potential for Groundwater Flooding to Occur
- Potential for Groundwater Flooding of Property Situated Below Ground Level
- Potential for Groundwater Flooding to Occur at Surface

Site Sensitivity Context Map - Slice A

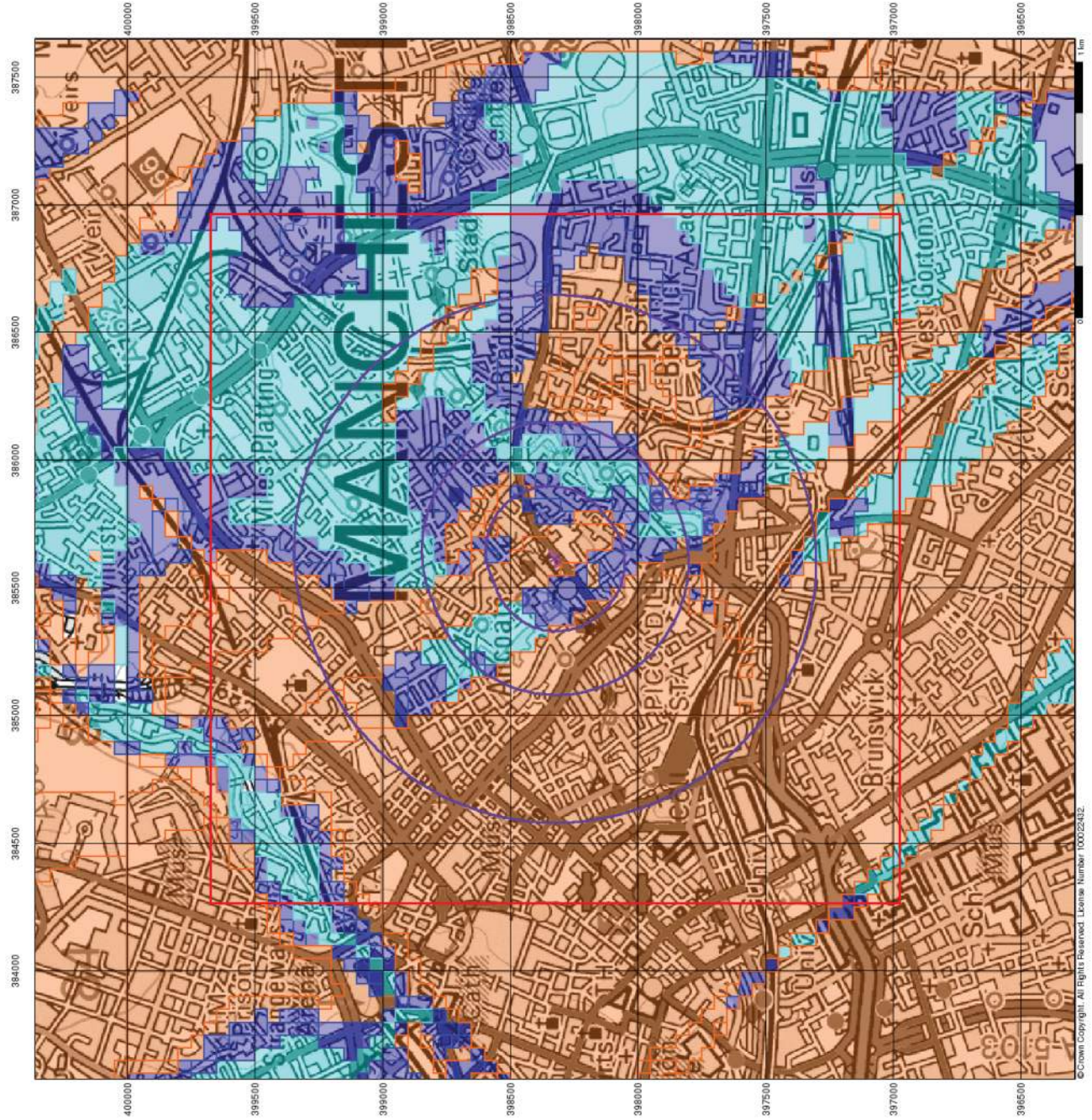


Order Details

Order Number: 192276069_1_1
Customer Ref: 18-831 MP_
National Grid Reference: 385610, 398330
Slice: A
Site Area (Ha): 0.09
Search Buffer (m): 1000

Site Details

Bowlers Yard, MANCHESTER, M4 7BB



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.environcheck.co.uk



General

- Specified Site
- Severely at Risk
- Agency and Hydrological
- Contaminated Land Register Entry or Notice
- Discharge Consent
- Enforcement or Prohibition Notice
- Integrated Pollution Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Pollution Incident to Controlled Waters
- Prosecution Relating to Controlled Waters
- Registered Radioactive Substance
- River Network or Water Feature
- River Quality Sampling Point
- Substantiated Pollution Incident Register
- Water Abstraction
- Water Industry Act Referral

Waste

- Bearing Reference Point
- Overhead Transmission Line
- BOS Recorded Landfill Site (Location)
- EA Historic Landfill (Buried Part)
- EA Historic Landfill (Polygon)
- Environmental Pollution Control Registered Waste Site
- Licensed Waste Management Facility (Landfill Inventory)
- Licensed Waste Management Facility (Location)
- Local Authority Recorded Landfill Site (Location)
- Local Authority Recorded Landfill Site
- Potentially Infiltrated Land (Non-water)
- Potentially Infiltrated Land (Non-water)
- Potentially Infiltrated Land (Water)
- Potentially Infiltrated Land (Water)
- Potentially Infiltrated Land (Water)
- Potentially Infiltrated Land (Water)
- Registered Landfill Site
- Registered Landfill Site (Location)
- Registered Landfill Site (Peak Buried to 10m)
- Registered Landfill Site (Peak Buried to 20m)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site (Location)
- Registered Waste Treatment or Disposal Site

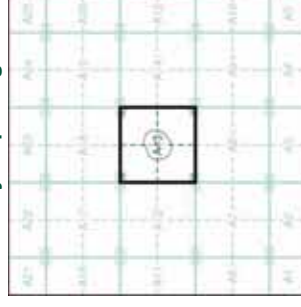
Hazardous Substances

- COMAH Site
- NIHS Site
- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

Geological

- BOS Recorded Mineral Site

Site Sensitivity Map - Segment A13



Order Details

Order Number: 192276069_1_1
Customer Ref: 18-831 MP
National Grid Reference: 385610, 398330
Site: A
Site Area (Ha): 0.09
Plot Buffer (m): 100

Site Details

Bowlers Yard, MANCHESTER, M4 7BB



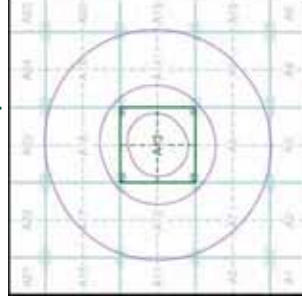
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



Industrial Land Use Map

- General**
- Specified Site
 - Specified Buffer(s)
 - Bearing Reference Point
 - Map ID
- Industrial Land Use**
- Contemporary Trade Directory Entry
 - Fuel Station Entry
 - Gas Pipeline
 - Points of Interest - Commercial Services
 - Points of Interest - Education and Health
 - Points of Interest - Manufacturing and Production
 - Points of Interest - Public Infrastructure
 - Points of Interest - Recreational and Environmental
 - Underground Electrical Cables

Industrial Land Use Map - Slice A



Order Details

Order Number: 192276069_1_1
Customer Ref: 18-831 MP
National Grid Reference: 385610, 398330
Site: A
Site Area (Ha): 0.09
Search Buffer (m): 1000

Site Details

Bowlers Yard, MANCHESTER, M4 7BB



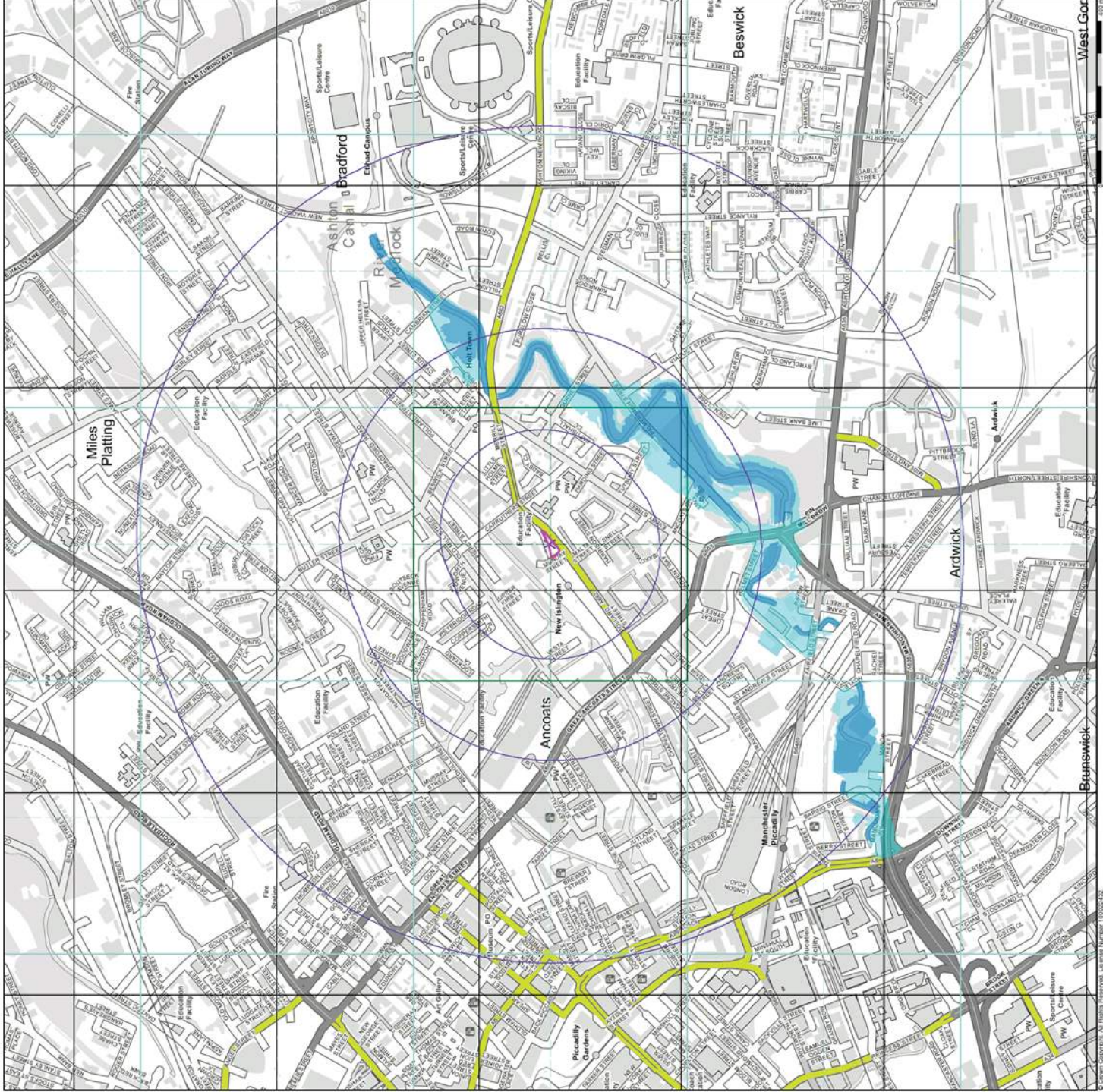
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Fax: 0844 844 9951
Web: www.envirocheck.co.uk



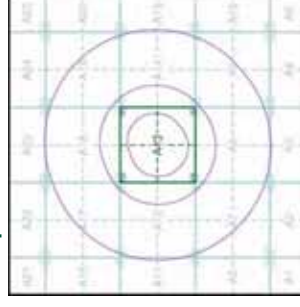
- General**
- Specified Site
 - Specified Buffer(s)
 - Bearing Reference Point

Agency and Hydrological (Flood)

- Extreme Flooding from Rivers or Sea without Defences (Zone 2)
- Flooding from Rivers or Sea without Defences (Zone 3)
- Area Benefiting from Flood Defence
- Flood Water Storage Areas
- Flood Defence



Flood Map - Slice A



Order Details

Order Number: 192276069_1_1
Customer Ref: 18-831 MP
National Grid Reference: 385610, 398330
Site: A
Site Area (Ha): 0.09
Search Buffer (m): 1000

Site Details

Bowlers Yard, MANCHESTER, M4 7BB



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



- General**
- Specified Site
 - Specified Buffer(s)
 - Bearing Reference Point
 - Map ID
 - Several of Type at Location

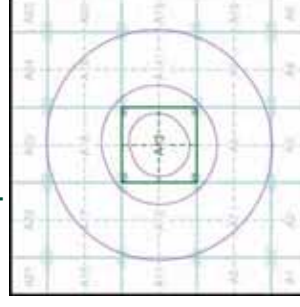
Agency and Hydrological (Boreholes)

- BGS Borehole Depth 0 - 10m
- BGS Borehole Depth 10 - 30m
- BGS Borehole Depth 30m +
- Confidential
- Other

For Borehole information please refer to the Borehole .csv file which accompanied this slice.

A copy of the BGS Borehole Ordering Form is available to download from the Support section of www.envirocheck.co.uk.

Borehole Map - Slice A



Order Details

Order Number: 192276069_1_1
Customer Ref: 18-831 MP
National Grid Reference: 385610, 398330
Site: A
Site Area (Ha): 0.09
Search Buffer (m): 1000

Site Details

Bowlers Yard, MANCHESTER, M4 7BB



Tel: 0844 844 9952
Fac: 0844 844 9951
Web: www.envirocheck.co.uk



General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

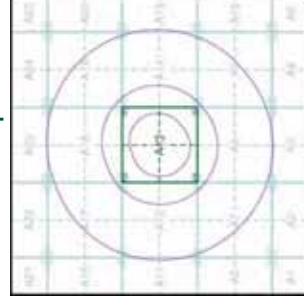
OS Water Network Data

- Canal
- Reservoir
- Foreshore
- Marsh
- Tidal River
- Inland River
- Drain
- Other
- Lake
- Transfer
- Lock Or Flight Of Locks
- Sea

Contours (height in meters)

- Standard Contour
- Master Contour
- Spot Height
- Mean Low Water
- Mean High Water

OS Water Network Map - Slice A



Order Details

Order Number: 192276069_1_1
Customer Ref: 18-831 MP
National Grid Reference: 385610, 398330
Site: A
Site Area (Ha): 0.09
Search Buffer (m): 1000

Site Details

Bowlers Yard, MANCHESTER, M4 7BB



Tel: 0844 844 9952
Fac: 0844 844 9951
Web: www.envirocheck.co.uk



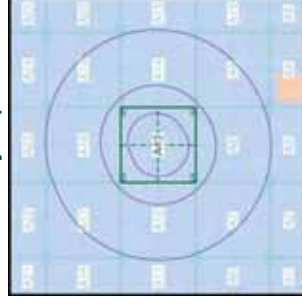
- General**
- Specified Site
 - Specified Buffer(s)
 - Bearing Reference Point

Risk of Flooding from Surface Water

- High - 30 Year Return
- Medium - 100 Year Return
- Low - 1000 Year Return

- Suitability**
- See the suitability map below
- National to county
 - County to town
 - Town to street
 - Street to parcels of land
 - Property

EANRW Suitability Map - Slice A



Order Details

Order Number: 192276069_1_1
Customer Ref: 18-831 MP
National Grid Reference: 385610, 398330
Site: A
Site Area (Ha): 0.09
Search Buffer (m): 1000

Site Details

Bowlers Yard, MANCHESTER, M4 7BB



Tel: 0844 844 9952
Fac: 0844 844 9951
Web: www.envirocheck.co.uk

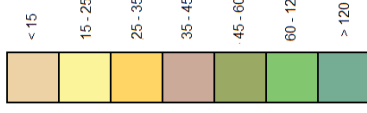


General

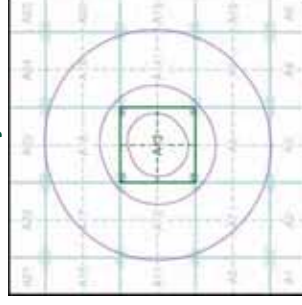
Specified Site Bearing Reference Point

Urban Soil Chemistry Arsenic

● BGS Urban Soil Chemistry Measured Concentration Values (mg/kg)
Arsenic Concentrations mg/kg



Urban Soil Chemistry Arsenic - Slice A



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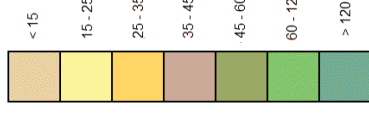


General

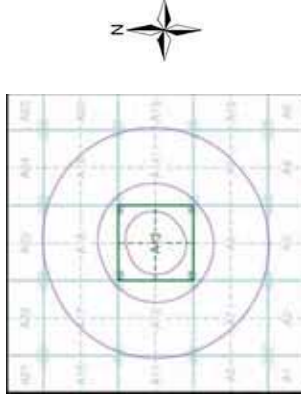
Specified Site Specified Buffer(s) Bearing Reference Point

Estimated Soil Chemistry Arsenic

Arsenic Concentrations mg/kg



Estimated Soil Chemistry Arsenic - Slice A



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