Cannock Chase District Council

Environmental Protection Act 1990, Part 2A: Initial Site Investigation

Infilled land north of Rawnsley, near Hednesford. Staffordshire

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1 INTRODUCTION

1.1 Terms of Reference

In January 2010, Grontmij Limited (Grontmij) was appointed by Cannock Chase District Council (the Council) to assist in the implementation of the Council's Part 2A Contaminated Land inspection strategy. Part 2A of the Environmental Protection Act 1990 (Part 2A) requires each local authority to inspect areas of land which it believes may constitute Part 2A Contaminated Land.

Contaminated Land is defined in Section 78(2) of Part 2A of the Environmental Protection Act 1990 as:

"any land which appears to the local authority in whose area the land is situated to be in such a condition, by reason of substances in, on or under the land, that

- *significant harm is being caused or there is a significant possibility of such harm being caused; or*
- *pollution of controlled waters is being, or is likely to be, caused.*

.
Further information is provided in the Act and associated statutory guidance (DEFRA Circular 01/2006 – EPA 1990, Part 2A: Contaminated Land).

Grontmij assisted the Council to prioritise a list of sites which could constitute Part 2A contaminated land for inspection, on the basis of the Council's Part 2A Inspection Strategy. The site subject to this report, located north of Rawnsley, Near Hednesford. Staffordshire (hereafter referred to as 'the site') was identified as a priority for inspection as:

- The site comprises an area of land which, from historical mapping, appears to have been infilled with unknown material
- The site is considered to be sensitive as residential properties with gardens and part of a children's playground overly the inferred extent of infilled ground and the site is underlain by a secondary A aquifer. Additionally, surface water receptors are located to the north east of the site (25m and 50m away), down-topographic gradient and inferred to be down-hydraulic gradient of the site.

Following the completion of a desktop study (see Appendix A) and a successful application for funding from DEFRA, Grontmij was subsequently appointed by the Council to implement a site investigation, which was undertaken in July 2010. Following a review of the investigation findings, supplementary gas monitoring was undertaken in May and June 2011, supplementary leachate analysis in September 2011 and supplementary localised soil testing for asbestos in November 2011, as described in Section 3.

This report presents the findings of the investigation and supplementary work, assesses the significance of the contaminant concentrations detected, and makes recommendations for further work.

This report is subject to the limitations presented in Appendix B.

2 BACKGROUND INFORMATION

2.1 Site Setting

The site's setting and location are summarised in Table 2.1 and Figure 2.1.

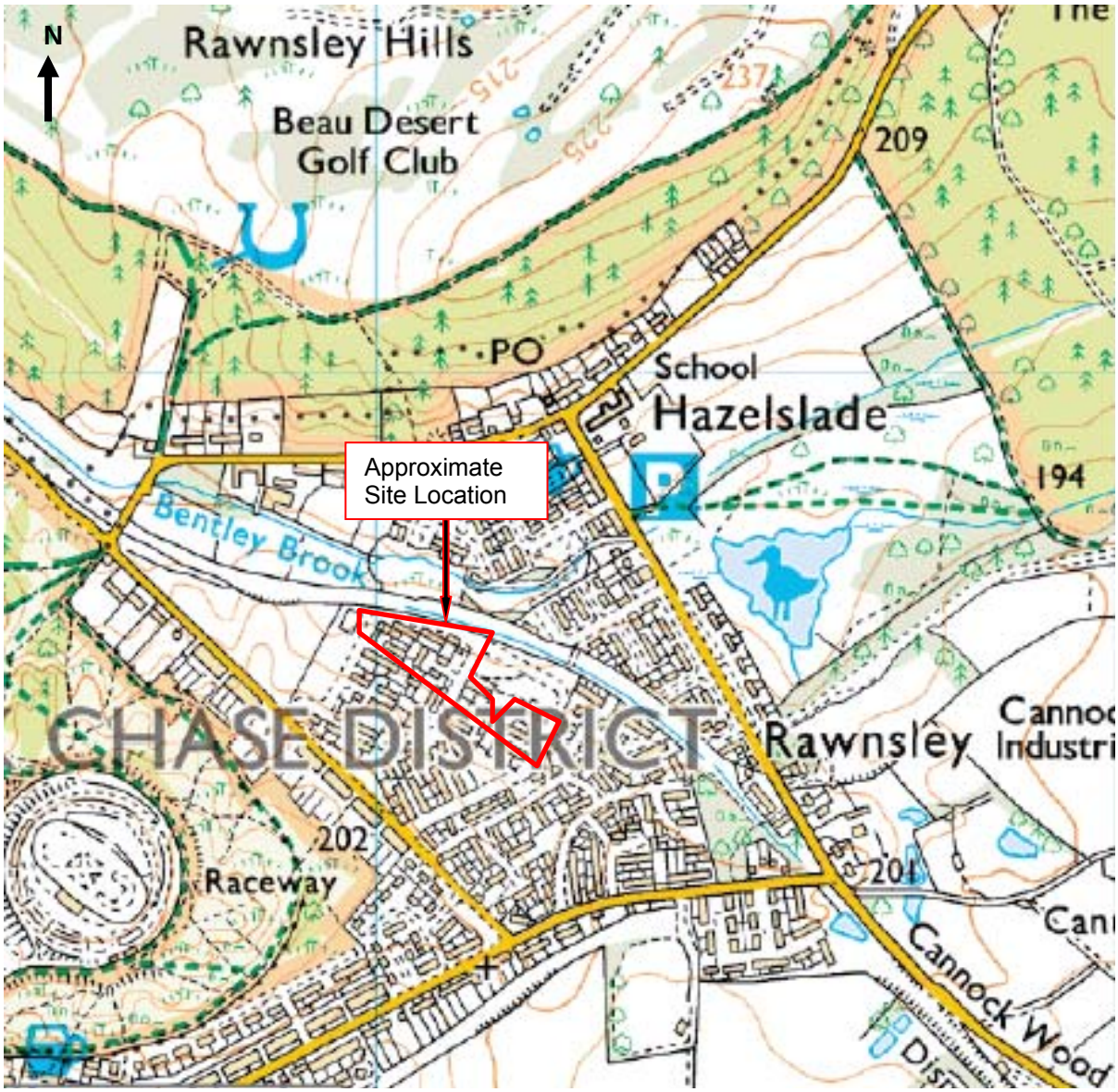
Table 2.1 - Site Setting

Data	Information
Address	Area of infilled ground now occupied by housing, to North of Rawnsley, near Hednesford, Staffordshire, WS12 0JS
Current site use	Residential houses with gardens, with the fringe of a children's playground occupying the north-western corner of the site
Grid Reference	Site centre: 402125, 312564
Site Area	Approximately 1.6 Ha
Topography	Site generally slopes downwards towards the north. Topography of surrounding area is varied due to nearby hills
Surrounding land use	The site is surrounded by residential land, with open ground to the west of the site
Geology	British Geological Survey (BGS) 1:63,360 scale map sheet 154 (Lichfield) and the BGS website Geoindex tool indicate Pennine Middle Coal Measures Formation consisting of mudstone, siltstone and sandstone. No superficial deposits are indicated.
Hydrogeology	The Pennine Middle Coal Measures are classified by the Environment Agency as a secondary A aquifer. The Desk study indicates that the soil classification for the site is low permeability (and therefore leaching potential). Secondary A aquifers are important for both local supplies and supplying base flow to rivers. Soils which are classified as low permeability are soils in which pollutants are unlikely to penetrate the soil layer because either water movement is largely horizontal, or they have the ability to attenuate diffuse pollutants. Lateral flow from these soils may contribute to groundwater recharge elsewhere in the catchment. The Environment Agency website indicates that there are no public licensed potable water abstraction points within a 500m radius of the site.
Source Protection Zones (SPZs)	The Environment Agency website indicates that the site is not located within a SPZ
Surface Waters	A ditch is indicated 25m to the north-east and north of the site of the site, whilst Bentley Brook is indicated 50m also to the north. The brook flows to the north-west
Ecologically designated sites[1]	Multi Agency Geographical Information for the Countryside (MAGIC) website search indicated Hednesford Hills AONB 50m to the north and north-west (down-gradient), and Chasewater and the Southern Staffordshire Coalfield Heaths SSSI and Local Nature Reserve 250m to the south-west (upgradient) of the site.
Archaeological Receptors	English Heritage Pastscape website indicates no scheduled monuments beneath or in proximity of the site
Historical Land Use	Information provided by Cannock Chase Council and held on the Environment Agency website indicate that the site comprises a parcel of landfilled ground. The old-maps.co.uk website indicates that the site was developed as residential housing between 1955 and 1961. No further information about the types of

[1] Includes sites designated as Site of Special Scientific Interest (SSSI), National Nature Reserve (NNR), Special Area of Conservation (SAC, including candidate sites), Special Protection Area (SPA including potential sites), listed Wetlands of International Importance (Ramsar site) and Local Nature Reserves (LNR).

	material used as infill and duration of operation is available. It is assumed that the site did not operate as a licensed landfill site

Figure 2.1 – Site Location



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Plan is not to scale.

2.2 Previous Reports

Grontmij has previously completed a desktop assessment of the site, as presented as Appendix A. The assessment included the review of information available from, on-line data resources, in-house mapping and records provided by the council including details of a previous site investigation, and a site walkover.

The Conceptual Site Model (CSM) of potential pollutant linkages resulting from the desk study and developed in accordance with the model procedures[2] and statutory guidance[3] is presented as Table 2.2 overleaf.

[2] CLR11 Model Procedures for the Management of Land Contamination (EA & DEFRA September 2004)
[3] DEFRA Circular 02/2006, Environmental Protection Act 1990: Part 2A Contaminated Land, September 2006.

Table 2.2 - Potential Pollutant Linkages

No.	Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability of Linkage Occuring[1]	Overall Risk[1]	Comments
Human Health							
1	Residents of properties above infilled ground – including children playing in gardens	Including (but not limited to) metals, hydrocarbons, PAHs, VOCs, SVOCs within Made Ground	Dermal contact and direct ingestion, inhalation of dust/vapours, consumption of home-grown vegetables	Medium	Likely	Moderate	Risk is greatest where possibly impacted soils are exposed or could be encountered, for example, when digging a vegetable patch. Site data needed to refine risk rating
2		Elevated ground gases derived from decomposition of fill material	Migration into residential properties, with subsequent asphyxiation and explosion risk	Medium	Low	Low/moderate risk	Infill likely to date from late 1950s at the latest, meaning a proportion of gas is likely to have dissipated. However, investigation and monitoring required to determine risk
Property							
3	Subsurface services serving the buildings (principally water supply)	Including (but not limited to) metals, hydrocarbons, PAHs, VOCs, SVOCs within Made Ground	Chemical attack and tainting of water supply could occur at high contaminant concentrations / severe pH levels	Medium	Likely	Moderate	Risk will depend on depth and concentration of contaminants within material(s) used around water supply pipes

No.	Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability of Linkage Occuring[1]	Overall Risk[1]	Comments
4	Property (Structures) – residential buildings on site	Decomposable elements of infill	Differential settlement of infill, causing structural failure of buildings	Medium	Low	Low / moderate risk	Council unaware of any complaints. Preliminary observation of buildings and information on ground conditions required
5	Property (structures); sub-surface concrete	Sulphate and pH	Contact between contaminants and concrete	Medium	Low (if appropriate concrete was used)	Low / moderate risk	Risk could only reasonably be established if concrete class used to construct buildings can be established (unlikely) and would require exposure of foundations to inspect (risk of damage and upheaval considered to outweigh benefit of assessment). Hence, a low priority for further investigation, which should prioritise assessment of risk to human health and controlled waters in accordance with council's inspection strategy
Controlled Waters							
6	Secondary A aquifer (Coal Measures) beneath site	Including (but not limited to) metals, hydrocarbons, PAHs, VOCs, SVOCs within Made Ground	Vertical contaminant migration (leaching) through unsaturated zone (Made Ground)	Medium	Likely	Moderate	Ground investigation required to determine risk as depends on several factors including leaching potential of contaminants within Made Ground (infill material), depth of aquifer beneath the site, presence/absence of low permeability layers between the Made Ground and aquifer.

No.	Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability of Linkage Occuring[1]	Overall Risk[1]	Comments
7	Ditch 25m to the north / north-east; Bentley Brook 50m to north (flowing to north-west)	Including (but not limited to) metals, hydrocarbons, PAHs, VOCs, SVOCs within Made Ground	Lateral migration of any impacted groundwater, either perched within Made Ground or in secondary aquifer, to watercourse	Medium	Likely	Moderate	Ground investigation required to determine risk as depends on several factors including depth/presence of impacted groundwater and hydraulic continuity between impacted groundwater and stream
Ecological Receptors							
8	AONB 50m to the north-west of the site (down-gradient)	Including (but not limited to) metals, hydrocarbons, PAHs, VOCs, SVOCs within Made Ground	Lateral migration of any shallower groundwater within Made Ground or Coal Measures	Medium	Likely	Moderate	Ground investigation required to determine risk as depends on several factors including depth/presence of impacted groundwater and hydraulic continuity between impacted groundwater and AONB

3 INITIAL INTRUSIVE INVESTIGATION

In order to further examine the potential pollutant linkages identified in Table 2.2, a initial site investigation was undertaken on the 7th and 13th July 2010. This section describes the site investigation undertaken and results obtained.

3.1 Scope and Methodology

The intrusive site investigation included the following:

- A consultation exercise with residents living at the site, including a mailshot and a public open evening;
- Obtaining plans of underground services and CAT-scanning proposed drilling locations, using a Radiodetection CAT1 and signal generator;
- Drilling seven window sample holes (WS1RN – WS7RN) to a maximum depth of 5.0m bgl, at the locations shown on Drawing 1. The window sample holes, which were drilled by Sherwood Drilling Services using a Geotool rig and hand-held equipment, were positioned in the gardens of housing / open verge areas located above the extent of infill, as indicated on historical mapping. Window sample positions were selected on the basis of achieving representative coverage of the area of infilling. The purpose of the window sample holes was to examine shallow and deeper soil conditions, enable the retention of soil samples for laboratory testing, and facilitate the installation of 50mm diameter dedicated gas monitoring wells in selected holes;
- Logging soil arisings in accordance with BS5930:1999, and additionally noting any visual or olfactory evidence of potential contamination;
- Retaining representative soil samples of the strata encountered, which were selected on the basis of field observations of potential contamination and achieving good spatial coverage of the site, in accordance with BS10175:2001 (since updated in 2011);
- Submitting retained samples to Alcontrol in chilled coolboxes and under chain of custody documentation, and instructing the analysis of samples;
- Undertaking four initial ground gas monitoring rounds, using a Geotechnical Instruments GA2000 gas analyser and flow pod, and two follow up rounds, using a Gas Data 435 gas analyser with integral flow pod, and;
- Undertaking a round of tap water sampling from five residential taps in May 2011.

Leachability analysis was not undertaken as part of this initial investigation as low permeability deposits (clay and mudstone) were encountered beneath the made ground and groundwater was not encountered in the top 5m of strata, meaning leaching of contaminants from shallow made ground to groundwater is less likely. The investigation approach is re-assessed in Section 5 (post-investigation conceptual model).

3.2 Results

3.2.1 Ground Conditions

The ground conditions encountered at the site generally comprised Made Ground over Coal Measures (encountered as clay, weak mudstones and siltstones).

Note that WS3RN to WS6RN inclusive were terminated at a maximum of 1.2m bgl (i.e. comprised hand-dug inspection pits only) as it was not possible to access the garden areas with the hand-held window sampling equipment.

Made Ground
Made Ground was encountered in all seven exploratory holes. Made Ground was proven to a maximum depth of 2.9m bgl (in WS7RN) and was predominantly granular in nature, consisting of sand and gravel with layers and pockets of clay. Ash was noted in all window sample holes except WS5RN. The gravel content of the Made Ground was variable and it comprised burnt shale, fabric, mudstone, coal, quartz, concrete and brick. No evidence of municipal waste material was encountered.

Exploratory holes WS1RN, and WS3RN to WS6RN inclusive, terminated within Made Ground at depths of 2m bgl (WS1RN) or 1m bgl (WS3RN to WS6RN).

Coal Measures
Weathered residual soils of the solid geology, comprising stiff gravelly clay, were encountered within WS2RN and WS7RN at depths of 2.7m and 3.9m bgl respectively. Weak interbedded mudstone and siltstone was encountered in WS7RN from 3.9m bgl to hole termination at 5.0m bgl.

Groundwater
Groundwater was not encountered in any of the window sample locations during drilling.

The above findings are discussed further in Section 4 (updated CSM). Window sample hole logs, providing full details of the strata encountered, are included within Appendix C.

3.2.2 Adequacy of Investigation Depth and Coverage

Natural ground was proven in two of the exploratory holes (WS2RN and WS7RN), i.e. the two holes that were successfully advanced beyond 2.0m bgl.

Increased depth and areal coverage of the site would be desirable to increase the confidence that the full depth of infill has been intersected. The investigation represents an initial assessment of ground conditions at the site.

3.2.3 Field Evidence of Contamination

The drilling arisings were inspected for visual and olfactory evidence of potential contamination. A summary of field observations recorded is presented in Table 3.1:

Table 3.1 - Field Evidence of Potential Contamination

Exploratory Hole	Visual and Olfactory Evidence of Contamination
WS1RN	0.3-1.9m bgl Matrix includes gravel of ash 1.9-2.0m bgl (EoB) Matrix includes ash
WS2RN	0.3-2.7m bgl Matrix includes gravel of ash
WS3RN	0.2-1.0m (EoB) bgl Matrix includes ash
WS4RN	0.7-1.0m bgl (EoB) Matrix includes ash
WS5RN	0.11-0.59m bgl Matrix includes brick concrete and fabric
WS6RN	0.37-1.0m bgl Matrix includes ash
WS7RN	0-0.26m bgl Matrix includes brick and ash 0.26-0.96m bgl Matrix includes brick, occasional burnt shale and coal 0.96-2.9m bgl Matrix includes ash

EoB = end of borehole

3.2.4 Soil Analysis Results

Sixteen samples were submitted for laboratory analysis, under chain of custody documentation and within chilled coolboxes, to ALcontrol of Deeside. ALcontrol holds ISO 17025:2000 accreditation (audited yearly by UKAS) for most methods and holds the stringent MCERTS accreditation for most soil analyses performed (see http://www.geochem.com/environment-water/united-kingdom/contaminated-land-waste-waste-water/l-2) . The samples were selected for analysis on the basis of the observations of potential contamination made in the field, and to achieve good spatial coverage of the site.

Table 3.2 presents a summary of the results of the analysis. The results have been compared to guidance values protective of human health, assuming the receptor is a residential property where plant uptake of contaminants occurs, and the plants (vegetables) are subsequently ingested by humans. The screening values used, in order of preference, comprise:

- 2009 Soil Guideline Values (SGVs) published by the Environment Agency / DEFRA, generated using the Contaminated Land Exposure Assessment (CLEA) model, version 1.04 (now available as V1.06),
- Generic Assessment Criteria (GAC) published by Land Quality Management Limited[4] (LQM) and the Environmental Industries Commission[5] (EIC), or calculated by Grontmij, all using CLEA[6],
- SGVs published by the Environment Agency / DEFRA between 2002 and 2007, calculated using prior versions of the CLEA model. This only applies to lead.
- The Dutch Intervention Value (this only applies to cyanide).

Full analytical testing results are included as Appendix D.

[4] The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (2nd Edition). Land Quality Press, 2009
[5] Soil Generic Acceptance Criteria for Human Health Risk Assessment. Environmental Industries Commission / AGS / CL:AIRE, January 2010
[6] EIC used CLEA V1.06, LQM and Grontmij used CLEA 1.04

Table 3.2 - Soil Analysis Results Summary

Determinand	No. of Samples Tested	Minimum Value	Maximum Value	SGV / GAC (using 1% SOM where SOM-dependant)[1]	Locations where SGV or GAC are exceeded
Arsenic	13	2.9	**48**	32	**WS2RN 0-0.1m bgl**
Antimony	6	<0.6	<0.6	550[2]	-
Beryllium	13	0.2	2.6	51	-
Boron (water-soluble)	13	<1	1.4	291	-
Cadmium	13	0.04	1	10	-
Chromium, hexavalent	11	<0.6	<1.2	4.3	-
Chromium, total	13	12	29	3,000[3]	-
Copper	13	18	170	2,330	-
Lead	13	18	140	450[4]	-
Mercury	13	<0.14	<0.14	170[5]	-
Nickel	13	4.3	71	130	-
Selenium	13	<1	3.8	350	-
Vanadium	13	15	36	75	-
Zinc	13	26	250	3,750	-
Cyanide	6	<1	<1	20	-
Thiocyanate	6	<1	<1	-	-
Asbestos screen	3	No fibres detected in any sample			-
Benzene	7	<0.01	<0.01	0.08	-
Toluene	7	<0.01	0.02	120	-
Ethyl Benzene	7	<0.01	<0.05	65	-
Xylene	7	<0.01	<0.05	42[6]	-
TPH – CWG[7] Hydrocarbons	7	None of the banded aliphatic/aromatic TPH-CWG screening criteria were exceeded. Full speciated results are presented in Appendix D			-
Phenols	6	<0.01	<0.01	180	-
Polyaromatic Hydrocarbons (PAHs)	4	None of the speciated PAH screening criteria were exceeded. Full speciated results are presented in Appendix D			-
Volatile Organic Compounds and Semi-Volatile Organic Compounds (excl above)	4	All laboratory results below limit of detection with exception of below:			-
bis(2-ethylhexyl) phthalate	4	<0.01	0.54	280	-
Styrene	4	<0.01	0.03	8.1	-

Values presented in mg/kg, correct to two significant figures (screening values presented without any rounding). **Bold values** indicate locations where observed concentrations exceed the screening value.

[1] Thirteen samples were tested for Soil Organic Matter (%SOM) content. A minimum value of 0.35% and a maximum of 71.4% were recorded. The maximum value contained coal fragments, and was excluded from the calculated mean and median values, which were 1.75% and 0.6% respectively. Where dependant upon SOM content, SGVs and GAC generated using a 1% SOM value in CLEA have therefore been used in the above Tier 1 screen, as a conservative assessment

[2] EIC GAC for "residential without plant uptake" scenario. A GAC including plant uptake of contaminants has not been derived as an industry-accepted plant concentration factor has not yet been calculated. The GAC excluding plant uptake is likely to provide an estimate of the magnitude of a GAC including plant uptake; as the maximum concentration of antimony was below the laboratory detection limit, it is unlikely that any GAC including plant uptake has been exceeded.

[3] Value is for trivalent chromium; a screening value for total chromium has not been published. Screening a total chromium laboratory result against a trivalent chromium screening value is a conservative measure.

[4] Earlier (2002) SGV published by DEFRA. An updated SGV is not currently available but may be published once the EA has evaluated a recent European Food Safety Authority toxicology report and confirmed the approach to be adopted for lead (CLEA may not be used).

[5] Testing results presented represent total mercury, whereas SGV presented is for inorganic mercury. Although the most stringent of the SGVs is for elemental Mercury, the Environment Agency SGV for mercury in soil science report SC050021/Mercury SGV indicates that in cases where preliminary risk assessment has not identified a mercury issue at the site or conditions such as peaty or flooded soils then '*For general surface contamination and to simplify the assessment, the SGVs for inorganic mercury can normally be compared with chemical analysis for total mercury content because the equilibrium concentrations of elemental and meth l mercury compounds are likely to be very low*

[6] SGV for para-xylene quoted (worst case of the three isomers)

[7] Total Petroleum Hydrocarbon Criteria Working Group

3.2.5 Ground Gas Monitoring

Four initial rounds of ground gas monitoring were undertaken, using a Geotechnical Instruments GA2000 gas analyser with flow pod. In response to moderate carbon dioxide concentrations recorded in two wells (WS1RN and WS4RN), two additional monitoring rounds were undertaken during May and June 2011 at these wells, using a Gas Data 435 gas analyser with internal flow pod. A summary of the **maximum** gas monitoring results recorded in each monitoring well is presented in Table 3.3, with full monitoring data in Appendix E:

Table 3.3 - Summary of Gas Monitoring Data

Well	Maximum Values Recorded During Monitoring Events:					Gas Screening Value[1] (l/hr)	Situation "A" Characteristic Situation[1]
	Peak CH_4 (%)	*Steady CO_2 (%)*	*Steady CO (ppm)*	*Steady H_2S (ppm)*	*Flow (l/hr)*		
WS1RN	0	7.0	1	0	0.1	0.007	CS1 (see text below)
WS2RN	0	3.9	0	0	0.1	0.0039	CS1
WS3RN	0	0.6	0	0	0.1	0.0006	CS1
WS4RN	0	9.1	2	0	0.1	0.0091	CS1 (see text below)
WS5RN	0	0.6	0	0	0.1	0.0006	CS1
WS6RN	0	4.0	0	0	0.1	0.004	CS1
WS7RN	0	4.1	0	0	0.1	0.0041	CS1

Atmospheric Pressure:	28/07/2010	993mb (steady trend throughout a day of monitoring in Staffordshire)
	11/08/2010	993mb (rising trend throughout a day of monitoring in Staffordshire)
	25/08/2010	989mb (falling trend throughout a day of monitoring in Staffordshire)
	08/09/2010	979mb (rising trend throughout a day of monitoring in Staffordshire)
	31/05/11	1005mb. Rising trend throughout the surrounding 24 hours, on basis of data obtained from private weather stations in Coalville and Solihull[2]
	20/06/11	994mb. Falling trend throughout the surrounding 24 hours, on basis of data obtained from private weather stations in Coalville and Solihull[2]

Readings obtained within a 3 minute measurement period, obtained with a Geotechnical Instruments GA2000plus gas analyser.
CH_4 – methane; O_2 – oxygen; CO_2 carbon dioxide; CO – carbon monoxide;
H_2S – hydrogen sulphide; mbgl – metres below ground level mb – millibars l/hr – litres per hour.
[1]Gas Screening Value and Characteristic Situation based on methodology presented in CIRIA Report C665, Assessing Risks Posed by Hazardous Gases to Buildings. Where the flow rate recorded in the field is zero or negative, a flow of 0.01 l/hr is assumed
[2] http://www.photoweather.com/aws/ and http://www.birminghamweather.org.uk/index.php?option=com_frontpage&Itemid=106 . These are private weather stations and the websites include disclaimers that the data should not be used for commercial decision making purposes. Nonetheless, the qualitative pressure trend observed is likely to be an accurate representation of true conditions.

The summary data presented above indicates that, in regard to methane and carbon dioxide, CIRIA characteristic situation CS1 should be applied to the majority of the wells. This is the lowest risk category (of six) presented in CIRIA report 665, and indicates that no special gas precautions would be required in the construction of new buildings.

In regard to WS1RN and WS4RN - CIRIA report 665, Table 8.5, indicates that the assessor should **consider** increasing the applied characteristic situation from CS1 to CS2 if the recorded CO_2 concentration is not "typically <5%". The CO_2 concentrations recorded on each gas monitoring event (see Appendix E) were as follows:

Table 3.4 – Carbon Dioxide Values Recorded in WS1RN and WS4RN

Location	CO2 Concentrations					
	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
WS1RN	7.0	6.2	4.6	NM[1]	0.0	5.0
WS4RN	9.1	8.9	4.9	5.6	7.4	7.4

[1] Not Measured – not possible to access the well as gate / house was locked

The concentrations of carbon dioxide in WS1RN and WS4RN are considered to be "typically above 5%". As discussed above, CIRIA 665 indicates that in this situation, the assessor should consider increasing the applied characteristic situation from CS1 to CS2. However, Grontmij considers that CS1 should apply because:

- low gas flow rates were recorded during the monitoring period. This suggests that minimal diffusive flow to the well is occurring, which in turn suggests that there is only a minimal pressure gradient between general ground gas and the well and therefore, generally small volumes of CO_2 in the ground,
- some of the monitoring events occurred in favourable gas generation conditions, meaning close-to worst case readings are likely to have been obtained and there is only a low risk that the worst-case condition has not been assessed (see paragraph below).

At least some of the monitoring events were undertaken in periods of falling atmospheric pressure, meaning that observations in favourable (if not optimal) gas generation pressure conditions have been made (optimal conditions being during a rapid fall to a very low pressure). As such, the data obtained is likely to be representative of gas conditions beneath the site during most days in a given year. As the recorded flow rates are very low, it is unlikely that even optimal gas generation conditions would cause sufficient carbon dioxide (CO_2) to enter the housing at the site to cause health effects (e.g. CIRIA 665 Table 2.2 quotes that 3% v/v of CO_2 can cause headaches and shortness of breath).

Although a maximum concentration of 2ppm ***carbon monoxide*** (CO) was recorded during the monitoring period, CO was typically not detected at a concentration in excess of the gas analyser detection limit (of 31 events where individual wells were successfully monitored across the site, 2ppm was recorded once and 1ppm once, the remainder of readings being 0ppm). Table 2.2 of CIRIA 665 indicates a long-term (i.e. most stringent) occupational exposure limit (OEL) of 30ppm for CO, and a long-term (i.e. most stringent) Environmental Exposure Limit (EAL) of 0.35mg/m^3 (1.15ppm CO). The former of these two values is protective of people in the workplace, the latter of the general public – considered to be a benchmark of protection while not having a statutory basis[7]. Given that 95% of the CO readings were below the EAL, and the two readings in excess of the EAL were only slight exceedances (using an instrument which is accurate to 1ppm), CO is unlikely to pose a risk to human health at the site.

Table 2.2 of CIRIA 665 indicates a long-term (i.e. most stringent) occupational exposure limit of 5ppm ***hydrogen sulphide*** (H_2S) and a long-term (i.e. most stringent) Environmental Exposure Limit (EAL) of 0.14mg/m^3 (1.39ppm H_2S). Hydrogen sulphide was not detected at a concentration in excess of the gas analyser detection limit of 1ppm during the entire monitoring period, and is therefore unlikely to pose a risk to human health.

[7] The last paragraph of p27 of Environment Agency Horizontal Guidance Note H1 – Integrated Pollution Prevention and Control: Environmental Assessment and Appraisal of BAT (V6, 2003) states that "Although these (EALs) do not carry any statutory basis, they are, again, a benchmark for harm against which any exceedance should be viewed as unacceptable.

3.2.6 Safety of Water Supply Pipes

As a preliminary assessment, soil quality data was screened against WRAS guidelines[8] (current at the time of the initial investigation, but now superseded) and UKWIR parameters[9]. This preliminary assessment, included as Appendix G, indicated that the concentration of contaminants in soil could potentially permeate into water supply pipes. Note that the WRAS and UKWIR guidelines are conservative and are normally used for the selection of materials when laying new pipes.

To confirm whether the concentrations of contaminants in the shallow Made Ground pose a risk to drinking water quality at the site, samples of drinking water were collected from taps from five properties (10 Westgate, 11 Goodwood Close, 2 Sandown Close, 3 Slade View Rise and 4 Kempton Close) on 18th May 2011. The samples were taken from properties where the highest concentrations of contaminants were encountered in soil, i.e. at locations where the greatest risk to drinking water quality may be posed.

At the instruction of Cannock Chase Council, samples were obtained after allowing the tap to run for one minute. The samples were submitted to Alcontrol Laboratories for chemical analysis for metals, BTEX and PAHs as commonly occurring contaminants and parameters for which drinking water standards can be applied. The results of the analyses are summarised in Table 3.4, along with a comparison to UK Drinking Water Standards (UKDWS) taken from the Water Supply (Water Quality) Regulations 2000 (as amended). Full testing results are included in Appendix D:

[8] 9-04-03 The Selection of Materials for Water Supply Pipes to be Laid in Contaminated Land. Water Regulations Advisory Scheme, October 2002.
[9] 10/WM/03/21 Guidance for the Selection of Water Supply Pipes to be Use in Brownfield Sites. UK Water Industry Research, 2010 (as re-issued)

Table 3.5- Tap Water Analysis Results

Contaminant	No of Samples Tested	Minimum Value µg/l	Maximum Value µg/l	UKDWS µg/l
Arsenic	5	1.9	2.2	10
Boron	5	89	130	1000
Cadmium	5	0.20	0.20	5.0
Chromium	5	13	14	50
Copper	5	28	180	2000
Lead	5	0.04	0.86	10
Nickel	5	1.5	4.5	20
Zinc	5	7.1	300	5000
Mercury	5	<0.01	<0.01	1.0
Sum of Benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene*	5	<0.08	<0.08	0.10
Benzo(a)pyrene*	5	<0.009	<0.009	0.01
Benzene	5	<1.3**	<1.3**	1.0

*There are no screening values in the WSWQ Regulations 2010 for the remaining commonly analysed 16 PAH compounds
**Limit of detection of analytical method

The maximum recorded metal and PAH concentrations within tap water did not exceed the corresponding UK Drinking Water Standards, where standards exist, or (in the case of benzene) were below the limit of detection of the laboratory instrumentation.

3.2.7 Controlled Waters

A clay-rich soil (probable weathered Coal Measures strata) has been identified beneath the made ground. This soil is likely to be of low permeability, and is likely to restrict the leaching of contaminants present in the made ground to the underlying Secondary A aquifer in the Coal Measures. Subsequent migration of dissolved contaminants to the off-site surface watercourse, 25m downgradient (north-east) of the site, or to the Area of Outstanding Natural Beauty (AONB), 50m downgradient of the site, is also therefore unlikely. The aquifer is also likely to be of lower sensitivity, as there are no licensed public water abstractions within 1km of the site boundary as indicated on the Environment Agency website (not precluding the presence of private abstractions). However, the clay-rich soil was only proven in the two exploratory holes which successfully penetrated beyond a depth of 2m bgl. Leachate testing was therefore undertaken in order to examine the potential dissolved contaminant concentrations which could reach the aquifer.

Three samples of the made ground soil, TPL01 to TPL03, were obtained by means of hand pitting on 16th September 2011. The sample locations, as shown on Drawing 1, were selected to provide good general coverage of the site, with the area around WS2RN deliberately targeted due to the single exceedance of a soil screening value (arsenic) at this location, i.e. potentially the “worst case” soil beneath the site. The hand pits were advanced to 0.7m bgl and the arisings from each hole were inspected and representative made ground samples retained in amber jars and phials and plastic pots supplied by the laboratory, Alcontrol of Hawarden. The samples were couriered to the laboratory in laboratory-supplied coolboxes which chilled coolant bricks.

The samples were scheduled for leachable metals and speciated polycyclic aromatic hydrocarbon (PAH) analyses, to provide a general screen for common contaminants. The leaching preparation requested was the BS12457 single-stage leaching test, as recommended in Environment Agency guidance[10]. The results of the chemical analyses are summarised in Table 3.6, with full laboratory testing certificates included in Appendix D. The results are presented with a comparison with the following Tier 1 screening values:

- For surface waters: the most stringent of:
  - "Inland freshwaters" Tier 1 screening values included in the River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Directions 2010, and;
  - Environmental Quality Standards (EQS) from The Surface Waters (Dangerous Substances)(Classification) Regulations 1989 and amendments (from 1992, 1997 and 1998);
- For groundwater, the most stringent of "Groundwater impacts on surface water" (expressed as minimum threshold values) Tier 1 values in the River Basins etc Directions, and UK Drinking Water Standards (DWS) have been used as a preliminary Tier 1 screen. Use of the DWS is a conservative screening assumption for a Secondary A aquifer, from which groundwater is unlikely to be abstracted for human consumption;
- For the AONB, the above screening values, which are protective of the environment and human health, have been deemed to be protective of water quality beneath the sensitive wildlife site.

Table 3.6 - Leachate Analysis Results

Contaminant	No Samples Tested	Max Value (ug/l)	Surface Waters Tier 1 (ug/l)	Groundwater Tier 1 (ug/l)
Arsenic	2	<0.12	50	10
Boron	2	<9.4	2000	1000
Cadmium	2	**<0.1**	**0.08**	0.2
Chromium	2	<0.22	3.4	50
Copper	2	<0.85	1.0	10
Mercury	2	<0.01	0.05	1.0
Nickel	2	<0.15	20	20
Lead	2	<0.02	4.0	7.3
Vanadium	2	<0.24	20	-
Zinc	2	<0.41	8.0	75
Naphthalene	2	<0.1	2.4	2.4
Benzo(a)pyrene	2	<0.009	0.05	0.01
Sum of benzo(b) and benzo(k) fluoranthene	2	**<0.05**	**0.03**	-
Sum benzo(ghi)perylene and indeno(123cd)pyrene	2	**<0.03**	**0.002**	-
Total PAHs	2	<0.25	-	0.1

The recorded concentrations of leachable contaminants were all less than the adopted Tier 1 screening values, with the exception of cadmium and the "sum of" PAH results, which exceeded the adopted surface water Tier 1 values. The concentrations of cadmium and PAHs recorded were less than the laboratory's method detection limit in all cases; the Tier 1 values were

[10] Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination. Environment Agency (2006). See Section 5.1 and Appendix B.

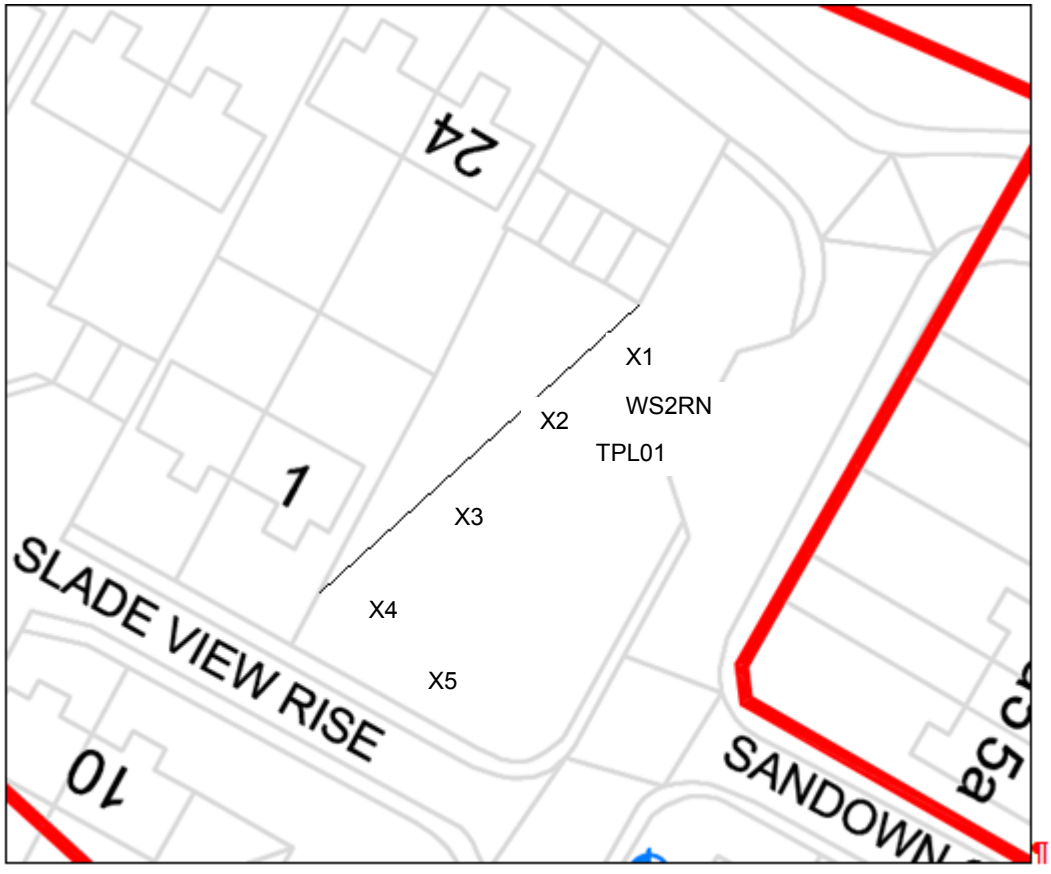
exceeded only because the laboratory detection limit was greater than the adopted Tier 1 value. On this basis, it is unlikely that unacceptable concentrations of leachable contaminants are reaching the surface water, groundwater and ecological receptors identified.

The laboratory routinely performs a screen of soil samples received for asbestos, in order to protect the health of the laboratory staff working with the samples. In the case of the three samples submitted, the sample from TPL01 was found to contain a piece of asbestos containing material (ACM), and was not analysed further in accordance with laboratory protocol. Possible human health risks posed by asbestos are discussed further in Section 3.2.8.

3.2.8 Asbestos in Soil

As discussed above, the sample taken from TPL01 was found to contain ACM, with the laboratory commenting that the sample was "typical of asbestos insulation board". Further analysis identified that amosite and crysotile asbestos fibres were present within the ACM.

TPL01 was located in an open grassed area to the west of Middleway and north of Slade View Rise. This sample was the only soil sample found to contain asbestos throughout the investigation – three samples scheduled for asbestos analysis in the initial investigation did not contain asbestos. In order to examine whether the result in TPL01 was representative of a "chance hit", or whether asbestos is abundant in the made ground around TPL01, five further soil samples (X1 to X5) were obtained on 22nd November 2011 in the vicinity of TPL01, as indicated below. Underground service plans were inspected and the sampling locations were CAT scanned, using a Radiodetection CAT3, prior to commencement of pitting. The samples were located towards the western and southern edges of the open grassed area as underground services and/or signals from the CAT prevented other areas being sampled.



The samples were obtained by hand excavating a pit to a maximum of 0.45m bgl, inspecting the arisings for any potential ACM (no field evidence was found) and retaining a representative sample of the made ground, which was double-bagged for health and safety reasons. The samples were submitted to Scientific Analytical Laboratories (SAL) of Manchester, which holds UKAS accreditation for the most stringent current methodology for asbestos in soil analysis. Briefly, the method involves drying the as-received sample under carefully controlled conditions, then inspecting the sample for both "bound" ACM and "free" asbestos fibres in the soil.

Disposable PPE, appropriate to working with asbestos, was worn while undertaking the sampling work as a precaution. The PPE was sealed in a tough plastic bag and was collected by a licensed waste disposal contractor for disposal at landfill.

A summary of the field and laboratory work undertaken is presented in Table 3.7:

Table 3.7 – Summary of Asbestos Findings

Sample Location	Strata Summary	Sample Depth (m bgl)	Lab Results
X1	Grass over brown fine to medium sand topsoil (typically GL to 0.1m). Made ground: brown fine to medium sand with some fine to medium gravel, including of brick (typically 0.1m to maximum of 0.45m – end of hand dug pit).	0.2m (made ground)	No ACM or fibres detected in any sample
X2		0.3m (made ground)	
X3		0.35m (made ground)	
X4		0.1m (interface of topsoil and made ground)	
X5		0.3m (made ground)	

On the basis of the above results, asbestos does not appear to be widespread within the open grassed area. Given that the subsurface soil is also likely to retain a degree of soil moisture, reducing the likelihood of liberating any asbestos fibres present in the soil into the air (and thus allowing inhalation), the risk of inhaling asbestos fibres is considered to be low, as follows:

- Very low risk posed to residents of the housing estate, as both adults and children are unlikely to disturb soil beneath the surface cover of grass, and the abundance of asbestos beneath the site appears to be low;
- Low risk posed to utilities or council parks maintenance staff, who may occasionally need to excavate soils within the open space area. The risk is slightly higher than for residents, as exposure to subsurface soils could occur, but the abundance of asbestos in the soil appears to be low and the likely existence of soil moisture will also restrict the liberation of any fibres present. While we cannot confirm a "zero" risk, the risk of exposure to fibres in the open space area is unlikely to be higher than when working within any other area where made ground has been placed (i.e. within most utility trenches).

4 FURTHER ASSESSMENT OF HUMAN HEALTH RISK

The site investigation has established that the concentration of arsenic in one sample exceeds the generic screening value applicable to the generic residential housing scenario, where plants are grown for human consumption. None of the 12 other samples obtained at <0.7m bgl depth and analysed at the laboratory contained an arsenic concentration in excess of the SGV.

Generic Soil Guideline Values (SGVs) and Generic Acceptance Criteria (GAC) represent concentrations of contaminants above which unacceptable impacts may occur and further assessment is generally required. Exceedance of SGVs or GAC does not necessarily mean that a significant possibility of significant harm ("SPOSH" – i.e. unacceptable risk to human health or the environment) is posed to human health. The SGVs and GAC have been derived using the CLEA model by various parties (see Section 3.2.3), using conservative input parameter values to generate screening values applicable, theoretically, to all UK sites. Therefore, an exceedance of a SGV or GAC does not necessarily mean that SPOSH exists – only that a generic, conservative screening value has been exceeded, and further assessment is required.

4.1 Statistical Analysis Approach

Guidance regarding how data collection, data review and statistical testing interact to produce defensible conclusions regarding the condition of land is provided within Part 2A of the Environmental Protection Act 1990 and Guidance on Comparing Soil Contamination Data with a Critical Concentration[11] ("the guidance").

In order for statistical analysis to be applied, the dataset under inspection should strictly be the result of an unbiased sampling strategy. While there are a number of reasons why the sampling strategy could be viewed as biased, we conclude that the strategy was as close to being unbiased as possible, as discussed below:

- Parts of the site, such as areas beneath houses and roads, were not accessible, thus some soils were much less likely to be sampled than others. However, it would be unreasonable to attempt to sample such soils in an initial investigation, and samples taken from garden areas are likely to be representative of infill material beneath the site as a whole (while acknowledging that recent additional made ground may have been placed to form structures)
- Residents were, in some cases, reluctant for some parts of their gardens to be disturbed, meaning that some soils were unlikely to be tested – but again, it is likely that the area available for sampling is likely to be representative of garden areas across the site as a whole
- Within each exploratory hole, contaminated land practitioners typically sample and analyse a "representative worst case" sample of the soil encountered – so, while a very small pocket of ash within otherwise "clean" soil may not be analysed, samples would typically be taken of a 0.2m wide band of ash, rather than from the "clean" soil above or below such a band. Such sampling and testing is desirable, as it gives an indication of "representative worst case" conditions. Thus, while such sampling is arguably biased, the bias is towards over-estimating typical concentrations of contaminants in the soil across the site. Thus, if the average concentration of such "representative worst case" samples is below the SGV or GAC, it follows that soil conditions across the site as a whole are also likely to be below the relevant SGV or GAC.

[11] The Chartered Institute of Environmental Health, CL:AIRE and The Soil and Groundwater Technology Association; May 2008.

Statistical analysis of the dataset has therefore been undertaken, as described below.

4.2 Averaging Areas

The first step of statistical analysis is to define the "averaging area" over which data would be examined. An averaging area is an area of soil which, when sampled, is considered to provide a representative indicator of how much contaminant a receptor is exposed to.

Based on the history of the site (i.e. all the site is thought to be underlain by infill) and current use of the site (i.e. residential housing, with minor areas of lower sensitivity), the entire site was defined as a single averaging area, and all recorded arsenic concentrations in the soil obtained at <0.7m bgl depth were examined as a single dataset.

It could be argued that each residential property should be defined as a single averaging area, based upon the exposure of each individual receptor. However, as the goal of the investigation is to examine whether there is a significant possibility of significant harm (SPOSH) to sensitive receptors at the site *as a whole* (as characterised by the samples obtained and tested), and given that it was excessively intrusive to residents to obtain and test multiple samples from each garden during an initial investigation, such an approach was rejected.

4.3 Outlier Test

The second stage of statistical analysis requires a test to identify whether any outliers, potentially indicative of laboratory error or a separate population of data (for which a separate averaging area should be defined), are present.

The Guidance indicates that an outlier should only be excluded from a population of data if

The outlier is obviously and demonstrably the result of an error that can be identified and explained – in which case the correct value should be identified and the dataset amended, where possible, or the erroneous value excluded with justification, or

The outlier clearly indicates that more than one soil population exists within the dataset and this can be justified by (or informs the further development of) the conceptual model – in which case the different population expressed by the outlier(s) should be explored in more detail either by reviewing and refining zoning decisions and treating outlier values as a separate population or even individually or, if necessary, by undertaking further site sampling to verify conditions in the vicinity of outlier values.

In all other cases, outlying data should be assumed to be genuine and reflective of the full range of soil concentrations to which receptors may be exposed.

The ESI Limited Statistical Calculator has been used to test for outliers. The Calculator applies Grubb's Test to the entire dataset, but first requires the user to manually check that the dataset (excluding maximum value) is normally distributed, otherwise the test is not applicable. The dataset excluding maximum value was therefore checked, and was identified to be normally distributed.

The Calculator identified that the maximum arsenic concentration of 47.5mg/kg, within WS2RN, was potentially a statistical outlier. However:

- manual inspection of the spread of arsenic concentrations across the site identifies that this maximum concentration is of a similar order of magnitude to the remainder of the dataset
- there is no reason to believe that the WS2RN result has been obtained from an area of the site which is somehow different to the site as a whole, and thus representative of a separate population of data (e.g. the sample was not taken immediately downgradient of an obvious and localised source)
- the WS2RN result is not an atypical concentration of arsenic within made ground, and is an entirely believable result.

The WS2RN result is therefore not considered to be an outlier and has therefore not been excluded from the dataset.

4.4 Hypothesis Testing

The second stage of statistical analysis is to define a null and alternative hypothesis and examine whether the null hypothesis should be rejected.

In a Part 2A scenario, the null (H_0) and alternative (H_1) hypothesis to be tested is:

'Is there sufficient evidence that the true mean concentration of the contaminant (μ) is greater than the critical concentration (C_c)?'.

The Null Hypothesis (H_o) and the Alternative Hypothesis (H_1) are therefore:

- H_o $\mu \leq C_c$ i.e. the true mean concentration is equal to or less than the critical concentration
- H_1 $\mu > C_c$ i.e. the true mean concentration is greater than the critical concentration

The "critical concentration" is the adopted arsenic residential SGV of 32mg/kg.

The Guidance provides a detailed explanation of the hypothesis testing procedure, which includes comparison of the lower confidence limit of the (estimated) mean value with the critical concentration, to provide additional assurance that the (true) mean is also below the critical concentration at a defined level of confidence (conventionally 95%; this value has been adopted in this case).

The guidance also states that in the Part 2A scenario, if the sample mean is less than the critical concentration (C_c), the lower confidence limit of the sample mean must also be below the critical concentration, and the Null Hypothesis cannot be rejected.

The ESI Calculator has been used to calculate the mean of the recorded arsenic concentrations across the averaging area (the site), which is **13.5mg/kg**. As this value is below the critical concentration of 32mg/kg, the null hypothesis cannot be rejected, i.e. at a 95% level of confidence, the true mean concentration of arsenic beneath the averaging area (whole site) is less than or equal to the SGV of 32mg/kg.

4.5 Conclusion

On the basis of the above assessment, and given that a SGV represents a conservative value, reflective of assumptions and/or uncertainty associated with exposure frequency and duration,

contaminant uptake and toxicology, below which harm to human health is very unlikely to occur, we conclude that:

- It is unlikely that a significant possibility of significant harm to human health (SPOSH) is posed by arsenic beneath the site
- It is unlikely that the maximum concentration of arsenic recorded is representative of a separate data population, i.e. it is not considered to be a hotspot, is not indicative of an additional, smaller averaging area and does not require further investigation
- No further assessment in regard to human health risk posed by arsenic is required.

5 UPDATED CONCEPTUAL SITE MODEL

The CSM presented in the earlier Grontmij desk study report (Appendix A) was updated, using the findings of the site investigation, as presented in the following sections.

Table 5.1 – Pollutant Linkages, Post-Site Investigation

No	Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability of Linkage Occuring[1]	Overall Risk[1]	Comments
1	Residents of properties above infilled ground – including children playing in gardens	Including (but not limited to) metals, hydrocarbons, PAHs, VOCs, SVOCs within Made Ground	Direct ingestion/dermal contact/inhalation of dust/inhalation of vapours/consumption of home-grown vegetables	Minor	Unlikely	Very Low	Although the concentration of arsenic in one sample (WS2RN) at 0.1m bgl exceeds the generic screening value, statistical analysis demonstrates that the average arsenic concentration across the site is below the generic screening value. All other contaminant concentrations were below the generic screening values. No further assessment proposed.
1a	Children potentially placing in open space to north of Slade View Rise	Asbestos containing material within soil (at apparently low abundance)	Disturbance of soil to liberate fibres; subsequent inhalation	Medium (arguably severe?)	Unlikely	Low	Sampling indicates low abundance of fibres. Soil likely to retain some moisture, reducing likelihood of liberation (if location contains any fibres at all). Exposure unlikely – would require child to dig hole through turf. Risk is not considered to constitute significant possibility of significant harm (SPOSH), but cannot be defined as "zero risk"
1b	Council or utilities maintenance staff working in open space to north of Slade View Rise	Asbestos containing material within soil (at apparently low abundance)	Disturbance of soil to liberate fibres; subsequent inhalation	Medium (arguably severe?)	Low	Low - moderate	Sampling indicates low abundance of fibres. Soil likely to retain some moisture, reducing likelihood of liberation (if location contains any fibres at all). Risk is not considered to constitute significant possibility of significant harm (SPOSH), but cannot be defined as "zero risk"

No	Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability of Linkage Occuring[1]	Overall Risk[1]	Comments
2	Residents of properties above infilled ground	Elevated ground gases derived from decomposition of fill material	Movement into buildings, subsequent asphyxiation and explosion risk	Minor	Unlikely	Very Low	Moderately elevated CO_2 recorded in WS1RN and WS4RN, albeit at low flow rates (even in favourable pressure conditions). All H2S readings and 95% of CO readings were below screening criteria (EAL). No further assessment proposed.
3	Subsurface services serving the buildings (principally water supply)	Including (but not limited to) metals, hydrocarbons, PAHs, VOCs, SVOCs within Made Ground	Chemical attack and tainting of water supply could occur at high contaminant concentrations / severe pH levels	Minor	Low	Very Low	Various contaminants present in soil at concentrations in excess of WRAS and UKWIR screening values. However, tap water sampling identified dissolved concentrations below drinking water standard. No further assessment proposed.
4	Property (Structures) – residential buildings on site	Decomposable elements of infill	Differential settlement of infill, causing structural failure of buildings	Medium	Unlikely	Low	Although a detailed inspection of buildings has not been undertaken, no obvious evidence of structural failure was noted in the field and all properties at the site appear to be currently occupied. As buildings appear to be fit for occupancy, it is unlikely that significant harm to the building has been caused or is being caused (ref: DEFRA Circular 01/2006 p86 – this is statutory guidance accompanying the Environmental Protection Act 190.

No	Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability of Linkage Occuring[1]	Overall Risk[1]	Comments
5	Property (structures); sub-surface concrete	Sulphate and pH	Contact between contaminants and concrete	Medium	Low (if appropriate concrete was used)	Low / moderate risk	Although a potential risk, concrete attack was not considered to be a priority for intrusive investigation and assessment (i.e. risks to human health and the environment were prioritised). To make a full assessment it would be necessary to expose foundations; likely risk of damage to property and disturbance to residents was considered to outweigh the benefit of exposing foundations for assessment.
6	Secondary A aquifer beneath site (Coal Measures)	Low concentrations of leachable metals and PAHs identified – below Tier 1 values or laboratory detection limit.	Vertical contaminant migration (leaching) through unsaturated zone (Made Ground)	Medium	Unlikely	Low risk	Logs indicate clay-rich soil (as weathered Coal Measures) beneath the made ground, underlain by mudstone – i.e. low permeability layer present beneath the made ground which will restrict leaching to the aquifer, albeit this was only proven in the two BHs successfully advanced beyond 2m bgl. Lab results suggest significant leachable concentrations of contaminants are not present. No further work proposed

No	Receptor	Contaminant(s)	Pathway(s)	Potential Severity of Linkage[1]	Probability of Linkage Occuring[1]	Overall Risk[1]	Comments
7	Ditch located 25m to north / north-east of site; Bentley Brook 50m to north (flowing to north-west)	Low concentrations of leachable metals and PAHs identified – below Tier 1 values or laboratory detection limit.	Lateral migration of any shallower groundwater within Made Ground or Coal Measures to watercourse (assuming hydraulic continuity)	Medium	Unlikely	Low risk	Low concentrations of contaminants detected in leachate. Ditch is unlikely to be in hydraulic continuity with groundwater beneath the site, based on groundwater being >5m bgl at WS7RN (ditch estimated to be an absolute maximum of 5m below the ground level elevation at WS7RN). Bentley Brook is potentially up to 10m below the ground level elevation at WS7RN, particularly with increasing distance north-west of the site, so continuity with groundwater beneath the site cannot be ruled out. However, the distance of the brook, some 50m from the site, will provide opportunity for attenuation and dispersion of dissolved contaminants, further reducing the risk. No further work proposed
8	AONB 50m downgradient of the site	Low concentrations of leachable metals and PAHs identified – below Tier 1 values or laboratory detection limit.	Lateral migration of any shallower groundwater within Made Ground or Coal Measures	Medium	Unlikely	Low risk	Bentley Brook denotes the approximate southerly extent of the AONB. As the brook could potentially be affected by leachate, the AONB could also be affected, e.g. by root uptake by trees. Low contaminant concentrations in leachate detected. No further work proposed

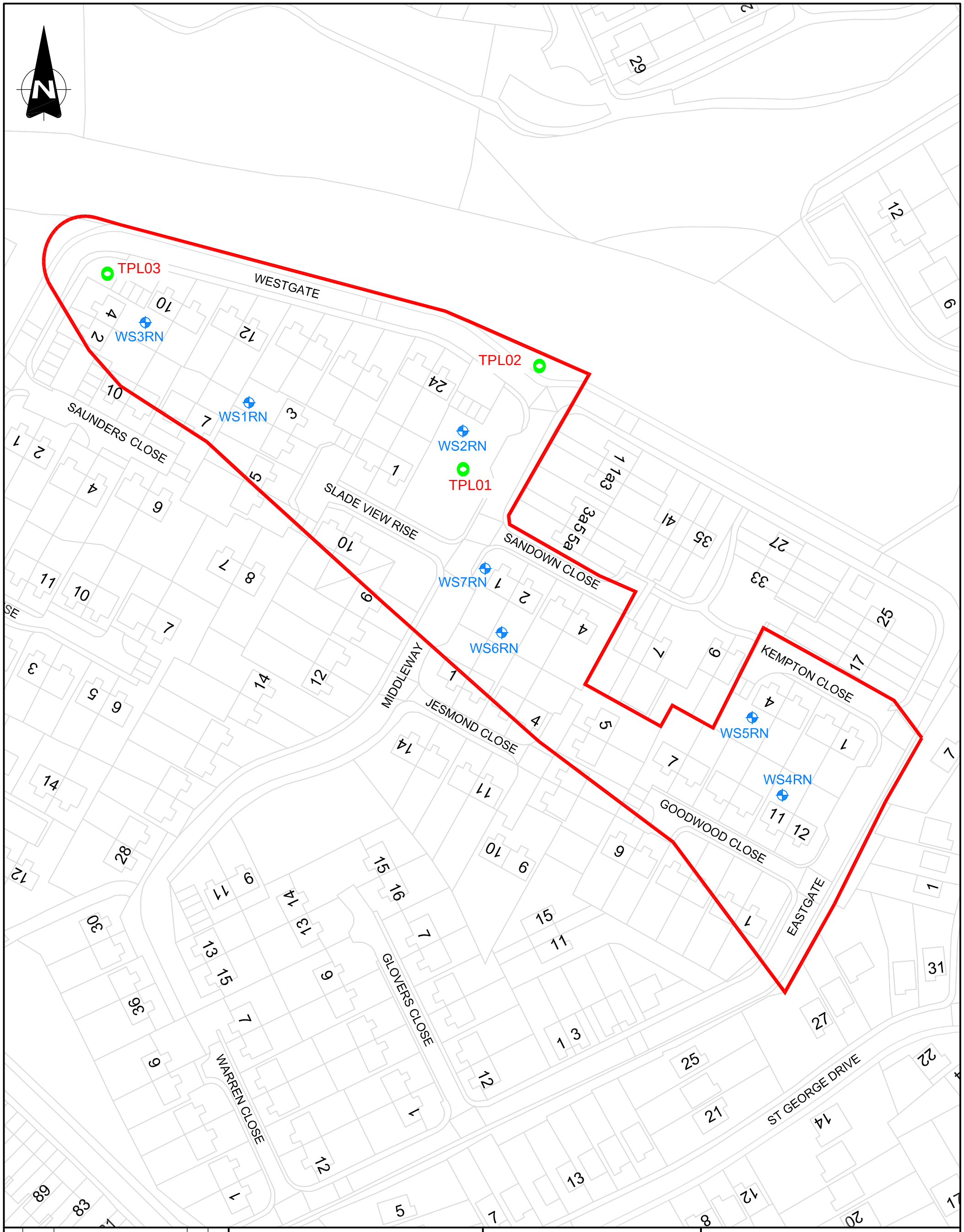
1 Taken from Table 6.3, CIRIA report 552 (Contaminated Land Risk Assessment – A Guide to Good Practice. Severity classified as minor, mild, medium or severe. Probability classified as unlikely, low, likely or high. Overall risk considers both the severity and probability of the linkage (very low, low, moderate, high or very high). See Appendix F for further details

6 SUMMARY AND CONCLUSION

- Review of historical mapping and EA records provided to Cannock District Council, plus anecdotal evidence obtained during public consultation, identified that land north of Rawnsley, near Hednesford, Staffordshire was infilled with unknown material which potentially posed a risk to human health and controlled waters.
- An initial investigation identified up to 2.9m of Made Ground, consisting of sand, clay and gravel, and including burnt shale, fabric, mudstone, coal, quartz, concrete and brick. No evidence of municipal waste material was encountered. The Made Ground was underlain by Coal Measures strata, comprising predominantly clay and mudstone. Groundwater was not encountered during drilling; exploratory holes reached a maximum depth of 5m bgl.
- The investigation identified that concentrations of metals in one sample of Made Ground slightly exceeded generic human health screening criteria. However, upon statistical assessment of the dataset and consideration of the conservatism associated with the generic screening values, it was concluded that the concentrations of contaminants beneath the site are unlikely to pose a significant possibility of significant harm to human health.
- Low permeability materials (clay and mudstone) were identified beneath the made ground in the two boreholes which reached a depth beyond 2m. This soil is likely to significantly restrict the leaching of contaminants from the made ground to the Coal Measures secondary aquifer, and thus possible migration to off-site surface watercourses and the AONB. Leachability testing identified low concentrations of leachable metals and PAHs. Therefore, the made ground is not considered to pose a significant possibility of significant harm to controlled waters and the AONB.
- Concentrations of several chemicals in the soil exceeded conservative screening criteria adopted for the protection of water pipework. Sampling of drinking water quality at consumers' taps identified that dissolved contaminant concentrations were all below UK drinking water standards. No further assessment is proposed.
- Generally low gas concentrations have been recorded, and some monitoring events have been undertaken during favourable gas generation pressure conditions. No further assessment is proposed.
- In obtaining soil samples for leachability testing, asbestos containing material (ACM0 was found in one sample of made ground, taken from a grassed open space area. Five further samples of made ground taken from the same area of the site did not contain ACM or "free" asbestos fibres. While the risk posed to residents and maintenance staff cannot be defined as zero, the low abundance of fibres indicated suggests that a SPOSH is unlikely to be posed to human health.

On the basis of the data obtained to date, the preceding assessment and the limitations listed in Appendix B, we consider that the site is unlikely to meet the definition of Contaminated Land under Part 2A of the Environmental Protection Act 1990. No further work is proposed.

DRAWINGS



A	08/02/11	First Issue	PSN	GVT
No.	Date	Revision	By	Chk

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File Ref : 103912-005	Drawing No : 103912-005		
Original Size: 420x297 - A3	Scale : 1:1000	Rev : A	

KEY:

STUDY SITE BOUNDARY

WS1 WINDOW SAMPLER

Leachate samples 16/09/11

Client / Project

Cannock Chase Council

Title

EXPLORATORY HOLE LOCATION PLAN

Drawing Status

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APPENDIX A

Cannock Chase District Council

Environmental Protection Act 1990 Part IIA: Initial Desktop Study and Site Walkover

Landfill site north of Rawnsley

January 2010

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FIGURES

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APPENDICES

1 INTRODUCTION

1.1 Terms of Reference

In January 2010, Grontmij Limited (Grontmij) was appointed by Cannock Chase District Council (the Council) to assist in the implementation of the Council's Contaminated Land inspection strategy. Part IIA of the Environmental Protection Act 1990 (Part IIA) requires each local authority to inspect areas of land which it believes may be Part IIA Contaminated Land.

The scope of work agreed between Grontmij and the Council included:

- Prioritisation of an initial list of potentially contaminated sites for intrusive investigation work, based upon the sensitivity of each site, using limited existing desktop study data provided by the Council, and
- Production of desktop study reports for priority sites, to improve understanding of the sites ground conditions and inform the planning of intrusive site investigations.

This report presents the findings of a desktop study for a site located in Rawnsley, near Hednesford, Staffordshire.

The site comprises an area of land which appears to have been an historic landfill. The site is considered to be sensitive as residential properties with gardens and part of a children's playground overly the inferred extent of landfill, the site is underlain by a minor aquifer with a watercourse 25m to the north-east, whilst a nature reserve exists 200m to the north-east.

This report is subject to the limitations presented in Appendix B.

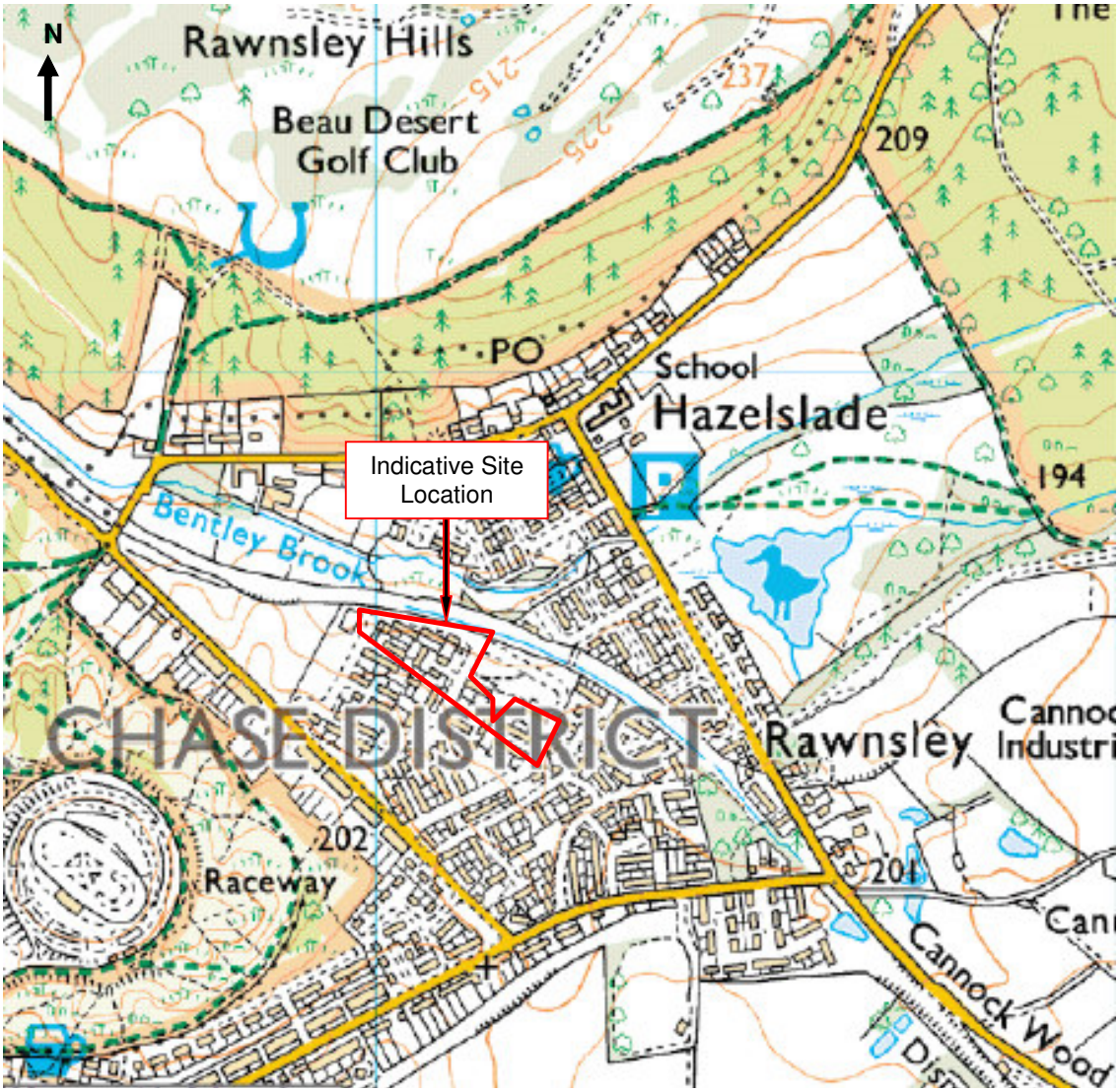
2 SITE SETTING

The site's setting and location are summarised in Table 2.1, Figure 2.1 and Drawing 1.

Table 2.1 – Site Setting

Data	Information
Address	Landfill site North of Rawnsley, near Hednesford, Staffordshire, WS12 0JS
Current site use	Residential houses and gardens; part of a children's playground
Grid Reference	Located around 402125, 312564
Site Area	Approximately 1.6 ha
Topography	Sloping generally towards the north-east
Surrounding land use	The site is surrounded by residential land with open ground to the west of the site
Geology	British Geological Survey (BGS) 1:63,360 scale map sheet 154 (Lichfield) and the BGS website Geoindex tool indicate Pennine Middle Coal Measures Formation consisting of mudstone, siltstone and sandstone. No superficial deposits are indicated
Hydrogeology	The Pennine Middle Coal Measures are classified by the Environment Agency as a minor aquifer with a low permeability (and therefore leaching potential) soil classification. Although minor aquifers will seldom produce large quantities of water for abstraction, they are important for both local supplies and supplying base flow to rivers. Soils which are classified as low permeability are soils in which pollutants are unlikely to penetrate the soil layer because either water movement is largely horizontal, or they have the ability to attenuate diffuse pollutants. Lateral flow from these soils may contribute to groundwater recharge elsewhere in the catchment
Source Protection Zones (SPZs)	The Environment Agency website indicates that the site is not located within a SPZ
Surface Waters	An unnamed stream is indicated 25m to the north-east (down topographic and inferred hydraulic gradient) of the site, whilst Bentley Brook is indicated 50m also to the north-east
Historical Land Use	Information provided indicates the site formerly operated as a landfill, which was subsequently developed as residential housing. No further information about the types of waste accepted and duration of operation is available

Figure 2.1 – Site Location



Reproduced from Ordnance Survey Map under licence AL549878 with permission from the Controller of HMSO, © Crown Copyright
Plan is not to scale.

3 SUMMARY OF AVAILABLE SITE INVESTIGATION DATA

A summary of existing investigation reports is provided below. The data held by the council is included as Appendix A.

3.1 Scope of Investigations

3.1.1 Rawnsley 3 Site Investigation

A site investigation was undertaken in 1997 by H.B. Boring and Company Limited at a site designated Rawnsley 3 (adjacent, to the north-east of the study site – see Drawing 1). Rawnsley 3 and the study site are both located above a former landfill site, as recorded on Envionment Agency records, therefore conditions at Rawnsley 3 may be representative of the study site. The purpose of the investigation appears to have been geotechnical and contamination assessment with subsequent gas monitoring. The investigation included the following:

- Gas monitoring at three borehole locations
- Retrieval of 4 soil samples with basic contamination testing, exact location unknown

3.1.2 Rawnsley 4 Site Investigation

A site investigation was carried out on 12th of March and 3rd April 1997 by H.B. Boring and Company Limited, at the site designated Rawnsley 4 (adjacent, to the south, of the study site – see Drawing 1). Rawnsley 4 is not located above the extent of former landfilling recorded by the Environment Agency, but ground gas conditions beneath this site may be indicative of conditions beneath the study site. .The purpose of the investigation appears to have been geotechnical assessment and subsequent gas monitoring. The investigation included the following:

- Advancement of five 150mm diameter boreholes to 4.4m bgl and two 125mm boreholes to 31.5m bgl
- Installation of gas monitoring wells

3.2 Investigation Results

3.2.1 Ground Conditions , Evidence of Contamination and Chemical Analysis Summary

Made Ground comprising gravel, brick, ashy sandy clay, fine silty clay with fine gravel of brick and red shale was recorded at Rawnsley 3. Subsequent chemical analysis indicates that contaminant concentrations do not exceed current SGVs/GAC for a residential end use. However, the analytical suite was not extensive (e.g. no polyaromatic hydrocarbons or total petroleum hydrocarbons) and there is evidence of possible contamination at the site from a review of the soil descriptions.

The ground conditions encountered at Rawnsley 4 comprised a variable shallow Made Ground layer, underlain by argillaceous rocks (completely weathered to soil at shallow depth). No chemical analysis was undertaken.

3.2.2 Rawnsley 3 Site Investigation Ground Gas Monitoring

Gas monitoring at Rawnsley 3, as presented below, identified a maximum carbon dioxide concentration of 3.4% v/v, suggesting the ground is generating hazardous gases. Flow rates were not recorded. Methane was not detected. .

Table 3.1 – Gas Monitoring Data at Rawnsley 3

Borehole No.	Date	CH_4 (%)	O_2 (%)	CO_2 (%)	Atmospheric Pressure (mB)	Groundwater (m bgl)	CIRIA Characteristic Situation
2	21/01/97	0.0	19	0.8	1010	3.7	No flow data available so unable to calculate
	29/03/97	0.0	19.3	0.8	1009	3.8	
	15/05/97	0.0	17.8	1.7	1001	1.45	
5	21/01/97	0.0	15.9	0.4	1010	2.5	
	29/03/97	0.0	16.3	0.3	1009	2.55	
	15/05/97	0.0	16.4	3.4	1000	1.47	
8	21/01/97	0.0	14.8	0.4	1010	2.15	
	29/03/97	0.0	14.5	0.4	1009	2.15	
	15/05/97	0.0	17.9	2.8	1002	1.65	

CIRIA Characteristic Situation based on methodology presented in CIRIA Report C665.
CH_4 – methane; O_2 – oxygen; CO_2 carbon dioxide; CO – carbon monoxide;
H_2S – hydrogen sulphide; mbgl – metres below ground level mB – millibars

Specific details of monitoring undertaken are not available, however a summary paragraph held in the council's archive indicates that carbon dioxide concentrations in excess of 5% were recorded. Flow rates were not recorded.

3.2.3 Regulatory Liaison

No planning consents were issued at the site after 1994, however the plot of land directly adjacent to the north-east of the site was granted planning approval in 2000, subject to a condition requiring a site investigation and report to be submitted to the council, and a remediation statement to be produced as necessary. However, there are no records of any site investigation or remediation works being undertaken.

4 PRELIMINARY CONCEPTUAL MODEL

4.1 Introduction

This section of the report presents a preliminary contaminated land assessment, on the basis of the available desktop data. The assessment presents an evaluation of the potential risks posed, should contaminants be present in the soil or groundwater beneath the site.

In the context of the Environmental Protection Act 1990 (EPA90), the Water Act 2003 and associated guidance[1,2], a preliminary (contaminated land) risk assessment should focus on whether the land at a subject site meets the statutory definition of Contaminated Land. Part IIA of the EPA90, as amended by the Water Act 2003, defines Contaminated Land as:

- *"any land which appears to the local authority in whose area it is situated to be in such condition by reason of substances in, on or under the land, that:*
- *significant harm is being caused or there is a significant possibility of significant harm being caused; or*
- *significant pollution of controlled waters is being caused or there is significant possibility of such pollution being caused*

The procedure for assessing contaminated land involves the development of a Conceptual Site Model (CSM) comprising the assessment of potential contaminants, pathways and receptors.

4.1.1 Sources of Contaminants

The "contaminants" term in the CSM has been evaluated by inspection of existing desktop study data provided by Cannock Chase District Council, and a preliminary site walkover. The following potential sources of contaminants have been identified:

- An area of infilled land which could contain contaminants including (but not limited to) metals, hydrocarbons, PAHs and possibly volatile and semi-volatile organic compounds (VOCs and SVOCs, respectively)
- Elevated concentrations of ground gases (including carbon dioxide, as evidenced in the investigation, and also possible methane, H2S and CO) from decomposition of any deleterious or combustible material within the Made Ground material

[1] CLR11 Model Procedures for the Management of Land Contamination (EA & DEFRA September 2004)
[2] DEFRA Circular 02/2006, Environmental Protection Act 1990: Part IIA Contaminated Land:, September 2006.

4.1.2 Receptors

DEFRA Circular 02/2006 defines a Receptor as:

- *"either (a) a living organism, a group of organisms, an ecological system or a piece of property which (i) is in a category listed in Table A as a type of receptor, and (ii) is being, or could be, harmed, by a contaminant; or (b) controlled waters which are being, or could be, polluted by a contaminant".*

Table 4.1 lists all of the receptors to be considered by a Part IIA or PPS23[3] assessment, and assesses whether the receptors are likely to be present at the site.

Table 4.1 - Potential Receptors

Receptor Type	Receptors	Present (✓ / X)	Notes
Humans	On-site residents	✓	Residential properties (houses and gardens) above indicated extent of landfill, assumed to have vegetable patches
	Construction staff and site investigation personnel	X	No known redevelopment proposed
	Future occupants of the site	X	Level of risk same as current residents so not requiring separate assessment
	Off site commercial workers or residents	✓	Present, but risk likely to be lower than to on-site residents, so not considered further
Ecosystems	Any designated ecological system[4], or living organism forming part of such a system	✓	Nature reserve approximately 200m east of the site, an ecologically designated site. However this is not considered a realistic receptor given its distance from the site
Property (Flora and Fauna)	Crops, including timber	X	Not present
	Produce grown domestically, or on allotments for consumption	✓	Vegetables grown in residential gardens.
	Livestock	X	Not present
	Other owned or domesticated animals	✓	Pets in gardens
	Wild animals which are the subject of shooting or fishing rights	X	Not present
Property (Buildings & Structures)	A 'building' means any structure, including any part below ground level, but does not include plant or machinery within a building.	✓	Residential houses above indicative extent of landfill
Controlled Waters[1]	Territorial waters	X	None feasibly close enough to be impacted
	Coastal waters	X	None feasibly close enough to be impacted

[3] Planning Policy Statement (PPS) 23: Planning and Pollution Control, Annex 2: Development on Land Affected by Contamination
[4] Includes sites designated as SSSI or National Nature Reserve by the Wildlife and Countryside Act 1981, Special Area of Conservation (including candidate sites), Special Protection Area or Ramsar Site by the Conservation (Natural Habitats etc) Regulations 1994, and Local Nature Reserve by the National Parks and Access to the Countryside Act 1949.

Receptor Type	Receptors	Present (✓ / X)	Notes
	Inland Freshwaters	✓	An unnamed stream located 25m to the north-east of the site and Bentley Brook 50m to the north-east
	Groundwater	✓	Pennine Middle Coal Measures, beneath site, is classified as a minor aquifer

[1] as defined in the Water Resources Act Section 104. Generally includes most surface water bodies excluding drains which discharge into sewers.

4.1.3 Pathways

DEFRA Circular 02/2006 defines a Pathway as:

- *"one or more routes or means by, or through, which a receptor: (a) is being exposed to, or affected by, a contaminant; or (b) could be exposed or affected"*

Pathways are examined as part of Table 4.2, overleaf.

4.1.4 Potential Pollutant Linkages

The pollutant linkages identified are also presented in Table 4.2.

Table 4.2 - Potential Pollutant Linkages

No.	Receptor	Contaminant(s)	Pathway(s)	Risk of Pollutant Linkage Being Realised	Comments
Human Health					
1	Residents of properties above infilled ground	Including (but not limited to) metals, hydrocarbons, PAHs, VOCs, SVOCs within Made Ground	Dermal contact and direct ingestion, inhalation of dust/vapours, consumption of home-grown vegetables	Medium to high risk	Grass and/or topsoil coverage likely to mitigate risk to an extent – risk is greatest where possibly impacted soils are exposed or could be encountered, for example, when digging a vegetable patch
2		Elevated ground gases from decomposition of deleterious elements within Made Ground	Migration into residential properties, with subsequent asphyxiation and explosion risk	Medium to high risk	Investigation and monitoring required to determine risk
Property					
3	Subsurface services serving the buildings (principally water supply)	Including (but not limited to) metals, hydrocarbons, PAHs, VOCs, SVOCs within Made Ground	Chemical attack and tainting of water supply could occur at high contaminant concentrations / severe pH levels	Medium risk	Risk will depend on depth and concentration of contaminants and material(s) used for water pipes
4	Property (structures); sub-surface concrete	Sulphate and pH	Contact between contaminants and concrete	Medium risk	Risk could only reasonably be established if concrete class used to construct buildings can be established (unlikely). Hence suggest that any further assessment should be focused on new structures/buildings as part of development / planning process
Controlled Waters					

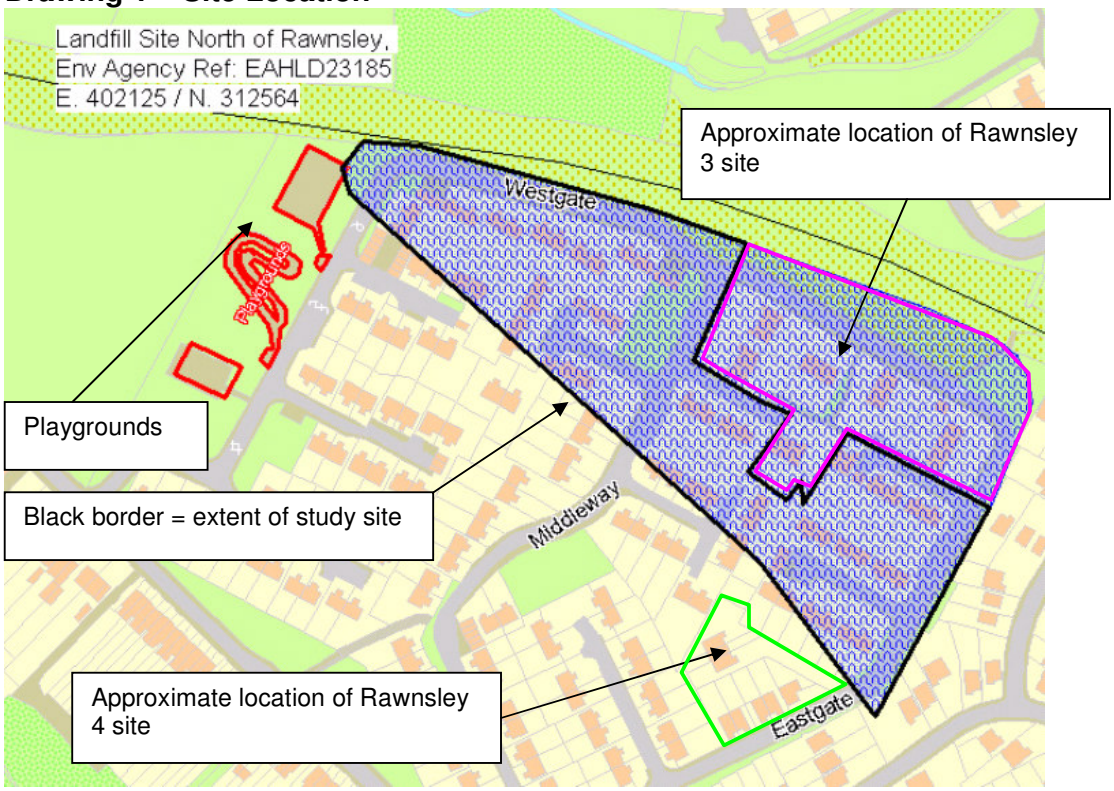
No.	Receptor	Contaminant(s)	Pathway(s)	Risk of Pollutant Linkage Being Realised	Comments
5	Minor aquifer (Coal Measures) beneath site	Including (but not limited to) metals, hydrocarbons, PAHs, VOCs, SVOCs within Made Ground	Leaching of contaminants to aquifer from overlying Made Ground	Medium risk	Ground investigation required to determine risk as depends on several factors including contaminant concentrations within Made Ground, depth of aquifer beneath the site, presence/absence of confining layers between the Made Ground and aquifer, leaching potential
6	Unnamed stream 25m to the north-east	Including (but not limited to) metals, hydrocarbons, PAHs, VOCs, SVOCs within Made Ground	Lateral contaminant migration within shallow groundwater	Medium risk	Ground investigation required to determine risk as depends on several factors including depth/presence of impacted groundwater and hydraulic continuity between impacted groundwater and stream

5 CLOSING REMARKS

Potential pollutant linkages providing human risks to on-site residents, risks to controlled waters and property have been identified at the site, and therefore an initial intrusive investigation should be undertaken to examine the likelihood of these potential linkages.

DRAWINGS

Drawing 1 – Site Location



APPENDIX A
of desk study

PLOTS 25-32 RAWNSLEY 4

1.0 INTRODUCTION.

On the instructions of Cannock Chase District Council a ground investigation has been undertaken by H.B. Boring and Company Limited at a site designated Rawnsley 4 which is being considered for residential development.

The geotechnical report of the investigation includes all factual records of the fieldwork and laboratory testing carried out together with the interpretation with respect to the proposed use of the land.

2.0 DESCRIPTION OF SITE.

This is located within an existing development of residential housing and occupies a shallow sloping parcel of land on the south east side of the housing area, Ordnance Survey Sheet 128. Grid Reference SK 022125 as shown on Site Location Plan Figure 1.

3.0 THE PROPOSAL

It is understood that Cannock Chase District Council are considering the disposal of the land for infill housing.

For the purpose of this report it is assumed that the proposed development will be of two storey dwellings similar to the surrounding existing houses.

4.0 FIELDWORK.

4.1. Scope of Work.

Ground and groundwater conditions were determined by drilling boreholes using light cable percussion and rotary drilling techniques, carrying out in-situ tests, obtaining disturbed and undisturbed and recording measurements of groundwater behaviour.

The fieldwork and compilation of this report has been undertaken in general accordance with the recommendations given in BS5930 : 1981 " A Code of Practice for Site Investigations".

Exploratory hole locations are shown on the Borehole Location Plan, Figure 2.

4.2 Cable Percussion Boreholes

The boring was carried out in two parts:-

a) Five 150mm diameter boreholes were drilled using light cable percussion techniques to depths of up to 4.40m below existing ground levels during the period 26th to 27th November 1996.

b) Two 125mm diameter boreholes were drilled using rotary open hole techniques to depths of up to 31.50m below existing ground level on 12th March and 3rd April 1997.

In the cable percussion boreholes Standard Penetration tests were performed in fill and weathered bedrock materials at 1.00 metre depth intervals together with the taking of small disturbed and large bulk disturbed samples of soil.

In cohesive soil materials undisturbed U100 samples were obtained.

In the rotary open holes samples of the flush materials were taken in the upper soil and rock layers.

Full details of the strata encountered, sampling and in-situ testing are presented on the Borehole Records.

5.0 LABORATORY TESTING.

The following testing was scheduled to provide information on:-

a) Moisture content and plasticity tests for general classification purposes.

b) Triaxial tests on undisturbed cohesive soil samples for measurement of undrained shear strength and assessment of bearing capacity.

c) Consolidation tests on undisturbed cohesive soil samples for measurement of compressibility and assessment of potential settlements.

d) Chemical tests on disturbed soil samples for measurement of pH/Sulphate and assessment of potential attack on buried concrete.

The testing was carried out in accordance with BS1377 : 1991 *"Methods of Test for Soil for Civil Engineering Purposes"*.

6.0 GROUND AND GROUNDWATER CONDITIONS

6.1 Published Information

Reference to British Geological Survey Sheet 154. "*Lichfield*" indicates the presence of rocks of the Middle Coal Measures of Carboniferous age. Underground faults are shown in the vicinity indicating that coal has been worked in the area.

No superficial drift deposits are shown.

6.2 Subsoil Profile

The results of the cable percussion boreholes indicate that beneath a variable surface veneer of fill materials. the site is underlain by typically argillaceous rock types which have been completely weathered to soil type materials in their upper layers.

The fill materials generally contain clay and brick, are soft/loose and up to approximately 0.50m thick.

The underlying completely weathered rock materials are generally clayey, of high plasticity and increasing strength with depth becoming typically stiff/very stiff at approximately 1.50m depth.

6.3 Coal Mining

A report has been obtained from The Coal Authority which is appended to this report.

The rotary open holes were sunk to check for the presence of coal seams beneath the site and the existence of voids in any workings which could affect the overall stability of the site.

The two boreholes appear to show different successions of rock types with depth although both encountered intact coal seams up to 1.50m thick. This may indicate that there is a fault between the two boreholes.

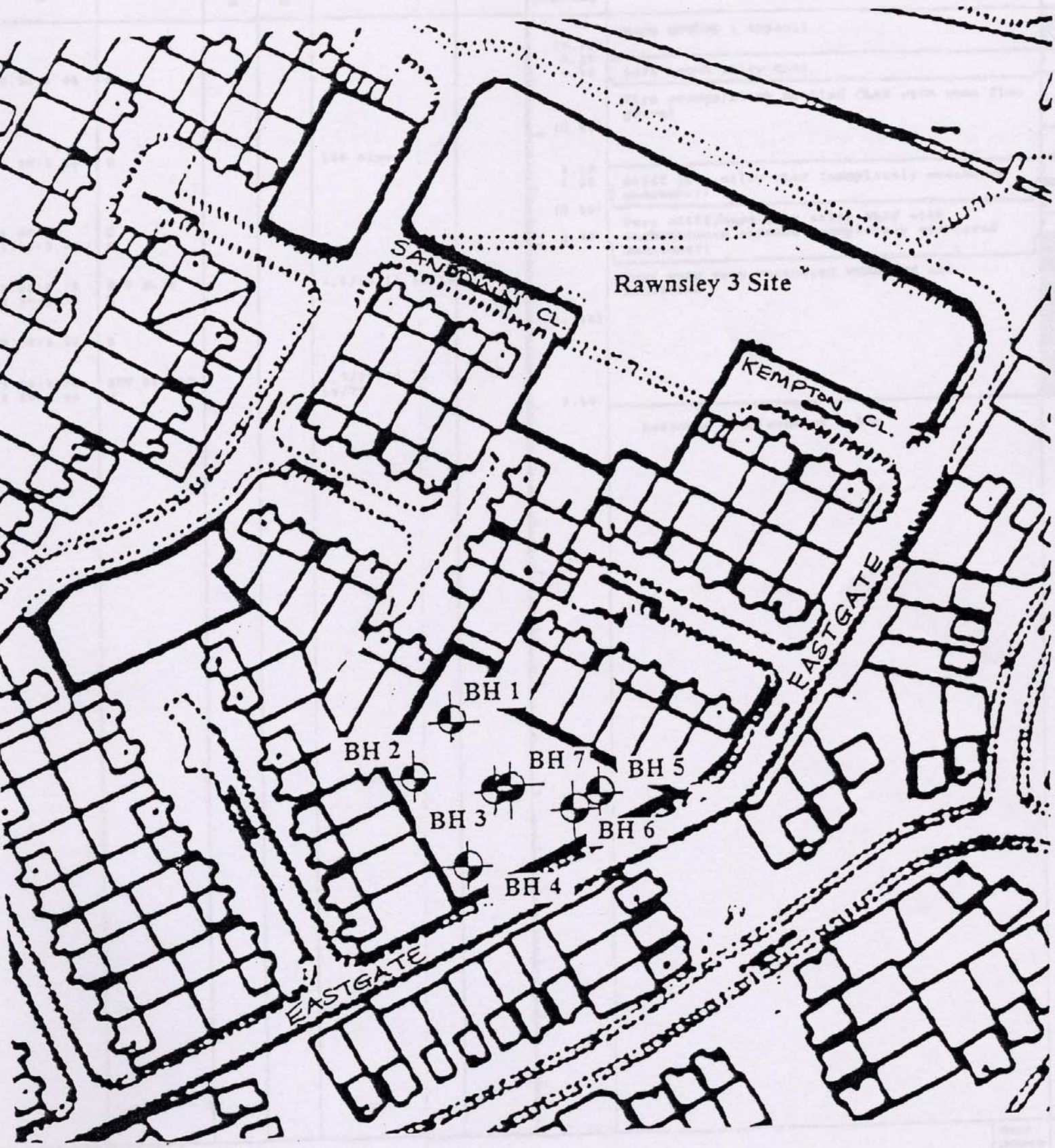
Due to the depth of the major coal seams and possible faulting. it has been assumed for the purposes of this report that the site is stable and unaffected by potential collapse of shallow workings.

6.4 Groundwater.

Isolated quantities of groundwater were encountered during drilling operations in the weathered rock materials.

H.B. Boring & Co. Ltd.

ontract. Rawnsley 4	Contract No: C97/647
lient. Cannock Chase Council	Scale:



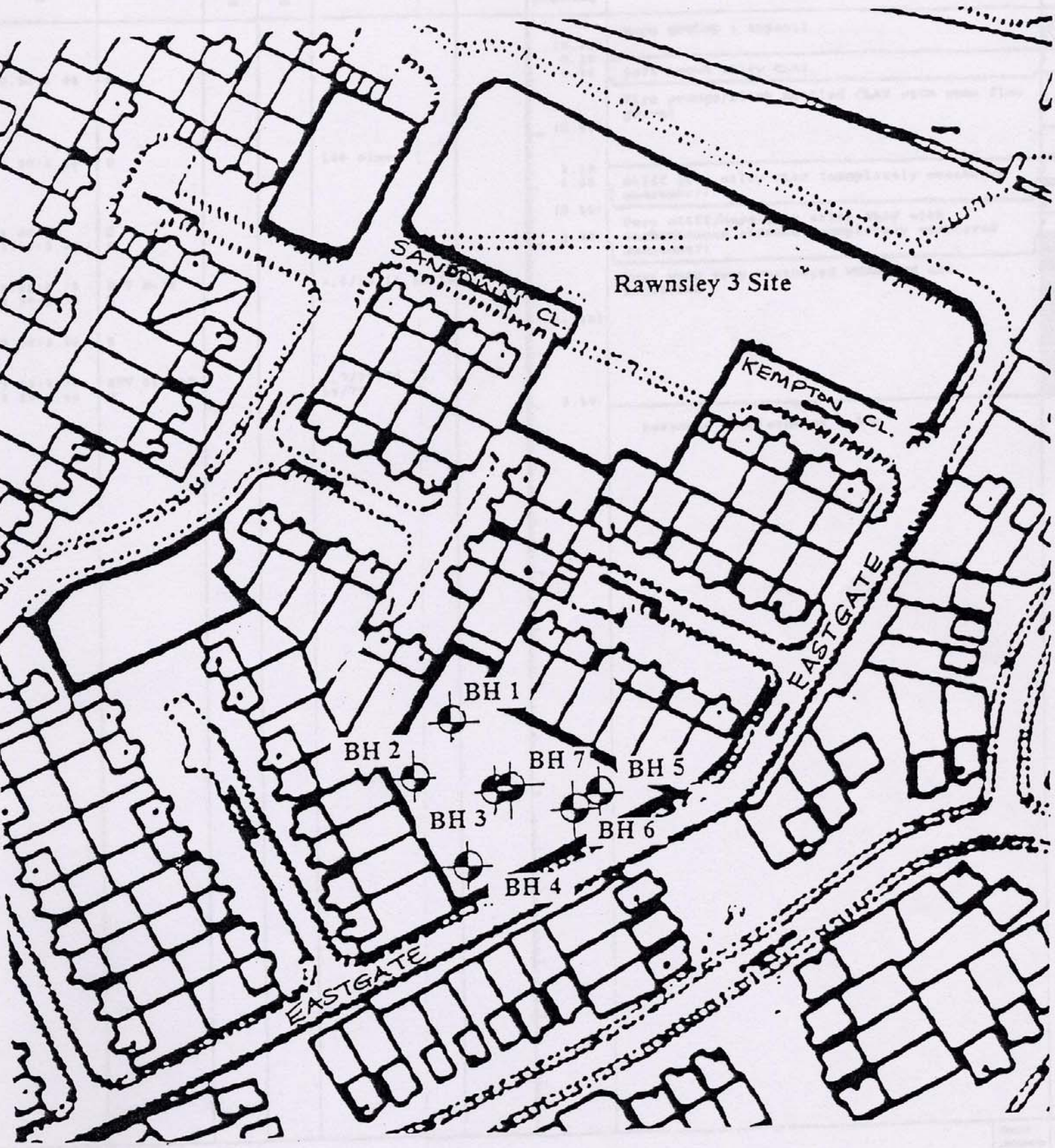
Borehole Location Plan

Figure:

2

H.B. Boring & Co. Ltd.

ontract. Rawnsley 4	Contract No: C97/647
lient. Cannock Chase Council	Scale:



Borehole Location Plan

Figure:

2

NRN

H·B BORING & COMPANY LTD

SITE INVESTIGATION SPECIALISTS

H. B. BORING & CO LIMITED
GEOTECHNICAL HOUSE
575 MANCHESTER ROAD
BLACKROD
BL6 5RU

TELEPHONE 01942 842882
FAX 01942 842883

passed to JC DDS Planning Client

Cannock Chase Council
Civic Centre
P.O. Box 28
Beecroft Road
Cannock
Staffordshire
WS11 1BG

22nd May 1997

For the attention of **Warren Beard**

Dear Sirs

Re : Rawnsley 3 & 4 Sites - Gas Monitoring.

Further to our recently submitted reports on the above sites we add the following comments with respect to soil gas conditions:-

a) Rawnsley 3 Plots 1 → 24

Gaswells were installed at this site in response to the presence of very shallow coal seams, the possibility of workings and hence methane gas.

As indicated in the report, monitoring has continued and the latest readings while still showing the absence of methane now indicate elevated levels of carbon dioxide. (see attached sheet).

The Building Regulations state that above 1.5% by volume in the ground there is a need to consider possible measures to prevent gas ingress in to buildings (see Approved Document C paragraph 2.10).

Design guidance is given within BRE Report 212 *" Construction of new buildings on gas contaminated land"*.

RAWNSLEY 3 SITE

Borehole No.	Date	CH4 0%	CO2 0%	O2 0%	Atmospheric Pressure Mb	Ground Water m bgl
2	21.01.97	0.0	0.8	19.0	1010	3.70
2	29.03.97	0.0	0.8	19.3	1009	3.80
2	15.05.97	0.0	1.7	17.8	1001	1.45
5	21.01.97	0.0	0.4	15.9	1010	2.50
5	29.03.97	0.0	0.3	16.3	1009	2.55
5	15.05.97	0.0	3.4	16.4	1000	1.47
8	21.01.97	0.0	0.4	14.8	1010	2.15
8	29.03.97	0.0	0.4	14.5	1009	2.15
8	15.05.97	0.0	2.8	17.9	1002	1.65

Company Reg. No.152

GEOTECHNICAL &

ENVIRONMENTAL

ENGINEERING

Your Ref :

Westbury Homes Ltd
Pendeford House
Pendeford Office Park
Wobaston Road
Wolverhampton WV9 5WH.

20th October 1999

For The Attention of : Sat Kalirai

Dear Sirs,

Eastgate, Rawnsley, Cannock.

We have pleasure in enclosing the results of the tests carried out on the samples taken by us for testing. The tests were carried out, and are reported, in accordance to the requirements of the methods stated on the following pages.

Any samples or residue will be retained for a minimum of two weeks from the date of issue of this report. Should you require a variation of this, which is our standard minor sample retention period, we reserve the right to charge a storage fee, subject to negotiation.

The client is advised to ensure that the number of samples taken, the degree of contamination from other sources, and the test methods specified are appropriate to the mass of material to be assessed.

We trust these results meet with your requirements and assure you always of our best services.

Yours faithfully,
for DTS Technology Ltd.

DTS Technology Ltd
Moor Lane, Witton
Birmingham B6 7HG
Tel: 0121 344 3826

TIONAL GAS TESTING MONITORING REPORT

Ground Investigation

at

Rawnsley 4, Cannock

plots 25

Addendum Report

tory Test Results

Contract Name **Eastgate, Rawnsley, Cannock.**

Date of Sampling **15th October 1999**

gineering Sample Description

Sample	Depth (m)	Type	Description
S1	0.60 - 0.75	Bag	FILL - Soft brown mottled yellow sandy cla with fine gravel of brick and red shale. 2m from house parking bay 20m from road i (5 holes in centre of area aborted at around 1 on suspected old hardstanding)
S2	0.50 - 0.60	Bag	FILL - friable dark brown ashy sandy clay w a little fine gravel of red shale. Third back from path, centre of narrow sect
S3	0.55 - 0.75	Bag	FILL - soft to firm yelllow brown silty clay fine gravel of brick and red shale. 15m from bottom road, 25m from side road.
S4	0.60 - 0.75	Bag	Soft to firm light grey laminated yellow bro silty CLAY with black partings. 5m from fence, 10m from road footpath.

The results of the tests carried out on the samples are given in appendix one of thi

Analysis Results Carried Out On Soil Samples

Contract Name **Eastgate, Rawnsley, Cannock**

Contract Number **99J49**

ICRCL 59/83 Group A Contaminants which may pose a hazard to health

Sample Identification			S1	S2	S3	3S4			
DTS Sample Number			99/6080	99/6081	99/6082	99/6083			
Arsenic	as As	mg/kg	12	16	10	13			
Cadmuim	as Cd	mg/kg	< 0.50	0.50	< 0.50	< 0.50			
Chromium Hexavalent	as Cr	mg/kg	~	~	~	~			
Chromium (Total)	as Cr	mg/kg	51	56	52	47			
Lead	as Pb	mg/kg	47	131	50	60			
Mercury	as Hg	mg/kg	0.10	< 0.10	< 0.10	< 0.10			
Selenium	as Se	mg/kg	1.1	1.9	2.3	1.0			

ICRCL (59/83) Group B Contaminants which are phytotoxic but not normally hazardous to health

Boron (Water Soluble)	as B	mg/kg	1.2	1.3	2.1	1.5			
Copper	as Cu	mg/kg	38	49	48	39			
Nickel	As Ni	mg/kg	20	29	28	19			
Zinc	As Zn	mg/kg	93	152	120	83			

ICRCL 59/83 Table 4 Contaminants associated with former coal carbonisation sites

PAH (Sum 16 Priority Pollutants)		mg/kg	~	~	~	~			
Phenols	as C_6H_5OH	mg/kg	< 1	1.5	1.5	1.1			
Free Cyanide	as CN	mg/kg	~	~	~	~			
Complex Cyanides	as CN	mg/kg	~	~	~	~			
Thiocyanates	as CN	mg/kg	~	~	~	~			
Sulphate (Acid Sol.)	as SO_4	mg/kg	400	610	1,680	530			
Sulphide	as S	mg/kg	< 10	< 10	< 10	< 10			
Elemental Sulphur	as S	mg/kg	< 50	< 50	< 50	< 50			
Acidity (pH)	~	~	8.0	8.0	7.5	6.5			

Other Determinands

Total Cyanide	as CN	mg/kg	< 5	< 5	< 5	< 5			
Toluene Extractable Matter		mg/kg	~	~	~	~			
Soluble Sulphate	as SO_4	g/l	~	~	~	~			
Total Petroleum Hydrocarbons		µg/kg	~	~	~	~			
as Petrol		µg/kg	~	~	~	~			
as Kerosene		µg/kg	~	~	~	~			
as Diesel		µg/kg	~	~	~	~			
as Mineral Oil		µg/kg	~	~	~	~			
Plotting Symbol			◆	■	▲	+			

DTS Technology Ltd Moor Lane Witton Birmingham B6 7HG
Phone 0121 344 3826 Fax 0121 344 4757 **email** rjc@dtstechnology.co.uk

ADDENDUM REPORT

RAWNSLEY 4

oduction

to the main investigation report, gas wells were installed at the site
nitored for the presence of methane and/or carbon dioxide.

ults of Monitoring

ing to date has not indicated the presence of methane although con
s of 5.0% of carbon dioxide have been noted.

ce to The Building Regulations Approved Document C, 1991 indica
tion specific design measures are necessary to prevent the ingress o
s.

ommendations

guidance on design measures is given in BRE Report 212 "*Constru
dings on gas contaminated land*".

.2 of the main report indicated that on the basis of the apparent thi
ials across the site that groundbearing floorslabs could be used and
it may be appropriate to protect structures utilising a gas-proof me
on with a reinforced concrete floorslab above a granular layer as op
l sub-floor void requiring a suspended floorslab.

ing & Company Limited

APPENDIX B
of desk study

Appendix B: Limitations Statement

1. This report has been prepared for the exclusive use of Cannock Chase District Council and copyright subsists with Grontmij Limited. Prior written permission must be obtained to reproduce all or part of the report.

2. This report and/or opinions have been prepared for the specific purpose stated in the document. The recommendations should not be used for other schemes on or adjacent to the site without further reference to Grontmij Limited.

3. Observations were made of the site and of structures on the site as indicated within the report.

4. Grontmij has relied upon the existing data provided by Cannock Chase District Council to be accurate, and has not taken steps to independently check the accuracy of the data provided.

5. Our interpretation of any regulatory database information (including the MAGIC and British Geological Survey websites) assumes that the data provided is accurate. A disclaimer provided by database search companies is as follows: '…the data is derived from historical sources or information available in public records or from third parties and is supplied to us without warranty by data suppliers and we cannot warrant the accuracy or completeness of the data or the reports.' We cannot therefore accept any responsibility for the accuracy of the data used in this study, only that its interpretation has been carried out with due skill, care and diligence.

APPENDIX B

Appendix B: Limitations Statement

1. This report has been prepared for the exclusive use of Cannock Chase District Council and copyright subsists with Grontmij Limited. Prior written permission must be obtained to reproduce all or part of the report.

2. This report and/or opinions have been prepared for the specific purpose stated in the document. The recommendations should not be used for other purposes or adjacent sites without further reference to Grontmij Limited.

3. Observations were made of the site and soil arisings as indicated within the report. Where access to portions of the site was unavailable or limited, Grontmij Limited renders no opinion as to the environmental status of such parts of the site.

4. Grontmij has relied upon the existing desktop study data provided by Cannock Chase District Council to be accurate, and has not taken steps to independently check the accuracy of the data provided.

5. Our interpretation of any regulatory database information (including the MAGIC and British Geological Survey websites) within an earlier report, and relied upon in this report, assumes that the data provided is accurate. A disclaimer provided by database search companies is as follows: ' the data is derived from historical sources or information available in public records or from third parties and is supplied to us without warranty by data suppliers and we cannot warrant the accuracy or completeness of the data or the reports.' We cannot therefore accept any responsibility for the accuracy of the data used in this study, only that its interpretation has been carried out with due skill, care and diligence.

6. The conclusions and recommendations submitted in this report are based in part upon the data obtained from soil samples from exploratory holes. The nature and extent of variations between the exploratory holes is inferred in the report and could only be confirmed by further investigation. If variations or other latent conditions become evident, it will be necessary to re-evaluate the recommendations of this report.

7. The generalised soil profile described in the text is intended to convey trends in sub-surface conditions. The boundaries between strata are approximate and idealised and have been developed in interpretations of widely spaced explorations and samples; actual soil transitions may be more gradual. For specific information, refer to the exploration logs.

8. Water levels and/or gas readings have been taken in the borings and/or observation wells at times and under conditions stated on the exploration logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater or gas may occur due to variations in rainfall, atmospheric pressure and other factors different from those prevailing at the time the measurements were made.

9. The conclusions and recommendations of this report are based in part upon various types of chemical analysis of soil, water or gases, and are contingent upon their validity. These data have been reviewed and interpretations made in the report. Variations in the types and concentrations of contaminants and variations in their flow paths may occur due to seasonal water table fluctuations, past disposal practices, the passage of time and other factors. Should additional analytical or monitoring data

become available in the future, these data should be reviewed and conclusions and recommendations presented herein modified accordingly.

10. Chemical analyses have been performed for specific parameters during the course of this study, as detailed in the text. It must be noted that additional constituents not searched for during the current study may be present in soil, groundwater and soil voids at the site.

APPENDIX C

WINDOW SAMPLE LOG

WINDOW SAMPLE No
WS1RN

Project	Client	Logged By
Land north of Rawnsley	Cannock Chase DC	MJH

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
103912	07-07-10 07-07-10			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument / Backfill
0.10-0.10	ES					0.30	MADE GROUND: (Turf over) Brown clayey gravelly fine to coarse SAND with occasional roots and rootlets. Gravel is fine to coarse rounded quartz and sub angular brick. (Topsoil)	
0.30-0.30	ES						MADE GROUND: Firm light grey and orange slightly sandy slightly gravelly CLAY. Gravel is fine angular ash	
0.60-0.60	ES					(1.60)		
1.00-1.00	ES					1.90		
						2.00	MADE GROUND: Black sandy GRAVEL. Gravel is fine angular ash. Sand is angular ash.	
							End of Hole at 2m bgl.	

Groundwater	General Remarks	Final Depth
Strike Depth: (m) Rising to: (m) Groundwater Remarks None Encountered	Location: Back garden in lawn area	**2m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand held window sampling	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ WINDOW SAMPLE LOG 2006 103912 RAWNSLEY.GPJ AGS3_ALL.GDT 8/3/10

WINDOW SAMPLE LOG

WINDOW SAMPLE No
WS2RN

Project	Client	Logged By
Land north of Rawnsley	Cannock Chase DC	MJH

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
103912	07-07-10 07-07-10			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument / Backfill
0.10-0.10	ES					0.30	MADE GROUND: (Turf over) Brown clayey gravelly fine to coarse SAND with occasional roots and rootlets. Gravel is fine to coarse rounded quartz and sub angular brick. (Topsoil)	
0.30-0.30	ES						MADE GROUND: Firm light brown and light grey slightly sandy slightly gravelly friable CLAY. Gravel is fine to medium angular weathered mudstone and occasional ash.	
0.60-0.60	ES					(2.40)		
1.00-1.00	ES					2.70		
						2.90	Very stiff light grey gravelly CLAY. Gravel is medium to coarse angular mudstone. (Coal Measures)	
						3.00	Extremely weak grey MUDSTONE. (Coal Measures)	
							End of Hole at 3m bgl.	

Groundwater	General Remarks	Final Depth
Strike Depth: (m) Rising to: (m) Groundwater Remarks None Encountered	Location: Grassed verge area open to public	**3m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Tracked window sample rig	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ WINDOW SAMPLE LOG 2006 103912 RAWNSLEY.GPJ AGS3_ALL.GDT 8/3/10

WINDOW SAMPLE LOG

Grontmij

WINDOW SAMPLE No **WS3RN**

Project	Client	Logged By
Land north of Rawnsley	Cannock Chase DC	MJH

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
103912	07-07-10 07-07-10			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument / Backfill
0.10-0.10 0.20-0.20 0.30-0.30	ES ES ES					0.20	MADE GROUND: Dark brown clayey fine grained SAND. (Topsoil)	
						(0.80) 1.00	MADE GROUND: Firm orange brown and light grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub rounded to rounded quartz and occasional fine angular ash.	
							End of Hole at 1m bgl.	

Groundwater	General Remarks	Final Depth
Strike Depth: (m) Rising to: (m) Groundwater Remarks None Encountered	Location: Back garden in flower bed	**1m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ WINDOW SAMPLE LOG 2006 103912 RAWNSLEY.GPJ AGS3_ALL.GDT 8/3/10

WINDOW SAMPLE LOG

Grontmij

WINDOW SAMPLE No
WS4RN

Project	Client	Logged By
Land north of Rawnsley	Cannock Chase DC	MJH

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
103912	13-07-10 13-07-10			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument / Backfill
0.10-0.10	ES					0.11	MADE GROUND: (Turf over) Brown very clayey fine grained SAND. (Topsoil)	
0.30-0.30	ES					(0.59)	MADE GROUND: Firm light grey and orange slightly sandy CLAY.	
						0.70		
0.70-0.70	ES					1.00	MADE GROUND: Black clayey very sandy GRAVEL. Gravel is fine to medium angular to sub angular ash and coal.	
							End of Hole at 1m bgl.	

Groundwater	General Remarks	Final Depth
Strike Depth: (m) Rising to: (m) Groundwater Remarks None Encountered	Location: Back garden in lawn area	**1m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ WINDOW SAMPLE LOG 2006 103912 RAWNSLEY.GPJ AGS3_ALL.GDT 8/3/10

WINDOW SAMPLE LOG

Grontmij

WINDOW SAMPLE No
WS5RN

Project	Client	Logged By
Land north of Rawnsley	Cannock Chase DC	MJH

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
103912	13-07-10 13-07-10			GVT

SAMPLES & TESTS			Water	STRATA				
Depth	Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument / Backfill
0.10-0.10	ES					0.11	MADE GROUND: (Turf over) Brown clayey gravelly fine to coarse SAND with occasional roots and rootlets. Gravel is fine to coarse rounded quartz. (Topsoil)	
0.30-0.30	ES					(0.48) 0.59		
0.60-0.60	ES					(0.41) 1.00	MADE GROUND: Brown very clayey very gravelly fine to coarse SAND. Gravel is fine to coarse angular to sub rounded brick, weathered mudstone, concrete, quartz and occasional fabric.	
1.00-1.00	ES						Firm light grey and orange brown slightly sandy slightly gravelly clay (probable MADE GROUND). Gravel is rounded quartz.	
							End of Hole at 1m bgl.	

Groundwater	General Remarks	Final Depth
Strike Depth: (m) Rising to: (m) Groundwater Remarks None Encountered	Location: Back garden in lawn area	**1m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50

Sheet 1 of 1

GRONTMIJ WINDOW SAMPLE LOG 2006 103912 RAWNSLEY.GPJ AGS3_ALL.GDT 8/3/10

WINDOW SAMPLE LOG

WINDOW SAMPLE No
WS6RN

Project	Client	Logged By
Land north of Rawnsley	Cannock Chase DC	MJH

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
103912	13-07-10 13-07-10			GVT

SAMPLES & TESTS			Water	STRATA				Instrument	Backfill
Depth	Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.10-0.10	ES					0.37	MADE GROUND: (Turf over) Brown clayey gravelly fine to coarse SAND with occasional roots and rootlets. Gravel is fine to coarse rounded quartz and sub angular brick. (Topsoil)		
0.30-0.30	ES								
0.60-0.60	ES					(0.63)	MADE GROUND: Stiff light orange brown and light grey slightly sandy slightly gravelly CLAY. Gravel is occasional fine medium angular ash.		
						1.00			
1.00-1.00	ES						End of Hole at 1m bgl.		

Groundwater	General Remarks	Final Depth
Strike Depth: (m) Rising to: (m) Groundwater Remarks None Encountered	Location: Back garden in lawn area	**1m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Hand tools	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ WINDOW SAMPLE LOG 2006 103912 RAWNSLEY.GPJ AGS3_ALL.GDT 8/3/10

WINDOW SAMPLE LOG

WINDOW SAMPLE No: **WS7RN**

Project	Client	Logged By
Land north of Rawnsley	Cannock Chase DC	MJH

Job No	Date	Ground Level (m)	Co-ordinates	Checked By
103912	13-07-10 13-07-10			GVT

SAMPLES & TESTS			Water	STRATA				Instrument	Backfill
Depth	Type	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.10-0.10	ES					0.26	MADE GROUND: Brown clayey very gravelly fine to coarse SAND. Gravel is fine to coarse angular to rounded quartz, brick and occasional ash.		
0.30-0.30	ES					(0.70)	MADE GROUND: Reddish brown clayey fine to coarse SAND and GRAVEL. Gravel is fine to coarse angular to well rounded quartz, brick and occasional burnt shale and coal		
0.80-0.80	ES					0.96			
1.00-1.00	ES					(1.94)	MADE GROUND: Firm light grey and orange brown slightly sandy slightly gravelly CLAY. Gravel is fine angular ash.		
						2.90			
2.90-2.90	ES					(1.00)	Stiff grey gravelly CLAY. Gravel is coarse angular mudstone. (Coal Measures)		
						3.90			
						(1.10)	Extremely weak interbedded MUDSTONE and SILTSTONE. (Coal Measures)		
						5.00			
							End of Hole at 5m bgl.		

Groundwater	General Remarks	Final Depth
Strike Depth: (m) Rising to: (m) Groundwater Remarks None Encountered	Location: Grassed verge area open to public	**5m bgl**

Contractor	Method/ Plant Used	
Sherwood Drilling	Tracked window sample rig	All dimensions in metres Scale 1:50 Sheet 1 of 1

GRONTMIJ WINDOW SAMPLE LOG 2006 103912 RAWNSLEY.GPJ AGS3_ALL.GDT 8/3/10

APPENDIX D

ALcontrol Laboratories

						Rawnsley site															
					Customer Sample ID	WS1 R10	WS1 R10	WS1 R10	WS2 R10	WS2 R10	WS3 R10	WS3 R10	WS4RN	WS4RN	WS5RN	WS5RN	WS6RN	WS6RN	WS6RN	WS7RN	WS7RN
					Depth	0.10-0.00	0.30-0.00	1.00-0.00	0.10-0.00	0.60-0.00	0.10-0.00	0.30-0.00	0.10-0.00	0.70-0.00	0.10-0.00	0.60-0.00	0.10-0.00	0.60-0.00	1.00-0.00	0.10-0.00	1.00-0.00
Case:	100707-41,100707-28,100709-53,100715-98,100715-104,100715-76,100716-5,100715-83				**AGS Id**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Customer:	Grontmij Solihull (5731)				**Sample Type**	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Customer ref:	CANNOCK PORT 2A				**Sampled Date**	07/07/2010	07/07/2010	07/07/2010	07/07/2010	07/07/2010	07/07/2010	07/07/2010	13/07/2010	13/07/2010	13/07/2010	13/07/2010	13/07/2010	13/07/2010	13/07/2010	13/07/2010	13/07/2010
Order no:	,146072				**Sample Received Date**	09/07/2010	09/07/2010	09/07/2010	09/07/2010	09/07/2010	09/07/2010	09/07/2010	15/07/2010	15/07/2010	15/07/2010	15/07/2010	15/07/2010	15/07/2010	15/07/2010	15/07/2010	15/07/2010
					Final Instruction Date	26/07/2010	26/07/2010	26/07/2010	27/07/2010	27/07/2010	27/07/2010	27/07/2010	27/07/2010	27/07/2010	27/07/2010	27/07/2010	27/07/2010	27/07/2010	26/07/2010	26/07/2010	26/07/2010
All results expressed on a dry weight basis					**Report Completed Date**	05/08/2010	05/08/2010	05/08/2010	05/08/2010	05/08/2010	05/08/2010	05/08/2010	05/08/2010	05/08/2010	05/08/2010	05/08/2010	05/08/2010	05/08/2010	05/08/2010	05/08/2010	05/08/2010
					Project	100709-53	100709-53	100709-53	100709-53	100709-53	100709-53	100709-53	100715-76	100715-76	100715-76	100715-76	100715-76	100715-76	100715-76	100715-98	100715-98
					Lab Sample Number	1799433	1799383	1799348	1799266	1799308	1799295	1799235	1824854	1824659	1824724	1824921	1824577	1824532	1824621	1826124	1826144
					Sample Temperature																
Analysis	**Test**	**Method**	**Units**	**LOD**																	
Sample Description																					
	Colour	PM024	-			Dark Brown	Grey	Dark Brown	Dark Brown	Light Brown	Light Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Light Brown	Light Brown	Light Brown	Light Brown	Dark Brown	Dark Brown
	Grain Size	PM024	-			0.1 - 2 mm	0.063 - 0.1 mm	0.1 - 2 mm	0.063 - 0.1 mm	0.063 - 0.1 mm	0.063 - 0.1 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	0.063 - 0.1 mm	0.063 - 0.1 mm	0.063 - 0.1 mm	0.1 - 2 mm	0.1 - 2 mm
	Description	PM024	-			Sand	Silty Clay	Sandy Clay	Silty Sand	Clay Loam	Silty Clay	Sandy Clay	Sand	Sandy Silt Loam	Sand	Sandy Clay	Silty Clay	Silty Clay	Silty Clay	Sandy Silt Loam	Sandy Clay
	Inclusions	PM024	-			Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Coal fragments	Vegetation	Stones	None	-	None	Stones	Stones
	Moisture	PM114	%			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Moisture content ratio	PM114	%			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dry matter content ratio	PM114	%			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos																					
	Asbestos Containing Material Screen	TM001	-			No ACM Detected	-	-	-	-	-	-	No ACM Detected	-	-	-	-	-	-	No ACM Detected	-
	Date of Analysis	TM048	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Analysed by	TM048	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Comments	TM048	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Asbestos, Chrysotile (white)	TM048	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Asbestos, Amosite (brown)	TM048	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Asbestos, Crocidolite (blue)	TM048	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Anthophyllite, Fibrous	TM048	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Tremolite, Fibrous	TM048	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Actinolite, Fibrous	TM048	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Non-asbestos fibre	TM048	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon																					
	Soil Organic Matter (SOM)	TM132	%	<0.35		3.19	0.445	-	4.83	0.519	0.364	0.476	1.61	71.4	3.21	0.6	0.35	0.51	-	4.9	-
Inorganics																					
	pH	TM133	pH Units	<1		7.04	4.93	-	7.66	5.78	5.71	5.79	4.99	4.49	7.05	5.3	5.05	5.01	-	7.33	-
	Cyanide, Total	TM153	mg/kg	<1		<1	-	-	-	<1	-	<1	<1	-	-	-	-	<1	-	<1	-
	Thiocyanate	TM153	mg/kg	<1		<1	-	-	-	<1	-	<1	<1	-	-	-	-	<1	-	<1	-
Metals																					
	Chromium, Hexavalent	TM151	mg/kg	<0.6		<0.6	<0.6	-	<1.2	<0.6	<1.2	<1.2	<1.2	-	<1.2	<1.2	<0.6	<0.6	-	-	-
	Antimony	TM181	mg/kg	<0.6		<0.6	-	-	-	<0.6	-	<0.6	<0.6	-	-	-	-	<0.6	-	<0.6	-
	Arsenic	TM181	mg/kg	<0.6		15.3	18.6	-	47.5	8.49	15.7	11.6	5.85	10.3	11	11.5	2.9	3.43	-	13.3	-
	Barium	TM181	mg/kg	<0.6		470	150	-	109	195	185	667	112	503	100	45.2	109	125	-	142	-
	Beryllium	TM181	mg/kg	<0.01		1.18	0.785	-	1.07	0.785	0.792	0.901	0.603	2.64	0.837	0.163	1.34	1.39	-	1.2	-
	Cadmium	TM181	mg/kg	<0.02		0.582	0.321	-	0.683	0.661	0.387	0.415	0.393	1.04	0.392	0.0394	0.248	0.275	-	0.675	-
	Chromium	TM181	mg/kg	<0.9		27.1	22.1	-	28.6	20.1	13.4	11.6	13.8	18.2	22.9	13.3	21.8	23	-	23.5	-
	Copper	TM181	mg/kg	<1.4		47.4	42.7	-	69.1	18.1	59.8	73.1	29.1	172	61.1	19.5	23.6	24.9	-	41.4	-
	Lead	TM181	mg/kg	<0.7		79.4	43.2	-	141	21.9	60.5	59	27.2	74.3	51.6	17.9	19.7	19.6	-	60.3	-
	Mercury	TM181	mg/kg	<0.14		<0.14	<0.14	-	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	<0.14	-	<0.14	-
	Nickel	TM181	mg/kg	<0.2		22.7	27	-	22.3	33.9	8.38	6.78	6.64	71.3	13.8	4.33	21.9	23.5	-	21.6	-
	Selenium	TM181	mg/kg	<1		1.46	<1	-	<1	1.28	<1	<1	<1	3.78	1.38	<1	1.06	1.27	-	1.45	-
	Vanadium	TM181	mg/kg	<0.2		29.4	20.5	-	24.6	25.5	21.4	21.3	15	36.1	28.1	25.8	20.9	23.2	-	35.2	-
	Zinc	TM181	mg/kg	<1.9		141	121	-	246	124	80.1	87.9	76.8	25.6	152	34.1	111	117	-	151	-
	Boron, water soluble	TM222	mg/kg	<1		<1	<1	-	1.43	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	<1	-
Phenols																					
	Phenol	TM062 (S)	mg/kg	<0.01		<0.01	-	-	-	<0.01	-	<0.01	<0.01	-	-	-	-	<0.01	-	<0.01	-
Gasoline Range Organics (GRO)																					
	Aliphatics >C5-C6	TM089	µg/kg	<10		-	-	<10	-	<10	-	<10	-	<10	-	-	-	-	<10	<10	<10
	Aliphatics >C6-C8	TM089	µg/kg	<10		-	-	<10	-	<10	-	<10	-	<10	-	-	-	-	<10	<10	<10
	Aliphatics >C8-C10	TM089	µg/kg	<10		-	-	<10	-	<10	-	<10	-	<10	-	-	-	-	<10	<10	<10
	Aliphatics >C10-C12	TM089	µg/kg	<10		-	-	<10	-	<10	-	<10	-	<10	-	-	-	-	<10	<10	<10
	Total Aliphatics >C5-C12	TM089	µg/kg	<10		-	-	<10	-	<10	-	<10	-	<10	-	-	-	-	<10	<10	<10
	Aromatics >C6-C7	TM089	µg/kg	<10		-	-	<10	-	<10	-	<10	-	<10	-	-	-	-	<10	<10	<10
	Aromatics >C7-C8	TM089	µg/kg	<10		-	-	<10	-	<10	-	<10	-	<10	-	-	-	-	<10	<10	<10
	Aromatics >EC8-EC10	TM089	µg/kg	<10		-	-	<10	-	<10	-	<10	-	<10	-	-	-	-	<10	<10	<10
	Aromatics >EC10-EC12	TM089	µg/kg	<10		-	-	<10	-	<10	-	<10	-	<10	-	-	-	-	<10	<10	<10
	Total Aromatics >C6-C12	TM089	µg/kg	<10		-	-	<10	-	<10	-	<10	-	<10	-	-	-	-	<10	<10	<10
	GRO Surrogate % recovery**	TM089	%			-	-	114	-	89	-	104	-	15	-	-	-	-	111	59	114
	Benzene	TM089	µg/kg	<10		-	-	<10	-	<10	-	<10	-	<10	-	-	-	-	<10	<10	<10
	Toluene	TM089	µg/kg	<2		-	-	<2	-	<2	-	<2	-	<2	-	-	-	-	<2	<2	<2
	Ethylbenzene	TM089	µg/kg	<3		-	-	<3	-	<3	-	<3	-	<3	-	-	-	-	<3	<3	<3
	m,p-Xylene	TM089	µg/kg	<6		-	-	<6	-	<6	-	<6	-	<6	-	-	-	-	<6	<6	<6
	o-Xylene	TM089	µg/kg	<3		-	-	<3	-	<3	-	<3	-	<3	-	-	-	-	<3	<3	<3
	m,p,o-Xylene	TM089	µg/kg	<10		-	-	<10	-	<10	-	<10	-	<10	-	-	-	-	<10	<10	<10
	BTEX, Total	TM089	µg/kg	<10		-	-	<10	-	<10	-	<10	-	<10	-	-	-	-	<10	<10	<10
	Methyl tertiary butyl ether (MTBE)	TM089	µg/kg	<5		-	-	<5	-	<5	-	<5	-	<5	-	-	-	-	<5	<5	<5
	GRO >C5-C12	TM089	µg/kg	<44		-	-	<44	-	<44	-	<44	-	<44	-	-	-	-	<44	<44	<44

Speciated EPH CWG																			
Aliphatics >C12-C16	TM173	µg/kg	<100	-	-	<100	-	<100	-	<100	-	10800	-	-	-	-	<100	<100	<100
Aliphatics >C16-C21	TM173	µg/kg	<100	-	-	<100	-	<100	-	<100	-	22400	-	-	-	-	<100	<100	<100
Aliphatics >C16-C35	TM173	µg/kg	<100	-	-	<100	-	<100	-	<100	-	65900	-	-	-	-	<100	13300	<100
Aliphatics >C21-C35	TM173	µg/kg	<100	-	-	<100	-	<100	-	<100	-	43600	-	-	-	-	<100	13300	<100
Aliphatics >C35-C44	TM173	µg/kg	<100	-	-	<100	-	<100	-	<100	-	2100	-	-	-	-	<100	<100	<100
Total Aliphatics >C12-C44	TM173	µg/kg	<100	-	-	<100	-	<100	-	<100	-	78900	-	-	-	-	<100	13300	<100
Aromatics >EC12-EC16	TM173	µg/kg	<100	-	-	<100	-	<100	-	<100	-	4500	-	-	-	-	168	5630	<100
Aromatics >EC16-EC21	TM173	µg/kg	<100	-	-	<100	-	<100	-	<100	-	21500	-	-	-	-	460	7540	<100
Aromatics >EC21-EC35	TM173	µg/kg	<100	-	-	<100	-	<100	-	<100	-	149000	-	-	-	-	929	43300	<100
Aromatics >EC35-EC44	TM173	µg/kg	<100	-	-	<100	-	<100	-	<100	-	43100	-	-	-	-	<100	22400	<100
Aromatics >EC40-EC44	TM173	µg/kg	<100	-	-	<100	-	<100	-	<100	-	11900	-	-	-	-	<100	7260	<100
Total Aromatics >EC12-EC44	TM173	µg/kg	<100	-	-	<100	-	<100	-	<100	-	218000	-	-	-	-	1560	78900	<100
Aliphatics >C35-C40	TM173	µg/kg	<100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	<100
Aliphatics >C40-C44	TM173	µg/kg	<100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	<100
Total Aliphatics >C12-C35	TM173	µg/kg	<100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13300	<100
Total Aliphatics >C12-C40	TM173	µg/kg	<100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13300	<100
Total Aliphatics & Aromatics >C12-C44	TM173	µg/kg	<100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	92200	<100
TPH Criteria Working Group (TPH CWG)																			
Total Aliphatics >C5-C44	TM173	µg/kg	<100	-	-	<100	-	<100	-	<100	-	78900	-	-	-	-	<100	13300	<100
Total Aromatics >C6-C44	TM173	µg/kg	<100	-	-	<100	-	<100	-	<100	-	218000	-	-	-	-	1560	78900	<100
Total Aliphatics & Aromatics >C5-C44	TM173	µg/kg	<100	-	-	<100	-	<100	-	<100	-	297000	-	-	-	-	1560	92200	<100
Total Aliphatics >C5-35	TM173	µg/kg	<100	-	-	<100	-	<100	-	<100	-	76800	-	-	-	-	<100	13300	<100
Total Aromatics >C5-35	TM173	µg/kg	<100	-	-	<100	-	<100	-	<100	-	175000	-	-	-	-	1560	56500	<100
Total Aliphatics & Aromatics >C5-35	TM173	µg/kg	<100	-	-	<100	-	<100	-	<100	-	252000	-	-	-	-	1560	69700	<100
Semi-Volatile Organic Compounds (SVOCs)																			
Phenol	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Pentachlorophenol	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
n-Nitroso-n-dipropylamine	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Nitrobenzene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Isophorone	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Hexachloroethane	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Hexachlorocyclopentadiene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Hexachlorobutadiene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Hexachlorobenzene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
n-Dioctyl phthalate	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Dimethyl phthalate	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Diethyl phthalate	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
n-Dibutyl phthalate	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Dibenzofuran	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Carbazole	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Butylbenzyl phthalate	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
bis(2-Ethylhexyl) phthalate	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	540	<100
bis(2-Chloroethoxy)methane	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
bis(2-Chloroethyl)ether	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Azobenzene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
4-Nitrophenol	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
4-Nitroaniline	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
4-Methylphenol	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
4-Chlorophenylphenylether	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
4-Chloroaniline	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
4-Chloro-3-methylphenol	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
4-Bromophenylphenylether	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
3-Nitroaniline	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
2-Nitrophenol	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
2-Nitroaniline	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
2-Methylphenol	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
1,2,4-Trichlorobenzene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
2-Chlorophenol	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
2,6-Dinitrotoluene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
2,4-Dinitrotoluene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
2,4-Dimethylphenol	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
2,4-Dichlorophenol	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
2,4,6-Trichlorophenol	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
2,4,5-Trichlorophenol	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
1,4-Dichlorobenzene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
1,3-Dichlorobenzene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
1,2-Dichlorobenzene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
2-Chloronaphthalene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
2-Methylnaphthalene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Acenaphthylene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Acenaphthene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Anthracene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Benzo(a)anthracene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Benzo(b)fluoranthene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Benzo(k)fluoranthene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Benzo(a)pyrene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Benzo(g,h,i)perylene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Chrysene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100

Fluoranthene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Fluorene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Indeno(1,2,3-cd)pyrene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Phenanthrene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Pyrene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	789	-	-	-	-	-	<100	<100
Naphthalene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Dibenzo(a,h)anthracene	TM157	µg/kg	<100	-	-	<100	-	-	-	-	-	<100	-	-	-	-	-	<100	<100
Volatile Organic Compounds (VOCs)																				
Dibromofluoromethane**	TM116	%		-	-	104	-	-	-	-	-	97.4	-	-	-	-	-	103	101
Toluene-d8**	TM116	%		-	-	97.5	-	-	-	-	-	75.5	-	-	-	-	-	96.4	102
4-Bromofluorobenzene**	TM116	%		-	-	104	-	-	-	-	-	170	-	-	-	-	-	133	103
Dichlorodifluoromethane	TM116	µg/kg	<4	-	-	<4	-	-	-	-	-	<4	-	-	-	-	-	<4	<4
Chloromethane	TM116	µg/kg	<7	-	-	<7	-	-	-	-	-	<7	-	-	-	-	-	<7	<7
Vinyl Chloride	TM116	µg/kg	<10	-	-	<10	-	-	-	-	-	<10	-	-	-	-	-	<10	<10
Bromomethane	TM116	µg/kg	<13	-	-	<13	-	-	-	-	-	<13	-	-	-	-	-	<13	<13
Chloroethane	TM116	µg/kg	<14	-	-	<14	-	-	-	-	-	<14	-	-	-	-	-	<14	<14
Trichlorofluoromethane	TM116	µg/kg	<6	-	-	<6	-	-	-	-	-	<6	-	-	-	-	-	<6	<6
1.1-Dichloroethene	TM116	µg/kg	<10	-	-	<10	-	-	-	-	-	<10	-	-	-	-	-	<10	<10
Carbon Disulphide	TM116	µg/kg	<7	-	-	<7	-	-	-	-	-	<7	-	-	-	-	-	<7	<7
Dichloromethane	TM116	µg/kg	<10	-	-	<10	-	-	-	-	-	<10	-	-	-	-	-	<10	<10
Methyl Tertiary Butyl Ether	TM116	µg/kg	<11	-	-	<11	-	-	-	-	-	<11	-	-	-	-	-	<11	<11
trans-1-2-Dichloroethene	TM116	µg/kg	<11	-	-	<11	-	-	-	-	-	<11	-	-	-	-	-	<11	<11
1.1-Dichloroethane	TM116	µg/kg	<8	-	-	<8	-	-	-	-	-	<8	-	-	-	-	-	<8	<8
cis-1-2-Dichloroethene	TM116	µg/kg	<5	-	-	<5	-	-	-	-	-	<5	-	-	-	-	-	<5	<5
2.2-Dichloropropane	TM116	µg/kg	<12	-	-	<12	-	-	-	-	-	<12	-	-	-	-	-	<12	<12
Bromochloromethane	TM116	µg/kg	<14	-	-	<14	-	-	-	-	-	<14	-	-	-	-	-	<14	<14
Chloroform	TM116	µg/kg	<8	-	-	<8	-	-	-	-	-	<8	-	-	-	-	-	<8	<8
1.1.1-Trichloroethane	TM116	µg/kg	<7	-	-	<7	-	-	-	-	-	<7	-	-	-	-	-	<7	<7
1.1-Dichloropropene	TM116	µg/kg	<11	-	-	<11	-	-	-	-	-	<11	-	-	-	-	-	<11	<11
Carbontetrachloride	TM116	µg/kg	<14	-	-	<14	-	-	-	-	-	<14	-	-	-	-	-	<14	<14
1.2-Dichloroethane	TM116	µg/kg	<5	-	-	<5	-	-	-	-	-	<5	-	-	-	-	-	<5	<5
Benzene	TM116	µg/kg	<9	-	-	<9	-	-	-	-	-	<9	-	-	-	-	-	<9	<9
Trichloroethene	TM116	µg/kg	<9	-	-	<9	-	-	-	-	-	<9	-	-	-	-	-	<9	<9
1.2-Dichloropropane	TM116	µg/kg	<12	-	-	<12	-	-	-	-	-	<12	-	-	-	-	-	<12	<12
Dibromomethane	TM116	µg/kg	<9	-	-	<9	-	-	-	-	-	<9	-	-	-	-	-	<9	<9
Bromodichloromethane	TM116	µg/kg	<7	-	-	<7	-	-	-	-	-	<7	-	-	-	-	-	<7	<7
cis-1-3-Dichloropropene	TM116	µg/kg	<14	-	-	<14	-	-	-	-	-	<14	-	-	-	-	-	<14	<14
Toluene	TM116	µg/kg	<5	-	-	<5	-	-	-	-	-	19.5	-	-	-	-	-	8.24	<5
trans-1-3-Dichloropropene	TM116	µg/kg	<14	-	-	<14	-	-	-	-	-	<14	-	-	-	-	-	<14	<14
1.1.2-Trichloroethane	TM116	µg/kg	<10	-	-	<10	-	-	-	-	-	<10	-	-	-	-	-	<10	<10
1.3-Dichloropropane	TM116	µg/kg	<7	-	-	<7	-	-	-	-	-	<7	-	-	-	-	-	<7	<7
Tetrachloroethene	TM116	µg/kg	<5	-	-	<5	-	-	-	-	-	<5	-	-	-	-	-	<5	<5
Dibromochloromethane	TM116	µg/kg	<13	-	-	<13	-	-	-	-	-	<13	-	-	-	-	-	<13	<13
1.2-Dibromoethane	TM116	µg/kg	<12	-	-	<12	-	-	-	-	-	<12	-	-	-	-	-	<12	<12
Chorobenzene	TM116	µg/kg	<5	-	-	<5	-	-	-	-	-	<5	-	-	-	-	-	<5	<5
1.1.1.2-Tetrachloroethane	TM116	µg/kg	<10	-	-	<10	-	-	-	-	-	<10	-	-	-	-	-	<10	<10
Ethylbenzene	TM116	µg/kg	<4	-	-	<4	-	-	-	-	-	45.2	-	-	-	-	-	6.47	<4
p/m-Xylene	TM116	µg/kg	<14	-	-	<14	-	-	-	-	-	50.8	-	-	-	-	-	<14	<14
o-Xylene	TM116	µg/kg	<10	-	-	<10	-	-	-	-	-	<10	-	-	-	-	-	<10	<10
Styrene	TM116	µg/kg	<10	-	-	<10	-	-	-	-	-	32.3	-	-	-	-	-	<10	<10
Bromoform	TM116	µg/kg	<10	-	-	<10	-	-	-	-	-	<10	-	-	-	-	-	<10	<10
Isopropylbenzene	TM116	µg/kg	<5	-	-	<5	-	-	-	-	-	<5	-	-	-	-	-	<5	<5
1.1.2.2-Tetrachloroethane	TM116	µg/kg	<10	-	-	<10	-	-	-	-	-	<10	-	-	-	-	-	<10	<10
1.2.3-Trichloropropane	TM116	µg/kg	<17	-	-	<17	-	-	-	-	-	<17	-	-	-	-	-	<17	<17
Bromobenzene	TM116	µg/kg	<10	-	-	<10	-	-	-	-	-	<10	-	-	-	-	-	<10	<10
Propylbenzene	TM116	µg/kg	<11	-	-	<11	-	-	-	-	-	<11	-	-	-	-	-	<11	<11
2-Chlorotoluene	TM116	µg/kg	<9	-	-	<9	-	-	-	-	-	<9	-	-	-	-	-	<9	<9
1.3.5-Trimethylbenzene	TM116	µg/kg	<8	-	-	<8	-	-	-	-	-	<8	-	-	-	-	-	<8	<8
4-Chlorotoluene	TM116	µg/kg	<12	-	-	<12	-	-	-	-	-	<12	-	-	-	-	-	<12	<12
tert-Butylbenzene	TM116	µg/kg	<12	-	-	<12	-	-	-	-	-	<12	-	-	-	-	-	<12	<12
1.2.4-Trimethylbenzene	TM116	µg/kg	<9	-	-	<9	-	-	-	-	-	<9	-	-	-	-	-	<9	<9
sec-Butylbenzene	TM116	µg/kg	<10	-	-	<10	-	-	-	-	-	<10	-	-	-	-	-	<10	<10
4-Isopropyltoluene	TM116	µg/kg	<11	-	-	<11	-	-	-	-	-	<11	-	-	-	-	-	<11	<11
1.3-Dichlorobenzene	TM116	µg/kg	<6	-	-	<6	-	-	-	-	-	<6	-	-	-	-	-	<6	<6
1.4-Dichlorobenzene	TM116	µg/kg	<5	-	-	<5	-	-	-	-	-	<5	-	-	-	-	-	<5	<5
n-Butylbenzene	TM116	µg/kg	<10	-	-	<10	-	-	-	-	-	<10	-	-	-	-	-	<10	<10
1.2-Dichlorobenzene	TM116	µg/kg	<12	-	-	<12	-	-	-	-	-	<12	-	-	-	-	-	<12	<12
1.2-Dibromo-3-chloropropane	TM116	µg/kg	<14	-	-	<14	-	-	-	-	-	<14	-	-	-	-	-	<14	<14
Tert-amyl methyl ether	TM116	µg/kg	<15	-	-	<15	-	-	-	-	-	<15	-	-	-	-	-	<15	<15
1.2.4-Trichlorobenzene	TM116	µg/kg	<6	-	-	<6	-	-	-	-	-	<6	-	-	-	-	-	<6	<6
Hexachlorobutadiene	TM116	µg/kg	<12	-	-	<12	-	-	-	-	-	<12	-	-	-	-	-	<12	<12
Naphthalene	TM116	µg/kg	<13	-	-	<13	-	-	-	-	-	<13	-	-	-	-	-	<13	<13
1.2.3-Trichlorobenzene	TM116	µg/kg	<6	-	-	<6	-	-	-	-	-	<6	-	-	-	-	-	<6	<6

ALcontrol Laboratories

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Tel: (01244) 528700
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Website: www.alcontrol.com

Grontmij
Radcliffe House
3rd Floor
Blenheim Court, Lode lane
Solihull
West Midlands
B912AA

Attention: Gareth Taylor

Please note: this lab certificate covers samples taken from a number of sites. The samples taken from the Rawnsley site are circled in red on the following page.

CERTIFICATE OF ANALYSIS

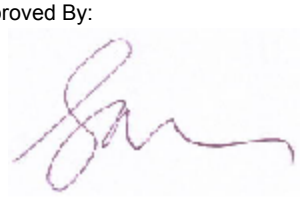
Date:	10 June 2011
Customer:	H_GRONTMIJ_SOL
Sample Delivery Group (SDG):	110602-58
Your Reference:	
Location:	Part 2a Assistance
Report No:	133432

We received 29 samples on Thursday June 02, 2011 and 25 of these samples were scheduled for analysis which was completed on Friday June 10, 2011. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:



Sonia McWhan

Operations Manager

CERTIFICATE OF ANALYSIS

SDG:	110602-58	**Location:**	Part 2a Assistance	**Order Number:**	
Job:	H_GRONTMIJ_SOL-54	**Customer:**	Grontmij	**Report Number:**	133432
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
3588820	1 NEWLANDS LANE FIVEWAYS		0.30	31/05/2011
3588809	10 WESTGATE			31/05/2011
3588808	11 GOODWOOD			31/05/2011
3588826	11 NEWLANDS COURT FIVEWAYS		0.30	31/05/2011
3588818	110 STAFFORD LANE			31/05/2011
3588805	121 ARMITAGE ROAD			31/05/2011
3588806	125 ARMITAGE ROAD			31/05/2011
3588811	2 SANDOWN			31/05/2011
3588819	21 HERONDALE			31/05/2011
3588807	3 SLADE VIEW RISE			31/05/2011
3588787	3A BLAKE CLOSE			31/05/2011
3588810	4 KEMPTON			31/05/2011
3588813	41 SWALLOWFIELDS			31/05/2011
3588822	5 NEWLANDS COURT FIVEWAYS		0.30	31/05/2011
3588814	73 STAGBOROUGH			31/05/2011
3588815	8 STAGBOROUGH WAY			31/05/2011
3588788	83 BLAKE CLOSE			31/05/2011
3588823	9 NEWLANDS COURT FIVEWAYS		0.30	31/05/2011
3588803	99 ARMITAGE ROAD			31/05/2011
3588802	FIVEWAYS 1 NEWLANDS LANE			31/05/2011
3588798	FIVEWAYS 11 NEWLANDS COURT			31/05/2011
3588799	FIVEWAYS 5 NEWLANDS COURT			31/05/2011
3588800	FIVEWAYS 9 NEWLANDS COURT			31/05/2011
3588795	VIEW ST. 32 FOSTERS AVE.			31/05/2011
3588793	VIEW ST. 53 VIEW ST.			31/05/2011
3588797	VIEW ST. 9 WARD ST.			31/05/2011
3588790	VIEW ST. WS2		1.20	31/05/2011
3588791	VIEW ST. WS3		1.10	31/05/2011
3588789	VIEW ST. WS4		1.60	31/05/2011

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	110602-58	**Location:**	Part 2a Assistance	**Order Number:**	
Job:	H_GRONTMIJ_SOL-54	**Customer:**	Grontmij	**Report Number:**	133432
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

LIQUID

Results Legend

X **Test**

N **No Determination Possible**

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
			3588802	FIVEWAYS 1			1l green glass bottle
			3588811	2 SANDOWN			1l green glass bottle
			3588790	VIEW ST. WS2		1.20	1l green glass bottle
			3588807	3 SLADE VIEW			Vial
			3588787	3A BLAKE CLOSE			1l green glass bottle
			3588791	VIEW ST. WS3		1.10	1l green glass bottle
			3588810	4 KEMPTON			1l green glass bottle
			3588789	VIEW ST. WS4		1.60	1l green glass bottle
			3588799	FIVEWAYS 5			Vial
			3588815	8 STAGBOROUGH			1l green glass bottle
			3588800	FIVEWAYS 9			1l green glass bottle
			3588797	VIEW ST. 9 WARD			1l green glass bottle
			3588809	10 WESTGATE			1l green glass bottle
			3588808	11 GOODWOOD			1l green glass bottle
			3588798	FIVEWAYS 11			1l green glass bottle
			3588819	21 HERONDALE			1l green glass bottle
			3588795	VIEW ST. 32			1l green glass bottle
			3588813	41			1l green glass bottle
			3588793	VIEW ST. 53 VIEW			1l green glass bottle
			3588814	73 STAGBOROUGH			1l green glass bottle
			3588788	83 BLAKE CLOSE			1l green glass bottle
			3588803	99 ARMITAGE			1l green glass bottle
			3588818	110 STAFFORD			1l green glass bottle
			3588805	121 ARMITAGE			1l green glass bottle
			3588806	125 ARMITAGE			1l green glass bottle
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 25	X X X X X X X X X X X X X X X X X X X X X X X X X				
Mercury Dissolved	All	NDPs: 0 Tests: 25	X X X X X X X X X X X X X X X X X X X X X X X X X				
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 25	X X X X X X X X X X X X X X X X X X X X X X X X X				
VOC MS (W)	All	NDPs: 0 Tests: 3	X X X				

CERTIFICATE OF ANALYSIS

SDG:	110602-58	**Location:**	Part 2a Assistance	**Order Number:**	
Job:	H_GRONTMIJ_SOL-54	**Customer:**	Grontmij	**Report Number:**	133432
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
§	Non-conforming work.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed

Component	LOD/Units	Method	Customer Sample R	99 ARMITAGE ROAD	121 ARMITAGE ROAD	125 ARMITAGE ROAD	83 BLAKE CLOSE	3A BLAKE CLOSE	FIVEWAYS 5 NEWLANDS COURT
			Depth (m)	.	.	.	.	.	.
			Sample Type	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)
			Date Sampled	31/05/2011	31/05/2011	31/05/2011	31/05/2011	31/05/2011	31/05/2011
			Date Received	02/06/2011	02/06/2011	02/06/2011	02/06/2011	02/06/2011	02/06/2011
			SDG Ref	110602-58	110602-58	110602-58	110602-58	110602-58	110602-58
			Lab Sample No.(s)	3588803	3588805	3588806	3588788	3588787	3588799
			AGS Reference						
Antimony (diss.filt)	<0.16 µg/l	TM152		0.367 #	0.327 #	0.881 #	0.297 #	0.301 #	2.25 #
Arsenic (diss.filt)	<0.12 µg/l	TM152		3.67 #	5.16 #	3.97 #	2.1 #	1.42 #	2.13 #
Boron (diss.filt)	<9.4 µg/l	TM152		58.5 #	57.7 #	66.9 #	125 #	85.7 #	102 #
Cadmium (diss.filt)	<0.1 µg/l	TM152		<0.1 #	<0.1 #	<0.1 #	0.117 #	0.201 #	0.165 #
Chromium (diss.filt)	<0.22 µg/l	TM152		12.4 #	12.2 #	13.7 #	13.4 #	7.95 #	16.5 #
Copper (diss.filt)	<0.85 µg/l	TM152		288 #	9.02 #	5.51 #	24.7 #	740 #	266 #
Lead (diss.filt)	<0.02 µg/l	TM152		0.107 #	0.293 #	1.09 #	0.165 #	0.311 #	0.266 #
Nickel (diss.filt)	<0.15 µg/l	TM152		2.16 #	1.01 #	1.4 #	0.993 #	4.32 #	1.19 #
Zinc (diss.filt)	<0.41 µg/l	TM152		74.4 #	7.67 #	29.2 #	14.5 #	606 #	94.9 #
Mercury (diss.filt)	<0.01 µg/l	TM183		<0.01 #	<0.01 #	<0.01 #	<0.01 #	<0.01 #	<0.01 #

CERTIFICATE OF ANALYSIS

SDG:	110602-58	**Location:**	Part 2a Assistance	**Order Number:**	
Job:	H_GRONTMIJ_SOL-54	**Customer:**	Grontmij	**Report Number:**	133432
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
§	Non-conforming work.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed

Component	LOD/Units	Method	Customer Sample R	11 GOODWOOD	21 HERONDALE	4 KEMPTON	FIVEWAYS 9 NEWL ANDS COURT	FIVEWAYS 11 NEW LANDS COURT	FIVEWAYS 1 NEWL ANDS LANE
			Depth (m)	.	.	.	.	.	.
			Sample Type	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)
			Date Sampled	31/05/2011	31/05/2011	31/05/2011	31/05/2011	31/05/2011	31/05/2011
			Date Received	02/06/2011	02/06/2011	02/06/2011	02/06/2011	02/06/2011	02/06/2011
			SDG Ref	110602-58	110602-58	110602-58	110602-58	110602-58	110602-58
			Lab Sample No.(s)	3588808	3588819	3588810	3588800	3588798	3588802
			AGS Reference						
Antimony (diss.filt)	<0.16 µg/l	TM152		0.344 #	0.266 #	0.421 #	0.489 #	0.381 #	0.246 #
Arsenic (diss.filt)	<0.12 µg/l	TM152		1.85 #	2.08 #	2.03 #	2.22 #	1.94 #	2.06 #
Boron (diss.filt)	<9.4 µg/l	TM152		96.5 #	114 #	88.8 #	92.2 #	113 #	80.7 #
Cadmium (diss.filt)	<0.1 µg/l	TM152		<0.1 #	<0.1 #	<0.1 #	<0.1 #	0.101 #	<0.1 #
Chromium (diss.filt)	<0.22 µg/l	TM152		14.2 #	11.2 #	12.8 #	14.1 #	13.1 #	8.22 #
Copper (diss.filt)	<0.85 µg/l	TM152		49 #	96.6 #	32.7 #	176 #	48.5 #	73.3 #
Lead (diss.filt)	<0.02 µg/l	TM152		0.109 #	0.184 #	0.093 #	0.048 #	0.057 #	0.231 #
Nickel (diss.filt)	<0.15 µg/l	TM152		1.68 #	0.594 #	1.6 #	0.559 #	1.02 #	1.79 #
Zinc (diss.filt)	<0.41 µg/l	TM152		21.6 #	18 #	7.11 #	6.25 #	9.53 #	8.76 #
Mercury (diss.filt)	<0.01 µg/l	TM183		<0.01 #	<0.01 #	<0.01 #	<0.01 #	<0.01 #	<0.01 #

CERTIFICATE OF ANALYSIS

SDG:	110602-58	**Location:**	Part 2a Assistance	**Order Number:**	
Job:	H_GRONTMIJ_SOL-54	**Customer:**	Grontmij	**Report Number:**	133432
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
§	Non-conforming work.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed

Component	LOD/Units	Method	Customer Sample R	2 SANDOWN	3 SLADE VIEW RISE	110 STAFFORD LANE	73 STAGBOROUGH	8 STAGBOROUGH WAY	41 SWALLOWFIELDS
			Depth (m)	.	.	.	.	.	.
			Sample Type	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)
			Date Sampled	31/05/2011	31/05/2011	31/05/2011	31/05/2011	31/05/2011	31/05/2011
			Date Received	02/06/2011	02/06/2011	02/06/2011	02/06/2011	02/06/2011	02/06/2011
			SDG Ref	110602-58	110602-58	110602-58	110602-58	110602-58	110602-58
			Lab Sample No.(s)	3588811	3588807	3588818	3588814	3588815	3588813
			AGS Reference						
Antimony (diss.filt)	<0.16 µg/l	TM152		0.202 #	0.426 #	0.303 #	0.246 #	0.239 #	0.298 #
Arsenic (diss.filt)	<0.12 µg/l	TM152		1.92 #	1.85 #	2.03 #	2.32 #	2.03 #	2.16 #
Boron (diss.filt)	<9.4 µg/l	TM152		107 #	128 #	123 #	135 #	118 #	123 #
Cadmium (diss.filt)	<0.1 µg/l	TM152		0.201 #	<0.1 #	0.179 #	0.142 #	0.276 #	0.108 #
Chromium (diss.filt)	<0.22 µg/l	TM152		12.5 #	13.3 #	11.2 #	13.5 #	11.9 #	11.3 #
Copper (diss.filt)	<0.85 µg/l	TM152		118 #	175 #	120 #	19.2 #	91.2 #	9.23 #
Lead (diss.filt)	<0.02 µg/l	TM152		0.862 #	0.042 #	0.329 #	0.121 #	0.398 #	0.126 #
Nickel (diss.filt)	<0.15 µg/l	TM152		4.46 #	1.69 #	1.06 #	1.49 #	15.3 #	0.697 #
Zinc (diss.filt)	<0.41 µg/l	TM152		295 #	26 #	29.9 #	6.85 #	356 #	2.69 #
Mercury (diss.filt)	<0.01 µg/l	TM183		<0.01 #	<0.01 #	<0.01 #	<0.01 #	<0.01 #	<0.01 #

CERTIFICATE OF ANALYSIS

SDG:	110602-58	**Location:**	Part 2a Assistance	**Order Number:**	
Job:	H_GRONTMIJ_SOL-54	**Customer:**	Grontmij	**Report Number:**	133432
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
§	Non-conforming work.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed

Component	LOD/Units	Method	Customer Sample R	VIEW ST. 32 FOSTERS AVE.	VIEW ST. 53 VIEW ST.	VIEW ST. 9 WARD ST.	VIEW ST. WS2	VIEW ST. WS3	VIEW ST. WS4
			Depth (m)	.	.	.	1.20	1.10	1.60
			Sample Type	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)
			Date Sampled	31/05/2011	31/05/2011	31/05/2011	31/05/2011	31/05/2011	31/05/2011
			Date Received	02/06/2011	02/06/2011	02/06/2011	02/06/2011	02/06/2011	02/06/2011
			SDG Ref	110602-58	110602-58	110602-58	110602-58	110602-58	110602-58
			Lab Sample No.(s)	3588795	3588793	3588797	3588790	3588791	3588789
			AGS Reference						
Antimony (diss.filt)	<0.16 µg/l	TM152		0.449 #	0.697 #	0.236 #			
Arsenic (diss.filt)	<0.12 µg/l	TM152		1.71 #	1.88 #	3.17 #	0.535 #	1.1 #	0.912 #
Boron (diss.filt)	<9.4 µg/l	TM152		121 #	102 #	106 #	171 #	226 #	59.5 #
Cadmium (diss.filt)	<0.1 µg/l	TM152		0.179 #	0.381 #	0.149 #	0.605 #	<0.1 #	0.167 #
Chromium (diss.filt)	<0.22 µg/l	TM152		11.7 #	13.8 #	10 #	11.5 #	20.9 #	28.6 #
Copper (diss.filt)	<0.85 µg/l	TM152		302 #	644 #	361 #	2.24 #	3.42 #	<0.85 #
Lead (diss.filt)	<0.02 µg/l	TM152		4.37 #	0.103 #	0.23 #	0.072 #	0.16 #	0.05 #
Nickel (diss.filt)	<0.15 µg/l	TM152		4.71 #	1.66 #	3.73 #	3.9 #	3.3 #	3.91 #
Vanadium (diss.filt)	<0.24 µg/l	TM152					2.88 #	4.02 #	8.48 #
Zinc (diss.filt)	<0.41 µg/l	TM152		175 #	661 #	293 #	15.9 #	4.05 #	<0.41 #
Mercury (diss.filt)	<0.01 µg/l	TM183		<0.01 #	<0.01 #	<0.01 #	<0.01 #	<0.01 #	<0.01 #

CERTIFICATE OF ANALYSIS

SDG:	110602-58	**Location:**	Part 2a Assistance	**Order Number:**	
Job:	H_GRONTMIJ_SOL-54	**Customer:**	Grontmij	**Report Number:**	133432
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
§	Non-conforming work.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed

Customer Sample R	10 WESTGATE
Depth (m)	.
Sample Type	Water(GW/SW)
Date Sampled	31/05/2011
Date Received	02/06/2011
SDG Ref	110602-58
Lab Sample No.(s)	3588809
AGS Reference	

Component	LOD/Units	Method	
Antimony (diss.filt)	<0.16 µg/l	TM152	0.203 #
Arsenic (diss.filt)	<0.12 µg/l	TM152	2.18 #
Boron (diss.filt)	<9.4 µg/l	TM152	106 #
Cadmium (diss.filt)	<0.1 µg/l	TM152	<0.1 #
Chromium (diss.filt)	<0.22 µg/l	TM152	13.9 #
Copper (diss.filt)	<0.85 µg/l	TM152	27.6 #
Lead (diss.filt)	<0.02 µg/l	TM152	0.066 #
Nickel (diss.filt)	<0.15 µg/l	TM152	1.47 #
Zinc (diss.filt)	<0.41 µg/l	TM152	9.15 #
Mercury (diss.filt)	<0.01 µg/l	TM183	<0.01 #

CERTIFICATE OF ANALYSIS

SDG:	110602-58	**Location:**	Part 2a Assistance	**Order Number:**	
Job:	H_GRONTMIJ_SOL-54	**Customer:**	Grontmij	**Report Number:**	133432
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

PAH Spec MS - Aqueous (W)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
§	Non-conforming work.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed

Component	LOD/Units	Method	Customer Sample R	99 ARMITAGE ROAD	121 ARMITAGE ROAD	125 ARMITAGE ROAD	83 BLAKE CLOSE	3A BLAKE CLOSE	FIVEWAYS 5 NEWLANDS COURT
			Depth (m)	.	.	.	.	.	.
			Sample Type	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)
			Date Sampled	31/05/2011	31/05/2011	31/05/2011	31/05/2011	31/05/2011	31/05/2011
			Date Received	02/06/2011	02/06/2011	02/06/2011	02/06/2011	02/06/2011	02/06/2011
			SDG Ref	110602-58	110602-58	110602-58	110602-58	110602-58	110602-58
			Lab Sample No.(s)	3588803	3588805	3588806	3588788	3588787	3588799
			AGS Reference						
Naphthalene (aq)	<0.1 µg/l	TM178		<0.1 #	<0.1 #	<0.1 #	0.11 #	<0.1 #	<0.1 #
Acenaphthene (aq)	<0.015 µg/l	TM178		<0.015 #	<0.015 #	<0.015 #	<0.015 #	<0.015 #	<0.015 #
Acenaphthylene (aq)	<0.011 µg/l	TM178		<0.011 #	<0.011 #	<0.011 #	<0.011 #	<0.011 #	<0.011 #
Fluoranthene (aq)	<0.017 µg/l	TM178		<0.017 #	<0.017 #	<0.017 #	<0.017 #	<0.017 #	<0.017 #
Anthracene (aq)	<0.015 µg/l	TM178		<0.015 #	<0.015 #	<0.015 #	<0.015 #	<0.015 #	<0.015 #
Phenanthrene (aq)	<0.022 µg/l	TM178		<0.022 #	<0.022 #	<0.022 #	<0.022 #	<0.022 #	<0.022 #
Fluorene (aq)	<0.014 µg/l	TM178		<0.014 #	<0.014 #	<0.014 #	<0.014 #	<0.014 #	<0.014 #
Chrysene (aq)	<0.013 µg/l	TM178		<0.013 #	<0.013 #	<0.013 #	<0.013 #	<0.013 #	<0.013 #
Pyrene (aq)	<0.015 µg/l	TM178		<0.015 #	<0.015 #	<0.015 #	<0.015 #	<0.015 #	<0.015 #
Benzo(a)anthracene (aq)	<0.017 µg/l	TM178		<0.017 #	<0.017 #	<0.017 #	<0.017 #	<0.017 #	<0.017 #
Benzo(b)fluoranthene (aq)	<0.023 µg/l	TM178		<0.023 #	<0.023 #	<0.023 #	<0.023 #	<0.023 #	<0.023 #
Benzo(k)fluoranthene (aq)	<0.027 µg/l	TM178		<0.027 #	<0.027 #	<0.027 #	<0.027 #	<0.027 #	<0.027 #
Benzo(a)pyrene (aq)	<0.009 µg/l	TM178		<0.009 #	<0.009 #	<0.009 #	<0.009 #	<0.009 #	<0.009 #
Dibenzo(a,h)anthracene (aq)	<0.016 µg/l	TM178		<0.016 #	<0.016 #	<0.016 #	<0.016 #	<0.016 #	<0.016 #
Benzo(g,h,i)perylene (aq)	<0.016 µg/l	TM178		<0.016 #	<0.016 #	<0.016 #	<0.016 #	<0.016 #	<0.016 #
Indeno(1,2,3-cd)pyrene (aq)	<0.014 µg/l	TM178		<0.014 #	<0.014 #	<0.014 #	<0.014 #	<0.014 #	<0.014 #
PAH, Total Detected USEPA 16 (aq)	µg/l	TM178		none detected	none detected	none detected	0.11	none detected	none detected

CERTIFICATE OF ANALYSIS

SDG:	110602-58	**Location:**	Part 2a Assistance	**Order Number:**	
Job:	H_GRONTMIJ_SOL-54	**Customer:**	Grontmij	**Report Number:**	133432
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

PAH Spec MS - Aqueous (W)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
§	Non-conforming work.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed

Component	LOD/Units	Method	Customer Sample R	11 GOODWOOD	21 HERONDALE	4 KEMPTON	FIVEWAYS 9 NEWL ANDS COURT	FIVEWAYS 11 NEW LANDS COURT	FIVEWAYS 1 NEWL ANDS LANE
			Depth (m)	.	.	.	.	.	.
			Sample Type	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)
			Date Sampled	31/05/2011	31/05/2011	31/05/2011	31/05/2011	31/05/2011	31/05/2011
			Date Received	02/06/2011	02/06/2011	02/06/2011	02/06/2011	02/06/2011	02/06/2011
			SDG Ref	110602-58	110602-58	110602-58	110602-58	110602-58	110602-58
			Lab Sample No.(s)	3588808	3588819	3588810	3588800	3588798	3588802
			AGS Reference						
Naphthalene (aq)	<0.1 µg/l	TM178		<0.1 #	<0.1 #	<0.1 #	<0.1 #	0.121 #	<0.1 #
Acenaphthene (aq)	<0.015 µg/l	TM178		<0.015 #	<0.015 #	<0.015 #	<0.015 #	<0.015 #	<0.015 #
Acenaphthylene (aq)	<0.011 µg/l	TM178		<0.011 #	<0.011 #	<0.011 #	<0.011 #	<0.011 #	<0.011 #
Fluoranthene (aq)	<0.017 µg/l	TM178		<0.017 #	<0.017 #	<0.017 #	<0.017 #	<0.017 #	<0.017 #
Anthracene (aq)	<0.015 µg/l	TM178		<0.015 #	<0.015 #	<0.015 #	<0.015 #	<0.015 #	<0.015 #
Phenanthrene (aq)	<0.022 µg/l	TM178		<0.022 #	<0.022 #	<0.022 #	<0.022 #	<0.022 #	<0.022 #
Fluorene (aq)	<0.014 µg/l	TM178		<0.014 #	<0.014 #	<0.014 #	<0.014 #	<0.014 #	<0.014 #
Chrysene (aq)	<0.013 µg/l	TM178		<0.013 #	<0.013 #	<0.013 #	<0.013 #	<0.013 #	<0.013 #
Pyrene (aq)	<0.015 µg/l	TM178		<0.015 #	<0.015 #	<0.015 #	<0.015 #	<0.015 #	<0.015 #
Benzo(a)anthracene (aq)	<0.017 µg/l	TM178		<0.017 #	<0.017 #	<0.017 #	<0.017 #	<0.017 #	<0.017 #
Benzo(b)fluoranthene (aq)	<0.023 µg/l	TM178		<0.023 #	<0.023 #	<0.023 #	<0.023 #	<0.023 #	<0.023 #
Benzo(k)fluoranthene (aq)	<0.027 µg/l	TM178		<0.027 #	<0.027 #	<0.027 #	<0.027 #	<0.027 #	<0.027 #
Benzo(a)pyrene (aq)	<0.009 µg/l	TM178		<0.009 #	<0.009 #	<0.009 #	<0.009 #	<0.009 #	<0.009 #
Dibenzo(a,h)anthracene (aq)	<0.016 µg/l	TM178		<0.016 #	<0.016 #	<0.016 #	<0.016 #	<0.016 #	<0.016 #
Benzo(g,h,i)perylene (aq)	<0.016 µg/l	TM178		<0.016 #	<0.016 #	<0.016 #	<0.016 #	<0.016 #	<0.016 #
Indeno(1,2,3-cd)pyrene (aq)	<0.014 µg/l	TM178		<0.014 #	<0.014 #	<0.014 #	<0.014 #	<0.014 #	<0.014 #
PAH, Total Detected USEPA 16 (aq)	µg/l	TM178		none detected	none detected	none detected	none detected	0.121	none detected

CERTIFICATE OF ANALYSIS

SDG:	110602-58	**Location:**	Part 2a Assistance	**Order Number:**	
Job:	H_GRONTMIJ_SOL-54	**Customer:**	Grontmij	**Report Number:**	133432
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

PAH Spec MS - Aqueous (W)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
§	Non-conforming work.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed

Component	LOD/Units	Method	Customer Sample R	2 SANDOWN	3 SLADE VIEW RISE	110 STAFFORD LANE	73 STAGBOROUGH	8 STAGBOROUGH WAY	41 SWALLOWFIELDS
			Depth (m)	.	.	.	.	.	.
			Sample Type	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)
			Date Sampled	31/05/2011	31/05/2011	31/05/2011	31/05/2011	31/05/2011	31/05/2011
			Date Received	02/06/2011	02/06/2011	02/06/2011	02/06/2011	02/06/2011	02/06/2011
			SDG Ref	110602-58	110602-58	110602-58	110602-58	110602-58	110602-58
			Lab Sample No.(s)	3588811	3588807	3588818	3588814	3588815	3588813
			AGS Reference						
Naphthalene (aq)	<0.1 µg/l	TM178		<0.1 #	0.103 #	0.131 #	<0.1 #	<0.1 #	<0.1 #
Acenaphthene (aq)	<0.015 µg/l	TM178		<0.015 #	<0.015 #	<0.015 #	<0.015 #	<0.015 #	<0.015 #
Acenaphthylene (aq)	<0.011 µg/l	TM178		<0.011 #	<0.011 #	<0.011 #	<0.011 #	<0.011 #	<0.011 #
Fluoranthene (aq)	<0.017 µg/l	TM178		<0.017 #	<0.017 #	<0.017 #	<0.017 #	<0.017 #	<0.017 #
Anthracene (aq)	<0.015 µg/l	TM178		<0.015 #	<0.015 #	<0.015 #	<0.015 #	<0.015 #	<0.015 #
Phenanthrene (aq)	<0.022 µg/l	TM178		<0.022 #	<0.022 #	<0.022 #	<0.022 #	<0.022 #	<0.022 #
Fluorene (aq)	<0.014 µg/l	TM178		<0.014 #	<0.014 #	<0.014 #	<0.014 #	<0.014 #	<0.014 #
Chrysene (aq)	<0.013 µg/l	TM178		<0.013 #	<0.013 #	<0.013 #	<0.013 #	<0.013 #	<0.013 #
Pyrene (aq)	<0.015 µg/l	TM178		<0.015 #	<0.015 #	<0.015 #	<0.015 #	<0.015 #	<0.015 #
Benzo(a)anthracene (aq)	<0.017 µg/l	TM178		<0.017 #	<0.017 #	<0.017 #	<0.017 #	<0.017 #	<0.017 #
Benzo(b)fluoranthene (aq)	<0.023 µg/l	TM178		<0.023 #	<0.023 #	<0.023 #	<0.023 #	<0.023 #	<0.023 #
Benzo(k)fluoranthene (aq)	<0.027 µg/l	TM178		<0.027 #	<0.027 #	<0.027 #	<0.027 #	<0.027 #	<0.027 #
Benzo(a)pyrene (aq)	<0.009 µg/l	TM178		<0.009 #	<0.009 #	<0.009 #	<0.009 #	<0.009 #	<0.009 #
Dibenzo(a,h)anthracene (aq)	<0.016 µg/l	TM178		<0.016 #	<0.016 #	<0.016 #	<0.016 #	<0.016 #	<0.016 #
Benzo(g,h,i)perylene (aq)	<0.016 µg/l	TM178		<0.016 #	<0.016 #	<0.016 #	<0.016 #	<0.016 #	<0.016 #
Indeno(1,2,3-cd)pyrene (aq)	<0.014 µg/l	TM178		<0.014 #	<0.014 #	<0.014 #	<0.014 #	<0.014 #	<0.014 #
PAH, Total Detected USEPA 16 (aq)	µg/l	TM178		none detected	0.103	0.131	none detected	none detected	none detected

CERTIFICATE OF ANALYSIS

SDG:	110602-58	**Location:**	Part 2a Assistance	**Order Number:**	
Job:	H_GRONTMIJ_SOL-54	**Customer:**	Grontmij	**Report Number:**	133432
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

PAH Spec MS - Aqueous (W)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
§	Non-conforming work.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed

Component	LOD/Units	Method	Customer Sample R	VIEW ST. 32 FOSTERS AVE.	VIEW ST. 53 VIEW ST.	VIEW ST. 9 WARD ST.	VIEW ST. WS2	VIEW ST. WS3	VIEW ST. WS4
			Depth (m)	.	.	.	1.20	1.10	1.60
			Sample Type	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)
			Date Sampled	31/05/2011	31/05/2011	31/05/2011	31/05/2011	31/05/2011	31/05/2011
			Date Received	02/06/2011	02/06/2011	02/06/2011	02/06/2011	02/06/2011	02/06/2011
			SDG Ref	110602-58	110602-58	110602-58	110602-58	110602-58	110602-58
			Lab Sample No.(s)	3588795	3588793	3588797	3588790	3588791	3588789
			AGS Reference						
Naphthalene (aq)	<0.1 µg/l	TM178		0.104 #	<0.1 #	<0.1 #	<0.1 #	<0.1 #	<0.1 #
Acenaphthene (aq)	<0.015 µg/l	TM178		<0.015 #	<0.015 #	<0.015 #	<0.015 #	0.0225 #	0.0156 #
Acenaphthylene (aq)	<0.011 µg/l	TM178		<0.011 #	<0.011 #	<0.011 #	<0.011 #	0.0181 #	<0.011 #
Fluoranthene (aq)	<0.017 µg/l	TM178		<0.017 #	<0.017 #	<0.017 #	<0.017 #	0.981 #	0.465 #
Anthracene (aq)	<0.015 µg/l	TM178		<0.015 #	<0.015 #	<0.015 #	<0.015 #	0.0538 #	0.0302 #
Phenanthrene (aq)	<0.022 µg/l	TM178		<0.022 #	<0.022 #	<0.022 #	<0.022 #	0.217 #	0.13 #
Fluorene (aq)	<0.014 µg/l	TM178		<0.014 #	<0.014 #	<0.014 #	<0.014 #	<0.014 #	<0.014 #
Chrysene (aq)	<0.013 µg/l	TM178		<0.013 #	<0.013 #	<0.013 #	<0.013 #	0.935 #	0.434 #
Pyrene (aq)	<0.015 µg/l	TM178		<0.015 #	<0.015 #	<0.015 #	<0.015 #	1.11 #	0.559 #
Benzo(a)anthracene (aq)	<0.017 µg/l	TM178		<0.017 #	<0.017 #	<0.017 #	<0.017 #	0.565 #	0.283 #
Benzo(b)fluoranthene (aq)	<0.023 µg/l	TM178		<0.023 #	<0.023 #	<0.023 #	<0.023 #	0.625 #	0.279 #
Benzo(k)fluoranthene (aq)	<0.027 µg/l	TM178		<0.027 #	<0.027 #	<0.027 #	<0.027 #	0.815 #	0.33 #
Benzo(a)pyrene (aq)	<0.009 µg/l	TM178		<0.009 #	<0.009 #	<0.009 #	<0.009 #	0.916 #	0.352 #
Dibenzo(a,h)anthracene (aq)	<0.016 µg/l	TM178		<0.016 #	<0.016 #	<0.016 #	<0.016 #	0.112 #	0.0359 #
Benzo(g,h,i)perylene (aq)	<0.016 µg/l	TM178		<0.016 #	<0.016 #	<0.016 #	<0.016 #	0.689 #	0.198 #
Indeno(1,2,3-cd)pyrene (aq)	<0.014 µg/l	TM178		<0.014 #	<0.014 #	<0.014 #	<0.014 #	0.54 #	0.164 #
PAH, Total Detected USEPA 16 (aq)	µg/l	TM178		0.104	none detected	none detected	none detected	7.6	3.28

CERTIFICATE OF ANALYSIS

SDG:	110602-58	**Location:**	Part 2a Assistance	**Order Number:**	
Job:	H_GRONTMIJ_SOL-54	**Customer:**	Grontmij	**Report Number:**	133432
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

PAH Spec MS - Aqueous (W)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
§	Non-conforming work.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed

Component	LOD/Units	Method	Customer Sample R: 10 WESTGATE
			Depth (m): .
			Sample Type: Water(GW/SW)
			Date Sampled: 31/05/2011
			Date Received: 02/06/2011
			SDG Ref: 110602-58
			Lab Sample No.(s): 3588809
			AGS Reference:
Naphthalene (aq)	<0.1 µg/l	TM178	<0.1 #
Acenaphthene (aq)	<0.015 µg/l	TM178	<0.015 #
Acenaphthylene (aq)	<0.011 µg/l	TM178	<0.011 #
Fluoranthene (aq)	<0.017 µg/l	TM178	<0.017 #
Anthracene (aq)	<0.015 µg/l	TM178	<0.015 #
Phenanthrene (aq)	<0.022 µg/l	TM178	<0.022 #
Fluorene (aq)	<0.014 µg/l	TM178	<0.014 #
Chrysene (aq)	<0.013 µg/l	TM178	<0.013 #
Pyrene (aq)	<0.015 µg/l	TM178	<0.015 #
Benzo(a)anthracene (aq)	<0.017 µg/l	TM178	<0.017 #
Benzo(b)fluoranthene (aq)	<0.023 µg/l	TM178	<0.023 #
Benzo(k)fluoranthene (aq)	<0.027 µg/l	TM178	<0.027 #
Benzo(a)pyrene (aq)	<0.009 µg/l	TM178	<0.009 #
Dibenzo(a,h)anthracene (aq)	<0.016 µg/l	TM178	<0.016 #
Benzo(g,h,i)perylene (aq)	<0.016 µg/l	TM178	<0.016 #
Indeno(1,2,3-cd)pyrene (aq)	<0.014 µg/l	TM178	<0.014 #
PAH, Total Detected USEPA 16 (aq)	µg/l	TM178	none detected

CERTIFICATE OF ANALYSIS

SDG:	110602-58	**Location:**	Part 2a Assistance	**Order Number:**	
Job:	H_GRONTMIJ_SOL-54	**Customer:**	Grontmij	**Report Number:**	133432
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

VOC MS (W)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
§	Non-conforming work.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed

Component	LOD/Units	Method	Customer Sample R	VIEW ST. WS2	VIEW ST. WS3	VIEW ST. WS4			
			Depth (m)	1.20	1.10	1.60			
			Sample Type	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)			
			Date Sampled	31/05/2011	31/05/2011	31/05/2011			
			Date Received	02/06/2011	02/06/2011	02/06/2011			
			SDG Ref	110602-58	110602-58	110602-58			
			Lab Sample No.(s)	3588790	3588791	3588789			
			AGS Reference						
Toluene-d8**	%	TM208		98.2	99	99.3			
Methyl tertiary butyl ether (MTBE)	<1.6 µg/l	TM208		<1.6 #	<1.6 #	<1.6 #			
Benzene	<1.3 µg/l	TM208		<1.3 #	<1.3 #	<1.3 #			
Toluene	<1.4 µg/l	TM208		<1.4 #	<1.4 #	<1.4 #			
Ethylbenzene	<2.5 µg/l	TM208		<2.5 #	<2.5 #	<2.5 #			
m,p-Xylene	<2.5 µg/l	TM208		<2.5 #	<2.5 #	<2.5 #			
o-Xylene	<1.7 µg/l	TM208		<1.7 #	<1.7 #	<1.7 #			

CERTIFICATE OF ANALYSIS

SDG:	110602-58	**Location:**	Part 2a Assistance	**Order Number:**	
Job:	H_GRONTMIJ_SOL-54	**Customer:**	Grontmij	**Report Number:**	133432
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Table of Results - Appendix

REPORT KEY

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03x10-7

NDP	No Determination Possible	#	ISO 17025 Accredited	*	Subcontracted Test	M	MCERTS Accredited
NFD	No Fibres Detected	PFD	Possible Fibres Detected	»	Result previously reported (Incremental reports only)	EC	Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM208	Modified: US EPA Method 8260b & 624	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	110602-58	**Location:**	Part 2a Assistance	**Order Number:**	
Job:	H_GRONTMIJ_SOL-54	**Customer:**	Grontmij	**Report Number:**	133432
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	3588803	3588805	3588806	3588788	3588808	3588787	3588799	3588800	3588798	3588802
Customer Sample Ref.	99 ARMITAGE ROAD	121 ARMITAGE ROAD	125 ARMITAGE ROAD	83 BLAKE CLOSE	11 GOODWOOD	3A BLAKE CLOSE	FIVEWAYS 5 NEWLANDS COURT	FIVEWAYS 9 NEWLANDS COURT	FIVEWAYS 11 NEWLANDS COURT	FIVEWAYS 1 NEWLANDS LANE
AGS Ref.										
Depth										
Type	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
Dissolved Metals by ICP-MS	08-Jun-2011	08-Jun-2011	08-Jun-2011	08-Jun-2011	07-Jun-2011	08-Jun-2011	09-Jun-2011	09-Jun-2011	08-Jun-2011	08-Jun-2011
Mercury Dissolved	07-Jun-2011	07-Jun-2011	08-Jun-2011	07-Jun-2011	07-Jun-2011	08-Jun-2011	08-Jun-2011	08-Jun-2011	07-Jun-2011	08-Jun-2011
PAH Spec MS - Aqueous (W)	09-Jun-2011	09-Jun-2011	09-Jun-2011	09-Jun-2011	09-Jun-2011	09-Jun-2011	09-Jun-2011	09-Jun-2011	09-Jun-2011	09-Jun-2011

Lab Sample No(s)	3588819	3588810	3588811	3588807	3588818	3588814	3588815	3588813	3588795	3588793
Customer Sample Ref.	21 HERONDALE	4 KEMPTON	2 SANDOWN	3 SLADE VIEW RISE	110 STAFFORD LANE	73 STAGBOROUGH	3 STAGBOROUGH WAY	41 SWALLOWFIELDS	VIEW ST. 32 FOSTERS AVE.	VIEW ST. 53 VIEW ST.
AGS Ref.										
Depth										
Type	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
Dissolved Metals by ICP-MS	08-Jun-2011	08-Jun-2011	08-Jun-2011	08-Jun-2011	08-Jun-2011	08-Jun-2011	08-Jun-2011	08-Jun-2011	08-Jun-2011	09-Jun-2011
Mercury Dissolved	07-Jun-2011	08-Jun-2011	08-Jun-2011	07-Jun-2011	07-Jun-2011	08-Jun-2011	07-Jun-2011	07-Jun-2011	07-Jun-2011	08-Jun-2011
PAH Spec MS - Aqueous (W)	09-Jun-2011	09-Jun-2011	09-Jun-2011	09-Jun-2011	09-Jun-2011	09-Jun-2011	09-Jun-2011	09-Jun-2011	09-Jun-2011	09-Jun-2011

Lab Sample No(s)	3588809	3588797	3588790	3588791	3588789
Customer Sample Ref.	10 WESTGATE	VIEW ST. 9 WARD ST.	VIEW ST. WS2	VIEW ST. WS3	VIEW ST. WS4
AGS Ref.					
Depth			1.20	1.10	1.60
Type	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
Dissolved Metals by ICP-MS	07-Jun-2011	10-Jun-2011	08-Jun-2011	08-Jun-2011	09-Jun-2011
Mercury Dissolved	07-Jun-2011	07-Jun-2011	07-Jun-2011	07-Jun-2011	08-Jun-2011
PAH Spec MS - Aqueous (W)	09-Jun-2011	09-Jun-2011	09-Jun-2011	09-Jun-2011	09-Jun-2011
VOC MS (W)			09-Jun-2011	09-Jun-2011	09-Jun-2011

SDG:	110602-58	**Location:**	Part 2a Assistance	**Order Number:**	
Job:	H_GRONTMIJ_SOL-54	**Customer:**	Grontmij	**Report Number:**	133432
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Appendix

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA Leach tests, flash point, ammonium as NH4 by the BRE method, VOC TICS, SVOC TICS, TOF-MS SCAN/SEARCH and TOF-MS TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for both soil jars, tubs and volatile jars. All waters and vials will be discarded 10 days after the analysis is completed (e-mailed). All material removed during an asbestos containing material screen and analysed for the presence of asbestos will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be screened in house for the presence of large asbestos containing material fragments/pieces. If no asbestos containing material is found this will be reported as 'no asbestos containing material detected'. If asbestos containing material is detected it will be removed and analysed by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If asbestos containing material is present no further analysis will be undertaken. At no point is the fibre content of the soil sample determined.

7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample -similarly, if a headspace or sediment is present in the volatile sample. This will be flagged up as an invalid VOC on the test schedule or recorded on the log sheet.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** -Most of our organic methods include surrogates, the recovery of which is monitored and reported. For EPH, MO, PAH, GRO and VOCs on soils the result is not surrogate corrected, but a percentage recovery is quoted. Acceptable limits for most organic methods are 70 -130 %.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors
employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials -whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute themajor part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C4 -C10 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

SOLID MATRICES EXTRACTION SUMMARY

ANALYSIS	D/C OR WET	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
SOLVENT EXTRACTABLE MATTER	D&C	DCM	SOXTHERM	GRAVIMETRIC
CYCLOHEXANE EXT. MATTER	D&C	CYCLOHEXANE	SOXTHERM	GRAVIMETRIC
THIN LAYER CHROMATOGRAPHY	D&C	DCM	SOXTHERM	IATROSCAN
ELEMENTAL SULPHUR	D&C	DCM	SOXTHERM	HPLC
PHENOLS BY GCMS	WET	DCM	SOXTHERM	GC-MS
HERBICIDES	D&C	HEXANE/ACETONE	SOXTHERM	GC-MS
PESTICIDES	D&C	HEXANE/ACETONE	SOXTHERM	GC-MS
EPH (DRO)	D&C	HEXANE/ACETONE	END OVER END	GC-FID
EPH (MIN OIL)	D&C	HEXANE/ACETONE	END OVER END	GC-FID
EPH (CLEANED UP)	D&C	HEXANE/ACETONE	END OVER END	GC-FID
EPH CWG BY GC	D&C	HEXANE/ACETONE	END OVER END	GC-FID
PCB TOT / PCB CON	D&C	HEXANE/ACETONE	END OVER END	GC-MS
POLYAROMATIC HYDROCARBONS (MS)	WET	HEXANE/ACETONE	MICROWAVE TM218.	GC-MS
C8-C40 (C8-C40) EZ FLASH	WET	HEXANE/ACETONE	SHAKER	GC-EZ
POLYAROMATIC HYDROCARBONS RAPID GC	WET	HEXANE/ACETONE	SHAKER	GC-EZ
SEMI VOLATILE ORGANIC COMPOUNDS	WET	DCM/ACETONE	SONICATE	GC-MS

LIQUID MATRICES EXTRACTION SUMMARY

ANALYSIS	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
PAH-MS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-MS
EPH	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-FID
EPH CWG	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-FID
MINERAL OIL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-FID
PCB 7 CONGENERS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-MS
PCB TOTAL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-MS
SVOC	DCM	LIQUID/LIQUID SHAKE	GC-MS
FREE SULPHUR	DCM	SOLID PHASE EXTRACTION	HPLC
PEST OCP/OPP	DCM	LIQUID/LIQUID SHAKE	GC-MS
TRIAZINE HERBS	DCM	LIQUID/LIQUID SHAKE	GC-MS
PHENOLS-MS	DCM	SOLID PHASE EXTRACTION	GC-MS
TPH by INFRARED (IR)	TCE	LIQUID/LIQUID SHAKE	HPLC
MINERAL OIL by IR	TCE	LIQUID/LIQUID SHAKE	HPLC
GLYCOLS	NONE	DIRECT INJECTION	GC-MS

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials or those identified as potentially asbestos containing during sample description which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: -
Trace -Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ALcontrol Laboratories

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Grontmij
Radcliffe House
3rd Floor
Blenheim Court, Lode lane
Solihull
West Midlands
B912AA

Attention: Gareth Taylor

Please note: this certificate, although titled "Mineral Railway", contains three samples (TPL01 to TPL03) which were collected from the Rawnsley site. The Rawnsley samples are circled in red overleaf.

CERTIFICATE OF ANALYSIS

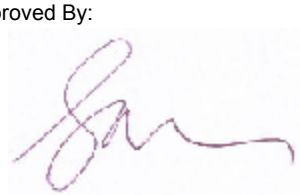
Date:	27 September 2011
Customer:	H_GRONTMIJ_SOL
Sample Delivery Group (SDG):	110919-28
Your Reference:	
Location:	Mineral Railway
Report No:	152120

We received 8 samples on Saturday September 17, 2011 and 8 of these samples were scheduled for analysis which was completed on Tuesday September 27, 2011. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:



Sonia McWhan

Operations Manager

CERTIFICATE OF ANALYSIS

SDG:	110919-28	**Location:**	Mineral Railway	**Order Number:**	
Job:	H_GRONTMIJ_SOL-32	**Customer:**	Grontmij	**Report Number:**	152120
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
4323021	TPL01		0.60	16/09/2011
4323022	TPL02		0.30	16/09/2011
4323023	TPL03		0.60	16/09/2011
4323024	TPNS01		0.10	16/09/2011
4323025	TPNS02		0.50	16/09/2011
4323026	TPNS03		0.10 - 0.20	16/09/2011
4323027	TPNS04		0.40 - 0.50	16/09/2011
4323028	TPNS05		0.30 - 0.40	16/09/2011

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	110919-28	**Location:**	Mineral Railway	**Order Number:**	
Job:	H_GRONTMIJ_SOL-32	**Customer:**	Grontmij	**Report Number:**	152120
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

SOLID

Results Legend

X **Test**

N **No Determination Possible**

			Lab Sample No(s)	4323021	4323024	4323022	4323025	4323023	4323026	4323027	4323028
			Customer Sample Reference	TPL01	TPNS01	TPL02	TPNS02	TPL03	TPNS03	TPNS04	TPNS05
			AGS Reference								
			Depth (m)	0.60	0.10	0.30	0.50	0.60	0.10 - 0.20	0.40 - 0.50	0.30 - 0.40
			Container	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	250g Amber Jar (AL	250g Amber Jar (AL
Asbestos Containing Material Screen	All	NDPs: 0 Tests: 1		X							
Asbestos Identification	All	NDPs: 0 Tests: 1		X							
CEN Readings	All	NDPs: 0 Tests: 2				X		X			
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 2				X		X			
Mercury Dissolved	All	NDPs: 0 Tests: 2				X		X			
Metals by iCap-OES (Soil)	Arsenic	NDPs: 0 Tests: 5			X		X		X	X	X
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 2				X		X			
Sample description	All	NDPs: 0 Tests: 8		X	X	X	X	X	X	X	X
TPH by IR Oils and Greases	All	NDPs: 0 Tests: 2				X		X			

CERTIFICATE OF ANALYSIS

SDG:	110919-28	**Location:**	Mineral Railway	**Order Number:**	
Job:	H_GRONTMIJ_SOL-32	**Customer:**	Grontmij	**Report Number:**	152120
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
4323021	TPL01	0.60	Light Brown	Sandy Loam	0.1 - 2 mm	Brick	Stones
4323022	TPL02	0.30	Dark Brown	Silt Loam	0.063 - 0.1 mm	Stones	None
4323023	TPL03	0.60	Light Brown	Sandy Loam	0.1 - 2 mm	Brick	Stones
4323024	TPNS01	0.10	Dark Brown	Sandy Silt Loam	0.1 - 2 mm	Stones	None
4323025	TPNS02	0.50	Dark Brown	Silty Clay	0.063 - 0.1 mm	Stones	None
4323026	TPNS03	0.10 - 0.20	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Vegetation
4323027	TPNS04	0.40 - 0.50	Dark Brown	Sandy Silt Loam	0.1 - 2 mm	Stones	Vegetation
4323028	TPNS05	0.30 - 0.40	Light Brown	Sandy Loam	0.1 - 2 mm	Stones	None

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	110919-28	**Location:**	Mineral Railway	**Order Number:**	
Job:	H_GRONTMIJ_SOL-32	**Customer:**	Grontmij	**Report Number:**	152120
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
§	Deviating sample.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed

Component	LOD/Units	Method	Customer Sample R	TPL01	TPNS01	TPNS02	TPNS03	TPNS04	TPNS05
			Depth (m)	0.60	0.10	0.50	0.10 - 0.20	0.40 - 0.50	0.30 - 0.40
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	16/09/2011	16/09/2011	16/09/2011	16/09/2011	16/09/2011	16/09/2011
			Date Received	17/09/2011	17/09/2011	17/09/2011	17/09/2011	17/09/2011	17/09/2011
			SDG Ref	110919-28	110919-28	110919-28	110919-28	110919-28	110919-28
			Lab Sample No.(s)	4323021	4323024	4323025	4323026	4323027	4323028
			AGS Reference						
Asbestos Containing Material Screen	-	TM001		Possible ACM Det					
Arsenic	<0.6 mg/kg	TM181			31.8 M	32.2 M	24.8 M	15.4 M	11.5 M

CERTIFICATE OF ANALYSIS

SDG:	110919-28	**Location:**	Mineral Railway	**Order Number:**	
Job:	H_GRONTMIJ_SOL-32	**Customer:**	Grontmij	**Report Number:**	152120
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Asbestos Identification

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Customer Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPL01 NS Z 0.60 SOLID 16/09/2011 00:00:00 19/09/2011 13:43:56 110919-28 4,323,021 TM048	23/09/11	Tomasz Pawlikowski	Typical of asbestos insulation board	Detected (#)	Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	110919-28	**Location:**	Mineral Railway	**Order Number:**	
Job:	H_GRONTMIJ_SOL-32	**Customer:**	Grontmij	**Report Number:**	152120
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

CEN 2:1 STAGE BATCH TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/1

Client Reference		**Site Location**	Mineral Railway
Mass Sample taken (kg)		**Moisture Content Ratio (%)**	
Mass of dry sample (kg)	0.175	**Dry Matter Content Ratio (%)**	
Particle Size <4mm	>95%		

Case				
SDG	110919-28			
Lab Sample Number(s)	4323021			
Sampled Date	16-Sep-2011			
Customer Sample Ref.	TPL01			
Depth (m)	0.60			

Solid Waste Analysis

Total Organic Carbon (%)	-	-	-	-
Loss on Ignition (%)	-	-	-	-
Sum of BTEX (mg/kg)	-	-	-	-
Sum of 7 PCBs (mg/kg)	-	-	-	-
Mineral Oil (mg/kg)	-	-	-	-
PAH Sum of 17 (mg/kg)	-	-	-	-
pH (pH Units)	-	-	-	-
ANC to pH 6 (mol/kg)	-	-	-	-
ANC to pH 4 (mol/kg)	-	-	-	-

Eluate Analysis

	Concⁿ in 2:1 eluate (mg/l)		2:1 concⁿ leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	Limit of Detection	Result	Limit of Detection			
Arsenic	-	-	-	-	0.5	2	25
Barium	-	-	-	-	20	100	300
Cadmium	-	-	-	-	0.04	1	5
Chromium	-	-	-	-	0.5	10	70
Copper	-	-	-	-	2	50	100
Mercury Dissolved (CVAF)	-	-	-	-	0.01	0.2	2
Molybdenum	-	-	-	-	0.5	10	30
Nickel	-	-	-	-	0.4	10	40
Lead	-	-	-	-	0.5	10	50
Antimony	-	-	-	-	0.06	0.7	5
Selenium	-	-	-	-	0.1	0.5	7
Zinc	-	-	-	-	4	50	200
Chloride	-	-	-	-	800	15000	25000
Fluoride	-	-	-	-	10	150	500
Sulphate (soluble)	-	-	-	-	1000	20000	50000
Total Dissolved Solids	-	-	-	-	4000	60000	100000
Total Monohydric Phenols (W)	-	-	-	-	1	-	-
Dissolved Organic Carbon	-	-	-	-	500	800	1000

Leach Test Information

Date Prepared	23-Sep-2011
pH (pH Units)	
Conductivity (µS/cm)	
Temperature (°C)	
Volume Leachant (Litres)	
Volume of Eluate VE1 (Litres)	

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation
Mcerts Certification does not apply to leachates
27/09/2011 21:22:11

21:22:08 27/09/2011

CERTIFICATE OF ANALYSIS

SDG:	110919-28	**Location:**	Mineral Railway	**Order Number:**	
Job:	H_GRONTMIJ_SOL-32	**Customer:**	Grontmij	**Report Number:**	152120
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

CEN 2:1 STAGE BATCH TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/1

Client Reference		**Site Location**	Mineral Railway
Mass Sample taken (kg)	0.190	**Moisture Content Ratio (%)**	8.71
Mass of dry sample (kg)	0.175	**Dry Matter Content Ratio (%)**	92.0
Particle Size <4mm	>95%		

Case				
SDG	110919-28			
Lab Sample Number(s)	4323022			
Sampled Date	16-Sep-2011			
Customer Sample Ref.	TPL02			
Depth (m)	0.30			

Solid Waste Analysis

Total Organic Carbon (%)	-	-	-	-
Loss on Ignition (%)	-	-	-	-
Sum of BTEX (mg/kg)	-	-	-	-
Sum of 7 PCBs (mg/kg)	-	-	-	-
Mineral Oil (mg/kg)	-	-	-	-
PAH Sum of 17 (mg/kg)	-	-	-	-
pH (pH Units)	-	-	-	-
ANC to pH 6 (mol/kg)	-	-	-	-
ANC to pH 4 (mol/kg)	-	-	-	-

Eluate Analysis

	Concⁿ in 2:1 eluate (mg/l)		2:1 concⁿ leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	Limit of Detection	Result	Limit of Detection			
Arsenic	0.00162	<0.00012	0.00324	<0.0012	0.5	2	25
Barium	-	-	-	-	20	100	300
Cadmium	0.000118	<0.0001	0.000236	<0.001	0.04	1	5
Chromium	0.00107	<0.00022	0.00214	<0.0022	0.5	10	70
Copper	0.0086	<0.00085	0.0172	<0.0085	2	50	100
Mercury Dissolved (CVAF)	0.0000137	<0.00001	0.0000274	<0.0001	0.01	0.2	2
Molybdenum	-	-	-	-	0.5	10	30
Nickel	0.00432	<0.00015	0.00864	<0.0015	0.4	10	40
Lead	0.00997	<0.00002	0.0199	<0.0002	0.5	10	50
Antimony	0.000868	<0.00016	0.00174	<0.0016	0.06	0.7	5
Selenium	-	-	-	-	0.1	0.5	7
Zinc	0.0121	<0.00041	0.0242	<0.0041	4	50	200
Chloride	-	-	-	-	800	15000	25000
Fluoride	-	-	-	-	10	150	500
Sulphate (soluble)	-	-	-	-	1000	20000	50000
Total Dissolved Solids	-	-	-	-	4000	60000	100000
Total Monohydric Phenols (W)	-	-	-	-	1	-	-
Dissolved Organic Carbon	-	-	-	-	500	800	1000

Leach Test Information

Date Prepared	21-Sep-2011
pH (pH Units)	6.17
Conductivity (µS/cm)	36.10
Temperature (°C)	20.40
Volume Leachant (Litres)	0.335
Volume of Eluate VE1 (Litres)	

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation
Mcerts Certification does not apply to leachates
27/09/2011 21:22:11

21:22:08 27/09/2011

CERTIFICATE OF ANALYSIS

SDG:	110919-28	**Location:**	Mineral Railway	**Order Number:**	
Job:	H_GRONTMIJ_SOL-32	**Customer:**	Grontmij	**Report Number:**	152120
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

CEN 2:1 STAGE BATCH TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/1

Client Reference		**Site Location**	Mineral Railway
Mass Sample taken (kg)	0.190	**Moisture Content Ratio (%)**	8.71
Mass of dry sample (kg)	0.175	**Dry Matter Content Ratio (%)**	92.0
Particle Size <4mm	>95%		

Case				
SDG	110919-28			
Lab Sample Number(s)	4323022			
Sampled Date	16-Sep-2011			
Customer Sample Ref.	TPL02			
Depth (m)	0.30			

Solid Waste Analysis

Total Organic Carbon (%)	-	-	-	-
Loss on Ignition (%)	-	-	-	-
Sum of BTEX (mg/kg)	-	-	-	-
Sum of 7 PCBs (mg/kg)	-	-	-	-
Mineral Oil (mg/kg)	-	-	-	-
PAH Sum of 17 (mg/kg)	-	-	-	-
pH (pH Units)	-	-	-	-
ANC to pH 6 (mol/kg)	-	-	-	-
ANC to pH 4 (mol/kg)	-	-	-	-

Eluate Analysis

	Concⁿ in 2:1 eluate (mg/l)		2:1 concⁿ leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	Limit of Detection	Result	Limit of Detection			
TPH	<1	<1	<2	<1	-	-	-
Boron	0.0994	<0.0094	0.199	<0.094	-	-	-
Vanadium	0.00325	<0.00024	0.0065	<0.0024	-	-	-
PAH Spec MS - Aqueous (W)							
Naphthalene by GCMS	0.000102	<0.0001	0.000204	<0.001	-	-	-
Acenaphthene by GCMS	0.0000254	<0.000015	0.0000508	<0.00015	-	-	-
Acenaphthylene by GCMS	<0.000011	<0.000011	<0.000022	<0.00011	-	-	-
Fluoranthene by GCMS	0.0000198	<0.000017	0.0000396	<0.00017	-	-	-
Anthracene by GCMS	<0.000015	<0.000015	<0.00003	<0.00015	-	-	-
Phenanthrene by GCMS	<0.000022	<0.000022	<0.000044	<0.00022	-	-	-
Fluorene by GCMS	0.0000159	<0.000014	0.0000318	<0.00014	-	-	-
Chrysene by GCMS	<0.000013	<0.000013	<0.000026	<0.00013	-	-	-
Pyrene by GCMS	0.0000162	<0.000015	0.0000324	<0.00015	-	-	-
Benz(a)anthracene by GCMS	<0.000017	<0.000017	<0.000034	<0.00017	-	-	-
Benzo(b)fluoranthene by GCMS	<0.000023	<0.000023	<0.000046	<0.00023	-	-	-
Benzo(k)fluoranthene by GCMS	<0.000027	<0.000027	<0.000054	<0.00027	-	-	-
Benzo(a)pyrene by GCMS	<0.000009	<0.000009	<0.000018	<0.00009	-	-	-
Dibenzo(ah)anthracene by GCMS	<0.000016	<0.000016	<0.000032	<0.00016	-	-	-
Benzo(ghi)perylene by GCMS	<0.000016	<0.000016	<0.000032	<0.00016	-	-	-
Indeno(123cd)pyrene by GCMS	<0.000014	<0.000014	<0.000028	<0.00014	-	-	-
PAH 16 EPA Total by GCMS	<0.000247	<0.000247	<0.000494	<0.00247	-	-	-

Leach Test Information

Date Prepared	21-Sep-2011
pH (pH Units)	6.17
Conductivity (µS/cm)	36.10
Temperature (°C)	20.40
Volume Leachant (Litres)	0.335
Volume of Eluate VE1 (Litres)	

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation
Mcerts Certification does not apply to leachates
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CERTIFICATE OF ANALYSIS

SDG:	110919-28	**Location:**	Mineral Railway	**Order Number:**	
Job:	H_GRONTMIJ_SOL-32	**Customer:**	Grontmij	**Report Number:**	152120
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

CEN 2:1 STAGE BATCH TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/1

Client Reference		**Site Location**	Mineral Railway
Mass Sample taken (kg)	0.196	**Moisture Content Ratio (%)**	11.8
Mass of dry sample (kg)	0.175	**Dry Matter Content Ratio (%)**	89.5
Particle Size <4mm	>95%		

Case	
SDG	110919-28
Lab Sample Number(s)	4323023
Sampled Date	16-Sep-2011
Customer Sample Ref.	TPL03
Depth (m)	0.60

Solid Waste Analysis

Total Organic Carbon (%)	-	-	-	-
Loss on Ignition (%)	-	-	-	-
Sum of BTEX (mg/kg)	-	-	-	-
Sum of 7 PCBs (mg/kg)	-	-	-	-
Mineral Oil (mg/kg)	-	-	-	-
PAH Sum of 17 (mg/kg)	-	-	-	-
pH (pH Units)	-	-	-	-
ANC to pH 6 (mol/kg)	-	-	-	-
ANC to pH 4 (mol/kg)	-	-	-	-

Eluate Analysis

	Concⁿ in 2:1 eluate (mg/l)		2:1 concⁿ leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	Limit of Detection	Result	Limit of Detection			
Arsenic	0.00222	<0.00012	0.00444	<0.0012	0.5	2	25
Barium	-	-	-	-	20	100	300
Cadmium	<0.0001	<0.0001	<0.0002	<0.001	0.04	1	5
Chromium	0.00535	<0.00022	0.0107	<0.0022	0.5	10	70
Copper	0.0126	<0.00085	0.0252	<0.0085	2	50	100
Mercury Dissolved (CVAF)	0.000013	<0.00001	0.000026	<0.0001	0.01	0.2	2
Molybdenum	-	-	-	-	0.5	10	30
Nickel	0.00267	<0.00015	0.00534	<0.0015	0.4	10	40
Lead	0.000564	<0.00002	0.00113	<0.0002	0.5	10	50
Antimony	0.00106	<0.00016	0.00212	<0.0016	0.06	0.7	5
Selenium	-	-	-	-	0.1	0.5	7
Zinc	0.00171	<0.00041	0.00342	<0.0041	4	50	200
Chloride	-	-	-	-	800	15000	25000
Fluoride	-	-	-	-	10	150	500
Sulphate (soluble)	-	-	-	-	1000	20000	50000
Total Dissolved Solids	-	-	-	-	4000	60000	100000
Total Monohydric Phenols (W)	-	-	-	-	1	-	-
Dissolved Organic Carbon	-	-	-	-	500	800	1000

Leach Test Information

Date Prepared	23-Sep-2011
pH (pH Units)	7.87
Conductivity (µS/cm)	272.00
Temperature (°C)	20.40
Volume Leachant (Litres)	0.329
Volume of Eluate VE1 (Litres)	

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
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CERTIFICATE OF ANALYSIS

SDG:	110919-28	**Location:**	Mineral Railway	**Order Number:**	
Job:	H_GRONTMIJ_SOL-32	**Customer:**	Grontmij	**Report Number:**	152120
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

CEN 2:1 STAGE BATCH TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/1

Client Reference		**Site Location**	Mineral Railway
Mass Sample taken (kg)	0.196	**Moisture Content Ratio (%)**	11.8
Mass of dry sample (kg)	0.175	**Dry Matter Content Ratio (%)**	89.5
Particle Size <4mm	>95%		

Case				
SDG	110919-28			
Lab Sample Number(s)	4323023			
Sampled Date	16-Sep-2011			
Customer Sample Ref.	TPL03			
Depth (m)	0.60			

Solid Waste Analysis

Total Organic Carbon (%)	-	-	-	-
Loss on Ignition (%)	-	-	-	-
Sum of BTEX (mg/kg)	-	-	-	-
Sum of 7 PCBs (mg/kg)	-	-	-	-
Mineral Oil (mg/kg)	-	-	-	-
PAH Sum of 17 (mg/kg)	-	-	-	-
pH (pH Units)	-	-	-	-
ANC to pH 6 (mol/kg)	-	-	-	-
ANC to pH 4 (mol/kg)	-	-	-	-

Eluate Analysis

	Concⁿ in 2:1 eluate (mg/l)		2:1 concⁿ leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	Limit of Detection	Result	Limit of Detection			
TPH	1.13	<1	2.26	<1	-	-	-
Boron	0.057	<0.0094	0.114	<0.094	-	-	-
Vanadium	0.0031	<0.00024	0.0062	<0.0024	-	-	-
PAH Spec MS - Aqueous (W)							
Naphthalene by GCMS	0.000139	<0.0001	0.000278	<0.001	-	-	-
Acenaphthene by GCMS	0.0000444	<0.000015	0.0000888	<0.00015	-	-	-
Acenaphthylene by GCMS	<0.000011	<0.000011	<0.000022	<0.00011	-	-	-
Fluoranthene by GCMS	0.0000755	<0.000017	0.000151	<0.00017	-	-	-
Anthracene by GCMS	<0.000015	<0.000015	<0.00003	<0.00015	-	-	-
Phenanthrene by GCMS	0.0000481	<0.000022	0.0000962	<0.00022	-	-	-
Fluorene by GCMS	0.0000232	<0.000014	0.0000464	<0.00014	-	-	-
Chrysene by GCMS	<0.000013	<0.000013	<0.000026	<0.00013	-	-	-
Pyrene by GCMS	0.0000514	<0.000015	0.000103	<0.00015	-	-	-
Benz(a)anthracene by GCMS	<0.000017	<0.000017	<0.000034	<0.00017	-	-	-
Benzo(b)fluoranthene by GCMS	<0.000023	<0.000023	<0.000046	<0.00023	-	-	-
Benzo(k)fluoranthene by GCMS	<0.000027	<0.000027	<0.000054	<0.00027	-	-	-
Benzo(a)pyrene by GCMS	<0.000009	<0.000009	<0.000018	<0.00009	-	-	-
Dibenzo(ah)anthracene by GCMS	<0.000016	<0.000016	<0.000032	<0.00016	-	-	-
Benzo(ghi)perylene by GCMS	<0.000016	<0.000016	<0.000032	<0.00016	-	-	-
Indeno(123cd)pyrene by GCMS	<0.000014	<0.000014	<0.000028	<0.00014	-	-	-
PAH 16 EPA Total by GCMS	0.000382	<0.000247	0.000764	<0.00247	-	-	-

Leach Test Information

Date Prepared	23-Sep-2011
pH (pH Units)	7.87
Conductivity (µS/cm)	272.00
Temperature (°C)	20.40
Volume Leachant (Litres)	0.329
Volume of Eluate VE1 (Litres)	

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
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CERTIFICATE OF ANALYSIS

SDG:	110919-28	**Location:**	Mineral Railway	**Order Number:**	
Job:	H_GRONTMIJ_SOL-32	**Customer:**	Grontmij	**Report Number:**	152120
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Table of Results - Appendix

REPORT KEY

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03x10-7

NDP	No Determination Possible	#	ISO 17025 Accredited	*	Subcontracted Test	M	MCERTS Accredited
NFD	No Fibres Detected	PFD	Possible Fibres Detected	»	Result previously reported (Incremental reports only)	EC	Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
PM114		Leaching Procedure for CEN Two Stage BatchTest 2:1/8:1 Cumulative		
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step		
TM001	In - house Method	Determination of asbestos containing material by screening on solids		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM235	The Determination of Hydrocarbon Oils in Waters by Solvent Extraction, Infra red Absorption and Gravimetry 1983, HMSO, London	Determination of Total Petroleum Hydrocarbons (TPH) in Waters By Infra-Red Spectroscopy		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	110919-28	**Location:**	Mineral Railway	**Order Number:**	
Job:	H_GRONTMIJ_SOL-32	**Customer:**	Grontmij	**Report Number:**	152120
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	4323021	4323022	4323023	4323024	4323025	4323026	4323027	4323028
Customer Sample Ref.	TPL01	TPL02	TPL03	TPNS01	TPNS02	TPNS03	TPNS04	TPNS05
AGS Ref.								
Depth	0.60	0.30	0.60	0.10	0.50	0.10 - 0.20	0.40 - 0.50	0.30 - 0.40
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos Containing Material Screen	23-Sep-2011		23-Sep-2011					
Asbestos Identification	26-Sep-2011							
CEN 2:1 Leachate (1 Stage)		22-Sep-2011	23-Sep-2011					
CEN Readings		26-Sep-2011	26-Sep-2011					
Dissolved Metals by ICP-MS		27-Sep-2011	27-Sep-2011					
Mercury Dissolved		27-Sep-2011	27-Sep-2011					
Metals by iCap-OES (Soil)				27-Sep-2011	27-Sep-2011	27-Sep-2011	27-Sep-2011	27-Sep-2011
PAH Spec MS - Aqueous (W)		27-Sep-2011	27-Sep-2011					
Sample description	26-Sep-2011	21-Sep-2011	21-Sep-2011	21-Sep-2011	21-Sep-2011	21-Sep-2011	23-Sep-2011	21-Sep-2011
TPH by IR Oils and Greases		27-Sep-2011	27-Sep-2011					

SDG:	110919-28	**Location:**	Mineral Railway	**Order Number:**	
Job:	H_GRONTMIJ_SOL-32	**Customer:**	Grontmij	**Report Number:**	152120
Client Reference:		**Attention:**	Gareth Taylor	**Superseded Report:**	

Appendix

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA Leach tests, flash point, ammonium as NH4 by the BRE method, VOC TICS, SVOC TICS, TOF-MS SCAN/SEARCH and TOF-MS TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for both soil jars, tubs and volatile jars. All waters and vials will be discarded 10 days after the analysis is completed (e-mailed). All material removed during an asbestos containing material screen and analysed for the presence of asbestos will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be screened in house for the presence of large asbestos containing material fragments/pieces. If no asbestos containing material is found this will be reported as 'no asbestos containing material detected'. If asbestos containing material is detected it will be removed and analysed by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If asbestos containing material is present no further analysis will be undertaken. At no point is the fibre content of the soil sample determined.

7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample -similarly, if a headspace or sediment is present in the volatile sample. This will be flagged up as an invalid VOC on the test schedule or recorded on the log sheet.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** -Most of our organic methods include surrogates, the recovery of which is monitored and reported. For EPH, MO, PAH, GRO and VOCs on soils the result is not surrogate corrected, but a percentage recovery is quoted. Acceptable limits for most organic methods are 70 -130 %.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors
employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials -whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute themajor part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C4 -C10 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

SOLID MATRICES EXTRACTION SUMMARY

ANALYSIS	D/C OR WET	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
SOLVENT EXTRACTABLE MATTER	D&C	DCM	SOXTHERM	GRAVIMETRIC
CYCLOHEXANE EXT. MATTER	D&C	CYCLOHEXANE	SOXTHERM	GRAVIMETRIC
ELEMENTAL SULPHUR	D&C	DCM	SOXTHERM	HPLC
PHENOLS BY GCMS	WET	DCM	SOXTHERM	GC-MS
HERBICIDES	D&C	HEXANE:ACETONE	SOXTHERM	GC-MS
PESTICIDES	D&C	HEXANE:ACETONE	SOXTHERM	GC-MS
EPH (DRO)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH (MIN OIL)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH (CLEANED UP)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH CWG BY GC	D&C	HEXANE:ACETONE	END OVER END	GC-FID
PCB TOT/PCB CON	D&C	HEXANE:ACETONE	END OVER END	GC-MS
POLYAROMATIC HYDROCARBONS (MS)	WET	HEXANE:ACETONE	MICROWAVE TM218.	GC-MS
C8-C40 (C8-C40) EZ FLASH	WET	HEXANE:ACETONE	SHAKER	GC-EZ
POLYAROMATIC HYDROCARBONS RAPID GC	WET	HEXANE:ACETONE	SHAKER	GC-EZ
SEMI VOLATILE ORGANIC COMPOUNDS	WET	DCM:ACETONE	SONICATE	GC-MS

LIQUID MATRICES EXTRACTION SUMMARY

ANALYSIS	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
PAH-MS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-MS
EPH	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
EPH CWG	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
MINERAL OIL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
PCB 7 CONGENERS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-MS
PCB TOTAL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-MS
SVOC	DCM	LIQUID/LIQUID SHAKE	GC-MS
FREE SULPHUR	DCM	SOLID PHASE EXTRACTION	HPLC
PEST OCP/OPP	DCM	LIQUID/LIQUID SHAKE	GC-MS
TRIAZINE HERBS	DCM	LIQUID/LIQUID SHAKE	GC-MS
PHENOLS-MS	DCM	SOLID PHASE EXTRACTION	GC-MS
TPH by INFRARED (IR)	TCE	LIQUID/LIQUID SHAKE	HPLC
MINERAL OIL by IR	TCE	LIQUID/LIQUID SHAKE	HPLC
GLYCOLS	NONE	DIRECT INJECTION	GC-MS

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials or those identified as potentially asbestos containing during sample description which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: -
Trace -Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Scientific Analysis Laboratories is a limited company registered in England and Wales (No 2514788) whose address is at Hadfield House, Hadfield Street, Manchester M16 9FE

Scientific Analysis Laboratories Ltd

Certificate of Analysis

Hadfield House
Hadfield Street
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Manchester
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Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: 259094-1

Date of Report: 05-Dec-2011

Customer: Grontmij
3rd Floor
Radcliffe House
Blenheim Court
Lode Lane
Solihull
B91 2AA

Customer Contact: Mr Gareth Taylor

Customer Job Reference:
Customer Site Reference: Rawnsley
Date Job Received at SAL: 24-Nov-2011
Date Analysis Started: 28-Nov-2011
Date Analysis Completed: 05-Dec-2011

The results reported relate to samples received in the laboratory
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs

Report checked
and authorised by :
Mr Ross Walker
Customer Services Manager
(Land)

Issued by :
Mr Ross Walker
Customer Services Manager
(Land)

SAL Reference: 259094
Project Site: Rawnsley
Customer Reference:

Soil Analysed as Soil
Miscellaneous

				SAL Reference	**259094 001**	**259094 002**	**259094 003**	**259094 004**	**259094 005**
				Customer Sample Reference	**X1**	**X2**	**X3**	**X4**	**X5**
				Date Sampled	**22-NOV-2011**	**22-NOV-2011**	**22-NOV-2011**	**22-NOV-2011**	**22-NOV-2011**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Asbestos ID	T27	AR			N.D.	N.D.	N.D.	N.D.	N.D.

Index to symbols used in 259094-1

Value	Description
AR	As Received
N.D.	Not Detected
S	Analysis was subcontracted
U	Analysis is UKAS accredited

Method Index

Value	Description
T27	PLM

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Asbestos ID	T27	AR			SU	001-005

APPENDIX E

TABLE 1 - GAS MONITORING DATA

Site: *Rawnsley* **Job No.** 103912

Monitoring Well Sampling & Testing Record

BH	Date	Pipe Internal Diameter mm	Monitored By	Gas Rel Pressure (mb)	Flow l/h	CH_4 % v/v	CH_4 GSV	CO_2 % v/v	CO_2 GSV	O_2 % v/v	CO ppm	H2S ppm	CH4 (% LEL)	Gas Analyser	Weather: Atmospheric Pressure mbar	Conditions @ Monitoring	Ambient Temp °C
WS1RN	28/07/2010			0.13	-0.1	0	0	7	-0.007	17.3	1	0	0	GA2000	993		15
WS1RN	11/08/2010			0.39	-0.1	0	0	6.2	-0.0062	14.3	0	0	0	GA2000	993		15.0
WS1RN	25/08/2010			0.40	0.1	0	0	4.6	0.0046	10	0	0	0	GA2000	989		12.
WS1RN	08/09/2010			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	979		13.0
WS2RN	28/07/2010			0.13	-0.1	0	0	2.6	-0.0026	17.7	0	0	0	GA2000	993		15
WS2RN	11/08/2010			0.38	0.1	0	0	2.7	0.0027	17.1	0	0	0	GA2000	993		15.0
WS2RN	25/08/2010			0.40	0.1	0	0	3.2	0.0032	16.7	0	0	0	GA2000	989		12.
WS2RN	08/09/2010			NM	0.1	0	0	3.9	0.0039	16.0	0	0	0	GA2000	979		13.0
WS3RN	28/07/2010			0.22	-0.1	0	0	0.4	-0.0004	17.6	0	0	0	GA2000	993		15
WS3RN	11/08/2010			0.38	-0.1	0	0	0.3	-0.0003	17.1	0	0	0	GA2000	993		15.0
WS3RN	25/08/2010			0.40	0.1	0	0	0.6	0.0006	17.1	0	0	0	GA2000	989		12.
WS3RN	08/09/2010			NM	0.1	0	0	0.6	0.0006	16.9	0	0	0	GA2000	979		13.0
WS4RN	28/07/2010			0.20	-0.1	0	0	9.1	-0.0091	17.6	0	0	0	GA2000	993		15
WS4RN	11/08/2010			0.37	-0.1	0	0	8.9	-0.0089	14.3	0	0	0	GA2000	993		15.0
WS4RN	25/08/2010			0.40	0.1	0	0	4.9	0.0049	13.9	0	0	0	GA2000	989		12.
WS4RN	08/09/2010			NM	-0.1	0	0	5.6	-0.0056	5.7	0	0	0	GA2000	979		13.0
WS5RN	28/07/2010			0.21	-0.1	0	0	0.6	-0.0006	17.7	0	0	0	GA2000	993		15
WS5RN	11/08/2010			0.35	0.1	0	0	0.5	0.0005	13.2	0	0	0	GA2000	993		15.0
WS5RN	25/08/2010			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	989		12.
WS5RN	08/09/2010			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	979		13.0
WS6RN	28/07/2010			0.21	-0.1	0	0	2	-0.002	17.7	0	0	0	GA2000	993		15
WS6RN	11/08/2010			0.35	0.1	0	0	2.1	0.0021	13.7	0	0	0	GA2000	993		15.0
WS6RN	25/08/2010			0.41	0.1	0	0	3.3	0.0033	13.3	0	0	0	GA2000	989		12.
WS6RN	08/09/2010			NM	0.1	0	0	4	0.004	16.0	0	0	0	GA2000	979		13.0
WS7RN	28/07/2010			0.11	-0.1	0	0	0.6	-0.0006	17.7	0	0	0	GA2000	993		15
WS7RN	11/08/2010			0.34	-0.1	0	0	0.7	-0.0007	14.3	0	0	0	GA2000	993		15.0
WS7RN	25/08/2010			0.40	0.1	0	0	3.1	0.0031	14.3	0	0	0	GA2000	989		12.
WS7RN	08/09/2010			NM	-0.1	0	0	4.1	-0.0041	16.4	0	0	0	GA2000	979		13.0

Pressure trend: steady on 15/11 and 3/12; slowly rising on 11/01

NOTES: NM = Not Measured

GSV (l/hr) = [gas well gas concentration (%v/v)] **x** [gas well flow rate (l/hr)]

100

APPENDIX F

Appendix F: Severity and Probability of Risk in Conceptual Site Models (after CIRIA552, Tables 6.3 to 6.5)

This report draws on guidance presented in CIRIA report 552, "Contaminated Land Risk Assessment, A Guide for Good Practice", wherein the "severity" term in the Conceptual Site Model is classified with reference to the sensitivity of the hazard and the receptor, as follows:

Severity Category	Description	Examples
Severe	Acute risk to human health likely to result in "significant harm" as defined in EPA90, catastrophic damage to buildings or property, acute risk of major pollution of controlled waters, acute risk of harm to ecosystems (as defined in Contaminated Land Regulations 2006)	High cyanide concentrations at the surface of a recreation area Major spillage into controlled waters Explosion, causing building collapse
Medium	Chronic risk to human health likely to result in "significant harm" as defined in EPA90, chronic pollution of sensitive controlled waters, significant change at a sensitive ecosystems or species, significant damage to buildings or structures	Contaminant concentrations at a site in excess of SGVs, GAC or similar screening values Leaching of contaminants to sensitive aquifer Death of a species within a nature reserve
Mild	Pollution of non-sensitive waters, significant damage to buildings, structures, services or crops, damage to sensitive buildings, structures, services or the environment, which nonetheless result in "significant harm"	Pollution to (former) non-aquifer or to non-controlled surface watercourse. Damage to building rendering it unsafe to occupy (e.g. foundation or structural damage)
Minor	Harm, not necessarily resulting in "significant harm" but probably requiring expenditure to resolve or financial loss. Non-permanent risks to human health that are easily mitigated, e.g. by wearing PPE. Easily-repairable damage to structures or services	Contaminant concentrations requiring the wearing of PPE during site work, but no other long-term mitigation. Discolouration of concrete

The likelihood of an event (probability) takes into account both the presence of hazard and receptor and the integrity of the pathway between hazard and receptor, and is assessed as follows:

Category	There is a pollution linkage and:
High	Event is likely in the short term and almost inevitable over the long term. Or, there is evidence of actual harm at/to the receptor
Likely	Event is possible in the short term and likely over the long term
Low	Event is unlikely in the short term and possible over the long term
Unlikely	Event is unlikely, even in the long term

Potential severity and probability have been assessed in the following matrix, to give an overall risk rating:

	Severity			
Probability	Severe	Medium	Mild	Minor
High	Very high	High	Moderate	Low/moderate
Likely	High	Moderate	Low/moderate	Low
Low	Moderate	Low/moderate	Low	Very low
Unlikely	Low/moderate	Low	Very low	Very low

The above risk categories are likely to result in the following actions:

- Very high: urgent intervention / investigation needed, remediation likely to be required
- High: urgent intervention / investigation needed, remediation possibly required in short term and probably required in long term
- Moderate: investigation needed to clarify and refine risk; remediation may be required over the long term
- Low: it is possible that harm could arise to a receptor, but if realised, such harm is likely to be, at worst, mild
- Very low: it is possible that harm could arise to a receptor, but if realised, such harm is unlikely to be severe

Appendix G: Initial Screen of Soil Quality Data Against WRAS and UKWIR Guidelines

Two publications have been reviewed in regard to potential risks to water supply pipes posed by contaminants in the ground:

- "Guidance for the Protection of Water Supply Pipes to be Used in Brownfield Sites" (UK Water Industry Research {UKWIR}, ref 10/WM/03/21, 2010 (re-issued version))
- The Selection of Materials for Water Supply Pipes to be Laid in Contaminated Land (Water Regulations Advisory Scheme {WRAS}, ref 9-04-03, October 2002)

Both reports present methodologies for the assessment of soil conditions and the specification of appropriate pipework materials to mitigate the presence of contaminants.

WRAS Screen

A comparison between the chemical analysis results obtained from samples taken from the top 1.2m of soil at the site and the older WRAS screening values is presented in the table below. Only soils from the top 1.2m of the soil profile have been selected for comparison as 1.2m is the typical maximum depth at which water pipes are laid within the highway – with local service connections to properties typically much shallower. Note, the table below does not constitute a full screen against all WRAS parameters; e.g. sulphate, cyanide and coal tar have not been tested for.

WRAS Threshold Screen

Analyte	Test Result (mg/kg)	WRAS Threshold Value (mg/kg)
	max	
Sulphate	Not analysed	2000
Sulphur	Not analysed	5000
Sulphide	Not analysed	250
pH	**4.49** – 7.66	**<5** or >8
Antimony	<1.2	10
Arsenic	**48**	**10**
Cadmium	1.0	3
Chromium (hexavalent)	<1.2	25
Chromium (total)	29	600
Cyanide (free)	Not analysed	25
Cyanide (complexed)	Not analysed	250
Lead	140	500
Mercury	<0.1	1
Selenium	**3.8**	**3**
Thiocyanate	<1	50
Coal Tar	Not analysed	50
Cyclohexane extractable	Not analysed	50
Phenol	<0.01	5
Polyaromatic Hydrocarbons	**180**	**50**
Toluene extractable	<0.01	50
Petroleum Hydrocarbons	**250**	**50**

Bold values indicate testing result > WRAS threshold value

The maximum concentrations of arsenic, selenium, polyaromatic hydrocarbons and petroleum hydrocarbons, and the minimum soil pH level recorded, exceed the WRAS threshold values.

UKWIR Screen

The UKWIR approach is the most recent and reflects further studies undertaken since the WRAS document was published in 2002. Key features of the UKWIR report include:

- A pipework material-specific assessment procedure (Table 3.1 of the report). This allows chemical analysis results to be compared to various threshold criteria associated with six possible pipework material types
- The discounting of metallic pipework (other than copper or steel/ductile iron with protective wrapping) as a modern pipework material
- The specification of a different chemical testing suite to that recommended in the earlier WRAS document – including the use of physio-chemical parameters and exclusion of analysis for metals (given the above discounting of metallic pipework).

The chemical analysis for the site was scheduled prior to the publication of the re-issued UKWIR report (despite a re-issue data of 2010, the report was not available until January 2011). Therefore, some of the parameters required for a UKWIR screen (as summarised in Appendix G) are not available. The available laboratory results from the top 1.2m of soil have been compared to the UKWIR thresholds. The screen indicates that:

- The total VOC (minus BTEX) and total SVOC (minus phenols and cresols) concentrations are acceptable
- BTEX concentrations are acceptable for PE pipe, but not for PVC pipe
- The mineral oil C11-20 result in WS4RN, 0.7m bgl exceeds the UKWIR threshold for PE pipework.
- Concentrations of mineral oil C21-40 are acceptable for PE pipework.

Summary

It was possible that the concentrations of contaminants at the site could adversely affect drinking water quality, depending on the materials used for water distribution (South Staffordshire Water pipes) and local connections to the South Staffs network (probably installed by the house builder). Further investigation, in the form of sampling of water quality at residents' taps, was therefore undertaken, as outlined in Section 3.2.6 of the main report.