

**PHASE 1 & 2 ENVIRONMENT RESUMÉ AND  
REMEDATION STATEMENT FOR A RESIDENTIAL  
DEVELOPMENT SITE AT**

**TOWER WORKS, MOORFIELD ROAD, UPPER ARMLEY,  
LEEDS**

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## **1.0 INTRODUCTION**

The site known as Tower Works, Moorfield Road, Upper Armley has previously had a planning permission (P/24/438/05/FU) for 9 houses and 53 apartments

In relation to the site the following reports have been prepared:

- Geo Environmental Appraisals Reference CO313 dated April 2005 prepared by Sirius Geotechnical and Environmental Ltd (Sirius)

A copy of the Sirius report has been submitted as part of a new planning application for the site.

KMRE Group Ltd have contracted to purchase the site and this report is intended to accompany their planning application on the site for a development of apartments and houses.

Whilst the aforementioned Sirius report has not been formally assigned to KMRE Group Ltd, permission has been granted to use the report to support the new planning application. This Phase 1 & 2 Environmental Resumé and Remediation Statement has been prepared on the information contained in the Sirius report.

Whilst CoDA Structures are not aware of any reason that any of the information contained in the Sirius report are incorrect or inaccurate additional ground investigation works have been undertaken on the site on 21 June 2016 as follows:

- A trial pit ground investigation with associated soil sampling and chemical testing (including speciated PAH and TPH testing). Once chemical test results have been obtained from selected samples taken in the additional trial pitting a further contamination risk assessment will be undertaken and this remediation statement will be revised accordingly.
- In addition 6No gas monitoring wells have been installed on the site and a set of six gas readings will be undertaken and a further risk assessment will be undertaken and this remediation statement will be revised accordingly.

The buildings on the site are believed to have been demolished in approximately 2008

## **2.0 PHASE 1 & 2 ENVIRONMENTAL RESUMÉ**

### **2.01 Site Description**

The site is located to the north of Moorfield Road and is approximately 3.0 miles to the west of Leeds City Centre. A site location plan (Fig. 1) is attached in Appendix A.

The Ordnance Survey co-ordinates for the centre of the site are 426200 mE, 433740 mN.

The site is approximately 0.8 hectares in area.

The boundaries of the site are defined as follows:-

- Northwestern boundary : boundary fence and retaining wall to adjacent property;
- Southeastern boundary : boundary fence to rear of the adjacent residential properties on Moorfield Road;
- Southwestern boundary : boundary wall and fencing to adjacent access road;
- Northeastern boundary : boundary retaining wall and fencing to adjacent recreation ground.

A site walk-over was undertaken on 12 May 2016 and the following noted:

- the works have been demolished but ground floor slabs and hardstanding are still in place.
- there is demolition rubble in the southern sector of the site.
- self seeded vegetation is growing on the site.
- there are no obvious signs of contamination on the site.

The site can be accessed from a private road adjacent the south western boundary.

The general fall of the site is to the southeast. Site levels range from:-

Location	Level m AOD
North western boundary	104.34 – 106.20; 102.33 – 102.53
South eastern boundary	97.88 – 99.23
North eastern boundary	99.04 – 102.33
South western boundary	99.16 – 106.51

A site topographical survey (Fig. 2) is attached in Appendix B.

A site aerial photograph is attached in Appendix C.

The local authority is Leeds City Council (LCC).

The site appears to have been filled to create the original building plateaux. Any fill that has been imported onto the site may have elevated levels of contamination, depending upon the source and nature of the material used.

The site has been used for the following activities:-

- Undeveloped (until approximately 1921).
- Tower Works (southern sector, approximately 1921 – approximately 2000).
- Tennis Courts (north eastern sector, approximately 1933 – approximately 1938).
- Tower Works (entire site, approximately 1960 – approximately 2000).

The 'Tower Works' use was in relation to the assembly and to test water and oil supply meters and is considered to be a moderate risk contaminative activity.

The tennis court use is considered to be very low risk contaminative activity.

Localised hydrocarbon contamination (TPH & PAH) may be present from the oil drum storage area that was on the site.

Potentially contaminative activities in the vicinity (within 250m) of the site included:-

- |                     |           |
|---------------------|-----------|
| - tannery           | - laundry |
| - railway lines     | - garage  |
| - engineering works | - mill    |

Potentially contaminative activities in the surrounding area (between 250 – 1000m) of the site have included:-

- |              |                   |
|--------------|-------------------|
| - tanneries  | - mills           |
| - clay pits  | - brickworks      |
| - coal pits  | - leather factory |
| - quarry     | - furniture works |
| - iron works |                   |

Therefore, it is possible the site may have been at risk from the uncontrolled tipping of waste products, residues and chemicals from surrounding past industries.

Contemporary Trade Directory entries in the vicinity (within 250m) of the site are as follows:

- |                        |            |                     |
|------------------------|------------|---------------------|
| - Garage Services      | (active)   | 6m to the west      |
| - Carburettor Services | (active)   | 6m to the west      |
| - Printers             | (active)   | 9m to the southeast |
| - Catering Equipment   | (inactive) | 33m to the south    |
| - Catering Equipment   | (active)   | 33m to the south    |

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- Catering Equipment	(inactive)	33m to the south
- Computer Manufacturers	(active)	54m to the south
- Engineers – General	(active)	124m to the east
- Dry Cleaners	(active)	129m to the east
- Steam Cleaning Services	(active)	183m to the east
- Brake & Clutch Services	(active)	188m to the southeast
- Vacuum Cleaners Repairs	(active)	191m to the north

However, the site is not considered to be at undue risk of contamination from current nearby activities.

There are no fuel station entries in the vicinity (within 250m) of the site.

## 2.02 **Ground Conditions:**

With reference to the Geo Environmental Approval report prepared by Sirius for the site (Reference: CO313 dated April 2005) the following ground conditions were encountered on the site.

Made ground was encountered in all exploratory holes to a maximum depth of 2.9m (TP7) but was typically less than 1m thick. Exceptions to this were WS3 (1.70m), WS4 (1.25m), WS106 (1.1m), WS107 (2.0m) WS108 (1.4m), WS111 (2.1m), RH101 (2.3m) and TP7 (2.9m) in the southern sector of the site.

Made ground was generally found to comprise a thin tarmac or concrete surface, with a maximum thickness of 0.4m, overlying a sandy gravel/ gravelly sand. Gravel included brick, sandstone, mudstone, burnt shale, clinker and concrete. Timber and glass fragments were occasionally encountered. Sandstone cobbles were commonly encountered. A soft or firm sandy gravelly clay was often encountered within the granular fill. The gravel in the clay included varying proportions of mudstone, sandstone, brick, ash, concrete and occasional coal. A made ground silt was encountered in WS111 (1.15 – 2.10m) and WS 108 (1.0m – 1.39m). Cobbles and boulders of brick, sandstone and concrete were encountered in TP103 (0.15 – 0.62). A metal sheet was encountered in TP105 at 0.4m.

The made ground was found to be underlain by a firm and stiff sandy gravelly clay in the central and north eastern parts of the site. Across the remainder of the site the made ground was found to directly overlie sandstone, mudstone or siltstone.

The sandy gravelly clay was encountered to depths of between 0.85 and 2.60m.

A soft sandy gravelly clay was encountered in WS110 between 1.1 and 1.6m.

A sandy gravel, and gravel and cobbles of sandstone (weathered sandstone) were encountered in TP106 and TP107 at depths between 0.27 and 0.92m and 0.2 and 0.75m respectively.

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The Sirius Trial Pit and Window Sampling Borehole Logs are attached in Appendix C.

The following soil profiles were encountered in the rotary drilling undertaken on the site:

R1		R2		R3	
Strata	Thickness (m)	Strata	Thickness (m)	Strata	Thickness (m)
Made ground	0.20	Made ground	0.15	Made ground	0.70
Sandstone	5.55	Sandstone	11.35	Sandstone	2.80
Sandstone/siltstone	7.05	Mudstone	16.50	Mudstone	5.00
Mudstone	14.90			Mudstone/ Siltstone	0.75
				Siltstone	2.75
				Mudstone	14.50
<b>Drilled Depth</b>	<b>27.50</b>	<b>Drilled Depth</b>	<b>28.00</b>	<b>Drilled Depth</b>	<b>28.50</b>

RH101		RH102		RH103	
Strata	Thickness (m)	Strata	Thickness (m)	Thickness (m)	Thickness (m)
Made ground	2.30	Made ground	0.30	Made ground	0.30
Sandstone	2.20	Sandstone	0.70	Sandstone	2.70
Mudstone	4.80	Mudstone	5.40	Mudstone	1.60
Sandstone	3.70	Sandstone	5.10	Mudstone/Siltstone	2.20
Mudstone	3.00	Siltstone	4.50	Sandstone	3.00
				Mudstone	3.20
<b>Drilled Depth</b>	<b>16.00</b>	<b>Drilled Depth</b>	<b>16.00</b>	<b>Drilled Depth</b>	<b>13.00</b>

RC201		RC202		RC203	
Strata	Thickness (m)	Strata	Thickness (m)	Strata	Thickness (m)
Made ground	0.30	Made ground	0.30	Made ground	0.50
Mudstone	3.10	Mudstone	4.20	Siltstone	0.30
Sandstone	8.20	Sandstone	5.00	Mudstone	5.70
				Sandstone	2.84
				Mudstone	0.66
<b>Drilled Depth</b>	<b>11.50</b>	<b>Drilled Depth</b>	<b>9.50</b>	<b>Drilled Depth</b>	<b>10.50</b>

RC204	
Strata	Thickness (m)
Made ground	0.50
Clay	0.70
Sandstone	1.40
Siltstone	0.40
Sandstone	0.40
Mudstone	4.20
Sandstone	4.40
<b>Drilled Depth</b>	<b>12.00</b>

The Sirius Rotary Borehole Logs are attached in Appendix C.

The locations of the Sirius Trial Pits, Window Sampling Boreholes and Rotary Boreholes are indicated on the Site Topographical Survey (Fig. 2) attached in Appendix B.

### 2.03 Groundwater:

Groundwater was encountered in the ground investigation works as follows:-

<b>Exploratory Hole</b>	<b>Groundwater Strike (m bgl)</b>
TP7	2.90m, rising to 2.75 in 20 minutes
RH1	17.50m
RH2	19.50m
RC201	6.0m
RC203	7.0m
RC204	8.50m

Groundwater levels measured during the gas monitoring period are indicated in the following table:-

<b>Borehole</b>	<b>Date</b>			
	<b>07.03.05</b>	<b>18.03.05</b>	<b>21.03.05</b>	<b>30.03.05</b>
WS103	Dry	Dry	Dry	Dry
WS106	Dry	Dry	Dry	Dry
WS108	Dry	Dry	Dry	Dry
WS109	Dry	Dry	Dry	Dry
RH1	14.20m	15.65m	11.65m	11.66m
RH2	14.35m	14.32m	14.26m	14.22m
RH3	15.85m	15.75m	15.65m	15.65m
RH101	14.0m	12.95m	12.95m	12.96m

All depths are below ground level.

### 2.04 Contamination Encountered on the site:

#### Soils

The investigation had revealed the presence of made ground across the site. The results have been re-assessed using the proposed Assessment Criteria for residential use with home grown produce attached in Appendix E.

The test results from samples taken from the made ground on the site are compared in the following table:-

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Contaminant	Concentration in soils mg/kg*	Number of samples tested	Intervention Value mg/kg	No. of samples exceeding Intervention Value
Arsenic	1.0 – 32.0	12	37	0
Cadmium	<0.2 – 3.5	12	26	0
Chromium	<1.0 – 36.0	12	910	0
Lead	4.0 – 160	12	200	0
Mercury	<0.3	12	40	0
Selenium	<0.3 – 1.2	12	250	0
Copper	<1.0 – 270	12	2400	0
Nickel	<1.0 – 44.0	12	180	0
Zinc	<1.0 – 600	12	3700	0
Boron	1.0 – 15.0	12	290	-
pH	6.5 – 12.0	12	<5	0
Sulphate (water soluble)	0.14 – 1.67 g/l	12	-	-
Cyanide (total)	<0.1 – 0.6	12	36	0
Phenols	<0.3 – 8.4	12	280	0
Asbestos	Non detected	6	detected	0
Sulphur	<0.5 – 1.7	12	-	-
Sulphide	<10.0 – 720	12	250	2
PAH	<5.0 – 270	12	#	#
TPH	<20.0 – 1500	10	#	#
Calorific Value	1.1 – 1.6 MJ/kg	3	2.0 MJ/kg	0
PCB's	<0.01	2	8	0

\* unless stated otherwise

# see later discussion

VOC testing on 6 selected soil samples from the made ground on the site did not detect any VOC compounds above the test detection limit of 0.1 mg/kg.

When compared with the proposed Assessment Criteria in relation to residential use with home grown produce the following determinants with levels in excess of Assessment Criteria were encountered in the made ground as follows:-

Sulphide	2 No	WS 109	0.15 - 0.25m	720 mg/kg
		WS 110	0.20 – 0.35m	590 mg/kg

The Upper Bound Value (US95) for the determinant with concentrations in excess of Assessment Criteria in the made ground have been calculated as follows:-

Sulphide                      278 mg/kg      >      AC of 250 mg/kg

The US95 level for sulphides in the made ground is above the former Dutch Standard and therefore at this stage only a potential significant pollution linkage is present and a further quantitative risk assessment may be required.

In addition, the following should be noted:-



- Speciated PAH testing has not been undertaken but, due to the total PAH results obtained, it is possible that there is a significant pollution linkage present on the site in relation to several PAH compounds.
- As speciated TPH testing has not been undertaken but, due to the total TPH results obtained, it is possible that there is a significant pollution linkage present on the site in relation to several TPH compounds.

The test results from samples taken from the natural ground on the site are compared in the following table:-

Contaminant	Concentration in soils mg/kg*	Number of samples tested	Intervention Value mg/kg	No. of samples exceeding Intervention Value
Arsenic	5.0 – 10.0	6	32	0
Cadmium	0.5 – 0.9	6	10	0
Chromium	11.0 – 31.0	6	3000	0
Lead	12.0 – 29.0	6	450	0
Mercury	<0.3	6	169	0
Selenium	<0.3 – 1.0	6	350	0
Copper	11.0 – 37.0	6	2330	0
Nickel	14.0 – 38.0	6	130	0
Zinc	56.0 – 87.0	6	3750	0
Boron	0.6 – 3.3	6	291	0
pH	3.5 – 8.0	15	<5	0
Sulphate (water soluble)	0.12 – 0.34 g/l	15	-	0
Cyanide (total)	<0.1 – 0.2	6	36	0
Phenols	<0.3	6	280	0
Sulphur	<0.5	6	-	-
Sulphide	<10.0- 20.0	6	250	0
PAH	<5.0 – 71.0	6	#	#
TPH	<20.0 - 6100	5	#	#

\* unless stated otherwise

# see later discussion

VOC testing on 5 selected soil samples from the natural ground on the site did not detect any VOC compounds above the test detection limit of 0.1 mg/kg.

When compared with the proposed Assessment Criteria in relation to residential use with home grown produce no determinants with levels in excess of Assessment Criteria were encountered in the natural ground.

However, the following should be noted:-

- Speciated PAH testing has not been undertaken but, due to the total PAH results obtained it is possible that there may be a significant pollution linkage present on the site in relation to several PAH compounds.
- As speciated TPH testing has not been undertaken but, due to the total TPH

results obtained, it is possible that there is a significant pollution linkage present on the site in relation to several TPH compounds.

The chemical test results from the Sirius investigation are attached in Appendix F.

In view of the above the following remediation measures are proposed on the site until further chemical testing, analysis and risk assessment is undertaken:-

- where the made ground is retained in garden areas, a 600mm inert capping including 150mm of topsoil should be provided.
- it is envisaged that TPH hotspot and possibly PAH hotspot removal may be required on the site.
- service trenches should be backfilled with clean inert materials.

## 2.05 Controlled Waters:

The results from leachate testing undertaken on selected soil samples from the made ground are assessed in the following table:

Contaminant	Concentration in Waters (µg/l)*	Number of samples tested	Intervention Value µg/l		No. of samples exceeding Intervention Value	
			A	B	A	B
Arsenic	<1.0	6	50	10	0	0
Cadmium	<2.0	6	5.0	5.0	0	0
Chromium	<10.0	6	20	50	0	0
Lead	20.0 – 30.0	6	10	25	0	0
Mercury	<0.2 - 0.2	6	1.0	1.0	0	0
Selenium	<3.0	6	-	10	-	0
Copper	<1.0 – 8.0	6	40	2000	0	0
Nickel	<10.0	6	150	20	0	0
Zinc	130 - 380	6	1000	-	0	-
Boron	110 - 240	6	2000	1000	0	0
Sulphate	<10.0 – 48.0 mg/l	6	-	250 mg/l	-	0
pH	5.2 – 9.9	6	6-9	-	0	-
PAH	0.26 – 72.0	6	-	0.1	-	6
Sulphide	<500	6	-	-	-	-
Cyanide (total)	<20.0	6	1500 <sup>1</sup>	50	0	0
Phenols	<0.5	6	2000 <sup>1</sup>	0.5	0	0
Sulphur	<100	6	-	-	-	-
Ammonia	<0.02 – 0.06	6	15	500	0	0
Chloride	<10.0 mg/l	6	-	250 mg/l	-	0
COD	<10.0 mg/l	6	-	-	-	-
Electrical Conductivity	43 – 180 µs/cm	6	-	2500 µs/cm	-	0
Iron	<10.0	6	1000	200 mg/l	0	0

\* unless noted otherwise

A Environmental Quality Standard (EQS) for List 1 & 2 Dangerous Substances and where appropriate a hardness band of 100 – 150 mg/l Ca CO<sub>3</sub> has been assumed or Dutch Intervention Value (<sup>1</sup>)

B Water Supply (Water Quality) Regulations 2000

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The results of leachate sampling from the made ground has not indicated any elevated levels of contamination above Intervention Value A or B except for PAH levels which were all above drinking water standard. However, drinking water standard is considered to be overly onerous for the site.

Generally the levels of leachate contamination encountered in the made ground are not considered to pose a significant risk to controlled waters but the elevated concentration of PAH of 72.0µg/l in WS102 (0.10 – 0.40m) corresponds to a relatively high PAH level (240 mg/kg) in the made ground at this location and requires further investigation.

Groundwater samples taken from RO1, RO2, RO3, and RO101 are assessed in the following table:

Contaminant	Concentration in Waters (µg/l)*	Number of samples tested	Intervention Value µg/l		No. of samples exceeding Intervention Value	
			A	B	A	B
Arsenic	<1.0	4	50	10	0	0
Boron	<100 – 160	4	2000	1000	0	0
Cadmium	<2.0	4	6	5	0	0
Chromium	10.0 – 20.0	4	20	50	0	0
Copper	<1.0	4	40	2000	0	0
Lead	<10.0	4	10	25	0	0
Nickel	<10.0	4	150	20	0	0
Selenium	<3.0	4	-	10	-	0
Zinc	80.0 - 210	4	1000	-	0	-
Mercury	<0.2	4	1.0	1.0	0	0
pH	7.1 – 7.7	4	6.9	-	0	-
Sulphate	120 – 192 mg/l	4	-	250 mg/l	-	0
Cyanide (total)	<20	4	1500 <sup>1</sup>	50	0	0
Phenols	<0.5	4	2000 <sup>1</sup>	0.5	0	0
Ammonia	<20.0 – 20.0	4	15	500	0	-
COD	<10.0 mg/l	4	-	-	-	-
TPH	<10.0	4	600 <sup>1</sup>	10	0	0
PAH	<0.2 – 0.5	4	-	0.1	-	4
Sulphide	<500	4	-	-	-	-
Sulphur	<100	4	-	-	-	-
Chloride	50 – 70 mg/l	4	-	250mg/l	-	0
Electrical conductivity	1100 - 1300µs/cm	4	-	2500 µs/cm	-	0
Iron	<10.0 - 1500	4	1000	200 mg/l	0	0

\* unless noted otherwise

A Environmental Quality Standard (EQS) for List 1 & 2 Dangerous Substances and where appropriate a hardness band of 100 – 150 mg/l Ca CO<sub>3</sub> has been assumed or Dutch Intervention Value (<sup>1</sup>)

B Water Supply (Water Quality) Regulations 2000

The results of ground water sampling have not indicated elevated levels of contamination above the Intervention Values A and B except for PAH levels which were all above drinking water standard. However, drinking water standard is considered to be overly onerous for the site. It does not appear that the chemical concentrations in the overlying made ground are having a detrimental effect on

ground water quality.

In addition, VOC testing did not indicate any compounds above test detection limit.

In addition it should be also noted that:-

- there are no groundwater abstractions within 750m of the site.
- the site is underlain by a minor aquifer.
- the site is not within a Source Protection Zone.
- there are no open watercourses in the vicinity of the site
- the redeveloped site will be approximately 60% positively drained hardcover, which will reduce the amount of rainwater percolating through the soils.

## 2.06 Landfill Gas:

The development does not appear to be at risk from the migration of landfill gas onto the site, as there are no landfill sites within 250m of the site.

However, the development may be at risk from landfill gases from back filled quarries within 250m of the site depending on the source and nature of the materials used.

In view of this gas wells were installed on the site in eight boreholes.

Gas monitoring at the site was carried out on four occasions over a period of approximately three weeks, from 07 March 2005 to 30 March 2005. One of the four monitoring visits were carried out when atmospheric pressure was at or below 1000mb. A summary of the monitoring results is shown in the table below.

Monitoring Point	Gas concentrations recorded (% v/v)		Flow rates recorded (litre/hour)
	Methane	Carbon Dioxide	
WS103	ND	ND – 0.4	ND
WS106	ND	2.0 – 2.8	ND
WS108	ND	1.0 – 1.2	ND
WS109	ND	ND – 0.2	ND
RH1	ND	1.0 – 1.8	ND
RH2	ND	1.9 – 2.2	0.4
RH3	ND	1.2 – 1.8	-1.0
RH101	ND	1.7 – 3.5	ND

ND: None detected

Where Flow rates are shown as 'none detected' a default value of 0.1 litres/hour has been used, representing the limit of detection of the measuring equipment.

The gas monitoring data has been appraised in order to assess the potential gas emission rate from the soils beneath the site.

Borehole gas screening values (GSV) for both methane and carbon dioxide have been calculated for each borehole. The table below shows the maximum GSV and indicates whether the maximum rate relates to methane or carbon dioxide.

<b>Borehole No:</b>	<b>Gas Screen Value – Methane (litres/hour)</b>	<b>Gas Screening Value – Carbon Dioxide (litres/hour)</b>
WS103	0.0	0.0004
WS106	0.0	0.0028
WS108	0.0	0.0012
WS109	0.0	0.0002
RH1	0.0	0.0018
RH2	0.0	0.0022
RH3	0.0	0.0018
RH101	0.0	0.0035

Based on the GSVs obtained the site is categorised in accordance with the NHBC ‘traffic light system’ as Green.

Based on the maximum concentrations of methane and carbon dioxide recorded the site is categorised in accordance with NHBC ‘traffic light system’ as Green.

Based on the current set of gas monitoring results no gas protection measures are required on the development.

However, the requirement for gas protection measures will be reviewed once a further set of six gas readings are taken from the new gas wells that have been installed on the site.

### **3.0 REMEDIATION STATEMENT**

#### **3.01 Objectives of the Remediation Works:**

The objective of reclamation works is to improve any marginal land into ground suitable for residential. The standard of work would be to that considered acceptable for residential developments and not forming part of the food production system. It should be noted that approximately 60% of the redeveloped site will be drained hardcover.

#### **3.02 Remediation Works:**

The proposed works shall include the following and includes works already undertaken on the site, although this does not necessarily indicate the order of the works.

- Disconnect and/or divert any live services on the site.
- Grub out all vegetation and remove from site. Any vegetation to be retained, should be adequately protected from the works.
- Inspect the site for hazardous materials visible on the surface; remove from site together with any fly tipping and rubbish to a suitably licensed tip, using approved methods and a suitably licensed contractor.
- Grub up remaining floor slab and foundation and crush suitable material for re-use in the works.
- Following the proposed additional ground investigation work it is possible that TPH hotspot and possibly PAH removal will be required.
- After the initial site strip the formation is to be inspected. Any areas of deleterious material or contamination not identified in the ground investigation identified by visual or olfactory evidence and subsequent chemical testing is to be remediated if necessary, in accordance with a risk assessment.
- Until further chemical testing, analysis and risk assessment is undertaken the made ground in garden areas should be capped with 600mm of inert capping including a minimum of 150mm topsoil.
- Any imported engineering fill material should be compacted in accordance with the Dpt. Highways Specification.
- Arisings from the made ground on the site may be classified as contaminated. Guidance should therefore be sought from the local Waste Management Regulation Office regarding the disposal of soils from the site.
- Subject to validation testing excavated natural ground can be stockpiled and used as inert capping material.

The above remediation works will be reviewed once the additional ground investigation works are undertaken.

### **3.03 Gas Projection Measures**

Based on the current set of gas monitoring results no gas protection measures are required on the development.

The requirement for gas protection measures will be reviewed once a further set of six gas readings are taken from the new gas wells that have been installed on the site.

The Envirocheck information indicates that the site is in an area where Radon

protection measures are not required.

### **3.04 Drawings and Specifications:**

A remediation drawing will be prepared for the site once the results from the additional ground investigation works have been assessed.

CoDA Structures Specification for Earthworks is attached in Appendix G.

### **3.05 Phasing & Programme of Works:**

To be advised.

### **3.06 Consents, Agreements and Licenses:**

- Planning approval;
- Licensed 'Waste' carrier to be used.
- Any materials removed from site to be disposed at suitably licensed tips (tip tickets and waste transfer notices to be obtained).

### **3.07 Site management procedures to protect site neighbours, environment and amenity during works:**

- A detailed method statement is to be prepared by the Main Contractor.

### **3.08 Details of how any necessary variations from the approved remediation statement arising during the course of the works will be dealt with:-**

- If ground conditions or contamination are encountered by the remediation contractor which are significantly different to those encountered during the ground investigation the consultant will be informed.
- Following site inspection, and if deemed necessary, the works in the immediate vicinity of the problem area will be ceased and cordoned off, and additional sampling and chemical testing undertaken.
- Following receipt of test results, should the proposed remediation works need to be varied this will be advised to the Local Authority in writing, together with associated correspondence and risk assessments, as appropriate.

### **3.09 Details of how the works will be validated to ensure the remediation objectives have been met:**

- Prior to importation onto site, chemical test analysis will be obtained on all

**PHASE 1& 2 ENVIRONMENTAL RESUMÉ AND  
REMEDIATION STATEMENT FOR A  
RESIDENTIAL DEVELOPMENT SITE AT  
TOWER WORKS, MOORFIELD ROAD, UPPER  
ARMLEY, LEEDS**

material proposed as inert capping at a frequency of 1 per 250m<sup>3</sup>.

- The soils chemical testing to be undertaken on imported topsoil or capping material, as a minimum should comprise:  

Arsenic	Mercury	Nickel	Sulphate (ws)	TPH (speciated)
Cadmium		Selenium	Zinc	PAH – (speciated)
Chromium		Boron (ws)	Phenols	Sulphide
Lead		Copper	pH	Cyanide
- The criteria to which chemical analysis will be compared and not exceeded, unless noted otherwise, will be for residential use with plant uptake as follows:-

Determinant	Max Concentration
<b>Heavy Metal / Metalloids</b>	
Arsenic	37 mg/kg
Cadmium	22 mg/kg
Chromium (III)	910 mg/kg
Chromium (VI)	21 mg/kg
Lead	200 mg/kg
Mercury	40 mg/kg
Nickel	180 mg/kg
Selenium	250 mg/kg
Boron	290 mg/kg
Copper	2400 mg/kg
Zinc	3700 mg/kg
<b>PAH I6EPA</b>	
Acenaphthene	210 mg/kg
Acenaphthylene	170 mg/kg
Anthracene	2400 mg/kg
Benzo (a) Anthracene	7.2 mg/kg
Benzo (a) pyrene	5.0 mg/kg
Benzo (b) + (k) fluoranthene	2.6 mg/kg
Benzo (g, h, i) perylene	320 mg/kg
Chrysene	15 mg/kg
Di-benzo (a, h) anthracene	0.24 mg/kg
Indeno (1, 2, 3-cd) pyrene	27 mg/kg
Fluoranthene	280 mg/kg
Fluorene	170 mg/kg
Napthalene	2.3 mg/kg
Phenanthrene	95 mg/kg
Pyrene	620 mg/kg
<b>Others</b>	
pH	<5
Sulphate	500 mg/l
Sulphide	250 mg/lg
<b>Phenolics</b>	
Phenol	280 mg/kg
<b>General Inorganics</b>	
Cyanide (free)	36 mg/kg
<b>Aliphatic Hydrocarbons</b>	
TPH Aliphatic > EC5-6	42 mg/kg
TPH Aliphatic > EC6-8	100 mg/kg
TPH Aliphatic > EC8-10	27 mg/kg
TPH Aliphatic > EC10-12	130 mg/kg
TPH Aliphatic > EC12-16	1100 mg/kg
TPH Aliphatic > EC16-35	65000 mg/kg
TPH Aliphatic > C35-44	65000 mg/kg
TPH Aromatic > EC5-7	70 mg/kg
TPH Aromatic > EC7-8	130 mg/kg
TPH Aromatic > EC8-10	34 mg/kg
TPH Aromatic > EC10-12	74 mg/kg



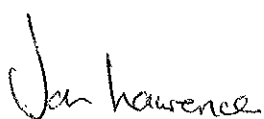
TPH Aromatic > EC12-16	140 mg/kg
TPH Aromatic > EC16-21	260 mg/kg
TPH Aromatic > EC 21-35	1100 mg/kg
TPH Aromatic > EC35-44	1100 mg/kg
Benzene	0.87 mg/kg
Toluene	130 mg/kg
Ethylbenzene	47 mg/kg
o - Xylene	45.2 mg/kg
m - Xylene	59 mg/kg
p - Xylene	56 mg/kg

- Placed depth of capping will be verified by trial pits once the material is insitu. A minimum of 10 no. locations is proposed.
- It is considered that excavated natural ground can be reused as capping subject to validation testing.
- A completion report will be prepared for the site by CoDA Structures.

#### 4.0 CAVEATS

- 4.01 The comments given in this report and recommendations made are based on the information that could be obtained from reasonably accessible sources. Detailed discussions have not yet been held with statutory bodies and the local authority.
- 4.02 This report has been prepared on information contained within a report prepared by Sirius. CoDA Structures cannot be held responsible for any inaccuracies within third party information that has been relied upon in the preparation of this report.
- 4.03 This report has been prepared for the sole use of KMRE Group Ltd and their development funders, unless agreed otherwise in writing by CoDA Structures.

Signed:

  
.....  
J Lawrence B Eng C Eng M I Struct E

## **APPENDIX A**

### **SITE LOCATION PLAN (FIG. 1)**



# CoDa + Structures

Consulting Civil & Structural Engineers

14 Springfield Court

Guiseley

Leeds LS20 8PD

Tel: 01943 872567

Fax: 01943 870824

Project Tower Works, Moorfield Road, Leeds

Title Location Plan

Drawn RD Date 10.04.12

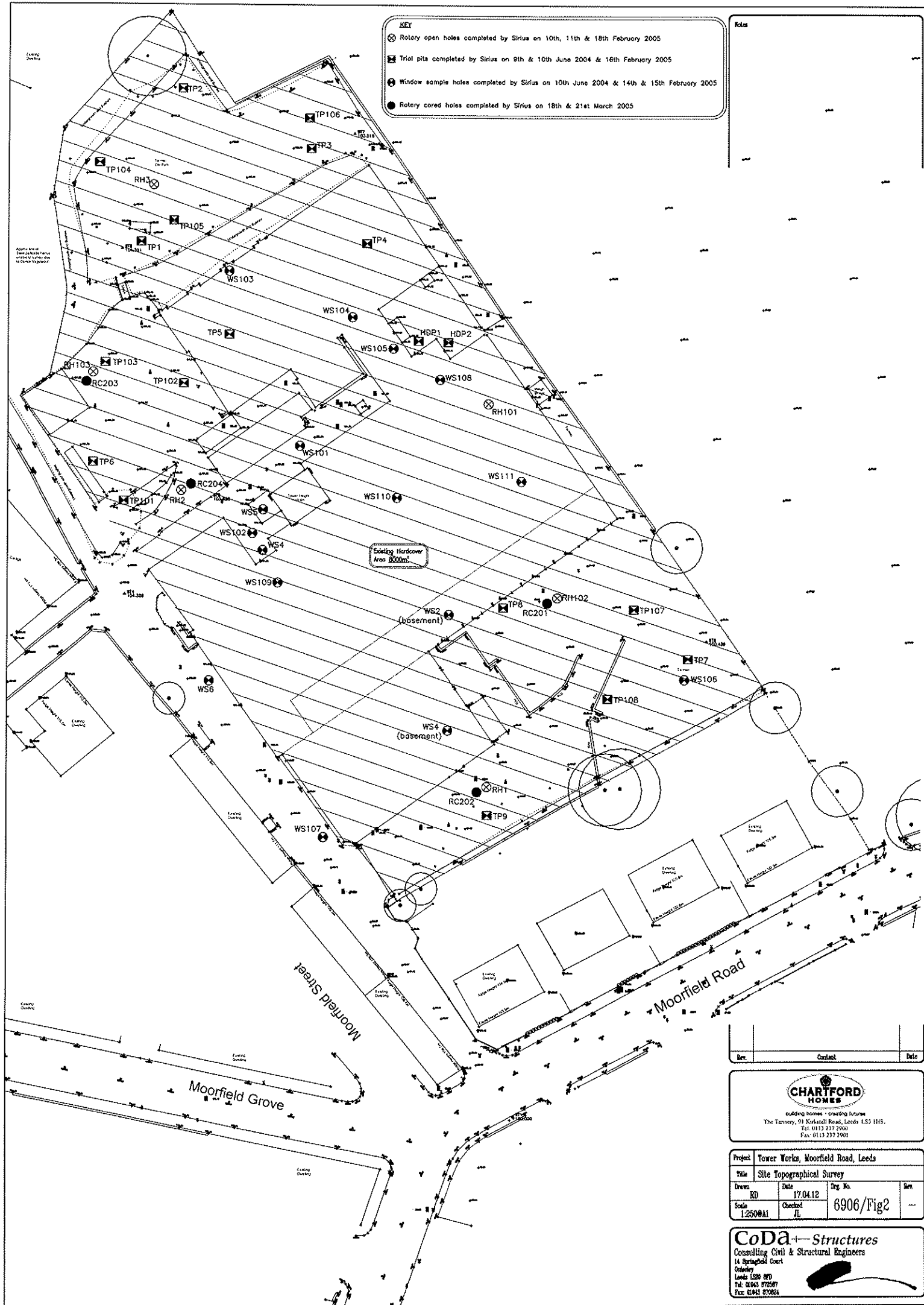
Scale NTS Checked MJ

Drwg. No. 6906/Fig1

Rev. —

## **APPENDIX B**

### **SITE TOPOGRAPHICAL SURVEY (FIG. 2)**



**CoDa Structures**

Consulting Civil & Structural Engineers  
14 Springfield Court  
GUISELEY  
Leeds LS20 8FD

**PHASE 1& 2 ENVIRONMENTAL RESUMÉ AND  
REMEDIATION STATEMENT FOR A  
RESIDENTIAL DEVELOPMENT SITE AT  
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ARMLEY, LEEDS**

## **APPENDIX C**

### **SITE AERIAL PHOTOGRAPH**



Google

Imagery Date: 9/28/2011 53°47'57.50" N 1°36'12.43" W elev 103 m eye al

© 2016 Google

2002

## **APPENDIX D**

### **SIRIUS TRIAL PIT, WINDOW SAMPLING & ROTARY BOREHOLE LOGS**





# TRIAL PIT RECORD

TP No. **TP1**  
 Sheet 1 of 1  
 Contract No: **C0313**

Site : **Tower Works, Armley**  
 Client : **Commercial Estates Group Ltd.**

Dates:  
 09/06/2004

Method : JCB 3CX with 0.60m wide toothed bucket and pecker

Scale **1:25**

Logged By: **JWB**

## SAMPLE DETAILS

## STRATA RECORD

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>	Groundwater	Description	Depth (m)	PID (ppm)	Legend	Well
D J	0.10m			MADE GROUND: Tarmac hardstanding.	0.07			
D J	0.40m			MADE GROUND: Grey clayey sandy angular fine to coarse GRAVEL of limestone with occasional pieces of tarmac. ---at 0.10m PID reading = 0.0ppm.	0.30			
D J	0.70m	90		MADE GROUND: Brown slightly clayey very gravely fine to coarse SAND with many cobbles of angular to subangular brick and occasional pieces of timber. Gravel is angular to subangular fine to coarse of sandstone, brick and slate. ---at 0.40m PID reading = 0.0ppm.	0.65			
D J	1.10m			Stiff light greyish brown slightly sandy gravelly CLAY. Gravel is angular fine to coarse of sandstone and mudstone. ---at 0.70m PID reading = 0.0ppm. ---at 1.10m PID reading = 0.0ppm.	1.10 1.20			
				Moderately weak to strong very thinly bedded light greyish brown fine to medium grained SANDSTONE with ripple marks along bedding planes. (Recovered as gravel, cobble and boulder sized fragments.) End of Trial Pit at 1.20 m				

## Remarks and Water Observations

1. No groundwater flows encountered during excavation.
2. All faces stable
3. Trial pit terminated on impenetrable rock.

Fig. No.

**TP1**



## TRIAL PIT RECORD

TP No. **TP2**

Sheet 1 of 1

Site : Tower Works, Armley

Contract No: **C0313**

Client : Commercial Estates Group Ltd.

Dates:  
09/06/2004

Method : JCB 3CX with 0.60m wide toothed bucket and pecker.

Scale 1:25

### SAMPLE DETAILS

Type	Depth		Vane Results kN/m <sup>2</sup>	Groundwater
	From	To (m)		
D	0.20m			
D	0.50m		100	
D	1.30m			
D	1.70m			
D	2.70m			
D	3.70m			

### STRATA RECORD

Description		Depth (m)	PID (mm)	Legend	Well
MADE GROUND: Tarmac hardstanding.		0.10			
MADE GROUND: Grey clayey sandy angular fine to coarse GRAVEL of limestone with occasional pieces of tarmac. ---from 0.30m to 0.40m with some angular cobbles of brick and occasional pieces of timber.		0.40			
Stiff light grey and orangish brown mottled slightly sandy very gravelly CLAY. Gravel is angular fine to coarse of sandstone and mudstone.		1.20			
Moderately weak very thinly bedded light greyish brown fine to medium grained SANDSTONE with ripple marks along bedding planes. (Recovered as gravel, cobble sized fragments.)		1.60			
Weak thinly laminated light greyish brown sandy MUDSTONE. (Recovered as gravel and cobble sized fragments.)		4.00			
End of Trial Pit at 4.00 m					

### Remarks and Water Observations

- 1 No groundwater flows encountered during excavation.
- 2 All faces stable.
- 3 Trial pit terminated at maximum depth, 4.00m.

Fig. No.

TP2



## TRIAL PIT RECORD

TP No. **TP3**

Sheet 1 of 1

Site : Tower Works, Armley

Contract No: **C0313**

Client : Commercial Estates Group Ltd.

Dates:  
09/06/2004

Method : JCB 3CX with 0.60m wide toothed bucket and pecker.

Scale 1:25

### SAMPLE DETAILS

Logged By: **JWB**

### STRATA RECORD

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>	Groundwater	Description	Depth (m)	PID (ppm)	Legend	Well
D J	0.20m			MADE GROUND: Tarmac hardstanding.	0.10			
D J	0.90m			MADE GROUND: Brown clayey gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of brick, sandstone and tarmac. ---at 0.20m PID reading = 30.0ppm.	0.85			
D	1.30m			Stiff light yellowish brown sandy gravelly CLAY with occasional cobbles of angular sandstone. Gravel is angular fine to coarse of sandstone. ---at 0.90m PID reading = 27.0ppm.	1.20			
D	2.30m			Moderately weak very thinly bedded light greyish brown fine to medium grained SANDSTONE with ripple marks along bedding planes. (Recovered as gravel, cobble and boulder sized fragments.)				
D J	2.50m			Weak thinly laminated light greyish brown sandy MUDSTONE. (Recovered as gravel sized fragments.) ---at 2.50m PID reading = 22.0ppm.	2.40			
D J	3.50m			---at 3.50m PID reading = 0.8ppm.				
				End of Trial Pit at 4.00 m	4.00			

#### Remarks and Water Observations

1. No groundwater flows encountered during excavation.
2. All faces stable.
3. Trial pit terminated at maximum depth, 4.00m.

Fig. No.

TP3



# TRIAL PIT RECORD

TP No. **TP4**

Sheet 1 of 1

Site : Tower Works, Armley

Contract No: **C0313**

Client : Commercial Estates Group Ltd.

Dates:  
09/06/2004

Method : JCB 3CX with 0.60m wide toothed bucket and pecker

Scale 1:25

## SAMPLE DETAILS

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>	Groundwater
D	0.30m		
D	1.00m		
D	1.50m	90	
D	2.50m		
D	2.70m		
W	3.60m		▽
D	3.70m		

## STRATA RECORD

Description	Depth (m)	PID (ppm)	Legend	Well
MADE GROUND: Concrete.				
MADE GROUND: Orangish brown gravelly fine to coarse SAND with some cobbles and boulders (max. 0.40m x 0.40m x 0.20m) of angular to subangular concrete, brick and sandstone. Gravel is angular to subrounded fine to coarse of concrete, brick, slate and sandstone. ---at 0.25m plastic membrane.	0.25			
Stiff light greyish brown sandy gravelly CLAY with occasional angular cobbles of sandstone. Gravel is angular fine to coarse of sandstone.	0.90			
Stiff light grey and orangish brown mottled slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to medium of mudstone.	1.40			
Weak thinly laminated light greyish brown MUDSTONE. (Recovered as gravel sized fragments.)	2.60			
End of Trial Pit at 4.00 m	4.00			

## Remarks and Water Observations

- 1 No groundwater flows encountered during excavation
- 2 Groundwater inflow overnight to a level of 3.60m
- 3 All faces stable
- 4 Trial pit terminated at maximum depth, 4.00m

## Fig. No.

TP4



# TRIAL PIT RECORD

TP No. **TP5**  
Sheet 1 of 1

Site : Tower Works, Armley

Contract No: **C0313**

Client : Commercial Estates Group Ltd.

Dates:  
09/06/2004

Method : JCB 3CX with 0.60m wide toothed bucket and pecker.

Scale 1:25

## SAMPLE DETAILS

Logged By: **JWB**

## STRATA RECORD

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>	Groundwater	Description	Depth (m)	PID (mm)	Legend	Well
				MADE GROUND: Concrete.				
D	0.40m			MADE GROUND: Brown gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of sandstone, concrete and brick.	0.30			
D	0.70m			Moderately strong very thinly bedded light greyish brown fine to medium grained SANDSTONE with ripple marks along bedding planes. (Recovered as gravel, cobble and boulder sized fragments.)	0.60			
				End of Trial Pit at 1.50 m	1.50			

## Remarks and Water Observations

- 1 No groundwater flows encountered during excavation
- 2 All faces stable
- 3 Trial pit terminated on impenetrable rock.

Fig. No.

**TP5**



## TRIAL PIT RECORD

TP No. **TP6**

Sheet 1 of 1

Site : Tower Works, Armley

Contract No:  
**C0313**

Client : Commercial Estates Group Ltd.

Dates:  
09/06/2004

Method : JCB 3CX with 0.60m wide toothed bucket and pecker.

Scale 1:25

### SAMPLE DETAILS

Logged By: **JWB**

### STRATA RECORD

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>	Groundwater	Description	Depth (m)	PID (ppm)	Legend	Well
				MADE GROUND: Concrete.				
D J	0.30m			Moderately weak thinly laminated light greyish brown sandy MUDSTONE. (Recovered as sand, gravel and cobble sized fragments.) ---at 0.30m PID reading = 400.0ppm.	0.20			
D	0.80m			Moderately strong very thinly bedded light greyish brown fine to medium grained SANDSTONE with ripple marks along bedding planes. (Recovered as gravel, cobble and boulder sized fragments.) End of Trial Pit at 0.90 m	0.80 0.90			

### Remarks and Water Observations

- 1 No groundwater flows encountered during excavation
- 2 All faces stable.
- 3 Trial pit terminated on impenetrable rock

Fig. No.

TP6



## TRIAL PIT RECORD

TP No. **TP7**

Sheet 1 of 1

Site : Tower Works, Armley

Contract No:  
**C0313**

Client : Commercial Estates Group Ltd.

Dates:  
10/06/2004

Method : JCB 3CX with 0.60m wide toothed bucket and pecker.

Scale 1:25

### SAMPLE DETAILS

Logged By: **JWB**

### STRATA RECORD

Type	Depth From - To (m)	Vane Results kN/m <sup>2</sup>	Groundwater	Description	Depth (m)	PID (ppm)	Legend	Well
D	0.10m			MADE GROUND: Tarmac hardstanding.	0.05			
D	0.20m			MADE GROUND: Buff fine to coarse SAND and fine to medium GRAVEL of limestone.	0.15			
D	0.40m			MADE GROUND: Black gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of clinker and glass.	0.35			
				MADE GROUND: Firm light greyish brown sandy gravelly CLAY with occasional cobbles of angular brick and concrete. Gravel is angular to subangular fine to coarse of mudstone, sandstone, brick and concrete.				
D	1.40m							
D	2.40m							
W	2.90m			Weak thinly laminated light greyish brown MUDSTONE. (Recovered as sand and gravel sized fragments.)	2.90			
D	3.00m			End of Trial Pit at 3.20 m	3.20			

### Remarks and Water Observations

- 1 Groundwater flow encountered at 2.90m, rose to 2.75m in 20 minutes.
- 2 Side walls unstable throughout the made ground
- 3 Trial pit terminated at 3.20m due to heavy groundwater flow

Fig. No.

**TP7**



## TRIAL PIT RECORD

TP No. **TP8**

Sheet 1 of 1

Site : Tower Works, Armley

Contract No:

**C0313**

Client : Commercial Estates Group Ltd.

Dates:  
10/06/2004

Method : JCB 3CX with 0.60m wide toothed bucket and pecker

Scale 1:25

### SAMPLE DETAILS

Type	Depth		Vane Results kN/m <sup>2</sup>
	From	To(m)	
D	0	10m	
D	0	20m	

Groundwater

### STRATA RECORD

Description

MADE GROUND: Tarmac hardstanding.

MADE GROUND: Light brown gravelly fine to coarse SAND with cobbles of angular to subangular limestone, sandstone and brick. Gravel is angular to subangular fine to coarse of sandstone, mudstone and limestone.

---at 0.10m PID reading = 0.0ppm.

Moderately strong very thinly bedded light greyish brown clayey fine to medium grained SANDSTONE with ripple marks along bedding planes. (Recovered as gravel, cobble and boulder sized fragments.)

End of Trial Pit at 0.80 m

Logged By: **JWB**

Depth (m)	PID (ppm)	Legend	Well
0.04			
0.15			
0.80			

### Remarks and Water Observations

1. No groundwater flows encountered during excavation.
2. All faces stable.
3. Trial pit terminated on impenetrable rock.

Fig. No.

**TP8**





## TRIAL PIT RECORD

TP No. **TP9**

Sheet 1 of 1

Site : Tower Works, Armley

Contract No: **C0313**

Client : Commercial Estates Group Ltd.

Dates:  
10/06/2004

Method : JCB 3CX with 0.60m wide toothed bucket and pecker.

Scale 1:25

### SAMPLE DETAILS

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>
------	-----------------------	--------------------------------------

D J	0.15m	
--------	-------	--

D J	0.40m	
--------	-------	--

Groundwater

### STRATA RECORD

Description

MADE GROUND: Tarmac hardstanding.

MADE GROUND: Buff sandy angular to subangular fine to coarse GRAVEL of limestone.  
---at 0.15m PID reading = 0.0ppm.Moderately strong very thinly bedded light greyish brown clayey fine to medium grained SANDSTONE with ripple marks along bedding planes. (Recovered as gravel, cobble and boulder sized fragments.)  
---at 0.40m PID reading = 0.0ppm.

End of Trial Pit at 0.70 m

Logged By: **JWB**

Depth (m)	PID (ppm)	Legend	Well
--------------	--------------	--------	------

0.10

0.30

0.70

### Remarks and Water Observations

1. No groundwater flows encountered during excavation
2. All faces stable
3. Trial pit terminated on impenetrable rock

Fig. No.

TP9



## TRIAL PIT RECORD

TP No. **TP101**

Sheet 1 of 1

Site : Tower Works, Armley

Contract No: **C0313**

Client : Commercial Estates Group Ltd.

Dates:  
16/02/2005

Method : JCB 3CX with 0.60m wide toothed bucket and pecker.

Scale 1:25

### SAMPLE DETAILS

Logged By: **MJC**

### STRATA RECORD

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>	Groundwater	Description	Depth (m)	PID (ppm)	Legend	Well
J	0.17m - 0.25m			MADE GROUND: Reinforced CONCRETE.	0.17			
D	0.25m - 0.40m			Weak to moderately weak brown weathered SILTSTONE with poorly defined extremely to very closely spaced subhorizontal bedding fractures and very closely to closely spaced subvertical discontinuities. Recovered as slightly sandy gravel and cobble size fragments.	0.63			
B	0.70m - 1.00m			0.17-0.25m: weathered to stiff clay along north face around fracture in concrete. Locally discoloured grey with a metholated spirits-like odour.	1.15			
				Moderately weak to moderately strong light brown fine grained SILTSTONE with extremely to very closely spaced subhorizontal bedding fractures and very closely to closely spaced subvertical discontinuities. Silt and sand infill (1-5mm) noted along bedding surfaces. Recovered as slightly sandy very gravelly cobble size fragments.				
				End of Trial Pit at 1.15 m				

### Remarks and Water Observations

- 1 Hardstanding reinforced concrete at surface broken out with an hydraulic breaker
- 2 Trial pit sides remained stable during excavation.
- 3 No groundwater encountered during excavation.
- 4 Excavation terminated on solid bedrock at 1.15m and backfilled

Fig. No.



# TRIAL PIT RECORD

TP No. **TP102**

Sheet 1 of 1

Site : Tower Works, Armley

Contract No: **C0313**

Client : Commercial Estates Group Ltd.

Dates:  
16/02/2005

Method : JCB 3CX with 0.60m wide toothed bucket and pecker.

Scale 1:25

## SAMPLE DETAILS

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>	Groundwater
D	0.15m - 0.25m		
D	0.47m - 0.57m		
B	0.57m - 0.70m		

## STRATA RECORD

MADE GROUND: Reinforced CONCRETE.

MADE GROUND: Firm brown slightly sandy slightly gravelly CLAY. Becoming very gravelly by 0.40m. Gravel is angular to subangular fine to coarse of mudstone.

0.15-0.25m: locally reworked with fragments of brick and topsoil noted.

Weak brown weathered SILTSTONE with extremely closely spaced subhorizontal bedding fractures. Recovered as slightly sandy gravel size fragments.

Moderately strong light brown fine to medium grained SANDSTONE with very closely spaced subhorizontal bedding fractures. Recovered as slightly sandy gravelly cobble size fragments.

End of Trial Pit at 0.70 m

Logged By: **MJC**

Depth (m)	pid (open)	Legend	Well
0.15			
0.47			
0.57			
0.70			

## Remarks and Water Observations

- 1 Hardstanding reinforced concrete at surface broken out with an hydraulic breaker
- 2 Trial pit sides remained stable during excavation.
- 3 No groundwater encountered during excavation
- 4 Excavation terminated on solid bedrock at 0.70m and backfilled.

Fig. No.



# TRIAL PIT RECORD

TP No. **TP103**  
Sheet 1 of 1  
Contract No: **C0313**

Site: **Tower Works, Armley**

Client: **Commercial Estates Group Ltd.**

Dates:  
**16/02/2005**

Method: **JCB 3CX with 0.60m wide toothed bucket and pecker**

Scale **1:25**

Logged By: **MJC**

## SAMPLE DETAILS

## STRATA RECORD

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>	Groundwater	Description	Depth (m)	PID (cm)	Legend	Well
D	0.20m - 0.35m			MADE GROUND: Reinforced CONCRETE.	0.15			
D	0.55m - 0.62m			MADE GROUND: Brown slightly sandy slightly gravelly COBBLES and BOULDERS (upto 0.20 x 0.30m x 0.50m in size). Gravel size fragments are angular to subangular fine to coarse of sandstone. Cobble and boulder size fragments are angular of sandstone and occasional brick. At 0.62m: solid concrete encountered in northern section of pit.	0.62			
B	0.62m - 0.70m			Moderately weak to moderately strong light brown fine grained SANDSTONE with very closely to closely spaced subhorizontal bedding fractures and closely to medium spaced subvertical discontinuities. Sand infill (1-3mm) noted along bedding surfaces. Recovered as slightly gravelly cobble and boulder size fragments (upto 0.50m across). End of Trial Pit at 0.95 m	0.95			

## Remarks and Water Observations

- 1 Hardstanding reinforced concrete at surface broken out with an hydraulic breaker
- 2 Trial pit sides unstable to 0.62m during excavation.
- 3 Second layer of concrete noted at 0.62m Pit extended to south to prove natural ground (bedrock)
- 4 No groundwater encountered during excavation.
- 5 Excavation terminated on solid bedrock at 0.95m and backfilled

Fig. No.



## TRIAL PIT RECORD

TP No. **TP104**

Sheet 1 of 1

Site : Tower Works, Armley

Contract No: **C0313**

Client : Commercial Estates Group Ltd.

Dates: 16/02/2005

Method : JCB 3CX with 0.80m wide toothed bucket and pecker.

Scale 1:25

Logged By: **MJC**

### SAMPLE DETAILS

### STRATA RECORD

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>	Groundwater	Description	Depth (m)	PID (mm)	Legend	Well
O	0.08m - 0.25m			MADE GROUND: TARMACADAM.	0.08			
O	0.25m - 0.40m			MADE GROUND: Brown clayey sandy GRAVEL. Gravel size fragments are angular to subrounded fine to coarse of sandstone and siltstone.	0.27			
O	0.50m - 0.70m			MADE GROUND: Dark brown sandy GRAVEL with much cobbles. Gravel size fragments are angular to subangular fine to coarse of brick, sandstone and concrete. Cobble size fragments are angular of brick.	0.47			
D	0.80m - 1.00m			Very weak light brown weathered MUDSTONE. Recovered as very clayey gravel size fragments.	1.05			
B	1.05m - 1.15m			0.75-1.05m: very weak to weak siltstone.  Moderately strong light brown fine to medium grained SANDSTONE with very closely spaced subhorizontal bedding fractures and closely to medium spaced subvertical discontinuities. Sand infill (1-4mm) noted along bedding surfaces. Recovered as slightly sandy gravelly cobbles with occasional boulder size fragments.  End of Trial Pit at 1.15 m	1.15			

### Remarks and Water Observations

1. Hardstanding tarmacadam at surface broken out with an hydraulic breaker
2. Trial pit sides remained stable during excavation.
3. No groundwater encountered during excavation.
4. Excavation terminated on solid bedrock at 1.15m and backfilled.

Fig. No.



# TRIAL PIT RECORD

TP No. **TP105**  
 Sheet 1 of 1  
 Contract No: **C0313**

Site : Tower Works, Armley

Client : Commercial Estates Group Ltd.

Dates:  
16/02/2005

Method : JCB 3CX with 0.60m wide toothed bucket and pecker.

Scale 1:25

Logged By: **MJC**

## SAMPLE DETAILS

Type	Depth From - To(m)	Vsne Results kN/m²
D	0.10m - 0.25m	
D	0.30m - 0.45m	
D	0.50m - 0.70m	
B	0.80m - 1.10m	

Groundwater

## STRATA RECORD

MADE GROUND: TARMACADAM.

MADE GROUND: Brown clayey sandy GRAVEL. Gravel size fragments are angular to subrounded fine to coarse of sandstone, siltstone and quartzite.

MADE GROUND: Dark brown sandy GRAVEL with much cobbles. Gravel size fragments are angular to subangular fine to coarse of brick, sandstone and concrete. Cobble size fragments are angular of brick.

At 0.40m: horizontally aligned metal sheet (5mm x 0.60m x 1.50m) noted.

Stiff becoming very stiff light brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to medium of mudstone.

Locally moderately weak to moderately strong light brown fine grained SANDSTONE with extremely to very closely spaced subhorizontal bedding fractures and closely to medium spaced subvertical discontinuities. Sand and sandy clay infill (1-8mm) noted along bedding surfaces.

End of Trial Pit at 1.15m

Depth (m)	PID (mm)	Legend	Well
0.08			
0.27			
0.50			
0.85			
1.15			

## Remarks and Water Observations

- 1 Hardstanding tarmacadam at surface broken out with an hydraulic breaker
- 2 Trial pit sides remained stable during excavation.
- 3 No groundwater encountered during excavation
- 4 Excavation terminated on solid bedrock at 1.15m and backfilled.

Fig. No.



## TRIAL PIT RECORD

TP No. **TP106**

Sheet 1 of 1

Site : Tower Works, Armley

Contract No: **C0313**

Client : Commercial Estates Group Ltd.

Dates:  
16/02/2005

Method : JCB 3CX with 0.60m wide toothed bucket and pecker

Scale 1:25

Logged By: **MJC**

### SAMPLE DETAILS

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>
D	0.07m - 0.25m	
D	0.25m - 0.35m	
D	0.50m - 0.70m	
B	1.00m - 1.30m	

Groundwater

### STRATA RECORD

Description	Depth (m)	PIP 100mm	Legend	Well
MADE GROUND: TARMACADAM.	0.07			
MADE GROUND: Dark brown and brown silty slightly sandy GRAVEL. Gravel is angular to subrounded fine to coarse of sandstone.	0.27			
Dark brown silty slightly sandy GRAVEL. Gravel is angular to subrounded fine to coarse of sandstone.	0.47			
Brown slightly clayey sandy to very sandy GRAVEL and COBBLES with occasional gravel to cobble size lenses / pockets of soft slightly sandy clay. Gravel is angular to subangular fine to coarse of sandstone. Cobbles are angular to subangular of sandstone.	0.92			
Moderately weak to moderately strong light grey heavily stained light brown fine grained SANDSTONE with extremely to very closely spaced subhorizontal bedding fractures and closely to medium spaced subvertical discontinuities. Sand and clayey sand infill (1-15mm) noted along bedding surfaces. Recovered as sandy gravelly cobble size fragments.	1.50			
End of Trial Pit at 1.50 m				

### Remarks and Water Observations

- 1 Hardstanding tarmacadam at surface broken out with an hydraulic breaker
- 2 Trial pit sides remained stable during excavation
- 3 No groundwater encountered during excavation.
- 4 Excavation terminated on solid bedrock at 1.50m and backfilled

Fig. No.



## TRIAL PIT RECORD

Site : Tower Works, Armley

Client : Commercial Estates Group Ltd.

Method : JCB 3CX with 0.60m wide toothed bucket and pecker.

TP No. **TP107**

Sheet 1 of 1

Contract No: **C0313**

Dates:  
16/02/2005

Scale **1:25**

Logged By: **MJC**

### SAMPLE DETAILS

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>
D	0.09m - 0.20m	
D	0.20m - 0.30m	
D	0.40m - 0.60m	
B	0.60m - 1.00m	

Groundwater

### STRATA RECORD

Description	Depth (m)	PID (mm)	Legend	Well
MADE GROUND: TARMACADAM.	0.09			
MADE GROUND: Dark brown slightly sandy GRAVEL. Gravel size fragments are angular to subangular fine to coarse of ash, clinker and occasionally sandstone.	0.20			
Dark brown clayey very sandy GRAVEL. Gravel is angular to subrounded fine to coarse of sandstone.	0.35			
Light brown clayey sandy GRAVEL with much cobbles. Gravel is angular to subangular fine to coarse of sandstone. Cobbles are angular to subangular of sandstone.	0.75			
Moderately weak to locally moderately strong light grey stained light brown fine grained SANDSTONE with extremely to very closely spaced subhorizontal bedding fractures and very closely to closely spaced subvertical discontinuities. Firm brown clay and sand infill (1-15mm) noted along bedding surfaces. Generally recovered as slightly clayey sandy gravelly cobble size fragments.	1.10			
Weak brown mottled orange brown sandy SILTSTONE with poorly defined extremely closely spaced subhorizontal bedding fractures. Recovered as angular to subangular tabular gravel size fragments.	1.65			
Very weak and locally weak brown occasionally mottled light grey SILTSTONE. Tending to mudstone in places. Recovered as silty slightly sandy gravel size fragments.	2.10			
Very weak to weak brown MUDSTONE with extremely closely spaced subhorizontal bedding fractures. Recovered as slightly clayey slightly sandy angular gravel size fragments.	3.00			
End of Trial Pit at 3.00 m				

### Remarks and Water Observations

1. Hardstanding tarmacadam at surface broken out with an hydraulic breaker
2. Trial pit sides remained stable during excavation.
3. No groundwater encountered during excavation
4. Excavation terminated at 3.00m and backfilled

Fig. No.





## TRIAL PIT RECORD

TP No. **TP108**

Sheet 1 of 1

Site : Tower Works, Armley

Contract No: **C0313**

Client : Commercial Estates Group Ltd.

Dates:  
16/02/2005

Method : JCB 3CX with 0.60m wide toothed bucket and pecker

Scale 1:25

Logged By: **MJC**

### SAMPLE DETAILS

Type	Depth		Vane Results kN/m <sup>2</sup>
	From	To(m)	
D	0.10m	0.27m	
B	0.40m	0.70m	

Groundwater

### STRATA RECORD

Description		Depth (m)	PID (mm)	Legend	Well
MADE GROUND: TARMACADAM		0.10			
MADE GROUND: Dark grey brown sandy GRAVEL. Gravel size fragments are angular to subangular fine to coarse of ash and clinker.		0.27			
Weak to moderately weak light brown fine grained SANDSTONE with extremely to very closely spaced subhorizontal bedding fractures and very closely to medium spaced subvertical discontinuities. Sand and fine gravel infill (1-10mm) noted along subhorizontal bedding surfaces.		0.70			
End of Trial Pit at 0.70 m					

### Remarks and Water Observations

1. Handsanding tarmacadam at surface broken out with an hydraulic breaker
2. Trial pit sides remained stable during excavation
3. No groundwater encountered during excavation
4. Excavation terminated on solid bedrock at 0.70m and backfilled

Fig. No.

# WINDOW SAMPLING RECORD

BH No. **WS1**  
Sheet 1 of 1

Site: Tower Works, Armley

Contract No: C0313

Client: **Commercial Estates Group Ltd.**

Dates:  
10/06/2004

**Method:** Hand held window sampler and breaker

Scale 1:25

## SAMPLE DETAILS

## STRATA RECORD

Orion SIRIUS (LS)

Logged By: JWB

Depth (m)	Level (m AOD)	Legend	Well
--------------	------------------	--------	------

0 10  
0 15

Level  
(mADD)

Legend

Weil

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>
------	-----------------------	--------------------------------------

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0	0.20m	
1	0.40m	

[illegible]

1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 26

J	0.90m
---	-------

**MADE GROUND: Concrete.**

Moderately strong very thinly bedded light greyish brown clayey fine to medium grained SANDSTONE. (Recovered as gravel sized fragments.)

Weak thinly laminated light greyish brown MUDSTONE  
(Recovered as sand and gravel sized fragments.)  
---at 0.40m PID reading = 0.4ppm.

---at 0.90m PID reading = 0.0ppm.

End of Window Sample at 1.00 m

100

## Remarks and Water Observations

- 1 No groundwater strikes encountered.  
2 Window sample hole terminated on impenetrable rock

GL (mAOD)

**Easting:**

**Nothing:**

Fig. No.

WS1



# WINDOW SAMPLING RECORD

BH No. **WS2**

Sheet 1 of 1

Site: Tower Works, Armley

Contract No: **C0313**

Client: Commercial Estates Group Ltd.

Dates:  
10/06/2004

Method: Hand held window sampler and breaker.

Scale **1:25**

## SAMPLE DETAILS

## STRATA RECORD

Driller: SIRIUS (LS)

Logged By: JWB

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>	Description	Depth (m)	Level (mAOD)	Legend	Well
D J	0.20m		MADE GROUND: Concrete.	0.10			
D J	0.40m		MADE GROUND: Light orangish brown clayey sandy angular to subangular fine to coarse GRAVEL of sandstone. ---at 0.20m PID reading = 0.0ppm.	0.30			
			Moderately strong very thinly bedded light greyish brown fine to medium grained SANDSTONE. (Recovered as gravel sized fragments.) ---at 0.40m PID reading = 0.0ppm.	0.50			
			End of Window Sample at 0.50 m				

## Remarks and Water Observations

- 1 No groundwater strikes encountered.
- 2 Window sample hole terminated on impenetrable rock

GL (mAOD)

Easting:

Northing:

Fig. No.

**WS2**



# WINDOW SAMPLING RECORD

BH No. **WS3**  
Sheet 1 of 1

Site: Tower Works, Armley

Contract No: **C0313**

Client: Commercial Estates Group Ltd.

Dates:  
10/06/2004

Method: Hand held window sampler and breaker.

Scale 1:25

Driller: SIRIUS (LS)

Logged By: JWB

Depth (m) Level (mAOD) Legend Well

## SAMPLE DETAILS

## STRATA RECORD

Type Depth From - To(m) Vane Results kN/m<sup>2</sup>

Description

D 0.20m

J 0.40m

D 1.20m

J 1.40m

D 1.80m

J 1.90m

MADE GROUND: Reinforced concrete.

MADE GROUND: Dark brown clayey gravelly fine to coarse SAND with cobbles of angular to subangular sandstone. Gravel is angular to subangular of sandstone, brick, mudstone and slate.  
---at 0.40m PID reading = 0.0ppm.

---at 1.40m PID reading = 0.0ppm.

Moderately strong very thinly bedded light greyish brown fine to medium grained SANDSTONE. (Recovered as gravel sized fragments.)  
---at 1.90m PID reading = 0.0ppm.

End of Window Sample at 2.00 m

## Remarks and Water Observations

1. No groundwater strikes encountered
2. Window sample hole terminated on impenetrable rock.

GL (mAOD)

Eastings:

Northings:

Fig. No.

WS3



# WINDOW SAMPLING RECORD

BH No. **WS4**

Sheet 1 of 1

Site: **Tower Works, Armley**

Contract No: **C0313**

Client: **Commercial Estates Group Ltd.**

Dates:  
10/06/2004

Method: **Hand held window sampler and breaker.**

Scale **1:25**

## SAMPLE DETAILS

## STRATA RECORD

Driller: **SIRIUS (LS)**

Logged By: **JWB**

Type: **D**  
Depth: **0.20m**  
From - To(m): **0.30m**

Description

Depth (m)

Level (mAOD)

Legend

Well

**MADE GROUND: Concrete.**

**MADE GROUND: Firm brown sandy gravelly CLAY.** Gravel is angular to subangular fine to coarse of sandstone, brick, concrete and slate.  
---at 0.30m PID reading = 5.0ppm.

0.15

**Stiff light greyish brown slightly sandy gravelly CLAY.** Gravel is angular to subangular fine to coarse of mudstone.  
---at 1.30m PID reading = 2.8ppm.  
---at 1.40m PID reading = 0.0ppm.

1.25

**Moderately strong very thinly bedded light greyish brown fine to medium grained SANDSTONE.** (Recovered as gravel sized fragments.)  
---at 1.75m PID reading = 0.6ppm.

1.70

1.80

**End of Window Sample at 1.80 m**

## Remarks and Water Observations

- 1 No groundwater strikes encountered.
- 2 Window sample hole terminated on impenetrable rock

GL (mAOD)

Easting:

Northing:

Fig. No.

**WS4**



## WINDOW SAMPLING RECORD

BH No. **WS5**  
Sheet 1 of 1

Site: Tower Works, Armley

Contract No: **C0313**

Client: Commercial Estates Group Ltd.

Dates:  
10/06/2004

Method: Hand held window sampler and breaker

Scale 1:25

### SAMPLE DETAILS

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>
D	0.30m	
J	0.40m	
D	0.60m	
J	0.70m	

Groundwater

### STRATA RECORD

MADE GROUND: Reinforced concrete.

MADE GROUND: Grey and black gravelly fine to coarse SAND.  
Gravel is angular to subangular fine to coarse of sandstone, concrete, brick and slag.  
---at 0.40m PID reading = 0.7ppm.

Firm light greyish brown slightly sandy gravelly CLAY.  
Gravel is angular to subangular fine to coarse of mudstone.  
---at 0.70m PID reading = 0.0ppm.

End of Window Sample at 1.50 m

Driller: SIRIUS (LS)

Logged By: JWB

Depth (m)	Level (mAOD)	Legend	Well
0.25			
0.55			
1.50			

### Remarks and Water Observations

- 1 No groundwater strikes encountered
- 2 Window sample hole terminated on sandstone obstruction, possible sandstone bedrock

GL (mAOD)

Easting:

Northing:

Fig. No.

WS5



# WINDOW SAMPLING RECORD

BH No. **WS6**  
Sheet 1 of 1

Site: **Tower Works, Armley**

Contract No: **C0313**

Client: **Commercial Estates Group Ltd.**

Dates: **10/06/2004**

Method: **Hand held window sampler and breaker.**

Scale **1:25**

## SAMPLE DETAILS

## STRATA RECORD

Driller: **SIRIUS (LS)**

Logged By: **JWB**

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>	Groundwater	Description	Depth (m)	Level (mAOD)	Legend	Well
D	0.10m			MADE GROUND: Tarmac hardstanding.	0.07			
				MADE GROUND: Brownish black clayey gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of brick, sandstone, concrete and glass.				
D	0.60m			Stiff orange and light grey mottled slightly sandy gravelly CLAY. Gravel is angular fine to coarse of sandstone and mudstone.	0.50			
				End of Window Sample at 1.20 m	1.20			

## Remarks and Water Observations

- 1 No groundwater strikes encountered
- 2 Window sample hole terminated on sandstone obstruction, possible sandstone bedrock

GL (mAOD)

Easting:

Northing:

Fig. No.

**WS6**



# WINDOW SAMPLING RECORD

BH No. **WS101**

Sheet 1 of 1

Site: Tower Works, Armley

Contract No: **C0313**

Client: Commercial Estates Group Ltd.

Dates:  
14/02/2005

Method: Hand held window sampler and breaker.

Scale 1:25

## SAMPLE DETAILS

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>
D	0.15m - 0.30	
D	0.30m - 0.55	
D	0.55m - 0.85	
D	1.10m - 1.30	
D	1.35m - 1.40	

Groundwater

## STRATA RECORD

MADE GROUND: TARMACADAM.

MADE GROUND: Grey sandy GRAVEL. Gravel size fragments are angular to subangular fine to coarse of limestone.

MADE GROUND: Dark brown sandy GRAVEL. Gravel size fragments are angular to subangular fine and medium of ash and clinker.

MADE GROUND: Firm locally stiff dark brown and brown slightly sandy slightly gravelly CLAY. Gravel size fragments are angular fine of ash, burnt mudstone / brick and coal.

Stiff brown slightly sandy slightly gravelly CLAY. Gravel size fragments are angular to subangular fine and medium of sandstone.

Moderately weak light brown and light grey fine grained SANDSTONE. Recovered as angular gravel sized fragments. Bedding subhorizontal.

End of Window Sample at 1.40 m

Driller VL & DB

Logged By MJC

Depth (m)	Level (mAOD)	Legend	Well
0.05			
0.15			
0.55			
1.35			
1.40			

## Remarks and Water Observations

- 1 Handstanding tarmacadam at surface broken out using a hand held breaker
- 2 No groundwater sinkhole encountered during drilling
- 3 PID gas reading of 0ppm taken at end of drilling

GL (mAOD)

- Easting:

- Northing:

Fig. No.

WS101





## WINDOW SAMPLING RECORD

BH No. **WS102**

Sheet 1 of 1

Site: **Tower Works, Armley**Contract No: **C0313**Client: **Commercial Estates Group Ltd.**Dates:  
14/02/2005Method: **Hand held window sampler and breaker.**Scale **1:25**

### SAMPLE DETAILS

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>
D	0.10m - 0.40	
D	0.42m - 0.56	
D	0.56m - 0.70	
D	0.70m - 0.85	
D	1.25m - 1.45	
D	1.65m - 1.72	

Groundwater

### STRATA RECORD

Description

**MADE GROUND: CONCRETE.****MADE GROUND:** Dark grey and locally brown sandy GRAVEL with occasional cobbles. Gravel size fragments are angular to subangular fine and medium of ash and clinker. Cobbles are angular to subangular of clinker and occasional slag.**MADE GROUND:** Soft and firm dark brown slightly sandy slightly gravelly CLAY. Gravel size fragments are angular fine and medium of sandstone, ash and coal.**POSSIBLE MADE GROUND:** Soft friable brown slightly sandy CLAY.

Stiff friable brown occasionally mottled orange brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine and medium mudstone and siltstone.

Weak brown sandy SILTSTONE with extremely closely spaced subhorizontal bedding fractures. Recovered as angular tabular gravel size fragments.

End of Window Sample at 1.72 m

Entered VL/DB

Logged By MJC

Depth (m)	Level (mAOD)	Legend	Well
0.09			
0.42			
0.56			
0.70			
1.65			
1.72			

### Remarks and Water Observations

1. Hardstanding concrete at surface broken out using a hand held breaker
2. Inspection pit hand excavated to 0.42m
3. No groundwater strike encountered during drilling
4. PID gas reading of 0ppm taken at end of drilling.

GL (mAOD)

Easting:

Northing:

Fig. No.

WS102



## WINDOW SAMPLING RECORD

BH No. **WS103**

Sheet 1 of 1

Site: Tower Works, Armley

Contract No: **C0313**

Client: Commercial Estates Group Ltd.

Dates:  
14/02/2005

Method: Hand held window sampler and breaker.

Scale 1:25

### SAMPLE DETAILS

### STRATA RECORD

Driller: VU/DB

Logged By: MJC

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>	Groundwater	Description	Depth (m)	Level (mAOD)	Legend	Well
D	0.12m - 0.35			MADE GROUND: CONCRETE.	0.12			
D	0.35m - 0.45			MADE GROUND: Brown sandy GRAVEL. Gravel size fragments are angular fine to coarse of sandstone, brick and occasional ash and clinker.	0.35			
D	0.50m - 0.80			MADE GROUND: Brown and dark grey very clayey sandy GRAVEL. Gravel size fragments are angular fine to coarse of sandstone, brick and occasional ash.	0.45			
				Moderately weak brown sandy SILTSTONE. Recovered as silty sandy angular to subangular fine to coarse gravel size fragments. Bedding subhorizontal.	1.00			
D	1.00m - 1.10			Moderately weak light brown fine grained SANDSTONE. Recovered as angular gravel and cobble size fragments. Bedding subhorizontal.	1.10			
				End of Window Sample at 1.10 m				

### Remarks and Water Observations

- 1 Hardstanding concrete at surface broken out using a hand held breaker
- 2 No groundwater strike encountered during drilling.
- 3 PID gas reading of 0ppm taken at end of drilling.
- 4 On completion a 19mm nominal diameter standpipe was installed to 1.10m (storted response zone from 0.50m to 1.10m with associated pea gravel filter).

GL (mAOD)

Easting:

Northing:

Fig. No.

WS103



# WINDOW SAMPLING RECORD

BH No. **WS104**

Sheet 1 of 1

Site: **Tower Works, Armley**

Contract No: **C0313**

Client: **Commercial Estates Group Ltd.**

Dates:  
**15/02/2005**

Method: **Hand held window sampler and breaker.**

Scale **1:25**

## SAMPLE DETAILS

## STRATA RECORD

Driller: **VL/DB**  
Logged By: **MJC**

Type	Depth From - To(m)	Vane Results kN/m²	Groundwater	Description	Depth (m)	Level (mAOD)	Legend	Well
				<b>MADE GROUND: CONCRETE.</b>				
D	0.20m - 0.30				0.15			
D	0.30m - 0.50			<b>MADE GROUND: Red brown sandy GRAVEL with occasional gravel to cobble size pockets of soft brown slightly sandy clay. Gravel size fragments are angular fine to coarse of burnt mudstone / brick.</b>	0.30			
D	0.50m - 0.60				0.50			
D	0.70m - 1.00			<b>MADE GROUND: Dark brown sandy GRAVEL with occasional gravel to cobble size pockets of slightly sandy clay. Gravel size fragments are angular fine to coarse of concrete and sandstone.</b>				
D	1.05m - 1.35			<b>MADE GROUND: Soft dark brown and dark grey slightly sandy slightly gravelly CLAY. Gravel size fragments are angular fine to coarse of sandstone and locally brick.</b>	1.00			
				<b>Moderately weak light brown fine grained SANDSTONE with poorly defined extremely to very closely spaced subhorizontal bedding fractures. Recovered as slightly silty sandy angular gravel size fragments. Locally weathered to silty sand (upto 9mm) along bedding surfaces.</b>	1.35			
				<b>End of Window Sample at 1.35 m</b>				

## Remarks and Water Observations

- 1 Hardstanding concrete at surface broken out using a hand held breaker
- 2 No groundwater strike encountered during drilling.
- 3 PID gas reading of 0ppm taken at end of drilling

GL (mAOD)

Easting:

Northing:

Fig. No.

**WS104**



# WINDOW SAMPLING RECORD

BH No. **WS105**  
Sheet 1 of 1

Site: **Tower Works, Armley**

Contract No: **C0313**

Client: **Commercial Estates Group Ltd.**

Dates:  
**14/02/2005**

Method: **Hand held window sampler and breaker.**

Scale **1:25**

## SAMPLE DETAILS

## STRATA RECORD

Driller: **VJDB**

Logged By: **MJC**

Type Depth  
From - To (m)

Groundwater

Description

Depth  
(m)

Level  
(mAOD)

Legend

Well

**MADE GROUND: Reinforced CONCRETE.**

D 0.40m - 0.67

Weak and locally moderately weak brown fine grained SANDSTONE with extremely to very closely spaced subhorizontal bedding fractures. Recovered as angular gravel and occasional cobble size fragments. Silt and occasional clay infill (1-8mm) noted along bedding surfaces.

0.33

D 0.67m - 1.00

Moderately weak and locally moderately strong light brown fine grained SANDSTONE with extremely to very closely spaced subhorizontal bedding fractures. Recovered as angular gravel and occasional cobble size fragments. Silt and occasional clay infill (1-3mm) noted along bedding surfaces.

0.67

1.00

End of Window Sample at 1.00 m

## Remarks and Water Observations

1. Hardstanding concrete at surface broken out using a hand held breaker
2. No groundwater strike encountered during drilling.
3. PID gas reading of 0ppm taken at end of drilling.

GL (mAOD)

Easting:

Northing:

Fig. No.

**WS105**



# WINDOW SAMPLING RECORD

BH No. **WS106**

Sheet 1 of 1

Site: **Tower Works, Armley**

Contract No: **C0313**

Client: **Commercial Estates Group Ltd.**

Dates: **14/02/2005**

Method: **Hand held window sampler and breaker.**

Scale **1:25**

## SAMPLE DETAILS

Type	Depth From - To(m)	Vane Results KN/m <sup>2</sup>
D	0.08m - 0.40	
D	0.40m - 0.60	
D	0.70m - 0.90	
D	1.10m - 1.30	
D	1.50m - 1.75	
D	1.75m - 1.90	

Groundwater

## STRATA RECORD

MADE GROUND: TARMACADAM.

MADE GROUND: Dark grey brown sandy GRAVEL. Gravel size fragments are angular to subangular fine to coarse of ash, clinker and occasional sandstone.

MADE GROUND: Brown occasionally mottled orange brown slightly sandy clayey GRAVEL. Gravel size fragments are angular fine to coarse of sandstone.

MADE GROUND: Soft dark brown slightly sandy slightly gravelly CLAY with occasional gravel to cobble size pockets of slightly sandy silt. Gravel size fragments are angular fine to coarse of sandstone and brick.

Weak to moderately weak light brown fine grained SANDSTONE. Locally weathered to silt (upto 5mm thick). Recovered as slightly silty sandy angular gravel size fragments.

Moderately weak to moderately strong brown fine grained SANDSTONE with extremely to very closely spaced subhorizontal bedding fractures. Recovered as slightly sandy angular gravel size fragments. Sand infill (1-5mm) noted along bedding surfaces.  
1.75-1.90m: very weak siltstone, locally weathered to silt.

End of Window Sample at 2.00 m

Driller: **VLDB**

Logged By: **MJC**

Depth (m)	Level (mAOD)	Legend	Well
0.08			
0.40			
0.60			
1.10			
1.30			
2.00			

## Remarks and Water Observations

- 1 Hardstanding tarmacadam at surface broken out using a hand held breaker
- 2 No groundwater sink encountered during drilling.
- 3 PID gas reading of 0ppm taken at end of drilling.
- 4 On completion a 19mm nominal diameter standpipe was installed to 1.10m (slotted response zone from 0.20m to 1.10m with associated pea gravel filter)

GL (mAOD)

Easting:

Northing:

Fig. No.

**WS106**



# WINDOW SAMPLING RECORD

BH No. **WS107**

Sheet 1 of 1

Site: **Tower Works, Armley**

Contract No: **C0313**

Client: **Commercial Estates Group Ltd.**

Dates:  
15/02/2005

Method: Hand held window sampler and breaker.

Scale **1:25**

## SAMPLE DETAILS

## STRATA RECORD

Driller: **VUDB**

Logged By: **MJC**

Depth (m) Level (mAOD) Legend Well

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>	Groundwater	Description	Depth (m)	Level (mAOD)	Legend	Well
D	0.20m - 0.30			MADE GROUND: CONCRETE.	0.20			
D	0.50m - 1.00			MADE GROUND: Grey brown sandy GRAVEL. Gravel size fragments are angular and subrounded fine to coarse of concrete.	0.30			
				MADE GROUND: Red brown brick setts.	0.45			
D	1.00m - 2.00			MADE GROUND: Brown slightly clayey sandy GRAVEL. Gravel size fragments are angular fine to coarse of sandstone, siltstone, and occasional brick and clinker.	1.00			
				MADE GROUND: Brown slightly clayey sandy GRAVEL. Gravel size fragments are angular fine to coarse of sandstone and siltstone. Poor recovery. Damp.				
				At 1.50m: possible foundation noted.				
D	2.00m - 2.20			MADE GROUND: Very soft and locally soft brown slightly sandy slightly gravelly CLAY. Gravel size fragments are angular to subangular fine to coarse of sandstone and siltstone.	2.00			
				End of Window Sample at 2.20 m	2.20			

## Remarks and Water Observations

1. Hardstanding concrete at surface broken out using a hand held breaker
2. Inspection pit hand excavated to 1.20m
3. No groundwater strike encountered during drilling
4. PID gas reading of 0ppm taken at end of drilling.

GL (mAOD)

Eastings:

Northings:

Fig. No.

**WS107**



# WINDOW SAMPLING RECORD

BH No. **WS108**

Sheet 1 of 1

Site: **Tower Works, Armley**

Contract No: **C0313**

Client: **Commercial Estates Group Ltd.**

Dates:  
15/02/2005

Method: **Hand held window sampler and breaker.**

Scale **1:25**

## SAMPLE DETAILS

## STRATA RECORD

Driller: **VL/DB**

Logged By: **MJC**

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>	Groundwater	Description	Depth (m)	Level (mAOD)	Legend	Well
D	0.15m - 0.20			MADE GROUND: CONCRETE.	0.15			
D	0.50m - 0.60			MADE GROUND: Brown sandy GRAVEL. Gravel size fragments are angular fine to coarse of sandstone, brick, clinker and rare quartz.	0.42			
D	0.75m - 1.00			MADE GROUND: Dark brown slightly clayey sandy GRAVEL with occasional gravel size pockets of soft slightly sandy clay. Gravel size fragments are angular to subangular fine to coarse of sandstone, brick and clinker.	0.75			
D	1.00m - 1.30			MADE GROUND: Firm locally soft friable dark brown and brown slightly sandy slightly gravelly CLAY. Gravel size fragments are angular to subangular fine to coarse of sandstone, and occasionally ash and coal.	1.00			
D	1.40m - 1.80			MADE GROUND: Dark brown and brown slightly sandy slightly gravelly SILT with occasional coarse gravel size pockets of soft slightly sandy slightly gravelly clay. Gravel size fragments are angular to subangular fine of brick, ash and sandstone.	1.39			
				Brown slightly sandy GRAVEL and with extremely to very closely spaced bands (upto 20mm) of soft friable slightly sandy clay. Gravel is angular to subangular fine to coarse of sandstone. (Weathered Sandstone)	1.64			
				Moderately weak to moderately strong light grey stained light brown fine grained SANDSTONE with extremely to very closely spaced subhorizontal bedding fractures. Recovered as slightly sandy angular gravel size fragments. Localised sand infill (1-6mm) noted along bedding surfaces.	1.79			
				End of Window Sample at 1.79 m				

## Remarks and Water Observations

1. Hardstanding concrete at surface broken out using a hand held breaker
2. No groundwater strike encountered during drilling.
3. PID gas reading of 0ppm taken at end of drilling.
4. On completion a 19mm nominal diameter standpipe was installed to 1.39m (slotted response zone from 0.50m to 1.39m with associated pea gravel filter)

GL (mAOD)

- Easting:

- Northing:

Fig. No.

**WS108**



# WINDOW SAMPLING RECORD

BH No. **WS109**

Sheet 1 of 1

Site: Tower Works, Armley

Contract No: **C0313**

Client: Commercial Estates Group Ltd.

Dates:  
15/02/2005

Method: Hand held window sampler and breaker.

Scale 1:25

## SAMPLE DETAILS

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>
D	0.15m - 0.25	
D	0.35m - 0.65	
D	0.70m - 0.90	
D	1.20m - 1.60	
D	2.10m - 2.50	

Groundwater

## STRATA RECORD

MADE GROUND: CONCRETE.

MADE GROUND: Grey brown sandy GRAVEL with occasional cobbles. Gravel size fragments are angular fine to coarse of brick and concrete. Cobble size fragments are angular of brick and concrete.

MADE GROUND: Dark brown becoming dark grey sandy GRAVEL. Gravel size fragments are angular fine to coarse of ash and clinker.

MADE GROUND: Soft friable dark brown and dark grey brown slightly sandy CLAY.

Firm friable brown slightly sandy CLAY.

Below 1.75m: becoming stiff and light brown.

Moderately weak to moderately strong light brown fine grained SANDSTONE with poorly defined extremely to very closely spaced subhorizontal bedding fractures. Recovered as sandy angular gravel size fragments. Localised sand infill (1-8mm) noted along bedding surfaces.

End of Window Sample at 2.60 m

Driller: VL/DB

Logged By: MJC

Depth (m)	Level (mAOD)	Legend	Well
0.12			
0.27			
0.70			
0.95			
2.00			
2.60			

## Remarks and Water Observations

1. Handstanding concrete broken out using a hand held breaker
2. No groundwater strike encountered during drilling.
3. Initial PID gas reading at surface of 0ppm during drilling. Second reading of 8.3ppm at end of drilling.
4. On completion a 19mm nominal diameter standpipe was installed to 2.60m (slotted response zone from 0.50m to 2.60m with associated pea gravel filter)

GL (mAOD)

Easting:

Northing:

Fig. No.

WS109





## WINDOW SAMPLING RECORD

BH No. **WS110**

Sheet 1 of 1

Site: Tower Works, Armley

Contract No: C0313

Client: Commercial Estates Group Ltd.

Dates:  
15/02/2005

Method: Hand held window sampler and breaker.

Scale 1:25

Driller: VJ/DB

Logged By: MJC

### SAMPLE DETAILS

### STRATA RECORD

Type	Depth From - To(m)	Vane Results kN/m <sup>2</sup>	Description	Depth (m)	Level (mAOD)	Legend	Well
			MADE GROUND: CONCRETE.	0.15			
D	0.20m - 0.35		MADE GROUND: Brown sandy GRAVEL with some cobbles. Gravel size fragments are angular fine to coarse of sandstone, brick and concrete. Cobble size fragments are angular of sandstone and brick.	0.35			
D	0.40m - 0.70		Light brown becoming brown slightly sandy slightly gravelly SILT. Gravel is angular to subangular fine to coarse of sandstone.	0.80			
D	0.80m - 1.00		Moderately weak to moderately strong thickly laminated to very thinly bedded brown fine grained SANDSTONE. Recovered as angular gravel size fragments. Clay infill (upto 8mm) noted in places along subhorizontal bedding surfaces.	1.10			
D	1.20m - 1.50		Soft friable brown and dark brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine of sandstone and siltstone. Tending to silt in places.	1.60			
D	1.60m - 1.80		Stiff brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine and medium of sandstone.	1.80			
			Moderately weak light brown fine grained SANDSTONE. Recovered as angular gravel size fragments. Bedding subhorizontal.	1.85			
			End of Window Sample at 1.85 m				

### Remarks and Water Observations

1. Hardstanding concrete at surface broken out using a hand held breaker
2. No groundwater strike encountered during drilling
3. PID gas reading of 8 ppm taken at end of drilling

GL (mAOD)

Easting:

Northing:

Fig. No.

WS110



# WINDOW SAMPLING RECORD

BH No. **WS111**  
Sheet 1 of 1

Site: **Tower Works, Armley**

Contract No: **C0313**

Client: **Commercial Estates Group Ltd.**

Dates:  
**15/02/2005**

Method: **Hand held window sampler and breaker.**

Scale **1:25**

## SAMPLE DETAILS

## STRATA RECORD

Driller: **VUDB**

Logged By: **MJC**

Depth (m) Level (mAOD) Legend Well

Type Depth From To (m) Vane Results kN/m<sup>2</sup>

D 0.15m - 0.30

D 0.30m - 0.60

D 0.60m - 1.00

D 1.00m - 1.15

D 1.30m - 1.90

D 2.10m - 2.38

MADE GROUND: CONCRETE.

MADE GROUND: Brown very sandy GRAVEL. Gravel size fragments are angular to subrounded fine to coarse of sandstone.

MADE GROUND: Soft and firm friable dark brown and brown slightly sandy to sandy slightly gravelly CLAY. Gravel size fragments are angular to subangular fine to coarse of sandstone and occasional brick.

MADE GROUND: Dark brown and brown slightly clayey sandy GRAVEL with some gravel to cobble size pockets of soft brown slightly sandy slightly gravelly clay. Gravel size fragments are angular to subangular fine to coarse of sandstone, and occasional brick and ash.

MADE GROUND: Brown sandy GRAVEL. Gravel size fragments are angular to subangular fine to coarse of sandstone and brick.

MADE GROUND: Dark brown slightly sandy slightly gravelly SILT with occasional gravel to cobble size pockets of soft brown slightly sandy clay. Gravel size fragments are angular fine of sandstone and brick.

Light brown fine grained SANDSTONE. Recovered as angular to subangular gravel size fragments. With poorly defined extremely to very closely spaced subhorizontal bedding fractures with sand infill (upto 8mm) in places.

End of Window Sample at 2.38 m

## Remarks and Water Observations

- 1 Hardstanding concrete at surface broken out using a hand held breaker
- 2 No groundwater sink encountered during drilling.
- 3 PID gas reading of 9.9ppm taken at end of drilling

GL (mAOD)

Easting:

Northing:

Fig. No.

WS111





# BOREHOLE RECORD

BH No. **RH1**  
Sheet 2 of 2

Site: Tower Works, Armley

Contract No:  
**C0313**

Client: Commercial Estates Group Ltd.

Dates:  
10/02/2005

Method: Beretta rotary open hole drilling, using air flush.

Scale **1:100**

## SAMPLE DETAILS

## STRATA RECORD

Driller Cape Site Serv

Logged By W C

Type	Depth From - To (m)	TCR (%)	SCR (%)	RQD (%)	N (Fl)	Groundwater (Casing)	Description	Depth (m)	Level (mAOD)	Legend	Well
							Silly MUDSTONE.	21			
								22			
								23			
								24			
								25			
								26			
								27			
							End of Borehole at 27.50 m	27.50			
								28			
								29			
								30			
								31			
								32			
								33			
								34			
								35			
								36			
								37			
								38			
								39			
								40			

### Remarks and Water Observations

- Groundwater strike encountered at 17.50m
- Drilling rate constant throughout borehole
- Borehole terminated at 27.50m
- 50mm diameter standpipe with gas tap installed to 20.00m

GL (m AOD)

Easting:

Northing:

Fig. No.

**RH1**



# BOREHOLE RECORD

BH No. **RH2**  
Sheet 1 of 2

Site: Tower Works, Armley

Contract No:  
**C0313**

Client: Commercial Estates Group Ltd.

Dates:  
10/02/2005

Method: Beretta rotary open hole drilling, using air flush.

Scale **1:100**

## SAMPLE DETAILS

## STRATA RECORD

Driller Cape Site Serv

Logged By WC

Depth (m) Level (mAOD) Legend Well

0 15

1

2

3

4

5

6

7

8

9

10

11

11 50

12

13

14

15

16

17

18

19

20

MADE GROUND: Concrete

Yellow fine grained SANDSTONE.

---below 2.50m becomes grey/yellow.

---Partial loss of returns between 9.60m and 11.20m.

Silty MUDSTONE.

Continued next sheet

## Remarks and Water Observations

- 1 Groundwater seepage encountered at 19.50m
- 2 Borehole terminated at 28.00m
- 3 50mm diameter standpipe with gas tap installed to 20.00m

GL (m AOD)

Eastings:

Northings:

Fig. No.

**RH2**



# BOREHOLE RECORD

BH No. **RH2**  
Sheet 2 of 2

Site: Tower Works, Armley

Contract No:  
**C0313**

Client: Commercial Estates Group Ltd.

Dates:  
10/02/2005

Method: Beretta rotary open hole drilling, using air flush.

Scale **1:100**

## SAMPLE DETAILS

## STRATA RECORD

Driller: Cape Site Serv  
Logged By: W C

Type	Depth From - To (m)	TCR (%)	SCR (%)	RCD (%)	N (Ft)	Groundwater (Casing)	Description	Depth (m)	Level (mAOD)	Legend	Well
							Silty MUDSTONE.				
					21			21			
					22			22			
					23			23			
					24			24			
					25			25			
					26			26			
					27			27			
					28			28	28.00		
					29			29			
					30			30			
					31			31			
					32			32			
					33			33			
					34			34			
					35			35			
					36			36			
					37			37			
					38			38			
					39			39			
					40			40			

End of Borehole at 28.00 m

### Remarks and Water Observations

- Groundwater seepage encountered at 19.50m
- Borehole terminated at 28.00m.
- 50mm diameter standpipe with gas tap installed to 20.00m

GL (m AOD)

Easting:

Northing:

Fig. No.

RH2



# BOREHOLE RECORD

BH No. **RH3**  
Sheet 1 of 2

Site: Tower Works, Armley

Contract No: **C0313**

Client: Commercial Estates Group Ltd.

Dates:  
11/02/2005

Method: Beretta rotary open hole drilling, using air flush.

Scale **1:100**

## SAMPLE DETAILS

## STRATA RECORD

Driller: Cape Site Serv

Logged By: W/C

Type	Depth From - To (m)	TCR (%)	SCR (%)	RCD (%)	N (FI)	Groundwater (Casing)	Description	Depth (m)	Level (mAOD)	Legend	Well
							MADE GROUND: Concrete	0 10			
							MADE GROUND: Ash and brick.	0 70			
					1		Yellow fine grained SANDSTONE	1			
					2			2			
					3			3			
					4		Yellow/grey silty MUDSTONE.	3 50			
					5		---below 4.50m becomes dark grey.	4			
					6		Yellow/brown silty MUDSTONE.	5 75			
					7			6			
					8			7			
					9		Yellow SILTSTONE and MUDSTONE.	8 50			
					10		Grey SILTSTONE.	9 25			
					11			10			
					12		Grey silty MUDSTONE	12 12 00			
					13			13			
					14		---Soft ground between 14.50m and 15.50m.	14			
					15			15			
					16		Grey MUDSTONE.	15 50			
					17		Brown/grey Mudstone.	16 16 00			
					18			17			
					19			18			
					20			19			
							Continued next sheet	20			

### Remarks and Water Observations

- 1 No groundwater strike encountered during drilling.
- 2 Borehole terminated at 28.50m.
- 3 50mm diameter standpipe with gas tap installed to 18.00m.

GL (m AOD)

Easting:

Northing:

Fig. No.

RH3



# BOREHOLE RECORD

BH No. **RH3**  
Sheet 2 of 2

Site: Tower Works, Armley

Contract No:  
**C0313**

Client: Commercial Estates Group Ltd.

Dates:  
11/02/2005

Method: Beretta rotary open hole drilling, using air flush.

Scale **1:100**

## SAMPLE DETAILS

## STRATA RECORD

Driller Cape Site Serv

Logged By W.C.

Type	Depth From - To (m)	TCR (%)	SCR (%)	RQD (%)	N (Fl)	Groundwater (Casing)
						21
						22
						23
						24
						25
						26
						27
						28
						29
						30
						31
						32
						33
						34
						35
						36
						37
						38
						39
						40

Brown/grey Mudstone.

End of Borehole at 28.50 m

Depth (m)	Level (mAOD)	Legend	Well
21			
22			
23			
24			
25			
26			
27			
28			
28.50			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			

### Remarks and Water Observations

1. No groundwater strike encountered during drilling
2. Borehole terminated at 28.50m
3. 50mm diameter standpipe with gas tap installed to 16.00m

GL (m AOD)

Easting:

Northing:

Fig. No.

**RH3**





# BOREHOLE RECORD

BH No. **RH101**  
Sheet 1 of 1

Site: Tower Works, Armley

Contract No:  
**C0313**

Client: Commercial Estates Group Ltd.

Dates:  
17/02/2005

Method: Beretta rotary open hole drilling, using air flush.

Scale **1:100**

## SAMPLE DETAILS

## STRATA RECORD

Driller: Cape  
Logged By: MJC

Type	Depth From - To (m)	TCR (%)	SCR (%)	ROD (%)	N (F)	Groundwater (Ceasing)	Description	Depth (m)	Level (mAOD)	Legend	Well
							MADE GROUND: CONCRETE.	0.15			
							MADE GROUND: Red brown sandy GRAVEL.	0.30			
							MADE GROUND: Dark brown sandy GRAVEL.	1			
								2			
							Brown weathered SANDSTONE.	2.30			
							Brown SANDSTONE.	2.80			
								3			
								4			
							Grey and brown MUDSTONE.	4.60			
								5			
								6			
								7			
								8			
								9			
							Brown broken SANDSTONE. 9.30-10.40m: very poor returns of chippings and significant loss of flush noted.	9.30			
								10			
							10.40-13.00m: intermittent loss of flush and returns noted.	11			
								12			
								13			
							Grey brown MUDSTONE.	13.00			
							Brown MUDSTONE.	13.60			
								14			
								15			
								16			
							End of Borehole at 16.00 m	16.00			
								17			
								18			
								19			
								20			

## Remarks and Water Observations

- 1 Handstanding concrete at surface broken out using a hand held breaker
- 2 No groundwater strike encountered during drilling.
- 3 Intermittent hammering action noted by odex hammer between 9.30m and 13.00m. Possible void or fractured/weathered bedrock.
- 4 On completion a 50mm nominal diameter standpipe was installed to 16.00m (slotted from 2.50 to 16.00m with associated pea gravel filter)

GL (m AOD)

Easting:

Northing:

Fig. No.

RH101



# BOREHOLE RECORD

BH No. **RH102**  
Sheet 1 of 1

Site: Tower Works, Armley

Contract No:

**C0313**

Client: Commercial Estates Group Ltd.

Dates:  
17/02/2005

Method: Beretta rotary open hole drilling, using air flush.

Scale **1:100**

## SAMPLE DETAILS

## STRATA RECORD

Driller Cape

Logged By

MJC

Depth (m) Level (mAOD) Legend Well

0.10			
0.30			
1.100			
2			
3			
4			
4.30			
5			
5.10			
6			
6.40			
6.60			
7			
7.40			
8			
9			
10			
11			
11.00			
11.50			
12			
13			
14			
15			
16			
16.00			
17			
18			
19			
20			

MADE GROUND: TARMACADAM.

MADE GROUND: Dark grey sandy GRAVEL.

Light grey SANDSTONE.

Grey and brown MUDSTONE.

Grey MUDSTONE.

Grey and brown MUDSTONE.

Brown broken SANDSTONE. Intermittent returns noted.

Light brown SANDSTONE.

Brown broken SANDSTONE.

Brown SANDSTONE.

Grey and brown SILTSTONE.

End of Borehole at 16.00 m

## Remarks and Water Observations

1. Hardstanding tarmacadam at surface broken out using a hand held breaker
2. No groundwater strike encountered during drilling.
3. Intermittent hammering action noted by odex hammer between 7.40m and 11.00m. Possible void or fractured/weathered bedrock.

GL (m AOD)

Easting:

Northing:

Fig. No.

**RH102**



# BOREHOLE RECORD

BH No. **RH103**  
Sheet 1 of 1

Site: Tower Works, Armley

Contract No:

**C0313**

Client: Commercial Estates Group Ltd.

Dates:  
17/02/2005

Method: Beretta rotary open hole drilling, using air flush.

Scale **1:100**

## SAMPLE DETAILS

## STRATA RECORD

Driller: Cape  
Logged By: MJC

Type	Depth From - To (m)	TCR (%)	SCR (%)	RCD (%)	N (Ft)	Groundwater (Casing)	Description	Depth (m)	Level (mAOD)	Legend	Well
							MADE GROUND: CONCRETE.	0.15			
							MADE GROUND: Brown sandy GRAVEL and COBBLES.	0.30			
					1		Brown SANDSTONE.	1			
					2			2			
					3		Grey MUDSTONE.	3	3.00		
					4			4			
					5		Grey and brown MUDSTONE with occasional bands of siltstone.	5	4.60		
					6			6			
					7		Brown SANDSTONE.	7	6.80		
					8		Brown SANDSTONE.	8	8.10		
					9			9			
					10		Grey and brown MUDSTONE.	10	9.80		
					11			11			
					12			12			
					13		End of Borehole at 13.00 m	13	13.00		
					14			14			
					15			15			
					16			16			
					17			17			
					18			18			
					19			19			
					20			20			

### Remarks and Water Observations

- 1 Hardstanding concrete at surface broken out using a hand held breaker
- 2 No groundwater sink encountered during drilling.
- 3 Intermittent hammering action noted in occasional places by odex hammer between 8.10m and 9.80m. Possible fractured/weathered bedrock

GL (m AOD)

Easting:

Northing:

Fig. No.

**RH103**





# BOREHOLE RECORD

BH No. **RC202**  
Sheet 1 of 1

Site: Tower Works, Armley

Contract No:

**C0313**

Client: Commercial Estates Group Ltd.

Dates:  
18/03/2005

Method: Beretta rotary open hole drilling and rotary core, using air flush.

Scale **1:100**

## SAMPLE DETAILS

## STRATA RECORD

Driller: SIS

Logged By: MJC

Type	Depth From - To (m)	TCR (%)	SCR (%)	RQD (%)	N (Fl)	Groundwater (Casing)	Description	Depth (m)	Level (mAOD)	Legend	Well
							MADE GROUND: TARMACADAM.	0.15			
							MADE GROUND: Roadstone subbase (driller's description).	0.30			
						1	Yellow brown MUDSTONE.	1			
						2	Grey and brown MUDSTONE.	1.50			
						3		2			
						4		3			
						5		4			
	5.00 - 6.50					5	Brown SANDSTONE.	4.50			
		99	84	29	(23)	6	Moderately strong light brown fine grained SANDSTONE. Bedding fractures 0-10 degrees, closely to medium spaced, planar, smooth to slightly rough, brown stained.	5	5.00		
	6.50 - 8.00					7	5.00-5.16m: weak to moderately weak grey brown mudstone.	6			
		99	96	75		8	5.50-5.63m: with interlamination of grey brown siltstone and mudstone.	7			
	8.00 - 9.50				(9)	9	5.86-6.25m: moderately weak grey brown mudstone.	8			
		100	92	81		10	7.47-8.58m: strong and light grey.	9			
						11	8.58-8.61m: moderately weak to moderately strong brown ironstone.	9.50			
						12	8.90-9.20m: with very closely to closely spaced sets of 35-55 degree and 70-90 degree, planar, rough, brown stained, closed discontinuities.	10			
						13	End of Borehole at 9.50 m	11			
						14		12			
						15		13			
						16		14			
						17		15			
						18		16			
						19		17			
						20		18			
						21		19			
						22		20			

## Remarks and Water Observations

- 1 No groundwater strike encountered during drilling
- 2 No voids detected during drilling.
- 3 Borehole backfilled on completion.

GL (m AOD)

Eastings:

Northings:

Fig. No.

**RC202**



# BOREHOLE RECORD

BH No. **RC203**  
Sheet 1 of 1

Site: Tower Works, Armley

Contract No:

**C0313**

Client: Commercial Estates Group Ltd.

Dates:

21/03/2005

Method: Beretta rotary open hole drilling and rotary core, using air flush.

Scale **1:100**

## SAMPLE DETAILS

## STRATA RECORD

Driller **SIS**

Logged By

**MJC**

Depth  
(m)

Level  
(mAOD)

Legend

Well

0.20

0.50

1

1.30

1.50

2

3

3.50

4

5

6

6.00

7

7.00

8

8.15

9

9.84

10

10.50

11

12

13

14

15

16

17

18

19

20

MADE GROUND: Reinforced CONCRETE.

MADE GROUND: Brown sandy GRAVEL and COBBLES.

Brown SANDSTONE.

Brown SILTSTONE.

Grey brown MUDSTONE.

Grey MUDSTONE.

Brown MUDSTONE.

Moderately weak and locally weak thinly to thickly laminated light brown fine grained SANDSTONE with occasional siltstone laminations. Bedding fractures 0-15 degrees, very closely to closely spaced, planar, smooth, brown stained. Discontinuities 75-90 degree, closely spaced, planar, rough, brown stained.

Moderately strong light brown fine grained SANDSTONE. Bedding fractures 0-10 degrees, closely to medium spaced, planar, smooth to slightly rough, brown stained, locally silt and clay infilled (up to 1mm).  
8.15-8.65m: with two intersecting 80-90 degree, planar, rough, brown stained discontinuities.  
9.19-9.27m: moderately weak siltstone.  
9.60-9.84m: with 45-70 degree, incipient fractures.

Moderately weak grey MUDSTONE with occasional very closely to closely spaced laminations of sandstone. Bedding fractures 0-20 degrees, very closely to closely spaced, planar, smooth, brown stained.

End of Borehole at 10.50 m

## Remarks and Water Observations

- 1 Groundwater seepage encountered at 7.00m
- 2 No voids detected during drilling
- 3 Borehole backfilled on completion.

GL (m AOD)

Eastings:

Northings:

Fig. No.

**RC203**



**CoDa Structures**

Consulting Civil & Structural Engineers  
14 Springfield Court  
GUISELEY  
Leeds LS20 8FD

**PHASE 1& 2 ENVIRONMENTAL RESUMÉ AND  
REMEDICATION STATEMENT FOR A  
RESIDENTIAL DEVELOPMENT SITE AT  
TOWER WORKS, MOORFIELD ROAD, UPPER  
ARMLEY, LEEDS**

## **APPENDIX E**

### **CONTAMINATION ASSESSMENT CRITERIA FOR RESIDENTIAL USE WITH HOME GROWN PRODUCE**



	Units	Residential Use With Homegrown Produce	Derivation Tool
<b>ORGANICS</b>			
Sum of PCDDs, PCDFs, (eg PCBs)	mg/kg	8	EA 2009
Phenol	mg/kg	280	LQM/CI/IEH S4UL's
Chlorophenols	mg/kg	0.87	LQM/CI/IEH S4UL's
Pentachlorophenols	mg/kg	0.22	LQM/CI/IEH S4UL's
<b>PAH 16 EPA</b>			
Acenaphthene	mg/kg	210	LQM/CI/IEH S4UL's
Acenaphthylene	mg/kg	170	LQM/CI/IEH S4UL's
Anthracene	mg/kg	2400	LQM/CI/IEH S4UL's
Benzo (a) Anthracene	mg/kg	7.2	LQM/CI/IEH S4UL's
Benzo (a) pyrene	mg/kg	5.0	SP1010: Development of C4SL's for Assessment of Land Affected by Contamination
Benzo (b) fluoranthene	mg/kg	2.6	LQM/CI/IEH S4UL's
Benzo (k) fluoranthene	mg/kg	77	LQM/CI/IEH S4UL's
Benzo (g, h, i) perylene	mg/kg	320	LQM/CI/IEH S4UL's
Chrysene	mg/kg	15	LQM/CI/IEH S4UL's
Di-benzo (a, h) anthracene	mg/kg	0.24	LQM/CI/IEH S4UL's
Indeno (1, 2, 3-cd) pyrene	mg/kg	27	LQM/CI/IEH S4UL's
Fluoranthene	mg/kg	280	LQM/CI/IEH S4UL's
Fluorene	mg/kg	170	LQM/CI/IEH S4UL's
Naphthalene	mg/kg	2.3	LQM/CI/IEH S4UL's
Phenanthrene	mg/kg	95	LQM/CI/IEH S4UL's
Pyrene	mg/kg	620	LQM/CI/IEH S4UL's
Total PAHs	mg/kg	no sum	
<b>VOCs</b>			
1,1,1 Trichloroethane	mg/kg	8.8	LQM/CI/IEH S4UL's
Vinyl Chloride	mg/kg	0.0064	LQM/CI/IEH S4UL's
1,2 Dichloroethane	mg/kg	0.0071	LQM/CI/IEH S4UL's
Tetrachloroethene	mg/kg	1.2	LQM/CI/IEH S4UL's
Chlorobenzene	mg/kg	0.46	LQM/CI/IEH S4UL's
1,2 Dichlorobenzene	mg/kg	23	LQM/CI/IEH S4UL's
1,3 Dichlorobenzene	mg/kg	0.4	LQM/CI/IEH S4UL's
1,4 Dichlorobenzene	mg/kg	61	LQM/CI/IEH S4UL's
1,2,3 Trichlorobenzene	mg/kg	1.5	LQM/CI/IEH S4UL's
1,2,4 Trichlorobenzene	mg/kg	2.6	LQM/CI/IEH S4UL's
1,3,5 Trichlorobenzene	mg/kg	0.33	LQM/CI/IEH S4UL's
1,2,3,4 Tetrachlorobenzene	mg/kg	15	LQM/CI/IEH S4UL's
1,2,3,5 Tetrachlorobenzene	mg/kg	0.68	LQM/CI/IEH S4UL's
1,2,4,5 Tetrachlorobenzene	mg/kg	0.33	LQM/CI/IEH S4UL's
Pentachlorobenzene	mg/kg	5.8	LQM/CI/IEH S4UL's
Hexachlorobenzene	mg/kg	1.8	LQM/CI/IEH S4UL's
Trichloroethene	mg/kg	0.016	LQM/CI/IEH S4UL's
Trichloromethane	mg/kg	0.01	LQM/CI/IEH S4UL's
<b>GENERAL INORGANICS</b>			
Easily Liberatable Cyanide (free)	mg/kg	36	Acute effects infant 1 dose 3g soil
Thiocyanate	mg/kg	50	Former ICRC Threshold Trigger Value
<b>HEAVY METAL/METALLOIDS</b>			
Arsenic	mg/kg	37	SP1010: Development of C4SL's for Assessment of Land Affected by Contamination
Cadmium	mg/kg	26	SP1010: Development of C4SL's for Assessment of Land Affected by Contamination
Chromium (iii)	mg/kg	910	LQM/CI/IEH S4UL's
Chromium (vi)	mg/kg	21	SP1010: Development of C4SL's for Assessment of Land Affected by Contamination
Lead	mg/kg	200	SP1010: Development of C4SL's for Assessment of Land Affected by Contamination
Mercury (inorganic)	mg/kg	40	LQM/CI/IEH S4UL's
Nickel	mg/kg	180	LQM/CI/IEH S4UL's
Selenium	mg/kg	250	LQM/CI/IEH S4UL's
Boron	mg/kg	290	LQM/CI/IEH S4UL's
Copper	mg/kg	2400	LQM/CI/IEH S4UL's
Zinc	mg/kg	3700	LQM/CI/IEH S4UL's
Beryllium	mg/kg	1.7	LQM/CI/IEH S4UL's
Vanadium	mg/kg	410	LQM/CI/IEH S4UL's
<b>MONOAROMATICS</b>			
Benzene	mg/kg	0.87	SP1010: Development of C4SL's for Assessment of Land Affected by Contamination
Toluene	mg/kg	130	LQM/CI/IEH S4UL's
Ethylbenzene	mg/kg	47	LQM/CI/IEH S4UL's
o - Xylene	mg/kg	80	LQM/CI/IEH S4UL's
m - Xylene	mg/kg	59	LQM/CI/IEH S4UL's
p - Xylene	mg/kg	56	LQM/CI/IEH S4UL's
<b>ALIPHATIC HYDROCARBONS</b>			
TPH Aliphatic>EC5-6	mg/kg	42	LQM/CI/IEH S4UL's
TPH Aliphatic>EC6-8	mg/kg	100	LQM/CI/IEH S4UL's
TPH Aliphatic>EC8-10	mg/kg	27	LQM/CI/IEH S4UL's
TPH Aliphatic>EC10-12	mg/kg	130	LQM/CI/IEH S4UL's
TPH Aliphatic>EC12-16	mg/kg	1100	LQM/CI/IEH S4UL's
TPH Aliphatic>EC16-35	mg/kg	65000	LQM/CI/IEH S4UL's
TPH Aliphatic>C35-44	mg/kg	65000	LQM/CI/IEH S4UL's
TPH Aromatic>EC5-7	mg/kg	70	LQM/CI/IEH S4UL's
TPH Aromatic>EC7-8	mg/kg	130	LQM/CI/IEH S4UL's
TPH Aromatic>EC8-10	mg/kg	34	LQM/CI/IEH S4UL's
TPH Aromatic>EC10-12	mg/kg	74	LQM/CI/IEH S4UL's
TPH Aromatic>EC12-16	mg/kg	140	LQM/CI/IEH S4UL's
TPH Aromatic>EC16-21	mg/kg	260	LQM/CI/IEH S4UL's
TPH Aromatic>EC21-35	mg/kg	1100	LQM/CI/IEH S4UL's
TPH Aromatic>EC35-44	mg/kg	1100	LQM/CI/IEH S4UL's
<b>PESTICIDES</b>			
Aldrin	mg/kg	5.7	LQM/CI/IEH S4UL's
Altrazine	mg/kg	3.3	LQM/CI/IEH S4UL's
Dichloroos	mg/kg	0.032	LQM/CI/IEH S4UL's
Endosulfans	mg/kg	7.4	LQM/CI/IEH S4UL's
Hexachlorocyclohexane	mg/kg	0.06	LQM/CI/IEH S4UL's
Dieldrin	mg/kg	0.97	LQM/CI/IEH S4UL's
<b>OTHERS</b>			
pH	Value	<5	Former ICRC Threshold Trigger Value
Asbestos	-	Presence	Lab Screening
Sulphate	mg/l	500	Class D51 - BRE Special Digest 1
Sulphide	mg/kg	250	Former ICRC Threshold Trigger Value
Sulphur	mg/kg	5000	Former ICRC Threshold Trigger Value
Caloric Value	MJ/kg	2	Fire Research

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**PHASE 1& 2 ENVIRONMENTAL RESUMÉ AND  
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TOWER WORKS, MOORFIELD ROAD, UPPER  
ARMLEY, LEEDS**

## **APPENDIX F**

### **SIRIUS CHEMICAL TEST RESULTS**



## CERTIFICATE OF ANALYSIS

Certificate Number : 16096

17 March 2005

Client Reference : C0313A

Our Reference : 16096

Clients Name : Sirius Geotechnical & Environmental  
Clients Address : Russell House  
Suite 2, Mill Road  
Langley Moor  
Durham  
DH7 8HJ

Contract Title : Tower Works, Armley

Description : Twenty five soil samples and six leachate samples prepared from soils

Date Received : 2 March 2005

Test Procedures : Identified by Prefix DETSn , Details available upon request.

Notes : # Denotes analysis carried out by an approved sub-contractor

\* Denotes test not included in laboratory scope of accreditation

Observations and Interpretations are Outside the UKAS Accreditation Scope

Approved By

Authorised Signatories : R Bennett  
Director

R Brown  
Laboratory/Technical Manager

S Wilson  
Quality Manager

Page 1 of 13 Pages

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material received by the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

# TOWER WORKS, ARMLEY

## Summary of Chemical Analyses on Soil Samples

Borehole or Trial Pit	Depth (m)	Sample Number	Sample Type	Laboratory Reference Number	Total Arsenic (mg/kg As)		Total Cadmium (mg/kg Cd)		Total Chromium (mg/kg Cr)		Total Lead (mg/kg Pb)		Total Mercury (mg/kg Hg)		Total Selenium (mg/kg Se)		Total Copper (mg/kg Cu)		Total Nickel (mg/kg Ni)		Total Zinc (mg/kg Zn)		Water Soluble Boron (B) (mg/kg)	
					DETS 042	DETS 042	DETS 042	DETS 042	DETS 042	DETS 042	DETS 042	DETS 042	DETS 015	DETS 042	DETS 042	DETS 042	DETS 042	DETS 042	DETS 042	DETS 042	DETS 042	DETS 042	DETS 042	DETS 042
WS101	0.30-0.55		D	16096/1	17	1.1	18	53	<0.3	1.1	130	25	89	2.0										
WS102	0.10-0.40		D	16096/2	30	0.6	16	160	<0.3	1.2	270	15	85	1.8										
WS103	0.12-0.35		D	16096/3																				
WS104	0.20-0.30		D	16096/4	18	0.8	35	74	<0.3	1.0	86	36	130	2.0										
WS105	0.40-0.67		D	16096/5	5	0.5	11	12	<0.3	0.9	37	15	68	0.6										
WS107	0.50-1.00		D	16096/6	1	<0.2	<1	4	<0.3	<0.3	<1	<1	<1	1.2										
WS107	1.00-2.00		D	16096/7																				
WS108	0.15-0.20		D	16096/8																				
WS108	0.75-1.00		D	16096/9	19	0.8	21	160	<0.3	1.1	43	19	95	2.6										
WS108	1.00-1.30		D	16096/10	30	0.7	16	79	<0.3	1.2	36	15	81	2.8										
WS108	1.40-1.80		D	16096/11	8	0.5	12	21	<0.3	1.0	11	14	56	1.7										
WS109	0.15-0.25		D	16096/12	7	0.4	8	13	<0.3	1.2	21	8	80	1.5										
WS109	0.70-0.90		D	16096/13	32	0.8	20	95	<0.3	1.1	42	19	96	7.4										
WS110	0.20-0.35		D	16096/14	6	0.3	6	18	<0.3	1.3	9	6	34	2.6										
WS110	0.40-0.70		D	16096/15	8	0.7	15	29	<0.3	0.9	12	14	73	1.2										
WS111	0.30-0.50		D	16096/16	12	0.6	13	47	<0.3	1.2	58	17	76	4.6										
WS111	0.50-1.00		D	16096/17																				
WS111	1.30-1.90		D	16096/18																				
WS111	2.10-2.38		D	16096/19	6	0.5	12	20	<0.3	0.9	19	17	56	3.3										
TP101	0.17-0.25		D	16096/20	5	0.7	20	13	<0.3	0.3	22	26	82	1.0										

Client Reference: C0313A

Laboratory Reference: 16096

# TOWER WORKS, ARMLEY

## Summary of Chemical Analyses on Soil Samples

Borehole or Trial Pit	Depth (m)	Sample Number	Sample Type	Laboratory Reference Number	Total Cyanide (mg/kg CN)		Free Cyanide (mg/kg CN)	Elemental Sulphur (mg/kg S)	Sulphide (mg/kg S <sup>2-</sup> )		Sulphate content (% SO <sub>4</sub> )		Sulphate content on 2:1 aqueous extract (g/l SO <sub>4</sub> )		pH Value	Monohydric Phenols (mg/kg)
					DETS 021	DETS 021		DETS 049	DETS 024	DETS 004	DETS 004	DETS 004	DETS 004	DETS 004	DETS 008	DETS 023
WS101	0.30-0.55		D	16096/1	<0.1	<0.1	<0.1	<0.5	250	0.29	0.35	0.18	0.22	12.0	8.4	
WS102	0.10-0.40		D	16096/2	0.6	0.2	<0.5	<0.5	32	0.23	0.28	0.28	0.34	7.0	<0.3	
WS103	0.12-0.35		D	16096/3												
WS104	0.20-0.30		D	16096/4	0.4	<0.1	<0.5	<0.5	57	0.51	0.61	1.39	1.67	8.8	<0.3	
WS105	0.40-0.67		D	16096/5	<0.1	<0.1	<0.5	<0.5	<10	0.02	0.02	0.28	0.34	7.4	<0.3	
WS107	0.50-1.00		D	16096/6	<0.1	<0.1	<0.5	<0.5	40	0.16	0.19	0.12	0.14	11.5	<0.3	
WS107	1.00-2.00		D	16096/7												
WS108	0.15-0.20		D	16096/8												
WS108	0.75-1.00		D	16096/9	0.3	0.1	<0.5	<0.5	12	0.04	0.05	0.27	0.32	8.9	<0.3	
WS108	1.00-1.30		D	16096/10	0.5	0.3	<0.5	<0.5	<10	0.03	0.04	0.26	0.31	6.5	<0.3	
WS108	1.40-1.80		D	16096/11	0.2	<0.1	<0.5	<0.5	20	0.02	0.02	0.23	0.28	7.3	<0.3	
WS109	0.15-0.25		D	16096/12	0.2	<0.1	<0.5	1.7	720	0.63	0.76	0.49	0.59	11.9	<0.3	
WS109	0.70-0.90		D	16096/13	0.5	0.3	<0.5	<0.5	28	0.02	0.02	0.31	0.37	7.3	<0.3	
WS110	0.20-0.35		D	16096/14	0.2	<0.1	<0.5	<0.5	590	0.77	0.92	0.19	0.23	11.7	<0.3	
WS110	0.40-0.70		D	16096/15	0.2	<0.1	<0.5	<0.5	<10	0.02	0.02	0.16	0.19	8.0	<0.3	
WS111	0.30-0.50		D	16096/16	0.2	<0.1	<0.5	<0.5	28	0.02	0.02	0.20	0.24	7.5	<0.3	
WS111	0.50-1.00		D	16096/17												
WS111	1.30-1.90		D	16096/18												
WS111	2.10-2.38		D	16096/19	0.1	<0.1	<0.5	<0.5	<10	0.02	0.02	0.13	0.16	7.9	<0.3	
TP101	0.17-0.25		D	16096/20	0.1	<0.1	<0.5	<0.5	<10	0.02	0.02	0.10	0.12	7.5	<0.3	

Client Reference: C0313A

Laboratory Reference: 16096

# TOWER WORKS, ARMLEY

## Summary of Chemical Analyses on Soil Samples

Borehole or Trial Pit	Depth (m)	Sample Number	Sample Type	Laboratory Reference Number	Toluene Extractable Matter (mg/kg)	Total PAH (mg/kg)	Gasoline Range Organics * (mg/kg)	Diesel Range Organics (mg/kg)	Mineral Range Organics (mg/kg)	Total Petroleum Hydrocarbons (mg/kg)	Polychlorinated Biphenyls * (mg/kg)	Calorific Value * (kJ/kg)
WS101	0.30-0.55		D	16096/1		32						
WS102	0.10-0.40		D	16096/2		240						1400
WS103	0.12-0.35		D	16096/3								1100
WS104	0.20-0.30		D	16096/4		9				240		
WS105	0.40-0.67		D	16096/5		<5				21		
WS107	0.50-1.00		D	16096/6		18						
WS107	1.00-2.00		D	16096/7								
WS108	0.15-0.20		D	16096/8								
WS108	0.75-1.00		D	16096/9	600	270				1500		
WS108	1.00-1.30		D	16096/10	800	37						
WS108	1.40-1.80		D	16096/11	1500	<5						
WS109	0.15-0.25		D	16096/12	1200	<5	<20	38	210	248		
WS109	0.70-0.90		D	16096/13	<40	<5				100		
WS110	0.20-0.35		D	16096/14	64	<5				270		
WS110	0.40-0.70		D	16096/15	<40	27				<20		
WS111	0.30-0.50		D	16096/16	66	130	<20	270	560	830		
WS111	0.50-1.00		D	16096/17						460		
WS111	1.30-1.90		D	16096/18								
WS111	2.10-2.38		D	16096/19	2700	71				450		
TP101	0.17-0.25		D	16096/20	<40	<5	<20	<20	<20	<20		

Client Reference: C0313A

Laboratory Reference: 16096

# TOWER WORKS, ARMLEY

## Summary of Chemical Analyses on Soil Samples

Borehole or Trial Pit	Depth (m)	Sample Number	Sample Type	Laboratory Reference Number	Total Arsenic (mg/kg As) DETS 042	Total Cadmium (mg/kg Cd) DETS 042	Total Chromium (mg/kg Cr) DETS 042	Total Lead (mg/kg Pb) DETS 042	Total Mercury (mg/kg Hg) DETS 015	Total Selenium (mg/kg Se) DETS 042	Total Copper (mg/kg Cu) DETS 042	Total Nickel (mg/kg Ni) DETS 042	Total Zinc (mg/kg Zn) DETS 042	Water Soluble Boron (B) (mg/kg) DETS 020
TP101	0.25-0.40		D	16096/21										
TP102	0.05-0.25		D	16096/22	9	0.9	36	23	<0.3	<0.3	43	44	97	1.0
TP102	0.47-0.57		D	16096/23	10	0.9	31	17	<0.3	<0.3	32	38	87	1.6
TP103	0.20-0.35		D	16096/24										
TP105	0.30-0.45		D	16096/25	20	3.5	19	160	<0.3	0.8	160	19	600	1.1
TP106	0.07-0.25		D	16096/26										
TP107	0.09-0.20		D	16096/27										
HOTP1	0.30-0.45		D	16096/28										
HOTP2	0.12-0.43		D	16096/29										

Client Reference: C0313A

Laboratory Reference: 16096

DERWENTSIDE ENVIRONMENTAL TESTING SERVICES LIMITED

# TOWER WORKS, ARMLEY

## Summary of Chemical Analyses on Soil Samples

Borehole or Trial Pit	Depth (m)	Sample Number	Sample Type	Laboratory Reference Number	Total Cyanide (mg/kg CN)	Free Cyanide (mg/kg CN)	Elemental Sulphur (mg/kg S)	Sulphide (mg/kg S <sup>2-</sup> )	Sulphate content (% SO <sub>4</sub> )	Sulphate content (% SO <sub>4</sub> )	Sulphate content on 2:1 aqueous extract (g/l SO <sub>4</sub> )	pH Value	Monohydric Phenols (mg/kg)
					DETS 021	DETS 021	DETS 049	DETS 024	DETS 004	DETS 004	DETS 004	DETS 008	DETS 023
TP101	0.25-0.40		D	16096/21									
TP102	0.05-0.25		D	16096/22	0.2	<0.1	<0.5	12	0.08	0.10	0.44	7.9	<0.3
TP102	0.47-0.57		D	16096/23	0.1	<0.1	<0.5	<10	0.02	0.02	0.19	7.9	<0.3
TP103	0.20-0.35		D	16096/24									
TP105	0.30-0.45		D	16096/25	0.2	<0.1	<0.5	36	0.18	0.22	0.12	9.8	<0.3
TP106	0.07-0.25		D	16096/26									
TP107	0.09-0.20		D	16096/27									
HDTP1	0.30-0.45		D	16096/28									
HDTP2	0.12-0.43		D	16096/29									

Client Reference: C0313A

Laboratory Reference: 16096

DERWENTSIDE ENVIRONMENTAL TESTING SERVICES LIMITED



# TOWER WORKS, ARMLEY

## Summary of Chemical Analyses on Soil Samples

Borehole or Trial Pit	Depth (m)	Sample Number	Sample Type	Laboratory Reference Number	Toluene Extractable Matter (mg/kg)	Total PAH (mg/kg)	Gasoline Range Organics * (mg/kg)	Diesel Range Organics (mg/kg)	Mineral Range Organics (mg/kg)	Total Petroleum Hydrocarbons (mg/kg)	Polychlorinated Biphenyls * (mg/kg)	Calorific Value * (kJ/kg)
					DETS 029	DETS 050	DETS 062	DETS 051	DETS 061	DETS 051	DETS 052	DETS 037
TP101	0.25-0.40	D	D	16096/21	<40		<20	4000	2100	6100		
TP102	0.05-0.25	D	D	16096/22	<40	<5	<20	<20	<20	<20		
TP102	0.47-0.57	D	D	16096/23	2100	<5						
TP103	0.20-0.35	D	D	16096/24								
TP105	0.30-0.45	D	D	16096/25		66	<20	140	240	380		
TP106	0.07-0.25	D	D	16096/26			<20	81	450	531		
TP107	0.09-0.20	D	D	16096/27								1600
HDTP1	0.30-0.45	D	D	16096/28							<0.01	
HDTP2	0.12-0.43	D	D	16096/29							<0.01	

Client Reference: C0313A

Laboratory Reference: 16096

DERWENTSIDE ENVIRONMENTAL TESTING SERVICES LIMITED

## VOC's - Soils

Client Reference: C0313A  
Laboratory Reference: 16096

## Summary of Chemical Analyses on Soil Samples

Date Analysed	Total Cyanide (mg/kg CN)	Free Cyanide (mg/kg CN)	Elemental Sulphur (mg/kg S)	Sulphide (mg/kg S <sup>2-</sup> )	Sulphate content		pH Value	Monohydric Phenols (mg/kg)
					(% SO <sub>3</sub> )	on 2:1 aqueous extract (g/l SO <sub>4</sub> )		
11/03/2005	DETS 021	DETS 021	DETS 049	DETS 024	DETS 004	DETS 004	DETS 008	DETS 023
09/03/2005								
08/03/2005								
09/03/2005								
11/03/2005								

Date Analysed	Toluene Extractable Matter (mg/kg)	Total PAH (mg/kg)	Gasoline Range Organics *	Diesel Range Organics	Mineral Range Organics	Total Petroleum Hydrocarbons	Polychlorinated Biphenyls *	VOC *	Calorific Value *
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(kJ/kg)
08/03/2005	DETS 029	DETS 050	DETS 062	DETS 051	DETS 051	DETS 051	DETS 052	DETS 068	DETS 037
08/03/2005		08/03/2005	10/03/2005	08/03/2005	08/03/2005	08/03/2005	10/03/2005	07/03/2005	09/03/2005

Laboratory Reference: 16096

# TOWER WORKS, ARMLEY

## Summary of Chemical Analyses on Leachate Samples Prepared from Soils

Borehole or Trial Pit	Depth (m)	Sample Number	Sample Type	Laboratory Reference Number	Arsenic (µg/l As) DETS 042	Cadmium (µg/l Cd) DETS 042	Chromium (µg/l Cr) DETS 042	Lead (µg/l Pb) DETS 042	Mercury (µg/l Hg) DETS 015	Selenium (µg/l Se) DETS 017	Copper (µg/l Cu) DETS 042	Nickel (µg/l Ni) DETS 042	Zinc (µg/l Zn) DETS 042	Boron (µg/l B) DETS 020
WS101	0.30-0.55		D	16096/1	<1	<2	<10	20	<0.2	<3	3	<10	190	110
WS102	0.10-0.40		D	16096/2	<1	<2	<10	30	<0.2	<3	8	<10	100	220
WS104	0.20-0.30		D	16096/4	<1	<2	10	30	<0.2	<3	5	<10	370	150
WS108	0.75-1.00		D	16096/9	<1	<2	<10	30	<0.2	<3	<1	<10	380	120
WS108	1.00-1.30		D	16096/10	<1	<2	<10	20	<0.2	<3	<1	<10	160	130
WS111	0.30-0.50		D	16096/16	<1	<2	<10	20	0.2	<3	<1	<10	130	240

Client Reference: C0313A

Laboratory Reference: 16096

DERWENTSIDE ENVIRONMENTAL TESTING SERVICES LIMITED

# TOWER WORKS, ARMLEY

## Summary of Chemical Analyses on Leachate Samples Prepared from Soils

Borehole or Trial Pit	Depth (m)	Sample Number	Sample Type	Laboratory Reference Number	Total Cyanide (µg/l CN)	Free Cyanide (µg/l CN)	Elemental Sulphur (µg/l S)	Sulphide (µg/l S <sup>2-</sup> )	Sulphate content (mg/l SO <sub>4</sub> )	pH Value	Total Phenols * (µg/l)	Total PAH # (µg/l)	Ammonia as N (mg/l)
					DETS 021	DETS 021	DETS 049	DETS 024	DETS 055	DETS 055	DETS 054		DETS 019
WS101	0.30-0.55		D	16096/1	<20	<20	<100	<500	50	5.4	<0.5	0.64	0.05
WS102	0.10-0.40		D	16096/2	<20	<20	<100	<500	<10	9.0	<0.5	72	0.06
WS104	0.20-0.30		D	16096/4	<20	<20	<100	<500	40	9.9	<0.5	0.26	0.03
WS108	0.75-1.00		D	16096/8	<20	<20	<100	<500	20	6.4	<0.5	0.70	<0.02
WS108	1.00-1.30		D	16096/10	<20	<20	<100	<500	20	5.2	<0.5	0.37	<0.02
WS111	0.30-0.50		D	16096/16	<20	<20	<100	<500	10	6.1	<0.5	0.47	<0.02

Client Reference: C0313A

Laboratory Reference: 16096

DERWENTSIDE ENVIRONMENTAL TESTING SERVICES LIMITED

# TOWER WORKS, ARMLEY

## Summary of Chemical Analyses on Leachate Samples Prepared from Soils

Borehole or Trial Pit	Depth (m)	Sample Number	Sample Type	Laboratory Reference Number	Chloride (mg/l)	COD (mg/l)	Electrical Conductivity (µs/cm)	Iron (mg/l)
					DETS 066	DETS 032	DETS 009	DETS 042
WS101	0.30-0.55		D	16096/1	<10	<10	43	<0.01
WS102	0.10-0.40		D	16096/2	<10	<10	49	0.01
WS104	0.20-0.30		D	16096/4	<10	<10	160	<0.01
WS108	0.75-1.00		D	16096/9	<10	<10	180	<0.01
WS108	1.00-1.30		D	16096/10	<10	<10	160	<0.01
WS111	0.30-0.50		D	16096/16	<10	<10	130	<0.01

Client Reference: C0313A

Laboratory Reference: 16096

DERWENTSIDE ENVIRONMENTAL TESTING SERVICES LIMITED

## TOWER WORKS, ARMLEY

### Summary of Chemical Analyses on Leachates Prepared from Soil Samples

Date Analysed	Arsenic	Cadmium	Chromium	Lead	Mercury	Selenium	Copper	Nickel	Zinc	Boron
	(µg/l As)	(µg/l Cd)	(µg/l Cr)	(µg/l Pb)	(µg/l Hg)	(µg/l Se)	(µg/l Cu)	(µg/l Ni)	(µg/l Zn)	(µg/l B)
	DETS 042	DETS 042	DETS 042	DETS 042	DETS 015	DETS 017	DETS 042	DETS 042	DETS 042	DETS 020
	15/03/2005	08/03/2005	08/03/2005	08/03/2005	16/03/2005	10/03/2005	08/03/2005	08/03/2005	08/03/2005	08/03/2005
Date Analysed										
Date Analysed	Total Cyanide (µg/l CN)	Free Cyanide (µg/l CN)	Elemental Sulphur (µg/l S)	Sulphide (µg/l S <sup>2-</sup> )	Sulphate content (mg/l SO <sub>4</sub> )		pH Value	Total Phenols *	Total PAH #	Ammonia as N
	DETS 021	DETS 021	DETS 049	DETS 024	DETS 055	DETS 055	DETS 008	DETS 054		(mg/l)
	08/03/2005	08/03/2005	09/03/2005	09/03/2005	09/03/2005		09/03/2005	07/03/2005	10/03/2005	DETS 019
	08/03/2005	08/03/2005	09/03/2005	09/03/2005	09/03/2005		09/03/2005	07/03/2005	10/03/2005	08/03/2005
Date Analysed										
Date Analysed	Chloride	COD	Electrical	Iron	Conductivity *	(mg/l)	DETS 042	DETS 009	DETS 032	DETS 055
	(mg/l)	(mg/l)	(µs/cm)	(mg/l)						
	DETS 055	DETS 032	DETS 009	DETS 042						
	09/03/2005	07/03/2005	08/03/2005	08/03/2005						
Date Analysed										

Client Reference: C0313A

Laboratory Reference: 16096

# BULK ANALYSIS REPORT:

Date Samples Received: 04 March 2005

Project Ref. No:  
5823

Report No: 22257  
Office Code: CON



Customer: Derwentside Environmental Testing Serv.  
Address Details: Unit 2A/2B  
Park Road Industrial Estate South  
Consett, Co Durham

Tel No: 01207 582333  
Fax Number: 01207 582444  
Order Number: 22780  
Contact: Richard Bennett  
DH8 5PY

## ANALYTICAL PROCEDURE (In house document based on HSE MDHS 77)

Fibres found in the sample or small portions of the sample were mounted on glass slides in specific refractive index liquids and examined using polarised light and dispersion staining microscopy. Fibres were identified by comparison of their optical properties with those of standard asbestos materials and published data. MIS Limited accepts responsibility only for results obtained from samples received. No responsibility is accepted for errors which may have arisen during the sampling or transportation of the samples by a third party. Re: Artox Samples - analysis is carried out to MDHS 77, however we would recommend that SEM (Scanning Electron Microscopy) analysis be used for this type of analysis.

RESULT KEY:	ASBESTOS	NON ASBESTOS	ESTIMATED CONTENT**
	Crocidolite (Blue Asbestos)	MMMF (Man Made Mineral Fibres)	Major (>10%)
	Amosite (Brown Asbestos)	NOF (Natural Organic Fibres)	Minor (1 - 10%)
	Chrysotile (White Asbestos)		Trace (<1%)

Sampled By: As Received  
Analysed By: A. Heels & J. Cruddas  
Date Analysed: 04/03/2005

Lab Code	Analyst Code	Sample Details/Location	Material	Result	Amount
81284	N/A	16096 - 2, WS 102, 0.1 - 0.4, Soil Tower Works, Amley	Soil	NOF	Trace
81285	N/A	16096 - 6, WS 107, 0.5 - 1.0, Soil Tower Works, Amley	Soil	NOF	Trace
81286	N/A	16096 - 7, WS 107, 1.0 - 2.0, Soil Tower Works, Amley	Soil	NOF	Trace
81287	N/A	16096 - 17, WS 111, 0.5 - 1.0, Soil Tower Works, Amley	Soil	NOF	Trace
81288	N/A	16096 - 24, TP 103, 0.2 - 0.35, Soil Tower Works, Amley	Soil	NOF	Trace
81289	N/A	16096 - 25, TP 105, 0.3 - 0.45 Tower Works, Amley	Soil	NOF	Trace

## COMMENTS\*

No asbestos fibres were found to be present in the above sample(s).

Analyst Signature:

*A Heels*

Date of Issue: 04 March 2005

Authorised Signature:

*LBell*

Jeff Cruddas - Laboratory Manager  
Alasdair Nairn - Director

☐ Peter Jackson - Bulk Analyst  
☐ Paul King - Environmental Manager

☒ Laurence Bell - Laboratory Administrator  
☐ Chris McConnell - Quality Manager

\* Comments, observations and opinions are outside of the UKAS Accreditation Scope.

\*\* The quantitative assessment % of fibre content made by the analyst is a non-accredited element of the testing.





## CERTIFICATE OF ANALYSIS

Certificate Number : 16462-1

Client Reference : C0313

08 April 2005

Our Reference : 16462-1

Clients Name : Sirius Geotechnical & Environmental  
Clients Address: Suite 2  
Russell House  
Mill Road  
Langley Moor  
Durham  
DH7 8HJ

Contract Title : Tower Works, Armley

Description : Four water samples

Date Received : 18 March 2005

Test Procedures : Identified by Prefix DETSn , Details available upon request.

Notes : # Denotes analysis carried out by approved sub-contractor

\* Denotes test not included in laboratory scope of accreditation

Observations and Interpretations are Outside the UKAS Accreditation Scope

This report supersedes 16462

Approved By:

Authorised Signatories R Bennett  
Director

R Brown  
Laboratory/Technical Manager

S Wilson  
Quality Manager

Page 1 of 6 Pages

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material received by the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory

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Registered in England No. 370 5645 • VAT No. 708 978 678

## TOWER WORKS, ARMLEY

### Summary of Chemical Analyses on Water Samples

Borehole or Trial Pit	Depth (m)	Sample Number	Sample Type	Laboratory Reference Number	Arsenic (µg/l As) DETS 042	Cadmium (µg/l Cd) DETS 042	Chromium (µg/l Cr) DETS 042	Lead (µg/l Pb) DETS 042	Mercury (µg/l Hg) DETS 016	Selenium (µg/l Se) DETS 017	Copper (µg/l Cu) DETS 042	Nickel (µg/l Ni) DETS 042	Zinc (µg/l Zn) DETS 042	Boron (µg/l B) DETS 020
RO1			W	16462/1	<1	<2	20	<10	<0.2	<3	<1	<10	180	160
RO2			W	16462/2	<1	<2	10	<10	<0.2	<3	<1	<10	160	120
RO3			W	16462/3	<1	<2	10	<10	<0.2	<3	<1	<10	210	<100
RO101			W	16462/4	<1	<2	10	<10	<0.2	<3	<1	<10	80	110

Client Reference: C0313

Laboratory Reference: 16462-1

DERWENTSIDE ENVIRONMENTAL TESTING SERVICES LIMITED

# TOWER WORKS, ARMLEY

## Summary of Chemical Analyses on Water Samples

Borehole or Tria Pit	Depth (m)	Sample Number	Sample Type	Laboratory Reference Number	Total Cyanide (µg/l CN)	Free Cyanide (µg/l CN)	Elemental Sulphur (µg/l S)	Sulphide (µg/l S <sup>2-</sup> )	Sulphate content (mg/l SO <sub>4</sub> )	pH Value	Total Phenols * (µg/l)	Total PAH # (µg/l)	Total Petroleum Hydrocarbons # (µg/l)	Ammonia as N (mg/l)
					DETS 021	DETS 021	DETS 049	DETS 024	DETS 066	DETS 008	DETS 064			DETS 019
RO1			W	16462/1	<20	<20	<100	<500	140	7.1	<0.5	0.31	<10	0.02
RO2			W	16462/2	<20	<20	<100	<500	192	7.5	<0.5	0.24	<10	<0.02
RO3			W	16462/3	<20	<20	<100	<500	140	7.7	<0.5	<0.2	<10	<0.02
RO101			W	16462/4	<20	<20	<100	<500	100	7.5	<0.5	0.50	<10	<0.02

Client Reference: C0313

Laboratory Reference: 16462-1

DERWENTSIDE ENVIRONMENTAL TESTING SERVICES LIMITED

## TOWER WORKS, ARMLEY

### Summary of Chemical Analyses on Water Samples

Borehole or Trial Pit	Depth (m)	Sample Number	Sample Type	Laboratory Reference Number	Chloride (mg/l) DETS 066	COD (mg/l) DETS 032	Electrical Conductivity (µs/cm) DETS 009	Iron (mg/l) DETS 042
RO1			W	16462/1	70	<10	1100	1.1
RO2			W	16462/2	50	<10	1300	0.1
RO3			W	16462/3	50	<10	1200	<0.1
RO101			W	16462/4	70	<10	1100	1.5

Client Reference: C0313

Laboratory Reference: 16462-1

DERWENTSIDE ENVIRONMENTAL TESTING SERVICES LIMITED

## TOWER WORKS, ARMLEY

## VOC's - Waters

Compound	Borehole or Trial Pit:				Depth:			
	RO1	RO2	RO3	RO101	W	W	W	W
Sample Number: 18462/1 18462/2 18462/3 18462/4								
Sample Type: DETS Reference Number: 18462/1 18462/2 18462/3 18462/4								
Units								
1,1-dichloroethene *	µg/l	<1	<1	<1	<1	<1	<1	<1
Methylene Chloride *	µg/l	<1	<1	<1	<1	<1	<1	<1
trans-1,2-dichloroethane *	µg/l	<1	<1	<1	<1	<1	<1	<1
1,1-dichloroethane *	µg/l	<1	<1	<1	<1	<1	<1	<1
2,2-dichloropropane * + 1,2-dichloroethene *	µg/l	<1	<1	<1	<1	<1	<1	<1
Bromochloromethane *	µg/l	<1	<1	<1	<1	<1	<1	<1
MTBE	µg/l	<1	<1	<1	<1	<1	<1	<1
Chloroform *	µg/l	<1	<1	<1	<1	<1	<1	<1
1,1,1-trichloroethane *	µg/l	<1	<1	<1	<1	<1	<1	<1
Carbon tetrachloride * + 1,1-dichloropropane	µg/l	<1	<1	<1	<1	<1	<1	<1
Benzene	µg/l	<1	<1	<1	<1	<1	<1	<1
1,2-dichloroethane *	µg/l	<1	<1	<1	<1	<1	<1	<1
Trichloroethylene *	µg/l	<1	<1	<1	<1	<1	<1	<1
1,2-dichloropropane *	µg/l	<1	<1	<1	<1	<1	<1	<1
Dibromomethane *	µg/l	<1	<1	<1	<1	<1	<1	<1
Bromodichloromethane *	µg/l	<1	<1	<1	<1	<1	<1	<1
cis-1,3-dichloropropene *	µg/l	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/l	<1	<1	<1	<1	<1	<1	<1
trans-1,3-dichloropropene *	µg/l	<1	<1	<1	<1	<1	<1	<1
1,1,2-trichloroethane *	µg/l	<1	<1	<1	<1	<1	<1	<1
Tetrachlorethylene *	µg/l	<1	<1	<1	<1	<1	<1	<1
1,3-dichloropropane *	µg/l	<1	<1	<1	<1	<1	<1	<1
Dibromochloromethane *	µg/l	<1	<1	<1	<1	<1	<1	<1
1,2-dibromoethane *	µg/l	<1	<1	<1	<1	<1	<1	<1
Chlorobenzene *	µg/l	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene + 1,1,1,2-tetrachloroethane *	µg/l	<1	<1	<1	<1	<1	<1	<1
m+p-xylene	µg/l	<1	<1	<1	<1	<1	<1	<1
o-xylene	µg/l	<1	<1	<1	<1	<1	<1	<1
Styrene *	µg/l	<1	<1	<1	<1	<1	<1	<1
Bromoform *	µg/l	<1	<1	<1	<1	<1	<1	<1
Isopropylbenzene *	µg/l	<1	<1	<1	<1	<1	<1	<1
Bromobenzene *	µg/l	<1	<1	<1	<1	<1	<1	<1
1,2,3-trichloropropane *	µg/l	<1	<1	<1	<1	<1	<1	<1
n-propylbenzene *	µg/l	<1	<1	<1	<1	<1	<1	<1
2-chlorotoluene *	µg/l	<1	<1	<1	<1	<1	<1	<1
1,3,5-trimethylbenzene *	µg/l	<1	<1	<1	<1	<1	<1	<1
sec-butylbenzene *	µg/l	<1	<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene * + p-isopropyltoluene *	µg/l	<1	<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene *	µg/l	<1	<1	<1	<1	<1	<1	<1
n-butylbenzene *	µg/l	<1	<1	<1	<1	<1	<1	<1
1,2-dichlorobenzene *	µg/l	<1	<1	<1	<1	<1	<1	<1
1,2-dibromo-3-chloropropane *	µg/l	<1	<1	<1	<1	<1	<1	<1
1,2,4-trichlorobenzene *	µg/l	<1	<1	<1	<1	<1	<1	<1
Hexachlorobutadiene *	µg/l	<1	<1	<1	<1	<1	<1	<1
Naphthalene *	µg/l	<1	<1	<1	<1	<1	<1	<1

Client Reference: C0313

Laboratory Reference: 16462-1

# TOWER WORKS, ARMLEY

## Summary of Chemical Analyses on Water Samples

Date Analysed	Arsenic	Cadmium	Chromium	Lead	Mercury	Selenium	Copper	Nickel	Zinc	Boron
	(µg/l As) DETS 042	(µg/l Cd) DETS 042	(µg/l Cr) DETS 042	(µg/l Pb) DETS 042	(µg/l Hg) DETS 016	(µg/l Se) DETS 017	(µg/l Cu) DETS 042	(µg/l Ni) DETS 042	(µg/l Zn) DETS 042	(µg/l B) DETS 020
05/04/2005		01/04/2005	01/04/2005	01/04/2005	04/04/2005	05/04/2005	01/04/2005	01/04/2005	01/04/2005	04/04/2005
Date Analysed	Total Cyanide (µg/l CN) DETS 021	Free Cyanide (µg/l CN) DETS 021	Elemental Sulphur (µg/l S) DETS 049	Sulphide (µg/l S <sup>2-</sup> ) DETS 024	Sulphate content (mg/l SO <sub>4</sub> ) DETS 066	pH Value DETS 008	Total Phenols * (µg/l) DETS 064	Total PAH # (µg/l)	Total Petroleum Hydrocarbons # (µg/l)	
01/04/2005		01/04/2005	04/04/2005	01/04/2005	04/04/2005	05/04/2005	04/04/2005	05/04/2005	05/04/2005	
Date Analysed	MTBE * (µg/l) DETS 062	VOC * (µg/l) DETS 068	Ammonia as N (mg/l) DETS 019	Chloride (mg/l) DETS 055	COD (mg/l) DETS 032	Electrical Conductivity (µs/cm) DETS 009	Iron * (mg/l) DETS 042			
07/04/2005		07/04/2005	01/04/2005	04/04/2005	01/04/2005	04/04/2005	01/04/2005			

# Water Analysis

PAGE 1 OF 1

DETS/B4406

Ammy

Your Reference:- 16462

Your Order:- PO22859

CAS Number:			647033	647034	647035	647036
Sample Ref			BH1	BH2	BH3	BH101
Detname	Method	Units				
>> TPH SUITE <<*						
TPH by GC (>C6 - C10)*	TPHWB	µg/l	< 10	< 10	< 10	< 10
TPH by GC (>C10 - C20)*	TPHWB	µg/l	< 10	< 10	< 10	< 10
TPH by GC (>C20 - C40)*	TPHWB	µg/l	< 10	< 10	< 10	< 10
TPH by GC (>C6 - C40)*	TPHWB	µg/l	< 10	< 10	< 10	< 10
>> PAH SUITE <<*						
naphthalene	331	µg/l	0.045	0.025	< 0.020	< 0.020
acenaphthene	331	µg/l	< 0.020	< 0.020	< 0.020	< 0.020
fluorene	331	µg/l	< 0.020	< 0.020	< 0.020	< 0.020
phenanthrene	331	µg/l	0.039	0.025	< 0.020	< 0.020
anthracene	331	µg/l	< 0.020	< 0.020	< 0.020	< 0.020
fluoranthene	331	µg/l	0.072	0.04	< 0.020	0.071
pyrene	331	µg/l	0.034	0.024	< 0.020	0.039
benzo(a)anthracene	331	µg/l	< 0.020	< 0.020	< 0.020	0.023
chrysene	331	µg/l	0.039	0.022	< 0.020	0.027
benzo(b)fluoranthene	331	µg/l	< 0.020	< 0.020	< 0.020	0.036
benzo(k)fluoranthene	331	µg/l	< 0.020	< 0.020	< 0.020	< 0.020
benzo(a)pyrene	331	µg/l	< 0.020	< 0.020	< 0.020	0.021
dibenzo(ah)anthracene	331	µg/l	< 0.020	0.025	< 0.020	0.068
benzo(ghi)perylene	331	µg/l	< 0.020	< 0.020	< 0.020	0.035
indeno(123cd)pyrene	331	µg/l	< 0.020	0.024	< 0.020	0.12
PAH (Total)	331	µg/l	0.31	0.24	< 0.200	0.5

## Key

N/S - Not Scheduled

I/S - Insufficient Sample

**CoDa Structures**

Consulting Civil & Structural Engineers  
14 Springfield Court  
GUISELEY  
Leeds LS20 8FD

**PHASE 1& 2 ENVIRONMENTAL RESUMÉ AND  
REMEDICATION STATEMENT FOR A  
RESIDENTIAL DEVELOPMENT SITE AT  
TOWER WORKS, MOORFIELD ROAD, UPPER  
ARMLEY, LEEDS**

## **APPENDIX G**

### **CODA STRUCURES SPECIFICATION FOR EARTHWORKS**



**CONTENTS**

- 1.0 GENERAL
- 2.0 METHOD OF WORKING
- 3.0 EXCAVATION
- 4.0 DISPOSAL OF MATERIAL
- 5.0 FORMATIONS
- 6.0 FILLING
- 7.0 DEFINITION OF MATERIALS
- 8.0 COMPACTION
- 9.0 SUPERVISION
- 10.0 TESTING

**APPENDICES**

- I. ACCEPTABLE EARTHWORKS MATERIALS: CLASSIFICATION
- II. GRADING REQUIREMENTS FOR ACCEPTABLE EARTHWORKS MATERIALS
- III. CHEMICAL CONTAMINATION THRESHOLDS

**1.0 GENERAL**

- 1.1 Where the 'Engineer' is referred to in this Specification it shall mean the Consulting Structural Engineer from CoDA Structures.
- 1.2 The expressions 'Approved' and 'Approval' shall mean the written approval of the Engineer.
- 1.3 The work shall be carried out in accordance with the Engineer's drawings, British Standard BS 6031, and the Department of Transport Specification for Highway Works.
- 1.4 All British Standards, Specifications, and British Standard Codes of Practice or any other Standards referred to in this Specification shall be the latest standards, including all amendments published before the last day of returning tenders, unless otherwise stated.
- 1.5 The works described in this Specification shall be carried out to the entire satisfaction of the Engineer. Clause 1.3 refers to the minimum standard of acceptance that may be supplemented, modified or amplified by this Specification.
- 1.6 In the case of any variance the following order of precedence shall apply: -
- a) CoDA Structures Specification
  - b) CoDA Structures Drawings
  - c) Reference Clause 1.3.

If in doubt about any requirements of the Specification refer to the Engineer.

**1.7 Site Investigation:**

Attached to this specification is the information already obtained from the site in the form of borehole logs, trial pits etc. as is appropriate to the site.

The Contractor should visit the site, inspect the subsoil information and ascertain for himself the nature of the ground, obtain all necessary information in respect of overhead and underground services, obstructions, site access, position of adjacent properties and any other features which may affect the cost of the programme of the work. No claim will be considered arising from lack of knowledge of this respect.

It is the responsibility of the Contractor to satisfy himself as to the suitability of his equipment and methods in the soil conditions existing on the site.

Should the tendering Contractor consider that he requires additional information in order to finalise his tender design, he is at liberty to carry out further site investigation work at his own expense. The Engineer should however be notified of this requirement so that any necessary permissions may be obtained and the Engineer should also be given the opportunity of attending the site during this investigation.

The Contractor should make all necessary enquiries concerning ground water level and allow for variations from this level when working on any part of the site.

### **1.8 Site Clearance:**

Before starting work verify with the Engineer and/or Architect which existing fences, gates, roads, paved areas and other site features are to be removed. Materials arising are to be removed from site subject to approval by the Engineer/Architect.

Before starting work verify with the Engineer and/or Architect that trees, shrubs and hedges are to be removed. Cut down, grub up main roots and fill voids with approved material.

Clear site of bushes, scrub, and undergrowth. Grub up and dispose of large roots.

The Contractor shall satisfy himself that the existing levels of ground shown on the drawings are correct and bring to the notice of the Engineer any discrepancies before any excavation is commenced. The drawings shall be deemed to be correct if no such notice is given to the Engineer.

## **2.0 METHOD OF WORKING**

- 2.1 In formulating his method the Contractor shall take account of ground water, weather, time and other influences on the excavated material and on the stability of unsupported and unprotected faces.
- 2.2 The Contractor shall employ only that plant which is suitable for the soils to be handled. He shall not use plant that damages or reduces the natural strength of the soil, either in its in-situ state or during handling, placing and compacting.
- 2.3 Where excavation reveals a combination of suitable and unsuitable materials the Contractor shall, unless otherwise agreed by the Engineer, carry out the excavation in such a manner that the suitable materials are excavated separately for use in the works without contamination by the unsuitable materials.
- 2.4 The Contractor shall not use explosives without the written permission of the Engineer.

- 2.5 Excavation from a cutting shall not proceed unless sufficient plant is available in the fill area to comply with the compaction requirement of Clause 8.0.
- 2.6 The gradient of slopes formed by cutting and filling areas shall be defined in the Contract and shall be well graded, trimmed and free of loose material.
- 2.7 The Contractor is deemed to have included for temporarily supporting as necessary any services, drains or ducts encountered.
- 2.8 Before starting work submit details or proposed methods for carrying out general excavation, processing (where required), deposition, and compaction for approval.
- 2.9 The Contractor is deemed to have allowed for the deterioration of material as a result of inclement weather and the replacement with suitable material as appropriate.
- 2.10 Before starting work verify with the Engineer which areas of turf are to be retained. At the Contractor's discretion, cost and/or profit, other turf may be either lifted or sold or left to be incorporated with the existing.
- 2.11 Prior to commencement on site the Contractor must prepare and agree a 'Schedule of Dilapidations' supported by photographs of all existing buildings, roads, footpaths, walls, fences etc. adjacent to the site with the Engineer and Statutory Authorities. The Contractor shall include for all costs in respect of this Schedule and allow for providing two additional copies of all written information together with the photographs for the exclusive use of the Employer.

### 3.0 EXCAVATION

#### 3.1 **Materials Arising:**

Unless otherwise noted, all materials arising from the excavations on site shall remain the property of the Employer. When any such materials are approved by the Engineer to be used in the works in substitution for any materials that the Contractor would otherwise have provided, the materials will be paid for by the Contractor at a price to be agreed.

#### 3.2 **Topsoil**

Before beginning general excavation or filling excavate topsoil from required area as indicated in the contract and keep separate from excavated subsoil. (Where available, refer to Architects requirements in respect of herbicidal treatment of topsoil)

#### 3.3 **Benching**

Surfaces of excavations with a gradient greater than 1 in 5 that are to receive filling must have horizontal benches cut to match the depths of compacted layers of filling.

**3.4 Adjacent Excavations:**

Where an excavation encroaches below a line drawing at an angle of 30° from the horizontal from the nearest formation level of another higher excavation, the lower excavation, all work within it and backfilling thereto must be completed before the higher excavation is made.

**3.5 Tolerances:**

Permissible deviations from formation levels: -

Beneath mass concrete foundations	± 25mm
Beneath ground bearing slabs and/or foundations	± 15mm
Embankments and cuttings	± 50mm

**3.6 Earthwork Support:**

The Contractor shall be entirely responsible for the sufficiency of all temporary earthwork support to excavations. Should a fall occur in any excavation, or excessive material be excavated, the Contractor shall carry out at his own expense any reinstatement or repairs which may become necessary as the result of such falls and excess. Any void caused by a fall shall be filled and consolidated by the Contractor at his own expense, to the requirement of the Engineer.

**3.7 Recorded and unrecorded Features:**

Break out old foundations, beds, drains etc. where indicated and to the extent stated on the drawings. Seal off drain ends, remove contaminated earth and disinfect as required by Local Authority. Backfill as specified on drawings.

Where old foundations, beds, basements, filling, tanks, service pipes, drains etc. not shown on the drawings are encountered, obtain instructions from the Engineer before proceeding.

**3.8 Watercourses:**

Temporarily divert as necessary all field drains and other waterways not shown on the drawings and encountered during the excavations and if possible, reinstate on completion.

If not possible to reinstate, obtain instructions.

Existing watercourses that have been diverted and are to be filled must be cleared of all vegetable growth and soft deposits before filling.

**3.9 Excess Excavation:**

Backfill any excavations taken wider than required with approved excavated material. Backfill any excavations for strip foundations taken deeper than required with lean mix concrete.

#### 4.0 DISPOSAL OF MATERIALS

All materials arising from the excavations and not used on the works shall be disposed of as directed by the Engineer.

##### 4.1 Topsoil:

Sufficient excavated preserved topsoil to carry out subsequent topsoiling operations is to be stockpiled in temporary spoil heaps.

The spoil heaps are not to be more than 3m high and are to be treated with an approved herbicide and covered with black polythene sheeting.

The Contractor shall make his own arrangements for the stockpiling of topsoil and suitable material for reuse on the Contract, unless otherwise provided for in the Contract.

Remove surplus topsoil from site, subject to approval by the Engineer.

##### 4.2 Surplus Materials:

The Contractor shall comply with the requirements of the Environment Protection Act 1990 with particular reference to the duty of care for the disposal of waste.

The Contractor shall be responsible for all testing and validation required by the Waste Regulation Authority and shall allow for all costs in connection with the same.

The Contractor shall provide the Employer with copies of all necessary licences, approvals, delivery notes and receipts relating to the discharge of the duty of care for the disposal of waste.

All suitable materials surplus to the Contract requirements and unsuitable materials shall be removed to an appropriately licensed tip to be provided by the Contractor unless other provisions are specifically made in the Contract, subject to approval by the Engineer.

##### 4.3 Water:

The permanent drainage system is not to be used for disposal of water from excavation without approval.

Keep all excavations free from water.

Do not disturb material in or around excavations by pumping operations.

Obtain approval of location of any sumps and fill with approved materials when no longer required.

## 5.0 FORMATIONS

### 5.1 Proof Rolling:

All reduced level surfaces to be rolled to give the compacted effort of 4 No. passes of Stothert and Pitt T182 vibratory roller, or similar approved.

### 5.2 Inspections:

The formation to all works shall be inspected by the Engineer before new work is laid on them. Give the Engineer not less than 24 hours notice when formations will be ready for inspection.

Remove the last 150mm of excavations just before inspection. Trim excavations to required profiles and levels, and remove all loose material.

Unless otherwise instructed seal formations within 4 hours of inspection with concrete and other specified fill.

Obtain instructions if: -

- i) a natural bearing formation of undisturbed subsoil is not obtained at the depth shown on the drawings;
- ii) the formation contains soft or hard spots or highly variable material.

## 6.0 FILLING:

### 6.1 General:

For approval to be given for the filling the Contractor shall be required to demonstrate that the material conforms to Section 7, and that the requisite information within Clause 8.2 has been approved by the Engineer.

Material in fill areas which has deteriorated due to the ingress of surface water or the trafficking of the Contractor's plant shall be removed and replaced at the Contractor's expense.

Fill areas shall be built up evenly over the whole area, unless the Contractor requires otherwise, and sufficient camber shall be maintained at all times to enable surface water to drain from them. The containment or disposal of surface water during the construction period shall be the Contractor's responsibility.

Fill shall be deposited in layers not exceeding 250mm uncompacted thickness.

Ensure that excavations and areas to be filled are free from organic material, loose soil, rubbish and standing water.

Plant employed for transporting, laying and compacting must be suited to the type of material being handled.

Lay differing materials separately so that only one type of material occurs in each layer.

**6.2 Benching in Fill:**

Where during the process of work the difference in level between adjacent areas of filling exceeds 600mm, cut into the edge of higher filling to form benches having a minimum width of 600mm and a height equivalent to the depth of a layer of compacted filling. Spread and compact new filling to ensure maximum continuity with the previous filling.

**6.3 Cold Weather Working:**

Frozen material or materials containing ice are not to be used.

Fill is not to be placed on a frozen surface.

**6.4 Imported Material:**

Sources, types of suitable material and the moisture content at which they may be placed and compacted shall meet the requirements of Appendix I, II, and III and be those approved by the Engineer. Suitable materials and grading are indicated in Section 7.0.

The Contractor shall have delivered to site sample loads of any imported material proposed for use for the approval of the Engineer before any filling material is placed in position. A minimum of 48 hours notice is required for inspection with a further 24 hours for approval. All samples must be accompanied by grading, aggregate crushing value or 10% fines test and Atterburg limits plus natural moisture content.

Materials shall be properly protected from snow, frost and inclement weather and any materials damaged shall be removed from the site immediately and replaced with sound materials.

## **7.0 DEFINITION OF MATERIALS**

Suitable materials shall comprise all that which is acceptable for the contract and more particularly in Clause 7.2.

**7.1 Unsuitable Material:**

- (a) Materials from swamps, marshes etc.
- (b) All organic or part organic material.
- (c) Material susceptible to spontaneous combustion.



- (d) Frozen materials. Such material may be re-defined as suitable when thawing has occurred at the direction of the Engineer.
- (e) Clay liquid limit exceeding 80 and/or plastic index exceeding 55.
- (f) Materials having moisture content greater than the maximum possible to achieve the requirements of Clause 8.1. Such material may be re-defined as suitable when drying has occurred.
- (g) Colliery shales – Unless otherwise agreed with the Engineer following suitable testing.
- (h) Ironstone shales.
- (i) Materials susceptible to frost damage, weathering and mechanical damage.

**7.2 Suitable Materials:**

- a) Bulk Fill:  
As the requirements of Appendices 1 and 11.
- b) Hardcore Fill:  
Hardcore fill shall be 75mm down imported limestone crusher run or any other material approved in writing by the Engineer. The grading shall be agreed and approved by the Engineer.
- c) Granular Fill:  
Imported granular fill shall be used behind retaining walls where indicated on the drawings. The granular fill shall be clean sands, gravels, rock or mixtures thereof. The grading shall be agreed and approved by the Engineer.

No fill materials containing soluble sulphate salts in excess of 2.5g per litre when tested to BS 1377 shall be used within 3 metres of any concrete without specific approval of the Engineer.

**7.3 Topsoil:**

Topsoil shall be the top layer of soil that can support vegetation and shall include turf.

Where required by the contract areas to be landscaped shall be covered with topsoil to the depth specified in the contract documents.

The topsoil shall be reduced to a fine tilth with no stone or other debris with any dimension greater than two thirds of the thickness of the topsoil layer and not upstanding more than 50mm above the upper surface of the topsoil.

**7.4 Rock:**

Rock shall mean those hard geological strata or deposits requiring the use of blasting, wedges, pneumatic tools or approved mechanical rippers for its excavation.

## 8.0 COMPACTION

- 8.1 Fill is to be compacted to end product requirements and shall have a field dry density, measured in accordance with BS 1377: Part 9, equal or greater than 95% of its maximum dry density as determined below.
- 8.2 Before any filling is commenced the Contractor is required to provide the following to the Engineer for approval. Approval by the Engineer will not relieve the Contractor of his obligation within Clause 8.1.
- i The information required within Appendix 1 for classification of the material.
  - ii. The values of maximum dry density and the optimum moisture content obtained in accordance with BS 1377: Part 4 using the 4.5kg rammer or vibrating hammer method as appropriate for each of the fills intended for use (where within any Class of material the fill contains material having different maximum dry densities and optimum moisture contents the Class shall be further sub-divided, by extending the identification system, in order to monitor the compacted density).
  - iii. A graph of density plotted against moisture content from which each of the values in (i) above of maximum dry density and optimum moisture content were determined.
  - iv. The type of excavation and compaction plant he proposes to use.
- 8.3 Material shall be placed at a moisture content appropriate to achieving the requirements of Clause 8.1.
- 8.4 The final formation shall be graded and rolled to the specified levels and tolerances.
- 8.5 Under no circumstances will earthmoving plant be accepted as compaction equipment.

## 9.0 SUPERVISION

- 9.1 The Contractor shall ensure that a competent supervisor is on the site during all working hours.
- 9.2 The Contractor shall allow the Engineer access to the works at any reasonable time and shall afford the Engineer reasonable facilities to enable him to check the adequacy of the works.

- 9.3 In the event of ground or other conditions changing such that the Contractor feels that a change in his plant or his method of working is required for compliance with Clauses 2.8 and 8.2 (iv) he shall give the Engineer thirty six hours notice for approval.

## **10.0 TESTING**

- 10.1 All requisite tests are to be undertaken by a UKAS accredited laboratory.
- 10.2 Tests referred to in Section 8.2 (i) and (ii) are to be undertaken at a rate of 1 per 2000m<sup>3</sup> of bulk fill material and submitted to the Engineer for comment prior to the material being imported or deposited.
- 10.3 Testing to comply with Clause 8.1 is to be undertaken at a rate of one test per 400m<sup>2</sup>, unless otherwise agreed with the Engineer.
- 10.4 The Contractor is to undertake testing at a rate of 1 per 250m<sup>3</sup> and provide sufficient evidence that contamination levels in all imported fill materials do not exceed the criteria laid out in Appendix III.
- 10.5 The Contractor shall test any of the materials used in the works, when so required by the Engineer, and shall at his own expense supply test samples, packed in suitable containers, and forward them to a firm or testing laboratory nominated or approved by the Engineer for such test as the Engineer may require.

## Appendix I

**ACCEPTABLE EARTHWORKS MATERIALS: CLASSIFICATION**

Class			General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and the Project Specification)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and the Project Specification)			
						Property (See Exceptions in Previous Column)	Defined and Tested in Accordance With:	Acceptable Limits Within:	
								Lower	Upper
GENERAL GRANULAR FILL	1	A	Well graded granular material	General Fill	Any material, or combination of materials, other than material designated as Class 3. (Properties i, and ii in the next column shall not apply to chalk)	(i) grading	BS 1377: Pt 2	Appendix 2	
						(ii) uniformity coefficient	See Note 4	10	-
						(iii) mc	BS 1377: Pt 2	See Note 2	
						(iv) SMC of chalk	Clause 634	-	20%
GENERAL GRANULAR FILL	1	B	Uniformly graded granular material	General Fill	Any material, or combination of materials, other than chalk and material designated as Class 3	(i) grading	BS 1377: Pt 2	Appendix 2	
						(ii) uniformity coefficient	See Note 4	-	10
						(iii) mc	BS 1377: Pt 2	See Note 2	
GENERAL GRANULAR FILL	1	C	Coarse granular material	General Fill	Any material, or combination of materials, other than material designated as Class 3. (Properties i, and ii in the next column shall not apply to chalk)	(i) grading	BS 1377: Pt 2	Appendix 2	
						(ii) uniformity coefficient	See Note 4	5	-
						(iii) 10% fines value	Clause 635	50kN	-
GENERAL COHESIVE FILL	2	A	Wet cohesive material	General Fill	Any material, or combination of materials, other than material designated as Class 3. (Properties i, and ii lower limit in the next column shall not apply to chalk)	(i) grading	BS 1377: Pt 2	Appendix 2	
						(ii) plastic limit	BS 1377: Pt 2	-	-
						(iii) mc	BS 1377: Pt 2	PI -4%	Note 2
						(iv) undrained shear strength of remoulded material	Clause 633	See Note 2	
						(v) SMC of chalk	Clause 634	20%	Note 2
GENERAL COHESIVE FILL	2	B	Dry cohesive material	General Fill	Any material, or combination of materials, other than chalk	(i) grading	BS 1377: Pt 2	Appendix 2	
						(ii) plastic limit	BS 1377: Pt 2	-	-

**PROJECT SPECIFICATION FOR  
EARTHWORKS**

					(iii) mc	BS 1377: Pt 2	Note 2	PL -4%
					(iv) undrained shear strength of remoulded material	Clause 633	See Note 2	
2	C	Stoney cohesive material	General Fill	Any material, or combination of materials, other than chalk	(i) grading	BS 1377: Pt 2	Appendix 2	
					(ii) plastic limit	BS 1377: Pt 2	-	-
					(iii) mc	BS 1377: Pt 2	See Note 2	
					(iv) undrained shear strength of remoulded material	Clause 633	See Note 2	
2	D	Silty cohesive material	General Fill	Any material, or combination of materials, other than chalk	(i) grading	BS 1377: Pt 2	Appendix 2	
					(ii) mc	BS 1377: Pt 2	See Note 2	
					(iv) undrained shear strength of remoulded material	Clause 633	See Note 2	

**NOTES:**

1. Clause numbers refer to the Specification for Highway Works Volume 1
2. Refer to Section 8 of the project specification
3. Where BS 1377: Pt 2 is specified for mc, this shall mean BS 812: Pt 3 as appropriate
4. Uniformity coefficient is defined as the ratio of the particle diameters  $D_{60}$  to  $D_{10}$  on the particle size distribution curve, where:  
 $D_{60}$  = particle diameter at which 60% of the soil by weight is finer  
 $D_{10}$  = particle diameter at which 10% of the soil by weight is finer

## Appendix II

**GRADING REQUIREMENTS FOR ACCEPTABLE EARTHWORKS MATERIALS**

Percentage by Mass Passing the Size Shown														
Class	Size (mm)		Size (mm) BS Series							Size (microns) BS Series				Size (microns)
	500	300	125	75	37.5	20	14	2	1.18	600	300	150	63	2
1A			100										<15	
1B			100										<15	
1C	100		10-95								0-25		<15	
2A, 2B			100					80- 100					15- 100	
2C			100					15- 80					15- 80	
2D			100										80- 100	0-20

Appendix III  
CHEMICAL CONTAMINATION THRESHOLDS

Determinant	Max Concentration
<b>Heavy Metal / Metalloids</b>	
Arsenic	37 mg/kg
Cadmium	22 mg/kg
Chromium (III)	910 mg/kg
Chromium (VI)	21 mg/kg
Lead	200 mg/kg
Mercury	40 mg/kg
Nickel	180 mg/kg
Selenium	250 mg/kg
Boron	290 mg/kg
Copper	2400 mg/kg
Zinc	3700 mg/kg
<b>PAH 16EPA</b>	
Acenaphthene	210 mg/kg
Acenaphthylene	170 mg/kg
Anthracene	2400 mg/kg
Benzo (a) Anthracene	7.2 mg/kg
Benzo (a) pyrene	5.0 mg/kg
Benzo (b) + (k) fluoranthene	2.6 mg/kg
Benzo (g, h, i) perylene	320 mg/kg
Chrysene	15 mg/kg
Di-benzo (a, h) anthracene	0.24 mg/kg
Indeno (1, 2, 3-cd) pyrene	27 mg/kg
Fluoranthene	280 mg/kg
Fluorene	170 mg/kg
Napthalene	2.3 mg/kg
Phenanthrene	95 mg/kg
Pyrene	620 mg/kg
<b>Others</b>	
pH	<5
Sulphate	500 mg/l
Sulphide	250 mg/lg
<b>Phenolics</b>	
Phenol	280 mg/kg
<b>General Inorganics</b>	
Cyanide (free)	36 mg/kg
<b>Aliphatic Hydrocarbons</b>	
TPH Aliphatic > EC5-6	42 mg/kg
TPH Aliphatic > EC6-8	100 mg/kg
TPH Aliphatic > EC8-10	27 mg/kg
TPH Aliphatic > EC10-12	130 mg/kg
TPH Aliphatic > EC12-16	1100 mg/kg
TPH Aliphatic > EC16-35	65000 mg/kg
TPH Aliphatic > C35-44	65000 mg/kg
TPH Aromatic > EC5-7	70 mg/kg
TPH Aromatic > EC7-8	130 mg/kg
TPH Aromatic > EC8-10	34 mg/kg
TPH Aromatic > EC10-12	74 mg/kg
TPH Aromatic > EC12-16	140 mg/kg
TPH Aromatic > EC16-21	260 mg/kg
TPH Aromatic > EC 21-35	1100 mg/kg
TPH Aromatic > EC35-44	1100 mg/kg
Benzene	0.87 mg/kg
Toluene	130 mg/kg
Ethylbenzene	47 mg/kg
o - Xylene	45.2 mg/kg
m - Xylene	59 mg/kg
p - Xylene	56 mg/kg