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KEYLAND DEVELOPMENTS LTD

FORMER NORTH BIERLEY WWTW

PHASE II GEO-ENVIRONMENTAL ASSESSMENT

NOVEMBER 2017

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DATE ISSUED: November 2017

JOB NUMBER: SH10534

REPORT NUMBER: RPT-002C

KEYLAND DEVELOPMENTS LTD

FORMER NORTH BIERLEY WWTW
PHASE II GEO-ENVIRONMENTAL ASSESSMENT

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Document Record

Issue No.	Date	Details
1	22 June 2012	Draft submitted to client for comment
2	13 November 2015	Revised layout and updated risk assessment
3	1 December 2017	Revised layout and updated risk assessment

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1 INTRODUCTION

1.1 Instruction

1.1.1 This report is prepared in accordance with instruction from Mr M Naylor of KeyLand Developments Ltd dated 13 May 2015 and in accordance with our standard terms and conditions as attached at Appendix I. This follows a proposal dated 12 May 2015 by Wardell Armstrong LLP.

1.2 Site Location

1.2.1 The site is North Bierley WWTW**,** and is located as shown on the site location plan, Drawing No. SH10534-001 (1:50,000 scale), and more detailed site plan SH10534-008 (1:2,500 scale). The site is located approximately 6km south of Bradford city centre, adjacent to the junction of the M606 and M62 motorways and comprises approximately 22ha of a disused wastewater treatment works and fields**.** The site is bounded by the M606 motorway to the west, Hunsworth Beck to the east, the M62 motorway to the south and fields to the north.

1.3 Purpose and Basis of Report

1.3.1 The purpose of this report is to present the findings of an intrusive site investigation that was carried out to further identify and examine the potential contamination issues identified in a previous environmental assessment, carried out by URS Corporation Ltd (report ref. 44320048, November 2006), that may arise in connection with present use or proposed use of the site and to determine geotechnical information of relevance to the proposed use of the site.

1.4 Proposed Site Use

1.4.1 It is proposed that the site is redeveloped for mixed residential and commercial land uses.

2 PREVIOUS INVESTIGATIONS

2.1 Introduction

2.1.1 A Phase I Environmental Site Assessment was carried out by URS Corporation Ltd in November 2006 (report ref. 44320048). At the time of the report the site was an operational WWTW. Historical plans show that a sewage works was present on part of the site in 1893. The Valley Pit Coal and Ironstone workings were also present in the west of the site at this time along with an Old Coal pit in the south. A tramway is reported extending across the western part of the site. By 1908 the pits were reported to be closed and the sewage works had expanded. Subsequent maps show further expansion and changes to the layout up until 2004.

2.1.2 The site is situated on Lower Coal Measures which are considered a minor aquifer. Alluvium drift deposits are indicated as likely to be present along the eastern boundary associated with the Hunsworth Beck. It is also likely that made ground of an unknown nature and thickness will be present on the site associated with the collieries and former layouts.

2.1.3 The Hunsworth Beck is located adjacent to the eastern site boundary. This was given a quality grading of Grade E (poor) in 2000. The report indicates that eastern parts of the site lie within an area at risk of extreme flooding (Flood Zone 3).

2.1.4 The conceptual model identifies sources of contamination from former on-site operations (contamination resulting from settlement tanks, sludge beds, organic matter, fuels), nearby off-site operations (chemical works, rope works, cotton mill, mills, garages, coal pits etc) and made ground.

2.2 Preliminary Conceptual Site Model

2.2.1 A preliminary conceptual site model was presented in the Phase I Environmental Site Assessment. The conceptual model identifies sources of contamination from former on-site operations (contamination resulting from settlement tanks, sludge beds, organic matter, fuels), nearby off-site operations (chemical works, rope works, cotton mill, mills, garages, coal pits etc) and made ground.

2.2.2 The report concludes that there are likely to be pollutant linkages present at the site. However the report allocates a low to moderate risk of significant harm based on a continued land use. The report indicates that should the use of the site change a higher risk may be applicable.

2.2.3 The updated conceptual model is in Section 9.

3 GEOLOGICAL AND HYDROGEOLOGICAL SETTING

3.1 Geology

3.1.1 The assessment of the geology of the site is based on the published geological mapping sheet (Sheets Yorkshire 231NE and 232NW (Solid and Drift Editions), 1:10,560 scale) supplemented by the geological memoir, topographical plans and site visit. A typical summary section is provided in Table I below along with other geological data.

TABLE I – Geological Summary

Strata	Description
Made ground.	Made ground of an unknown nature and thickness associated with past site uses is likely to be present across the site.
Natural superficials.	An unknown thickness of alluvium may be present to the east of the site adjacent to Hunsworth Beck.
Solid strata.	Sandstones, mudstones and shales of the Lower Coal Measures.
Dip and dip direction.	Sub-horizontal.
Evidence of faulting.	Two faults trending NE-SW are located to the north of the site; the north is the downthrow side.

3.2 Hydrogeology

3.2.1 Hydrogeological information from the Environment Agency changed in April 2010 in order to comply with the Water Framework Directive. Where possible, this report considers both the old and new information obtained from:

- Groundwater Protection Policy and Groundwater Vulnerability maps published by the Environment Agency;
- Hydrogeological maps published by the British Geological Survey; and
- Groundwater Protection: Policy and Practice (Environment Agency, 2006).

3.2.2 This information indicates the site to be underlain by sandstones, mudstones and shales of the Lower Coal Measures which are classified as a Secondary A Aquifer.

3.2.3 Secondary A aquifers are generally fractured or potentially fractured formations and do not have a high primary permeability. Although not producing large quantities of water for abstraction, they are important for local supplies and may supply base flow to rivers.

3.2.4 The site does not lie within a source protection zone.

3.3 Hydrology

Surface Water Features

3.3.1 The nearest graded surface watercourse is Hunsworth Beck, which forms the eastern boundary of the site. The Environment Agency has given Hunsworth Beck a General Quality Assessment (Chemistry) rating of E (Poor).

Flooding

3.3.2 The Environment Agency maintains national flood maps based on ground levels, predicted flood levels, information on flood defences and local knowledge. The flood maps show the predicted likelihood of flooding in an area in the context of current and also the proposed land use considered in development planning.

Flooding – Existing Use

3.3.3 For existing land use purposes, the likelihood of flooding is classed as very low, low, medium or high based on the Environment Agency map entitled Risk of Flooding from Rivers and Sea. Where applicable, these flood risk categories take into account the effect of any flood defences that may be in the area.

3.3.4 The majority of the site is within a very Low risk area. The chance of flooding each year is less than 1 in 1,000 (0.1%).

3.3.5 An area to the east of the site towards the Hunsworth Beck is within a Low risk area where the chance of flooding is between 1 in 1000 (0.1%) and 1 in 100 (1%) and is within a Medium risk area where the chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%).

Flooding – Planning Purposes

3.3.6 For planning purposes, the likelihood of flooding is classed as low, medium or high based on flood zones identified in National Planning Policy Guidance (2014) attached to the National Planning Policy Framework (2012) and the EA map

entitled Flood Map for Planning (Rivers and Sea). The Flood Map for Planning would only apply if the site was intended for redevelopment.

3.3.7 The majority of the site is within Zone 1 and has a low probability of flooding. The chance of flooding each year is less than 0.1% (1 in 1,000).

3.3.8 An area to the east of the site towards the Hunsworth Beck is within Zone 2 and has a moderate probability of flooding. The chance of flooding each year is between 1.0% (1 in 100) and 0.1% (1 in 1,000).

3.3.9 A thin strip along the Hunsworth Beck is within Zone 3 and has a high probability of flooding. The chance of flooding each year is 1.0% (1 in 100) or greater.

3.4 Mining

General

3.4.1 Research of the mining setting is based on examination of the published topographical and geological information as described in Section 2 and 4 of this report along with other mining archive information. A Coal Authority report for the site has been obtained, dated 23 November 2010 and is attached at Appendix II, a visit was also made to the Coal Authority abandoned mine records office at Mansfield on 25 November 2010.

Surface Workings

3.4.2 Research of topographical, geological and other archive mining records has indicated no evidence of surface workings within the vicinity of the site..

Shallow Underground Workings

3.4.3 From the enquiries made and examination of the geological information there is evidence of shallow underground mining activity beneath the site. Reference to the abandonment plans indicate that these shallow workings are likely to be in the Shertcliffe Bed.

Potential Surface Instability

3.4.4 Most of the ancient and frequently unrecorded mining activity of the nineteenth and earlier centuries was carried out by the room and pillar system. The problems of potential surface instability over such old mine workings arises when the process of upward collapse under gravity penetrates through the solid strata,

either to the surface sub-soil, to superficial deposits and/or tipped material above.

3.4.5 The height above the working to which the collapse process can take place before total choke-filling occurs, is generally governed by the volume of the original tunnel or roadway, and by the change in volume of the collapsed material. The greater the volume of the tunnel or void (ie, the greater its height and width), or the smaller the change in volume of the collapsed material, the higher the process of collapse is likely to take place. The change in volume of the collapsed materials may be as little as 10% and as much as 50%. Therefore, the ultimate height of collapse through solid strata is not likely to be less than twice or more than ten times the thickness of the seam mined.

3.4.6 The above leads directly to a definition of "shallow" old mine workings and to the delineation of problem areas. Research of existing records, an appreciation of the caving or collapse, and the characteristics of the solid strata overlying such old workings, allows the evaluation of problems and appropriate action.

Deep Mining

3.4.7 The Coal Authority report indicates evidence of deep underground mining activity beneath the site in the Blocking and Better Bed Coal seams.

3.4.8 Deep mining is generally defined as that mining undertaken at depths greater than about 30m below rockhead.

3.4.9 Whilst ground movements would have occurred due to the mining of any deeper seams, surface subsidence effects should have been largely contemporaneous with the mining. The site is considered stable in respect of any past deep mining.

3.4.10 There are no current mining activities affecting the site and the site does not lie within influencing distance of any presently known planned future workings.

Mine Entries

3.4.11 The Coal Authority report has indicated that there are ten recorded mine entries on or within influencing distance of the site. Only one of the mine entries is noted to have had any treatment; entry 417427-005 (to the north west of the site) was treated on behalf of the Coal Authority with mass concrete following its collapse in 1997.

Mine Shafts

3.4.12 In old abandoned mining areas, it was common practice to backfill the abandoned shafts either completely or, to a staging built at some level above the shaft bottom with loose colliery refuse. In many cases such old mine shafts have subsequently been covered over and have become overgrown and visually indistinguishable. Where no special plugging precautions were taken to seal off the shaft fill material from old workings or, where a shaft was filled on to staging in the shaft, the fill material can run into the old workings or into the empty shaft space beneath the staging. In both cases, the result is the sudden appearance of a collapse hole in the ground the diameter of which may be considerably greater than that of the original shaft.

3.4.13 In addition to the recorded mine entries at or near the site, the possibility of there being additional unrecorded mine entries cannot be entirely discounted. During development a careful watch should be maintained for any feature which may represent an unrecorded mine entry, such as circular brickwork or anomalous areas of fill/timber. Should any such feature be identified it should be reported, investigated and acted upon as necessary.

Coal Mine Gas

3.4.14 Examination of the mining and geological information indicates that it is possible that gases migrating from now abandoned coal mine workings may affect the site.

4 SITE INVESTIGATION

4.1 Introduction

4.1.1 The current investigation was designed around the preliminary conceptual site model that identified all potential sources, pathways and receptors. This allowed a targeted sampling approach to be undertaken and provide general coverage of the site. Results of the investigation are used to revise the conceptual site model, establish whether linkages identified are plausible and establish the level of risk associated with the site.

4.1.2 The site investigation was also carried out to assess the geotechnical nature of the ground. The site investigation comprised of seven cable percussion boreholes, three of which had rotary follow-on, ten window sample boreholes and nineteen trial pits across the site area. Locations were positioned to provide complete coverage of the whole site. Site investigation locations are shown on Drawing SH10534-008 (1:2,500 scale).

4.1.3 The investigation including sampling techniques was carried out in accordance with BS10175:2001 Investigation of potentially contaminated sites – code of practice.

4.2 Scope

4.2.1 The investigation was designed as a series of tasks that are summarised below in Table II.

TABLE II – Summary of Tasks

Task	Summary	Date(s)
Preparatory Work	Setting up site investigation contract, including services enquiries, contractor health & safety document and site meeting with contractor/client.	November 2010- May 2011
Intrusive site investigation	7 Cable percussion boreholes to a nominal depth of 10m with rotary open-hole follow-on in 3 boreholes to 30mbgl. 10 window sample boreholes to a nominal depth of 5m and 19 trial pits to a nominal depth of 4m. Installation of monitoring wells for groundwater and gas.	16th May- 20th May 2011

TABLE II – Summary of Tasks		
Task	**Summary**	**Date(s)**
Laboratory analysis	Chemical / geotechnical testing in accredited laboratory – 34 soil and 5 groundwater samples.	20th May – 24th June 2011
Monitoring	Gas and water level monitoring.	19th May 2011- 17th May 2012

4.2.2 The investigation was completed in accordance with Construction (Design and Management) (CDM) Regulations 2007 and a site specific Health & Safety plan. Contractors used during this project include; JB Site Investigations (cable percussion and rotary drillers), Exploration Ltd (window sample borehole drillers), Pudsey Plant Hire (trial pits), ALcontrol Laboratories (geochemical analysis) and Professional Soils Laboratory (geotechnical analysis). Drilling was completed using a variety of methods and these are discussed in more detail below.

4.3 Cable Percussion Boreholes

4.3.1 Cable percussion drilling was completed under the part-time supervision of a Wardell Armstrong engineer. Seven cable percussion boreholes (BH1-BH7) were drilled to a maximum depth of 10.7m below ground level (bgl). Locations (see Drawing No. SH10534-008) were positioned provide widespread coverage of the site.

4.3.2 Cable percussion borehole logs are attached at Appendix III.

4.4 Rotary Open-Hole Boreholes

4.4.1 Rotary open-hole drilling was completed under the part-time supervision of a Wardell Armstrong engineer. Three rotary open-hole boreholes (BH4-BH6) were drilled from the base of the cable percussion boreholes to depths of either 16.7m bgl (BH6) or 30m bgl (BH4 and BH5). Locations (see Drawing No. SH10534-008) were positioned to the south of the site in the area of suspected shallow mine workings.

4.4.2 Rotary open-hole drilling borehole logs are attached at Appendix III.

4.5 Window Sample Boreholes

4.5.1 Window sample boreholes were completed under the full-time supervision of a Wardell Armstrong engineer. Ten window sample boreholes (WS101-WS110) were drilled to depths of between 2m bgl and 5m bgl. Drilling beyond these depths was not possible due to shallow rockhead or underground obstructions. Locations (see Drawing No. SH10534-008) were positioned to provide widespread coverage of the site.

4.5.2 Window sample borehole logs are attached at Appendix IV.

4.6 Trial Pit Excavations

4.6.1 Trial pit excavations were completed under the full-time supervision of a Wardell Armstrong engineer. Nineteen trial pits (TP101-TP119) were excavated to depths of between 1.4m and 3.6m bgl using a JCB 3CX Sitemaster hydraulic excavator. Excavations beyond these depths were not possible due to difficult excavation conditions brought about by stiff clay and/or boulders or to carry out soakaway tests. Locations (see Drawing No. SH10534-008) were positioned to provide widespread coverage of the site.

4.6.2 Trial pit logs are included at Appendix V.

4.7 Ground Gas and Groundwater Monitoring Standpipes

4.7.1 Nine gas and groundwater monitoring standpipes were installed by the cable percussion, rotary open-hole or window sampling drilling contractor at locations BH1, BH5, BH6, BH7, WS102, WS104, WS105, WS107 and WS110.

4.7.2 The standpipes were completed with 50mm diameter screen and casing between 4m and 10m bgl, with the screened section extended from the base to 1.00m bgl in boreholes BH1, BH7, WS102, WS104, WS105, WS107 and WS110 and from 9m to 1m bgl in boreholes BH5 and BH6 as 1m of plain standpipe was installed from the base to 9m bgl in these boreholes to provide a sump for groundwater monitoring purposes. A filter pack of 4-6mm washed gravel was placed in each well annulus to just above the screened section. Thereafter the annulus was sealed to the surface with bentonite. Installations were completed with concreted headworks to protect the inner casing and gas valves. All installations were supervised by a Wardell Armstrong engineer on a part-time basis.

4.7.3 After installation, all water-monitoring wells were developed using a submersible pump or bailer. Development was continued to until the pH, temperature and electrical conductivity of the purged water had stabilised (i.e. until any two successive reading are within 10% of each other), the water in the wells was visibly clean or until five well volumes of water had been removed.

4.7.4 Newly installed monitoring boreholes were left for 24 hours to allow gas levels to equilibrate. Data for methane, carbon dioxide, oxygen and flow rate was collected using a portable infrared gas analyser. Atmospheric pressure was recorded at the time of monitoring. Soil gases were analysed and assessed following guidance from:

- NHBC Report No. 4, Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present (March, 2007);
- BS 8485, Code of practice for the characterization and remediation of ground gas in brownfield developments (October 2007); and
- CIRIA C665, Assessing Risks Posed by Hazardous Ground Gases to Buildings (2007).

4.8 Sampling and Testing

Sampling and Chemical Analysis of Soils

4.8.1 Thirty four disturbed samples of material from beneath the site were collected for laboratory analysis. Samples were taken at regular depths, changes in strata and any discrete horizons with a high potential to retain contaminants and logged in general accordance with BS ISO 14688:2002 and BS ISO 10381:2002. Samples were obtained using a fresh pair of nitrile gloves.

4.8.2 Samples scheduled for analysis of organic contaminants were placed in amber bottles with a minimum of headspace. The bottles were immediately sealed with polytetrafluoroethylene (PTFE) lined caps and labelled. The remaining small disturbed samples were placed in polypropylene tubs with a minimum of headspace, sealed with airtight polypropylene 'snap-on' lids and labelled. The labels detailed individual sample number, location, depth and sampler identity.

4.8.3 Collected samples were stored away from sunlight in temperature controlled conditions and transported by courier to ALcontrol Laboratories. Chain of custody forms were completed for all samples sent to the laboratory. The forms

detailed individual bottle identification number and sample location. The forms were signed on release by the Wardell Armstrong field engineer and upon receipt by the laboratory.

4.8.4 The laboratory analyses scheduled were selected to establish the type, level and distribution of the possible harmful contaminants that may be present on the site given its past and current uses. In order to provide cost effective analysis, solid samples were analysed for a number of substances depending on depth, matrix and a visual assessment of ground conditions. The analysis scheduled is presented in Table III.

TABLE III – Summary of Sample Analysis

Substance	No. Soil Samples	No. Groundwater Samples	No. Leachate Samples
A standard suite of industrial pollutants including common metals (arsenic, water-soluble boron, cadmium, chromium, chromium^{VI}, copper, lead, mercury, nickel, selenium, and zinc), pH, sulphate, sulphide, sulphur, thiocyanate, total cyanide and phenols.	30	4	6
Petroleum hydrocarbons (C_5 – C_{40} with aliphatic/aromatic class separation and carbon banding), BTEX, MTBE.	10	5	3
Polycyclic Aromatic Hydrocarbons (PAH).	12	4	6
Volatile Organic Compounds (VOCs).	10	4	-
Semi-Volatile Organic Compounds (SVOCs).	18	5	-
Poly-chlorinated Biphenyl (PCBs).	4	-	-
Soluble Sulphate (2:1).	23	-	-
Total Organic Carbon (TOC).	12	-	-
Asbestos.	13	-	-
Hardness.	-	4	-

4.8.5 The results of the chemical analyses are attached at Appendix VI.

Sampling and Chemical Analysis of Groundwater

4.8.6 Five groundwater samples were collected for laboratory analysis from groundwater monitoring installations using procedures that ensured the collection and preservation of sample quality.

4.8.7 Prior to sampling, each well was purged until three well volumes of water had been removed or the well became dry.

4.8.8 All water samples were taken using disposable bailers or disposable peristaltic pump tubing, to avoid cross-contamination, with a bottom pour tap, to minimise the loss of more volatile components. Samples were placed in laboratory prepared amber bottles with a minimum of headspace. The bottles were immediately sealed with polytetrafluoroethylene (PTFE) lined caps and labelled. The labels detailed individual sample number, location, depth and sampler identity. The analysis scheduled is presented in Table III.

4.8.9 The results of the chemical analyses are attached at Appendix V.

4.9 Quality Assurance and Quality Control

4.9.1 The soil and groundwater samples were collected, transferred to the laboratory under chain of custody and analysed to ensure traceability and reliability of analytical results. Based on the laboratory QA data the analytical results are considered acceptable for interpretative use.

4.10 Limitations of Site Investigation

4.10.1 It should be noted that the interpretation of the results of the physical site investigation is based on a limited number of investigation points. The locations and numbers of the investigation locations were governed by the physical state of the site and the location of known services at the time of the investigation. Although reasonable inferences have been made during the interpretation, it is possible that variances in the thickness, distribution and physical/chemical characteristics of the strata present will exist.

5 RESULTS OF SITE INVESTIGATION

5.1 Ground Conditions

Made Ground

5.1.1 Made Ground was present in the majority of borehole, window sample and trial pit locations on site; exceptions to this were borehole locations BH1 and BH3, window sample location WS110, and trial pit locations TP108, TP112, TP113, TP114 and TP116. The made ground on site comprised four horizons and varied in thickness from 0.15m in trial pit TP115 to 8.3m in borehole BH6.

5.1.2 The first horizon of made ground was a soft to firm, orange to black, locally cobbly, sandy, gravelly clay. The second horizon of made ground consisted of a loose to dense, grey or brown, locally clayey or cobbly, sandy gravel or gravelly sand. The gravel fraction in these two horizons consisted of a number of constituents including sandstone, mudstone, shale, coal fragments, brick, typical aggregate, concrete, tarmac and wood fragments. The third horizon of made ground consisted of a loose to medium dense, grey to black, locally slightly clayey, sandy gravel of shale. The fourth horizon consisted of a loose, black, locally slightly clayey, sandy gravel or gravelly sand. The gravel fraction in this horizon consisted of sandstone, mudstone, shale, coal fragments, brick, typical aggregate, concrete, tarmac and ash. This horizon was observed in window sample borehole WS108 and trial pits TP110, TP111 and TP115. Ash was also observed in the made ground in borehole BH7 and trial pit TP105.

5.1.3 The thickness of the made ground was unproven in window sample borehole WS109 due to drilling refusals caused by obstructions and in trial pits TP101, TP102, TP103, TP106 and TP107 due to the extent of the made ground and limitations of the excavator.

Natural Strata

5.1.4 The natural materials encountered during the intrusive investigation comprised a 3.5m thickness of predominantly soft to stiff, orange-brown mottled grey, locally cobbly with rare boulders, sandy, gravelly clay. The gravel fraction consisted of angular to subrounded, fine to medium grained sandstone, shale, mudstone and coal fragments. Cobbles and boulders were typically subangular to subrounded, fine to medium grained sandstone.

5.1.5 Rockhead was encountered at all borehole locations and at window sample borehole locations WS102 and WS105 during the intrusive investigation and consisted of sandstone and mudstone. The rock was proven to 30m bgl by rotary open-hole drilling. All natural strata were interpreted as the weathering profile of the underlying Middle Coal Measures geology.

5.1.6 A summary of the strata beneath the site is shown in Table IV.

Table IV – Summary of strata beneath the site

Depth to base of strata (mbgl)			Mean Thickness (m)	Typical Description
Max.	Min.	Mean		
0.5	0.1	0.21	0.21	Topsoil
8.4*	0.4*	2.55*	2.42*	Made Ground
1.4*	10.5*	7.27*	3.47*	Natural Material
*	*	*	*	Rockhead

* Base of strata not always proven.

5.2 Groundwater

5.2.1 Groundwater was encountered during the intrusive investigation works in boreholes BH5 and BH6 and in window sample boreholes WS102, WS105 and WS110. During development and purging the water was initially cloudy but became increasingly clear until visibly clean with the increasing volume removed. Recharge was observed to be moderate in all monitoring wells. No visual or olfactory evidence of contamination was observed in the water extracted from the wells.

5.2.2 Water levels were measured on six occasions using a product/water interface probe. No free phase product was detected. Water elevations measured relative to a site datum (ground level) are shown in Table V.

Table V						
Borehole Identification	**Date and Depth to Water** (m bgl)					
	19/5/11	1/6/11	22/7/11	3/4/12	20/4/12	17/5/12
BH1	DRY	DRY	DRY	DRY	DRY	DRY
BH5	-	8.42	8.94	7.73	7.49	7.41
BH6	-	9.56	9.60	9.07	8.50	8.70
BH7	-	DRY	DRY	DRY	5.13	5.37
WS102	4.58	4.90	4.80	DRY	2.04	DRY
WS104	DRY	DRY	DRY	DRY	DRY	DRY
WS105	2.17	2.24	2.10	1.61	DRY	1.481
WS107	DRY	DRY	DRY	DRY	3.50	DRY
WS110	3.01	4.50	3.21	-	-	-

5.2.3 Analysis of the reduced groundwater levels is inconclusive and it is assumed that the overall groundwater flow is to the south east.

5.3 Soakaway Tests

5.3.1 Five soakaway tests were carried out on site in trial pits TP101 and TP103 (to the east of the site), TP105 (to the south of the site), TP108 (to the north of the site) and TP113 (to the west of the site). The results indicate that soil in the vicinity of:

- TP101 has an approximate infiltration rate of 2.708 x 10^{-4}m/s; and
- TP103 has an approximate infiltration rate of 2.197 x 10^{-4}m/s.

5.3.2 However, no infiltration was observed in the soakaway tests in trial pits TP105, TP108 and TP113.

5.3.3 These infiltration rates indicate that the made ground beneath the former wastewater treatment works area of the site is likely to be suitable for the construction of soakaways but the natural materials observed to the west and north of the site are not suitable for the construction of soakaways.

5.3.4 The results of the soakaway tests are attached at Appendix IX.

5.4 Ground Gas

5.4.1 There are several regulatory authorities that require the assessment of ground gas on potentially contaminated sites. The main stakeholders are Building Control, Local Authority Planning and Environmental Health (Contaminated Land Officers). CIRIA have published guidance (C665, 2007) on risk assessment for new buildings and existing structures on ground with potentially hazardous gassing regimes. This guidance indicates that a semi-quantitative risk assessment for ground gas can be completed using Gas Screening Values (GSV) and consideration of the conceptual site model.

5.4.2 Six gas monitoring rounds were completed over a 12 month period. Three sets of readings were recorded at low and falling atmospheric pressure. Gas monitoring results are attached at Appendix X.

5.5 Observations of contamination

5.5.1 Observations of soil contamination noted during the site investigation are presented on the borehole, window sample borehole and trial pit logs (Appendices III, IV and V). These can be summarised as follows:

- Ash was observed in made ground in borehole BH7, window sample borehole WS108 and trial pits TP105, TP110, TP111 and TP115 at ground level to depths of up to 4.3mbgl.

5.6 Shallow mining

5.6.1 No intact coal seams were encountered during the rotary drilling in the south of the site. However, there was evidence of broken/soft ground accompanied by loss of flush in BH6 which may indicate the presence of workings. The broken ground was observed at depths of between 11.3m and 16.7m bgl. The borehole collapsed at 16.7m bgl and drilling was terminated at that depth.

5.6.2 Boreholes BH4 and BH5 were drilled to a depth of 30m bgl with no evidence of shallow mining.

6 GUIDANCE ON CONTAMINATION RISK ASSESSMENT

6.1 Introduction

6.1.1 The following section aims to assess the magnitude and significance of potential risks to human health, surface water, groundwater, ecosystems and buildings from contaminated soil and groundwater. The assessment provides information that is fit for purpose given the regulatory context and completed in accordance with UK best practice. A summary of the risk assessment process is presented below. More detailed information on risk assessments is contained in various reports published by the Environment Agency and DEFRA including:

- Contaminated Land Science Reports (SR2 to 4); and
- Model Procedures for the Management of Land Contamination (CLR 11).

6.2 General Soil Contamination Guidance

6.2.1 The Environment Agency (EA) has a statutory duty to ensure the protection of the environment and the remediation of contaminated land and groundwater. In order to achieve this, the EA employs the principle of risk assessment - the risk of a contaminant source causing harm or pollution via a given pathway to an identified receptor. If one of the source-pathway-receptor linkages is not considered to be present then there is deemed to be no risk. However, if a contaminant source is present and there is a pathway for that contaminant to reach a receptor then there is a potential risk of significant harm to the receptor. Therefore, if the source-pathway-receptor linkages are complete, there is a requirement to undertake a risk assessment related to the receptor of concern, be it human health, surface water, groundwater, buildings or other property or ecological issues.

6.2.2 The first stage in the assessment of a site is development of a conceptual model. This includes consideration of all possible sources of contamination on the site, the potential receptors and whether there is a plausible pathway between the two. This allows evaluation of whether further more complicated risk assessment for an identified receptor is necessary. A site-specific conceptual model is presented in previous reports and is revised here in Section 9 based on the findings of the site investigations.

Generic Assessment Criteria

6.2.3 In March 2002 the Environment Agency and the Department of Environment, Food and Rural Affairs (DEFRA) released a package of guidance to assess the health risks posed by contaminated land as part of the statutory framework for contaminated land. The Contaminated Land Exposure Assessment (CLEA) model is a framework for estimating the likely exposure to contaminants in soil as part of the wider approach of the UK's assessment of risk and suitability for use. The methodology adopted for CLEA builds upon the source-pathway-receptor model for the assessment of risk. Following the CLEA model, generic Soil Guideline Values (SGVs) were developed to act as triggers for intervention in a number of end-use scenarios. The Environment Agency commenced a programme looking at 55 contaminants. The CLEA methodology has been updated and the SGVs were withdrawn from use in August 2008. New SGVs have been published by the EA since March 2009 onwards.

6.2.4 The CLEA SGVs are derived using specific parameters, which may not be relevant to each site. The CLEA software allows parameters to be changed and site specific assessment criteria (SSAC) can be developed. The CLEA methodology also uses a statistical evaluation of all the data collected in order to give an overall impression of the site and therefore the exposure to a modelled receptor rather then using individual contaminant values, which may vary dramatically across the site. The statistical tests calculate a normalised upper bound value for the site as a whole and also give an indication of whether a particular data value is a statistical outlier (potential hotspot) or whether it is part of the whole population of samples.

6.2.5 The Soil Guideline Values derived from the CLEA model are intended for use in assessing the risk to long term human users of the site. There is also a requirement to consider the potential for harm from short-term exposure to contaminants at the site, e.g. to construction workers who may be exposed to risk via inhalation of dust or dermal contact with the contaminated material.

6.2.6 In the absence of SGVs published under the new CLEA methodology, Land Quality Management (LQM) and the Chartered Institute of Environmental Health (CIEH) published their third edition of generic assessment criteria (GAC) for 82 inorganic and organic substances in January 2015 which are termed Suitable 4 Use Levels or S4UL's. In addition, GAC values for 30 separate organic compounds were

published in December 2009 by the Environmental Industries Commission (EIC), the Association of Geotechnical and Geoenvironmental Specialists (AGS) and CL:AIRE. These GAC values have been derived in the same vein as SGVs and are intended to be used in the same manner. Additionally, the GAC values have been produced for varying soil organic matter content (i.e. 1%, 2.5% and 6%).

Category 4 Screening Levels (C4SLs)

6.2.7 Revised Statutory Guidance to support Part 2A of the Environmental Protection Act 1990 was published in April 2012 by DEFRA. This Guidance introduced a new four-category system for classifying land under Part 2A for cases of a Significant Possibility of Significant Harm to human health:

- Category 1 includes land where the level of risk is clearly unacceptable;
- Category 2/3 border defines the point at which land is determined under the legislation;
- Category 3 would include sites that regulators conclude should not be designated as contaminated under Part 2A; and
- Category 4 includes land where the level of risk posed is acceptably low.

6.2.8 Land is determined as 'contaminated land' under Part 2A if it falls within Categories 1 or 2.

6.2.9 In March 2014, DEFRA published C4SLs for four generic land-uses comprising residential, commercial, allotments and public open space for six substances – arsenic, benzene, benzo(a)pyrene, cadmium, chromium (VI) and lead.

6.2.10 The C4SLs have been derived in support of Defra's revised Statutory Guidance for Part 2A of the Environmental Protection Act 1990 but it was anticipated that they could be used under the planning regime as generic screening criteria within a GQRA, albeit describing a higher level of risk than the currently or previously available SGVs.

6.2.11 In the case of lead where the SGV was removed in 2008 and was not replaced, the C4SL for lead is considered a suitable generic screening value.

6.3 Statistical analysis

6.3.1 Statistical analysis has been completed to identify if the data set for each substance tested contains outliers, has as normal or non-normal distribution and if there is significant evidence that the mean concentration, as defined by the

95% upper confidence level (UCL), is less than the adopted screening value. This process follows the CL:AIRE/CIEH Guidance on Comparing Soil Contamination Data with a Critical Concentration, May 2008. Results from this statistical testing can be used to inform decisions on whether land is suitable for use under the land use planning system without mitigation to break identified pollutant linkages.

6.4 General Water Contamination Guidance

6.4.1 Concentrations of contaminants detected in groundwater have been compared to the UK Drinking Water Standards (UKDWS) encompassing the Water Supply (Water Quality) Regulations 1989 and Water Supply (Water Quality) Regulations 2000 where drinking water is the receptor. Where surface water is the receptor the Environment Agency Environmental Quality Standards (EQS) have also been used.

6.4.2 Where the UKDWS and EQS do not encompass contaminants of concern to human health, reference is made to other appropriate guidance. This includes the European Union Council Directives 98/83/EC and 75/440/EEC on the quality of water intended for human consumption and the quality required of surface water intended for the abstraction of drinking water respectively. Additional screening values are derived from the World Health Organisation (WHO) Guidelines for Drinking-water Quality (1984) and the Dutch Target and Intervention Values for Soil Remediation.

7 GENERIC QUANTITATIVE RISK ASSESSMENT

7.1 Soil Results

7.1.1 Soil samples taken from the site have been tested for potential chemicals of concern appropriate to the former land uses. Results from the chemical testing have been evaluated with reference to each of the plausible receptors identified in the conceptual model. The results are evaluated differently for each receptor.

7.1.2 The proposed redevelopment is for commercial/industrial use. Therefore, the results have been assessed for commercial assessment criteria.

7.2 Human Health - occupiers

7.2.1 As the receptor is human health, the most relevant risk assessment model is the CLEA model. The model estimates child and adult exposures to soil contaminants for those potentially living, working and/or playing on contaminated sites over long time periods and has been used to produce the SGVs for the United Kingdom.

7.2.2 The principal pathways of concern for human health are dermal contact, ingestion, and inhalation. Generally, in the assessment of risk to site users, only samples taken in the top 1m are considered as contact with deeper samples is unlikely.

7.2.3 The geometric mean soil organic matter content at the site is 3.67%. Therefore, GAC values derived using 2.5% SOM have been selected in this assessment. The pH of the soil ranged from 6.29 in TP111-0.7m to 8.67 in WS103-0.3m.

Metals

7.2.4 The mean concentration (95% UCL) for arsenic, boron, cadmium, chromium (III and VI), copper, lead, mercury, nickel, selenium and zinc were below their respective SGV or GAC. Therefore, it may be considered that the concentrations of these substances in soil on site do not present a significant risk to long-term human health.

7.2.5 Statistical analysis of the laboratory results is attached at Appendix VII.

Total Petroleum Hydrocarbons

7.2.6 Most samples recorded low concentrations of all petroleum hydrocarbon fractions (TPH) and no visual or olfactory evidence of petroleum hydrocarbons was observed during the intrusive investigation.

7.2.7 The maximum recorded concentrations for all TPH fractions are significantly less than the adopted GAC, as is shown in Table VI below. Therefore, TPH contamination is considered unlikely to present a significant risk to long term human health at the site.

Table VI – TPH Summary

TPH Fraction	Max. Recorded (mg/kg)	Location	Generic Assessment Criteria (mg/kg)
GRO (C4-C12)	0.828	WS105-0.3m	-
Aliphatics C5-C6	0.0123	WS105-0.3m	5,900 (558)s
Aliphatics >C6-C8	0.0526	WS105-0.3m	17,000 (322)s
Aliphatics >C8-C10	0.113	WS105-0.3m	4,800 (190)v
Aliphatics >C10-C12	0.328	WS105-0.3m	23,000 (118)v
Aliphatics >C12-C16	79.3	TP104-05m	82,000 (59)s
Aliphatics >C16-C35	288.6	TP105-0.3m	1,700,000
Aliphatics >C35-C44	36.3	TP105-0.3m	1,700,000
Aromatics C6-C7	<0.01	-	690
Aromatics >C7-C8	0.0135	WS108-0.4m	1,800
Aromatics >EC8-EC10	0.0963	WS105-0.3m	110
Aromatics >EC10-EC12	0.218	WS105-0.3m	590
Aromatics >EC12-EC16	58	WS108-0.4m	2,300 (419)s
Aromatics >EC16-EC21	247	WS108-0.4m	1,900
Aromatics >EC21-EC35	517	WS108-0.4m	1,900
Aromatics >EC35-EC44	125	WS108-0.4m	1,900

NB – calculation of GAC values assumes that no free phase product is present.

Semi-Volatile Organic Compounds and Polycyclic Aromatic Hydrocarbons

7.2.8 The majority of the samples tested contained concentrations of Semi-Volatile Organic Compounds (SVOC) below the Limit of Detection (LOD). However, minor concentrations of dibenzofuran, carbazole and 2-methylnaphthalene were detected above the LOD but below their respective screening criteria. Therefore, these compounds are unlikely to present a significant risk to long term human health.

7.2.9 The mean concentrations (95% UCL) of all Polycyclic Aromatic Hydrocarbons (PAH) compounds analysed (naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benz(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(123cd)pyrene, dibenz(ah)anthracene and benzo(ghi)perylene) were below their respective GAC. Therefore, these PAHs are unlikely to present a significant risk to long term human health.

7.2.10 Statistical analysis of the laboratory results is attached at Appendix VII.

Table VII – PAH Soil Exceedances

Substance	Number of Individual Sample Exceedences	Mean Concentration (95% Confidence Level) (mg/kg)	Generic Assessment Criteria (mg/kg)
Acenaphthene	0	1.85	97,000
Acenaphthylene	0	0.26	97,000
Anthracene	0	2.67	540,000
Benzo(a)anthracene	0	5.53	170
Benzo(a)pyrene	0	5.44	35
Benzo(b)fluoranthene	0	4.67	44
Benzo(ghi)perylene	0	3.02	4000
Benzo(k)fluoranthene	0	3.44	1200
Chrysene	0	5.27	350
Dibenzo(ah)anthracene	0	0.73	3.6
Fluoranthene	0	12.29	23,000
Fluorene	0	1.39	68,000
Indeno(123cd)pyrene	0	2.74	510
Naphthalene	0	1.97	460
Phenanthrene	0	11.56	22,000
Pyrene	0	10.31	54,000

Volatile Organic Compounds

7.2.11 The recorded concentrations of Volatile Organic Compounds (VOC) were all recorded at their respective limits of detection (LOD) or below their respective SGV or GAC. Therefore, these compounds are unlikely to present a significant risk to long term human health.

Polychlorinated Biphenyls

7.2.12 Concentrations of Polychlorinated Biphenyls (PCB - ICES 7) have been compared to their respective screening values. None of the samples tested contained concentrations of PCB above their limit of detection or screening value. Therefore, these compounds are unlikely to present a significant risk to long term human health.

Other Substances

7.2.13 Statistical analysis for monohydric phenol, total cyanide and sulphide was carried out to identify the 95% confidence limits of the measured mean and to compare the upper 95th percentile with the respective screening criteria.

7.2.14 The upper bound values (US95) for phenol, cyanide and sulphide were below their respective screening values. Therefore, it may be considered that the concentrations of these substances in soil on site do not present a significant risk to long-term human health.

7.2.15 Statistical analysis of the laboratory results is attached at Appendix VII.

Asbestos

7.2.16 Guidance on the need for asbestos surveys and the method of carrying them out are given in HSE Publication HSG264.

7.2.17 Thirteen samples were screened for asbestos and no fibres were detected. In addition, no visual evidence of asbestos was recorded during site investigation works. Therefore, asbestos contamination is unlikely to pose a risk to future site occupiers.

7.3 Human Health – Construction Workers

7.3.1 The CLEA Soil Guideline Values only apply to the protection of health for long term chronic exposure. Construction workers are more likely to be at risk from a

high single exposure, i.e. an acute dose, which can result in contaminant poisoning. Suggested values for acute lethal doses of arsenic, cadmium, chromium, inorganic mercury, nickel and selenium is outlined in the Environment Agency R&D SGV reports from 2002.

7.3.2 None of the samples contained concentrations of cadmium, chromium, inorganic mercury, nickel or selenium that are elevated with respects to an acute lethal dose. No acute lethal dose value is given for lead.

7.4 Ecology – Future Landscaped Areas

7.4.1 Ecological Soil Screening Levels (Eco-SSL) have been published by the USEPA for a range of metals. The Eco-SSLs present indicative values for assessing potential risk to plants and other ecological receptors. As no relevant UK guidance exists for assessing risk to ecology, the recorded metal concentrations have been compared on an individual basis to Eco-SSLs.

7.4.2 The mean concentrations (95% UCL) for cadmium and nickel were below the Eco-SSLs for plants. Therefore, it may be considered that the concentrations of cadmium and nickel in soil on site do not present a risk to sensitive plants.

7.4.3 The mean concentrations (95% UCL) for arsenic, copper, lead and zinc were above the Eco-SSLs for plants. Therefore, it may be considered that the concentrations of these elements may pose a risk to sensitive plant growth in future garden or landscaped areas.

7.5 Groundwater Results

7.5.1 Groundwater samples taken from the site have been tested for potential chemicals of concern appropriate to the former land uses. As a number of the installed wells were dry our assessment of the risk to controlled waters is guided by the analysis of groundwater samples and soil samples submitted for leachate preparation. While leachate preparation is considered to be more aggressive than natural processes in the unsaturated zone, the results give broadly representative estimate of the leachability of contaminants.

7.5.2 Due to the proximity of the Hunsworth Beck, concentrations of contaminants detected in groundwater have been compared to EQS as surface water is the most sensitive fate of the groundwater beneath the site. The hardness of the

water ranged from 399mg/l to 1,220mg/l and the maximum hardness dependent EQS have been selected.

7.5.3 The main pathway by which contaminants are likely to reach the groundwater is through infiltration of rainwater causing vertical movement through the ground. At present the majority of the site is covered by hardstanding in the form of tarmac and/or a substantial thickness reinforced concrete, surfaced in places by a vinyl screed which should prevent the downward passage of any contaminants.

Metals, Semi-metals and Non-metals

7.5.4 The majority of metal concentrations were below their respective LOD or screening value and are considered unlikely to pose a significant risk to controlled waters. However, elevated concentrations of several metals in some samples were recorded as discussed below.

7.5.5 The recorded concentration of total chromium ranged from 6.14µg/l to 29.1µg/l which are elevated with respect to the EQS of 4.7µg/l but are below the chromium UKDWS of 50µg/l.

7.5.6 The concentration of chromium VI ranged from <LOD to 54µg/l which are elevated with respect to the EQS of 3.4µg/l. The analytical method for total chromium is more sensitive with a lower limit of detection compared with the method for chromium VI and is considered more representative of the chromium concentrations in the samples.

7.5.7 The recorded concentration of cadmium ranged from <LOD to 0.346µg/l which are elevated with respect to the EQS of 0.08µg/l but below the UKDWS of 5µg/l.

7.5.8 The recorded concentration of nickel in BH6, with a concentration of 50.2µg/l, was elevated with respect to the hardness dependent EQS of 20µg/l. The recorded concentrations of nickel in boreholes downstream of BH6 were below the EQS.

7.5.9 Therefore, these metals are not considered to represent a significant risk to controlled waters at the site based on the majority of groundwater samples recording very low to low concentrations with several samples with minor exceedences of EQS with no significant exceedance of UKDWS.

Total Petroleum Hydrocarbons

7.5.10 There is no EQS value for TPH, so reference is made to the UK Drinking Water Standards (UKDWS) which provides a value for the maximum tolerable concentration of dissolved/emulsified hydrocarbons allowed in drinking water at the tap (0.01mg/l). There are also limits for dissolved or emulsified hydrocarbons given in the Surface Waters (Abstraction for Drinking Water) (Classification) Regulations 1996 of 0.05mg/l, 0.2mg/l or 1mg/l dependent on the degree of treatment required.

7.5.11 A conservative approach of comparing each speciated TPHCWG fraction with the UKDWS of 0.01mg/l has been performed. In the majority of the samples analysed, the concentration of aromatic and aliphatic petroleum hydrocarbon fractions between C6 and C35 were below the Limit of Detection (LOD).

7.5.12 Slightly elevated concentrations of long chain-length aliphatic hydrocarbons (C21-C35) from BH5 and WS110 were recorded at 0.216mg/l and 0.017mg/l respectively. These concentrations exceed the UKDWS of 0.01mg/l but are below the DWS surface water abstraction limit of 1mg/l.

7.5.13 Elevated concentrations of medium to long chain-length aliphatic and aromatic hydrocarbons (C16-C35) were detected in borehole BH6. The maximum concentration was recorded in the aliphatic fraction C21-C35, 3.39mg/l, which exceeds the UKDWS of 0.01mg/l and the DWS surface water abstraction limit of 1mg/l.

7.5.14 Although elevated TPH groundwater concentrations were identified in BH6, negligible or low levels of TPH were recorded up gradient of this area and it is considered to represent an isolated hotspot. Given the localised occurrence and lack of obvious source or presence of free product, this is not considered significant and is not considered further.

Volatile Organic Compounds (VOC)

7.5.15 The recorded concentrations of VOC were all recorded at or below the respective LOD, with the exception of toluene in sample WS110 which recorded a minor concentration of 1.44µg/l. Therefore, these compounds are unlikely to present a significant risk to controlled waters at the site.

Semi-Volatile Organic Compounds and Polycyclic Aromatic Hydrocarbons

7.5.16 The recorded concentrations of SVOC were all at or below the respective LOD, with the exception of bis(2-ethylhexyl)pthalate in samples BH5 and BH6 which recorded minor concentrations of 8.11µg/l and 3.92µg/l respectively. Therefore, these compounds are unlikely to present a significant risk to controlled waters at the site.

7.5.17 For the purposes of this risk assessment, benzo(a)pyrene and dibenz(a,h)anthracene are considered to be the most carcinogenic PAH compound and naphthalene is considered to be the most mobile PAH. These compounds have been used as surrogates to assess the degree of risk posed by PAH compounds in groundwater and surface water.

7.5.18 The recorded concentrations of naphthalene ranged from <0.1µg/l to 1.22µg/l which are below the annual average EQS of 2.4µg/l.

7.5.19 The recorded concentrations of benzo(a)pyrene ranged from <0.009µg/l to 2.55µg/l in BH5 which is above the maximum allowable EQS of 0.1µg/l.

7.5.20 The recorded concentrations of dibenzo(a,h)anthracene ranged from <0.016µg/l to 0.369µg/l in BH5 which is above the maximum allowable EQS of 0.1µg/l for benzo(a)pyrene.

7.5.21 Boreholes downstream of BH5 recorded concentrations of benzo(a)pyrene and dibenzo(a,h)anthracene below the maximum allowable EQS which may indicate an off-site source of benzo(a)pyrene and dibenzo(a,h)anthracene in groundwater around BH5. As boreholes closer to the Hunsworth Beck have recorded concentrations of benzo(a)pyrene and dibenzo(a,h)anthracene are below the maximum allowable EQS and it is considered unlikely to present a significant risk to controlled waters at the site.

7.6 Leachate Results

Metals, Semi-metals and Non-metals

7.6.1 The majority of leachable metal concentrations were below their respective LOD or screening value and are considered unlikely to pose a significant risk to controlled waters. In contrast to this, the recorded concentration of leachable copper ranged from 1.34µg/l to 4.65µg/l in most samples. An elevated

concentration in WS108-0.4m was recorded at 60.9µg/l compared to its EQS of 28µg/l but was below the UKDWS of 2,000µg/l. These values are not considered to pose a significant risk to controlled waters.

Total Petroleum Hydrocarbons

7.6.2 The concentration of leachable aromatic and aliphatic petroleum hydrocarbon fractions were below the LOD and are not considered to pose a significant risk to controlled waters.

Polycyclic Aromatic Hydrocarbons

7.6.3 The recorded concentrations of benzo(a)pyrene ranged from <0.009µg/l to 0.00926µg/l which is below the maximum allowable EQS of 0.1µg/l.

7.6.4 The recorded concentrations of dibenzo(a,h)anthracene was less than the LOD of <0.016µg/l and the maximum allowable EQS of 0.1µg/l for benzo(a)pyrene.

7.6.5 The recorded concentrations of naphthalene was less than the LOD of <0.1µg/l and below the annual average EQS of 2.4µg/l.

7.6.6 Based on these results, the soils on site are not considered to pose a significant risk to controlled waters from PAH compounds.

7.7 Ground Gas

7.7.1 The potential for elevated ground gas concentrations at the site has been identified in the desk study report and subsequent research into the mining setting of the site.

Ground Gas Assessment

7.7.2 The ground gas assessment has been carried out in consultation with the following guidance:

- Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (BS 8485:2015);
- Assessing Risks Posed by Hazardous Ground Gases to Buildings, CIRIA C665, 2007.

7.7.3 The ground gas assessment has been undertaken using the Wilson and Card classification adopted by BS 8485: 2015 to derive a Characteristic Situation.

Development Area

7.7.4 The monitoring wells within the development area are characterised by low concentrations of methane (max 1.6%) and moderate concentrations of carbon dioxide (max 3.7%) (Table I overleaf). Flow rates for the boreholes were typically 0.1l/hr with a peak reading of 0.4l/hr and barometric pressures ranging from 978mb to 1014mb.

7.7.5 Using the Wilson and Card classification system and based on the monitoring results, a GSV of 0.015l/hr has been calculated. This corresponds to Characteristic Situation 1 (green or very low risk) classification.

Outside of Development Area – BH5

7.7.6 An exception to the general site trend was borehole BH5 to the south of the site (outside of the proposed development layout) which recorded very high concentrations of methane (max 34.6%) and moderate concentrations of carbon dioxide (max 3.0%). Flow rates for BH5 ranged from 0.0-0.2l/hr.

7.7.7 Using the Wilson and Card classification system and based on the monitoring results for BH5, a GSV of 0.07l/hr has been calculated. This corresponds to Characteristic Situation 2 for area around BH5. If the area around BH5 is developed in the future then consideration of ground gas protection measures appropriate to Characteristic Situation 2 and/or further monitoring will be required.

TABLE I: SUMMARY OF GROUND GAS MONITORING DATA

Borehole	Response Zone/Strata	No. Tests	CH_4 (%)	CO_2 (%)	Flow (l/hr)	Atmospheric Pressure (mb)
BH1	1m-6.4m/ Natural	6	0.0	0.0-3.4	0.0-0.2	980-1014
BH5	1m-10m/MG, Natural	5	0.0-34.6	0.2-3.0	0.0-0.2	981-1014
BH6	1m-10m/MG, Natural	5	0.0	0.3-3.4	0.0-0.1	981-1014
BH7	1m-7.8m/MG, Natural	5	0.0-1.6	0.0-1.4	0.0-0.3	978-1013

TABLE I: SUMMARY OF GROUND GAS MONITORING DATA						
Borehole	**Response Zone/Strata**	**No. Tests**	**CH_4 (%)**	**CO_2 (%)**	**Flow (l/hr)**	**Atmospheric Pressure (mb)**
WS102	1m-5m/ Natural	6	0.0	0.1-1.4	0.0-0.1	980-1014
WS104	1m-5m/MG, Natural	6	0.0	0.0-3.7	0.0-0.4	981-1014
WS105	1m-6.4m/MG, Natural	6	0.0	0.0-2.4	0.0-0.1	981-1014
WS107	1m-6.4m/MG, Natural	6	0.0	0.0-2.0	0.0-0.3	980-1014
WS110	1m-6.4m/MG, Natural	3	0.0	0.0-1.3	0.0-0.1	1005-1014

Ground Gas Protection Measures

7.7.8 CIRIA Report C735, entitled 'Good Practice and verification of protection systems for buildings against hazardous ground gases' presents guidance on the approach for verification of gas protection systems and describes how it should be reported.

7.7.9 The calculation of the GSV using the ground gas data from the monitoring wells at the site indicates a classification of Characteristic Situation 1 and no special ground gas protection measures are required for the development area.

7.7.10 Although outside of the development area, the monitoring results from BH5 indicates a classification of Characteristic Situation 2. If the area around BH5 is developed in the future then consideration of ground gas protection measures appropriate to Characteristic Situation 2 and/or further monitoring will be required.

7.8 Radon Gas

7.8.1 An initial assessment for radon gas has been carried out. The determination follows the two-stage procedure outlined in *BR211 Radon: Guidance on protective measures for new dwellings (2015)*. The assessment confirms that no specific radon protection measures are required at the site

7.9 Building Materials

Concrete

7.9.1 Concentrations of total sulphate were measured in order to indicate the potential for concrete attack. Concentrations on site ranged between 0.005% and 0.456% indicating that there is potential for concrete attack on site.

7.9.2 Results from sulphate (2:1 extract) for materials on site ranged between 0.008g/l and 0.204g/l. These results indicate that a worst case design sulphate class of DS-2 and Aggressive Chemical for Concrete (ACEC) class of AC-2 may be appropriate for the site. Relevant guidelines are given in BRE Special Digest 1: Concrete in Aggressive Ground.

Water Supply Pipes

7.9.3 Permeation and accelerated deterioration of pipe material can occur due to chemical reactions between the pipe and contaminants in the ground in which it is laid. This can lead to premature failures resulting in leakage and loss of water quality.

7.9.4 The Water Supply (Water Quality) Regulations in England and Wales, the Byelaws in Scotland and the Northern Ireland Water Regulations include a requirement to use only suitable materials when laying water pipes and the laying of unprotected water supply pipes through contaminated land is not permitted.

7.9.5 A table of threshold values for various contaminants has been produced by UKWIR in their report Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites (ref: 10/WM/03/21). These threshold values allow an assessor to select an appropriate pipe material where the contaminant concentrations are below the threshold values.

7.9.6 The selection of an appropriate pipe material based on the worst case (maximum) contaminant concentrations at the site is presented below in Table XI. Based on the available chemical test results, it is recommended that either wrapped ductile iron or barrier pipe is used for water supply to the site. Further information regarding the selection of materials for water supply pipes is given in the UKWIR Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites.

TABLE XI – UKWIR Pipe Material and Threshold Value (mg/kg)							
Contaminant	Max / Range Concentration	PE	PVC	Barrier Pipe (PE-AL-PE)	Wrapped Steel	Wrapped Ductile Iron	Copper
VOC's	0.754mg/kg	0.5	0.125	Pass	Pass	Pass	Pass
BTEX +MTBE	<0.029mg/kg	0.1	0.03	Pass	Pass	Pass	Pass
SVOC's including aliphatic and aromatic fraction C5-C10)	290.75mg/kg	2	1.4	Pass	Pass	Pass	Pass
Phenols	<0.1mg/kg	2	0.4	Pass	Pass	Pass	Pass
Mineral Oil C11-C20	328.35mg/kg	10	Pass	Pass	Pass	Pass	Pass
Mineral Oil C21-C40	782.3mg/kg	500	Pass	Pass	Pass	Pass	Pass
Corrosive (conductivity, redox and pH)	6.29-8.67 pH range	Pass	Pass	Pass	Fail	Pass	Fail
Nitrobenzene	<0.1	0.5	0.4	Pass	Pass	Pass	Pass
Preferred Pipe Type		-	-	✓	-	✓	-

8 GEOTECHNICAL RESULTS

8.1 Introduction

8.1.1 Site investigation works have identified significant thicknesses of made ground across the majority of the site. This is underlain by natural deposits of sandy, gravelly clay.

8.1.2 In total fifty five samples of made ground and natural material were collected from various depths and tested for range of geotechnical parameters including:

- Moisture content;
- Particle Size Distribution;
- Atterberg Limits;
- 2.5kg Rammer Compaction;
- One Dimensional Consolidation;
- Undrained Shear Strength in Triaxial Compression; and
- Hand Shear Vane Tests.

All tests were performed in accredited geotechnical laboratory and in accordance with the appropriate British Standard.

8.2 Made Ground

8.2.1 Twenty five samples of made ground were sent to the laboratory for analysis. The made ground was described as brown, locally silty to very silty, sandy to very sandy, gravelly to very gravelly clay. The gravel fraction in this horizon consisted of sandstone, mudstone, shale, coal fragments, brick, typical aggregate, concrete, tarmac and ash.

Particle Size Distribution Test

8.2.2 Particle Size Distribution tests were performed on six samples from the made ground. The range in quantities of each soil fraction is shown in Table XII.

Table XII: PSD Made Ground	
Soil Fraction	**Total Percentage**
Cobbles	0
Gravel	12-47
Sand	6-28
Silt/Clay	36-77

Moisture Content

8.2.3 Fourteen samples of made ground were tested for natural moisture content and the results varied between 11% and 36%.

Atterberg Limits

8.2.4 Eight samples from the made ground were tested for determination of Atterberg limits. The majority of the results determined intermediate plasticity material with a plasticity index (PI) ranging between 14% (BH4-2.4m) and 24% (BH7-6.0m). One sample was described as high plasticity material with PI of 30% (BH4-7.0m).

2.5kg Rammer Compaction

8.2.5 Four compaction tests were carried out on made ground samples taken at various depths from boreholes BH4, BH5 and BH6. The results for maximum dry density ranged between 1.82Mg/m^3 (BH4, 1.2-2.4mbgl) and 1.87Mg/m^3 (BH5, 0.5-2.7mbgl) with optimum moisture contents ranging from 13% (BH6) to 15% (BH4).

One Dimensional Consolidation

8.2.6 Two samples from the made ground were subjected to one dimensional consolidation testing. The results are presented in Table XIII.

Table XIII: ODC Made Ground		
INITIAL CONDITIONS	**BH4 4.5m-4.95mbgl**	**BH7 1.2-1.65m bgl**
Bulk density (g/cm3)	2.04	1.98
Dry density (g/cm3)	1.68	1.63
Moisture content (%)	21	22
Degree of saturation	97.9	90.9
Void ratio	0.5771	0.6306

Table XIII: ODC Made Ground				
	BH4 4.5m-4.95mbgl		**BH7 1.2-1.65m bgl**	
PRESSURE RANGE (KPa)	COEFFICIENTS		COEFFICIENTS	
	Mv (m2/MN)	Cv (m2/yr)	Mv (m2/MN)	Cv (m2/yr)
0 – 50	0.235	6.514	0.261	4.547
50 – 100	0.215	6.368	0.217	6.387
100 - 200	0.147	14.339	0.152	11.887
200 – 400	0.105	9.612	0.108	13.848
400 - 50	0.024	8.668	0.020	7.990

Undrained Shear Strength in Triaxial Compression

8.2.7 Three samples representing the made ground were subjected to undrained triaxial compression tests. The results are presented in Table XIV.

TABLE XIV: UTS Made Ground		
Depth of Sample, mbgl	**BH**	**Undrained Shear strength, C_u**
2.5-2.95	4	70
5.5-5.85	7	66
7.0-7.45	6	57

Hand Shear Vane Tests

8.2.8 Hand Shear Vane tests were performed on two samples representing the made ground. Shear Strength values ranged from 84kPa (BH4, 6.5-6.95m) to 92kPa (BH7, 2.2-2.65m).

8.3 Natural Materials - Clay

8.3.1 Twenty six samples representing the natural clay were sent to the geotechnical laboratory. The natural clay was described as, predominantly firm to very stiff, brown, slightly gravelly to very gravelly, sandy to very sandy clay.

Particle Size Distribution Test

8.3.2 Particle Size Distribution tests were performed on five samples from the natural clay. The range in quantities of each soil fraction is shown in Table XV.

Table XV: PSD Natural Materials - Clay	
Soil Fraction	**Total Percentage**
Cobbles	0
Gravel	5-36
Sand	23-31
Silt/Clay	37-69

Moisture content

8.3.3 Thirteen samples of the natural clay were tested for natural moisture content and the results varied between 9.4% and 32%.

Atterberg Limits

8.3.4 Thirteen samples from the natural clay were tested for determination of Atterberg limits. The majority of the results determined low to intermediate plasticity material with a plasticity index (PI) ranging between 9% (BH1-2.5m) and 25% (TP108-0.9m).

2.5kg Rammer Compaction

8.3.5 Two compaction tests were carried out on natural clay samples taken at various depths from trial pits TP111 and TP118. The results for maximum dry density ranged between 2.65Mg/m^3 (TP111-2.2mbgl) and 2.68Mg/m^3 (TP118-1.4mbgl) with optimum moisture contents ranging from 19% (TP111) to 20% (TP118).

One Dimensional Consolidation

8.3.6 One sample from the natural clay was subjected to one dimensional consolidation testing. The results are presented in Table XVI.

Table XVI: ODC Natural Materials - Clay

INITIAL CONDITIONS	**BH3 1.2m-1.65mbgl**
Bulk density (g/cm3)	2.05
Dry density (g/cm3)	1.66
Moisture content (%)	24
Degree of saturation	104.2
Void ratio	0.6008

Table XVI: ODC Natural Materials - Clay		
	BH3 1.2m-1.65mbgl	
PRESSURE RANGE (KPa)	COEFFICIENTS Mv (m2/MN)	Cv (m2/yr)
0 – 50	0.259	5.057
50 – 100	0.236	4.932
100 - 200	0.162	7.248
200 – 400	0.114	15.148
400 - 50	0.065	6.916

Undrained Shear Strength in Triaxial Compression

8.3.7 Seven samples representing the natural clay were subjected to undrained triaxial compression tests. The results are presented in Table XVII.

TABLE XVII: UTS Natural Materials - Clay		
Depth of Sample, mbgl	**BH**	**Undrained Shear strength, C_u**
1.2-1.65	3	112
2.0-2.45	1	161
2.3-2.7	3	183
3.5-3.95	1	127
5.7-6.15	5	32
6.7-7.15	5	48
8.5-9.15	6	101

Hand Shear Vane Tests

8.3.8 A Hand Shear Vane test was performed on one sample representing the natural materials. A Shear Strength value of 57kPa was recorded for the sample from BH6, 9.5-9.85mbgl.

8.4 Natural Materials - Gravel

8.4.1 Four samples representing the natural gravel were sent to the geotechnical laboratory. The natural gravel was described as, predominantly, brown, sandy to very sandy, slightly clayey to very clayey, gravel.

Particle Size Distribution Test

8.4.2 Particle Size Distribution tests were performed on two samples from the natural gravel. The range in quantities of each soil fraction is shown in Table XVIII.

Table XVIII: PSD Natural Materials - Gravel

Soil Fraction	Total Percentage
Cobbles	0
Gravel	32-58
Sand	22-36
Silt/Clay	20-32

Moisture content

8.4.3 Two samples of the natural gravel were tested for natural moisture content and the results varied between 7.4% and 9.4%.

Atterberg Limits

8.4.4 One sample from the natural gravel was tested for determination of Atterberg limits. The sample (BH1-6.1m) was described as non-plastic material.

8.5 Standard/Cone Penetration Testing

8.5.1 In addition to laboratory geotechnical testing, in situ standard/cone penetration tests were carried out during the site investigation and the results are summarised in Table XIX.

TABLE XIX: RESULTS FOR STANDARD/CONE PENETRATION TESTS

Depth (m bgl)	BH1		BH2		BH3		BH4		BH5		BH6		BH7	
	N-value	Geol Unit	N-value	Geol Unit	N-value	Geol Unit	N-value	Geol Unit	N-value	Geol Unit	N-value	Geol Unit	N-value	Geol Unit
1.00			13	MG			45	MG	25	MG	18	MG		
1.50														
2.00			REF	MG					13	MG	REF	MG		
2.50														
3.00														
3.50			18	MG			12	MG						
4.00									8	MG	23	MG		
4.50	REF	Nat.												
5.00	REF	Nat.			20	Nat.			10	MG	15	MG		
5.50							12	MG						
6.00	REF	CM			24	Nat.					15	MG		
6.50			30	Nat.										
7.00					REF	Nat.								
7.50			REF	Nat.	REF	CM							REF	CM
8.00											19	MG		
8.50			REF	CM					41	Nat.				
9.00							REF	CM						
9.50									REF	CM				
10.00														
10.50											REF	CM		

Key: MG = Made Ground, Nat. = Natural Materials, CM = Coal Measures, REF = Refusal

At depths where no Standard/Cone Penetration Test results are shown a U100 sample was taken.

8.5.2 The table shows that N-values within the made ground range between 8 and Refusal (>50). The N-values in the made ground suggest that the material is highly variable between loose/soft and very dense/very stiff.

8.5.3 N-values obtained within underlying natural materials are also highly variable, ranging between 20 and Refusal (>50). There is typically an increase in N value with depth.

8.5.4 N-values obtained within the coal measures all show Refusal (>50).

9 REVISED CONCEPTUAL SITE MODEL

9.1 Introduction

9.1.1 In line with current Environment Agency guidance, plausible source, pathway and receptor linkages have been identified for the site. The plausible linkages are indicated in the conceptual site model outlined and discussed below. This conceptual site model is based on the findings of the intrusive site investigation works and associated geochemical testing and is illustrated in Drawing SH10534-009.

9.2 Contamination Sources

9.2.1 No significantly elevated contaminant concentrations were identified in soil on site.

9.2.2 There are minor elevated concentrations of petroleum hydrocarbons in groundwater at the site.

9.3 Pathways

Human Health

9.3.1 In terms of human health the main pathways are considered to be dermal contact, ingestion and inhalation. Future occupiers and construction workers are likely to be at risk from all three potential pathways whilst working on the site.

Groundwater

9.3.2 The main pathway by which contaminants are likely to reach the saturated zone beneath the site is through infiltration of rainwater causing vertical movement through the unsaturated zone.

9.3.3 The site investigation has identified and sampled groundwater from the coal measures strata.

9.4 Receptors

9.4.1 A number of sensitive receptors have been identified in close proximity to the site. These receptors are:

- Future human receptors (site occupiers and construction workers);
- Shallow groundwater;
- Surface water in the Hunsworth Beck.

9.5 Summary

9.5.1 Based on the land use history and identified sources of contamination, a conceptual site model has been developed. This is shown in Table XX and details the potential sources, pathways and receptors and the inter-relationship of these factors.

9.5.2 It is considered that the risks to the proposed development for residential use without any mitigation are as follows.

TABLE XX

Source	Pathway	Receptor	Risk
Ground gases (carbon dioxide, methane)	Lateral and vertical migration of gases and inhalation	Construction workers and future occupiers	Low to Moderate
Minor petroleum hydrocarbons in groundwater	Infiltration, advection, diffusion and dispersion	Groundwater and Surface water	Low to Moderate

10 CONCLUSIONS

10.1 General

10.1.1 The site history indicates that a sewage works was present on part of the site in 1893. The Valley Pit Coal and Ironstone workings were also present in the west of the site at this time along with an Old Coal pit in the south. A tramway is reported extending across the western part of the site. By 1908 the pits were reported to be closed and the sewage works had expanded. Subsequent maps show further expansion and changes to the layout up until 2004.

10.1.2 A total of seven cable percussion boreholes (to a maximum depth of 10.7mbgl), three of which had rotary follow-on (to a maximum depth of 30mbgl), ten window sample boreholes (2.0m to 5.0mbgl) and nineteen trial pits (1.4m-3.6mbgl) were completed as part of this Phase II investigation. Observations from the intrusive work have confirmed the presence of 0.15m and 8.3m thick over the majority of the site, underlain by soft to stiff, orange-brown mottled grey, locally cobbly with rare boulders, sandy, gravelly clay and mudstone bedrock of the Middle Coal Measures geology.

10.1.3 Thirty soil and six groundwater samples from across the site were tested for a suite of potential chemicals of concern comprising: volatile and semi-volatile organic compounds; aliphatic, aromatic and polyaromatic hydrocarbons; metals and other inorganic elements.

10.2 Human Health

10.2.1 Analytical results were analysed using CLEA methodology to assess the risk to human health in both a residential and a commercial/industrial scenario.

10.2.2 The mean concentrations of all determinands across the site are below screening criteria and should not pose a risk to human health for a commercial/ industrial end use.

10.3 Surface Water and Groundwater

10.3.1 The risk to surface water and groundwater is considered to be low to moderate. The recorded concentrations of medium to long chain petroleum hydrocarbons

are elevated with respect to the UKDWS in the southern part of the site, particularly BH6. However, concentrations of petroleum hydrocarbons in groundwater across the site are generally below the LOD and/or UKDWS, therefore the risk to surface water and groundwater can be considered more towards low than moderate.

10.4 Buildings and Property

10.4.1 Results from sulphate (2:1 extract) testing indicate that a worst case design sulphate class of DS-2 and Aggressive Chemical for Concrete (ACEC) class of AC-2 may be appropriate for the site.

Ground Gas

Development Area

10.4.2 The monitoring wells within the development area are characterised by low concentrations of methane (max 1.6%) and moderate concentrations of carbon dioxide (max 3.7%). Using the Wilson and Card classification system and based on the monitoring results, a GSV of 0.015l/hr has been calculated. This corresponds to Characteristic Situation 1 (green or very low risk) classification.

Outside of Development Area – BH5

10.4.3 An exception to the general site trend was borehole BH5 to the south of the site (outside of the proposed development layout) which recorded very high concentrations of methane (max 34.6%) and moderate concentrations of carbon dioxide (max 3.0%). Using the Wilson and Card classification system and based on the monitoring results for BH5, a GSV of 0.07l/hr has been calculated. This corresponds to Characteristic Situation 2 for area around BH5. If the area around BH5 is developed in the future then consideration of ground gas protection measures appropriate to Characteristic Situation 2 and/or further monitoring will be required.

10.4.4

10.4.5 Low concentrations of methane, up to 1.6%, and low concentrations of carbon dioxide, up to 1.4% have been reported in one borehole in this area.

10.4.6 For a CIRIA Situation A development type, a gassing regime of Characteristic Situation 1 (CS1) can be attributed to this area and no special ground gas protection measures are required.

10.4.7 For a CIRIA Situation B development type, a gassing regime of Amber 1 can be attributed to this area which requires low-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to limit the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414 (Johnson, 2001). Ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours.

Ground Gas - Commercial

10.4.8 High concentrations of methane, up to 34.6%, have been reported in one borehole, BH5, and moderate concentrations of carbon dioxide, up to 3.7%, have been reported across the remainder of the site. Through reference to CIRIA C665 a gassing regime of Characteristic Situation 1 (CS1) can be attributed to the commercial area due to low flow rates. However, given the high levels of methane recorded in the south of the site, we would recommend increasing the classification in this area (BH's 4, 5 and 6) to Characteristic Situation 2 (CS2) as a precaution.

Ground Gas Protection Measures

10.4.9 The calculation of the GSV using the ground gas data from the monitoring wells at the site indicates a classification of Characteristic Situation 1 and no special ground gas protection measures are required for the development area.

10.4.10 Although outside of the development area, the monitoring results from BH5 indicates a classification of Characteristic Situation 2. If the area around BH5 is developed in the future then consideration of ground gas protection measures appropriate to Characteristic Situation 2 and/or further monitoring will be required.

Radon

10.4.11 An initial assessment for radon gas has been carried out. The determination follows the two-stage procedure outlined in *BR211 Radon: Guidance on protective measures for new dwellings (2015)*. The assessment indicates that no specific radon protection measures are required.

10.5 Ecology

10.5.1 The phytotoxic metals arsenic, copper, lead and zinc were analysed against the ECO-SSL threshold values for risk to plants. The results displayed numerous samples to have elevated metals considered likely to hinder plant growth in planned areas of landscaping. These samples were widespread across the site.

10.6 Coal Mining

10.6.1 A Coal Authority report for the site has been obtained, dated 23 November 2010 and is attached at Appendix II, a visit was also made to the Coal Authority abandoned mine records office at Mansfield on 25 November 2010.

Shallow Underground Workings

10.6.2 From the enquiries made, examination of the geological information and site investigation observations there is evidence of shallow underground mining activity beneath the south of the site. Reference to the abandonment plans indicate that these shallow workings are likely to be in the Shertcliffe Bed.

10.6.3 No intact coal seams were encountered during the investigation. However, there was evidence of broken/soft ground accompanied by loss of flush which may indicate the presence of workings. This broken/soft ground was observed at depths of between 11.3m and 16.7mbgl in borehole BH6. Due to collapse of the borehole, drilling was terminated at 16.7mbgl. Further investigation and stabilisation of the underground conditions with respect to mining is likely to be necessary in this area of the site.

Mine Entries

10.6.4 The Coal Authority report has indicated that there are ten recorded mine entries on or within influencing distance of the site. Only one of the mine entries is noted to have had any treatment; entry 417427-005 (to the north west of the site) was treated on behalf of the Coal Authority with mass concrete following its collapse in 1997. Prior to development the mine entries will require location, investigation and stabilisation.

10.6.5 Mining constraints on development are indicated on drawing SH10534-008.

10.7 Geotechnical and foundation design

10.7.1 The geology of the site is relatively homogenous and comprises made ground (up to 8.4m bgl to the south of the site) underlain by sandy, gravelly clay with occasional layers of very sandy, very clayey gravel of weathered Coal Measures which is in turn underlain by weak to moderate strong mudstone and sandstone of the Coal Measures.

10.7.2 As the site is proposed for commercial redevelopment it has been assumed that the commercial units constructed on the site will be steel framed structures with clad walls. These structures typically apply pressure to the ground at the end points of the steel columns and the foundations should be constructed to minimise the effect of applying localised pressure to the ground. Provided that some degree of settlement can be accommodated within the structure, pad or raft foundations should be satisfactory for structures on site founded on the weathered coal measures or on the made ground after ground improvement. Ground bearing floor slabs should be constructed to allow for some differential movement of the ground where pad foundations are employed.

10.7.3 Standard Penetration Tests (SPTs) were carried out in all borehole locations at 1m centres. The results obtained from the made ground are highly variable due to the impact that large particles can have on the test results. The tests indicate that the made ground would be unsuitable as a founding medium in its current condition due to this variability and the loose nature of some of the fill materials. Therefore some form of ground improvement would be required, either by excavation and recompaction or dynamic compaction, where foundations cannot be placed on the solid Coal Measures.

10.7.4 The weathered Coal Measures are described as firm to very stiff with undrained shear strength values in the range 32kPa to 161kPa and SPT n-values ranging from 30 to Refusal (>50). The tests indicate that the weathered Coal Measures across the majority of the site would be suitable as a founding medium in their current condition.

10.7.5 The shear strength of the weathered Coal Measures suggests C_u values for firm to very stiff clay which may be suitable for allowable bearing pressures up to 125kPa-250kPa. The results of consolidation testing suggest that these materials demonstrate low to medium compressibility and that, at the allowable bearing

pressure above, settlement should be restricted to less than 25mm. Detailed analysis of foundations should be carried out to ensure that the design loads for a particular building can be accommodated and that both total and differential settlements at design loads can be tolerated by the proposed structure.

10.7.6 Monitoring of boreholes on site indicates that groundwater is approximately 2m to 9m below ground level. Based on the site topography the groundwater level is fairly consistent across the site and is considered to be the natural groundwater level in the weathered Coal Measures. Caution may be required where foundations are constructed close to the water table.

10.7.7 As an alternative, piled foundations might be suitable to the south of the site where made ground thicknesses are up to 8.3m but consideration should be given to ground settlement around the structures if no other ground treatment was carried out. There would also likely be negative skin friction loads on piles caused by this settlement and these should be considered in any design.

11 RECOMMENDATIONS

11.1 Contamination

11.1.1 No elevated concentrations of contaminants were identified on site and, therefore, there is unlikely to be a significant risk to long term human health given a commercial land use.

11.2 Mining

11.2.1 Further investigation of the mining setting of the site is recommended. This is likely to take the form of further rotary open-hole drilling to the south of the site and exploratory excavation of areas around potential mine shaft locations. Drawing SH10534-008 shows the location of shafts and likely shallow mining.

11.2.2 There are a number of constraints to development as shown on Drawing SH10534-008, of which the mining position and existing structures represent the most significant elements from a construction viewpoint. Once broad architectural layouts are available, it would be useful to compare with existing site constraints in order to determine remedial options and costs.

11.3 Ground Gas

11.3.1 Gas protection measures are recommended as a precaution in the southern area of the site (CS2) to address high levels of methane recorded in this area. No gas protection is required over the remainder of the site.

APPENDIX I

Standard Terms and Conditions and Limitations to Reports

STANDARD TERMS AND CONDITIONS AND LIMITATIONS TO REPORTS

This report is provided for the stated purpose and for the sole use of the client. It is confidential to the client and his professional advisors and cannot be shown to any other party without prior written consent. Wardell Armstrong LLP accepts no responsibility whatsoever to any person other than the client.

The findings of this report are based upon information relating to the property supplied by the client or their agents. The information has been accepted and used in good faith and unless otherwise stated, no attempt has been made to verify the information supplied. Should any of these factors or information change then the conclusions of the report may need to be amended.

The findings and recommendations are considered to be valid and appropriate at the time of preparation and for the specific purpose or purposes intended. Wardell Armstrong LLP will not be liable if any findings are used by third parties, without the written agreement of the company, or if an interpretation is made and action taken without further consultation.

APPENDIX II

Coal Authority Report

The Coal Authority

Issued by:
The Coal Authority, Mining Reports Office, 200 Lichfield Lane, Berry Hill, Mansfield, Nottinghamshire NG18 4RG
ON-Line Service: www.groundstability.com - Phone: 0845 762 6848 - DX 716176 MANSFIELD 5

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Our reference:	**00052445-10**
Your reference:	33198658
Electronic Ref:	EME_00014987250003_005
RRUID:	005.00014987250003
Date of your enquiry:	**23 November 2010**
Date we received your enquiry:	**23 November 2010**
Date of issue:	**24 November 2010**

This report is for the property described in the address below and the attached plan.

Non-Residential Coal and Brine Report

Site At, North Bierley Works, Bradford Road, Oakenshaw, Bradford, West Yorkshire

This report is based on and limited to the records held by, the Coal Authority, and the Cheshire Brine Subsidence Compensation Board's records, at the time we answer the search.

Coal mining	Yes
Brine Compensation District	No

Information from the Coal Authority

Underground Coal Mining

Past

The property is in the likely zone of influence from workings in 3 seams of coal at shallow to 120m depth, and last worked in 1929.

Present

The property is not in the likely zone of influence of any present underground coal workings.

Future

The property is not in an area for which the Coal Authority is determining whether to grant a licence to remove coal using underground methods.

The property is not in an area for which a licence has been granted to remove coal using underground methods.

The property is not in an area that is likely to be affected at the surface from any planned future workings.

However reserves of coal exist in the local area which could be worked at some time in the future.

No notice of the risk of the land being affected by subsidence has been given under section 46 of the Coal Mining Subsidence Act 1991.

Mine entries

Within, or within 20 metres of, the boundary of the property there are 10 mine entries, the approximate positions of which are shown on the attached plan.

Coal Authority records disclose the following information:

418427-005. No treatment details.

417427-001. No treatment details.

417427-002. No treatment details.

417427-015. No treatment details.

417427-005. after collapsing in 1997 was plugged with mass concrete by IMC Ltd. on behalf of the Coal Authority in September 1997 .

418427-011. No treatment details.

417427-004. No treatment details.

417427-003. No treatment details.

417427-014. No treatment details.

417427-016. No treatment details.

Records may be incomplete. Consequently, there may exist in the local area mine entries of which the Coal Authority has no knowledge.

Coal-mining geology

The Authority is not aware of any evidence of damage arising due to geological faults or other lines of weakness that have been affected by coal mining.

Opencast Coal Mining

Past

The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.

Present

The property does not lie within 200 metres of the boundary of an opencast site from which coal is being removed by opencast methods.

Future

The property is not within 800 metres of the boundary of an opencast site for which the Coal Authority is determining whether to grant a licence to remove coal by opencast methods.

The property is not within 800 metres of the boundary of an opencast site for which a licence to remove coal by opencast methods has been granted.

Coal-mining subsidence

The Coal Authority has not received a damage notice or claim for the property since 1 January 1984. There is no current Stop Notice delaying the start of remedial works or repairs to the property.

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

Mine gas

There is no record of a mine gas emission requiring action by the Coal Authority within the boundary of the property.

Hazards related to coal mining

The property has been subject to remedial works, by or on behalf of the Authority, under its Emergency Surface Hazard Call Out procedures.

Withdrawal of Support

The property is not in an area for which a notice of entitlement to withdraw support has been published.

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

Working Facilities Orders

The property is not in an area for which an Order has been made under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification or amendment thereof.

Payments to Owners of Former Copyhold Land

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

Comments on Coal Authority information

In view of the mining circumstances a prudent developer would seek appropriate technical advice before any works are undertaken.

Therefore if development proposals are being considered, technical advice relating to both the investigation of coal and former coal mines and their treatment should be obtained before beginning work on site. All proposals should apply good engineering practice developed for mining areas. No development should be undertaken that intersects, disturbs or interferes with any coal or mines of coal without the permission of the Coal Authority. Developers should be aware that the investigation of coal seams/ former mines of coal may have the potential to generate and/or displace underground gases and these risks both under and adjacent to the development should be fully considered in developing any proposals. The need for effective measures to prevent gases entering into public properties either during investigation or after development also needs to be assessed and properly addressed. This is necessary due to the public safety implications of any development in these circumstances.

The attached plan shows the approximate location of the disused mine entry/entries referred to in this report. For reasons of clarity, mine entry symbols may not be drawn to the same scale as the plan. Property owners have the benefit of statutory protection (under the Coal Mining Subsidence act 1991*). This contains provision for the making good, to the reasonable satisfaction of the owner, of physical damage from disused coal mine workings including disused coal mine entries. A leaflet setting out the rights and the obligations of either the Coal Authority or other responsible persons under the 1991 Act can be obtained by telephoning 0845 762 6848 or online at www.coal.gov.uk/services/subsidence.
If you wish to discuss the relevance of any of the information contained in this report you should seek the advice of a qualified mining engineer or surveyor. If you or your adviser wish to examine the source

plans from which the information has been taken these are normally available at our Mansfield office, free of charge, by prior appointment, telephone 01623 637233. Should you or your adviser wish to carry out any physical investigations that may enter, disturb or interfere with any disused mine entry the prior permission of the owner must be sought. For coal mine entries the owner will normally be the Coal Authority.
The Coal Authority, regardless of responsibility and in conjunction with other public bodies, provide an emergency call out facility in coalfield areas to assess the public safety implications of mining features (including disused mine entries). Our emergency telephone number at all times is 01623 646333.

*Note, this Act does not apply where coal was worked or gotten by virtue of the grant of a gale in the Forest of Dean, or any other part of the Hundred of St. Briavels in the county of Gloucester.

Information from the Cheshire Brine Subsidence Compensation Board

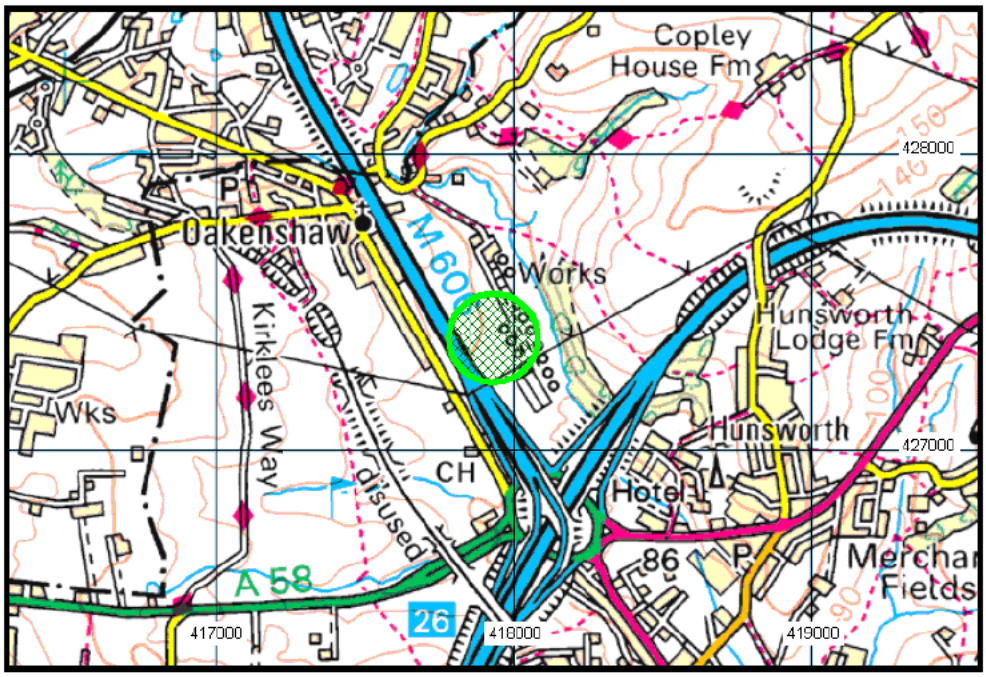
The property lies outside the Cheshire Brine Compensation District.

Additional remarks

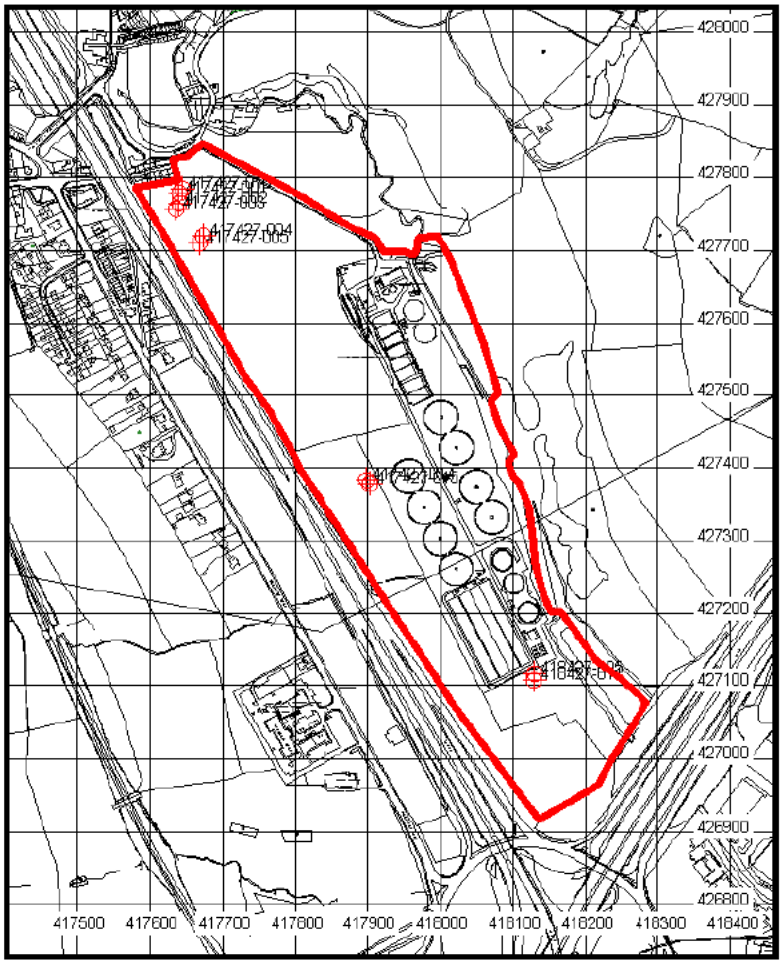
This report is prepared in accordance with the Law Society's Guidance Notes 2006, the User Guide 2006 and the Coal Authority and Cheshire Brine Board's Terms and Conditions 2006. The report is compliant with Home Information Pack requirements.

Location map

Approximate position of property



Enquiry boundary



Key

Approximate position of enquiry boundary shown

Disused Adit or Mineshaft

Mapping sourced from Ordnance Survey®

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APPENDIX III

Borehole Logs

wardell armstrong

Site	Borehole Number
North Bierley WWTW	BH1

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion			KeyLand Developments	SH10534
	Location See Drawing SH10534-002	**Dates** 16/05/2011	**Engineer** M Kelly	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(0.15) 0.15	Loose dark brown slightly clayey SAND (TOPSOIL).			
0.20 0.30-0.80	D1 B2					(0.65)	Firm dark brown sandy gravelly CLAY. Gravel of angular-subrounded sandstone and coal fragments.			
0.80 0.85-1.20	D3 B4					0.80	Firm orange brown sandy CLAY.			
1.20-1.65	U5			68 blows		(1.10)				
1.70 1.90 2.00-2.45	D6 D7 U8			83 blows		1.90	Firm-Stiff brown sandy gravelly CLAY. Gravel of angular-subrounded sandstone and shale.			
2.50 2.50-3.00	D9 B10									
3.00-3.20 3.00-3.20	B11 U			100 blows						
3.50-3.95	U12			100 blows		(3.20)				
4.00	D13									
4.50-4.95 4.50-4.95 4.50-5.00	SPT N=53 S14 B15			5,8/9,11,14,19						
5.10 5.20-5.65 5.20-5.65 5.20-6.10	D16 SPT N=52 S18 B17			4,9/10,12,14,16		5.10	Dense grey sandy GRAVEL of weatehred sandstone, mudstone and shale.			
						(1.00)				
6.10 6.20-6.65 6.20-6.40	D19 SPT N=50 S20			16,9/31,19		6.10 (0.30) 6.40	Strong orange brown grey SANDSTONE.			
							Complete at 6.40m			

Remarks

Scale (approx)	Logged By
1:50	M Kelly

Figure No. SH10534.BH1

wardell armstrong

Site	Borehole Number
North Bierley WWTW	BH2

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion			KeyLand Developments	SH10534
	Location	**Dates**	**Engineer**	**Sheet**
	See Drawing SH10534-002	16/05/2011-17/05/2011	M Kelly	1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.15)	Loose dark brown slightly clayey SAND (TOPSOIL).		
						0.15			
0.20	D1						MADE GROUND: Soft brown sandy gravelly CLAY. Gravel of sandstone aggregate, sandstone and brick.		
0.50-1.00	B2								
						(1.55)			
1.20-1.65	SPT(C) N=13			1,2/3,3,3,4					
1.20-1.65	C								
1.20-1.70	B3								
						1.70			
1.70	D4						MADE GROUND: Dense grey brown slightly clayey sandy gravel of sandstone, mudstone, coal fragments and rare brick with cobbles and boulders of sandstone and mudstone.		
2.00-2.45	SPT(C) N=50			4,7/11,18,21		(0.90)			
2.00	C								
2.00-2.60	B5								
						2.60			
2.60	D6						MADE GROUND: Concrete.		
2.60-3.40	B7								
						(0.80)			
						3.40			
3.40	D8						MADE GROUND: Medium Dense grey sandy gravel of shale.		
3.50-3.95	SPT N=18			2,3/4,4,5,5					
3.50-3.95	S9								
3.50-4.90	B10								
						(1.40)			
4.50-4.90	U11			100 blows					
						4.80			
4.90	D12						Firm-Stiff orange mottled grey slightly cobbly sandy gravelly CLAY with rare boulders. Gravel, cobbles and boulders of angular-subrounded sandstone.		
5.20-5.65	U13			78 blows					
						(1.70)			
5.70	D14								
6.20-6.40	U			100 blows					
6.40-6.50	D15								
						6.50			
6.60-7.05	SPT N=30			5,7/8,6,8,8			Stiff orange brown mottled grey slightly cobbly gravelly very sandy CLAY with rare boulders. Gravel, cobbles and boulders of angular-subrounded sandstone and mudstone.		
6.60-7.05	S16								
6.60-7.10	B17								
						(1.90)			
7.60-8.05	SPT N=50			3,9/9,11,12,18					
7.60-8.00	S18								
7.60-8.10	B19								
						8.40			
8.40	D20						Strong orange brown weathered SANDSTONE.		
8.50-8.95	SPT N=50			17,8/38,12		(0.40)			
8.50-8.70	S22					8.80			
8.50-8.80	B21								
							Complete at 8.80m		

Remarks

Scale (approx)	Logged By
1:50	M Kelly

Figure No. SH10534.BH2

wardell armstrong

Site	Borehole Number
North Bierley WWTW	BH3

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion			KeyLand Developments	SH10534
	Location See Drawing SH10534-002	**Dates** 17/05/2011	**Engineer** M Kelly	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.20)	Loose dark brown slightly clayey SAND (TOPSOIL).		
0.20	D1					0.20	Firm orange brown mottled grey slightly cobbly gravelly very sandy CLAY with rare boulders. Gravel, cobbles and boulders of angular-subrounded sandstone.		
0.50-1.00	B2					(0.90)			
1.10	D3					1.10	Firm-Stiff orange brown mottled grey slightly cobbly sandy gravelly CLAY with rare boulders. Gravel, cobbles and boulders of angular-subrounded sandstone. Very sandy with increasing gravel and cobbles from 3.5m.		
1.10-1.70	B6								
1.20-1.65	U4			54 blows					
1.70	D5								
2.10-2.30	D7								
2.30-2.70	U8			100 blows					
2.70	D9								
3.30-3.75	U10			95 blows					
3.80	D11								
4.30-4.40	U			100 blows		(6.50)			
4.30-4.70	B12								
4.70-5.15	SPT N=20			2,3/5,4,5,6					
4.70-5.15	S13								
4.70-5.20	B14								
5.70-6.15	SPT N=24			3,4/4,6,6,8					
5.70-6.15	S15								
5.70-6.20	B16								
6.70-7.15	SPT N=50			3,6/8,9,33					
6.70-7.00	B18								
6.70-7.05	S17								
7.00	D19								
						7.60			
7.60-8.05	SPT N=50			20,5/50		(0.15)	Strong brown SANDSTONE.		
7.60-7.75	S21					7.75			
							Complete at 7.75m		

Remarks

Scale (approx)	Logged By
1:50	M Kelly

Figure No. SH10534.BH3

wardell armstrong

Site	Borehole Number
North Bierley WWTW	BH4

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable percussion to 9mbgl with Rotary Open-hole drilling to 30mbgl.			KeyLand Developments	SH10534
	Location See Drawing SH10534-002	**Dates** 17/05/2011-19/05/2011	**Engineer** M Kelly	**Sheet** 1/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.15)	Loose dark brown slightly clayey SAND (TOPSOIL).		
						0.15	MADE GROUND: Firm orange brown sandy gravelly clay. Gravel of sandstone, mudstone, coal fragments, shale and brick.		
0.20	D1								
0.50	B2								
1.20-1.65	SPT(C) N=45			4,6/9,9,11,16					
1.20	B3								
1.20-1.00	C					(2.85)			
2.00-2.40	B4								
2.40	D5								
2.50-2.95	U6			80 blows					
						3.00	MADE GROUND: Soft-Firm grey orange brown sandy gravelly clay. Gravel of sandstone, mudstone, coal fragments and rare brick with organic debris observed at 6.3m.		
3.00	D7								
3.50-3.95	SPT(C) N=12			1,2/3,2,3,4					
3.50-3.95	C								
3.50-4.00	B8								
4.50-4.95	U9			62 blows					
5.00	D10					(4.20)			
5.50-5.95	SPT(C) N=12			2,2/2,3,3,4					
5.50-5.95	C								
5.50-6.00	B11								
6.50-6.95	U12			85 blows					
7.00	D13								
						7.20	Firm-Stiff orange brown mottled grey slightly cobbly sandy gravelly CLAY with rare boulders. Gravel, cobbles and boulders of angular-subrounded sandstone.		
7.20	D14								
7.20-7.60	B15								
7.30-7.75	U16			80 blows		(0.90)			
7.80	D17								
						8.10	Stiff orange brown mottled grey sandy gravelly CLAY. Gravel of angular-subrounded mudstone and shale.		
8.10	D18								
8.20-8.40	U			100 blows		(0.60)			
8.20-8.70	B19								
						8.70	Weak grey MUDSTONE.		
8.70-9.15	SPT N=50			7,11/22,28					
8.70	D20								
8.70-9.00	S21								
						(1.90)			

Remarks

Scale (approx)	Logged By
1:50	M Kelly

Figure No. SH10534.BH4

wardell armstrong			**Site** North Bierley WWTW	**Borehole Number** BH4
Boring Method Cable percussion to 9mbgl with Rotary Open-hole drilling to 30mbgl.	**Casing Diameter**	**Ground Level (mOD)**	**Client** KeyLand Developments	**Job Number** SH10534
	Location See Drawing SH10534-002	**Dates** 17/05/2011-19/05/2011	**Engineer** M Kelly	**Sheet** 2/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(1.90)			
						10.60	Medium Strong grey MUDSTONE.		
						(4.70)			
						15.30	Medium Strong grey MUDSTONE with siltstone bands.		
						(8.50)			

Remarks

Scale (approx)	Logged By
1:50	M Kelly

Figure No. SH10534.BH4

wardell armstrong		**Site** North Bierley WWTW	**Borehole Number** BH4
Boring Method Cable percussion to 9mbgl with Rotary Open-hole drilling to 30mbgl.	**Casing Diameter**	**Ground Level (mOD)**	**Client** KeyLand Developments	**Job Number** SH10534
	Location See Drawing SH10534-002	**Dates** 17/05/2011-19/05/2011	**Engineer** M Kelly	**Sheet** 3/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(8.50)			
						23.80	Strong grey brown SANDSTONE.		
						(6.20)			
						30.00			

Remarks

Scale (approx)	Logged By
1:50	M Kelly

Figure No. SH10534.BH4

wardell armstrong

Site	Borehole Number
North Bierley WWTW	BH5

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable percussion to 9.85mbgl with Rotary Open-hole drilling to 30mbgl.			KeyLand Developments	SH10534
	Location See Drawing SH10534-002	**Dates** 18/05/2011-19/05/2011	**Engineer** M Kelly	**Sheet** 1/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(0.10) 0.10	Loose dark brown slightly clayey SAND (TOPSOIL).			
0.20	D1						MADE GROUND: Medium Dense brown slightly clayey gravelly cobbly sand. Gravel and cobbles of brick, concrete, mudstone and sandstone.			
0.50-1.00	B2									
1.20-1.65	SPT(C) N=25			4,5/7,7,5,6						
1.20-1.65	C									
1.20-1.70	B3									
2.20-2.65	SPT(C) N=13			1,3/2,3,3,5						
2.20-2.65	C									
2.20-2.70	B4					(5.10)				
2.95	W6									
3.20-3.50	B5									
3.20-3.50	U			100 blows						
4.00-4.45	SPT(C) N=8			2,1/2,1,2,3						
4.00-4.45	C									
4.00-4.50	B7									
5.00-5.45	SPT(C) N=10			1,1/2,2,3,3						
5.00-5.45	C					5.20				
5.00-5.50	B8						MADE GROUND: Soft dark grey clayey silt with a little organic debris.			
5.30	D9					(0.60)				
5.70-6.15	U10			58 blows		5.80				
5.80-6.50	B12						Firm-Stiff orange brown mottled grey slightly cobbly sandy gravelly CLAY with rare boulders. Gravel, cobbles and boulders of angular-subrounded sandstone.			
6.20	D11									
6.70-7.15	U13			87 blows		(1.70)				
7.20	D14									
7.50	D15					7.50				
7.70-8.15	U16			93 blows		(0.50)	Stiff brown mottled grey sandy gravelly CLAY. Gravel of angular-subrounded mudstone and shale.			
8.20	D17					8.00	Stiff dark brown mottled grey sandy gravelly CLAY. Gravel of angular-subrounded sandstone.			
8.50-8.95	SPT N=41			4,8/9,8,10,14						
8.50-8.95	S18									
8.50-9.00	B19					(1.40)				
9.50-9.95	SPT N=50			9,13/16,18,16		9.40	Weak grey brown MUDSTONE.			
9.50-9.85	S20									

Remarks

Scale (approx)	Logged By
1:50	M Kelly

Figure No. SH10534.BH5

wardell armstrong		Site: North Bierley WWTW	Borehole Number: BH5
Boring Method: Cable percussion to 9.85mbgl with Rotary Open-hole drilling to 30mbgl.	Casing Diameter	Ground Level (mOD)	Client: KeyLand Developments	Job Number: SH10534
	Location: See Drawing SH10534-002	Dates: 18/05/2011-19/05/2011	Engineer: M Kelly	Sheet: 2/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(6.30)				
						15.70	Medium Strong grey MUDSTONE with siltstone bands.			
						(7.70)				

Remarks

Scale (approx)	Logged By
1:50	M Kelly

Figure No. SH10534.BH5

wardell armstrong		**Site** North Bierley WWTW	**Borehole Number** BH5
Boring Method Cable percussion to 9.85mbgl with Rotary Open-hole drilling to 30mbgl.	**Casing Diameter**	**Ground Level (mOD)**	**Client** KeyLand Developments	**Job Number** SH10534
	Location See Drawing SH10534-002	**Dates** 18/05/2011-19/05/2011	**Engineer** M Kelly	**Sheet** 3/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(7.70)				
						23.40	Strong grey brown SANDSTONE.			
						(6.60)				
						30.00				

Remarks

Scale (approx)	Logged By
1:50	M Kelly

Figure No. SH10534.BH5

wardell armstrong

Site	Borehole Number
North Bierley WWTW	BH6

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable percussion to 10.7mbgl with Rotary Open-hole drilling to 30mbgl.			KeyLand Developments	SH10534
	Location See Drawing SH10534-002	**Dates** 18/05/2011-20/05/2011	**Engineer** M Kelly	**Sheet** 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(0.10) 0.10	Loose dark brown slightly clayey SAND (TOPSOIL).			
0.25	D1						MADE GROUND: Medium Dense brown slightly clayey gravelly cobbly sand. Gravel and cobbles of brick, concrete, mudstone and sandstone.			
0.50-1.00	B2									
1.20-1.65	SPT(C) N=18			3,4/4,3,5,6						
1.20-1.65	C									
1.20-1.70	B3									
1.80	D4									
2.20-2.65	SPT(C) N=50			3,5/6,20,24						
2.20-2.52	C									
2.20-2.90	B5					(4.90)				
3.20-3.60	U6			100 blows						
3.60	D7									
4.20-4.65	SPT(C) N=23			3,3/4,4,7,8						
4.20-4.65	C									
4.20-4.70	B8									
4.80	D9									
						5.00	MADE GROUND: Firm orange grey brown sandy gravelly CLAY. Gravel and cobbles of mudstone and sandstone.			
5.20-5.65	SPT(C) N=15			1,1/2,4,4,5						
5.20-5.65	C									
5.20-5.70	B10									
						(1.90)				
6.20-6.65	SPT(C) N=15			3,2/4,3,4,4						
6.20-6.65	C									
6.20-6.70	B11									
6.90	D12					6.90				
7.00-7.45	U13			61 blows			MADE GROUND: Firm grey brown slightly gravelly sandy CLAY. Gravel of shale.			
7.50	D14									
						(1.50)				
8.00-8.45	SPT(C) N=19			2,3/3,4,6,6						
8.00-8.40	B15									
8.00-8.45	C									
8.40	D16					8.40				
8.50-8.95	U17			90 blows			Stiff orange brown mottled grey sandy gravelly CLAY. Gravel of angular-subrounded sandstone.			
9.00	D18									
9.00-9.50	B19									
						(2.10)				
9.50-9.85	U20			100 blows						
9.85	D21									

Remarks

Scale (approx)	Logged By
1:50	M Kelly

Figure No. SH10534.BH6

wardell armstrong	Site: North Bierley WWTW		Borehole Number: BH6
Boring Method: Cable percussion to 10.7mbgl with Rotary Open-hole drilling to 30mbgl.	Casing Diameter	Ground Level (mOD)	Client: KeyLand Developments	Job Number: SH10534
	Location: See Drawing SH10534-002	Dates: 18/05/2011-20/05/2011	Engineer: M Kelly	Sheet: 2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.40-10.85 10.40-10.70	SPT N=50 S22			10,14/25,25		(2.10) 10.50 (0.20) 10.70 (0.60) 11.30 (5.40) 16.70	Medium Strong brown SANDSTONE. Weak brown grey weathered MUDSTONE. Soft ground; possible workings. Complete at 16.70m			

Remarks

Scale (approx)	Logged By
1:50	M Kelly

Figure No. SH10534.BH6

wardell armstrong

Site	Borehole Number
North Bierley WWTW	BH7

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
Cable Percussion			KeyLand Developments	SH10534
	Location See Drawing SH10534-002	**Dates** 19/05/2011	**Engineer** M Kelly	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(0.30)	Loose dark brown slightly clayey SAND (TOPSOIL).			
0.30	D1					0.30	MADE GROUND: Firm-Stiff orange brown mottled grey sandy gravelly CLAY. Gravel of sandstone, mudstone, shale, ash and brick.			
0.50-1.00	B2									
1.20-1.65	U3			88 blows						
1.70	D4									
1.70-2.20	B5									
2.20-2.65	U6			77 blows		(4.00)				
2.70	D7									
3.20-3.35	U			100 blows						
3.20-3.60	B8									
3.60-4.05	U9			58 blows						
4.10	D10									
4.30	D11					4.30	MADE GROUND: Medium Dense dark grey slightly clayey sandy gravel of mudstone and shale.			
4.30-5.00	B12									
4.50-4.95	U13			100 blows						
5.00	D14					(1.70)				
5.50-5.85	U15			100 blows						
6.00	D16					6.00	Stiff orange brown mottled grey sandy gravelly CLAY. Gravel of angular-subrounded sandstone and shale.			
6.00-6.50	B17									
6.30-6.70	U18			100 blows						
6.90	D19					(1.40)				
7.10-7.40	U20			100 blows						
7.40-7.85	SPT N=50			6,8/10,12,15,13		7.40				
7.40	D21					(0.40)	Medium Strong brown grey weathered SANDSTONE.			
7.40-7.80	S22					7.80				
							Complete at 7.80m			

Remarks

Scale (approx)	Logged By
1:50	M Kelly

Figure No. SH10534.BH7

APPENDIX IV

Windowless Sample Logs

wardell armstrong

Site	Number
North Bierley WWTW	WS101

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			KeyLand Developments	SH10534
	Location	**Dates**	**Engineer**	**Sheet**
	See Drawing SH10534-002	16/05/2011	M Kelly	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Loose brown slightly gravelly slightly clayey SAND (TOPSOIL). Gravel of sandstone aggregate, rare brick and concrete.		
0.40	D				0.20 (0.50)	MADE GROUND: Firm brown slightly gravelly sandy clay. Gravel of sandstone and rare concrete and brick.		
					0.70 (0.20)	MADE GROUND: Loose-Medium Dense light grey slightly sandy cobbly gravel of concrete.		
					0.90 (1.60)	Firm brown slightly gravelly sandy CLAY. Gravel of angular-subrounded sandstone and mudstone.		
					2.50 (2.50)	Soft-Firm orange mottled grey sandy gravelly CLAY. Gravel of angular-subrounded sandstone, mudstone and coal fragments.		
					5.00	Complete at 5.00m		

Remarks

Scale (approx)	Logged By
1:40	M Kelly

Figure No. SH10534.WS101

wardell armstrong

Site	Number
North Bierley WWTW	WS102

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			KeyLand Developments	SH10534
	Location	**Dates**	**Engineer**	**Sheet**
	See Drawing SH10534-002	16/05/2011	M Kelly	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.70	D				(0.10) 0.10	Loose brown slightly clayey SAND (TOPSOIL).			
					(0.15) 0.25	MADE GROUND: Loose grey slightly sandy gravel of limestone aggregate.			
					(0.15) 0.40	MADE GROUND: Dense red gravelly cobbles of brick.			
					(0.20) 0.60	MADE GROUND: Medium strong orange fine grained sandstone.			
					(0.40) 1.00	Firm dark grey slightly gravelly sandy CLAY. Gravel of coal fragments.			
					(0.60) 1.60	Soft brown slightly sandy slightly gravelly CLAY. Gravel of angular-subrounded sandstone.			
					(1.00) 2.60	Soft orange sandy gravelly CLAY. Gravel of angular-subrounded sandstone, mudstone and coal fragments.			
					(0.60) 3.20	Soft-Firm orange mottled grey slightly sandy gravelly CLAY. Gravel of angular-subrounded sandstone, mudstone and coal fragments.			
					(0.50) 3.70	Stiff grey slightly sandy gravelly CLAY. Gravel of angular-subrounded mudstone.			
					(1.30) 5.00	Weak grey MUDSTONE.			
						Complete at 5.00m			

Remarks

Scale (approx)	Logged By
1:40	M Kelly

Figure No. SH10534.WS102

wardell armstrong		**Site** North Bierley WWTW	**Number** WS103
Excavation Method Drive-in Window Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** KeyLand Developments	**Job Number** SH10534
	Location See Drawing SH10534-002	**Dates** 16/05/2011	**Engineer** M Kelly	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	MADE GROUND: Firm brown slightly sandy gravelly clay. Gravel of sandstone aggregate, brick, sandstone and concrete.		
0.30	D				0.40			
0.60	D				(4.10)	Firm brown sandy gravelly CLAY. Gravel of angular-subrounded sandstone, mudstone and coal fragments. Increasing strength with depth. Decreasing sand with depth.		
					4.50	Complete at 4.50m		

Remarks

Scale (approx)	Logged By
1:40	M Kelly

Figure No. SH10534.WS103

wardell armstrong	Site: North Bierley WWTW		Number: WS104
Excavation Method: Drive-in Window Sampler	Dimensions	Ground Level (mOD)	Client: KeyLand Developments	Job Number: SH10534
	Location: See Drawing SH10534-002	Dates: 16/05/2011	Engineer: M Kelly	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.40	D				(0.75)	MADE GROUND: Firm brown slightly sandy gravelly clay. Gravel of sandstone, sandstone aggregate and mudstone.			
					0.75 (0.75)	MADE GROUND: Soft black slightly sandy gravelly clay. Gravel of angular-subangular mudstone.			
					1.50 (0.30)	Soft-Firm dark grey slightly sandy gravelly CLAY. Gravel of angular-subangular mudstone.			
					1.80 (2.70)	Firm orange mottled grey slightly sandy gravelly CLAY. Gravel of angular-subrounded sandstone and mudstone.			
					4.50 (0.50)	Firm grey slightly sandy gravelly CLAY. Gravel of angular-subrounded mudstone and coal fragments.			
					5.00	Complete at 5.00m			

Remarks	Scale (approx)	Logged By
	1:40	M Kelly
	Figure No. SH10534.WS104	

wardell armstrong	Site: North Bierley WWTW		Number: WS105
Excavation Method: Drive-in Window Sampler	Dimensions	Ground Level (mOD)	Client: KeyLand Developments	Job Number: SH10534
	Location: See Drawing SH10534-002	Dates: 16/05/2011	Engineer: M Kelly	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.30	D				(1.20)	MADE GROUND: Soft grey slightly sandy gravelly clay. Gravel of sandstone, sandstone aggregate, wood fragments, mudstone and rare brick.			
					1.20				
					(1.20)	Firm orange brown mottled grey slightly sandy gravelly CLAY. Gravel of angular-subrounded sandstone and mudstone and rare coal fragments.			
					2.40				
					(1.20)	Soft-Firm grey slightly sandy gravelly CLAY. Gravel of angular-subangular mudstone.			
					3.60				
					(0.40)	Weak light grey MUDSTONE.			
					4.00				
						Complete at 4.00m			

Remarks	Scale (approx)	Logged By
	1:40	M Kelly
	Figure No. SH10534.WS105	

wardell armstrong		**Site** North Bierley WWTW	**Number** WS106
Excavation Method Drive-in Window Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** KeyLand Developments	**Job Number** SH10534
	Location See Drawing SH10534-002	**Dates** 16/05/2011	**Engineer** M Kelly	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	D				(1.40)	MADE GROUND: Loose brown slightly clayey sandy gravel of sandstone, sandstone aggregate, mudstone and rare brick.		
					1.40			
					(0.10)	MADE GROUND: Brick		
					1.50			
					(0.80)	MADE GROUND: Loose dark grey black slightly clayey slightly sandy gravel of shale.		
					2.30			
					(1.30)	Firm orange brown mottled grey slightly sandy gravelly CLAY. Gravel of angular-subrounded sandstone, mudstone and coal fragments.		
					3.60			
					(0.40)	Very stiff grey slightly sandy gravelly CLAY. Gravel of angular-subangular mudstone.		
					4.00			
						Complete at 4.00m		

Remarks

Scale (approx)	Logged By
1:40	M Kelly

Figure No. SH10534.WS106

wardell armstrong		**Site** North Bierley WWTW	**Number** WS107
Excavation Method Drive-in Window Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** KeyLand Developments	**Job Number** SH10534
	Location See Drawing SH10534-002	**Dates** 17/05/2011	**Engineer** M Kelly	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.50	D				(0.15) 0.15	Loose brown slightly clayey slightly gravelly SAND (TOPSOIL). Gravel of sandstone, sandstone aggregate, mudstone and rare brick.			
					(1.85) 2.00	MADE GROUND: Firm brown slightly sandy gravelly CLAY. Gravel of shale, sandstone, mudstone and rare brick.			
					(1.70) 3.70	MADE GROUND: Loose black slightly clayey slightly sandy gravel of shale.			
					(1.10) 4.80	Soft-Firm orange brown mottled grey slightly sandy slightly gravelly CLAY. Gravel of angular-subrounded sandstone and mudstone.			
					(0.20) 5.00	Medium Dense orange brown sandy GRAVEL of angular-subrounded fine grained sandstone.			
						Complete at 5.00m			

Remarks

Scale (approx)	Logged By
1:40	M Kelly

Figure No. SH10534.WS107

wardell armstrong		**Site** North Bierley WWTW	**Number** WS108
Excavation Method Drive-in Window Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** KeyLand Developments	**Job Number** SH10534
	Location See Drawing SH10534-002	**Dates** 17/05/2011	**Engineer** M Kelly	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40	D				(0.50) 0.50	MADE GROUND: Loose black slightly clayey gravelly sand. Gravel of sandstone aggregate, brick, tarmac and concrete.		
					(1.90) 2.40	MADE GROUND: Firm orange brown slightly sandy gravelly CLAY. Gravel of shale, sandstone, mudstone and rare brick.		
					(0.10) 2.50	MADE GROUND: Loose black sandy gravel of crushed tarmac and rare ash.		
					(0.40) 2.90	Soft grey slightly gravelly CLAY. Gravel of angular-subrounded sandstone.		
					(1.50) 4.40	Firm-Stiff orange brown mottled grey slightly sandy gravelly CLAY. Gravel of angular-subrounded sandstone and mudstone.		
						Complete at 4.40m		

Remarks

Scale (approx)	Logged By
1:40	M Kelly

Figure No. SH10534.WS108

wardell armstrong		**Site** North Bierley WWTW	**Number** WS109
Excavation Method Drive-in Window Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** KeyLand Developments	**Job Number** SH10534
	Location See Drawing SH10534-002	**Dates** 17/05/2011	**Engineer** M Kelly	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.45) 0.45	MADE GROUND: Medium Dense orange brown slightly clayey sandy gravel of sandstone aggregate, sandstone and tarmac.		
0.70	D				(1.05) 1.50	MADE GROUND: Soft brown sandy gravelly CLAY. Gravel of coal, mudstone, sandstone and very rare brick.		
					(0.50) 2.00	MADE GROUND: Dense orange slightly clayey sandy cobbly gravel of sandstone.		
						Complete at 2.00m		

Remarks

Scale (approx)	Logged By
1:40	M Kelly

Figure No. SH10534.WS109

wardell armstrong

Site	Number
North Bierley WWTW	WS110

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler			KeyLand Developments	SH10534
	Location	**Dates**	**Engineer**	**Sheet**
	See Drawing SH10534-002	17/05/2011	M Kelly	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					(0.50) 0.50	Soft black slightly sandy CLAY (TOPSOIL).			
0.60	D				(1.00) 1.50	Soft-Firm brown slightly sandy slightly gravelly CLAY. Gravel of angular-subrounded sandstone and mudstone.			
					(3.00) 4.50	Firm orange mottled grey slightly sandy gravelly CLAY. Gravel of angular-subrounded sandstone and mudstone.			
						Complete at 4.50m			

Remarks

Scale (approx)	Logged By
1:40	M Kelly

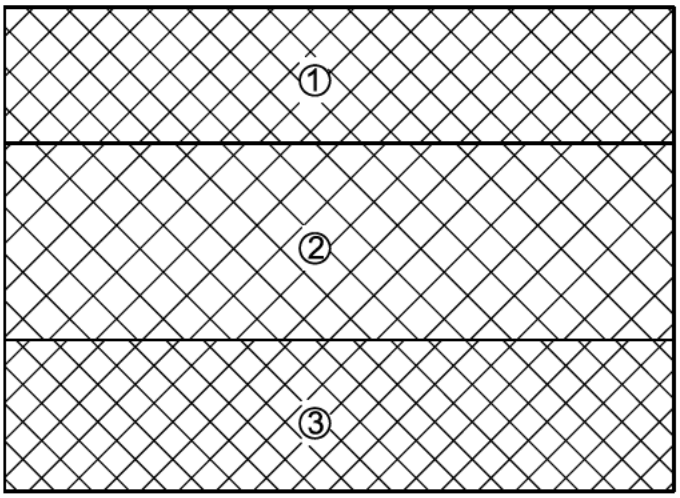
Figure No. SH10534.WS110

APPENDIX V

Trial Pit Logs

TRIAL PIT RECORD

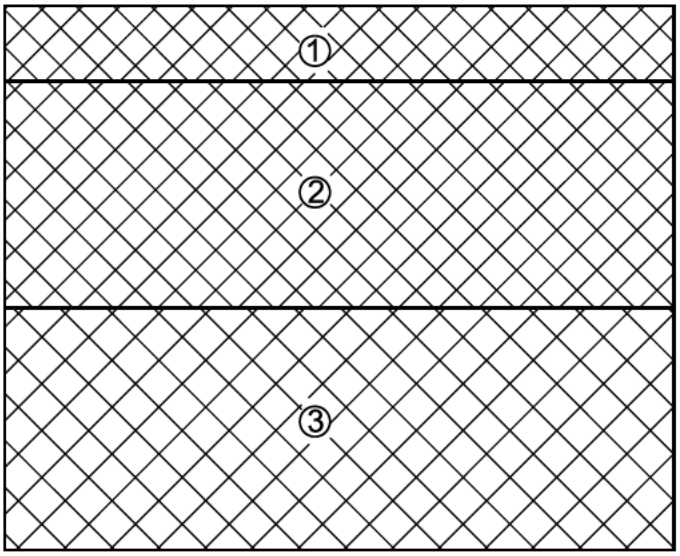
Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Cool, windy with showers.		**Trial Pit:** TP101
Grid Ref:	**Remarks:**	**Date:** 17/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-0.90	0.90	1	MADE GROUND: Loose brown slightly clayey gravelly sand. Gravel of brick, mudstone, sandstone and concrete.	0.6	D	Soil MAXI SVOC, Soluble Sulphate (2:1), TOC.
0.90-2.20	1.30	2	MADE GROUND: Soft brownish grey sandy gravelly clay. Gravel of brick, mudstone, shale, sandstone and concrete.			
2.20-3.20	1.00	3	MADE GROUND: Loose black slightly clayey slightly sandy gravel of angular-subangular shale.			

TRIAL PIT RECORD

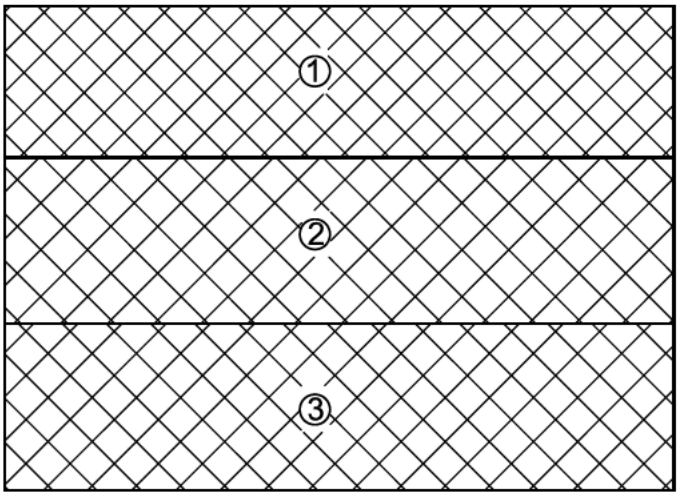
Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Cool, windy with showers.		**Trial Pit:** TP102
Grid Ref:	**Remarks:**	**Date:** 17/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-0.50	0.50	1	MADE GROUND: Loose brown slightly clayey gravelly sand. Gravel of brick, mudstone, sandstone and concrete.			
0.50-2.00	1.50	2	MADE GROUND: Soft brownish grey sandy gravelly clay. Gravel of mudstone, shale, sandstone and rare brick.	0.8 1.2	D B	Soil MIDI. Moisture Content, Atterberg Limits, PSD.
2.00-3.60	1.60	3	MADE GROUND: Loose black slightly clayey slightly sandy gravel of angular-subangular shale.			

TRIAL PIT RECORD

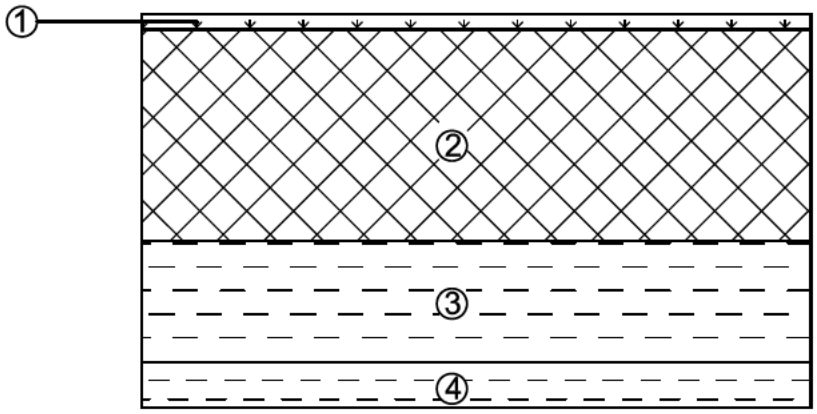
Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Cool, windy with showers.		**Trial Pit:** TP103
Grid Ref:	**Remarks:**	**Date:** 17/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-1.00	1.00	1	MADE GROUND: Loose brown sandy gravel of brick, sandstone aggregate, mudstone, sandstone and concrete.	0.4	D	Soil MAXI SVOC, Soluble Sulphate (2:1), TOC.
1.00-2.10	1.10	2	MADE GROUND: Soft dark brown-black sandy gravelly clay. Gravel of mudstone, shale, sandstone and rare brick.	1.2	D	
2.10-3.20	1.10	3	MADE GROUND: Loose black slightly sandy clayey gravel of angular-subangular shale.			

TRIAL PIT RECORD

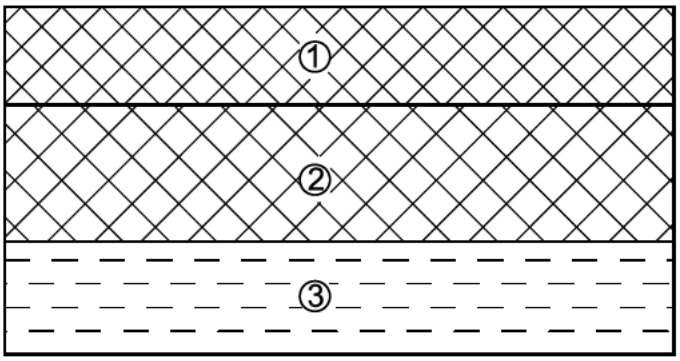
Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Cool, windy with showers.		**Trial Pit:** TP104
Grid Ref:	**Remarks:**	**Date:** 17/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-0.10	0.10	1	Loose dark brown slightly clayey slightly gravelly SAND (TOPSOIL). Gravel of sandstone aggregate, shale, mudstone and rare brick.	0.5	D	Soil MAXI SVOC, UKCWG, VOC, Asbestos.
0.10-1.50	1.40	2	MADE GROUND: Loose black slightly sandy cobbly gravel of angular-subangular shale.	1.0	B	2.5kg Compaction.
1.50-2.30	0.80	3	Soft-Firm orange brown sandy gravelly CLAY. Gravel of angular-subrounded sandstone, mudstone and coal fragments.			
2.30-2.60	0.30	4	Stiff brown mottled grey slightly sandy gravelly CLAY. Gravel of angular-subrounded sandstone and mudstone.			

TRIAL PIT RECORD

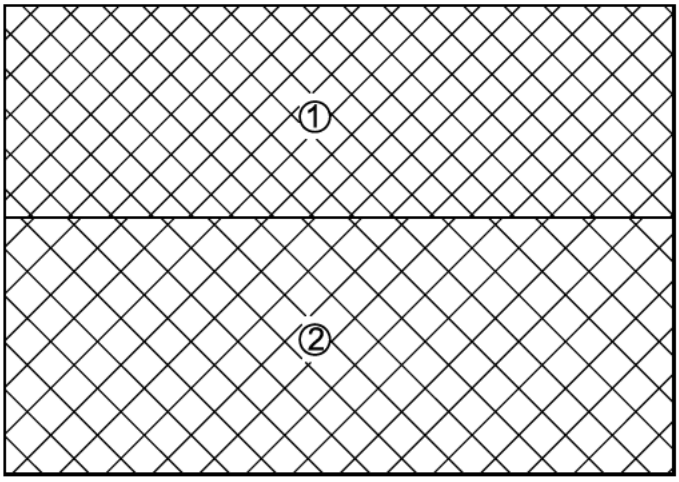
Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Light rain, breezy.		**Trial Pit:** TP105
Grid Ref:	**Remarks:**	**Date:** 18/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-0.65	0.65	1	MADE GROUND: Loose brown sandy cobbly gravel of brick, concrete, clinker, sandstone aggregate, sandstone, tarmac and rare ash; cobbles of brick, sandstone, tarmac and concrete.	0.3	D	Soil MAXI SVOC, UKCWG, VOC.
0.10-1.50	1.40	2	MADE GROUND: Loose black slightly sandy cobbly gravel of angular-subangular shale.	0.9	D	Soil MIDI.
1.55-2.30	0.75	3	Soft grey slightly gravelly CLAY. Gravel of angular-subrounded sandstone and mudstone.			

TRIAL PIT RECORD

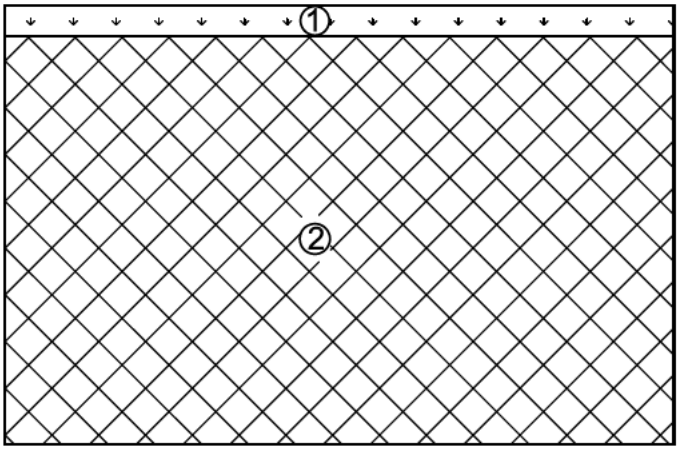
Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Light rain, breezy.		**Trial Pit:** TP106
Grid Ref:	**Remarks:**	**Date:** 18/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-1.40	1.40	1	MADE GROUND: Loose brown gravelly cobbly sand. Gravel of cobbles of brick, concrete, mudstone and sandstone.	0.5	D	Soil MAXI SVOC, Asbestos, Soluble Sulphate (2:1), TOC.
1.40-3.10	1.70	2	MADE GROUND: Soft grey sandy cobbly gravelly clay. Gravel and cobbles of mudstone, sandstone and rare brick.			

TRIAL PIT RECORD

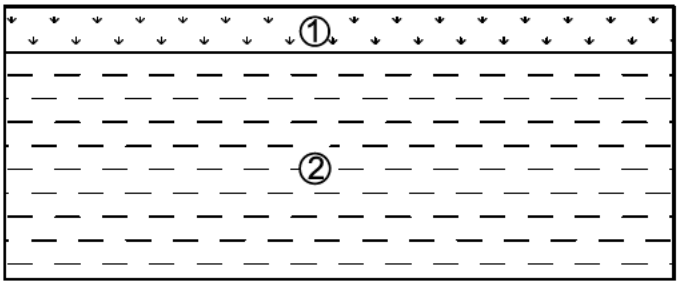
Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Light rain, breezy.		**Trial Pit:** TP107
Grid Ref:	**Remarks:**	**Date:** 18/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-0.20	0.20	1	Loose dark brown clayey SAND (TOPSOIL).			
0.20-2.90	2.70	2	MADE GROUND: Soft brownish grey slightly cobbly sandy gravelly clay. Gravel and cobbles of brick, mudstone, sandstone, shale, concrete and tarmac.	0.7	D	Soil MAXI SVOC, UKCWG, VOC, Asbestos,

TRIAL PIT RECORD

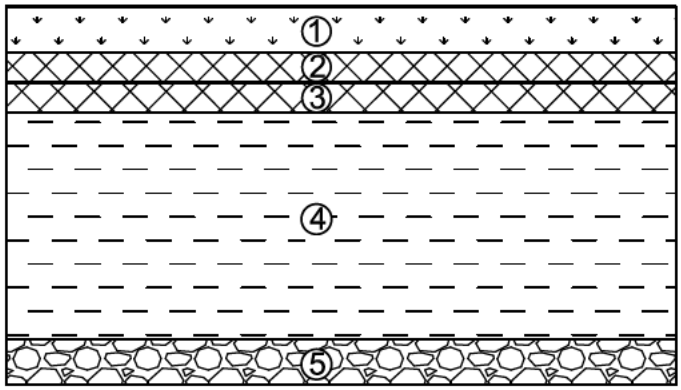
Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Light rain, breezy.		**Trial Pit:** TP108
Grid Ref:	**Remarks:**	**Date:** 18/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-0.30	0.30	1	Loose black slightly clayey gravelly SAND (TOPSOIL). Gravel of angular-subrounded sandstone and mudstone.			
0.30-1.80	1.50	2	Firm orange mottled grey slightly cobbly sandy gravelly CLAY. Gravel and cobbles of angular-subrounded sandstone.	0.75 0.9	D B	Soil MAXI SVOC. Moisture Content, Atterberg Limits, PSD.

TRIAL PIT RECORD

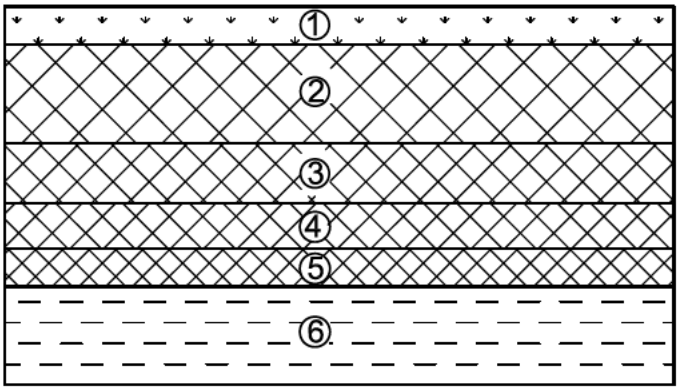
Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Light rain, breezy.		**Trial Pit:** TP109
Grid Ref:	**Remarks:**	**Date:** 18/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-0.30	0.30	1	Loose black slightly clayey gravelly SAND (TOPSOIL). Gravel of angular-subrounded sandstone and mudstone.			
0.30-0.50	0.20	2	MADE GROUND: Firm orange mottled grey slightly cobbly sandy gravelly CLAY. Gravel and cobbles of sandstone, mudstone and rare brick.	0.6	D	Soil MIDI, Soluble Sulphate (2:1), TOC.
0.50-0.70	0.20	3	MADE GROUND: Soft black sandy gravelly clay. Gravel of sandstone, mudstone and rare brick.			
0.70-2.20	1.50	4	Firm orange mottled grey slightly cobbly sandy gravelly CLAY. Gravel and cobbles of angular-subrounded sandstone.			
2.20-2.50	0.30	5	Dense orange slightly clayey sandy GRAVEL of angular-subrounded sandstone.			

TRIAL PIT RECORD

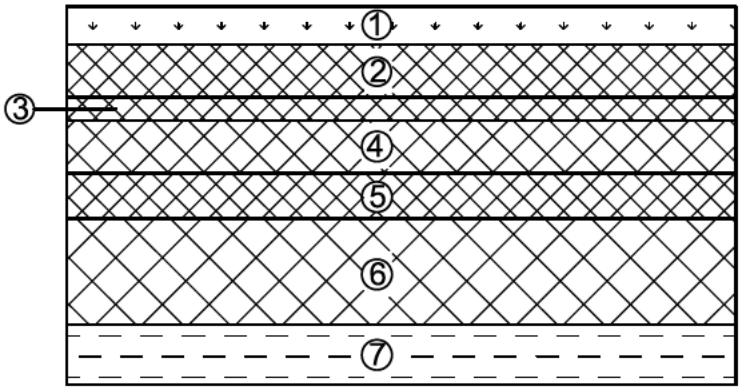
Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Light rain, breezy.		**Trial Pit:** TP110
Grid Ref:	**Remarks:**	**Date:** 18/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-0.25	0.25	1	Loose black slightly clayey gravelly SAND (TOPSOIL). Gravel of angular-subrounded sandstone and mudstone.			
0.25-0.90	0.65	2	MADE GROUND: Firm orange mottled grey slightly cobbly sandy gravelly CLAY. Gravel and cobbles of sandstone, mudstone and rare brick.			
0.90-1.30	0.40	3	MADE GROUND: Soft black sandy gravelly clay. Gravel of sandstone, mudstone and rare brick.	1.0	D	Soil MAXI SVOC, UKCWG, VOC, Asbestos.
1.30-1.60	0.30	4	MADE GROUND: Loose black slightly clayey slightly sandy gravel of angular-subangular shale.	1.4	D	
1.60-1.85	0.25	5	MADE GROUND: Loose black gravelly sand, Gravel of ash, shale, coal fragments and brick.			
1.85-2.50	0.65	6	Firm orange mottled grey slightly cobbly sandy gravelly CLAY with rare boulders. Gravel, cobbles and boulders. Gravel, cobbles and boulders of angular-subrounded sandstone.			

TRIAL PIT RECORD

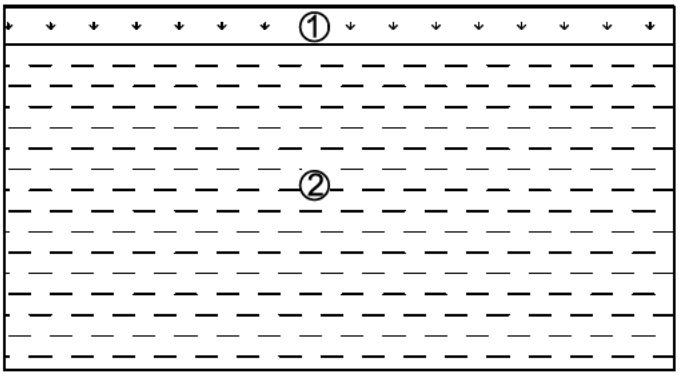
Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Light rain, breezy.		**Trial Pit:** TP111
Grid Ref:	**Remarks:**	**Date:** 18/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-0.25	0.25	1	Loose black slightly clayey gravelly SAND (TOPSOIL). Gravel of angular-subrounded sandstone and mudstone.			
0.25-0.60	0.35	2	MADE GROUND: Loose brown sandy gravel sandstone, mudstone and rare brick.			
0.60-0.75	0.15	3	MADE GROUND: Loose black sandy gravel of ash, shale, mudstone and rare brick.	0.7	D	Soil MAXI SVOC, UKCWG, VOC, Asbestos, Soluble Sulphate (2:1), TOC.
0.75-1.10	0.35	4	MADE GROUND: Soft black sandy gravelly clay. Gravel of sandstone, mudstone and rare brick.			
1.10-1.40	0.30	5	MADE GROUND: Loose black sandy gravel of ash, shale, mudstone, sandstone and brick.	1.2	D	Soil MAXI SVOC, UKCWG, VOC.
1.40-2.10	0.70	6	MADE GROUND: Soft grey sandy gravelly clay. Gravel of mudstone, shale and brick.			
2.10-2.50	0.40	7	Firm orange mottled grey slightly cobbly sandy gravelly CLAY with rare boulders. Gravel, cobbles and boulders of angular-subrounded sandstone.	2.2	B	2.5kg Compaction.

TRIAL PIT RECORD

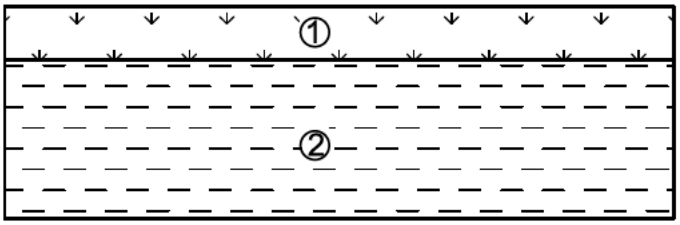
Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Light rain, breezy.		**Trial Pit:** TP112
Grid Ref:	**Remarks:**	**Date:** 18/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-0.25	0.25	1	Loose dark brown slightly clayey SAND (TOPSOIL).			
0.25-2.40	2.15	2	Firm orange mottled grey slightly cobbly sandy gravelly CLAY with rare boulders. Gravel, cobbles and boulders of angular-subrounded sandstone.	0.5	D	Soil MIDI.

TRIAL PIT RECORD

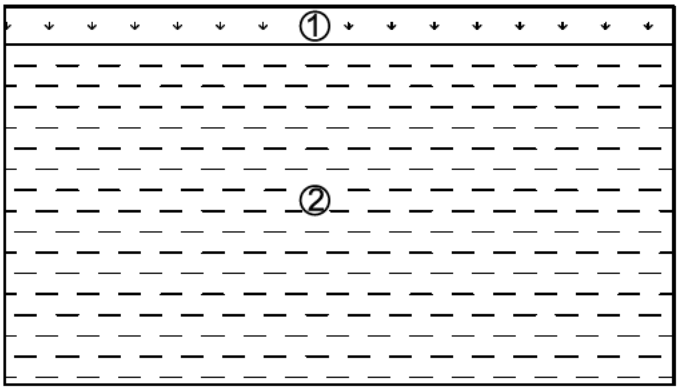
Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Mild, sunny, breezy.		**Trial Pit:** TP113
Grid Ref:	**Remarks:**	**Date:** 19/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-0.35	0.35	1	Loose dark brown slightly clayey slightly gravelly SAND (TOPSOIL). Gravel of sandstone.			
0.35-1.40	1.05	2	Firm orange mottled grey slightly cobbly sandy gravelly CLAY with rare boulders. Gravel, cobbles and boulders of angular-subrounded sandstone.	0.45	D	Soil MAXI SVOC, Soluble Sulphate (2:1), TOC.

TRIAL PIT RECORD

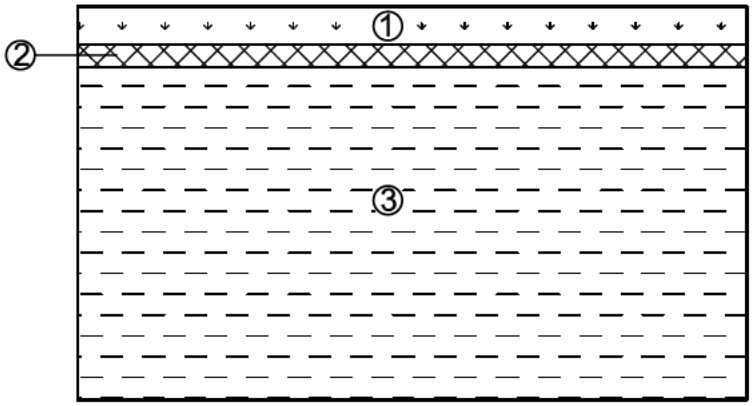
Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Mild, sunny, breezy.		**Trial Pit:** TP114
Grid Ref:	**Remarks:**	**Date:** 19/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-0.25	0.25	1	Loose dark brown slightly clayey slightly gravelly SAND (TOPSOIL). Gravel of sandstone.			
0.25-2.50	2.25	2	Firm-Stiff orange mottled grey slightly cobbly sandy gravelly CLAY with rare boulders. Gravel, cobbles and boulders of angular-subrounded sandstone. Increasing gravel, cobbles and boulders with depth.	0.8 1.1	D B	Soil MIDI, Soluble Sulphate (2:1), TOC. Moisture Content, Atterberg Limits, PSD.

TRIAL PIT RECORD

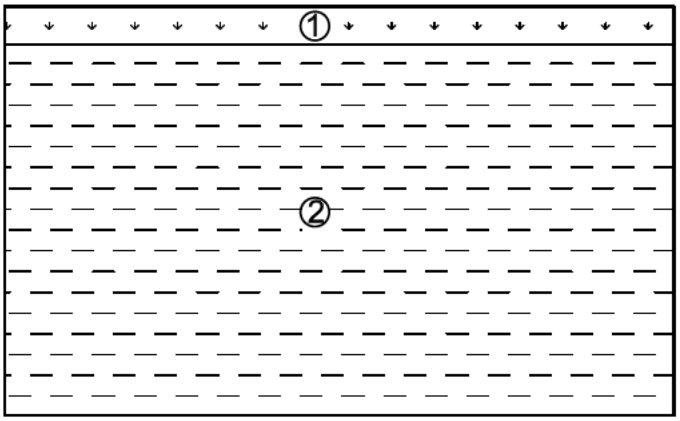
Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Mild, sunny, breezy.		**Trial Pit:** TP115
Grid Ref:	**Remarks:**	**Date:** 19/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-0.25	0.25	1	Loose black slightly clayey gravelly SAND (TOPSOIL). Gravel of angular-subrounded sandstone and shale.			
0.25-0.40	0.15	2	MADE GROUND: Loose black sandy gravel of brick, sandstone aggregate, shale, mudstone, sandstone and rare brick.	0.3	D	Soil MAXI SVOC, UKCWG, VOC, Asbestos.
0.40-2.60	2.20	3	Firm-Stiff orange brown mottled grey slightly cobbly sandy gravelly CLAY with rare boulders. Gravel, cobbles and boulders of angular-subrounded sandstone.			

TRIAL PIT RECORD

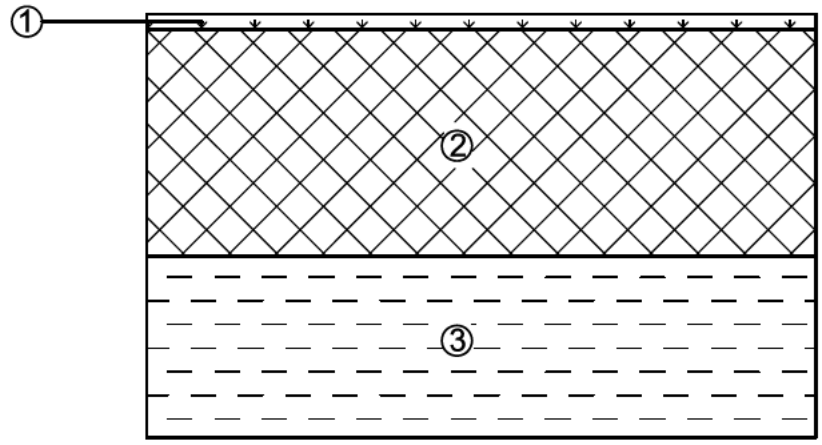
Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Mild, sunny, breezy.		**Trial Pit:** TP116
Grid Ref:	**Remarks:**	**Date:** 19/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-0.25	0.25	1	Loose dark brown slightly clayey slightly gravelly SAND (TOPSOIL). Gravel of sandstone.			
0.25-2.70	2.45	2	Firm orange brown mottled grey slightly cobbly sandy gravelly CLAY with rare boulders. Gravel, cobbles and boulders of angular-subrounded sandstone.	0.6	D	

TRIAL PIT RECORD

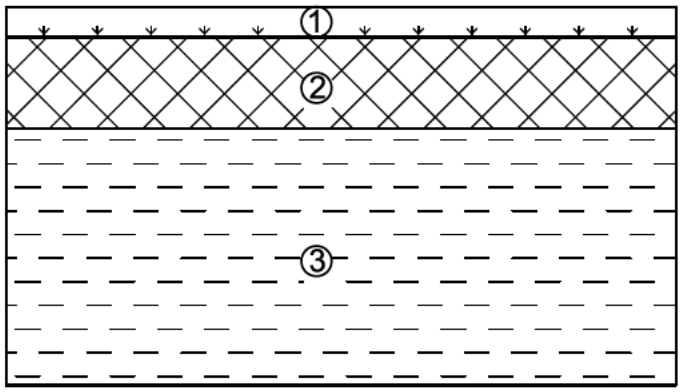
Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Mild, sunny, breezy.		**Trial Pit:** TP117
Grid Ref:	**Remarks:**	**Date:** 20/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-0.10	0.10	1	Loose dark brown clayey SAND (TOPSOIL).			
0.10-1.60	1.50	2	MADE GROUND: Loose dark grey slightly cobbly sandy gravel of shale and brick.	0.4	D	Soil MIDI.
1.60-2.80	1.20	3	Soft-Firm orange brown mottled grey slightly cobbly slightly gravelly sandy CLAY. Gravel and cobbles of angular-subrounded sandstone.			

TRIAL PIT RECORD

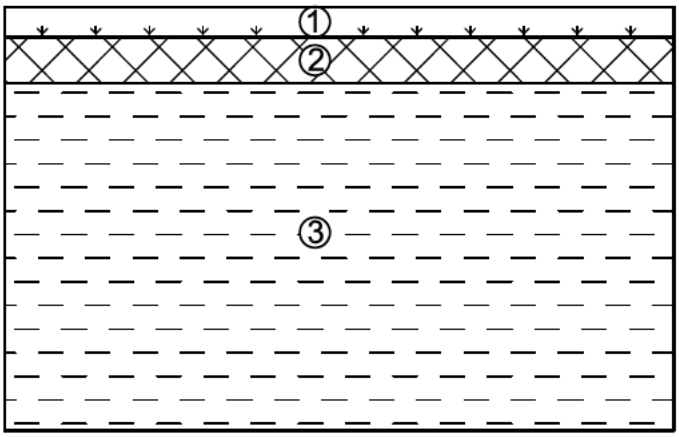
Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Mild, sunny, breezy.		**Trial Pit:** TP118
Grid Ref:	**Remarks:**	**Date:** 20/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-0.20	0.20	1	Loose dark brown clayey SAND (TOPSOIL).			
0.20-0.80	0.60	2	MADE GROUND: Loose brown slightly clayey gravelly sand. Gravel of sandstone, shale and rare brick.	0.7	D	Soil MAXI SVOC, Asbestos.
0.80-2.50	1.70	3	Firm orange mottled grey slightly cobbly sandy gravelly CLAY with rare boulders. Gravel, cobbles and boulders of angular-subrounded sandstone.	1.4	B	2.5kg Compaction.

TRIAL PIT RECORD

Excavator: JCB 3CX	**Project:** North Bierley WWTW	**Job No:** SH10534
Weather: Mild, sunny, breezy.		**Trial Pit:** TP119
Grid Ref:	**Remarks:**	**Date:** 20/05/2011
Logged By: M Kelly		



STRATA				SAMPLES		TESTS
Depth (m)	**Thickness (m)**	**No.**	**Description**	**Depth (m)**	**Type**	**Chemical / Geotechnical**
0.00-0.20	0.20	1	Loose dark brown clayey SAND (TOPSOIL).			
0.20-0.50	0.30	2	MADE GROUND: Loose brown slightly clayey gravelly sand. Gravel of sandstone, shale and rare brick.	0.3	D	Soil MIDI.
0.50-2.80	2.30	3	Firm orange mottled grey slightly cobbly sandy gravelly CLAY with rare boulders. Gravel, cobbles and boulders of angular-subrounded sandstone.			

APPENDIX VI

Geochemical Laboratory Results

ALcontrol Laboratories

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: mkt@alcontrol.com
Website: www.alcontrol.com

Wardell Armstrong LLP
Unit 4 Newton Business Centre
Thorncliffe Park
Sheffield
South Yorkshire
S35 2PH

Attention: James Lymer

CERTIFICATE OF ANALYSIS

Date:	23 June 2011
Customer:	H_WARDELL_SHF
Sample Delivery Group (SDG):	110523-40
Your Reference:	SH10534
Location:	
Report No:	135537

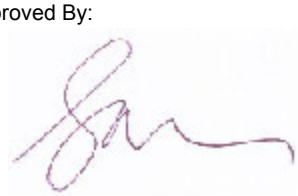
This report has been revised and directly supersedes 132894 in its entirety.

We received 34 samples on Saturday May 21, 2011 and 30 of these samples were scheduled for analysis which was completed on Thursday June 23, 2011. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

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

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

Approved By:



Sonia McWhan

Operations Manager

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
3515843	TP 101		0.60	17/05/2011
3515844	TP 102		0.80	17/05/2011
3515847	TP 103		0.40	17/05/2011
3515848	TP 103		1.20	17/05/2011
3515852	TP 104		0.50	17/05/2011
3515853	TP 105		0.30	18/05/2011
3515854	TP 105		0.90	18/05/2011
3515856	TP 106		0.50	18/05/2011
3515860	TP 107		0.70	18/05/2011
3515861	TP 108		0.75	18/05/2011
3515862	TP 109		0.60	18/05/2011
3515863	TP 110		1.00	18/05/2011
3515864	TP 110		1.40	18/05/2011
3515866	TP 111		0.70	18/05/2011
3515870	TP 112		0.50	18/05/2011
3515872	TP 113		0.45	19/05/2011
3515876	TP 114		0.80	19/05/2011
3515881	TP 116		0.60	19/05/2011
3515882	TP 117		0.40	20/05/2011
3515883	TP 118		0.70	20/05/2011
3515886	TP 119		0.30	20/05/2011
3515887	WS 101		0.40	16/05/2011
3515888	WS 102		0.70	16/05/2011
3515891	WS 103		0.30	16/05/2011
3515892	WS 103		0.60	16/05/2011
3515894	WS 104		0.40	16/05/2011
3515895	WS 105		0.30	16/05/2011
3515897	WS 106		0.50	16/05/2011
3515899	WS 107		0.50	17/05/2011
3515902	WS 109		0.70	17/05/2011
3515903	WS 110		0.60	17/05/2011

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

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

SOLID

Results Legend

X Test

N No Determination Possible

Lab Sample No(s)				3515843		3515844		3515847			3515852			3515853		3515854		3515856			3515860		3515861		3515862			3515863			3515866			3515869		3515870		3515872		3515876		3515878
Customer Sample Reference				TP 101		TP 102		TP 103			TP 104			TP 105		TP 105		TP 106			TP 107		TP 108		TP 109			TP 110			TP 111			TP 111		TP 112		TP 113		TP 114		TP 115
AGS Reference																																										
Depth (m)				0.60		0.80		0.40			0.50			0.30		0.90		0.50			0.70		0.75		0.60			1.00			0.70			1.20		0.50		0.45		0.80		0.30
Container			250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)
Anions by Kone (soil)	All	NDPs: 0 Tests: 23	X				X		X			X					X		X			X		X		X			X			X					X		X		X	
Anions by Kone (w)	All	NDPs: 0 Tests: 3																															X									X
Asbestos Containing Material Screen	All	NDPs: 0 Tests: 13						X		X		X						X		X							X			X												X
Asbestos Identification	All	NDPs: 0 Tests: 1						X																																		
Boron Water Soluble	All	NDPs: 0 Tests: 12			X										X									X											X				X			
CEN Readings	All	NDPs: 0 Tests: 6		X						X																							X									X
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 30		X		X		X		X			X			X		X		X			X		X		X			X			X			X		X		X		X
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 6		X						X																							X									X
Easily Liberated Sulphide	All	NDPs: 0 Tests: 12				X										X									X											X				X		
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 3																															X									X
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 10							X			X							X							X			X			X									X	
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 3																															X									X
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 10							X			X							X							X			X			X									X	
GRO by GC-FID (S)	All	NDPs: 0 Tests: 10									X			X							X							X			X			X								
GRO by GC-FID (W)	All	NDPs: 0 Tests: 3																															X									X

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

SOLID

Results Legend

X **Test**

N **No Determination Possible**

Lab Sample No(s)			3515843		3515844		3515847		3515852			3515853			3515854		3515856		3515860			3515861		3515862		3515863			3515866			3515869			3515870		3515872		3515876		3515878	
Customer Sample Reference			TP 101		TP 102		TP 103		TP 104			TP 105			TP 105		TP 106		TP 107			TP 108		TP 109		TP 110			TP 111			TP 111			TP 112		TP 113		TP 114		TP 115	
AGS Reference																																										
Depth (m)			0.60		0.80		0.40		0.50			0.30			0.90		0.50		0.70			0.75		0.60		1.00			0.70			1.20			0.50		0.45		0.80		0.30	
Container			250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 30		X		X		X		X			X			X		X		X			X		X		X			X			X			X		X		X		X		X
Hexavalent Chromium (w)	All	NDPs: 0 Tests: 3																															X								X
Mercury Dissolved	All	NDPs: 0 Tests: 6		X						X																							X								X
Metals by iCap-OES (Soil)	Arsenic	NDPs: 0 Tests: 30	X		X		X		X			X			X		X		X			X		X		X			X			X			X		X		X		X	
	Cadmium	NDPs: 0 Tests: 30	X		X		X		X			X			X		X		X			X		X		X			X			X			X		X		X		X	
	Chromium	NDPs: 0 Tests: 30	X		X		X		X			X			X		X		X			X		X		X			X			X			X		X		X		X	
	Copper	NDPs: 0 Tests: 30	X		X		X		X			X			X		X		X			X		X		X			X			X			X		X		X		X	
	Lead	NDPs: 0 Tests: 30	X		X		X		X			X			X		X		X			X		X		X			X			X			X		X		X		X	
	Mercury	NDPs: 0 Tests: 30	X		X		X		X			X			X		X		X			X		X		X			X			X			X		X		X		X	
	Nickel	NDPs: 0 Tests: 30	X		X		X		X			X			X		X		X			X		X		X			X			X			X		X		X		X	
	Selenium	NDPs: 0 Tests: 30	X		X		X		X			X			X		X		X			X		X		X			X			X			X		X		X		X	
	Thallium	NDPs: 0 Tests: 1																				X																				
	Vanadium	NDPs: 0 Tests: 18	X				X		X			X					X		X			X				X			X			X					X				X	
	Zinc	NDPs: 0 Tests: 30	X		X		X		X			X			X		X		X			X		X		X			X			X			X		X		X		X	
PAH by GCMS	All	NDPs: 0 Tests: 12			X										X									X											X				X			

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

SOLID

Results Legend

X **Test**

N **No Determination Possible**

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
			3515843	TP 101		0.60	250g Amber Jar (AL
			3515843	TP 101		0.60	400g Tub (ALE214)
			3515844	TP 102		0.80	250g Amber Jar (AL
			3515844	TP 102		0.80	400g Tub (ALE214)
			3515847	TP 103		0.40	250g Amber Jar (AL
			3515847	TP 103		0.40	400g Tub (ALE214)
			3515852	TP 104		0.50	250g Amber Jar (AL
			3515852	TP 104		0.50	400g Tub (ALE214)
			3515852	TP 104		0.50	60g VOC (ALE215)
			3515853	TP 105		0.30	250g Amber Jar (AL
			3515853	TP 105		0.30	400g Tub (ALE214)
			3515853	TP 105		0.30	60g VOC (ALE215)
			3515854	TP 105		0.90	250g Amber Jar (AL
			3515854	TP 105		0.90	400g Tub (ALE214)
			3515856	TP 106		0.50	250g Amber Jar (AL
			3515856	TP 106		0.50	400g Tub (ALE214)
			3515860	TP 107		0.70	250g Amber Jar (AL
			3515860	TP 107		0.70	400g Tub (ALE214)
			3515860	TP 107		0.70	60g VOC (ALE215)
			3515861	TP 108		0.75	250g Amber Jar (AL
			3515861	TP 108		0.75	400g Tub (ALE214)
			3515862	TP 109		0.60	250g Amber Jar (AL
			3515862	TP 109		0.60	400g Tub (ALE214)
			3515863	TP 110		1.00	250g Amber Jar (AL
			3515863	TP 110		1.00	400g Tub (ALE214)
			3515863	TP 110		1.00	60g VOC (ALE215)
			3515866	TP 111		0.70	250g Amber Jar (AL
			3515866	TP 111		0.70	400g Tub (ALE214)
			3515866	TP 111		0.70	60g VOC (ALE215)
			3515869	TP 111		1.20	250g Amber Jar (AL
			3515869	TP 111		1.20	400g Tub (ALE214)
			3515869	TP 111		1.20	60g VOC (ALE215)
			3515870	TP 112		0.50	250g Amber Jar (AL
			3515870	TP 112		0.50	400g Tub (ALE214)
			3515872	TP 113		0.45	250g Amber Jar (AL
			3515872	TP 113		0.45	400g Tub (ALE214)
			3515876	TP 114		0.80	250g Amber Jar (AL
			3515876	TP 114		0.80	400g Tub (ALE214)
			3515878	TP 115		0.30	250g Amber Jar (AL
			3515878	TP 115		0.30	400g Tub (ALE214)
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 6					
pH	All	NDPs: 0 Tests: 30					
pH Value	All	NDPs: 0 Tests: 3					
Phenols by HPLC (S)	All	NDPs: 0 Tests: 30					
Phenols by HPLC (W)	All	NDPs: 0 Tests: 3					
Sample description	All	NDPs: 0 Tests: 30					
Semi Volatile Organic Compounds	All	NDPs: 0 Tests: 18					
Sulphide	All	NDPs: 0 Tests: 3					
Total Organic Carbon	All	NDPs: 0 Tests: 12					
Total Sulphate	All	NDPs: 0 Tests: 30					
Total Sulphur	All	NDPs: 0 Tests: 12					
TPH CWG (W)	All	NDPs: 0 Tests: 3					
TPH CWG GC (S)	All	NDPs: 0 Tests: 10					
VOC MS (S)	All	NDPs: 0 Tests: 10					

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

SOLID

Results Legend

- X = **Test**
- N = **No Determination Possible**

Lab Sample No(s)			3515887		3515888		3515891			3515894		3515895			3515897		3515899		3515901			3515902		3515903		3515878	3515882		3515883		3515886	
Customer Sample Reference			WS 101		WS 102		WS 103			WS 104		WS 105			WS 106		WS 107		WS 108			WS 109		WS 110		TP 115	TP 117		TP 118		TP 119	
AGS Reference																																
Depth (m)			0.40		0.70		0.30			0.40		0.30			0.50		0.50		0.40			0.70		0.60		0.30	0.40		0.70		0.30	
Container			250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)
Anions by Kone (soil)	All	NDPs: 0 Tests: 23	X				X			X		X					X		X			X		X					X			
Anions by Kone (w)	All	NDPs: 0 Tests: 3																		X												
Asbestos Containing Material Screen	All	NDPs: 0 Tests: 13						X					X							X					X					X		
Boron Water Soluble	All	NDPs: 0 Tests: 12	X		X					X					X							X					X				X	
CEN Readings	All	NDPs: 0 Tests: 6																		X										X		
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 30		X		X		X			X		X			X		X		X			X		X			X		X		X
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 6																		X										X		
Easily Liberated Sulphide	All	NDPs: 0 Tests: 12		X		X					X					X							X					X				X
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 3																		X												
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 10					X					X							X													
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 3																		X												
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 10					X					X							X													
GRO by GC-FID (S)	All	NDPs: 0 Tests: 10							X					X							X					X						
GRO by GC-FID (W)	All	NDPs: 0 Tests: 3																		X												
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 30		X		X		X			X		X			X		X		X			X		X			X		X		X

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

SOLID

Results Legend

X **Test**

N **No Determination Possible**

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
			3515887	WS 101		0.40	250g Amber Jar (AL
			3515888	WS 102		0.70	400g Tub (ALE214)
			3515891	WS 103		0.30	250g Amber Jar (AL
			3515894	WS 104		0.40	400g Tub (ALE214)
			3515895	WS 105		0.30	250g Amber Jar (AL
			3515897	WS 106		0.50	400g Tub (ALE214)
			3515899	WS 107		0.50	250g Amber Jar (AL
			3515901	WS 108		0.40	400g Tub (ALE214)
			3515902	WS 109		0.70	60g VOC (ALE215)
			3515903	WS 110		0.60	250g Amber Jar (AL
			3515878	TP 115		0.30	400g Tub (ALE214)
			3515882	TP 117		0.40	60g VOC (ALE215)
			3515883	TP 118		0.70	250g Amber Jar (AL
			3515886	TP 119		0.30	400g Tub (ALE214)
Hexavalent Chromium (w)	All	NDPs: 0 Tests: 3					
Mercury Dissolved	All	NDPs: 0 Tests: 6					
Metals by iCap-OES (Soil)	Arsenic	NDPs: 0 Tests: 30					
	Cadmium	NDPs: 0 Tests: 30					
	Chromium	NDPs: 0 Tests: 30					
	Copper	NDPs: 0 Tests: 30					
	Lead	NDPs: 0 Tests: 30					
	Mercury	NDPs: 0 Tests: 30					
	Nickel	NDPs: 0 Tests: 30					
	Selenium	NDPs: 0 Tests: 30					
	Vanadium	NDPs: 0 Tests: 18					
	Zinc	NDPs: 0 Tests: 30					
PAH by GCMS	All	NDPs: 0 Tests: 12					
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 6					
PCBs by GCMS	All	NDPs: 0 Tests: 4					

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

SOLID

Results Legend

X Test

N No Determination Possible

Lab Sample No(s)			3515887		3515888		3515891			3515894		3515895			3515897		3515899		3515901			3515902		3515903		3515878	3515882		3515883		3515886	
Customer Sample Reference			WS 101		WS 102		WS 103			WS 104		WS 105			WS 106		WS 107		WS 108			WS 109		WS 110		TP 115	TP 117		TP 118		TP 119	
AGS Reference																																
Depth (m)			0.40		0.70		0.30			0.40		0.30			0.50		0.50		0.40			0.70		0.60		0.30	0.40		0.70		0.30	
Container			250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)
pH	All	NDPs: 0 Tests: 30		X		X		X			X		X			X		X		X			X		X			X		X		X
pH Value	All	NDPs: 0 Tests: 3																		X												
Phenols by HPLC (S)	All	NDPs: 0 Tests: 30		X		X		X			X		X			X		X		X			X		X			X		X		X
Phenols by HPLC (W)	All	NDPs: 0 Tests: 3																		X												
Sample description	All	NDPs: 0 Tests: 30	X		X		X			X		X			X		X		X			X		X			X		X		X	
Semi Volatile Organic Compounds	All	NDPs: 0 Tests: 18					X					X					X		X					X					X			
Sulphide	All	NDPs: 0 Tests: 3																		X												
Total Organic Carbon	All	NDPs: 0 Tests: 12	X							X							X					X		X								
Total Sulphate	All	NDPs: 0 Tests: 30	X		X		X			X		X			X		X		X			X		X			X		X		X	
Total Sulphur	All	NDPs: 0 Tests: 12	X		X					X					X							X					X				X	
TPH CWG (W)	All	NDPs: 0 Tests: 3																		X												
TPH CWG GC (S)	All	NDPs: 0 Tests: 10					X					X							X													
VOC MS (S)	All	NDPs: 0 Tests: 10							X					X							X					X						

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

Sample Descriptions

Grain Sizes

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

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
3515843	TP 101	0.60	Dark Brown	Top Soil	0.063 - 0.1 mm	Stones	Vegetation
3515844	TP 102	0.80	Dark Brown	Silty Clay	0.063 - 0.1 mm	Stones	N/A
3515847	TP 103	0.40	Light Brown	Sandy Loam	0.1 - 2 mm	Stones	None
3515852	TP 104	0.50	Light Brown	Clay	<0.063 mm	None	None
3515853	TP 105	0.30	Dark Brown	Silty Sand	0.063 - 0.1 mm	Crushed Brick	Vegetation
3515854	TP 105	0.90	Light Brown	Clay	<0.063 mm	None	None
3515856	TP 106	0.50	Light Brown	Silt Loam	0.063 - 0.1 mm	Stones	None
3515860	TP 107	0.70	Light Brown	Silty Clay Loam	0.063 - 0.1 mm	Stones	None
3515861	TP 108	0.75	Light Brown	Silty Clay	0.063 - 0.1 mm	Stones	None
3515862	TP 109	0.60	Dark Brown	Silty Sand	0.063 - 0.1 mm	Stones	None
3515863	TP 110	1.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	None
3515866	TP 111	0.70	Light Brown	Silt Loam	0.063 - 0.1 mm	None	None
3515869	TP 111	1.20	Dark Brown	Silty Clay Loam	0.063 - 0.1 mm	Crushed Brick	Stones
3515870	TP 112	0.50	Light Brown	Silty Clay Loam	0.063 - 0.1 mm	Stones	None
3515872	TP 113	0.45	Light Brown	Silt Loam	0.063 - 0.1 mm	None	None
3515876	TP 114	0.80	Light Brown	Silt	0.063 - 0.1 mm	Vegetation	Stones
3515878	TP 115	0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	None
3515882	TP 117	0.40	Grey	Shale	0.063 - 0.1 mm	Vegetation	None
3515883	TP 118	0.70	Light Brown	Silt Loam	0.063 - 0.1 mm	Stones	None
3515886	TP 119	0.30	Light Brown	Clay Loam	<0.063 mm	Stones	None
3515887	WS 101	0.40	Dark Brown	Silty Clay	0.063 - 0.1 mm	Stones	Vegetation
3515888	WS 102	0.70	Dark Brown	Silty Clay Loam	0.063 - 0.1 mm	Stones	None
3515891	WS 103	0.30	Light Brown	Silty Clay	0.063 - 0.1 mm	Stones	None
3515894	WS 104	0.40	Light Brown	Clay	<0.063 mm	Stones	None
3515895	WS 105	0.30	Light Brown	Clay	<0.063 mm	Stones	None
3515897	WS 106	0.50	Dark Brown	Silty Clay Loam	0.063 - 0.1 mm	Stones	None
3515899	WS 107	0.50	Dark Brown	Clay	<0.063 mm	Stones	None
3515901	WS 108	0.40	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	None
3515902	WS 109	0.70	Dark Brown	Clay Loam	<0.063 mm	Vegetation	None
3515903	WS 110	0.60	Dark Brown	Silt Loam	0.063 - 0.1 mm	Stones	None

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

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

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

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	TP 101	TP 102	TP 103	TP 104	TP 105	TP 105
			Depth (m)	0.60	0.80	0.40	0.50	0.30	0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	17/05/2011	17/05/2011	17/05/2011	17/05/2011	18/05/2011	18/05/2011
			Date Received	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011
			SDG Ref	110523-40	110523-40	110523-40	110523-40	110523-40	110523-40
			Lab Sample No.(s)	3515843	3515844	3515847	3515852	3515853	3515854
			AGS Reference						
Moisture	%	PM114		13.7			7.84		
Moisture content ratio	%	PM114		15.8			8.51		
Dry matter content ratio	%	PM114		86.4			92.2		
Asbestos Containing Material Screen	-	TM001				Possible ACM Det	No ACM Detected	No ACM Detected	
Phenol	<0.01 mg/kg	TM062 (S)			<0.01				<0.01
Phenols, Total Detected monohydric	mg/kg	TM062 (S)		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Organic Carbon, Total	<0.2 %	TM132		1.87 #		3.27 #			
Sulphur, Total	<0.02 %	TM132			0.03 #				0.03 #
pH	1 pH Units	TM133		8.13 M	7.85 M	8.16 M	7.9 M	8.31 M	7.88 M
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<1.2 #	<0.6 #	<0.6 #	<0.6 #
Total Cyanide	<1 mg/kg	TM153			3.75 M				<1 M
Free Cyanide	<1 mg/kg	TM153			<1 M				<1 M
Thiocyanate	<1 mg/kg	TM153			<1 M				<1 M
Cyanide, Free	<1 mg/kg	TM153		<1 M		<1 M	<1 M	<1 M	
Sulphide, Easily liberated	<15 mg/kg	TM180			<15 #				<15 #
Arsenic	<0.6 mg/kg	TM181		18.2 M	25.6 M	41.2 M	12.8 M	20.7 M	6.09 M
Cadmium	<0.02 mg/kg	TM181		1.58 M	0.463 M	<0.02 M	0.49 M	0.502 M	0.447 M
Chromium	<0.9 mg/kg	TM181		19.7 M	25.6 M	810 M	23.1 M	166 M	28 M
Copper	<1.4 mg/kg	TM181		84.6 M	115 M	85.1 M	45.1 M	85.6 M	22.8 M
Lead	<0.7 mg/kg	TM181		1680 M	1150 M	73.1 M	26.1 M	95.8 M	21.5 M
Mercury	<0.14 mg/kg	TM181		0.147 M	0.61 M	<0.14 M	<0.14 M	<0.14 M	<0.14 M
Nickel	<0.2 mg/kg	TM181		20.8 M	39.2 M	50.6 M	49.3 M	34.7 M	31.9 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	2.69 #	<1 #	1.06 #	<1 #
Vanadium	<0.2 mg/kg	TM181		38.8 #		107 #	16.4 #	61.6 #	
Zinc	<1.9 mg/kg	TM181		1230 M	122 M	154 M	113 M	208 M	76 M
Sulphate, Total	<48 mg/kg	TM221		248 M	101 M	1340 M	217 M	1410 M	173 M
Boron, water soluble	<1 mg/kg	TM222			<1 M				<1 M
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l	TM243		<0.008 M		0.0879 M	0.0393 M	0.0582 M	

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	TP 106	TP 107	TP 108	TP 109	TP 110	TP 111
			Depth (m)	0.50	0.70	0.75	0.60	1.00	0.70
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	18/05/2011	18/05/2011	18/05/2011	18/05/2011	18/05/2011	18/05/2011
			Date Received	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011
			SDG Ref	110523-40	110523-40	110523-40	110523-40	110523-40	110523-40
			Lab Sample No.(s)	3515856	3515860	3515861	3515862	3515863	3515866
			AGS Reference						
Asbestos Containing Material Screen	-	TM001		No ACM Detected	No ACM Detected			No ACM Detected	No ACM Detected
Phenol	<0.01 mg/kg	TM062 (S)					<0.01		
Phenols, Total Detected monohydric	mg/kg	TM062 (S)		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Organic Carbon, Total	<0.2 %	TM132		1.43 #			3.29 #		10.1 #
Sulphur, Total	<0.02 %	TM132					0.07 #		
pH	1 pH Units	TM133		8.07 M	6.79 M	7.72 M	7.53 M	7.12 M	6.29 M
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<1.2 #	<0.6 #	<1.2 #
Total Cyanide	<1 mg/kg	TM153					1.47 M		
Free Cyanide	<1 mg/kg	TM153					<1 M		
Thiocyanate	<1 mg/kg	TM153					<1 M		
Cyanide, Free	<1 mg/kg	TM153		<1 M	<1 M	<1 M		<1 M	<1 M
Sulphide, Easily liberated	<15 mg/kg	TM180					<15 #		
Arsenic	<0.6 mg/kg	TM181		8.64 M	10 M	7.88 M	101 M	28.1 M	45.9 M
Cadmium	<0.02 mg/kg	TM181		0.511 M	<0.02 M	1.08 M	1.21 M	1.3 M	<0.02 M
Chromium	<0.9 mg/kg	TM181		24.1 M	24.6 M	24.3 M	98.8 M	25.4 M	19.7 M
Copper	<1.4 mg/kg	TM181		32.1 M	24 M	24.8 M	127 M	85.4 M	37.9 M
Lead	<0.7 mg/kg	TM181		21.2 M	21.7 M	21.7 M	160 M	70.1 M	22.2 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	<0.14 M	<0.14 M	<0.14 M	<0.14 M
Nickel	<0.2 mg/kg	TM181		34.3 M	36.1 M	10.6 M	29.6 M	44.5 M	30.3 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<10 #	<10 #	2.1 #	<1 #
Thallium	<0.7 mg/kg	TM181				<7 #			
Vanadium	<0.2 mg/kg	TM181		22.8 #	24.9 #	29 #		43.6 #	25.6 #
Zinc	<1.9 mg/kg	TM181		92 M	92.2 M	51.1 M	219 M	313 M	62.9 M
Sulphate, Total	<48 mg/kg	TM221		748 M	765 M	161 M	505 M	258 M	4560 M
Boron, water soluble	<1 mg/kg	TM222					<1 M		
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l	TM243		0.0291 M	0.167 M	0.0226 M	<0.016 M	0.0414 M	0.204 M

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	TP 111	TP 112	TP 113	TP 114	TP 115	TP 117
			Depth (m)	1.20	0.50	0.45	0.80	0.30	0.40
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	18/05/2011	18/05/2011	19/05/2011	19/05/2011	19/05/2011	20/05/2011
			Date Received	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011
			SDG Ref	110523-40	110523-40	110523-40	110523-40	110523-40	110523-40
			Lab Sample No.(s)	3515869	3515870	3515872	3515876	3515878	3515882
			AGS Reference						
Moisture	%	PM114		17.5				12.5	
Moisture content ratio	%	PM114		21.2				14.3	
Dry matter content ratio	%	PM114		82.5				87.5	
Asbestos Containing Material Screen	-	TM001						No ACM Detected	
Phenol	<0.01 mg/kg	TM062 (S)			<0.01		<0.01		<0.01
Phenols, Total Detected monohydric	mg/kg	TM062 (S)		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Organic Carbon, Total	<0.2 %	TM132				0.46 #	2.48 #		
Sulphur, Total	<0.02 %	TM132			0.02 #		0.02 #		0.07 #
pH	1 pH Units	TM133		7.76 M	7.27 M	8.25 M	8.36 #	7.94 M	7.56 #
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Total Cyanide	<1 mg/kg	TM153			<1 M		<1 #		<1 #
Free Cyanide	<1 mg/kg	TM153			<1 M		<1 #		<1 #
Thiocyanate	<1 mg/kg	TM153			<1 M		<1 #		<1 #
Cyanide, Free	<1 mg/kg	TM153		<1 M		<1 M		<1 M	
Sulphide, Easily liberated	<15 mg/kg	TM180			<15 #		<15 #		<15 #
Arsenic	<0.6 mg/kg	TM181		52.3 M	9.61 M	9.84 M	19.4 #	56.8 M	5.79 #
Cadmium	<0.02 mg/kg	TM181		<0.2 M	0.331 M	0.35 M	1.82 #	<0.02 M	0.307 #
Chromium	<0.9 mg/kg	TM181		30.4 M	23.4 M	23.3 M	40 #	63.7 M	26.6 #
Copper	<1.4 mg/kg	TM181		51 M	24 M	16.7 M	40.1 #	64.3 M	46.3 #
Lead	<0.7 mg/kg	TM181		43.5 M	16.5 M	17.8 M	34.4 #	52.6 M	16.9 #
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	<0.14 M	<0.14 #	<0.14 M	<0.14 #
Nickel	<0.2 mg/kg	TM181		36.7 M	26.6 M	18.8 M	33.3 #	33.1 M	52.4 #
Selenium	<1 mg/kg	TM181		<10 #	<1 #	<1 #	<10 #	<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		45.5 #		25.2 #		27.4 #	
Zinc	<1.9 mg/kg	TM181		79.8 M	74.4 M	59.8 M	130 #	115 M	105 #
Sulphate, Total	<48 mg/kg	TM221		837 M	78.7 M	153 M	74.5 #	2040 M	136 #
Boron, water soluble	<1 mg/kg	TM222			<1 M		<1 #		<1 #
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l	TM243		0.2 M		<0.016 M	<0.008 #	0.123 M	

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	TP 118	TP 119	WS 101	WS 102	WS 103	WS 104
			Depth (m)	0.70	0.30	0.40	0.70	0.30	0.40
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	20/05/2011	20/05/2011	16/05/2011	16/05/2011	16/05/2011	16/05/2011
			Date Received	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011
			SDG Ref	110523-40	110523-40	110523-40	110523-40	110523-40	110523-40
			Lab Sample No.(s)	3515883	3515886	3515887	3515888	3515891	3515894
			AGS Reference						
Moisture	%	PM114		17.8					
Moisture content ratio	%	PM114		21.7					
Dry matter content ratio	%	PM114		82.2					
Asbestos Containing Material Screen	-	TM001		No ACM Detected				No ACM Detected	
Phenol	<0.01 mg/kg	TM062 (S)			<0.01	<0.01	<0.01		<0.01
Phenols, Total Detected monohydric	mg/kg	TM062 (S)		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Organic Carbon, Total	<0.2 %	TM132				2.1 #			0.971 #
Sulphur, Total	<0.02 %	TM132			0.04 #	0.04 #	0.16 #		0.02 #
pH	1 pH Units	TM133		8.23 M	7.65 M	7.86 M	8.1 M	8.67 M	8.08 M
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	1.37 #	<0.6 #	<0.6 #
Total Cyanide	<1 mg/kg	TM153			<1 M	<1 M	8.7 M		1.13 M
Free Cyanide	<1 mg/kg	TM153			<1 M	<1 M	<1 M		<1 M
Thiocyanate	<1 mg/kg	TM153			<1 M	<1 M	<1 M		<1 M
Cyanide, Free	<1 mg/kg	TM153		<1 M				<1 M	
PCB congener 28	<3 µg/kg	TM168					<3 M	<3 M	
PCB congener 52	<3 µg/kg	TM168					<3 M	<3 M	
PCB congener 101	<3 µg/kg	TM168					<3 M	<3 M	
PCB congener 118	<3 µg/kg	TM168					<3 M	<3 M	
PCB congener 138	<3 µg/kg	TM168					<3 M	<3 M	
PCB congener 153	<3 µg/kg	TM168					<3 M	<3 M	
PCB congener 180	<3 µg/kg	TM168					<3 M	<3 M	
PCBs, Total ICES 7	µg/kg	TM168					<3	<3	
Sulphide, Easily liberated	<15 mg/kg	TM180			<15 #	<15 #	<15 #		<15 #
Arsenic	<0.6 mg/kg	TM181		15.7 M	8.26 M	40.3 M	625 M	10.8 M	9.26 M
Cadmium	<0.02 mg/kg	TM181		<0.2 M	0.363 M	0.577 M	1.82 M	<0.02 M	0.345 M
Chromium	<0.9 mg/kg	TM181		25.3 M	24 M	68.5 M	477 M	35.5 M	29.7 M
Copper	<1.4 mg/kg	TM181		31.9 M	26.1 M	78.5 M	447 M	49.6 M	21.6 M
Lead	<0.7 mg/kg	TM181		40.1 M	17.3 M	105 M	485 M	92.5 M	19.7 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	<0.14 M	0.936 M	<0.14 M	<0.14 M
Nickel	<0.2 mg/kg	TM181		34.5 M	38.1 M	28 M	36.8 M	29.2 M	34.8 M
Selenium	<1 mg/kg	TM181		<10 #	<1 #	<5 #	1.77 #	<10 #	<1 #
Vanadium	<0.2 mg/kg	TM181		30.3 #				46.1 #	
Zinc	<1.9 mg/kg	TM181		113 M	81.4 M	126 M	396 M	91.7 M	79.1 M
Sulphate, Total	<48 mg/kg	TM221		272 M	310 M	135 M	1440 M	217 M	49.9 M
Boron, water soluble	<1 mg/kg	TM222			<1 M	<1 M	<1 M		<1 M

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

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

Component	LOD/Units	Method	Customer Sample R	TP 118	TP 119	WS 101	WS 102	WS 103	WS 104
			Depth (m)	0.70	0.30	0.40	0.70	0.30	0.40
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	20/05/2011	20/05/2011	16/05/2011	16/05/2011	16/05/2011	16/05/2011
			Date Received	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011
			SDG Ref	110523-40	110523-40	110523-40	110523-40	110523-40	110523-40
			Lab Sample No.(s)	3515883	3515886	3515887	3515888	3515891	3515894
			AGS Reference						
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l	TM243		0.0265 M		<0.008 M		0.0206 M	0.0154 M

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	WS 105	WS 106	WS 107	WS 108	WS 109	WS 110
			Depth (m)	0.30	0.50	0.50	0.40	0.70	0.60
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	16/05/2011	16/05/2011	17/05/2011	17/05/2011	17/05/2011	17/05/2011
			Date Received	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011
			SDG Ref	110523-40	110523-40	110523-40	110523-40	110523-40	110523-40
			Lab Sample No.(s)	3515895	3515897	3515899	3515901	3515902	3515903
			AGS Reference						
Moisture	%	PM114					24.2		
Moisture content ratio	%	PM114					31.9		
Dry matter content ratio	%	PM114					75.8		
Asbestos Containing Material Screen	-	TM001		No ACM Detected			No ACM Detected		No ACM Detected
Phenol	<0.01 mg/kg	TM062 (S)			<0.01			<0.01	
Phenols, Total Detected monohydric	mg/kg	TM062 (S)		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Organic Carbon, Total	<0.2 %	TM132				5.69 #		0.927 #	2.43 #
Sulphur, Total	<0.02 %	TM132			0.13 #			0.04 #	
pH	1 pH Units	TM133		8.15 M	8.36 M	8.25 M	7.91 M	7.94 M	8.4 M
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<1.2 #	<0.6 #	<3 #	<0.6 #	<0.6 #
Total Cyanide	<1 mg/kg	TM153			23.8 M			<1 M	
Free Cyanide	<1 mg/kg	TM153			<1 M			<1 M	
Thiocyanate	<1 mg/kg	TM153			<1 M			<1 M	
Cyanide, Free	<1 mg/kg	TM153		<1 M		<1 M	<1 M		<1 M
PCB congener 28	<3 µg/kg	TM168		<3 M			<3 M		
PCB congener 52	<3 µg/kg	TM168		<3 M			<3 M		
PCB congener 101	<3 µg/kg	TM168		<3 M			<3 M		
PCB congener 118	<3 µg/kg	TM168		<3 M			<3 M		
PCB congener 138	<3 µg/kg	TM168		<3 M			<3 M		
PCB congener 153	<3 µg/kg	TM168		<3 M			<3 M		
PCB congener 180	<3 µg/kg	TM168		<3 M			<3 M		
PCBs, Total ICES 7	µg/kg	TM168		<3			<3		
Sulphide, Easily liberated	<15 mg/kg	TM180			<15 #			<15 #	
Arsenic	<0.6 mg/kg	TM181		5.56 M	28 M	25.1 M	160 M	15.8 M	17.2 M
Cadmium	<0.02 mg/kg	TM181		<0.02 M	0.693 M	0.543 M	<0.02 M	0.481 M	<0.02 M
Chromium	<0.9 mg/kg	TM181		26.6 M	176 M	32.4 M	168 M	25.9 M	20.3 M
Copper	<1.4 mg/kg	TM181		24.5 M	158 M	41.7 M	259 M	23.6 M	30.6 M
Lead	<0.7 mg/kg	TM181		30.5 M	137 M	112 M	508 M	23.8 M	31.1 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	<0.14 M	0.895 M	<0.14 M	<0.14 M
Nickel	<0.2 mg/kg	TM181		35.8 M	38 M	28.4 M	22.4 M	33.6 M	35.7 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	1.02 #	<10 #	1.06 #	<1 #
Vanadium	<0.2 mg/kg	TM181		20.1 #		34.8 #	47.4 #		21.9 #
Zinc	<1.9 mg/kg	TM181		87.5 M	209 M	96.2 M	329 M	90.1 M	88.2 M
Sulphate, Total	<48 mg/kg	TM221		396 M	779 M	598 M	1360 M	139 M	254 M
Boron, water soluble	<1 mg/kg	TM222			<1 M			<1 M	

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

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

Component	LOD/Units	Method	Customer Sample R	WS 105	WS 106	WS 107	WS 108	WS 109	WS 110
			Depth (m)	0.30	0.50	0.50	0.40	0.70	0.60
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	16/05/2011	16/05/2011	17/05/2011	17/05/2011	17/05/2011	17/05/2011
			Date Received	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011
			SDG Ref	110523-40	110523-40	110523-40	110523-40	110523-40	110523-40
			Lab Sample No.(s)	3515895	3515897	3515899	3515901	3515902	3515903
			AGS Reference						
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l	TM243		0.102 M		0.013 M	0.14 M	0.0351 M	<0.008 M

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

PAH by GCMS

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	TP 102	TP 105	TP 109	TP 112	TP 114	TP 117
			Depth (m)	0.80	0.90	0.60	0.50	0.80	0.40
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	17/05/2011	18/05/2011	18/05/2011	18/05/2011	19/05/2011	20/05/2011
			Date Received	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011
			SDG Ref	110523-40	110523-40	110523-40	110523-40	110523-40	110523-40
			Lab Sample No.(s)	3515844	3515854	3515862	3515870	3515876	3515882
			AGS Reference						
Naphthalene	<9 µg/kg	TM218		55.4 M	11.7 M	166 M	<9 M	<9 #	155 #
Acenaphthylene	<12 µg/kg	TM218		<12 M	<12 M	81.9 M	<12 M	<12 #	<12 #
Acenaphthene	<8 µg/kg	TM218		<8 M	<8 M	186 M	<8 M	<8 #	<8 #
Fluorene	<10 µg/kg	TM218		<10 M	<10 M	153 M	<10 M	<10 #	12.6 #
Phenanthrene	<15 µg/kg	TM218		92.4 M	24 M	1620 M	<15 M	77 #	206 #
Anthracene	<16 µg/kg	TM218		<16 M	24.3 M	442 M	<16 M	<16 #	<16 #
Fluoranthene	<17 µg/kg	TM218		80.9 M	<17 M	2860 M	<17 M	70.7 #	23.8 #
Pyrene	<15 µg/kg	TM218		73.2 M	18.7 M	2400 M	<15 M	62.3 #	26.8 #
Benz(a)anthracene	<14 µg/kg	TM218		69.6 M	24 M	1600 M	<14 M	53.9 #	24.8 #
Chrysene	<10 µg/kg	TM218		57.5 M	23.1 M	1500 M	<10 M	56.1 #	33.1 #
Benzo(b)fluoranthene	<15 µg/kg	TM218		77.8 M	40.2 M	2200 M	<15 M	43.7 #	25.8 #
Benzo(k)fluoranthene	<14 µg/kg	TM218		27.6 M	<14 M	810 M	<14 M	19.8 #	<14 #
Benzo(a)pyrene	<15 µg/kg	TM218		50.4 M	<15 M	1560 M	<15 M	26.9 #	<15 #
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		31.9 M	<18 M	992 M	<18 M	<18 #	<18 #
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		<23 M	<23 M	310 M	<23 M	<23 #	<23 #
Benzo(g,h,i)perylene	<24 µg/kg	TM218		40.9 M	<24 M	1100 M	<24 M	29.5 #	<24 #
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		658	166	18000	<118	440	508

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

PAH by GCMS

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	TP 119	WS 101	WS 102	WS 104	WS 106	WS 109
			Depth (m)	0.30	0.40	0.70	0.40	0.50	0.70
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	20/05/2011	16/05/2011	16/05/2011	16/05/2011	16/05/2011	17/05/2011
			Date Received	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011
			SDG Ref	110523-40	110523-40	110523-40	110523-40	110523-40	110523-40
			Lab Sample No.(s)	3515886	3515887	3515888	3515894	3515897	3515902
			AGS Reference						
Naphthalene	<9 µg/kg	TM218		36.2 M	49 M	6390 M	11.7 M	567 M	85.7 M
Acenaphthylene	<12 µg/kg	TM218		<12 M	28.3 M	395 M	<12 M	68.2 M	<12 M
Acenaphthene	<8 µg/kg	TM218		<8 M	55 M	4050 M	<8 M	92.7 M	<8 M
Fluorene	<10 µg/kg	TM218		<10 M	36.4 M	3590 M	<10 M	71.7 M	<10 M
Phenanthrene	<15 µg/kg	TM218		179 M	620 M	29600 M	33.5 M	1350 M	196 M
Anthracene	<16 µg/kg	TM218		18.9 M	174 M	7930 M	<16 M	259 M	<16 M
Fluoranthene	<17 µg/kg	TM218		130 M	2040 M	35800 M	33 M	2290 M	64.5 M
Pyrene	<15 µg/kg	TM218		125 M	1830 M	28600 M	30.4 M	2060 M	60.4 M
Benz(a)anthracene	<14 µg/kg	TM218		82.3 M	1000 M	16500 M	31.4 M	1550 M	54.4 M
Chrysene	<10 µg/kg	TM218		98.2 M	951 M	14000 M	24.7 M	1460 M	67.8 M
Benzo(b)fluoranthene	<15 µg/kg	TM218		147 M	1270 M	16500 M	37.5 M	2260 M	62 M
Benzo(k)fluoranthene	<14 µg/kg	TM218		39.9 M	528 M	7130 M	<14 M	859 M	<14 M
Benzo(a)pyrene	<15 µg/kg	TM218		69.2 M	1050 M	16300 M	19.9 M	1980 M	29.5 M
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		46.3 M	642 M	8940 M	<18 M	1470 M	<18 M
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		<23 M	165 M	2530 M	<23 M	400 M	<23 M
Benzo(g,h,i)perylene	<24 µg/kg	TM218		84.6 M	791 M	9650 M	<24 M	1850 M	41.2 M
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		1060	11200	208000	222	18600	661

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

Semi Volatile Organic Compounds

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	TP 101	TP 103	TP 104	TP 105	TP 106	TP 107
			Depth (m)	0.60	0.40	0.50	0.30	0.50	0.70
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	17/05/2011	17/05/2011	17/05/2011	18/05/2011	18/05/2011	18/05/2011
			Date Received	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011
			SDG Ref	110523-40	110523-40	110523-40	110523-40	110523-40	110523-40
			Lab Sample No.(s)	3515843	3515847	3515852	3515853	3515856	3515860
			AGS Reference						
Phenol	<100	TM157		<100	<200	<100	<100	<100	<100
Pentachlorophenol	<100	TM157		<100	<200	<100	<100	<100	<100
n-Nitroso-n-dipropylamine	<100	TM157		<100	<200	<100	<100	<100	<100
Nitrobenzene	<100	TM157		<100	<200	<100	<100	<100	<100
Isophorone	<100	TM157		<100	<200	<100	<100	<100	<100
Hexachloroethane	<100	TM157		<100	<200	<100	<100	<100	<100
Hexachlorocyclopentadiene	<100	TM157		<200	<200	<100	<200	<100	<100
Hexachlorobutadiene	<100	TM157		<100	<200	<100	<100	<100	<100
Hexachlorobenzene	<100	TM157		<100	<200	<100	<100	<100	<100
n-Dioctyl phthalate	<100	TM157		<100	<200	<100	<100	<100	<100
Dimethyl phthalate	<100	TM157		<100	<200	<100	<100	<100	<100
Diethyl phthalate	<100	TM157		<100	<200	<100	<100	<100	<100
n-Dibutyl phthalate	<100	TM157		<100	<200	<100	<100	<100	<100
Dibenzofuran	<100	TM157		457	284	216	<100	110	<100
Carbazole	<100	TM157		516	458	<100	<100	<100	<100
Butylbenzyl phthalate	<100	TM157		<100	<200	<100	<100	<100	<100
bis(2-Ethylhexyl) phthalate	<100	TM157		<100	<200	<100	<100	<100	<100
bis(2-Chloroethoxy)methane	<100	TM157		<100	<200	<100	<100	<100	<100
bis(2-Chloroethyl)ether	<100	TM157		<100	<200	<100	<100	<100	<100
Azobenzene	<100	TM157		<100	<200	<100	<100	<100	<100
4-Nitrophenol	<100	TM157		<100	<200	<100	<100	<100	<100
4-Nitroaniline	<100	TM157		<100	<200	<100	<100	<100	<100
4-Methylphenol	<100	TM157		<100	<200	<100	<100	<100	<100
4-Chlorophenylphenylether	<100	TM157		<100	<200	<100	<100	<100	<100
4-Chloroaniline	<100	TM157		<100	<200	<100	<100	<100	<100
4-Chloro-3-methylphenol	<100	TM157		<100	<200	<100	<100	<100	<100
4-Bromophenylphenylether	<100	TM157		<100	<200	<100	<100	<100	<100
3-Nitroaniline	<100	TM157		<100	<200	<100	<100	<100	<100
2-Nitrophenol	<100	TM157		<100	<200	<100	<100	<100	<100
2-Nitroaniline	<100	TM157		<100	<200	<100	<100	<100	<100
2-Methylphenol	<100	TM157		<100	<200	<100	<100	<100	<100
1,2,4-Trichlorobenzene	<100	TM157		<100	<200	<100	<100	<100	<100
2-Chlorophenol	<100	TM157		<100	<200	<100	<100	<100	<100
2,6-Dinitrotoluene	<100	TM157		<100	<200	<100	<100	<100	<100
2,4-Dinitrotoluene	<100	TM157		<100	<200	<100	<100	<100	<100

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

Semi Volatile Organic Compounds

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

Component	LOD/Units	Method	Customer Sample R	TP 101	TP 103	TP 104	TP 105	TP 106	TP 107
			Depth (m)	0.60	0.40	0.50	0.30	0.50	0.70
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	17/05/2011	17/05/2011	17/05/2011	18/05/2011	18/05/2011	18/05/2011
			Date Received	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011
			SDG Ref	110523-40	110523-40	110523-40	110523-40	110523-40	110523-40
			Lab Sample No.(s)	3515843	3515847	3515852	3515853	3515856	3515860
			AGS Reference						
2,4-Dimethylphenol	<100 µg/kg	TM157		<100	<200	<100	<100	<100	<100
2,4-Dichlorophenol	<100 µg/kg	TM157		<100	<200	<100	<100	<100	<100
2,4,6-Trichlorophenol	<100 µg/kg	TM157		<100	<200	<100	<100	<100	<100
2,4,5-Trichlorophenol	<100 µg/kg	TM157		<100	<200	<100	<100	<100	<100
1,4-Dichlorobenzene	<100 µg/kg	TM157		<100	<200	<100	<100	<100	<100
1,3-Dichlorobenzene	<100 µg/kg	TM157		<100	<200	<100	<100	<100	<100
1,2-Dichlorobenzene	<100 µg/kg	TM157		<100	<200	<100	<100	<100	<100
2-Chloronaphthalene	<100 µg/kg	TM157		<100	<200	<100	<100	<100	<100
2-Methylnaphthalene	<100 µg/kg	TM157		373	260	982	334	180	<100
Acenaphthylene	<100 µg/kg	TM157		<100	<200	<100	<100	<100	<100
Acenaphthene	<100 µg/kg	TM157		597	442	<100	<100	127	<100
Anthracene	<100 µg/kg	TM157		1030	1220	<100	<100	796	<100
Benzo(a)anthracene	<100 µg/kg	TM157		1980	4630	<100	236	2350	<100
Benzo(b)fluoranthene	<100 µg/kg	TM157		1100	4670	124	272	1860	<100
Benzo(k)fluoranthene	<100 µg/kg	TM157		1480	4140	<100	287	1830	<100
Benzo(a)pyrene	<100 µg/kg	TM157		1720	5710	<100	305	2400	<100
Benzo(g,h,i)perylene	<100 µg/kg	TM157		746	3210	<100	199	1250	<100
Chrysene	<100 µg/kg	TM157		2020	4600	198	344	2210	<100
Fluoranthene	<100 µg/kg	TM157		4520	8750	176	445	4790	<100
Fluorene	<100 µg/kg	TM157		483	377	<100	<100	116	<100
Indeno(1,2,3-cd)pyrene	<100 µg/kg	TM157		690	3020	<100	164	1140	<100
Phenanthrene	<100 µg/kg	TM157		4550	4350	622	382	1950	<100
Pyrene	<100 µg/kg	TM157		3880	7940	181	425	4140	<100
Naphthalene	<100 µg/kg	TM157		795	381	387	162	166	<100
Dibenzo(a,h)anthracene	<100 µg/kg	TM157		178	739	<100	<100	255	<100

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

Semi Volatile Organic Compounds

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	TP 108	TP 110	TP 111	TP 111	TP 113	TP 115
			Depth (m)	0.75	1.00	0.70	1.20	0.45	0.30
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	18/05/2011	18/05/2011	18/05/2011	18/05/2011	19/05/2011	19/05/2011
			Date Received	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011
			SDG Ref	110523-40	110523-40	110523-40	110523-40	110523-40	110523-40
			Lab Sample No.(s)	3515861	3515863	3515866	3515869	3515872	3515878
			AGS Reference						
Phenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Pentachlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
n-Nitroso-n-dipropylamine	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Nitrobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Isophorone	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachloroethane	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachlorocyclopentadiene	<100 µg/kg	TM157		<200	<100	<100	<100	<200	<100
Hexachlorobutadiene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Hexachlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
n-Dioctyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Dimethyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Diethyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
n-Dibutyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Dibenzofuran	<100 µg/kg	TM157		<100	<100	264	<100	<100	224
Carbazole	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Butylbenzyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
bis(2-Ethylhexyl) phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
bis(2-Chloroethoxy)methane	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
bis(2-Chloroethyl)ether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Azobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Nitrophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Chlorophenylphenylether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Chloroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Chloro-3-methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
4-Bromophenylphenylether	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
3-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Nitrophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,2,4-Trichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Chlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,6-Dinitrotoluene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dinitrotoluene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

Semi Volatile Organic Compounds

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

Component	LOD/Units	Method	Customer Sample R	TP 108	TP 110	TP 111	TP 111	TP 113	TP 115
			Depth (m)	0.75	1.00	0.70	1.20	0.45	0.30
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	18/05/2011	18/05/2011	18/05/2011	18/05/2011	19/05/2011	19/05/2011
			Date Received	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011
			SDG Ref	110523-40	110523-40	110523-40	110523-40	110523-40	110523-40
			Lab Sample No.(s)	3515861	3515863	3515866	3515869	3515872	3515878
			AGS Reference						
2,4-Dimethylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4-Dichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4,6-Trichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2,4,5-Trichlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,4-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,3-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
1,2-Dichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Chloronaphthalene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
2-Methylnaphthalene	<100 µg/kg	TM157		<100	<100	607	239	<100	1160
Acenaphthylene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Acenaphthene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Anthracene	<100 µg/kg	TM157		<100	132	<100	226	<100	<100
Benzo(a)anthracene	<100 µg/kg	TM157		<100	544	128	628	<100	191
Benzo(b)fluoranthene	<100 µg/kg	TM157		<100	523	<100	502	<100	236
Benzo(k)fluoranthene	<100 µg/kg	TM157		<100	466	<100	456	<100	150
Benzo(a)pyrene	<100 µg/kg	TM157		<100	594	<100	568	<100	204
Benzo(g,h,i)perylene	<100 µg/kg	TM157		<100	335	<100	290	<100	179
Chrysene	<100 µg/kg	TM157		<100	569	243	636	<100	296
Fluoranthene	<100 µg/kg	TM157		<100	1040	135	1330	<100	312
Fluorene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100
Indeno(1,2,3-cd)pyrene	<100 µg/kg	TM157		<100	291	<100	267	<100	133
Phenanthrene	<100 µg/kg	TM157		<100	618	931	916	<100	801
Pyrene	<100 µg/kg	TM157		<100	950	174	1130	<100	317
Naphthalene	<100 µg/kg	TM157		<100	<100	187	133	<100	309
Dibenzo(a,h)anthracene	<100 µg/kg	TM157		<100	<100	<100	<100	<100	<100

CERTIFICATE OF ANALYSIS

SDG:	110523-40	**Location:**		**Order Number:**	SH3068
Job:	H_WARDELL_SHF-37	**Customer:**	Wardell Armstrong LLP	**Report Number:**	135537
Client Reference:	SH10534	**Attention:**	Mike Kelly	**Superseded Report:**	132894

Semi Volatile Organic Compounds

Results Legend

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

Component	LOD/Units	Method	Customer Sample R	TP 118	WS 103	WS 105	WS 107	WS 108	WS 110
			Depth (m)	0.70	0.30	0.30	0.50	0.40	0.60
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	20/05/2011	16/05/2011	16/05/2011	17/05/2011	17/05/2011	17/05/2011
			Date Received	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011	21/05/2011
			SDG Ref	110523-40	110523-40	110523-40	110523-40	110523-40	110523-40
			Lab Sample No.(s)	3515883	3515891	3515895	3515899	3515901	3515903
			AGS Reference						
Phenol	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
Pentachlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
n-Nitroso-n-dipropylamine	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
Nitrobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
Isophorone	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
Hexachloroethane	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
Hexachlorocyclopentadiene	<100 µg/kg	TM157		<100	<100	<100	<200	<1000	<100
Hexachlorobutadiene	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
Hexachlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
n-Dioctyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
Dimethyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
Diethyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
n-Dibutyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
Dibenzofuran	<100 µg/kg	TM157		<100	<100	<100	474	4750	<100
Carbazole	<100 µg/kg	TM157		<100	<100	<100	627	4870	<100
Butylbenzyl phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
bis(2-Ethylhexyl) phthalate	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
bis(2-Chloroethoxy)methane	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
bis(2-Chloroethyl)ether	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
Azobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
4-Nitrophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
4-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
4-Methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
4-Chlorophenylphenylether	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
4-Chloroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
4-Chloro-3-methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
4-Bromophenylphenylether	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
3-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
2-Nitrophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
2-Nitroaniline	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
2-Methylphenol	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
1,2,4-Trichlorobenzene	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
2-Chlorophenol	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
2,6-Dinitrotoluene	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100
2,4-Dinitrotoluene	<100 µg/kg	TM157		<100	<100	<100	<100	<1000	<100