



Wolverhampton Bus Depot

Site Investigation Interpretative Report

A090070-150

Homes and Communities Agency

November 2016

Prepared on behalf of WYG Environment Planning Transport Limited.



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1.0 Executive Summary

Proposed Development	Residential development is proposed.
Site Conditions	The site is roughly rectangular in shape and occupies approximately 1.0ha, comprising a former bus depot, intact at the time of investigation.
Ground Investigation	The ground investigation was undertaken from the 3 rd to 5 th October 2016. The investigation comprised 6 No. window sample boreholes and 10 No. trial pits.
Ground Conditions	Ground conditions at the site comprised made ground with reinforced concrete and whole brick foundations in the southern section. Made ground in the northern section overlies light brown gravelly SAND interbedded with reddish brown CLAY between depths of 0.5 to 3.5mbgl.
Contamination Assessment	<p>An area of hydrocarbons contamination was identified in the west of the site, consistent with previous investigations.</p> <p>Asbestos was identified in 3 of 6 samples tested, including asbestos cement fragments and fibres of chrysotile, amosite and crocidolite. Although concentrations were low, the material may represent a health risk on disturbance.</p> <p>Localised contamination by lead was identified in made ground.</p> <p>Preliminary ground gas risk assessment indicates a requirement for protection of buildings to CGS 2. This should be reviewed on completion of monitoring.</p>
Conclusions and Recommendations	<p>Remediation of hydrocarbons contamination will be required.</p> <p>Due to the presence of asbestos in made ground, control measures will be required avoid risk during the removal of the floor slab and subsequent groundworks.</p> <p>Gas protection is likely to be required in future construction.</p>
This sheet is intended as a summary of the assessment of the site in relation to ground contamination and geotechnical conditions. It does not provide a definitive engineering analysis.	



2.0 Introduction

2.1 Instruction

WYG Environment (WYG) were commissioned by the Home and Communities Agency to conduct a ground investigation of the former Wolverhampton Bus Depot. The ground investigation has been carried out in line with BS10175 [1] and BS5930:2015 [2].

2.2 Scope of Services

The investigation was undertaken to assess the ground conditions in order to inform remedial requirements and geotechnical design.

The scope of the fieldwork programme included:

- 6 No. Window sample boreholes to 4.0mbgl or refusal and the installation of gas monitoring boreholes in all six locations;
- 10 No. Trial pits to a maximum depth of 3.5mbgl or refusal to obtain soil samples for environmental testing;
- Contamination laboratory testing;
- Geotechnical laboratory testing.

2.3 Terms and Conditions

Attention is drawn to the report conditions, included in Appendix A, and to the terms and conditions of the engagement.



3.0 Site Details

3.1 General

Site location and layout plans are included as Figures 1 and 2.

3.2 Site Location

The site is located between the A41 Bilston Road and Cleveland Road, approximately 0.5 miles south east of Wolverhampton City Centre. The bus depot building is roughly rectangular shaped and occupies a 1ha area. Salient site details are summarised in Table 1.

Table 1: Site Location

Site Address	Cleveland Road Wolverhampton WV2 1BP
NGR (Centre of Site)	391896E 298277N

3.3 Site Description

The site occupies approximately 1ha of covered car parking space. The internal structure of the building is divided into two sections by a brick retaining wall and elevation change. Ground conditions across the site were observed as hard standing concrete.

The southern section of the bus depot occupies approximately 0.5ha and can be accessed from Cleveland Road. Fuel storage tanks are installed above the entrance, supported by steel beams. The ground at the entrance is demarcated into two lanes separated by an elevated concrete pavement, a former fuel pump island. Each of the lanes are slightly concave shaped and comprise a large rectangular drainage grid in the middle, assumed to drain to an interceptor. An "L" shaped structure delineates the southern site boundary comprising an office block with boiler house to the east. The eastern section of the site is occupied by twelve backfilled inspection pits. This area is partially divided from the rest of the depot by sliding shutter doors.

The northern section of the site covers approximately 0.3ha and is at a lower elevation to the southern section. The area can be accessed by a slope located on the northwest side of the site. A second building block was located toward the east of the retaining wall.

Two large fuel tanks, believed to be diesel, were identified in a basement beneath the northeast of the upper floor area, accessible via a shutter door in the retaining wall. A waste oil tank was encountered in the north of the backfilled inspection pit area, observed via an inspection cover in the floor.

3.4 Surrounding Land Uses

The site is located in the Wolverhampton district approximately 0.5 km south east of Wolverhampton city centre. The surrounding areas of the site are predominately commercial buildings and roads.

Table 2: Surrounding Land Uses

Boundary	Description
North	Bilston Street Island Roundabout and Bilston Road A41
East	Commercial buildings and associated roads.
South	Commercial properties and Wolverhampton Royal Hospital (disused) beyond
West	Commercial buildings.

3.5 Proposed development

Residential development is proposed.

3.6 Previous Reports

Site investigations within the depot area have been undertaken by QDS Environmental (2000) and Delta Simons (2013).

QDS Environmental, 2000 [12]

The investigation included both the bus depot and hospital land to the south. Extracts from the QDS report are reproduced in Appendix E.

Within the bus station area, the presence of diesel and waste oil tanks were recorded in the northeast, and former fuel pumps in the southwest (see QDS report extracts, Figure 5).



The QDS report noted that four 40,000 litre diesel tanks were present in a 'purpose built underground basement', connected to the fuel pumps via a combination of overhead and underground pipework. Three underground waste oil tanks were identified in the vicinity of the diesel tanks and maintenance pit area. The report also refers to an above-ground storage tank, assumed to relate to the overhead tank adjacent to the Cleveland Road entrance.

Ground conditions beneath the bus depot comprised up to 2.0m of made ground comprising ash and clinker, slag, brick, concrete, glass, ceramics and clay, overlying approximately 6m of red firm clay with sand lenses.

Contamination by petroleum hydrocarbons was identified at QDS borehole BH4 (1.1%) and at TP12 (6,800mg/kg) in the vicinity of the fuel pumps. Downward migration of hydrocarbons was considered to have been arrested by the underlying boulder clay (Till). 'Elevated' concentrations of volatile hydrocarbons (m/p xylenes, ethyl benzene and isopropylbenzene) were reported, though concentrations were substantially below current WYG 'residential' screening criteria. Further investigation was proposed in this area to delineate the extent of impact. Trial pit TP9, in the vicinity of the diesel / waste oil tanks, indicated 40µg/kg trichloroethene in soil at 0.35m, slightly exceeding the residential criterion of 34µg/kg.

Localised contamination of soils by metals was identified (notably QDS TP5: lead 1,170mg/kg, exceeding the residential criterion of 200mg/kg).

Delta Simons, 2015 [13]

A Land Quality Summary Report produced by Delta Simons in 2015 referred to additional site investigation works undertaken within the bus garage in 2013. A full copy of the site investigation report has not been made available.

The additional investigation comprised one rotary borehole to 8.85m bgl and 4 dynamic sampler boreholes to a maximum of 4m. Monitoring installations were provided in the rotary and 2 dynamic sampler boreholes.

Made ground observations were similar to the 2000 investigation, comprising clayey brick fill with ash, clinker, ceramic, concrete and timber, to 2.7m maximum.

Hydrocarbon odours were identified in both the made ground and underlying Till Diamicton at 2 locations, with site observations of 'oils / free product'. Visual evidence of hydrocarbons contamination was observed in groundwater in the rotary and one dynamic sampler borehole.



Details of contamination testing, and a borehole location plan, are not available. However, the 2015 report notes that:

“Elevated concentrations of Aliphatic C8-C16 and Aromatic C10-C16 hydrocarbons, above the saturation limits, have been identified in the soils collected from RBH201, DS201, DS203 and DS204, principally from depths between 2.00 m bgl and 3.80 m bgl and as such, there is the potential for free product to exist in these locations. Potential evidence of free product was identified in RBH201 at between 2.25 and 3.35 m bgl and DS204 at 2.00 to 3.50 m bgl, which identified a slightly greasy feel within the soils. No non aqueous phase liquid (NAPL) was recorded during groundwater monitoring events.”

The maximum total petroleum hydrocarbons concentration in soils was recorded at 26,000mg/kg, predominantly >C8-C16 aliphatic; >C16-C44 aromatic. This may indicate the presence of both diesel and lubricating oil.

Groundwater analysis showed up to 33mg/l petroleum hydrocarbons, of similar composition range to soils (though aromatic >C21-C35 was less prominent). Chlorinated hydrocarbons were below the detection limit at both sampling locations.

Ground gas monitoring in the bus garage area in 2013 was assessed by Delta Simons as Characteristic Gas Situation CGS1 (methane <0.1%, carbon dioxide 10.7% maximum). The assessment should be regarded as tentative in the absence of detailed monitoring results.

3.7 Geology

Details of the geology underlying the site have been obtained from the following sources:

- British Geological Survey (BGS) 1:50,000 Solid & Drift Sheet 153 - Wolverhampton, 2003;
- BGS GeoIndex Website.

3.7.1 Superficial Geology

Available geological records describe the superficial geology of the site as Till, Devensian – Diamicton.

3.7.2 Solid Geology

The majority of the site is underlain by Clent Formation and Enville Formation with Mudstone and Sandstone Sedimentary rock across the site.

The BGS Lexicon of named rock units gives the following generic description of the Clent Formation:



"Breccia, sub-angular, with red-brown mudstone matrix, clasts predominantly 'Precambrian-Uriconian' volcanic rocks and subordinate Lower Palaeozoic rocks. Red pebbly mudstone and sandstone in Wolverhampton area"

The BGS Lexicon of named rock units gives the following generic description of the Enville Formation Group:

"Red mudstone and red-brown, fine- to coarse-grained sandstone, locally pebbly, and lenticular beds of conglomerate. Sandstone mostly sublitharenite; conglomerate clasts mostly Carboniferous limestone and chert"

3.7.3 Structural Geology

The BGS Geindex indicates there are no faults present on site.

3.7.4 Historic BGS Borehole Information

BGS record 7 historic boreholes present within 100m from the site. The available borehole scans generally follow the published geology.



4.0 Fieldwork

The ground investigation was undertaken from the 3rd October to 5th October 2016.

The investigation comprised 6 No. window sample boreholes and 10 No. trial pits. Trial pits were distributed across the site to provide improved density of exploratory locations. Window sample boreholes were targeted to further investigate areas where contamination had previously been identified by earlier investigations, or to target features including below-ground tanks.

The locations of exploratory holes are shown on the Exploratory Hole Location Plan, included as Figure 3. The exploratory holes were supervised, logged and sampled by a WYG Engineer. Fieldworks were undertaken in accordance with BS5930:2015. [2]

4.1 Trial Pits

A total of 10 trial pits were excavated to a maximum depth of 3.50mbgl using a JCB 3CX with 600mm bucket. During the fieldworks the trial pits were excavated to gain a spread of geotechnical and contamination data across the site. Sampling of the recovered materials was undertaken at discrete intervals and at changes of strata. Representative samples of soils were scheduled for geotechnical and contamination testing.

4.2 Window Sample Boreholes

Six window sample boreholes were advanced through the subsurface strata using window sample techniques to a maximum depth of 5mbgl to obtain chemical and geotechnical data and to enable gas and groundwater monitoring. Sampling of the recovered materials was undertaken at discrete intervals and at changes in material. Standard penetration tests (SPTs) were carried out at selected intervals throughout the window sample boreholes. Standpipes were installed in 6 No. window sample boreholes. Details of the installations are provided in the borehole records attached as Appendix B.



5.0 Contamination Laboratory Testing

Selected soil samples from the ground investigations works were scheduled for contamination testing.

16 No. Screening contamination suites were undertaken, comprising:

- Metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Se, Zn)
- Boron (water soluble)
- pH value
- Cyanide (free)
- Water Soluble Sulphate as SO₄
- Speciated PAHs (US EPA 16 priority pollutants)
- Extractable petroleum hydrocarbons
- Chromium (hexavalent)

Selected samples were also tested for asbestos. The results of the chemical analytical testing are discussed in Section 8.0 and attached in Appendix C.

Groundwater encountered in TP05 and in boreholes was sampled and scheduled for contamination testing.



6.0 Encountered Subsurface Conditions

In general the southern section of the site comprises made ground encountered at depths between 0 to 3.0mbgl. Brick and reinforced concrete were common, including relict laid brick structures, in some cases forming the base of the holes. The northern section of the site comprises made ground over SAND interbedded with CLAY lenses at depths between 0.3 to 3.5mbgl.

6.1 Made Ground

Made ground was encountered within all exploratory holes typically comprising dark brown gravelly SAND. Gravel comprised fine to coarse sub-angular to sub-rounded reinforced concrete with occasional whole bricks and shards of glass. Strong hydrocarbon odour was noted in TP05, TP10 and WS02. In addition, inflowing water from the trial pit wall was noted in TP05 at a depth of 2.8mbgl. The depth of made ground in the southern section of the site was encountered at depths up to 3.0mbgl. However, due to the difference in ground elevation, the depth of made ground in the northern section was encountered at depth between 0.3 to 1.7mbgl.

6.2 Superficial Geology

Superficial deposits of light brown SAND interbedded with reddish brown clay lenses encountered within WS03, TP01, TP02, TP03 and TP04 underlying concrete made ground from depths of 1.8 to 3.5mbgl.

6.3 Solid Geology

The firm reddish brown slightly sandy CLAY with interbedded orange to brown SAND lenses are attributed to the Clent Formation and Enville Formation were encountered in exploratory holes TP01, TP02, TP03, TP04 and WS03.

6.4 Groundwater

With the exception of TP05, Groundwater was not encountered in any of the exploratory holes during the site investigation. Three gas and groundwater monitoring rounds are to be undertaken.



7.0 Contamination Assessment Criteria

7.1 Soils

A Generic Quantitative Risk Assessment (GQRA) has been undertaken by comparing recorded concentrations of chemical constituents in soil with Generic Assessment Criteria (GAC) to identify whether, at the concentrations recorded, the presence of the constituent has the potential to adversely affect the health of site users.

If the recorded concentrations of a particular constituent are below the GAC then the risk is considered to be acceptable. Where a substance is recorded at concentrations higher than GAC this does not necessarily indicate that a particular risk is present, but signifies the requirement to undertake further review / assessment in line with the UK tiered risk assessment framework.

The Soil Screening Values (SSVs) used to screen analytical results derive from various sources. Preferentially WYG have used Category 4 Screening Levels (C4SL) derived by DEFRA with CL:AIRE (Contaminated Land: Applications in Real Environments) [10]. C4SLs are currently available for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead.

Where C4SLs are unavailable, 'Suitable for Use Levels' (S4ULs) developed by LQM/CIEH [11] have been applied. The LQM/CIEH S4ULs are based on minimal or tolerable risk intended to be protective of human health.

An SSV for 'Easily Liberatable Cyanide' has also been generated by WYG, based on potential short term exposure.

SSVs are available for a number of land uses. Based on current proposals, criteria for 'Residential with plant uptake' use have been applied.



8.0 Contamination Assessment

8.1 General

Contamination testing was undertaken on 10 soil samples at depths from 0.50mbgl to 2.8mbgl.

Results exceeding human health screening criteria were obtained for lead and petroleum hydrocarbons. Positive asbestos results were also identified.

8.1.1 Lead

A single sample, TP05, 0.1m, slightly exceeded the 200mg/kg screening value, at 228mg/kg. The sample represented made ground, with much concrete and brick. As the material would be physically unsuitable for retention at the surface in gardens, and the exceedance of the criterion is minimal, the result is not considered to represent any significant risk.

8.1.2 Petroleum hydrocarbons

Hydrocarbon odours were identified at several exploratory locations.

TP10, 2.5m, indicated significantly elevated total hydrocarbons, at 5,695mg/kg, with exceedances of the human health screening criteria for the >C8-C10, and potentially >C10-C12, >C12-C16 and >C16-21, carbon bands, dependant on the aliphatic / aromatic composition. Although the hydrocarbons present were predominantly in the diesel range, there were contributions from both higher and lower carbon bands, suggesting that a combination of sources might contribute to the total.

Elevated concentrations were also identified at TP03, 973mg/kg (predominantly lubricating oil range); TP05, 1,170mg/kg (diesel range), and WS02, 8,609mg/kg (diesel / mixed sources). The elevated concentrations were coincident with observed odours at TP05, TP10 and WS02. Trial pits TP5, TP10 and WS02 were located to the north of the former fuel delivery island near to the site entrance, suggesting a source relating to tank, fuel pipe or interceptor leakage.

8.1.3 Asbestos

Suspected asbestos cement was identified immediately beneath the ground slab at WS04. The material was not sampled, and the hole abandoned for health and safety reasons. No other visible evidence of suspected asbestos-containing materials was identified.

Six samples of made ground were scheduled for asbestos screening, targeting material observed to contain demolition arisings (brick, concrete).



Asbestos was detected in samples retrieved from a depth of 1.0mbgl from exploratory holes TP05, TP08 and TP09. Laboratory observations are summarised below:

TP05	Asbestos cement debris & fibre bundles	Chrysotile	<0.1%
TP08	Fibre bundles	Chrysotile	<0.1%
TP09	Fibre bundles	Chrysotile, amosite and crocidolite	-

Asbestos presents a health risk only by inhalation of airborne fibres and the presence of asbestos beneath the existing ground slab does not represent a risk. However, removal of the slab, and groundworks which may create airborne dust, has the potential to result in risk by inhalation.

Identifiable asbestos-containing products, asbestos cement, were only identified by the laboratory at TP05, and the abandoned WS04. At the other two positive locations, the laboratory observation of 'fibre bundles' only suggests a low concentration of more finely divided material.

Except at TP09, the asbestos type was restricted to chrysotile, most commonly associated with asbestos cement. Chrysotile represents a lower health risk than the other asbestos forms. TP09 identified chrysotile, amosite and crocidolite, including the higher-risk forms (brown and blue asbestos) and suggesting that an additional source other than asbestos cement might be present.

Material beneath the groundslab and above groundwater are both loose / granular in nature and likely to be dry, conditions more likely to result in airborne dust on disturbance.

The combination of risk factors represents a moderate risk to health during demolition (slab removal) and subsequent groundworks. As a minimum, damping-down of the ground is recommended to minimise dust. It is also recommended that an assessment should be undertaken to assess whether other precautions are required, in compliance with the Control of Asbestos Regulations.

Retention of made ground slightly impacted by asbestos on site, beneath cover, may be acceptable, provided that future disturbance can be prevented. Removal of any more significant accumulations of asbestos products identified during demolition / groundworks would be recommended.



8.1.4 Ground water Samples

A groundwater sample recovered from trial pit TP05 was tested for hydrocarbons, to further assess visible evidence of sheen and odour. Elevated concentrations, at 593mg/l total, predominantly diesel range and consistent with soil analysis from this location, were recorded. Whilst the measured concentration may be elevated by inclusion of floating free product, the sample being obtained by bailing. The sample was also scheduled for a volatile organic compound suite, which identified only trace concentrations of hydrocarbons, and trichloroethene at 5µg/l, below the freshwater Environmental Quality Standard.

All WYG boreholes were dry on the occasion that groundwater sampling was undertaken. Two boreholes which were located from previous investigations by others, adjacent to the fuel pump island, were sampled and tested for petroleum hydrocarbons and VOCs. The boreholes have been allocated the identification WS201 and WS202. The depth to groundwater differed significantly between the two boreholes (WS201, 2.45m, WS202, 6.19m) despite the two boreholes being adjacent, suggesting that the response zones of the boreholes are at differing levels.

Borehole WS201 did not indicate any contamination. WS202 indicated significant contamination by petroleum hydrocarbons, predominantly diesel range, consistent with WYG soil and trial pit water testing in this vicinity. No volatile organic compounds, other than trace concentrations of hydrocarbons potentially attributable to minor components of diesel, were identified.

8.1.5 Comparison with previous investigations

Results of the investigation were generally consistent with the previous investigations by QDS and Delta-Simons.

An area of hydrocarbons contamination was identified by WYG to the north of the former fuel pump island, near to the western boundary of the site. This was consistent with a hydrocarbons contamination zone previously identified, centred on QDS borehole BH4 and trial pit TP12. The extent of the contaminated area found by WYG was approximately consistent with that indicated in QDS Figure 5 (included in Appendix E). Delta-Simons also confirmed hydrocarbons, consistent with a combination of diesel and lubricating oil, in the same area.

No significant evidence of contamination was identified in the vicinity of the fuel and waste oil tanks in the west of the site. Boreholes in this vicinity were dry on monitoring and no groundwater analysis has currently been undertaken. QDS identified trace contamination by trichloroethene in soils in this vicinity, not currently replicated by WYG.

Localised contamination by metals, notably lead, was identified by both WYG and QDS.



Ground gas monitoring by Delta-Simons indicated Characteristic Gas Situation 1 conditions, with moderately elevated carbon dioxide. No significant methane was identified. This appears generally consistent with WYG data, excepting methane at one WYG location.

9.0 Gas Assessment

Ground gas monitoring has been undertaken on 2 occasions over a 2 week period with one visit remaining. Results are included in Appendix F.

The maximum methane concentration was 27.3% and the maximum carbon dioxide concentration was 15.2%. Significant methane was detected only at borehole WS02, maximum concentration at any other borehole not exceeding 0.2%. Elevated carbon dioxide concentration was more widespread, 4 of 7 boreholes exceeding 5% on at least one occasion. Only WS02 maintained a carbon dioxide concentration in excess of 5% after the first monitoring round.

The maximum total gas flow detected was 0.4 l/h giving a maximum gas screening value (based on worst case flow and concentration, irrespective of location or time) for the site of 0.108 l/h.

Based on the guidance in CIRIA C665 [7], the site falls within 'Characteristic gas situation 2'. Gas protection measures compliant with BS 8485:2015 [8] will be required. This assessment should be reviewed on completion of the monitoring programme. Requirements for gas protection might be limited in extent.

The elevated methane concentration at WS02 coincides with an area of hydrocarbons contamination. The apparent methane may be due to biological degradation of the hydrocarbons (diesel) present, or may be due to instrument cross-sensitivity to hydrocarbon vapour. Remediation of hydrocarbons contamination in this vicinity may result in a reduction of hazardous gas concentrations.



10.0 Summary and Conclusions

- WYG Environment (WYG) were commissioned by the Homes and Communities Agency to conduct a ground investigation for the former Bus Depot, Wolverhampton.
- The ground investigation was undertaken from the 3rd October to 5th October 2016.
- The site works comprised 5 No. Window sampling boreholes to a maximum depth of 6mbgl or refusal. Groundwater sampling was also undertaken from two pre-existing boreholes.
- Generally the site comprised granular made ground, with much brick, overlying superficial sand deposits with interbedded clay lenses creating the base of the boreholes.
- Groundwater was not encountered in any of the exploratory holes during the site investigation, however, inflowing water in TP05 was observed at 2.80mbgl and a strong hydrocarbon odour noted from the trial pit.
- Based on the guidance in CIRIA C665, the site falls within 'Characteristic gas situation 2' due to elevated carbon dioxide and localised methane. Gas protection measures may be required. This should be reviewed on completion of monitoring.
- Contamination testing was undertaken on 10 soil samples at depths from 0.50mbgl to 2.8mbgl. Results exceeding human health screening criteria were obtained for lead and petroleum hydrocarbons from sample locations TP03, TP05, TP10 and WS02. The contaminant was characterised as a combination of lubricating oil and diesel. Results were consistent with earlier investigations by others.
- Localised evidence of lead contamination was identified by WYG and earlier by QDS.
- Ground gas protection to CGS 2 requirements is indicated to be required. The level of protection, and area requiring gas protection, should be reviewed on completion of monitoring.
- Remediation of localised hydrocarbons contamination is likely to be required.



- Positive asbestos results were identified in samples collected at 1.0mbgl depth from trial pit locations TP05, TP08 and TP09. The combination of risk factors represents a **moderate risk** to health during demolition (slab removal) and subsequent groundworks. As a minimum, damping-down of the ground is recommended to minimise dust. It is also recommended that an assessment should be undertaken to assess whether other precautions are required, in compliance with the Control of Asbestos Regulations.



11.0 References

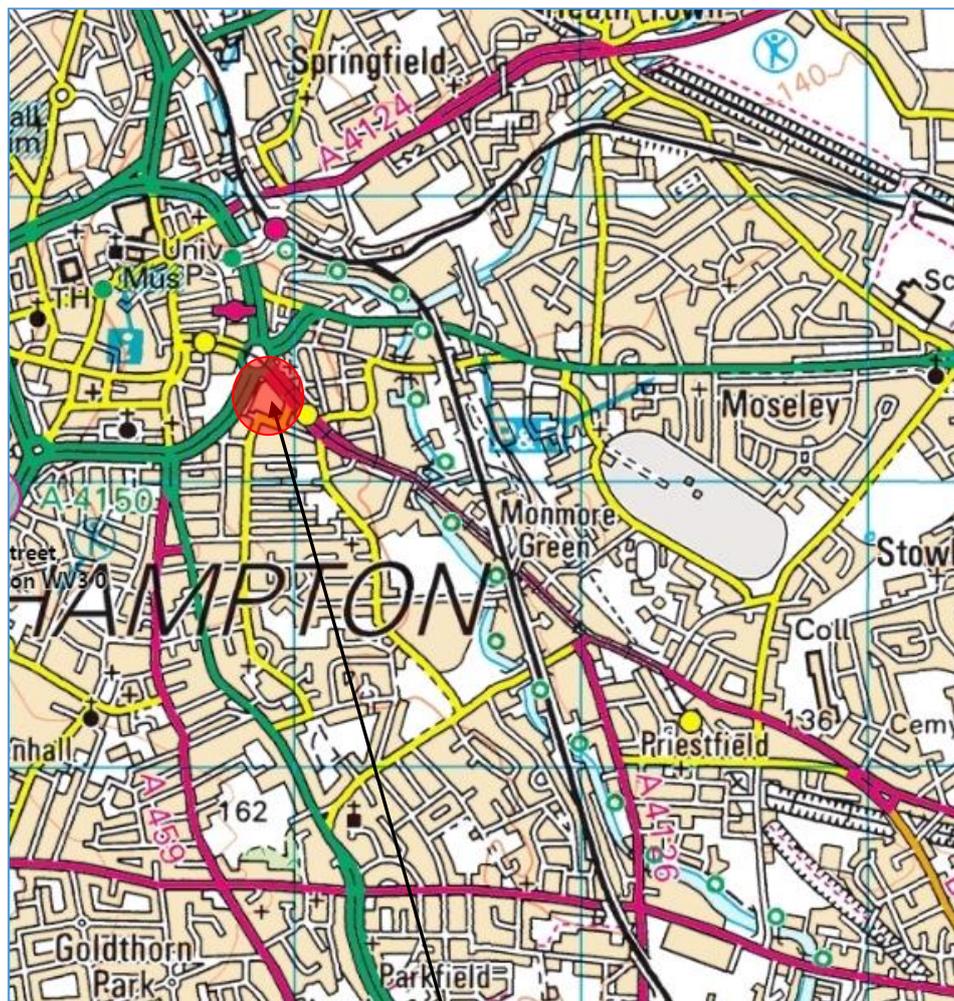
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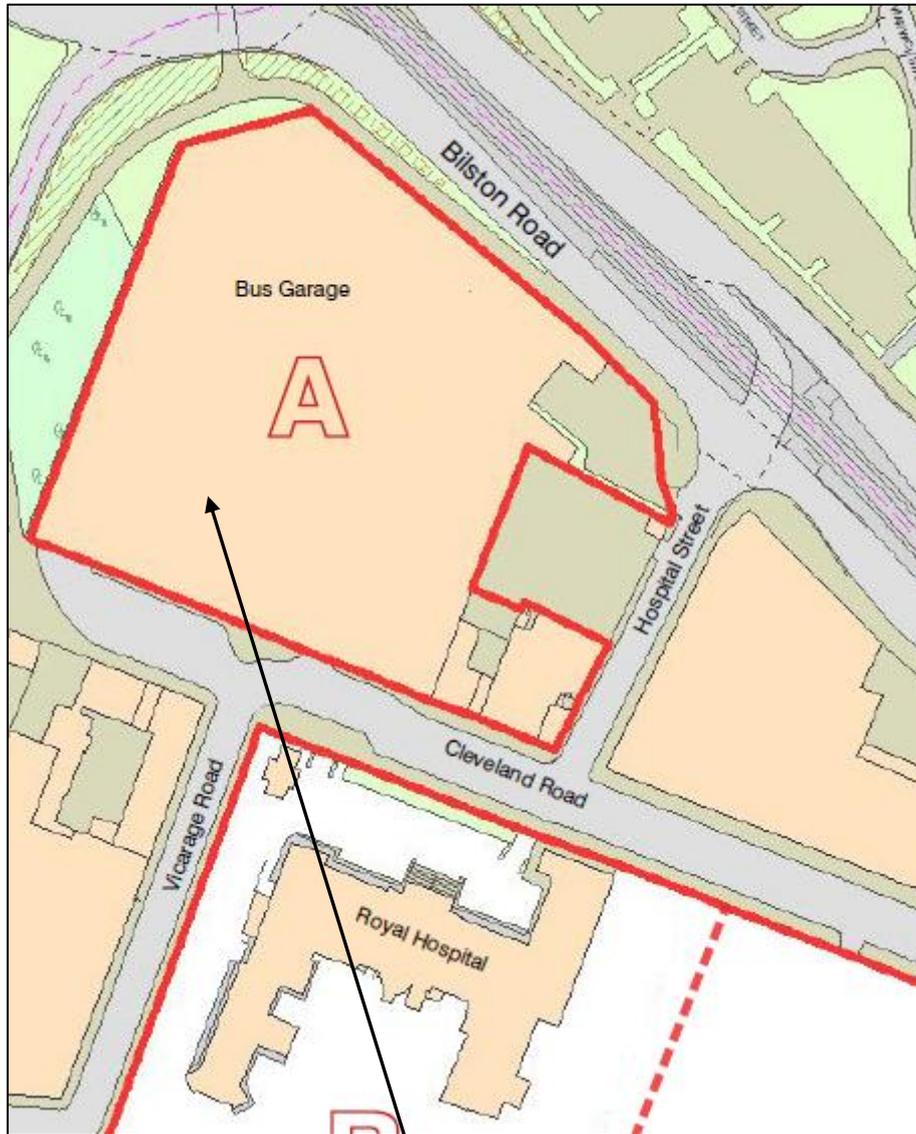
12.0 Figures and Appendices

Figure 1 – Regional Location Plan



The Site

Figure 2 – Local Site Location Plan

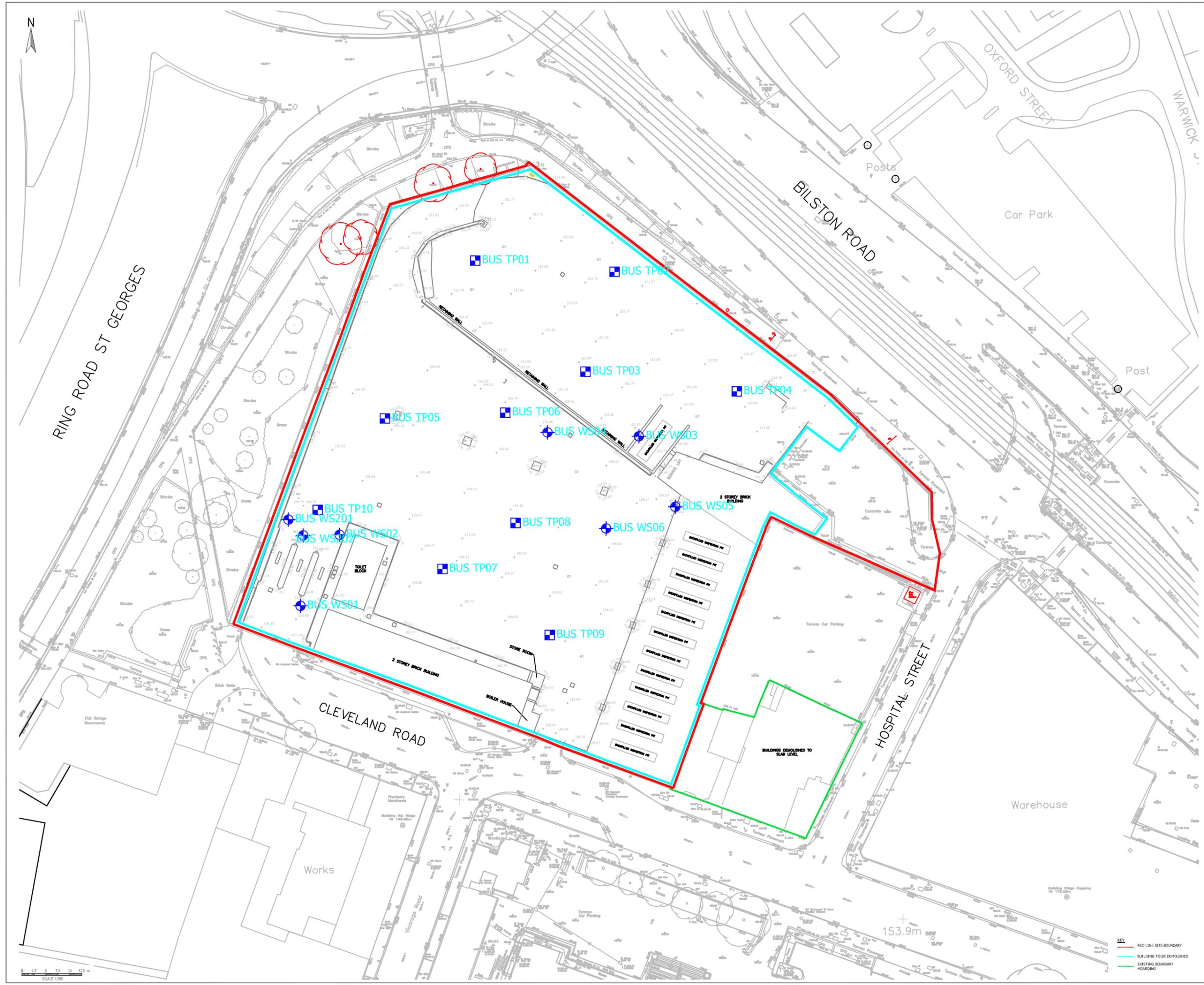


The Site



Figure 3 – Exploratory Borehole Location Plan

- DO NOT SCALE; CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS
- NOTES
- DO NOT SCALE.
 - DRAWINGS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT CONTRACT DRAWINGS AND SPECIFICATION.
 - ANY DISCREPANCIES ON THIS DRAWING NOTED BY THE CONTRACTOR SHALL BE BOUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO COMMENCEMENT OF WORKS ON-SITE.
 - ANY SURVEY INFORMATION USED IN THE PREPARATION OF THE DRAWING IS NOT WARRANTED. IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THIS SURVEY INFORMATION PROVIDED.



PRELIMINARY ISSUE

REV	DESCRIPTION	BY	CHK	APP	DATE

Homes & Communities Agency

GENEVA BUILDING,
LAKE VIEW DRIVE,
SHERWOOD BUSINESS PARK,
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Project:
**FORMER BUS GARAGE
WOLVERHAMPTON ROYAL HOSPITAL SITE**

Drawing Title:
PROPOSED BOREHOLE LOCATION PLAN

Scale @	Drawn	Date	Checked	Date	Approved	Date
1:250	HJW	09/2016	GE	09/2016	GE	09/2016
Project No.	Office	Type	Drawing No.	Revision		
A090070-150	B11	ENV	002	-		

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- KEY
- RED LINE SITE BOUNDARY
 - CYAN LINE BUILDING TO BE DEMOLISHED
 - GREEN LINE EXISTING BOUNDARY HOARDING



Appendix A – Report Conditions



Report Conditions

GROUND INVESTIGATION

This report is produced solely for the benefit of The Home and Communities Agency no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the site.

This report is based on a visual site inspection, reference to accessible referenced historical records, information supplied by those parties referenced in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented as the best that can be obtained without further extensive research. Where ground contamination is suspected but no physical site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to activities related to the site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, perhaps in higher concentrations, elsewhere on the site cannot be discounted.

Whilst confident in the findings detailed within this report because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categorical assurances that they will be accepted by Authorities or Funds etc. without question as such bodies often have unpublished, more stringent objectives. This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to WYGE. In time improved practices or amended legislation may necessitate a re-assessment.

The assessment of ground conditions within this report is based upon the findings of the study undertaken. We have interpreted the ground conditions in between locations on the assumption that conditions do not vary significantly. However, no investigation can inspect each and every part of the site and therefore changes or variances in the physical and chemical site conditions as described in this report cannot be discounted.

The report is limited to those aspects of land contamination specifically reported on and is necessarily restricted and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents. The opinions expressed cannot be absolute due to the limitations of time and resources imposed by the agreed brief and the possibility of unrecorded previous use and abuse of the site and adjacent sites. The report concentrates on the site as defined in the report and provides an opinion on surrounding sites. If migrating pollution or contamination (past or present) exists further extensive research will be required before the effects can be better determined.



Appendix B – Exploratory Hole Logs



Project : Royal Hospital, Wolverhampton
Project Number : A090070-150
Client : Homes and Communities Agency
Method : Window sample drilling rig
Co-ordinates : 391870.00E - 298282.00N
Level :

Scale 1:50 Sheet 1 of 1

Logged By : LS
Checked By : SM
Start Date : 03/10/16
Finish Date : 03/10/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Casing (m)	Water Strike (m)	Installation Backfill	Sample Test		Notes / Remarks
							Depth	Type	
MADE GROUND comprising dark brown to black slightly gravelly SAND. Gravel is fine to coarse asphalt and brick. Light brown from 0.30mbgl.							0.00		
Light grey clayey SAND.			0.70						
Soft light grey sandy CLAY. Strong hydrocarbon odour from 1.2mbgl.			1.20				1.20	ES1 C	N=6 (3,2/1,1,2,2)
Firm CLAY from 1.80mbgl.			1.45				1.45	ES2	
Soft light reddish brown sandy CLAY.			2.00				2.00	ES3 C	N=3 (0,0/0,1,0,2)
							3.00	D04 C	N=11 (2,1/2,3,3,3)
							3.00-3.45		
							4.00	D05 C	N=17 (4,5/4,4,4,5)
							4.00-4.45		
End of Window Sample at 5.00 m			5.00				5.00	D06 C	N=22 (3,3/3,5,7,7)
							5.00-5.45		

Observations / Remarks

Window sample borehole terminated at 5.0mbgl due to SPT refusal. Groundwater not encountered.



Project : Royal Hospital, Wolverhampton
Project Number : A090070-150
Client : Homes and Communities Agency
Method : Window sample dilling rig
Co-ordinates : 391934.00E - 298307.00N
Level :

Scale 1:50 **Sheet** 1 of 1

Logged By : LS
Checked By : SM
Start Date : 03/10/16
Finish Date : 03/10/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Casing (m)	Water Strike (m)	Installation Backfill	Sample Test		Notes / Remarks
							Depth	Type	
MADE GROUND comprising light grey concrete with re-bar.									
Soft light brown CLAY.			0.30						
Firm light brown slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded sandstone.			1.00				1.20	ES1 C	N=9 (1,1/3,2,2,2)
							2.00	ES2 C	N=15 (2,3/3,4,4,4)
							3.00	ES3 C	N=15 (3,3/3,3,4,5)
Very dense light brown to orange SAND.			3.50						
End of Window Sample at 4.00 m			4.00				4.00	ES4 C	50 (3,7/12,13,13,12 for 70mm)

Observations / Remarks

Window sample borehole terminated at 4.0m bgl due to SPT refusal. Groundwater not encountered. gas monitoring installation installed.

WYG ENVIRONMENT

Ground Engineering Services

Geneva Building, Sherwood Business Park, Annesley, Nottingham, NG15 0ED
Tel: 01623 684550

Exploratory Hole Number

BUS WS04



Project : Royal Hospital, Wolverhampton
Project Number : A090070-150
Client : Homes and Communities Agency
Method : Window sample drilling rig
Co-ordinates : 391913.00E - 298309.00N
Level :

Scale 1:50 Sheet 1 of 1

Logged By : LS
Checked By : SM
Start Date : 03/10/16
Finish Date : 03/10/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Casing (m)	Water Strike (m)	Installation Backfill	Sample Test		Notes / Remarks
							Depth	Type	
MADE GROUND comprising light brown gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded brick and concrete cobbles.									
							1.20	ES1 C	N=11 (2,3/2,3,3,3)
							2.00	ES2 C	N=38 (8,8/9,12,7,10)
End of Window Sample at 2.50 m			2.50				2.50	ES3 C	50 (25/50 for 60mm)

Observations / Remarks

Window sample borehole terminated at 2.5m bgl due to hard made ground.



Project : Royal Hospital, Wolverhampton
Project Number : A090070-150
Client : Homes and Communities Agency
Method : Window sample drilling rig
Co-ordinates : 391936.00E - 298285.00N
Level :

Scale 1:50 Sheet 1 of 1

Logged By : LS
Checked By : SM
Start Date : 03/10/16
Finish Date : 03/10/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Casing (m)	Water Strike (m)	Installation Backfill	Sample Test		Notes / Remarks
							Depth	Type	
MADE GROUND comprising orange to black gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded concrete, brick and asphalt.			0.30						
Dark brown to black gravelly SAND			0.60						
Light brown clayey SAND.									
Black gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded brick, sandstone and concrete.			1.50				1.20	ES1 C	N=2 (1,0/1,0,1,0)
Very loose orange brown SAND.			2.00				2.00	ES2 C	N=2 (1,0/0,0,1,1)
							2.45	ES3	
Soft light brown CLAY.			3.00				3.00	C	N=8 (1,1/2,2,2,2)
End of Window Sample at 5.00 m			4.00				4.00	ES4 C	N=9 (2,2/2,2,2,3)
							5.00	G	N=21 (4,4/4,5,5,7)

Observations / Remarks

Window sampling borehole terminated at 5.00m due to refusal. Groundwater not encountered.

WYG ENVIRONMENT

Ground Engineering Services

Geneva Building, Sherwood Business Park, Annesley, Nottingham, NG15 0ED
Tel: 01623 684550

Exploratory Hole Number

BUS WS06



Project : Royal Hospital, Wolverhampton
Project Number : A090070-150
Client : Homes and Communities Agency
Method : Window sampling drilling rig
Co-ordinates : 391922.00E - 298283.00N
Level :

Scale 1:50 Sheet 1 of 1

Logged By : LS
Checked By : SM
Start Date : 03/10/16
Finish Date : 03/10/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Casing (m)	Water Strike (m)	Installation Backfill	Sample Test		Notes / Remarks
							Depth	Type	
MADE GROUND comprising dark brown to black gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded brick, concrete and tarmac.							0.45		
Very loose from 1.2mbgl.							1.20	C	N=3 (1,1/0,1,1,1)
----- End of Window Sample at 1.70 m			1.70						

Observations / Remarks

Window sample borehole terminated at 1.70mbgl due to metal tank at the base.



Project : Royal Hospital, Wolverhampton
Project Number : A090070-150
Client : Homes and Communities Agency
Method : JCB 3CX
Co-ordinates : 391861.00E - 298337.00N
Level :

Scale 1:25 **Sheet** 1 of 1

Logged By : LS
Checked By : SM
Start Date : 05/10/16
Finish Date : 05/10/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Installation/Backfill	Sample Test		Notes / Remarks
						Depth	Type	
MADE GROUND comprising dark brown gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded with a high brick, reinforced concrete cobble count. Two ceramic drainage pipes encountered at 0.50mbgl.			0.30					
Firm reddish brown CLAY.			1.00			1.00	ES1	
Firm dark reddish brown slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded sandstone and mudstone.			2.50			2.10	ES002 ES2	
----- End of Trial Pit at 2.50 m								

Observations / Remarks

Groundwater was not encountered.

Trial pit terminated at 2.50 due to restricted reach of JCB arm.

Excavation Information

Length : 2.00m
 Width : 0.60m
 Orientation : -
 Stability : Trial pit stable.
 Shoring : n/a

Groundwater

Struck	Rising to	Time	Remarks



Project : Royal Hospital, Wolverhampton
Project Number : A090070-150
Client : Homes and Communities Agency
Method : JCB 3CX
Co-ordinates : 391930.00E - 298337.00N
Level :

Scale 1:25 **Sheet** 1 of 1

Logged By : LS
Checked By : SM
Start Date : 05/10/16
Finish Date : 05/10/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Installation/ Backfill	Sample Test		Notes / Remarks
						Depth	Type	
MADE GROUND comprising dark brown gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded brick, asphalt and reinforced concrete blocks.								
Light brown clayey SAND.			0.50			0.70	ES1	
Soft light brown gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded quartzite and sandstone.			1.80			2.00	ES2	
Light orange to brown slightly gravelly clayey SAND. Gravel is fine to coarse sub-angular to sub-rounded quartzite and sandstone.			2.50					
End of Trial Pit at 3.20 m			3.20					

Observations / Remarks

Groundwater not encountered.
 Trial pit terminated at target depth of 3.20mbgl.

Excavation Information

Length : 1.50m
 Width : 0.60m
 Orientation : -
 Stability : Trial pit stable.
 Shoring : n/a

Groundwater

Struck	Rising to	Time	Remarks



Project : Royal Hospital, Wolverhampton
Project Number : A090070-150
Client : Homes and Communities Agency
Method : JCB 3CX
Co-ordinates : 391951.00E - 298324.00N
Level :

Scale 1:25 **Sheet** 1 of 1

Logged By : LS
Checked By : SM
Start Date : 05/10/16
Finish Date : 05/10/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Installation/ Backfill	Sample Test		Notes / Remarks
						Depth	Type	
MADE GROUND comprising light orangy brown gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded brick and concrete.			0.20					
MADE GROUND comprising black gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded alphalt, sandstone with a high reinforced concrete, bricks cobble count.			0.40			0.50	E001	
Light brown clayey SAND.								
Soft dark brown sandy CLAY. Slightly gravelly from 1.80mbgl. Gravel is fine to coarse sub-angular to sub-rounded quartzite and sandstone.			1.70			1.70	E002	
Light brown slightly gravelly clayey SAND. Gravel is fine to coarse sub-angular to sub-rounded sandstone.			2.20					
			2.50			2.50	E003	
End of Trial Pit at 3.00 m			3.00					

Observations / Remarks

Groundwater not encountered.
Trial pit terminated at target depth of 3.2mbgl.

Excavation Information

Length : 1.50m
Width : 0.60m
Orientation : -
Stability : trial pit observed as stable.
Shoring : n/a

Groundwater

Struck	Rising to	Time	Remarks



Project : Royal Hospital, Wolverhampton
Project Number : A090070-150
Client : Homes and Communities Agency
Method : JCB 3CX
Co-ordinates : 391883.00E - 298307.00N
Level :

Scale 1:25 **Sheet** 1 of 1

Logged By : LS
Checked By : SM
Start Date : 04/10/16
Finish Date : 04/10/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Installation/ Backfill	Sample Test		Notes / Remarks
						Depth	Type	
MADE GROUND comprising light grey gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded concrete with a high whole brick and reinforced concrete count.						0.30	ES1	
MADE GROUND comprising dark brown gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded concrete cobbles and whole brick.		0.60				1.00	ES2	
Dark brown to black slightly gravelly clayey SAND. Gravel is fine to coarse sub-angular to sub-rounded sandstone and whole bricks. Very strong hydrocarbon odour.		1.50				1.60	ES3	
Liquid observed flowing into the trial pit at 2.70mbgl. ----- End of Trial Pit at 2.80 m		2.80				2.80	ES4	

Observations / Remarks

Groundwater encountered from 2.70mbgl.

Excavation terminated at 2.80mbgl due to inflowing liquid at the base of the trial pit. Very strong hydrocarbon odour.

Excavation Information

Length : 2.00m
 Width : 0.60m
 Orientation : -
 Stability : Trial pit stable.
 Shoring : n/a

Groundwater

Struck	Rising to	Time	Remarks

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Project : Royal Hospital, Wolverhampton
Project Number : A090070-150
Client : Homes and Communities Agency
Method : JCB 3CX
Co-ordinates : 391901.00E - 298313.00N
Level :

Scale 1:25 **Sheet** 1 of 1

Logged By : LS
Checked By : SM
Start Date : 04/10/16
Finish Date : 04/10/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Installation/ Backfill	Sample Test		Notes / Remarks
						Depth	Type	
MADE GROUND comprising light grey gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded concrete with re-bar.			0.40					
MADE GROUND comprising dark brown gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded concrete, flint and whole bricks.						1.00	ES1	
			2.10			2.00	ES2	
End of Trial Pit at 2.10 m								

Observations / Remarks

Groundwater not encountered.
 Trial pit terminated at 2.10 due to metal tank encountered.

Excavation Information

Length : 2.00m
 Width : 0.60m
 Orientation : -
 Stability : Trial pit stable.
 Shoring : n/a

Groundwater

Struck	Rising to	Time	Remarks



Project : Royal Hospital, Wolverhampton
Project Number : A090070-150
Client : Homes and Communities Agency
Method : JCB 3CX
Co-ordinates : 391887.00E - 298282.00N
Level :

Scale 1:25 **Sheet** 1 of 1

Logged By : LS
Checked By : SM
Start Date : 04/10/16
Finish Date : 04/10/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Installation/ Backfill	Sample Test		Notes / Remarks
						Depth	Type	
MADE GROUND comprising dark brown gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded reinforced concrete, whole bricks and shards of glass. Steel support beam encountered at 0.50mbgl.						0.60	ES1	
Dark brown clayey SAND. Hydrocarbon odour noted from 2.0mbgl.			1.70					
End of Trial Pit at 2.90 m			2.90					

Observations / Remarks

Groundwater not encountered.

Excavation ended at 2.90 due to whole brick foundation and concrete with re-bar.

Excavation Information

Length : 2.00m
 Width : 0.60m
 Orientation : -
 Stability : Trial pit stable.
 Shoring : n/a

Groundwater

Struck	Rising to	Time	Remarks



Project : Royal Hospital, Wolverhampton
Project Number : A090070-150
Client : Homes and Communities Agency
Method : JCB 3CX
Co-ordinates : 391907.00E - 298287.00N
Level :

Scale 1:25 **Sheet** 1 of 1

Logged By : LS
Checked By : SM
Start Date : 04/10/16
Finish Date : 04/10/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Installation/ Backfill	Sample Test		Notes / Remarks
						Depth	Type	
MADE GROUND comprising light grey gravelly SAND. gravel is fine to coarse sub-angular to sub-rounded concrete with re-bar.			0.30					
MADE GROUND comprising dark brown to black gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded sandstone with whole bricks and concrete boulders.						1.00	ES1	
MADE GROUND comprising slightly gravelly clayey SAND. Gravel is fine to coarse sub-angular to sub-rounded brick fragments, mudstone and concrete.			1.80			2.00	ES2	
End of Trial Pit at 3.00 m			3.00					

Observations / Remarks

Groundwater not encountered.
 Trial pit terminated at target depth of 3.00mbgl.

Excavation Information

Length : 2.00m
 Width : 0.60m
 Orientation : -
 Stability : Trial pit stable
 Shoring : n/a

Groundwater

Struck	Rising to	Time	Remarks



Project : Royal Hospital, Wolverhampton
Project Number : A090070-150
Client : Homes and Communities Agency
Method : JCB 3CX
Co-ordinates : 391914.00E - 298270.00N
Level :

Scale 1:25 **Sheet** 1 of 1

Logged By : LS
Checked By : SM
Start Date : 04/10/16
Finish Date : 04/10/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Installation/ Backfill	Sample Test		Notes / Remarks
						Depth	Type	
MADE GROUND comprising light brown gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded reinforced concrete cobbles with a high whole bricks count and shards of glass.						1.00	ES1	
						2.00	ES2	
End of Trial Pit at 2.00 m			2.00					

Observations / Remarks

Groundwater not encountered.

Trial pit terminate due to brick foundations and concrete with re-bar.

Excavation Information

Length : 2.00m
 Width : 0.60m
 Orientation : -
 Stability : Trial pit stable.
 Shoring : n/a

Groundwater

Struck	Rising to	Time	Remarks



Appendix C – Contamination Laboratory Results



Jones Environmental Laboratory

Registered Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Deeside, CH5 2UA. UK

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

WYG
Geneva Building, Lake View Drive
Sherwood Business Park
Annesley
Nottingham
NG15 0ED

Tel: +44 (0) 1244 833780

Fax: +44 (0) 1244 833781



Attention : Simon Croxford
Date : 18th October, 2016
Your reference : A090070-150
Our reference : Test Report 16/15397 Batch 1
Location : Wolverhampton Bus Depot
Date samples received : 7th October, 2016
Status : Final report
Issue : 1

Twenty nine samples were received for analysis on 7th October, 2016 of which ten were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied. All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Bruce Leslie
Project Co-ordinator

Jones Environmental Laboratory

Client Name: WYG
Reference: A090070-150
Location: Wolverhampton Bus Depot
Contact: Simon Croxford
JE Job No.: 16/15397

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	6-7	10	15-16	19-20	29-30	31	32	33-34	37				
Sample ID	TP03	TP04	TP05	TP05	TP07	TP08	TP08	TP09	TP10				
Depth	1.00	0.50	1.00	2.80	2.80	1.00	2.00	1.00	2.50				
COC No / misc													
Containers	V T	T	V J	V J	V J	J	T	V J	T				
Sample Date	05/10/2016	05/10/2016	04/10/2016	04/10/2016	04/10/2016	04/10/2016	04/10/2016	04/10/2016	04/10/2016				
Sample Type	Soil	Soil											
Batch Number	1	1	1	1	1	1	1	1	1				
Date of Receipt	07/10/2016	07/10/2016	07/10/2016	07/10/2016	07/10/2016	07/10/2016	07/10/2016	07/10/2016	07/10/2016				
										LOD/LOR	Units	Method No.	
Arsenic ^{#M}	6.8	4.8	-	-	3.3	-	5.9	-	6.3	<0.5	mg/kg	TM30/PM15	
Arsenic	-	-	13.5	-	-	8.4	-	15.3	-	<0.5	mg/kg	TM30/PM62	
Cadmium ^{#M}	<0.1	<0.1	-	-	0.3	-	0.2	-	0.3	<0.1	mg/kg	TM30/PM15	
Cadmium	-	-	1.2	-	-	0.2	-	1.5	-	<0.1	mg/kg	TM30/PM62	
Chromium ^{#M}	33.2	29.9	-	-	48.1	-	27.2	-	32.2	<0.5	mg/kg	TM30/PM15	
Chromium	-	-	23.6	-	-	18.1	-	17.2	-	<0.5	mg/kg	TM30/PM62	
Copper ^{#M}	13	10	-	-	234	-	23	-	132	<1	mg/kg	TM30/PM15	
Copper	-	-	146	-	-	56	-	414 ^{AB}	-	<1	mg/kg	TM30/PM62	
Lead ^{#M}	8	5	-	-	145	-	31	-	133	<5	mg/kg	TM30/PM15	
Lead	-	-	228	-	-	54	-	180	-	<5	mg/kg	TM30/PM62	
Mercury ^{#M}	<0.1	<0.1	-	-	1.8	-	<0.1	-	1.0	<0.1	mg/kg	TM30/PM15	
Mercury	-	-	<0.1	-	-	0.3	-	0.6	-	<0.1	mg/kg	TM30/PM62	
Nickel ^{#M}	27.0	18.8	-	-	37.1	-	17.3	-	25.6	<0.7	mg/kg	TM30/PM15	
Nickel	-	-	27.7	-	-	13.3	-	25.7	-	<0.7	mg/kg	TM30/PM62	
Selenium ^{#M}	<1	<1	-	-	<1	-	<1	-	<1	<1	mg/kg	TM30/PM15	
Selenium	-	-	<1	-	-	<1	-	<1	-	<1	mg/kg	TM30/PM62	
Water Soluble Boron ^{#M}	2.1	3.0	-	-	2.8	-	2.7	-	9.4	<0.1	mg/kg	TM74/PM32	
Water Soluble Boron	-	-	4.6	-	-	2.6	-	8.0	-	<0.1	mg/kg	TM74/PM61	
Zinc ^{#M}	48	30	-	-	152	-	73	-	155	<5	mg/kg	TM30/PM15	
Zinc	-	-	307	-	-	77	-	320	-	<5	mg/kg	TM30/PM62	
PAH MS													
Naphthalene ^{#M}	0.05	<0.04	0.06	-	0.05	0.06	<0.04	0.05	0.08	<0.04	mg/kg	TM4/PM8	
Acenaphthylene	0.03	<0.03	0.04	-	0.05	0.18	<0.03	0.03	0.06	<0.03	mg/kg	TM4/PM8	
Acenaphthene ^{#M}	<0.05	<0.05	<0.05	-	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8	
Fluorene ^{#M}	<0.04	<0.04	<0.04	-	0.08	0.15	<0.04	<0.04	0.19	<0.04	mg/kg	TM4/PM8	
Phenanthrene ^{#M}	0.58	<0.03	0.58	-	0.38	1.28	0.06	0.41	0.40	<0.03	mg/kg	TM4/PM8	
Anthracene [#]	0.16	<0.04	0.28	-	0.13	0.47	0.10	0.14	<0.04	<0.04	mg/kg	TM4/PM8	
Fluoranthene ^{#M}	1.14	<0.03	1.23	-	0.48	1.41	0.23	0.55	0.12	<0.03	mg/kg	TM4/PM8	
Pyrene [#]	0.98	<0.03	1.07	-	0.51	0.97	0.18	0.50	0.12	<0.03	mg/kg	TM4/PM8	
Benzo(a)anthracene [#]	0.68	<0.06	0.78	-	0.23	0.81	0.18	0.30	0.12	<0.06	mg/kg	TM4/PM8	
Chrysene ^{#M}	0.56	<0.02	0.67	-	0.29	0.62	0.12	0.27	0.06	<0.02	mg/kg	TM4/PM8	
Benzo(bk)fluoranthene ^{#M}	0.99	<0.07	1.23	-	0.55	0.87	0.17	0.43	0.09	<0.07	mg/kg	TM4/PM8	
Benzo(a)pyrene [#]	0.58	<0.04	0.62	-	0.25	0.50	0.10	0.24	0.05	<0.04	mg/kg	TM4/PM8	
Indeno(123cd)pyrene ^{#M}	0.44	<0.04	0.55	-	0.19	0.29	0.05	0.24	<0.04	<0.04	mg/kg	TM4/PM8	
Dibenzo(ah)anthracene [#]	0.08	<0.04	0.07	-	<0.04	0.08	<0.04	0.05	<0.04	<0.04	mg/kg	TM4/PM8	
Benzo(ghi)perylene [#]	0.33	<0.04	0.40	-	0.13	0.19	<0.04	0.19	<0.04	<0.04	mg/kg	TM4/PM8	
PAH 16 Total	6.6	<0.6	7.6	-	3.3	7.9	1.2	3.4	1.3	<0.6	mg/kg	TM4/PM8	
Benzo(b)fluoranthene	0.71	<0.05	0.89	-	0.40	0.63	0.12	0.31	0.06	<0.05	mg/kg	TM4/PM8	
Benzo(k)fluoranthene	0.28	<0.02	0.34	-	0.15	0.24	0.05	0.12	0.03	<0.02	mg/kg	TM4/PM8	
PAH Surrogate % Recovery	104	109	107	-	115	103	109	102	107	<0	%	TM4/PM8	
EPH >C8-C10 ^{#M}	<5	<5	<5	-	<5	<5	<5	<5	173	<5	mg/kg	TM5/PM8	
EPH >C10-C12 ^{#M}	<10	<10	<10	-	<10	<10	<10	<10	247	<10	mg/kg	TM5/PM8	

Please see attached notes for all abbreviations and acronyms

Client Name: WYG
Reference: A090070-150
Location: Wolverhampton Bus Depot
Contact: Simon Croxford
JE Job No.: 16/15397

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	6-7	10	15-16	19-20	29-30	31	32	33-34	37				
Sample ID	TP03	TP04	TP05	TP05	TP07	TP08	TP08	TP09	TP10				
Depth	1.00	0.50	1.00	2.80	2.80	1.00	2.00	1.00	2.50				
COC No / misc													
Containers	V T	T	V J	V J	V J	J	T	V J	T				
Sample Date	05/10/2016	05/10/2016	04/10/2016	04/10/2016	04/10/2016	04/10/2016	04/10/2016	04/10/2016	04/10/2016				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil				
Batch Number	1	1	1	1	1	1	1	1	1				
Date of Receipt	07/10/2016	07/10/2016	07/10/2016	07/10/2016	07/10/2016	07/10/2016	07/10/2016	07/10/2016	07/10/2016				
										LOD/LOR	Units	Method No.	
EPH >C12-C16 ^{#M}	15	<10	<10	-	54	<10	<10	<10	1603	<10	mg/kg	TM5/PM8	
EPH >C16-C21 ^{#M}	168	<10	109	-	140	79	<10	35	2726	<10	mg/kg	TM5/PM8	
EPH >C21-C40	790	<10	577	-	213	279	<10	325	946	<10	mg/kg	TM5/PM8	
EPH >C8-C40	973	<30	686	-	407	358	<30	360	5695	<30	mg/kg	TM5/PM8	
TPH CWG													
Aliphatics													
>C5-C6 ^{#M}	-	-	-	<1.0 _{AC}	-	-	-	-	-	<0.1	mg/kg	TM36/PM12	
>C6-C8 ^{#M}	-	-	-	6.6 _{AC}	-	-	-	-	-	<0.1	mg/kg	TM36/PM12	
>C8-C10	-	-	-	87.3 _{AC}	-	-	-	-	-	<0.1	mg/kg	TM36/PM12	
>C10-C12 ^{#M}	-	-	-	36.5	-	-	-	-	-	<0.2	mg/kg	TM5/PM16	
>C12-C16 ^{#M}	-	-	-	169	-	-	-	-	-	<4	mg/kg	TM5/PM16	
>C16-C21 ^{#M}	-	-	-	242	-	-	-	-	-	<7	mg/kg	TM5/PM16	
>C21-C35 ^{#M}	-	-	-	76	-	-	-	-	-	<7	mg/kg	TM5/PM16	
Total aliphatics C5-35	-	-	-	617	-	-	-	-	-	<19	mg/kg	TM5/PM8/PM12/PM16	
Aromatics													
>C5-EC7	-	-	-	<1.0 _{AC}	-	-	-	-	-	<0.1	mg/kg	TM36/PM12	
>EC7-EC8	-	-	-	<1.0 _{AC}	-	-	-	-	-	<0.1	mg/kg	TM36/PM12	
>EC8-EC10 ^{#M}	-	-	-	2.5 _{AC}	-	-	-	-	-	<0.1	mg/kg	TM36/PM12	
>EC10-EC12	-	-	-	16.7	-	-	-	-	-	<0.2	mg/kg	TM5/PM16	
>EC12-EC16	-	-	-	138	-	-	-	-	-	<4	mg/kg	TM5/PM16	
>EC16-EC21	-	-	-	236	-	-	-	-	-	<7	mg/kg	TM5/PM16	
>EC21-EC35	-	-	-	160	-	-	-	-	-	<7	mg/kg	TM5/PM16	
Total aromatics C5-35	-	-	-	553	-	-	-	-	-	<19	mg/kg	TM5/PM8/PM12/PM16	
Total aliphatics and aromatics(C5-35)	-	-	-	1170	-	-	-	-	-	<38	mg/kg	TM5/PM8/PM12/PM16	
MTBE [#]	-	-	-	<50 _{AC}	-	-	-	-	-	<5	ug/kg	TM31/PM12	
Benzene [#]	-	-	-	<50 _{AC}	-	-	-	-	-	<5	ug/kg	TM31/PM12	
Toluene [#]	-	-	-	79 _{AC}	-	-	-	-	-	<5	ug/kg	TM31/PM12	
Ethylbenzene [#]	-	-	-	27 _{AC}	-	-	-	-	-	<5	ug/kg	TM31/PM12	
m/p-Xylene [#]	-	-	-	1867 _{AC}	-	-	-	-	-	<5	ug/kg	TM31/PM12	
o-Xylene [#]	-	-	-	291 _{AC}	-	-	-	-	-	<5	ug/kg	TM31/PM12	
Total Phenols HPLC	<0.15	<0.15	<0.15	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	mg/kg	TM26/PM21	
Natural Moisture Content	15.0	9.7	-	31.3	21.5	-	15.7	-	27.1	<0.1	%	PM4/PM0	
Natural Moisture Content	-	-	16.8	-	-	12.6	-	16.1	-	<0.1	%	PM4/PM0	
Hexavalent Chromium [#]	<0.3	<0.3	<0.3	-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	mg/kg	TM38/PM20	
Sulphate as SO4 (2:1 Ext) ^{#M}	0.1518	0.0484	-	-	0.3019	-	0.2098	-	0.2122	<0.0015	g/l	TM38/PM20	
Sulphate as SO4 (2:1 Ext)	-	-	0.4396	-	-	0.5512	-	0.9051	-	<0.0015	g/l	TM38/PM60	
Free Cyanide	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	mg/kg	TM89/PM45	

Please see attached notes for all abbreviations and acronyms

Client Name: WYG
 Reference: A090070-150
 Location: Wolverhampton Bus Depot
 Contact: Simon Croxford
 JE Job No.: 16/15397

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	6-7	10	15-16	19-20	29-30	31	32	33-34	37				
Sample ID	TP03	TP04	TP05	TP05	TP07	TP08	TP08	TP09	TP10				
Depth	1.00	0.50	1.00	2.80	2.80	1.00	2.00	1.00	2.50				
COC No / misc													
Containers	V T	T	V J	V J	V J	J	T	V J	T				
Sample Date	05/10/2016	05/10/2016	04/10/2016	04/10/2016	04/10/2016	04/10/2016	04/10/2016	04/10/2016	04/10/2016				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil				
Batch Number	1	1	1	1	1	1	1	1	1				
Date of Receipt	07/10/2016	07/10/2016	07/10/2016	07/10/2016	07/10/2016	07/10/2016	07/10/2016	07/10/2016	07/10/2016				
											LOD/LOR	Units	Method No.
pH #M	7.54	8.51	10.21	-	7.85	8.09	7.92	9.61	7.67		<0.01	pH units	TM73/PM11
Sample Type	Clay	Clay	NDP	Clay	Clay	NDP	Clay	NDP	Clay			None	PM13/PM0
Sample Colour	Medium Brown	Medium Brown	NDP	Dark Brown	Dark Brown	NDP	Medium Brown	NDP	Dark Brown			None	PM13/PM0
Other Items	stones, sand	stones, sand	NDP	stones, blue tint	stones, sand	NDP	stones, sand, clinker	NDP	stones, sand			None	PM13/PM0

Please see attached notes for all abbreviations and acronyms

Client Name: WYG
Reference: A090070-150
Location: Wolverhampton Bus Depot
Contact: Simon Croxford

Note:

Analysis was carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Jones Environmental Laboratory consultant, Jones Environmental Laboratory cannot be responsible for inaccurate or unrepresentative sampling.

Signed on behalf of Jones Environmental Laboratory:



Ryan Butterworth
 Asbestos Team Leader

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
16/15397	1	TP05	1.00	16	10/10/2016	General Description (Bulk Analysis)	soil/stones
					10/10/2016	Asbestos Fibres	Fibre Bundles
					10/10/2016	Asbestos ACM	Asbestos Cement Debris
					10/10/2016	Asbestos Type	Chrysotile
					10/10/2016	Asbestos Level Screen	<0.1%
16/15397	1	TP07	2.80	30	10/10/2016	General Description (Bulk Analysis)	soil/stones
					10/10/2016	Asbestos Fibres	NAD
					10/10/2016	Asbestos Fibres (2)	NAD
					10/10/2016	Asbestos ACM	NAD
					10/10/2016	Asbestos ACM (2)	NAD
					10/10/2016	Asbestos Type	NAD
					10/10/2016	Asbestos Type (2)	NAD
10/10/2016	Asbestos Level Screen	NAD					
16/15397	1	TP08	1.00	31	10/10/2016	General Description (Bulk Analysis)	soil/stones
					10/10/2016	Asbestos Fibres	Fibre Bundles
					10/10/2016	Asbestos ACM	NAD
					10/10/2016	Asbestos Type	Chrysotile
16/15397	1	TP08	2.00	32	10/10/2016	General Description (Bulk Analysis)	soil/stones
					10/10/2016	Asbestos Fibres	NAD
					10/10/2016	Asbestos Fibres (2)	NAD
					10/10/2016	Asbestos ACM	NAD
					10/10/2016	Asbestos ACM (2)	NAD
					10/10/2016	Asbestos Type	NAD
					10/10/2016	Asbestos Type (2)	NAD
10/10/2016	Asbestos Level Screen	NAD					
16/15397	1	TP09	1.00	34	10/10/2016	General Description (Bulk Analysis)	soil/stones
					10/10/2016	Asbestos Fibres	Fibre Bundles
					10/10/2016	Asbestos Fibres (2)	Fibre Bundles
					10/10/2016	Asbestos Fibres (3)	Fibre Bundles
					10/10/2016	Asbestos ACM	NAD
					10/10/2016	Asbestos ACM (2)	NAD
					10/10/2016	Asbestos ACM (3)	NAD
					10/10/2016	Asbestos Type	Chrysotile
					10/10/2016	Asbestos Type (2)	Amosite

Client Name: WYG
 Reference: A090070-150
 Location: Wolverhampton Bus Depot
 Contact: Simon Croxford

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
16/15397	1	TP09	1.00	34	10/10/2016	Asbestos Type (3)	Crocidolite
					10/10/2016	Asbestos Level Screen	Asbestos level cannot be determined at this stage of analysis
16/15397	1	TP10	2.50	37	10/10/2016	General Description (Bulk Analysis)	soil/stones
					10/10/2016	Asbestos Fibres	NAD
					10/10/2016	Asbestos Fibres (2)	NAD
					10/10/2016	Asbestos ACM	NAD
					10/10/2016	Asbestos ACM (2)	NAD
					10/10/2016	Asbestos Type	NAD
					10/10/2016	Asbestos Type (2)	NAD
					10/10/2016	Asbestos Level Screen	NAD



Jones Environmental Laboratory

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Attention : Simon Croxford
Date : 14th October, 2016
Your reference : A090070-150
Our reference : Test Report 16/15397 Batch 2
Location : Wolverhampton Bus Depot
Date samples received : 7th October, 2016
Status : Final report
Issue : 1

Ten samples were received for analysis on 7th October, 2016 of which three were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Phil Sommerton BSc
Project Manager

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS) accredited - UK.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range



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Fax: +44 (0) 1244 833781



Attention : Simon Croxford
Date : 26th October, 2016
Your reference : A090070-150
Our reference : Test Report 16/15397 Batch 3
Location : Wolverhampton Bus Depot
Date samples received : 19th October, 2016
Status : Final report
Issue : 1

Two samples were received for analysis on 19th October, 2016 of which two were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Phil Sommerton BSc
Project Manager

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 16/15397

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 (UKAS) accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Please include all sections of this report if it is reproduced

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS) accredited - UK.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
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+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
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AD	Samples are dried at 35°C ±5°C
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LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 16/15397

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5/TM36	TM005: Modified USEPA 8015B. Determination of solvent Extractable Petroleum Hydrocarbons (EPH) including column fractionation in the carbon range of C10-35 into aliphatic and aromatic fractions by GC-FID. TM036: Modified USEPA 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C5-10 by headspace GC-FID. Including determination of	PM30/PM12	CWG GC-FID	Yes			
TM15	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.				
TM15	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes			
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes			



Appendix D – Contamination Assessment Criteria



WYG Tier One Human Health Screening Values, Issue 15
Residential without plant uptake, 2.5% SOM

Determinand	Units	SOIL ORGANIC MATTER			SOURCE
		1%	2.5%	6%	
pH		<5, >9			
Asbestos	%	Presence			
HEAVY METALS/METALLOIDS					
Arsenic	mg/kg		40		C4SL
Cadmium	mg/kg		150		C4SL
Chromium (III)	mg/kg		910		CIEH/LQM S4ULs
Chromium (VI)	mg/kg		21		C4SL
Lead	mg/kg		310		C4SL
Mercury (Elemental)	mg/kg				1.2
Mercury (Inorganic)	mg/kg		56		CIEH/LQM S4ULs
Mercury (Methyl)	mg/kg				15
Nickel	mg/kg		180		CIEH/LQM S4ULs
Selenium	mg/kg		430		CIEH/LQM S4ULs
Beryllium	mg/kg		1.7		CIEH/LQM S4ULs
Boron	mg/kg		11,000		CIEH/LQM S4ULs
Vanadium	mg/kg		1,200		CIEH/LQM S4ULs
Copper	mg/kg		7,100		CIEH/LQM S4ULs
Zinc	mg/kg		40,000		CIEH/LQM S4ULs
GENERAL INORGANICS					
Easily Liberatable Cyanide (free)	mg/kg		24		Acute effects infant 1 dose 5g soil
US EPA PRIORITY PAHs					
Acenaphthene	mg/kg	3,000	4,700	6,000	CIEH/LQM S4ULs
Acenaphthylene	mg/kg	2,900	4,600	6,000	CIEH/LQM S4ULs
Anthracene	mg/kg	31,000	35,000	37,000	CIEH/LQM S4ULs
Benzo(a)Anthracene	mg/kg	11	14.0	15.0	CIEH/LQM S4ULs
Benzo(b)fluoranthene	mg/kg	3.9	4.0	4.0	CIEH/LQM S4ULs
Benzo(k)fluoranthene	mg/kg	110	110	110	CIEH/LQM S4ULs
Benzo(g,h,i)perylene	mg/kg	360	360	360	CIEH/LQM S4ULs
Benzo(a)Pyrene	mg/kg	5.3	5.3	5.3	C4SL 1.071
Chrysene	mg/kg	30	31	32	CIEH/LQM S4ULs
Di-benzo(a,h)anthracene	mg/kg	0.31	0.32	0.32	CIEH/LQM S4ULs

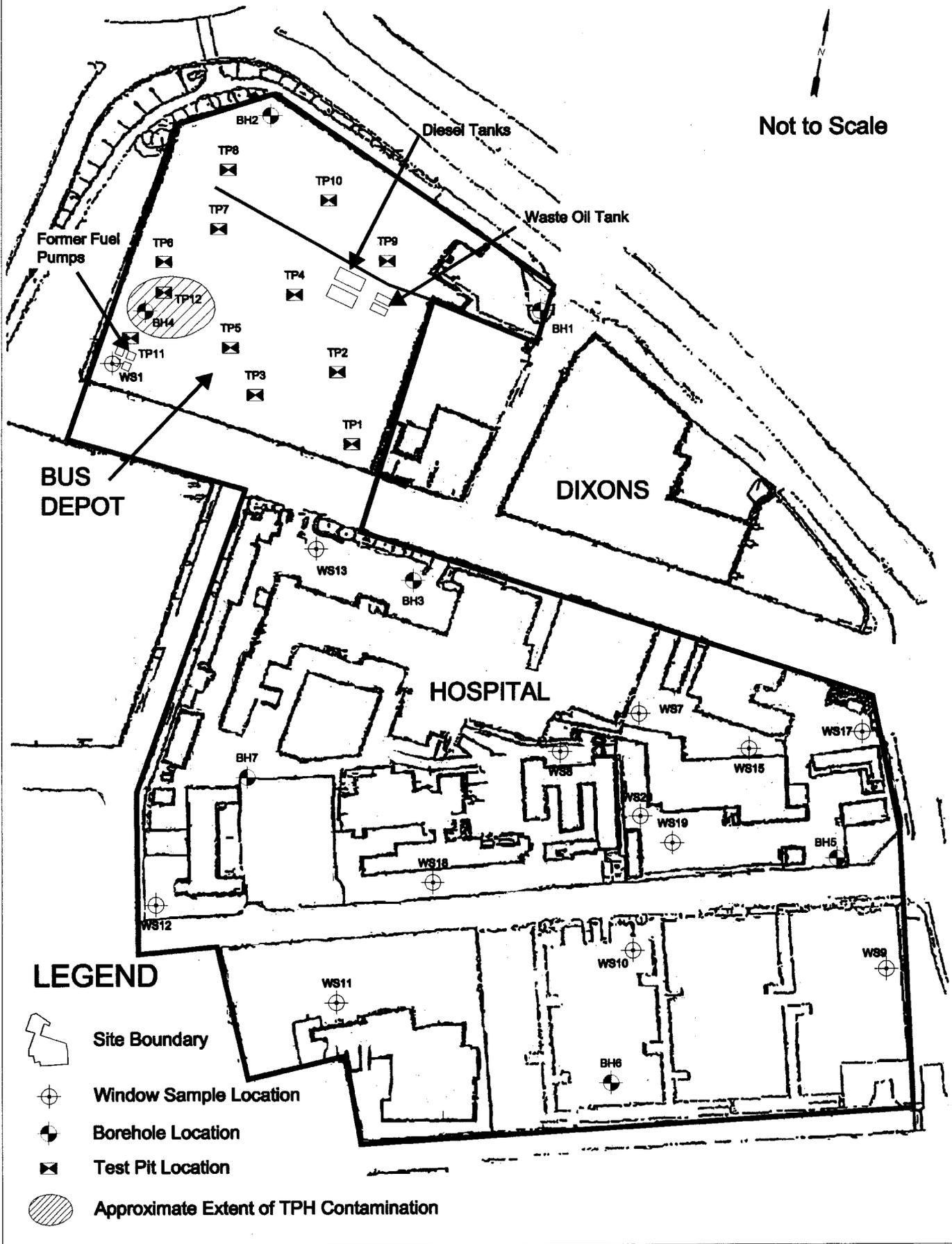


Determinand	Units	SOIL ORGANIC MATTER			SOURCE
		1%	2.5%	6%	
Fluoranthene	mg/kg	1,500	1,600	1,600	CIEH/LQM S4ULs
Fluorene	mg/kg	2,800	3,800	4,500	CIEH/LQM S4ULs
Indeno(1,2,3-cd)pyrene	mg/kg	45	46	46	CIEH/LQM S4ULs
Naphthalene	mg/kg	2.3	5.6	13	CIEH/LQM S4ULs
Phenanthrene	mg/kg	1,300	1,500	1,500	CIEH/LQM S4ULs
Pyrene	mg/kg	3,700	3,800	3,800	CIEH/LQM S4ULs
Phenolics					
Phenol	mg/kg	440	690	1,200	CIEH/LQM S4ULs
TPH					
TPH Aliphatic >C5-6	mg/kg	42	78	160	CIEH/LQM S4ULs
TPH Aliphatic >C6-8	mg/kg	100	230	530	CIEH/LQM S4ULs
TPH Aliphatic >C8-10	mg/kg	27	65	150	CIEH/LQM S4ULs
TPH Aliphatic >C10-12	mg/kg	130	330	770	CIEH/LQM S4ULs
TPH Aliphatic >C12-16	mg/kg	1,100	2,400	4,400	CIEH/LQM S4ULs
TPH Aliphatic >C16-35	mg/kg	65,000	92,000	110,000	CIEH/LQM S4ULs
TPH Aliphatic >C35-44	mg/kg	65,000	92,000	110,000	CIEH/LQM S4ULs
TPH Aromatic >EC5-7 (Benzene)	mg/kg	370	690	1,400	C4SL v1.071
TPH Aromatic >EC7-8	mg/kg	860	1,800	3,900	CIEH/LQM S4ULs
TPH Aromatic >EC8-10	mg/kg	47	110	270	CIEH/LQM S4ULs
TPH Aromatic >EC10-12	mg/kg	250	590	1,200	CIEH/LQM S4ULs
TPH Aromatic >EC12-16	mg/kg	1,800	2,300	2,500	CIEH/LQM S4ULs
TPH Aromatic >EC16-21	mg/kg	1,900	1,900	1,900	CIEH/LQM S4ULs
TPH Aromatic >EC21-35	mg/kg	1,900	1,900	1,900	CIEH/LQM S4ULs
TPH Aromatic >EC35-44	mg/kg	1,900	1,900	1,900	CIEH/LQM S4ULs
TPH Aliphatic & Aromatic >EC44-70	mg/kg	1,900	1,900	1,900	CIEH/LQM S4ULs



Appendix E – Extracts from QDS 2000 Report

Not to Scale



LEGEND

-  Site Boundary
-  Window Sample Location
-  Borehole Location
-  Test Pit Location
-  Approximate Extent of TPH Contamination



TITLE: **APPROXIMATE EXPLORATORY HOLE LOCATION PLAN**
ROYAL HOSPITAL
WOLVERHAMPTON

OWN: NAD	DES: POB
GRD:	APP:
DATE: 03/11/00	REV:

PROJECT NO.: 99-248.01
FIGURE NO.: 5

BOREHOLE RECORD - Cable Percussion

Sheet 1 of 1

Project ROYAL HOSPITAL, WOLVERHAMPTON

Engineer PINNACLE CONSULTING ENGINEERS

Borehole BHI
Coordinates

Client

Project No 00-10462

Sampling				Properties			Strata			
depth	Sample Type	Depth Cased	Depth to Water	Strength kN/m ²	u	SPT N	Description	Depth	Legend	Level 00
0.50	J						TARMAC on hardcore**.	0.20		
0.50 - 0.80	B						TARMAC on SLAG**.	0.50		
0.80 - 1.50	B						Dark brown slightly silty and gravel. Gravel angular to subangular fine to coarse brick, clay clods, slag and glass. MADE GROUND.	0.80		
1.00	J						Dark brown slightly gravelly sandy SILT with rare clay pockets. Gravel angular to subangular brick, flint, slag and ceramic fragments. MADE GROUND.	1.50		
1.50 - 1.95	J					6	Soft becoming stiff below 3.00m, light brown sandy to slightly sandy CLAY with occasional rounded flint gravel.			
1.50 - 1.95	S						DRAFT			
1.50 - 2.00	J									
2.00	J									
2.50 - 2.95	S					5				
2.50 - 2.95	J									
3.00	J									
3.20	J									
3.50 - 3.95	U30									
3.95 - 4.00	J						Dense becoming very dense below 5.50m, slightly silty slightly gravelly SAND. Gravel subrounded flint and sandstone.	3.85		
4.00	J									
4.50 - 4.95	J									
4.50 - 4.95	S					37				
4.50 - 5.00	J									
5.00	J									
5.50 - 5.95	J									
5.50 - 5.95	S					55				
6.50 - 6.90	S					90				
							Very dense slightly cemented slightly gravelly SAND, gravel of flint.	6.90 6.90		

Boring				Progress				Groundwater				Remarks on Groundwater
Depth	Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	am (A) Date pm (P)	Depth Struck	Depth Cased	Depth after 20 mins	Depth Sealed	
1.20 6.90	150mm	Inspection Pit. Cable Percussion.	PB	Start 6.90 End	4.50		11/09/00 A11/09/00 11/09/00	2.80	2.30	2.80	4.00	No seepage.

Remarks Inspection pit excavated to 1.20m.
Installation details: bentonite seal 0.30-1.00m, standpipe to 6.50m.
CH₄ = 0% CO₂ = 0% O₂ = 19.8% mb = 995
** Drillers description.



Logged by: TJH Symbols and abbreviations are explained on the accompanying key. All linear dimensions are in metres.

Scale: 1:50

BOREHOLE RECORD - Window Sampling

Project ROYAL HOSPITAL, WOLVERHAMPTON

Engineer PINNACLE CONSULTING ENGINEERS

Borehole Coordinates WS1

Client

Project No 00-10462

Sampling			Properties		Strata			
Depth	Sample Type	Sample Dia	Strength kN/m ²	u x	Description	Depth	Legend	Level 00
0.60 - 2.00	B				Concrete.	0.20		
					Cobbles of bricks and concrete ??? with a little sand.	0.60		
					Firm red brown slightly gravelly slightly sandy CLAY. Gravel is angular to rounded fine to coarse flint, coal and brick. 1.50m, becoming soft.			
2.50	J				Firm red brown clay with rare rounded flint gravel.	2.50		
3.25	J				Soft dark red brown to black very sandy CLAY (possible alluvium type deposit) high organic content.	3.25		
						3.40		

DRAFT

Boring				Progress		Groundwater		
Depth	Dia	Technique	Crew	Date	Depth Cased	Depth Struck	Depth on Completion	Remarks on Groundwater
1.60	75mm	Window Sampling.		A				None encountered during sampling.
2.60	65mm	Window Sampling.						
3.00	55mm	Window Sampling.						
3.40	45mm	Window Sampling.						

Remarks

Corehole too small, surface concrete broken out. Terminated at 4.00m due to obstruction.



Logged by: TJM Symbols and abbreviations are explained on the accompanying key. All linear dimensions are in metres.

Scale: 1:50

BOREHOLE RECORD - Cable Percussion

Sheet 1 of 1

Project ROYAL HOSPITAL, WOLVERHAMPTON

Engineer PINNACLE CONSULTING ENGINEERS

Borehole **BH4**
Coordinates

Client

Project No 00-10462

Sampling				Properties			Strata			
Depth	Sample Type	Depth Cased	Depth to Water	Strength kN/m ²	W %	SPT N	Description	Depth	Legend	Level 00
0.00 - 0.20	B						Concrete.	0.20		
0.30 - 0.60	B						Hardcore**	0.30		
0.60 - 1.50	B						Brown to dark brown slightly silty very gravelly SAND. Gravel angular to rounded fine to coarse brick, flint and sandstone. MADE GROUND.	0.60		
1.00	J						Black slightly silty gravelly SAND. Gravel is angular ash, flint, concrete, brick, glass and ceramic fragments. Diesel like odour. MADE GROUND.			
1.50 - 1.95	J					8	Firm red brown sandy slightly gravelly CLAY. Gravel is fine to medium flint. Diesel like odour.	1.70		
1.50 - 1.95	S									
1.50 - 2.00	B									
2.50	J					6	DRAFT			
2.50 - 2.95	J									
2.50 - 2.95	S									
2.50 - 3.00	B									
3.30	J						Firm red brown sandy CLAY with rare rounded flint gravel.	3.20		
3.50	J									
3.50 - 3.95	U25									
3.95 - 4.00	J									
4.30	J									
4.50	J					16				
4.50 - 4.95	J									
4.50 - 4.95	S									
4.50 - 5.00	B									
5.30	J									
5.50	J									
5.50 - 6.00	U(F)									
5.50 - 6.00	B									
6.00 - 6.45	J					7	Firm red brown slightly gravelly slightly sandy SILT, black oil stains, and diesel like odour.	6.00		
6.00 - 6.45	S									
6.00 - 6.45	B									
6.80	J									
7.00	J									
7.00 - 7.45	J					116	Hard red brown CLAY with rare fine sand.	7.00		
7.00 - 7.45	S									
7.70	S									
7.00	J							7.70		

Boring				Progress				Groundwater				
Depth	Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	no (A) Date	Depth Struck	Depth Cased	Depth after 20 mins	Depth Sealed	Remarks on Groundwater
1.20 7.70	150mm	Inspection Pit. Cable Percussion.	PB	Start 7.70 End	6.00		13/09/00 13/09/00 13/09/00	6.00				

Remarks
 Inspection pit excavated to 1.20m.
 Installation details : bentonite seal 0.30-1.00m, standpipe to 7.00m.
 CH4 = 0.20% CO2 = 0.50% O2 = 19.3% mb = 997
 ** Drillers description.
 chiselling 7.50-7.70m for 0.50 hrs.



Logged by: TJH Symbols and abbreviations are explained on the accompanying key. All linear dimensions are in metres.

Scale: 1:50

ROYAL HOSPITAL, WOLVERHAMPTON
TESTPIT LOGS
QDS PROJECT NUMBER: 99-248.01

TP1

<u>Depth (m)</u>	<u>Description</u>
0-0.2	reinforced concrete
0.2-0.7	MADEGROUND - whole red bricks in brown clayey sand matrix
0.7-1.4	MADEGROUND - red/brown clayey sand with occasional red brick fragment
1.4-1.8	MADEGROUND - brown/black clayey sand
1.8-2.7	red/orange sandy CLAY with occasional rounded gravel

TP2

<u>Depth (m)</u>	<u>Description</u>
0-0.2	reinforced concrete
0.2-0.25	hardcore
0.25-0.55	second layer of reinforced concrete
0.55-1.0	MADEGROUND - brown/red sandy clay with frequent red brick fragments and occasional ash and clinker
1.0-1.4	MADEGROUND - dark brown/black sandy clay with frequent ash and clinker
1.4 -	third layer of reinforced concrete.

Testpit abandoned

TP3

<u>Depth (m)</u>	<u>Description</u>
0-0.2	reinforced concrete
0.2-0.25	hardcore
1.25-1.0	MADEGROUND - brown red sandy clay with many whole bricks
1.0-1.1	MADEGROUND - ash and clinker band
1.1-2.0	MADEGROUND - firm brown/black sandy clay with crushed red brick, angular gravel and ash and clinker
2.0-2.5	MADEGROUND - firm sandy dark brown clay with occasional crushed red brick.
2.5-2.9	yellow/brown sandy CLAY with occasional rounded gravel
2.9-3.2	orange SAND with frequent gravel

TP4

<u>Depth (m)</u>	<u>Description</u>
0-0.2	reinforced concrete

0.2-0.3	hardcore
0.3-0.8	concrete and brick slab
0.8-1.8	MADEGROUND – brown/black clayey sand with many large whole bricks

Testpit abandoned as becoming unstable

TP5

<u>Depth (m)</u>	<u>Description</u>
0-0.2	reinforced concrete
0.2-0.4	compact hardcore
0.4-0.7	compact whole red bricks
0.7-1.0	MADEGROUND - brown clayey sand with frequent rounded gravel and crushed brick fragments
1.0-1.15	MADEGROUND – black ash and clinker band
1.15-1.5	MADEGROUND – orange/brown clayey sand with brick and rounded/angular gravel
1.5-2.3	MADEGROUND - black clayey sand with much ash and clinker with large tarry stones
2.3-2.9	MADEGROUND - brown clayey sand with occasional brick fragment
2.9-3.2	orange clayey SAND

TP6

<u>Depth (m)</u>	<u>Description</u>
0-0.2	reinforced concrete
0.2-0.3	hardcore
0.3-0.6	second layer reinforced concrete
0.6-1.1	MADEGROUND - whole red bricks in brown sandy matrix
1.1-	third layer reinforced concrete

TP7

<u>Depth (m)</u>	<u>Description</u>
0-0.2	reinforced concrete
0.2-0.4	MADEGROUND - large grey angular stones in a grey clayey matrix
0.4-0.6	second layer reinforced concrete
0.6-0.75	hardcore
0.75-0.95	MADEGROUND - brown clayey sand with whole red bricks
0.95-1.1	MADEGROUND – brown/black clayey sand with occasional crushed red brick and angular gravels.
1.1-1.3	third reinforced concrete
1.3-1.6	MADEGROUND – brown/black clayey sand with occasional crushed red brick and angular gravels.
1.6-	fourth concrete layer

TP8

<u>Depth (m)</u>	<u>Description</u>
0-0.2	reinforced concrete

0.2-0.3	hardcore
0.3-0.5	MADEGROUND – brown clayey sand with occasional red brick and angular gravel.
0.6-3.4	firm red CLAY with occasional pocket of sand and frequent fine angular gravels

TP9

<u>Depth (m)</u>	<u>Description</u>
0-0.15	tarmac
0.15-0.3	concreted red bricks
0.3-0.5	MADEGROUND - ash and clinker with whole red bricks. Hydrocarbon odour.
0.5-3.4	firm red CLAY with occasional pocket of sand and frequent fine angular gravels

TP10

<u>Depth (m)</u>	<u>Description</u>
0-0.05	tarmac
0.05-0.2	MADEGROUND - concreted red bricks
0.2-0.5	MADEGROUND - ash and clinker with whole red bricks.
0.5-3.4	firm brown/red CLAY with occasional pocket of sand and frequent rounded gravel. Gravels becoming smaller and less frequent with depth.

TP11

<u>Depth (m)</u>	<u>Description</u>
0-0.2	reinforced concrete
0.2-0.4	MADEGROUND - large grey angular stones in a grey clayey matrix
0.4-0.6	second layer reinforced concrete

second layer too thick to break through. Testpit abandoned.

TP12

<u>Depth (m)</u>	<u>Description</u>
0-0.2	reinforced concrete
0.2-0.3	hardcore
0.3-1.4	MADEGROUND - black/brown clayey sand with whole red bricks and ash and clinker.
1.4-2.2	MADEGROUND - black/brown slightly moist sandy clay with frequent ash and clinker with crushed red brick fragments. Possible hydrocarbon odour.
2.2-3.4	moist brown CLAY with slight silver/grey hydrocarbon staining and odour.

Collapse at 3.4 m.

ANALYSIS OF SOIL SAMPLES

Date rec'd : 22/9/2000
 Our Ref. : 50-1499
 Your Ref. : Royal Hospital, Wolverhampton
 Report Date : 9/10/2000

DETERMINAND	CLIENT ID. LAB ID. Result number	TP8 1.8 232495	TP9 0.35 232497	TP12 1.6 232499	QA Actual	QA Found	QA Blank
OC (Headspace) (µg/Kg)							
Dichloromethane		<50	<50	<50	-	-	<50
Chloroform		<2	2	<2	[40]	[43]	<2
1,1,1-Trichloroethane		<10	<10	<10	-	-	<10
Carbon tetrachloride		<2	<2	<2	-	-	<2
Benzene		<2	<2	<2	[45]	[51]	<2
1,2-Dichloroethane		<2	<2	<2	-	-	<2
Trichloroethene		<2	40	<2	[49]	[46]	<2
Bromodichloromethane		<2	<2	<2	-	-	<2
Dibromochloromethane		<2	<2	<2	-	-	<2
1,1,2,2-Tetrachloroethane		<2	<2	<2	-	-	<2
Toluene		<2	<2	<2	[51]	[52]	<2
Freon-113		<2	<2	<2	-	-	<2
Tetrachloroethene		<2	<2	<2	-	-	<2
Chlorobenzene		<2	<2	<2	-	-	<2
Ethylbenzene		<2	<2	4	[43]	[40]	<2
m/p-Xylenes		<2	<2	<2	-	-	<2
o-Xylenes		<2	<2	<2	-	-	<2
Hexachlorobutadiene		<2	<2	<2	-	-	<2
4-Chlorotoluene		<2	<2	<2	-	-	<2
2-Chlorotoluene		<2	<2	<2	-	-	<2
Isopropyl benzene		<2	<2	38	-	-	<2
Bromoform		<2	<2	<2	-	-	<2
Styrene		<2	<2	<2	-	-	<2
1,3,5-Trichlorobenzene		<2	<2	<2	-	-	<2
1,2,3-Trichlorobenzene		<2	<2	<2	-	-	<2
1,2,4-Trichlorobenzene		<2	<2	<2	-	-	<2
1,2-Dichlorobenzene		<2	<2	<2	-	-	<2
1,3-Dichlorobenzene		<2	<2	<2	-	-	<2
1,4-Dichlorobenzene		<2	<2	<2	-	-	<2
alpha-Methyl styrene		<2	<2	<2	-	-	<2
1,1-Dichloroethane		<2	<2	<2	-	-	<2
1,1,2-Trichloroethane		<2	<2	<2	-	-	<2
1,1-Dichloroethene		<2	<2	<2	-	-	<2
trans 1,2-Dichloroethene		<2	<2	<2	-	-	<2
cis 1,2-Dichloroethene		<2	<2	<2	[45]	[53]	<2
tert Butyl methyl ether		<2	<2	<2	-	-	<2
Vinyl chloride		<2	<2	<2	-	-	<2
Methyl methacrylate		<10	<10	<10	-	-	<10
Freon-11		<50	<50	<50	-	-	<50

□ indicates QA data.
 □ list of test methods and procedures used
 are appended. The material analysed above
 was not sampled at source by Robertson.
 □ please see comments following results.

ANALYSIS OF SOIL SAMPLES

Date rec'd : 19/9/2000
 Our Ref. : 50-1497
 Your Ref. : ROYAL HOSPITAL, WOLVERHAMPTON 99.248.01
 Report Date : 9/10/2000

CLIENT ID	LAB ID	TPH/GC (mg/Kg)	Characterisation
WS1 1.5	232151	<10	-
WS7 2.2	232152	<10	-
WS9 0.6	232153	160	Possible Lube Oil
WS9 2.8	232154	<10	-
WS10 1.1	232155	<10	-
WS11 1.2	232156	<10	-
WS12 2.0	232157	<10	-
WS13 0.4	232158	20	Uncharacteristic Profile
WS13 5.8	232159	<10	-
BH1 1.0	232160	<10	-
BH1 4.0	232161	<10	-
BH2 2.5	232162	<10	-
BH3 6.0	232163	<10	-
BH3 5.5	232164	480	Possible Diesel
BH4 2.5	232165	1.1%	Possible Weathered Diesel
BH4 7.0	232166	340	Possible Weathered Diesel

Indicates QA data.
 List of test methods and procedures used
 are appended. The material analysed above
 was not sampled at source by Robertson.
 Please see comments following results.

ANALYSIS OF SOIL SAMPLES

Date rec'd : 22/9/2000
 Our Ref. : 50-1499
 Your Ref. : Royal Hospital, Wolverhampton
 Report Date : 9/10/2000

CLIENT ID	LAB ID	TPH/GC (mg/Kg)	Characterisation
P11.9	232489	<10	-
TP4 1.5	232491	290	Possible Lube Oil
TP5 1.7	232492	1100	Possible PAH's
P6 1.0	232494	160	Possible Lube Oil
P8 1.8	232495	<10	-
TP9 1.9	232496	<10	-
TP9 0.35	232497	80	Possible Weathered Diesel
P12 1.6	232499	6800	Poss Very Weathered Diesel
P12 3.4	232500	840	Poss Very Weathered Diesel
WS17 1.7	232503	<10	-
WS18 0.7	232504	<10	-
WS19 4.0	232505	<10	-
WS19 1.2	232506	<10	-
WS20 0.7	232507	130	Possible PAH's
WS20 4.0	232508	<10	-
P11 0.7	232509	110	Possible PAH's

indicates QA data.
 list of test methods and procedures used
 are appended. The material analysed above
 was not sampled at source by Robertson.
 please see comments following results.





Appendix F - Monitoring

