Hamson
Barron
Smith



# Land Off Schwabisch Gmund Way
# Barnsley

## Ground Conditions Report

On behalf of Barnsley Metropolitan Borough Council

Report 23-24-19-1-6002/GCR1
July 2018

# Report Issue Record

| | |
|---|---|
| Project No.: | 23-24-19-1-6002 |
| Project Title: | Land Off Schwabisch Gmund Way |
| Site Location: | Barnsley |
| Client: | Barnsley Metropolitan Borough Council |
| Report Title: | Ground Conditions Report |
| Issue Date: | 26th July 2018 |
| Report No.: | 23-24-19-1-6002/GCR1 |
| Revision: | - |

| **Prepared by** | Written | Reviewed and Approved |
|---|---|---|
| Name | **Catherine Riley** | **Craig Roberts** |
| Signature |  |  |
| Position | Senior Geo-Environmental Engineer | Technical Director |

# Contents

1 Introduction 1
2 Site Location 3
3 Site Description 4
4 BWB Phase I Assessment 2006 21
5 BWB Phase II Assessment 2006 27
6 HBS Data Collation and Review 37
7 Ground Conditions 43
8 Mining Risk Assessment 49
9 Geotechnical Assessment 52
10 Land Quality Assessment 60
11 Ground Gas Assessment 69
12 Site Conceptual Model 72
13 Remedial Requirements 78
14 Recommendations for Further Work 81
15 Limitations and Uncertainties 82
16 General Notes 84

# Appendices

A Site Plan
B BWB Phase I Report
C BWB Phase II Report
D EnviroInsight Report
E GeoInsight Report
F Historical Plans
G SYMAS Mineral Report

# Executive Summary

| SITE INFORMATION | |
|---|---|
| Client | Barnsley Metropolitan Borough Council. |
| Site | Land Off Schwabisch Gmund Way. |
| Location | Barnsley, S71 1BP (nearest). NGR 434821, 406618. |
| Approximate area | 1.6Ha. |
| Topography | The land generally falls from an elevation of approximately 98m OD in the south to 91m OD in the south. The western boundary of the site lies circa 4m to 6m higher Schwabisch Gmund Way; the boundary is formed by a brick retaining wall to the south and a steep grassed slope to the north. |
| Current land use | Derelict land, former electricity depot. |
| Proposed development | Low rise residential, including youth centre. |

| SITE SETTING | |
|---|---|
| Geology | Pennine Middle Coal Measures Formation (mudstone, siltstone and sandstone). No superficial deposits shown. |
| Hydrogeology | Secondary A Aquifer. |
| Hydrology | No surface water within 250m of the site. |
| History | The site remained relatively undeveloped until the late 1960's to early 1970's. The site use up to this period was residential with open gardens and plantations. This was replaced with an electricity board depot, the buildings of which were still present in 2006. These buildings have subsequently been demolished. |

| INVESTIGATION | |
|---|---|
| Previous site investigations | • BWB Consulting (BWB) report entitled Phase I Environmental Risk Assessment Barnsley Interchange, report ref LDS126/Final, dated May 2006 – NOTE no appendices were included with the report text.<br>• BWB Consulting report entitled Phase II Geo-Environmental Risk Assessment, report ref LDS126/02/v1 dated September 2006. |
| Ground conditions | The 2006 investigation identified between 0.30m and 1.90m, locally 2.3m, of Made Ground over very weak to weak mudstone, locally the mudstone was overlain by firm to stiff clay. Intact coal (0.20m to 1.50m thick) was recorded in all of the boreholes and six of the trial pits at depths ranging from 0.70m bgl to 25.00m bgl. In the boreholes between one and four coal seams were recorded. During subsequent monitoring of the standpipes in July and August 2006, groundwater was recorded at depths greater than 5m bgl. |

| GEOTECHNICAL | |
|---|---|
| Foundations | Conventional spread foundations would be suitable for the proposed structures across the majority of the site. These would be constructed within the firm to stiff clay or very weak mudstone of the weathered Pennine Middle Coal Measures Formation (150kPa at 1.0m.). In the north eastern corner of the site where deeper Made Ground is present to below circa 2.5m then, alternative foundations may be required. |
| Shrinkable soils | The clay soils are medium volume change potential. |
| Buried concrete | DS1 and AC2z. FDN2z |
| Floor slabs | Suspended floors recommended |
| Gas protection | A “CIRIA Characteristic Situation 2 low risk” is likely to be appropriate for the Youth centre development; therefore gas protection measures will be required.<br>A NHBC “Traffic Light System” of Green is likely to be appropriate for the residential development. No gas protection required.<br>No radon protection measures required. |
| Slope stability | Gradients are considered generally stable but careful assessment of changes of elevation or construction near existing slopes would still be needed.<br>A retaining wall abuts Schwabisch Gmund Way assessment of its structural integrity was outside the scope of this commission. |
| Pavement | CBR 4%. |
| Soakaways | The clay soils encountered are likely to possess infiltration rates of less than 1 x $10^{-6}$ m/s and therefore efficient soakaway drainage is unlikely to be feasible. |
| Natural cavities | None expected. |
| Mining | The risk of shallow coal workings causing stability issued to future development is considered to be low to moderate. The BWB report states that up to seven coal seams 0.1m to 1.3m thick, were recorded beneath the site; however no evidence of previous workings was recorded by the investigation. Further investigation recommended |

| CONTAMINATION | |
|---|---|
| Human health | Elevated concentrations of Beryllium, Lead, Dibenzo(a,h)anthracene and Benzo(a)pyrene were recorded in one of the samples tested. The sample was from TP11 at 0.8m bgl. In this location, Made Ground comprising of stiff dark grey sandy gravel clay, inc ash and clinker, was recorded. These materials were only encountered in TP11 and TP12. |
| Controlled waters | Risks to controlled waters are considered low |
| Water supply pipes | Localised elevated concentrations of PAH hydrocarbons have been encountered, which may have the potential to attack plastics. Confirmation should be sought from the water supply company at the earliest opportunity as to their specific requirements. |
| Remediation | Remediation soft cover areas (gardens and soft landscaped areas) required in the north east of the site. |

# 1 Introduction

In May 2018 Hamson Barron Smith Ltd (HBS) was commissioned by Barnsley Metropolitan Borough Council (BMBC) to undertake a review of existing ground investigation reports for Land Off Schwabisch Gmund Way, Barnsley and to, based on the report, produce a report the detailing ground conditions and assessment geotechnical and contamination risks.

The site comprises of 1.6 hectares of derelict brownfield land. The location of the site is shown on Figure 1 and a site plan is included in Appendix A.

It is understood that the site is being considered for residential redevelopment including a Youth Zone facility. Although no proposed development plans were available at the time of reporting, it has assumed the development is to consist of two or three storey residential properties of traditional construction together with associated infrastructure.

This report presents a review of the existing site data obtained together with an evaluation of their significance in relation to the proposed works.

## 1.1 Project Requirements and Scope of Works

The objectives of the investigation were based on the findings of investigations by others to:

- Review the findings of previous investigations.
- Establish the environmental setting, including sensitivity in relation to human health, surface water, groundwater and ecological receptors.
- Develop a ground model for the site.
- Quantitatively assess the potential nature and extent of contamination from those uses and the environmental risks and liabilities which may be posed to the identified receptors (human health and the environment).
- Assess any potential geotechnical risks.
- Provide geotechnical recommendations to assist in construction design.
- Provide recommendations for required further works.

## 1.2 Previous Investigations / Information Sources

Two previous investigations undertaken for the site have been provided to HBS for review, these are.

- BWB Consulting (BWB) report entitled Phase I Environmental Risk Assessment Barnsley Interchange, report ref LDS126/Final, dated May 2006 – NOTE no appendices were included with the report text.
- BWB Consulting report entitled Phase II Geo-Environmental Risk Assessment, report ref LDS126/02/v1 dated September 2006.

The information contained in the two BWB reports has been utilised in the writing of this interpretative ground investigation report. Copies of the reports are provided as Appendix B and C respectively. The findings of these investigations are provided in Sections 4 and 5 respectively.

In addition, the following sources have been collated and reviewed by HBS:

- An EnviroInsight Report prepared by Groundsure (Report Number GS5235675 dated 13th July 2018).
- A GeoInsight Report prepared by Groundsure (Report Number GS5235676 dated 13th July 2018).
- A Mineral Report prepared by South Yorkshire Mining Advisory Service (SYMAS) (Report Number M4089/6 dated 13th February 2018).
- Historic Ordnance Survey maps.
- British Geological Survey maps.
- British Geological Survey borehole records.
- Groundsure landfill records.
- Groundsure groundwater data.

# 2 Site Location

Address: Land Off Schwabisch Gmund Way, Barnsley

Post Code: S71 1BP (nearest)

National Grid Reference: 434821, 406618

The site located between Schwabisch Gmund Way and Harborough Hill Road, immediately east of Barnsley town centre as shown on Figure 1.

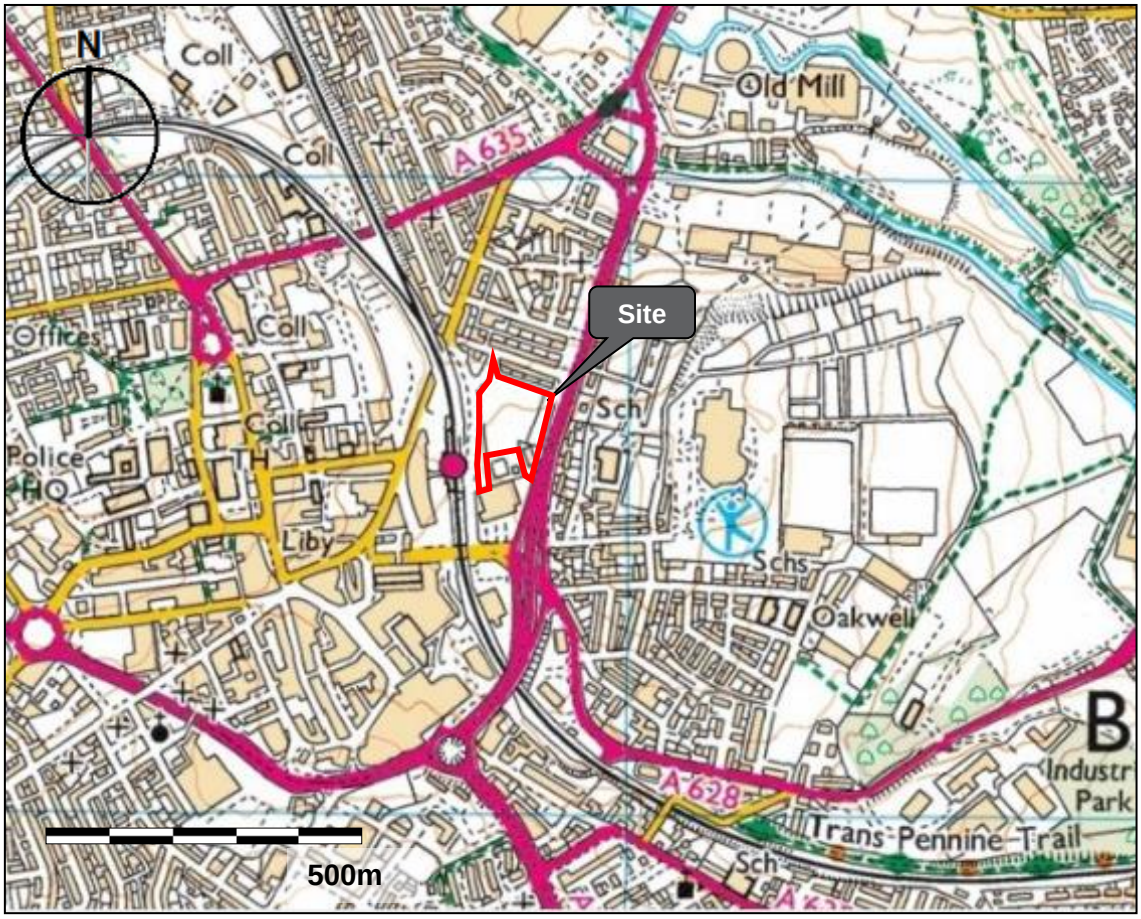



Figure 1 Site Location Plan

# 3 Site Description

HBS undertook a site inspection on 23rd May 2018. The site comprises of an area of derelict brownfield land and is approximately 1.6Ha in area.

The site is irregular in shape and comprises a former Yorkshire Electricity Depot that was also utilised for other industrial purposes. All former buildings have been demolished. The majority of the site is covered by concrete with tarmacked hardstanding present along the northern and eastern edges.

The land generally falls from an elevation of approximately 98m OD in the south to 91m OD in the south. The western boundary of the site lies circa 4m to 6m higher than the adjacent road (Schwabisch Gmund Way). The boundary is formed by a brick retaining wall to the south (see Photo 1) and a steep grassed slope to the north (see Photo 2). Access to majority of the site is from the north east off Harborough Hill Road (See Photo 3). An area used for car parking is present to the east of the gate.

Within the site a road (see Photo 4), runs along the eastern boundary, this, gives access to south eastern corner of the site, which formerly housed a club. This area of the site lies circa 2m higher than the site to the west and south and is separated by a retaining wall (See Photo 5). A stockpile of brick rubble (assumed demolition material) is present over the majority of this portion of the site (see Photo 6). Fibrous material (possible asbestos containing materials (ACM)) was recorded in the western edge of the rubble stockpile (see Photo 7).

There is a tarmacked strip of land along the western boundary of the site. The area is inaccessible to vehicles due to a barrier at the northern end (See Photo 8). The southern edge of this portion is overgrown with shrubs and trees (see Photo 9).

The central area of the site is tarmacked, from the old markings this area is anticipated to have previously comprises an access road and car parking (see Photo 10). A small substation is present on the northern boundary (see Photo 11).

The southern portion of the site is covered with concrete hardstanding (see Photo 12). To the west of the site lies the concrete floor of the former depot building (See Photo 13).

Fly tipping / rubbish is scattered over the majority of the site. The waste typically comprises plastic bottles, cans, juice cartons, clothes, cardboard household items such as duvets, settees, wire springs from former mattress, a children's scooter and some old/used fireworks were present along the eastern area of the site.

A series of manholes (some with missing covers) and inspection pits are present over the whole of the site / around the former buildings, indicating that historical service runs, possibly drainage, are still present beneath the hardstanding. No evidence of interceptors was recorded during the site walkover.

## 3.1 Surrounding Land-Use

The site is bound to the west by Schwabisch Gmund Way with the railway and bus station beyond, to the north by residential premises of Mottram Street, to the east by the A61 Harborough Hill Road and to the south by a large electricity substation and commercial buildings. Figure 2 shows the site setting.

## 3.2 Visual and Olfactory Evidence of Potential Contamination

During the walkover the following potential sources of soil / groundwater contamination

- Small electricity substation in north east corner.
- Large electricity substation to the south of the site.
- Sporadic fly tipping throughout the site.
- Made Ground from the demolition of former buildings including a stockpile of materials in the south east that include fibrous materials.

The BWB report indicated the presence of an above ground storage tank. The report indicated that visually, several rust patches were evident on the tank. BWB confirmed that no information was available regarding the product inside the tanks. However, it is likely that the tanks contained either diesel or fuel oil. No evidence of the tank was present during the HBS walkover and no staining noted to the ground near its former location.




Figure 2 Site Plan / Setting

## 3.3 Photographs



Photograph 1 Tarmacked area to south west of site, showing retaining wall to main site area, looking south.





Photograph 2 The embankment which forms the western boundary of the site, looking north.






Photograph 3 The access to the main site area with car parking areas in front (to the east) of the gate, looking west.





Photograph 4 Access road which runs along the eastern site boundary, looking north east.





Photograph 5 Retaining wall, looking south west.





Photograph 6 Brick stockpile located centrally within former club site, looking south west.





Photograph 7 Fibrous materials identified in the western face of the brick stockpile, looking east.





Photograph 8 The western portion of the site, looking north east.





Photograph 9 View east of area of overgrown area affected fly tipping.





Photograph 10 Former car parking area / access road, looking south west.





Photograph 11 Substation, looking north east.






Photograph 12 Concrete hardstanding at southern end of site with electricity substation beyond, looking south west.





Photograph 13 Concrete floor slab of former building, looking north west.





Photograph 14 The northern portion of the site, looking south east.



# 4 BWB Phase I Assessment 2006

A Phase I Environmental Risk Assessment report was undertaken for the site by BWB Consulting in May 2006. The findings of the Phase I are summarised below. No appendices were included with the report.

The report comprised a desk based assessment of the site, which included consideration of the findings of a series of previous investigations, with particular reference to the two following reports.

- Project Report 101009, “Ground Investigation for a Site at Harborough Hill Road Barnsley, South Yorkshire”, prepared for Bett Brothers Limited by Soil Mechanics, May 2001.
- Project Report Sd01-0058-Rep, “Harborough Hill Road, Barnsley, Mining Report”, prepared for Waterman BBT by Wardell Armstrong, June 2001.

Copies of these reports were not included in the BWB Phase I report and consequently their findings have not been validated by HBS.

## 4.1 Geology

BWB state that given the known history of the site it is not anticipated that significant thicknesses of Made Ground will be present on site. They indicate that the 1:50,000 scale British Geological Survey (BGS) geological mapping indicates the site to be underlain by the Carboniferous Lower Westphalian Coal Measures. These may have been remapped / or misidentified in the Envirocheck report.

The BWB 2006 Phase I report also states that a historical investigation at the site undertaken by Soil Mechanics in 2001 recorded Made Ground comprising sandy gravel of limestone and sandstone to a max of 1.0m bgl over weathered mudstone with subordinate sandstones, siltstones and coal seams. Up to seven coal seams were recorded present beneath the site. They were encountered at depths of between just below the Made Ground to 60m and ranged in thickness from 0.1m to 1.3m. No evidence of deep or shallow coal mining was recorded during this investigation.

## 4.2 Hydrogeology

BWB state that the underlying Lower Coal Measures are identified as a Minor Aquifer (HBS note the aquifer has been reclassified by the Environment Agency at the site to be Secondary A Aquifer), that there are no groundwater abstraction points are present within 500m of the site and that the site does not lie within a source protection zone.

Soils underlying the site are ascribed a high leaching potential with a worst case vulnerability classification (U) until proven otherwise, this rated is given due to the urban nature of the site and the lack of data obtainable from these urban areas.

BWB state that the previous investigative works encountered perched groundwater as seepage over the lower coal measures rockhead. Subsequent groundwater monitoring within the coal measures recorded piezometric levels of between 76.0m AOD and 86.0m AOD.

## 4.3 Hydrology

BWB indicate that the nearest watercourse is the River Don, located some 800m north east of the site and that river does represent a receptor for any potential on site contamination due to the distance involved.

## 4.4 Ground Gas

BWB state that the NRPB-W26 ‘Radon Atlas of England and Wales’ 2002 edition indicates that less than 1% of homes in the area around the site have recorded radon levels above the recommended action level and that BRE211 ‘Radon: guidance on protective measures for new dwellings’ 1999 edition indicates basic radon protection may be required.

They state that a geological assessment should be carried out and consideration given to installing basic measures if the assessment shows that they are necessary.

## 4.5 Mining

BWB indicate that the Wardell Armstrong Mining Report, June 2001 Report indicates the outcropping of two coal seams beneath the site. The Top Beamshaw and Winter

seams and highlights the potential for unrecorded shallow mine workings particularly within the winter seam in the east part of the site.

BWB state that the site lies in a zone affected by coal mining and the risk from shallow mining is considered to be low to moderate.

The BWB report states that a Coal Authority Report was commissioned, and that this indicated:

- The site is not within the zone of influence of past mine workings, however coal is believed to exist under the site, at or close to the surface that may have been worked historically.
- The site does not lie within the zone of influence of present underground or surface mine working. No licence to extract coal exists for this area, although the reserves of coal present beneath the site could be worked in the future, subject to feasibility, licenses and planning.
- There are no known shafts or adits within the site or within 20m of the site boundary.
- No records of faults or other lines of weakness that may affect the stability of the property are kept by the Coal Authority.
- The Coal Authority holds no records of any damage notice or claim having been made in respects of the property since 1984.

BWB state that the Wardell report was undertaken to address mining issue specific to the site and their Environmental Risk Assessment defers to the Wardell report.

## 4.6 Site History

The BWB Phase I report reviewed available editions of Ordnance Survey maps. Copies of the Ordnance Survey Maps were presented in Appendix 2 of the BWB 2006 report, however HBS were not provided a copy of the reports appendices. The findings of the BWB report are summarised in Table 1.

**Table 1 Site History Summary (BWB)**

| Date | Scale | On Site | Surrounding area |
|---|---|---|---|
| 1855 | 1:10,560 | The site is occupied open fields and plantations with several small buildings including Harborough cottage. | The site is located on the eastern outskirts of Barnsley town. Barnsley **RAILWAY STATION** with sidings lies at the western boundary of the site. To the north, east and south are open fields, small buildings and plantations. Harborough Hill Road marks the eastern boundary of the site. |
| 1892-1893 | 1:2,500 | The site is occupied by Harborough Hill House with gardens and plantations. | **RAILWAY LINES** lie along the eastern boundary of the site. An **ENGINE SHED** is found 40m away. Approximately 100m to the south east are a **RAILWAY FOUNDRY AND TIMBER YARD**. Located to the south is Harborough House with gardens. Fields occupy the north and east. |
| 1906 | 1:2,500 | There are no significant changes. | There are no significant changes. |
| 1930 | 1:2,500 | The site is occupied by allotment gardens. An existing small building to the south east of the site is named a club, gardens surround it. | Mottram Street and houses have been developed and mark the northern boundary of the site. Harborough House to the south is marked “club”. The **RAILWAY FOUNDRY** is not marked on the map instead there is an **EXCHANGE STATION AND TRAVEL CRANE**. Approximately 170m to the east of the site is **BORO COLLIERY** |
| 1955-1956 | 1:10,560 | There are no significant changes. | There is a development of houses on the east side of Harborough Hill Road. **THE EXCHANGE STATION AND TIMBER YARD** has been demolished**.** |
| 1961 | 1:1,250 | The site is occupied by open ground a number of small unidentified buildings are found along the northern edge and north west corner of the site. | A **BUS STATION** occupies the grounds of the former foundry and timber yard to the south east of the site. |
| 1968-1972 | 1:1,250 | The site is occupied by the **ELECTRICITY BOARD DEPOT**. | A bowling club has been developed 30m south of the site. **A COAL AND COKE YARD** is located approximately 60m to the south west of the site boundary. |
| 1987 | 1:1,250 | There are no significant changes. | Harborough Hill Road has become a duel carriage way. |
| 1991 | 1:1,250 | Several small buildings appear in the south west corner of the site | A **BUS STATION** is found adjacent to the western boundary of the site. |
| 2004 | 1:10,000 | There are no significant changes. | There are no significant changes. |

### 4.6.1 Summary of Development History

***On site***

The BWB 2006 Phase I report confirmed that historical ordnance survey plans showed the site remained relatively undeveloped until the late 1960's to early 1970's. The site use up to this period was residential with open gardens and plantations. This was replaced with an electricity board depot, the buildings of which were still present when the BWB report was written in 2006. These buildings have subsequently been demolished.

The BWB 2006 confirmed that the site walkover identified the presence of an above ground oil tank. The tank had no evidence of former covering with a bund consisting of one brick thickness. The report identified that the bund was not stable with cracks present on all side. The report recorded no visible evidence of oil spills. The tank was located to the south of the site near the electricity substation.

***Off Site***

The BWB 2006 Phase I report confirmed that the surrounding area to the west has been developed since the mid nineteenth century. The land immediately adjacent to the site has been railway land until the late 1980s with associated heavy industries existing into the mid twentieth century. Industrial works known to have existed were a foundry and a timber yard. The north, east and south of the site have seen development as a mixed residential and commercial area since the early part of the 1900's. A small colliery "Boro Colliery" existed from the 1930's until the 1960's located approximately 150m east of the site. The surrounding area currently comprises a mixed residential and commercial properties with a bus and railway station's located adjacent to the western boundary of the site.

The BWB does not indicate when the electricity substation, located on the southern boundary of the site, was constructed however it is assume to have been constructed around the same time as the Electricity depot was constructed on site.

## 4.7 Regulatory Review

A review of public registers was undertaken by the BWB 2006 Phase I report.

The report states the review indicated that the land uses immediately surrounding the site present a negligible risk with respect to potential environmental impacts to the site and its environment.

One record for a waste management facility was identified for the site. The record was held by Yorkshire Electricity. No further details are available.

## 4.8 Conclusions of Phase I Risk Assessment

The report included source, pathway, receptor assessment and provided a qualitative assessment the associated risks.

BWB identified the following potential on-site sources of the contamination

- Electricity substation
- Fuel Tanks
- Demolition

BWB also identified the following potential off-site sources of contamination.

- Colliery / coal yard
- Timber yard
- Railway land and foundry
- Bus depot

BWB concluded that:

- The site represents a moderate human health risk, a moderate risk controlled waters risk and a low to moderate risk to site structures and that during redevelopment the risk to human health will rise to high to moderate due to demolition activities associated with earthworks and construction activities over the site.

- Consideration should be given to the use of appropriate materials should buried services traverse through the area if deleterious contaminants are be identified.

- Asbestos may be present on site within the made ground and as a result of the demolition of existing buildings. A specialist contractor should assess the risk posed by this potential contaminant source.

# 5 BWB Phase II Assessment 2006

## 5.1 Introduction

An intrusive ground investigation was undertaken on the site in 2006 by BWB Consulting, report reference LDS126/02/v1 dated September 2006. The findings of the investigation are summarised below. The BWB report is presented in Appendix C.

## 5.2 Objectives

The investigation was undertaken for the potential redevelopment of the site, which was to comprise the extension of the Barnsley interchange with an associated retail complex; this scheme did not progress.

BWB's objective for the investigation were:

- Provide outline design advice with respect to foundations for the proposed development foundations.
- Refine the Phase I conceptual site model through chemical assessment of soil conditions.
- Provide preliminary recommendations with respect to potentially contaminated soils and possible remedial measures.

## 5.3 Scope of Works

The intrusive works were undertaken in June and July 2006 and comprised the following:

- Five cable percussion boreholes with rotary follow on to a max depth of 30m with insitu testing in residual soils.
- Ground & gas monitoring wells installed in all five boreholes.
- Fifteen machine excavated trial pits.
- Completion of five rounds of ground gas monitoring.

Four of the trial pits TP03 to TP06 targeted the above ground oil/fuel storage tank.

BWB's report indicates that their 2006 site investigation works were carried out in general accordance with BS 5930:1999 - Code of Practice for Site Investigations. The

Association of Geotechnical and Geo-Environmental Specialist Guidelines for Good Practice in Site Investigations (August 1998) and BS10175 2001 'Code of Practice for the Investigating of Potentially Contaminated Sites'.

The approximate positions of the exploratory holes are shown on the Exploratory Hole Location Plan Figure 2 in BWB's Phase 2 report which is presented in Appendix C.

Samples of soil retained from the exploratory holes were scheduled for geotechnical laboratory testing. The following tests were carried out on selected samples:

- Seven natural moisture contents
- Five particle size distribution (PSD) tests
- Four Atterberg Limits
- Three 2.5kg compaction tests.

Nineteen samples of soils were retained from the exploratory holes and were scheduled for chemical laboratory testing. The soil samples were analysed for a combination of the following:

| | |
|---|---|
| Arsenic | Vanadium |
| Boron (water soluble) | Zinc |
| Barium | Sulphate (water soluble) |
| Beryllium | Cyanide (free and complex) |
| Cadmium | pH |
| Chromium (total) | Fraction of Organic Carbon |
| Copper | Phenols |
| Lead | PAH (USEPA 16) |
| Mercury | TPH (CWG) |
| Nickel | Asbestos screen |
| Selenium | |

The chemical analysis was undertaken by MCERTS and UKAS accredited laboratory Alcontrol GeoChem Ltd.

## 5.4 Results of Investigation

The results of this investigation were consistent with the anticipated geology. A summary of the strata encountered is presented **Table 2** (overleaf) and discussed in Section 5.5 for full details of the strata encountered reference should be made to the exploratory hole logs which are included in BWB's Phase 2 report in Appendix C.

## 5.5 Recorded Ground Conditions

The BWB report provides an interpretation from the combined exploratory records of based on the findings of their investigation and of the previous Soil Mechanics 2001 site investigation.

BWB recorded between 0.3m and 1.3m of Made Ground comprising pavement materials and reworked natural soils overlying completely to highly weathered Coal Measures mudstone.

**Table 2 Summary of Ground Conditions Recorded By Investigations to Date**

| Soil Type | Description | Depth encountered (bgl) | Thickness Proven (m) |
|---|---|---|---|
| Pavement | Asphalt/Reinforced concrete typically over Limestone or brick and sandstone gravel base. | GL | 0.15m to 0.9m |
| Made Ground | Gravelly clay with gravel and cobbles of brick, limestone and sandstone and occasional glass, coal, polythene, ash and slag | 0.15m to 0.6m | NP to 2.7m |
| Completely Weathered Mudstone | Firm to very stiff thinly laminated CLAY | 0.3m to 3.2m | NP to 2.3m |
| Middle Coal Measures | Very weak to weak thinly laminated mudstones and siltstones with coal seams and sandstone bands at depth. | 0.3m to 5.2m | Proven up to 60.m bgl |
| | Coal Seam 1 – intact where encountered. | 0.5m to 6.4m | NP to 1.0m |
| | Coal Seam 2 – intact where encountered, split in two by a thin mudstone band. | 5.2m to 18.6m | 0.4m to 15m |
| | Coal Seam 3 – intact where encountered. | 12.6m to 30.9m | 0.1m to 1.5m |
| | Coal Seam 4 – BH5/RC3 (soil mechanics 2001) records quick penetration through the seam. | 38.8m (BH5/RC3) | Possibly up to 1.2m |
| | Coal Seam 5 – drillers description only (open holed borehole) | 58.4m (RC5/RC3 only) | 1.3m |

The BWB report recorded the mudstone bedrock between 0.3m and 3.2m bgl, typically encountered at 1.8m bgl. Bedrock comprises very weak becoming weak to moderately weak thinly laminated mudstone. Locally the mudstone was completely weathered and encountered as a firm to very stiff clay.

Several near surface coal seams (see Figure 3), varying in thickness from 0.4m to 1.5m, were recorded in the mudstone. Two of these seams were present within 15m of ground level. The seams sub-crop beneath the superficial deposits and dip approximately 6º to 8º to the east. No evidence of workings was recorded in these shallow coal seams.

Groundwater was recorded in all of the boreholes at depths of between 12.50m to 14.50m. The groundwater rose to between 9.6m and 11.90m bgl. No groundwater strikes were recorded in the shallow trial pits.

## 5.6 Summary of Mining Risk Assessment

The BWB phase I report stated that a Coal Authority report, commissioned as part of their phase I desk study, confirmed that the site lies in an area where coal exists near surface that may have been worked in the past. The Coal Authority report indicated that the site was within the likely zone of influence from the working of four deep seams, at depths of between 50m and 350m although ground movement relating to these workings should now have ceased. No records of any mine entries within 20 metres of, the boundary of the property were held by Coal Authority.

The BWB 2006 Phase II report indicates that a Mining Report was undertaken in 2001, by Wardell Armstrong, which concluded that at the site was considered stable with respects to past deep coal mining. In addition, this report concluded that there was a potential for unrecorded shallow mine workings across the eastern third of the site associated with the underlain by the Winter Seam (see Figure 4).

The BWB report indicated that the Wardell mining report concluded that the shallowest seam is known locally as the Winter (Abdy) and the next shallowest seam is known as the Top Beamshaw (see Figure 4 for outcrop location). Mine abandonment plans relating to an adjacent colliery indicate that the Winter Seam has been worked as far west as Harborough Hill Road, which lies on the eastern boundary of the site. The Beamshaw seam is not known to have been worked.

The Wardell mining report concluded that "*the Beamshaw Seam(s) are thin, inconsistent and/or poor quality and very unlikely to have been worked beneath the*

*site*". The Wardell report recommended that further investigation and stabilisation should be carried out over any construction footprint including a 3m standoff perimeter.

The BWB report indicated that published information and the subsequent intrusive investigations suggest that two coal seams are present beneath the site within 15m of the existing ground surface (Figure 3). The site investigation works suggested that the second shallowest seam recorded on site (Seam 2 / Beamshaw) is split in two by a thin mudstone band. The shallowest coal seam (seam 1 / Winter Seam) was proven within up to 6.4m (90.6m AOD) of the existing ground surface and has been recorded at between 0.4m to 1.0m thickness.

The BWB report has taken on board, but not significantly reassessed, the mining risk as set out in the Wardell Mining report. The report therefore concluded that there is a potential for unrecorded shallow mine workings over the eastern third of the site and stated that the Wardell mining report recommended further investigation and stabilisation.

In addition, the BWB report indicated that all of the ground investigation to date have recorded an over-deepened area of backfill in the north eastern corner of the site (see Figure 4). The BWB report also states that only am thick layer of coal was proven by one of the two boreholes drilled in this area over the anticipated level of the shallowest coal seam.

The BWB concluded:

- There is a high risk of voids migrating over the surface from unrecorded older mine workings present over the areas of the site underlain by the Winter Seam (assumed to be Seam 1).
- There is a low risk of voids migrating to the surface from unrecorded older mine workings present over areas of the site underlain by the Beamshaw Seam (assumed to be Seam 2).
- An area of over-depended Made Ground is the north east of the site may represent historical shallow opencast/bell pit excavation associated with the Winter Seam.

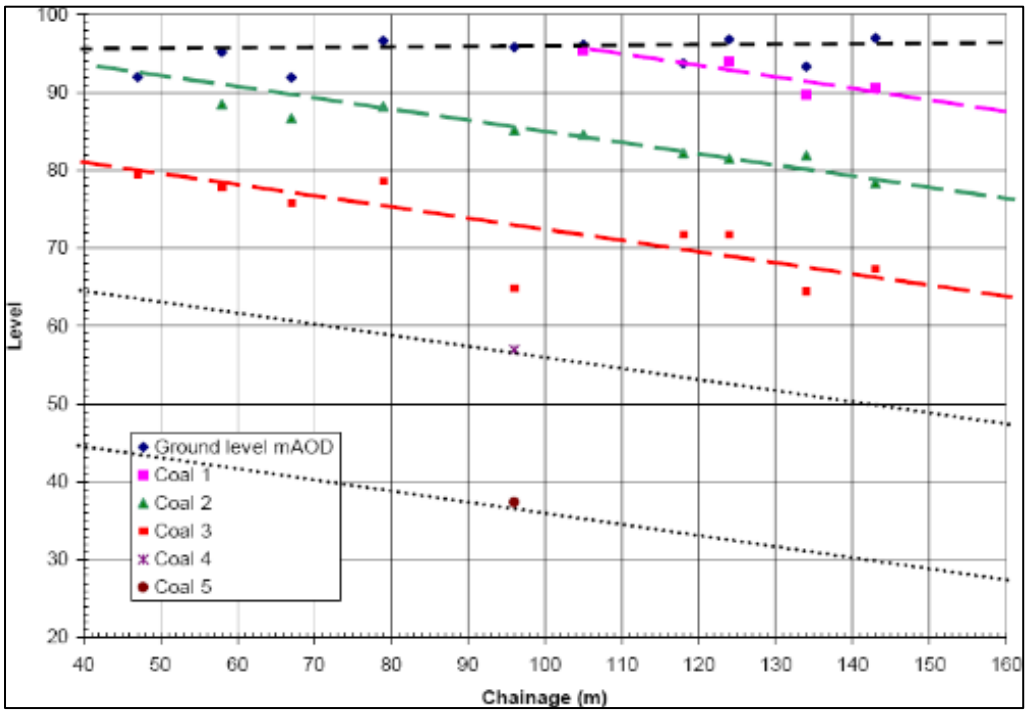



Figure 3 Extract of Figure 5 from BWB report showing Cross Section running north west to south east though centre of the site (location of cross section indicated in blue on Figure 4, cross section runs from NW to SE).

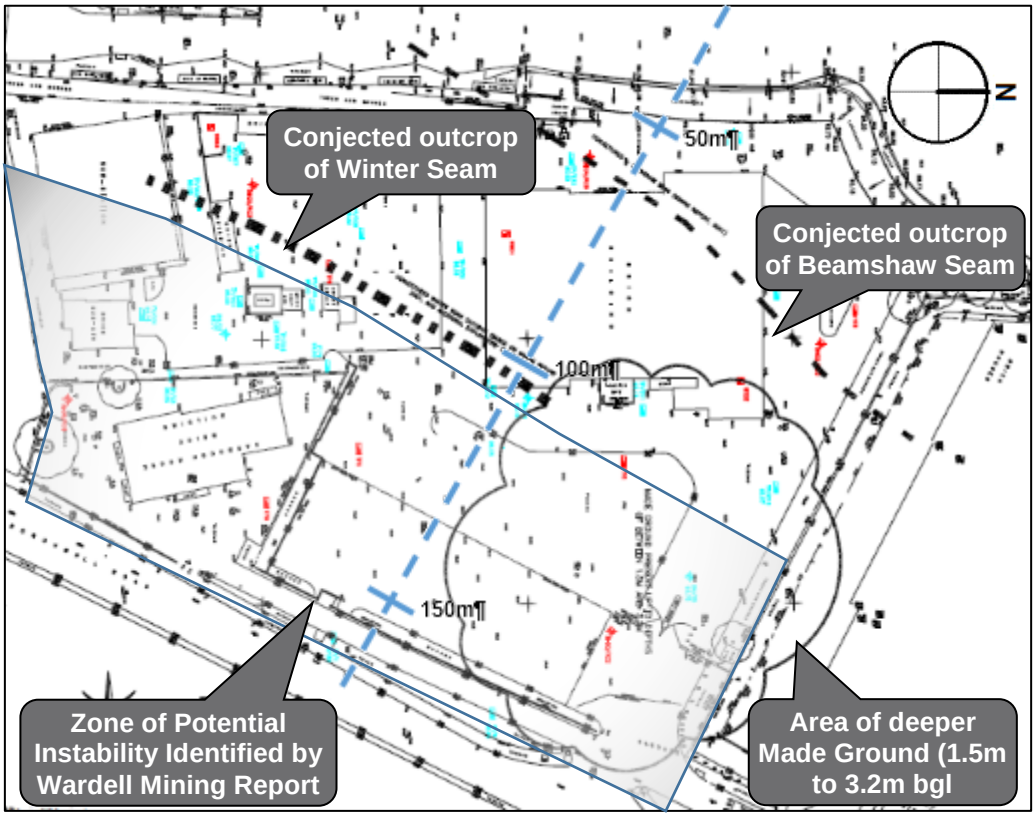



Figure 4 Extract of Figure 2 from BWB report showing conjected outcrop of Beamshaw and Winter Seams.

## 5.7 Summary of Geotechnical Results

The BWB report confirmed the presence of a localised area of Made Ground comprising gravelly clay with gravel and cobbles of brick, limestone and sandstone with ash clinker coal, plastic and glass fragments recorded over the north eastern corner of the site to between 1.5m and 3.2m bgl. The BWB report confirmed that these soils are of variable composition and therefore not suitable as a founding stratum without further ground improvement. In this area ground improvement and or alternative foundations are likely to be required.

The BWB report recommended that foundations were taken down to the weathered mudstone. Shallow foundations bearing upon the firm to stiff clay of the completely weathered mudstone at a minimum depth of 1.0m bgl should be limited to bearing pressures of <150kPa in order to limit estimated total settlements to less than 25mm. Higher bearing pressures can be achieved by taking the foundations deeper and founding on the very weak mudstone bedrock.

The BWB report confirmed a preliminary design CBR of 4%.

The BWB report suggested that a design sulphate class of DS1 would be appropriated for the development.

## 5.8 Summary of Contamination Assessment

Nineteen soils samples were selected and submitted for a general suite of contaminants. The results were compared to CLEA Soil Guidance Values (SGV); where no SGV exist an assessment was made against BWB generic site assessment criteria (GSAC) calculated using the SNIFFER or CLEA model.

The results recorded were all below the SCG or BWB GSAC values.

BWB undertook leachate testing on eight soils samples. The results of the testing indicated that none on the determinants were considered to be leachable.

One round of groundwater samples were retrieved from four wells (BH02 to BH05) and sent for analysis. The BWB report indicate that lightly elevated PAH (max 0.4μg/l) was

recorded in one well (BH03). All other determinants were below the BWB screening criteria.

BWB undertook five rounds of gas monitoring. The monitoring recorded flow rates between <0.1 to 2.7 l/hr, methane concentrations of <0.1% and a carbon dioxide concentration of between <0.1% to 4.1%.

## 5.9 Summary of BWB Conclusions and Recommendations

### 5.9.1 Environmental Issues

The BWB report concluded that for a commercial end use no remediation was required prior to redevelopment.

It also concluded that the gas monitoring indicated a Characteristic Situation 1 be adopted on accordance with CIRCIA 149, indicating no special precautions are required.

The environmental risk assessment was reduced to an overall rating of negligible.

### 5.9.2 Geotechnical Issues

The BWB report took on board, but did not reassess, the mining risk as set out in the Wardell Mining report. It is noted that BWB did limited investigation in the ae identified by Wardell Armstrong as the "*Zone of Potential Instability associated with shallow coal mining*".

The report concluded that the site is known to be located within an area that may have been affected by past mining activities. Two shallow coal seams are known to sub-crop beneath the site. It is anticipated that the rock beneath the site will dip approximately 6$^{o}$ to 8$^{o}$ towards the southeast.

The BWB report, in conjunction with the Wardell mining report, concluded that there is a high risk of voids migrating to the surface from unrecorded older mine workings within the shallowest of these seams known to underlie the eastern part of the site. In addition the BWB report concluded that the area of over-deepened Made Ground in the north east of the site may represent historical shallow opencast/bell pit excavation associated with this seam.

The BWB outlined several remedial works options with respect to the proposed construction over the affected areas of the site, these options included:

- Grouting and Ground Improvement
- Partially piled foundations/slab
- Cellular raft foundations beneath smaller retail units
- Incorporation of a high strength geo-textile/grid beneath pavement areas.

The BWB report stated that the Made Ground was not a suitable founding stratum. Where the depth of Made Ground was shallow enough foundations should be taking through the Made Ground and founded on the underlying firm to stiff clay, typically encountered around 1m bgl. A bearing pressure of <150kPa was proposed for this stratum. The BWB report indicated that for higher loads piled foundation may be required.

For deeper areas of Made Ground, the BWB report recommended consideration of deep ground improvement e.g. vibro-compaction or installation of vibro-stone/concrete columns. Consultation with specialist ground improvement contractors should be undertaken in order to establish the appropriate allowable bearing pressures of improved ground.

The BWB report indicated that if a ground bearing slab was required the shallow thickness of the Made Ground may allow for improvement by compaction.

The report stated that demolition materials (concrete floors / tarmac) were anticipated to be suitable for crushing, grading and reuse beneath pavement areas.

The report concluded that a design sulphate class of DS1 would be suitable for the site.

### 5.9.3 Further work

The BWB report recommended the following further works:

- Options to relocate proposed buildings should be explored (Note this was for the then proposed commercial development).

- Further confirmatory drilling to determine the potential for worked coal seams beneath the footprint of the proposed building should be undertaken prior to any development.
- Further trial pitting should be undertaken to determine the extent of the localised area of Made Ground over the north east of the site.
- Global stability of retaining structures overlying existing slopes along the northwest boundary should be undertaken (NB this was due to proposals to increase the site levels in this area).
- Consultation with specialist contractors should be undertaken to establish the potential to re-use won materials within reinforced earth structures.
- Consultation with specialist bored pile contractors should be undertaken to establish pile capacities and settlement tolerances if piled foundations required.
- Trial grouting/further open hole drilling may be required beneath areas where it is proposed to stabilise potential mine workings.

# 6 HBS Data Collation and Review

The BWB desk study did not contain factual appendices. Furthermore the data was collated in 2006. In light of this and to validate the findings of the BWB Phase I report HBS collated the following information to the findings of the completed report.

- An EnviroInsight Report prepared by Groundsure (Report Number GS-5235675 dated 13th July 2018).
- A GeoInsight Report prepared by Groundsure (Report Number GS-5235675 dated 13th July 2018).
- A Mineral Report prepared by South Yorkshire Mining Advisory Service (SYMAS) (Report Number M4089/6 dated 13th February 2018).
- Historic Ordnance Survey maps.
- British Geological Survey maps.
- British Geological Survey borehole records.
- Groundsure landfill records.
- Groundsure groundwater data.

To supplement the Phase I report, a Mineral Report has been obtained; the report was prepared by SYMAS (Report Number M4089/6 dated 13th February 2016)

A review of this information is provided below.

## 6.1 Geology

The 1:50,000 scale British Geological Survey (BGS) geological mapping indicates the site to be underlain by the Pennine Middle Coal Measures Formation. No superficial deposits are anticipated to underlie the site. Given the previous development of the site, Made Ground is anticipated to be present.

The Pennine Middle Coal Measures Formation is described by the BGS as "*Interbedded grey mudstone, siltstone, pale grey sandstone and commonly coal seams*".

The Pennine Middle Coal Measures Formation strata in the vicinity of the site is known to dip to the east at a rate of 1 on 12 or 5 degrees.

Four coal seams are anticipated to outcrop on or in the immediate vicinity of the site.

The BWB indicates that five coal seams are present beneath the site from immediately below the Made Ground to circa 58m bgl. The BWB report records the coal as dipping approximately 6° to 8° to the east beneath the site. A summary of the depths to coal recorded during BWBs 2006 investigation and in the 2001 Soils Mechanics investigation is given in the BWB report. An extract of the information is given in Table **2**).

## 6.2 Solution Features / Natural Cavities

The site is expected to be underlain by interbedded mudstones, siltstones and sandstones of the Pennine Middle Coal Measures Formation which is not prone to dissolution.

## 6.3 Underground Mining

The site lies within an area affected by coal mining. A SYMAS Report was provided by NPS Barnsley, the report confirms the following:

- The two foot coal seam is conjectured to outcrop on the eastern boundary of the site. The thickness of coal is expected to be in the region of 0.95m. This seam is therefore only potentially present beneath the site on the eastern edge only.
- The Adby or Winter coal seam is shown to outcrop in the western portion of the site. The thickness of coal is expected to be in the region of 1.00m. This seam is anticipated to be present centrally and to the east of the site at shallow depth.
- The Top Beamshaw coal seam is conjectured to outcrop circa 70m to the north or north west of the site. The thickness of coal is expected to be in the region of 1.20m. This seam will dip beneath the site; the SYMAS report estimates this seam to lie at Around 7m below ground level in the western edge of the site dropping to 20m bgl in the eastern edge.

- No shallow underground mine workings are recorded in the shallow coal seams. However, working are known to be present in the wider surroundings, in particular workings are known to be present in the Two Foot and Adby/Winter seams, to the east of Harborough Hill Road. Consequently the likelihood of further unknown historic mine working should not be ruled out.
- There are no known workings in the Top Beamshaw in the surroundings; this may be due to the relatively poor quality of this seam in the area.
- Deep mining (>100m bgl) occurred in the vicinity of the site in the Barnsley coal seam in the mid 1900s. All subsidence from these working should have ceased. The site is therefore considered to remain stable from deep mining.
- There are no known mine entries on or within 20m of the site. The closest are two disused shaft located circa 100m to the east. However, given the likely presence of shallow workable coal the potential for unknown historical mine entries cannot be ruled out.

The report concludes that the risk of shallow coal workings causing stability issued to future development is considered to be low to moderate. It indicates that a limited site investigation to check the depth and nature of the Adby/Winter coal seam and potential the Two Foot Seam would be prudent for future development.

The SYMAS Report is presented in Appendix G.

## 6.4 Soil Geochemistry

BGS estimated soil geochemistry information is included as part of the Groundsure GeoInsight report. The BGS digital estimated soil chemistry data indicates the estimated geometric mean concentrations (mg/kg) of Arsenic, Cadmium, Chromium, Nickel and Lead in topsoil derived by spatial interpolation of the point source soil chemistry data. The original samples were collected and analysed as part of the BGS Geochemical Baseline Survey of the Environment (G-BASE) project.

Table 3 summarises the typical estimated concentrations of each determinant in topsoil in the locality of the site.

**Table 3: Summary of BGS Estimated Soil Geochemistry**

| Determinant | Concentration Range (mg/kg) |
|---|---|
| Arsenic | 15 – 25 |
| Cadmium | <1.8 |
| Chromium | 90 – 120 |
| Lead | 100 – 200 |
| Nickel | 30 – 45 |

## 6.5 Hydrogeology

The Environment Agency classifies the Pennine Middle Coal Measures Formation at the site to be Secondary A Aquifer. The site does not lie within a Source Protection Zone and there are no potable groundwater abstractions within 1km of the site.

Groundwater is anticipated to lie between 5m and 22m bgl.

The depth to groundwater and the anticipated low permeability of the residual soils would suggest that groundwater would be of low sensitivity to any potential on site sources of contamination.

## 6.6 Hydrology

The nearest surface water is Slough Dyke which lies circa 135m south west at its closest point. The Dyke is known to be culverted as it runs through the centre of Barnsley. There are no other watercourses within 250m of the site. Surface water is therefore considered to be of low sensitivity to any potential on site sources of contamination.

## 6.7 Landfill Sites

There are no current or historical recorded landfill sites within 250m of the site. The closest site lies circa 355m north west of the site. The site is registered as Land off Old Mill Lane and was active from 1984 to 1994. The waste type was inert and commercial.

A Waste Management licence was historically held by Yorkshire Electricity for the site. The licence did not permit the disposal of materials and was surrendered in 1999.

On the basis of the underlying geology and the distance from the site, the landfill is not considered likely to present a risk to the site from gas or leachate migration.

## 6.8 Radon

The Groundsure radon report states that the site is in an area where the estimated probability of homes being above the action level of 200Bqm$^{-3}$ is less than 1%. No radon protective measures are required in the construction of new buildings.

Confirmation of any protection measures should be agreed with the local authority building control and / or NHBC.

The historical land uses of the site and its surrounding area have been established from superseded editions of Ordnance Survey maps and are detailed in Table 4.

Copies of the maps are included in Appendix F.

**Table 4: Summary of Historical Maps**

| Date | On Site | Offsite |
|---|---|---|
| 1850 | The site is part of Harborough Hill House estate. | The railway line and sidings are present along the western edge of the site, with the town of Barnsley beyond. The remaining surrounding land typically comprises agricultural land with scattered residential properties. Mount Osbourne Well Colliery lies circa 310m north east. A sandstone quarry is marked circa 320m north east. |
| 1889-1893 | Harborough house is shown to lie immediately adjacent to / in the south east corner of the site. The remainder of the site is covered by formal gardens. | The colliery is no longer marked. A second quarry is marked circa 195m south west. An engine shed and carriage works are present c.30m west. A railway foundry and timber yard are lie c.40m and 70m south west. A saw mill and Union foundry lie c 180m south west. |
| 1904-1906 | No significant changes are evident. | A glass works lies c.150m north east. |
| 1929 | The site appears to have been redeveloped for allotment gardens. | Harborough House is marked as a club. Residential houses have been constructed to the north of the site. A gas works is marked c.200m south west. Boro drift colliery lies c.125m east. |
| 1938 | No significant changes are evident. | No significant changes are evident. |
| 1948 | No significant changes are evident. | No significant changes are evident. |
| 1956 | No significant changes are evident. | No significant changes are evident. |
| 1960-1966 | The south eastern corner of the site has been developed as part of “Barnsley National Reserve Club”. A series of small structures (?garages) are marked in the north western corner. | Boro Colliery is no longer marked and the air shaft is marked as disused. The railway foundry, timber yard and engine shed have been redeveloped as a bus station. The Union Foundry is no longer present. |

| Date | On Site | Offsite |
|---|---|---|
| 1972-1975 | The site has been developed as an electricity Board Depot. The club in the south east corner of the site has been extended. | The substation has been constructed to the south of the site with a commercial building beyond. |
| 1985-1993 | The club site in the south east corner has been redeveloped. | The bus station to the west has expanded. The majority of the sidings have been removed. |
| 2002 | No significant changes are evident. | No significant changes are evident. |
| 2010 | No significant changes are evident. | No significant changes are evident. |
| 2014 | The buildings are no longer present on site. | No significant changes are evident. |

### 6.8.1 Summary of Development History

On site

By the time of the earliest mapping in the mid 1800s the site comprises part of Harborough Hill House estate. Harborough House was shown to lie immediately adjacent to / in the south east corner of the site. The remainder of the site was covered by formal gardens. In the 1920s the site appears was redeveloped for allotment gardens. In the 1960s a series of small structures (potentially garages) were developed in the north western corner and a club was developed in the south east corner of the site. By the 1970s the site had been redeveloped and was utilised as an electricity depot. The depot buildings were still present when the BWB report was written in 2006, but are no longer marked on the 2014 map.

Off Site

The surrounding land use was typically industrial to the west with the remainder comprising undeveloped farmland. Over time this has changes to a mixture of commercial and residential properties with a bus and railway station's located adjacent to the western boundary of the site. Mount Osbourne Well Colliery was present circa 310m north east in the mid to late 1800s, Boro Colliery was present circa 150m east from the 1930s to the 1960s.

# 7 Ground Conditions

## 7.1 General

The results of the BWB Phase II ground investigation were consistent with the anticipated geology. A summary of the strata encountered is presented in Table 5 and Table 6 and discussed in sections 7.2 to 7.5. For full details of the strata encountered reference should be made to the exploratory hole logs which are included in BWB's Phase 2 report in Appendix C.

**Table 5 Ground Conditions – Boreholes**

| Stratum | Depth to Base (m bgl) | | | | |
|---|---|---|---|---|---|
| | BH01 | BH02 | BH03 | BH04 | BH05 |
| Reinforced Concrete | - | 0.30 | 0.30 | - | 0.30 |
| Tarmac | 0.08 | - | - | 0.08 | - |
| Made Ground: sandy gravel | 0.30 | 1.00 | 0.40 | 0.40 | 0.50 |
| Made Ground: firm locally sandy very gravelly clay with variable cobbles | 0.70 | - | - | - | 2.00 |
| Stiff, locally firm, thinly laminated gravelly clay | - | - | - | - | 2.50 |
| Very weak thinly laminated mudstone. | - | 2.90 | - | - | - |
| Black coal with lustre. | - | 3.68 | - | - | - |
| Very weak thinly laminated mudstone. | - | 4.76 | - | - | - |
| Black coal with lustre. | 1.70 | 5.00 | - | - | - |
| Very weak thinly laminated mudstone. | 11.46 | 15.25 | 8.40 | 12.58 | 11.50 |
| Black coal with lustre. | 11.82 | 16.00 | 9.23 | 14.08 | 11.95 |
| Completely weathered mudstone, recovered as clay | 12.16 | 16.20 | 9.40 | - | 12.30 |
| Black coal with lustre. | 12.60 | 16.76 | 9.95 | - | 12.50 |
| Very weak to weak thinly laminated mudstone. | 20.50 | 29.00* | 18.03 | 17.87 | 21.90 |
| Black coal with lustre. | 21.74 | - | 18.59 | - | 22.50 |
| Very weak to weak thinly laminated mudstone. | 26.50 | - | 25.00 | - | 30.00* |
| Moderately strong thinly laminated mudstone | - | - | - | 20.36 | - |
| Moderately weak thinly laminated slightly micaceous sandstone | 30.00* | - | 30.50* | 30.00* | - |

* base of hole

**Table 6 Ground Conditions – Trial Pits**

| Stratum | Depth to Base (m bgl) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TP01 | TP02 | TP03 | TP04 | TP05 | TP06 | TP07 | TP08 | TP09 | TP10 | TP11 | TP12 | TP13 | TP14 | TP15 |
| Reinforced Concrete | 0.25 | 0.30 | 0.26 | 0.30 | 0.20 | 0.22 | 0.30 | 0.20 | - | - | - | - | - | 0.14 | 0.15 |
| Tarmac | - | - | - | - | - | - | - | - | 0.05 | 0.15 | 0.09 | 0.07 | 0.06 | | - |
| Made Ground: sandy gravel | - | 0.46 | 0.46 | 0.60 | 0.90 | 0.70 | 0.6 | 0.50 | 0.15 | 0.60 | 0.30 | 0.15 | 0.35 | 0.50 | 0.50 |
| Made Ground: clayey very sand very gravelly cobbles and boulders | 0.50 | - | - | - | - | - | - | - | - | - | - | 1.00 | - | - | - |
| Made Ground: firm locally sandy very gravelly clay with variable cobbles | - | - | - | - | - | - | - | - | 0.30 | 0.80 | 1.20 | 1.50 | - | - | - |
| Made Ground: cobbles and boulders of sandstone | - | - | - | - | - | - | - | - | - | - | 1.90 | - | - | - | - |
| Stiff, locally firm, thinly laminated gravelly clay | 1.10 | 0.80 | 1.20 | 1.50 | - | 1.10 | - | - | - | 1.10 | - | 2.00 | - | - | - |
| Very weak thinly laminated mudstone. | 2.90* | - | 2.00 | 2.20 | 2.40 | - | 2.10* | 1.50* | 3.40* | 2.50 | 2.10* | 3.10* | 3.10* | 2.40* | 1.70* |
| Black coal with lustre. | - | 1.40 | 2.10* | 2.40* | 2.80 | 1.80 | - | - | - | 2.60* | - | - | - | - | - |
| Very weak to weak thinly laminated mudstone. | - | 2.00* | - | - | 3.10 | 3.20* | - | - | - | - | - | - | - | - | - |
| Groundwater | Dry | Dry | Dry | Dry | Dry | Dry | Dry | Dry | Dry | Dry | Dry | Dry | Dry | Dry | Dry |

* base of hole

## 7.2 Hardstanding

A 0.10m to 0.30m thick layer of reinforced concrete was recorded in ten of the trial pits and three of the boreholes. In five of the trial pits (TP09 to TP13) and two of the boreholes (BH01 and BH04) a thin layer 0.05m to 0.15m thick layer of tarmac was recorded. The tarmac was typically found to the north and east of the site.

## 7.3 Made Ground

Made Ground materials were encountered in all locations to depths ranging from 0.30m to 1.90m bgl. The materials generally comprised yellow / yellowish brown very sandy gravel (subbase) which was present to between 0.15m and 0.90m bgl; the gravel typically comprises limestone however locally brick and sandstone were recorded. This layer was absence in TP01; the Made Ground in this location comprises clayey very sandy very gravelly cobbles and boulders to 0.50m bgl

In TP09 to TP12, BH01 and BH05 this layer was underlain with a sandy gravelly clay layer to between 0.30m and 2.00m bgl. The gravel and cobbles in this strata typically comprised of brick, limestone and sandstone and occasional glass, coal, polythene, ash, clinker and slag. In TP11 this layer was in turn underlain by a layer of sandstone cobbles and boulders to 1.90m bgl.

The BWB report indicates that historical information on the site indicates locally deeper Made Ground up to 3.2m depth was recorded over the north east part the site in BH03/RC02 drilled by Soil Mechanics in 2001. The borehole was located in the area to the north east of the site currently utilised as a car park.

## 7.4 Pennine Middle Coal Measures Formation

The Made Ground was underlain by the solid geology of the Pennine Middle Coal Measures Formation.

In seven of the trial pits, this material was weathered to stiff locally firm thinly laminated clay to between 0.80m and 2.00m bgl. This stratum was typically found in the exploratory hole located centrally and running north south though the site.

In all of the trial pits, the bedrock comprises very weak to weak thinly laminated mudstone. In three of the boreholes, BH01, BH03 and BH04, moderately weak thinly laminated slightly micaceous sandstone was recorded at 26.5m bgl, 25.0m bgl and 20.36m bgl respectively.

Coal (0.40m to 0.70m thick where proven) was recorded in six of the trial pits, TP02 to TP06 and TP10. Between one and four coal seams were recorded in all of the rotary boreholes. All of the coal recorded was intact and no evidence of workings was recorded by the 2006 exploratory holes. A summary of the depths and thickness of the coal seams encountered is given in Table 7.

**Table 7 Summary of Coal Seams**

| Exp Hole Ref | Top m bgl (m OD) | Bottom m bgl (m OD) | Thickness m |
|---|---|---|---|
| TP02 | 0.80 (94.78) | 1.40 (95.18) | 0.6 |
| TP03 | 2.00 (94.86) | NP | NP >0.2 |
| TP04 | 2.20 (94.49) | NP | NP >0.1 |
| TP05 | 2.40 (94.13) | 2.80 (93.73) | 0.40 |
| TP06 | 1.10 (95.4) | 1.80 (93.8) | 0.70 |
| TP10 | 2.60 (93.45) | NP | NP >0.1 |
| BH01 | 0.70 (95.40) | 1.70 (94.4) | 1.00 |
| | 11.46 (84.64) | 11.82 (84.28) | 0.36 |
| | 12.16 (83.94) | 12.60 (83.50) | 0.44 |
| | 20.50 (75.60) | 21.74 (74.36) | 1.24 |
| BH02 | 2.90 (93.87) | 3.68 (93.09) | 0.78 |
| | 4.76 (92.01) | 5.00 (91.77) | 0.24 |
| | 15.25 (81.52) | 16.00 (80.77) | 0.75 |
| | 16.20 (80.57) | 16.76 (80.01) | 0.56 |
| | 25.00 (71.77) | 25.83 (70.94) | 0.83 |
| BH03 | 8.40 (88.21 | 9.23 (87.38) | 0.83 |
| | 9.40 (87.21) | 9.95 (86.66) | 0.55 |
| | 18.03 (78.58) | 18.59 (78.02) | 0.56 |
| BH04 | 12.58 (79.44) | 14.08 (77.94) | 1.50 |
| BH05 | 11.50 (82.22) | 11.95 (81.77) | 0.45 |
| | 12.30 (81.42) | 12.50 (81.22) | 0.20 |
| | 21.90 (71.82) | 22.25 (71.47) | 0.35 |

NP – Not proven

## 7.5 Groundwater

No groundwater strikes were recorded in the trial pits during the intrusive works. Groundwater strikes were recorded in the boreholes, in the Pennine Middle Coal

Measures, at between 4.50m and 29.7m bgl during drilling. Monitoring of groundwater levels within the standpipes installed was undertaken in July 2006. The results are presented in Table 8.

**Table 8 Groundwater Monitoring Results**

| Hole / Depth to water (m BGL) | BH01 | BH02 | BH03 | BH04 | BH05 |
|---|---|---|---|---|---|
| 14/07/06 | Dry | 5.67 | 8.00 | 17.52 | 19.78 |
| 21/07/06 | Dry | 5.79 | 7.97 | 17.68 | 19.93 |
| 27/07/06 | 8.93 | 6.49 | 8.94 | 17.38 | 20.05 |
| 14/08/06 | 8.94 | 6.59 | 8.91 | 17.44 | 20.01 |
| 21/08/06 | 6.51 | 6.10 | 8.80 | 17.44 | 20.09 |

## 7.6 Field Observations of Contamination

Anthropogenic material such as brick, ash, coal, clinker, polythene and glass was locally recorded in the Made Ground, principally in the north eastern corner of the site.

In TP11 BWB recorded an organic odour between 0.60m and 1.20m bgl. BWB indicated that the organic odour may be related to the drain encountered in the excavation.

No other visual or olfactory evidence of contamination was encountered.

## 7.7 Shrinkable Soils

Cohesive soils (clay and silt) may undergo volume change when subject to changes in moisture content. This can cause ground movement of soils where seasonal changes or tree root action affect the moisture content. Where foundations are constructed in such soils these movements can lead to damage of the superstructure. These movements are greatest where trees are removed or tree root systems are severed as this allows the soils to regain their equilibrium moisture content resulting in expansion.

The NHBC (National House Building Council) has derived minimum foundation depths and other precautions relating to ground movements in shrinkable soils. These standards are set out in NHBC Chapter 4.2 “Building Near Trees” (2017) and are commonly adopted for both residential and non-residential structures.

The Modified Plasticity Index is related to volume change potential and NHBC recommended minimum foundation depths as indicated in Table 9.

**Table 9 Volume Change Potential**

| Modified Plasticity Index | Volume Change Potential | Minimum Foundation Depth |
|---|---|---|
| 40% or greater | High | 1.00m |
| 20% to <40% | Medium | 0.90m |
| 10% to <20% | Low | 0.75m |

Shrinkable soils are generally considered as clays having a modified plasticity index (I'p) of 10% or greater. The Modified Plasticity Index is defined as the Plasticity Index (Ip) of the soil multiplied by the percentage of particles less than 425µm. Soils containing less than 35% fine particles (< 63µm) are non-shrinkable.

The plasticity indices of four soil samples of the weathered bedrock, taken by BWB, ranged from 15% to 34%, with the percentage of the soil <425µm ranging from 72% to 100%. The calculated modified plasticity indices ranged from 13% to 34%.

On this basis, the weathered bedrock soils would therefore be considered to be of **medium volume change potential** with respect to NHBC Chapter 4.2 "Building Near Trees" (NHBC, 2017). Consequently, a minimum foundation depth of 0.90m is recommended where foundations are outside the influence zone of trees.

## 7.8 Soil Strength

The Standard Penetration Tests (SPTs) ranged from 22 to >50 (refusal) in the weathered bedrock (see Figure 5).

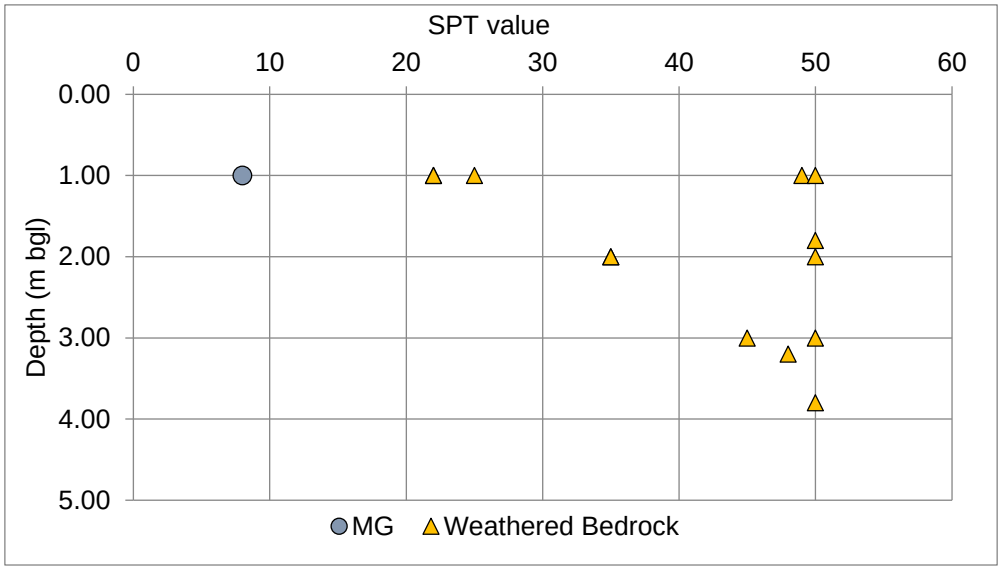



Figure 5 SPT Values

# 8 Mining Risk Assessment

The site lies within an area affected by coal mining. A SYMAS Report was provided by NPS Barnsley, this confirmed that three coal seams (the Two Foot, the Winter (Adby) and Top Beamshaw) outcrop on or immediately adjacent to the site. The Wardell mining report and BWB Phase II report has identified the winter and Top Beamshaw seams outcropping on site (see Figure 6).

Deep mining (>100m bgl) has occurred in the vicinity of the site in the Barnsley coal seam in the mid 1900s. All subsidence from these working should have ceased. The site is therefore considered to remain stable from deep mining.

There are no known mine entries on or within 20m of the site. The closest are two disused shaft located circa 100m to the east. However, given the likely presence of shallow workable coal the potential for unknown historical mine entries cannot be ruled out.

The SYMAS report recorded no shallow underground mine workings in the shallow coal seams, beneath the site however it did not rule out the likelihood of further unknown historic mine working. Workings are known to be present in the wider surroundings; in particular, workings are known to be present in the Two Foot and Winter/Adby seams, to the east of Harborough Hill Road. There are no known workings in the Top Beamshaw in the surroundings; this is likely to be due to the relatively poor quality of this seam in the area. The Two Foot was not recorded on site.

The Wardell Mining Assessment and BWB report interpreted the shallowest seam as the Winter Seam (Coal Seam 1). This seam was recorded at shallow depth between 1.1m and 2.9m bgl, in TP02 to TP06, TP 10, BH01 and BH02 (see Figure 6). In each location, the coal was recorded as intact. In BH05, TP11 and TP12 the shallow coal seam was not recorded however, in these locations Made Ground was recorded to between 1.5m and 2.0m bgl. It is understood from the BWB report that immediately adjacent to these locations another borehole (BH3/RC2) drilled in 2002 by Soil Mechanics recorded no shallow coal but Made Ground up to a depth of 3.2m bgl.

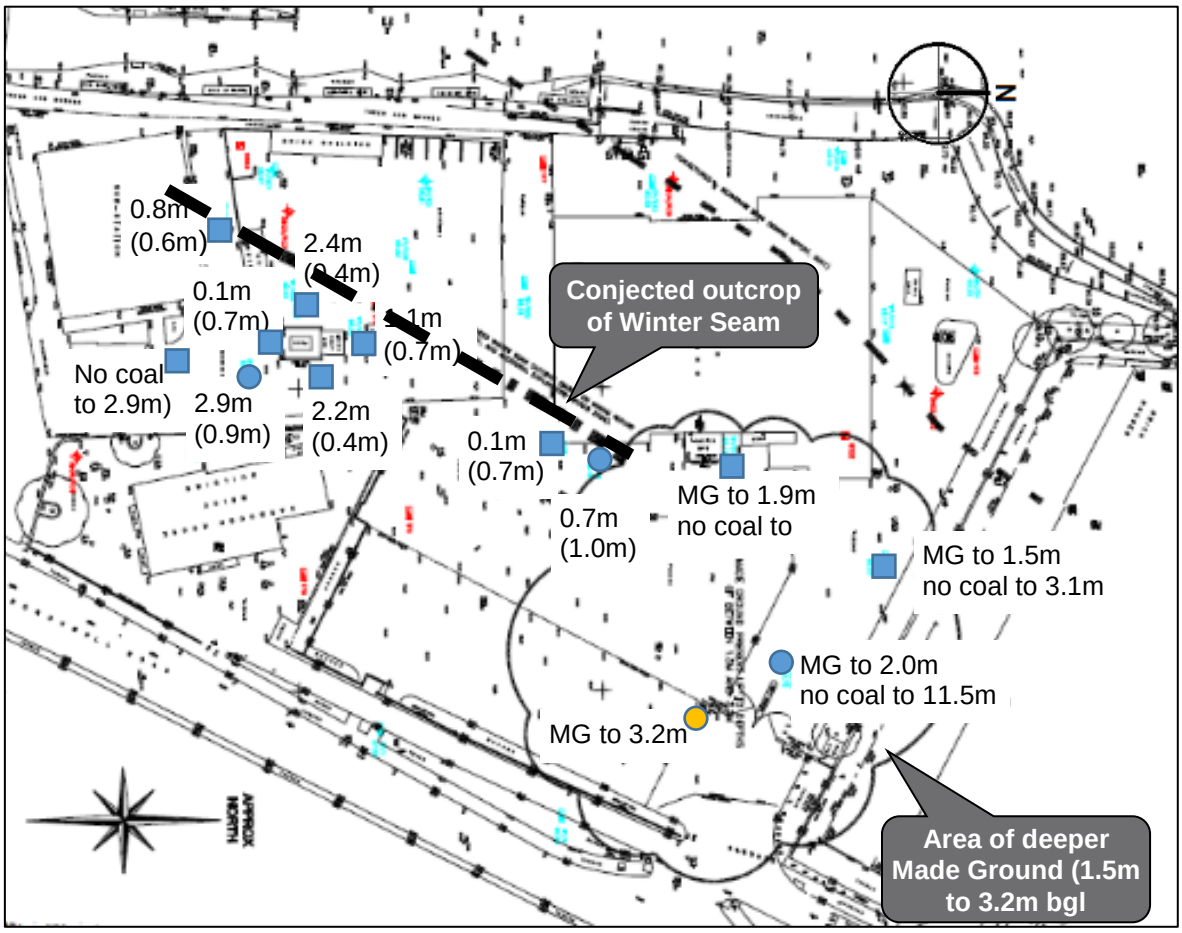



Figure 6 Depths to top of Winter Coal Seam (seam thickness)

The SYMAS report concludes that the risk of shallow coal workings causing stability issues to future development is considered to be low to moderate. This correlates with the conclusion of the Wardell mining report which states, according to the BWB report, that there was a potential for unrecorded shallow mine workings across the eastern third of the site associated with the underlain by the Winter Seam. The investigations undertaken to date by BWB, which included the investigation by Soil Mechanics, have proved that shallow coal, where present, was found to be intact i.e. unworked. The risk of unknown working is therefore considered to be low however as the majority of the rotary boreholes were undertaken along the line of the outcrop HBS consider it would be prudent to advance an additional three rotary holes within the eastern edge of the site to confirm that coal in this location is also intact.

In addition, the BWB report indicated that all of the ground investigation to date have recorded an over-deepened area of backfill in the north eastern corner of the site (see

Figure 6). The BWB (inc Wardell interpretation) report indicated that this area may represent historical shallow opencast/bell pit excavation associated with the Winter Seam. It would be prudent therefore to undertaken further trial pitting within the anticipated areas of deeper Made Ground to delineate to its extent, composition and depth.

# 9 Geotechnical Assessment

## 9.1 Proposed Development

It is understood that the site is being considered for residential redevelopment including a Youth Zone facility. Although no proposed development plans were available at the time of reporting, it has assumed the residential development is to consist of two or three storey residential properties of traditional construction together with associated infrastructure.

## 9.2 Ground Conditions

The 2006 investigation identified between 0.30m and 1.90m, locally 3.20m, of Made Ground over very weak to weak mudstone, locally the mudstone was overlain by firm to stiff clay. Intact coal (0.20m to 1.50m thick) was recorded in all of the boreholes and six of the trial pits at depths ranging from 0.70m bgl to 25.00m bgl. In the boreholes between one and four coal seams were recorded.

During subsequent monitoring of the standpipes in July and August 2006, groundwater was recorded at depths greater than 5m bgl.

## 9.3 Foundation Design Principles

The two primary factors controlling the performance of foundations are bearing capacity and settlement. Usually the settlement tolerances of the structure are considerably less than the settlement that would be expected as the ultimate bearing capacity of the soils is approached. Therefore, it is usually tolerable settlement that dictates the bearing pressure for foundation design. In general, the ultimate bearing capacity is usually divided by a safety factor of 3 for an allowable bearing capacity in order to maintain total settlement within tolerable limits for most structures, which is generally accepted to be 25mm. However, it should be noted that total settlements are usually less than this value as the average actual imposed load will be less than the design load.

## 9.4 Foundation Design

Based on the ground conditions encountered, and subject to the findings of the recommended investigation conventional spread foundations would be suitable for the proposed structures across the majority of the site.

The foundations should be taken down through any Topsoil, Made Ground or soft deposits and constructed within the firm to stiff clay or very weak mudstone of the weathered Pennine Middle Coal Measures Formation. To avoid seasonal ground movements associated with the shrinkable clay soils a minimum foundation depth of 0.90m should be adopted, although it is acknowledged that depths would need to be greater locally where deeper Made Ground or soft soils are present, or where foundations need to be deepened in the vicinity of trees.

The depth to founding strata is typically around 1.0m bgl over the majority of the site extending to between 1.9m and 3.2m bgl in the north eastern corner of the site. Where Made Ground is present to below circa 2.5m then, alternative foundations may be required.

Assessment of the soils strengths would suggest a safe bearing capacity of 150kPa for strip foundations within the clay soils. Higher bearing pressures would be permissible on the very weak mudstone bedrock.

The clay soils are shrinkable (medium volume change potential) and therefore foundations will need to be deepened and heave precautions adopted within the influence zone of existing, proposed or felled trees, in accordance with NHBC Chapter 4.2.

A tree survey to determine species and height will be required to calculate foundation depths in shrinkable soils.

Where the design bearing capacity is imposed on clay strata then 15mm to 25mm of settlement may occur. There will be negligible settlements of foundations placed on bedrock. Consequently, foundations that span from clay strata to mudstone bedrock would need reinforcement to resist differential settlements.

All foundations should be inspected by a suitably qualified and competent person to ensure that foundations are placed in competent material capable of supporting the intended loads and below any desiccated clay soils.

## 9.5 Alternative Foundations

In the north eastern corner of the site the Made Ground extended to around 2.0m bgl in BWB's 2006 exploratory holes. However, the BWB report confirms that the Made Ground extended to 3.2m bgl in one of the 2001 Soil Mechanics boreholes (BH03/RC2) in the north eastern corner of the site.

It would be prudent to undertaken further investigation within the anticipated areas of deeper Made Ground to delineate to its extent, composition and depth and inform the foundation design in this location.

Where Made Ground is present to below circa 2.5m then, alternative foundations may be required. These could include piled foundation, ground improvement or excavation and replacement of the Made Ground.

### 9.5.1 Piled Foundations

Where the thickness of Made Ground is too great for practical or economical construction of strip foundations, piled foundations can offer a suitable alternative solution.

Potential issues that may need to be addressed are:

- The bedrock may present difficulties with pile penetration. Driven steel tubes or bored rock sockets may be needed.
- Piling can result in connection of groundwater bodies and we would recommend early agreement with the Environment Agency to ensure that they are satisfied that works will not have a detrimental impact on water bearing aquifers present at the site. The investigation has indicated that groundwater lies at <5m bgl within the Coal Measures. No significant concentrations of determinants was recorded on the site and leachate analysis has indicated that the in-situ soils are unlikely to act as a diffuse source of groundwater contamination. Groundwater testing confirm no issue.

Therefore, the risk of piling works resulting in contamination of the aquifer are considered to be low.

The advice of a specialist piling contractor should be sought on the suitability and load carrying capacity of their proprietary techniques for use at this site.

Where foundations are within the influence of trees, a suitable compressible material or void former may be required for ring beams and sufficient longitudinal reinforcement incorporated into piles to resist tensile forces resulting from heave. The clay Made Ground soils are of medium volume change potential.

In order to ensure the safe operation of tracked plant (e.g. piling rigs, cranes etc), it will be necessary to design a suitable working platform. This can only be done in the context of the precise rig to be used and the route it will take to gain access. The data will require specific study for this design case. In some cases further specific shallow investigation may be necessary.

### 9.5.2 Ground Improvement

There are a number of different techniques and construction methods available to increase the bearing capacity and reduce settlement of the low strength soils to support structural loads and floor slabs.

Conventional ground improvement techniques, such as vibro-replacement stone columns, could be used. The low strength soils at depth may suffer from deformation however.

With all ground improvement techniques, the performance of the improved ground is dependent on the ground conditions, the method adopted, the depth to the water table and the proposed loading intensity and distribution, as well as the settlement tolerances of the proposed structures. Specialist ground improvement contractors would be able to advise on the suitability of their various techniques to provide the required stiffness to support traditional foundations and floor slabs.

### 9.5.3 Excavation and Replacement of Made Ground

If the proposed final levels are such that a significant degree of re-profiling is required to create a more level development platform then the degree of cut and fill required

may be such that it may be considered an earthworks solution that would create engineered platforms using site won materials. This would a more uniform material in terms of constituents and strength, allowing easier construction of shallow foundations in the underlying natural strata where thickness allows, or the use of reinforced box beam type foundations for suitable structures where the thickness of fill is too great. Liaison and agreement with the NHBC or other warranty provider would be advised at an early stage should this solution be considered.

The economy and practicality of this solution would need to be discussed at an early stage with groundworks contractors and the NHBC / Building Control. An earthworks strategy, specification and subsequent validation would be required if this the option adopted.

## 9.6 Floor Slabs

The underlying soils near surface soils were either shrinkable (medium volume change potential) or consisted of Made Ground, therefore a suspended floor slab should is recommended with an appropriate underfloor void. Should a ground bearing floor slab be required then all shrinkable soils and Made Ground should be removed and replaced with well compacted high quality granular fill.

No radon protection measures are considered necessary.

The ground gas risks assessment indicate

- For Situation A (Youth Centre) a CIRIA Characteristic Situation 1 - very low risk" is applicable and gas protection measures are considered necessary.
- For Situation B (low-rise housing development with a clear ventilated underfloor void) a NHBC 'Green' situation would be appropriate. Therefore, no gas protection measures would be required.

## 9.7 Buried Structures

Notwithstanding the ground conditions revealed by the intrusive investigations, it is important to note that both foundation and ground floor slab construction could be significantly influenced by pre-existing subsurface construction, associated with the historical development of the site. This could include, for example, foundations and

underground services, infilled pits and channels, which will need to be treated / managed as part of the development works.

The desk based assessment, walk over and investigations have confirmed that drainage associated with the former development is present. The extent of the drainage has not been confirmed, we would envisage that in addition to the drainage pipework, infrastructure potentially including petrol interceptors may be present.

## 9.8 Concrete Protection

Buried concrete classification is based on guidelines provided in BRE Special Digest 1 (BRE, 2005).

Chemical Analysis was undertaken on eighteen soil samples for pH and a water soluble sulphate. In addition, eight groundwater samples were tested (two rounds from each of the four wells).

The pH values were 4.9 to 10.4 with water soluble sulphate concentrations of <3mg/l to 410mg/l. Therefore, it is recommended that a Design Class of DS1 and AC2z should be assumed for buried concrete in accordance with BRE Special Digest 1 assuming natural ground and mobile groundwater conditions.

For low rise residential on mass concrete foundations, this corresponds to a concrete type of FDN2z. It is recommended that the concrete supplier confirm the necessary concrete type based on its intended use and the chemical test results in the BWB report presented in Appendix C.

## 9.9 Pavement Design

Equilibrium CBR values for various materials are given in Interim Advice Note 73/06 "Design Guidance for Road Pavement Foundations (Draft HD25)" produced by the Highways Agency and these are summarised in Table 10 assuming a high water table and thin pavement construction.

**Table 10 Typical CBR Values**

| Soil Type | PI (%) | Equilibrium CBR (%) |
|---|---|---|
| Heavy clay | 50-70 | 2 |
| Silty clay | 30 | 3 |
| Sandy clay | 10-20 | 3-4 |
| Silt | - | 1 |
| Sand and Gravel | | > 5% |

The near surface soils are predominantly existing subbase over clays / mudstone of the weathered bedrock. Locally Made Ground comprising clay with gravel and cobbles is also present

Based on Table 10 and on the materials we would envisage a CBR of 4% would be appropriate. The BWB report indicates that CBR testing was undertaken during the 2001 Soil Mechanics investigation; CBRs ranging from 4% to 7% were recorded.

Road construction thicknesses for a range of CBR values are given in Interim Advice Note 73/06 Revision 1 (2009) - Design Guidance for Road Pavement Foundations. The thickness of construction for different options are summarised in Table 11.

**Table 11 Road Foundation Construction**

| CBR | 2.5% | 3% | 4% | 5% |
|---|---|---|---|---|
| Capping only (600 Series) | 550mm | 510mm | 450mm | 390mm |
| Sub-base only (800 Series) | 450mm | 420mm | 360mm | 320mm |

| CBR | 2.5% | 3% | 4% | 5% |
|---|---|---|---|---|
| Sub-base (800 Series) | 350mm | 320mm | 275mm | 240mm |
| Capping (600 Series) | 250mm | 240mm | 225mm | 210mm |
| Total | 600mm | 560mm | 500mm | 450mm |

The construction thickness can be reduced by the use of a basal geo-grid, although detailed design would be required, specific to the loads and geo-grid used.

The formation level should be proof rolled to identify any loose or soft spots, which should be removed and replaced with compacted granular fill.

The conditions prevailing at the time of construction will affect the CBR of the sub-grade soil and its strength. Research has shown the importance of the equilibrium moisture content of the sub-grade. The relationship between soil suction and the moisture content shows that a soil that becomes wet during construction will retain

water and will therefore be weaker under the pavement in the equilibrium condition than a foundation that has remained dry, particularly for soils of low to medium plasticity. Consequently, the formation level will also need to be protected during inclement weather from deterioration; all slopes should be trimmed to falls to shed rain water and the surface sealed to limit infiltration.

## 9.10 Excavations

Conventional mechanical backhoe excavators should prove suitable for excavation within the near surface weathered bedrock. The foundations / floor slabs to the demolished structures on the site are likely to require heavier plant to remove them.

The soils may be subject to spalling and collapse within excavations and concrete should be poured as soon as possible and temporary support may be required. Entry into shallow excavations by personnel should be minimised, and excavation stability should be assessed by suitably qualified and experienced staff and shoring used when required. Entry into deeper excavations should not be permitted unless full support is provided.

Groundwater strikes were recorded in the boreholes at between 4.50m and 29.7m bgl during drilling. During subsequent monitoring of the standpipes in July and August 2006, groundwater was recorded at depths greater than 5m bgl. Groundwater control is therefore unlikely to be required in near surface excavations.

## 9.11 Soakaway Drainage

No soakaway testing was undertaken as part of the BWB investigation. However the investigation confirmed that the natural near surface soils comprise firm to stiff clay and very weak mudstone of the weathered bedrock.

The clay soils encountered are likely to possess infiltration rates of less than $1 \times 10^{-6}$ m/s and therefore efficient soakaway drainage is unlikely to be feasible.

# 10 Land Quality Assessment

The primary legislative mechanism for contaminated land management in the UK is Part 2A of the Environmental Protection Act, 1990 (EPA). Part 2A was introduced into the EPA under Section 57 of the Environment Act 1995 to help deal with the substantial legacy of land contamination. Local authorities are the principal regulator for inspection of land under Part 2A. In England, Part 2A is described fully in DEFRA Circular 01/2006, which also contains the statutory guidance (DEFRA, 2006). Part 2A defines contaminated land as:

*'…any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that*

*a. significant harm is being caused or there is a significant possibility of such harm being caused; or*

*b. Pollution of controlled waters is being, or is likely to be, caused.'*

In applying the definition of Contaminated Land, Part 2A states that 'the Local Authority must:

- Identify a 'Pollution Linkage'. That is, a linkage between a contaminant and a receptor, by means of a pathway(s).
- Determine if the contaminant is causing significant harm to that receptor, or there is a significant possibility of such harm being caused by that contaminant to that receptor.

If any one element of the pollutant linkage is not present then the land should not be identified as 'contaminated land'.

Part 2A is designed to 'enable the identification and remediation of land on which contamination is causing unacceptable risks to human health or the wider environment. It does not necessarily include all land where contamination is present, even though such contamination may be relevant in the context of other regimes'. It is not directed to assessing risks in relation to a future use of the land that would require a specific grant of planning permission.

The control of development and land use in the future is the responsibility of the planning system. A fundamental principle of sustainable development is that the condition of land, its use and its development should be protected from potential hazards. The National Planning Policy Framework (NPPF) states that '*to prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location*.'

Planning policies and decisions should also ensure that the site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation.

NPPF also states that after any required remediation, the land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990.

## 10.1 Introduction to Human Health Risk Assessment

A generic quantitative risk assessment (GQRA) has been undertaken using the geochemical results for the soil samples retained from the site investigation in 2006. The approach to human health risk assessment adopted in this report is consistent with the Environment Agency's Model Procedures (CLR11) and other relevant guidance (including SR3, BS10175:2001 and NPPF).

The laboratory soil data has been compared to relevant and applicable critical concentrations as outlined in the guidance. These criteria can be either Generic Assessment Criteria (GAC) or Site Specific Assessment Criteria (SSAC). For the purpose of this generic quantitative risk assessment, GAC will be used. The GACs been derived from

- LQM/CIEH 'Suitable 4 Use Levels' (S4ULs) where available, or
- DEFRA C4SL Health Criteria Values (March 2014),

The proposed development is to comprise residential housing and youth centre therefore a '***residential with plant uptake'*** end use has been assumed for the

assessment. Not that for the area of the youth centre the application of residential with plant uptake criteria is considered conservative.

The chemical testing from the BWB report only tested for fraction of organic carbon (FOC). There is no direct relationship between FOC and % total organic carbon (TOC) or Soil Organic Matter (SOM). Therefore, where the assessment criteria are reliant on Soil Organic Matter (SOM); assessment criteria derived for 1% SOM have conservatively been used.

Review of the retrieved chemical data indicates that seven samples of Made Ground and twelve of the underlying natural soils were subjected to chemical analysis.

Typically, collected data would be subject to statistical assessment to ensure a true representative assessment of the site is made and allow a comparison with the appropriate GAC. As part of the assessment data would be zoned, based on strata type / depth, with particular focus on near surface soils with which there is a greater risk of direct contact. Only seven samples of the near surface Made Ground were however analysed by BWB, this data set is insufficient for a robust statistical assessment. In light of this, the results have been compared directly against their respective GAC.

## 10.2 Soil Assessment

To ascertain a preliminary assessment of the contaminative nature of the near surface materials across the site, nineteen soil samples were retained during the 2006 BWB site investigation works and submitted for laboratory analysis. The samples were taken from the following strata.

- 3 Made Ground – subbase
- 2 Made Ground sandy gravel
- 1 Made Ground – gravelly clay
- 1 Made Ground – cobbles and boulders
- 3 Natural Clay
- 1 coal

- 8 mudstone

The chemical analysis was undertaken at Alcontrol Geochem Ltd laboratories. The results are included in BWB's report in Appendix C.

### 10.2.1 Asbestos

Ten selected soil samples (4 Made Ground, 4 Clay and 2 Mudstone) were screened for asbestos. No fibres were detected in any of the samples.

### 10.2.2 Metals, Metalloids and Inorganic compounds

The results of the chemical analysis for heavy metal concentrations within the soil samples are summarised in Table 12.

**Table 12 Summary of Heavy Metals**

| Determinant | GAC | Concentration Range | | No. samples tested | No. samples exceed GAC |
|---|---|---|---|---|---|
| | | Min | Max | | |
| Arsenic | 37 | <1 | 26 | 19 | 0 |
| Beryllium | 1.7 | <1 | 2 | 19 | 1 |
| Boron (w/s) | 290 | <1 | 4 | 19 | 0 |
| Cadmium | 11 | <1 | <1 | 19 | 0 |
| Chromium (total) | 910 | <1 | 23 | 19 | 0 |
| Copper | 2400 | <1 | 60 | 19 | 0 |
| Lead | 200* | <1 | 205 | 19 | 1 |
| Mercury | 11 | <1.2 | <1.2 | 19 | 0 |
| Nickel | 130 | <1 | 32 | 19 | 0 |
| Selenium | 250 | <3 | <3 | 19 | 0 |
| Vanadium | 410 | <1 | 37 | 19 | 0 |
| Zinc | 3700 | <1 | 216 | 19 | 0 |

Results in mg/kg unless stated otherwise
GACs are LQM GAC unless stated otherwise
*DEFRA C4SL

### 10.2.3 Polyaromatic Hydrocarbons

The results of the chemical analysis for Polyaromatic Hydrocarbons (PAH US-EPA16) are summarised in Table 13.

**Table 13 Summary of Polyaromatic Hydrocarbons**

| Determinant | GAC | Concentration Range | | No. samples tested | No. samples exceed GAC |
|---|---|---|---|---|---|
| | | Min | Max | | |
| Acenaphthene | 210 | <0.05 | 0.25 | 19 | 0 |
| Acenaphthylene | 170 | <0.05 | 0.21 | 19 | 0 |
| Anthracene | 2400 | <0.05 | 1.26 | 19 | 0 |
| Benz(a)anthracene | 7.2 | <0.05 | 3.11 | 19 | 0 |
| Benzo(a)pyrene | 2.2 | <0.05 | 2.58 | 19 | 1 |
| Benzo(b)fluoranthene | 2.6 | <0.05 | 2.47 | 19 | 0 |
| Benzo(ghi)perylene | 320 | <0.05 | 1.17 | 19 | 0 |
| Benzo(k)fluoranthene | 77 | <0.05 | 0.84 | 19 | 0 |
| Chrysene | 15 | <0.05 | 3.52 | 19 | 0 |
| Dibenz(a,h)anthracene | 0.24 | <0.05 | 0.30 | 19 | 1 |
| Fluoranthene | 280 | <0.05 | 7.14 | 19 | 0 |
| Fluorene | 170 | <0.05 | 0.57 | 19 | 0 |
| Indeno(1,2,3-cd)pyrene | 27 | <0.05 | 1.21 | 19 | 0 |
| Naphthalene | 2.3 | <0.05 | 0.91 | 19 | 0 |
| Phenanthrene | 95 | <0.05 | 5 | 19 | 0 |
| Pyrene | 620 | <0.05 | 5.35 | 19 | 0 |

Results in mg/kg unless stated otherwise
GACs are LQM S4UL for SOM of 1% unless stated otherwise

### 10.2.4 Petroleum Hydrocarbons and Phenols

Twelve soil samples were analysed for total petroleum hydrocarbons (TPH CGW) in an aromatic/aliphatic split and eight for BTEX (benzene, toluene, ethylbenze and xylene), the results of which are summarised in Table 14.

**Table 14 Summary of Petroleum Hydrocarbons**

| Determinant | GAC | Concentration Range | | No. samples tested | No. samples exceed GAC |
|---|---|---|---|---|---|
| | | Min | Max | | |
| EC>5-6 Aliphatic | 42 | <10 | <10 | 11 | 0 |
| EC>6-8 Aliphatic | 100 | <10 | <10 | 11 | 0 |
| EC>8-10 Aliphatic | 27 | <10 | <10 | 11 | 0 |
| EC>10-12 Aliphatic | 130 | <10 | <10 | 11 | 0 |
| EC>12-16 Aliphatic | 110 | <10 | 74.8 | 11 | 0 |
| EC>16-35 Aliphatic | 65,000 | <10 | 155.5 | 11 | 0 |
| EC>35-44 Aliphatic | 65,000 | <10 | <10 | 11 | 0 |
| EC>5-7 Aromatic | 70 | <10 | <10 | 11 | 0 |
| EC>7-8 Aromatic | 130 | <10 | <10 | 11 | 0 |

| Determinant | GAC | Concentration Range | | No. samples tested | No. samples exceed GAC |
|---|---|---|---|---|---|
| | | Min | Max | | |
| EC>8-10 Aromatic | 34 | <10 | <10 | 11 | 0 |
| EC>10-12 Aromatic | 74 | <10 | <10 | 11 | 0 |
| EC>12-16 Aromatic | 140 | <10 | 27.9 | 11 | 0 |
| EC>16-21 Aromatic | 260 | <10 | 80.3 | 11 | 0 |
| EC>21-35 Aromatic | 1,100 | <10 | 136.7 | 11 | 0 |
| Phenols | 280 | <0.01 | 0.01 | 19 | 0 |
| Benzene | 0.087 | <0.001 | <0.001 | 8 | 0 |
| Toluene | 130 | <0.001 | <0.001 | 8 | 0 |
| Ethyl benzene | 47 | <0.001 | <0.001 | 8 | 0 |
| m & p Xylene | 56 | <0.001 | <0.001 | 8 | 0 |
| o Xylene | 60 | <0.001 | <0.001 | 8 | 0 |

Results in mg/kg unless stated otherwise
GACs are LQM S4UL for SOM of 1% unless stated otherwise
*DEFRA C4SL

## 10.3 Human Health Summary

Slightly elevated concentrations of Beryllium, Lead, Dibenzo(a,h)anthracene and Benzo(a)pyrene were recorded in one of the samples tested. The sample was from TP11 at 0.8m bgl. In this location, Made Ground comprising of stiff dark grey sandy gravel clay was recorded. The gravel constituents comprised brick, sandstone, ash and slag.

These materials were only encountered in TP11 and TP12; however, no testing of the strata from TP12 was undertaken. Both of these trial pits were located in the former tarmacked car park to the north east of the site, in the area where deeper Made Ground as recorded.

The sample of Made Ground, where elevated determinants were recorded, included a proportion of ash and clinker, which we envisage is the source of the elevated compounds.

We understand that a residential end use is being considered, the presence of hardstanding and buildings over a proportion of the site will break the pathway between the source and the end user and therefore remove the potential risk in these areas. Therefore, with respect to human health no action will be required beneath areas of hardstanding. In areas of soft landscaping and gardens, further assessment and / or

remediation will be required. Once a fixed development plan has been agreed we would recommend that the data is re-assessed to consider the risks and remedial actions.

It is noted that the site is current covered principally by hardstanding and in the area of TP11 and TP12, the underlying Made Ground would not provide a suitable growing medium for garden areas and therefore topsoil/subsoil will need to be imported to site to form gardens / soft landscaped areas. A cover system over gardens / landscaped areas in the vicinity of TP11 and TP12 may therefore be a suitable remediation option.

Comparison of the exceedance with a Public Open Space near residential housing (POSresi) end use criteria, which HBS consider would be appropriate for the youth centre indicate that none of the determinants exceed the appropriate GAC.

**Table 15 Summary of Heavy Metals**

| Determinant | GAC (POS Resi) | Concentration Range | | No. samples tested | No. samples exceed GAC |
|---|---|---|---|---|---|
| | | Min | Max | | |
| Beryllium | 2.2 | <1 | 2 | 19 | 0 |
| Lead* | 630 | <1 | 205 | 19 | 0 |
| Benzo(a)pyrene | 5.7 | <0.05 | 2.58 | 19 | 0 |
| Dibenz(a,h)anthracene | 0.30 | <0.05 | 0.30 | 19 | 0 |

Results in mg/kg unless stated otherwise
GACs are LQM GAC unless stated otherwise
*DEFRA C4SL
GACs are LQM S4UL for SOM of 1% unless stated otherwise

## 10.4 Controlled Waters

A typical GQRA for controlled waters comprises:

- comparison of detected concentrations in soil leachate with GAC to assess the potential risk posed to the groundwater receptor. The GAC selected for groundwater are the UK Drinking Water Quality Standards (DWS); and
- comparison of detected concentrations in soil leachate with GAC to assess the potential risk posed to the surface water receptors. The GAC selected for surface water are the Environmental Quality Standards (EQS). Robson Liddle considers that one pathway to surface water receptors is migration within groundwater. Therefore, if the contaminant is below the GAC in groundwater, it

is unlikely to be above the GAC at the surface water receptor into which the groundwater may discharge, unless other factors are operating.

For groundwater, if no DWS are available, then EQS have been used as GAC. For surface water, if no EQS are available, then DWS have been used as GAC. World Health Organisation (WHO) guidelines have been used as GAC if neither DWS nor EQS are available.

### 10.4.1 Leachate Analysis

As the site is underlain by Made Ground, leachate testing of eight soil samples were scheduled for a suite of metals.

Comparison of the leachate chemical test data with the selected generic screening criteria was undertaken and no exceedances were recorded. All of the determinants were recorded in the eluate generated from the soil samples subjected to leachate testing were below the limit of detection and the appropriate GAC.

Leachate analysis has indicated that the in-situ soils are unlikely to act as a diffuse source of groundwater contamination.

### 10.4.2 Groundwater Analysis

One round of groundwater samples were taken sent for analysis suite of metals and PAH. None of the results recorded concentrations in the groundwater in excess of the UK DWS. Consequently, based on the information available the ground conditions present at the site are unlikely to pose a significant risk to controlled waters.

## 10.5 Water Pipelines

The current guidance on selection of materials for water supply pipes to be laid in contaminated land is contained in UKWIR Report 10/WM/03/02 (re-issued 2010) which sets out in Table 3.1 of that document threshold values for a selection of organic contaminants that may have a detrimental effect on pipes and fittings. However, the document is for guidance and is not mandatory and has not been adopted universally by all water suppliers.

In addition, various consultative technical bodies have expressed concern on the nature of the document and the methodologies proposed, which would result in significant cost and time implications for all site assessments.

The site is brownfield and there is a presumption in the guidance that barrier pipe will be required. The investigation and assessment has indicated localised elevated concentrations of PAH contaminants within the Made Ground which may have the potential to attack plastics and as such standard pipework may not be suitable for the site. In light of the conflicting and ambiguous guidance, confirmation should be sought from the water supply company at the earliest opportunity as to their specific requirements.

# 11 Ground Gas Assessment

### 11.1.1 Radon

The Radon Atlas of England and Wales indicates that the site is in an area where the estimated probability of homes being above the action level of 200Bqm$^{-3}$ is less than 1%. BRE211 therefore indicated that no radon protective measures are required in the construction of new buildings and extensions.

### 11.1.2 Landfill Gas

There are no current or historical recorded landfill sites within 250m of the site. The closest site lies greater than 315m north west of the site. The site is registered as Land off Old Mill lane and was active from 1984 to 1994. The waste type was inert and commercial.

On the basis of the underlying geology and the distance from the site, the landfill is not considered likely to present a risk to the site from gas or leachate migration. However, the site lies in an area where shallow coal seams are known to exist and where recorded shallow mine working may exist.

As part of the 2006 BWB intrusive ground investigation, gas / groundwater monitoring wells were installed in all five of the boreholes. Five rounds of monitoring were undertaken at the site over a two month period. The results of the gas monitoring are presented in Table 16.

Current UK best practice guidance suggests that the ground gas assessment and characterisation for a site is dealt with separately for different types of development:

- ‘Situation A’ covers all forms of development (residential and industrial/commercial developments), other than low rise residential development; and
- ‘Situation B’ is defined as the specific development of low-rise (one to three storeys in height) housing with beam and block floors, vented sub-floor void and gardens.

Based on our understanding of the likely redevelopment of the site, Situation A would be appropriate for the Youth centre and Situation B would be appropriate for the residential housing.

**Table 16 Gas Monitoring Results - Maximum recorded values**

| Visit No | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Pressure (mb) | 1006 | 1009 | 1024 | 1003 | 1003 |

| Max values recorded | | BH01 | | BH02 | | BH03 | | BH04 | | BH05 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max |
| Flow | (l/h) | -0.2 | 0.9 | -0.1 | -0.4 | -0.2 | -1.2 | -0.4 | -2.8 | -0.4 | -2.9 |
| Methane | (%) | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| LEL | (%) | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Carbon monoxide | (ppm) | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Carbon dioxide | (%) | <0.6 | 3.4 | <0.1 | <0.1 | <0.1 | 0.8 | 0.2 | 4.1 | 0.7 | 1.8 |
| Oxygen | (%) | 3.8 | 17.2 | 19.8 | 20.4 | 17.9 | 20.2 | 13.2 | 19.7 | 12.9 | 16.7 |
| Hydrogen Sulphide | (ppm) | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |

For both Situation A and Situation B a risk based “Gas Screening Value” (GSV) is calculated using the maximum gas concentration (%) x worst case borehole flow rate (l/h). Where zero values are recorded a conservative “less than minimum” detection value is adopted. For borehole flow rate this is < 0.1l/hr and for gas detection <0.1%.

*Situation A (youth centre)*

For Situation A this gives 0.041 x 2.9 = <0.1189 l/hr, which is above the 0.07 l/hr threshold for “CIRIA Characteristic Situation 1 - very low risk” but below the 0.7l/hr threshold for “CIRIA Characteristic Situation 2 - low risk. Therefore, it is considered that the low risk classification is applicable and gas protection measures are considered necessary.

*Situation B (low rise residential)*

For Situation B the NHBC have developed a characterisation system specific to low-rise housing development with a clear ventilated underfloor void. This is a risk-based approach that is designed to allow an identification of gas protection for a low-rise

housing development by comparing the measured gas emission rates to generic “traffic lights” scenarios. The calculations need to be carried out for both methane and carbon dioxide, and the worst case adopted in order to establish the appropriate protection measures.

For methane, a maximum concentration of <0.1% was recorded with a maximum flow rate of 2.9/hr, giving a methane GSV of <0.0029 l/hr. It is considered that “Green” situation would be appropriate.

For carbon dioxide, a maximum concentration of 4.1% was recorded with a maximum flow rate of 2.9l/hr, giving a carbon dioxide GSV of <0.1189 l/hr. The ‘Green’ classification suggests a maximum $CO^2$ concentration of 5.0%; all recorded concentrations are below this value. It is considered that “Green” situation would be appropriate.

### 11.1.3 Recommendations

*Situation A (youth centre)*

On the basis of the gas monitoring to date a “CIRIA Characteristic Situation 2 low risk” are likely to be appropriate for the Youth centre development.

CIRIA 665 (2007) suggests the following protection measures for buildings.

a) Reinforced concrete cast in situ floor slab (suspended, non-suspended or raft) with at least 1200g DPM.
b) Beam and block or pre cast concrete slab and minimum 2000g DPM / reinforced gas membrane.
c) Possibly underfloor venting or pressurisation in combination with a) and b) depending on use.

All joints and penetrations sealed.

*Situation B (low rise residential)*

On the basis of the gas monitoring to date the NHBC “Traffic Light System” of Green is likely to be appropriate for the residential development. A negligible gas regime has been identified and gas protection measures are not considered necessary.

# 12 Site Conceptual Model

Following the generic quantitative risk assessment, a summary of the receptors, sources and potential pollutant linkages identified for the site is presented in the following sections. This Site Conceptual Model is summarised in Table 17.

## 12.1 Receptors

It is understood that the majority of the site will be redeveloped with residential dwellings; a youth centre is also being proposed. The location of the youth centre is not known. Residents are assumed to occupy the site full time and residents and / or visitors may be expected to be exposed directly to soils within the site. Construction workers would be directly exposed to soils, however this would only be short term.

- Residents and visitors of / to the proposed development.
- Construction workers.
- Construction materials (including services).
- Groundwater – Secondary A classification – considered to be at low risk.
- Surface water – None within 250m.
- Flora and fauna.

## 12.2 Sources

### 12.2.1 Contaminants

Marginally elevated concentrations of Beryllium, Lead, Dibenzo(a,h)anthracene and Benzo(a)pyrene were recorded in one of the samples tested. The sample was from TP11 at 0.8m bgl. In this location, Made Ground comprising of stiff dark grey sandy gravel clay was recorded. The gravel constituents comprised brick, sandstone, ash and slag.

These materials were only encountered in TP11 and TP12; however, no testing of the strata from TP12 was undertaken. Both of these trial pits were located in the former tarmacked car park to the north east of the site, in the area where deeper Made Ground as recorded.

The sample of Made Ground, where elevated determinants were recorded, included a proportion of ash and clinker, which we envisage is the source of the elevated compounds.

### 12.2.2 Landfill gas

No risks from ground gas have been identified.

### 12.2.3 Radon

No radon protective measures are necessary in the construction of new developments or extensions.

## 12.3 Pathways

Generic possible pathways between potential sources and receptors are discussed as follows:

### 12.3.1 Receptor – Residents and Visitors

- Dermal contact with contaminated soil.
- Ingestion of contaminated soil.
- Indoor and outdoor inhalation of dust or vapours.
- Ingestion of produce or soil particles on produce grown on site.

### 12.3.2 Receptor – Construction Workers

- Dermal contact with contaminated soil or water.
- Ingestion of contaminated soil or water.
- Outdoor inhalation of dust or vapours.

### 12.3.3 Receptor – Buildings and services

- Sulphate attack on concretes.
- Hydrocarbon attack on plastics which can result in tainting of potable water carried in supply pipes.

### 12.3.4 Receptor – Groundwater

- Infiltration and leaching of contaminants in soil into groundwater.

- Migration of contaminated water via drainage system.
- Migration of polluted groundwater to drinking water abstraction.

### 12.3.5 Receptor – Surface Water

- Run off of contaminants into surface water.
- Migration of contaminated water via drainage system.

### 12.3.6 Receptor – Flora and Fauna

- Uptake via root system.
- Displacement of oxygen from root systems.
- Harm to ecosystems from contaminated surface water.

Following the generic quantitative risk assessment, a summary of the potential pollutant linkages identified for the site is presented in the Site Conceptual Model in Table 17.

**Table 17 Site Conceptual Model**

| Potential Source and Pollutant | Receptor | Pathway | Potential Pollutant Linkage? | Probability of exposure, consequence and magnitude of risk. |
|---|---|---|---|---|
| Beryllium, Lead, Dibenzo(a,h)anthracene and Benzo(a)pyrene in TP11 and TP12 (NE of site) | Human Health (Residential Development) – future users of the site e.g. residents and visitors. | Direct contact - Dermal contact, soil ingestion and dust inhalation. | Possible – localised source identified in TP11 and TP12. | Probability: Possible<br>Consequence: Medium<br>Magnitude: **Medium Risk** |
| | | Indirect Contact - Vapour inhalation. | Unlikely – no volatile sources identified. | Probability: Unlikely<br>Consequence: Medium<br>Magnitude: **Low Risk** |
| | | Hydrocarbon tainting of potable water supply pipes. | Unlikely – no significant sources identified. | Probability: Unlikely<br>Consequence: Medium<br>Magnitude: **Low Risk** |
| | Human Health (Youth centre Development) – future users of the site e.g. staff and visitors.<br>. | Direct contact - Dermal contact, soil ingestion and dust inhalation. | Unlikely – for POSresi no exceedance recorded. | Probability: Unlikely<br>Consequence: Medium<br>Magnitude: **Low Risk** |
| | | Indirect Contact - Vapour inhalation. | Unlikely – no volatile sources identified. | Probability: Unlikely<br>Consequence: Medium<br>Magnitude: **Low Risk** |
| | | Hydrocarbon tainting of potable water supply pipes. | Unlikely – no significant sources identified. | Probability: Unlikely<br>Consequence: Medium<br>Magnitude: **Low Risk** |
| | Human Health – Construction workers | Direct contact - Dermal contact, soil ingestion and dust inhalation. | Possible – localised source identified in TP11 and TP12. Envisaged that risks can be managed through use of appropriate working practises | Probability: Possible<br>Consequence: Medium<br>Magnitude: **Medium Risk** |

| Potential Source and Pollutant | Receptor | Pathway | Potential Pollutant Linkage? | Probability of exposure, consequence and magnitude of risk. |
|---|---|---|---|---|
| | | Indirect Contact - Vapour inhalation. | Unlikely – no volatile sources identified. | Probability: Unlikely<br>Consequence: Medium<br>Magnitude: **Low Risk** |
| | Controlled Waters – groundwater (Secondary A Aquifer) | Leaching and percolation. | Unlikely – no sources identified. Leachate and groundwater testing indicated potential for determinants to become mobile was negligible. | Probability: Unlikely<br>Consequence: Low<br>Magnitude: **Low Risk** |
| | Controlled Waters – No surface water lies within 250m of the site. | Groundwater migration & run-off to surface waters carrying entrained sediment or diffuse contamination | Unlikely – no sources identified and no surface water lies within 250m of the site. | Probability: Unlikely<br>Consequence: Low<br>Magnitude: **Low Risk** |
| | Buried structures – Aggressive ground conditions | Direct contact and/or leaching (sulphate, pH). | Unlikely – underlying geology not expected to be aggressive. | Probability: Unlikely<br>Consequence: Medium<br>Magnitude: **Low Risk** |
| | Ecology - existing trees and landscaping on site. | Plant uptake. | Unlikely – no significant sources identified. | Probability: Unlikely<br>Consequence: Low<br>Magnitude: **Low Risk** |
| Ground gases. | Human Health (Residential development) – future users of the site e.g. residents and visitors. | Permeation through ground and intrusion into buildings and structures. | Unlikely – no sources identified. | Probability: Unlikely<br>Consequence: High<br>Magnitude: **Low Risk** |
| | Human Health (Youth centre Development) – future users of the site e.g. staff and visitors. | Permeation through ground and intrusion into buildings and structures. | Possible – gas monitoring confirmed CIRCIA situation 2 basic gas protection measures required. | Probability: Possible<br>Consequence: High<br>Magnitude: **Low Risk** |

| Potential Source and Pollutant | Receptor | Pathway | Potential Pollutant Linkage? | Probability of exposure, consequence and magnitude of risk. |
|---|---|---|---|---|
| | Flora | Displacement of oxygen from root systems | Unlikely – no sources identified. | Probability: Unlikely<br>Consequence: Low<br>Magnitude: **Low Risk** |
| Radon. | Human Health – future users of the site e.g. residents and visitors. | Permeation through ground floor. | Unlikely – no protection measures required. | Probability: Unlikely<br>Consequence: Medium<br>Magnitude: **Low Risk** |

# 13 Remedial Requirements

Marginally elevated concentrations of Beryllium, Lead, Dibenzo(a,h)anthracene and Benzo(a)pyrene were recorded in one of the samples tested. The sample was from TP11 at 0.8m bgl. In this location, Made Ground comprising of stiff dark grey sandy gravel clay was recorded. The gravel constituents comprised brick, sandstone, ash and slag.

These materials were only encountered in TP11 and TP12; however, no testing of the strata from TP12 was undertaken. Both of these trial pits were located in the former tarmacked car park to the north east of the site, in the area where deeper Made Ground as recorded.

The sample of Made Ground, where elevated determinants were recorded, included a proportion of ash and clinker, which we envisage is the source of the elevated compounds.

We understand that a residential end use is being considered, the presence of hardstanding and buildings over a proportion of the site will break the pathway between the source and the end user and therefore remove the potential risk in these areas. Therefore, with respect to human health no action will be required beneath areas of hardstanding. In areas of soft landscaping and gardens, further assessment and / or remediation will be required. If the area of TP11 / TP12 is developed for a youth centre (POSrei end use) then risk would be lower and no remediation would be required.

Once a fixed development plan has been agreed we would recommend that the data is re-assessed to consider the risks and remedial actions. As part of the assessment we suggest that additional investigation is undertaken and additional samples are gathered for chemical analysis. This additional data would allow a statistical assessment of the data to be undertaken. This may demonstrate that the materials do not pose an unacceptable risk.

It is noted that the site is current covered principally by hardstanding and in the area of TP11 and TP12, the underlying Made Ground would not provide a suitable growing medium for garden areas and therefore topsoil/subsoil will need to be imported to site

to form gardens / soft landscaped areas. A cover system over gardens / landscaped areas in the vicinity of TP11 and TP12 may therefore be a suitable remediation option if remedial action is required.

A preferred remedial strategy for the site will have to be developed in consultation with the design team and the regulatory authorities. Liaison should be continued during implementation and subsequent verification.

The methodology for the remediation should be detailed in a Remediation Method Statement which will need to be submitted to the NHBC and the regulatory authorities for approval.

In addition, the writing and approval of a Materials Management Plan may be required to allow re-use of suitable material at the site (see Section 13.1).

Following completion of the above works verification reports, undertaken by a suitably qualified independent engineer will be required.

## 13.1 Material Reuse

Based on the GQRA carried the majority of the soils present would be suitable for reuse. Only the cohesive Made Ground strata containing ash and clinker which may pose a potential risk to human receptors and would not be chemically suitable for re-use in areas where there is a risk of direct contact. The materials are however chemically suitable for use in areas where it can be demonstrated risk of dermal contact is negligible.

The re-use of on-site soils may be undertaken either under the Environmental Permitting Regulations 2007 (EPR), in which case soils other than uncontaminated soils are classed as waste, or under the CL:AIRE Voluntary Code of Practice (CoP) Version 2 which was published in March 2011 and is now widely accepted as an alternative regime to the EPR.

Under the EPR, material that is contaminated but otherwise suitable for re-use is also classified as waste and its re-use should be in accordance with the Environmental Permitting Regulations 2007 (EPR).

Under the CL:AIRE Voluntary Code of Practice (CoP) materials excavated on-site are not deemed contaminated if suitable for re-use at specified locations or generally within the site. Material that may have been classified as hazardous waste under the EPR may be re-used. The CoP regime requires that a 'Qualified Person' as defined under the CoP reviews the development of the Materials Management Plan, including review of Risk Assessments and Remediation Strategy/Design Statement together with documentation relating to Planning and Regulatory issues, and signs a Declaration which is forwarded to the Environment Agency and which confirms compliance with the CoP.

# 14 Recommendations for Further Work

The following further works are recommended:

- Specialist asbestos survey of the stockpile of demolition materials to confirm if ACM is present.
- Further investigation beneath the former building footprint to validate the ground conditions present.
- Supplemental investigation around TP11 and TP12 to collate chemical data to allow a detailed quantitative risk assessment to be completed. We would recommend that these works.
- Supplemental investigation in north eastern corner of the site to investigate the extent of the deeper Made Ground reported present.
- Full scale soakaway testing to BRE365 standards in the location of proposed soakaways, if proposed.
- It would be prudent to drill an additional three holes within the eastern edge of the site to confirm that shallow coal in this location is intact.
- Discussions with service providers regarding the materials suitable for pipework etc.
- Discussions with regulatory bodies regarding the conclusions of this report.
- Foundation depth due to trees assessment.
- Detailed design of foundations.
- Remediation of the site.
- Verification of the remedial works.

In addition to the above HBS recommend that it would be prudent to as part of the due diligence process commission a structural inspection of the retaining wall against to the Schwabisch Gmund Way.

# 15 Limitations and Uncertainties

## 15.1 General

This report has been prepared by Hamson Barron Smith with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the Client.

The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true representative data with respect to site conditions. The information reported herein is based on the interpretation of data collected during the site investigations by others, pertaining specifically to the soil samples retained from the identified locations. Should additional information become available that may influence the opinions expressed in this report, Hamson Barron Smith reserves the right to review such information and, if warranted, to alter the opinions accordingly.

The evaluation and conclusions do not preclude the existence of other site conditions and contamination, which could not reasonably have been revealed by the site investigation works undertaken at the time of writing. This report should be used for information purposes only and should not be construed as a comprehensive characterisation of all site conditions or potential contaminants.

It must be noted that the locations of the exploratory holes are, by requirement, usually free from buried services and structures, and therefore are more likely to encounter natural strata at a shallower depth than areas underlain by services and structures.

This report has been prepared solely for the use of the client, and may not be relied upon by other parties without written consent from Hamson Barron Smith.

Hamson Barron Smith disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

## 15.2 Site Specific

BWB did not undertake investigation beneath buildings, which have subsequently been demolished. There may be deeper areas of Made Ground and buried structures

associated with these buildings.  It would be prudent to confirm ground conditions to validate design assumptions,

# 16 General Notes

This report will be prepared for the exclusive use of the client named in the document and copyright will subsist with Hamson Barron Smith Limited. Prior written permission must be obtained to reproduce all or part of the report. It will be prepared on the understanding that you will disclose its contents to parties directly involved in the current investigation, preparation and development of the site. Further copies may be obtained with the client's written permission from Hamson Barron Smith Limited with whom a master copy of the document will be retained.

The report and /or opinion will be prepared for the specific purpose stated in the document and in relation to the nature and extent of proposals made available to us at the time of your enquiry. The recommendations should not be used for other schemes on or adjacent to the site without further reference to Hamson Barron Smith Limited. The assessment of the factual data will be provided to assist the client and his Engineer and/or advisors in the preparation of their designs.

The report will be based on the ground conditions encountered in the exploratory holes together with the results of field and laboratory testing in the context of the proposed development. There may be special conditions, appertaining to the site, however, which may not be revealed by the investigation, and which may not be taken into account in the report.

Methods of construction and/or design other than those proposed by the designers or referred to in the report may require consideration during the evolution of the proposals and further assessment of the geotechnical data would be required to provide discussion and recommendation appropriate to these methods.

The accuracy of the results reported will depend upon the technique of measurement, investigation and test used and these values should not be regarded necessarily as characteristic of the strata as a whole. Where such measurements are critical, the technique of the investigation will need to be reviewed and supplementary investigation undertaken in accordance with the advice of the company where necessary.

Whilst the report may express an opinion on possible configurations of strata between or beyond exploratory holes, or on possible presence of a feature based on either visual, verbal, written, cartographical, photographic or published evidence, this will be for guidance only and no liability can be accepted for its accuracy.

Ground conditions should be monitored during the construction of the works and the recommendations of the report re-evaluated in the light of these data by the supervising geotechnical engineers.

Any comments on groundwater conditions will be based on observations made at the time of the investigation, unless specifically stated otherwise. It should be noted, however, that the observations are subject to the method and speed of the boring, drilling or excavation and that groundwater levels will vary due to seasonal or other effects.

Unless specifically stated, the investigation will not take into account of possible effects of mineral extraction.

The economic viability of the proposals referred to in the report, or of the solutions put forward to any problems encountered, will depend on very many factors in addition to geotechnical considerations hence its evaluation will be outside the scope of the report.

# Appendix A

# Site Plan




| | |
|---|---|
| Project: | Schwabisch Gmund Way |
| Client: | Barnsley Council |
| Title: | Location Plan |
| Drawing: | 23-24-19-1-6002 |
| Date: | 01 Jul 2018 |

Notes:

Hole Locations Approximate.

Key

| | |
|---|---|
| 1 | Barnsley markets |
| 2 | The Glassworks |
| 3 | Barnsley Station and Interchange |
| 4 | Barnsley Digital Media Centre |
| 5 | Gala Bingo |
| 6 | Queens Road Academy |
| 7 | Parkway Cinema |
| 8 | The Civic |

Hamson Barron Smith

# Appendix B

# BWB Phase I Report

# ENVIRONMENTAL

RWE npower

Phase I Environmental Risk Assessment
Barnsley Interchange

BWB Consulting
Whitehall Waterfront
2 riverside Way
Leeds
LS1 4EH

Ref: LDS126/Final

Date: May 2006

| | | |
|---|---|---|
| AUTHOR: | S. Steel BSc | |
| CHECKED: | R. Sutton<br>BSc.(Hons), MSc. FGS | |
| APPROVED: | Eur Ing A D Dickinson BScTech (Hons); CEng; MEI; MIGEM; MRICS; SiLC | |
| REPORT REF NO: | LDS126/01/v1 | |
| STATUS: | Final | |

## CONTENTS PAGE

**1.0 INTRODUCTION 1**

*1.1 Instruction 1*

*1.2 Objectives 1*

*1.3 Limitations 1*

*1.4 Guidance 1*

*1.5 Judicial Precedents and Legislation 2*

*1.6 Technical Competence 2*

*1.7 Scope of Work 3*

**2.0 AVAILABLE INFORMATION 5**

**3.0 THE SITE 6**

*3.1 Site Location 6*

*3.2 Site Description 6*

*3.3 Site Reconnaissance Visit 7*

*3.3.1 General Site Description: 7*

*3.3.2 The Oil Tank 8*

*3.3.3 The lean too shelter 8*

*3.3.4 The "L" Shaped Terrace Of Garage Sized Storage Buildings 8*

*3.3.5 The Central Building 9*

*3.4 Proposed Redevelopment 9*

**4.0 SITE HISTORY 10**

*4.1 OS Plans 10*

*4.2 Aerial Photographs 12*

*4.3 Previous Investigation Reports 12*

*4.3.1 Ground Investigation for a Site at Harborough Hill Road Barnsley, South Yorkshire: Soil Mechanics, May 2001. 12*

*4.3.2 Harborough Hill Road, Barnsley, Mining Report: Wardell Armstrong, June 2001. 13*

*4.3.3 Environmental Assessment Yorkshire Electricity Depot, Harborough Hill, Barnsley; Waterman Environmental, July 2001. 13*

*4.3.4 DRAFT Summary of The Site Investigation Reports And Assessment Of Abnormal Geotechnical And Contamination Issues At Harborough Hill Road, Barnsley; Waterman BBT Consulting Engineers, August 2001. 13*

**5.0 REGULATORY REVIEW 14**

*5.1 Envirocheck® report No. 14081101-1-1 14*

*5.2 Local Authority Contaminated Land Team 14*

*5.3 Local Planning Authority 15*

**6.0 GROUND CONDITIONS 16**

*6.1 Geology 16*

*6.2 Hydrogeology 16*

*6.3 Hydrology 16*

*6.4 Ground Gas 17*

*6.5 Mining 17*

**7.0 PHASE I ENVIRONMENTAL RISK ASSESSMENT 18**

*7.1 Pollutant Sources 18*

*7.2 Pathways 20*

*7.3 Receptors 20*

*7.4 Preliminary Conceptual Site Model 21*

*7.5 Hazard Assessment 21*

*7.6 Risk Evaluation 21*

*7.7 Risk to Human Health 22*

*7.7.1 Contamination in the Soils 22*

*7.7.2 Contamination in the Surface and Groundwater 22*

*7.8 Risk to Controlled Waters 22*

*7.8.1 Contamination in the Soils 22*

*7.8.2 Contamination in the Surface and Ground Water 22*

*7.9 Risk to Buildings and Services 23*

*7.9.1 Contamination in the Soils 23*

*7.9.2 Contamination in the Surface and Ground Water 23*

*7.10 Risk Categorisation 23*

**8.0 CONCLUSIONS AND RECOMMENDATIONS 24**

## CONTENTS PAGE

### TABLES

Table 1 Key Points of Site Development History
Table 2 Key Points of Regulatory Review
Table 3 Pollutant Linkages associated with the site
Table 4 Risk Evaluation Matrix
Table 5 DoE Risk Categorisations

### FIGURES

Figure 1 Site Location Plan (included in main text)
Figure 2 Current Site Layout
Figure 3 Proposed Post Development Site Layout
Figure 4 Aerial Photograph

### APPENDICES

Appendix 1 Site Photographs
Appendix 2 Historical Maps
Appendix 3 Envirocheck® report No. 14081101-1-1
Appendix 4 Regulatory Responses
Appendix 5 Coal Authority Report

# 1.0 INTRODUCTION

## 1.1 Instruction

**BWB Consulting (BWB) was instructed by RWE npower (the Client) to carry out a Phase I Environmental Risk Assessment in relation to potential redevelopment of the site at Harborough Hill Road, Barnsley.**

## 1.2 Objectives

**The purpose of the review is to assess the environmental risks and liabilities associated with the site. The environmental assessment considers any likely contamination of soil and/or groundwater on the site in order to produce a preliminary Conceptual Site Model (CSM) of the site and an interpretative qualitative environmental risk assessment.**

**This report will also advise on any additional work that may be required.**

## 1.3 Limitations

**This report is limited to the data collected from proprietary sources, the contacted Statutory Authorities and observations made during the site walkover. All of the comments and opinions contained in this report, including any conclusions, are based on the information obtained by BWB during our investigations. The conclusions drawn by BWB could therefore differ if the information obtained is found to be misrepresentative, inaccurate, or misleading.**

**Except as otherwise requested by the Client, BWB is not obliged and disclaims any obligation to update the report for events taking place after:**

**a) the date on which this assessment was undertaken; and**
**b) the date on which the final report is delivered**

**BWB makes no representation whatsoever concerning the legal significance of its findings or to other legal matters referred to in the following report.**

## 1.4 Guidance

**BWB Consulting Ltd is a registered Engineering Practice and is regulated by the Institute of Civil Engineers.**

**This report has been prepared in accordance with:**

- **CLR11 – Model Procedures**
- **Contamination and Environmental Matters - Their implications for Property Professionals (2nd Edition RICS Nov 2003)**

- **Brownfields – Managing the development of previously developed land – A client's guide, CIRIA 2002**
- **DEFRA and Environment Agency publications CLR7 – 10, supported by the TOX guides and SGV guides, dated March 2002**
- **DETR Circular 02/2000, Contaminated Land: Implementation of Part IIA of the Environmental Protection Act 1990**
- **Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part IIA of the EPA1990, May 2002**

**And any other protocols advised by DEFRA and the EA and guidance's prepared by BSI, CERTA, BURA, and other industry advisory bodies including BS5930 and BS10175.**

## 1.5 Judicial Precedents and Legislation

**The following non-exhaustive list of legislative framework documents has been considered in the compilation of this document.**

- **The Environment Act (1995)**
- **The Environment Protection Act (1990)**
- **The Water Resources Act (1991)**
- **The Radioactive Substances Act (1993)**
- **The Pollution Prevention and Control (England and Wales) Regulations (2000)**
- **The Contaminated Land (England) Act (2000)**
- **The Environment Act 1995 (Commencement No.16 and Saving Provision) (England) Order (2000)**
- **The Contaminated Land (England) (Amendment) Regulations (2001)**
- **The Landfill Regulations (England and Wales) Regulations (2002)**
- **The Landfill (England and Wales) (Amendment) Regulations (2004)**
- **Rylands v Fletcher - Private Nuisance, Escape**
- **Health and Safety at Work Act**
- **The Building Regulations 1991, Part C of Schedule 1**
- **The controlled Waste Regulations 1992**
- **Special Waste Regulations 1996.**

**Neither the list of guidance documents nor the list of judicial precedents and legislation should be considered exclusive or comprehensive. There are approximately 85 individual items of legislation regulating contaminated land work. BWB makes every effort to ensure that all are adhered to in the preparation and presentation of this report.**

## 1.6 Technical Competence

**BWB is a leading specialist multi-disciplinary engineering practice working in the contaminated land market. Most of the workload undertaken by BWB is within the commercial property development market dealing with brownfield re-**

**development and associated environmental and geotechnical issues.**

**Established in 1990, BWB is at the forefront of environmental asset management providing expertise in Environmental Risk Assessments, Environmental Site Investigations, Geotechnical Site Investigations and Remediation Strategies.**

**BWB's staff come from a wide variety of backgrounds within the geotechnical and environmental sectors and are all degree qualified. Specialists include Geotechnical Engineers, Geologists, Environmental Engineers, IEMA Auditors, Chartered Environmental Surveyors, Chartered Engineers; up to SiLC (Specialist in Land Condition) accreditation.**

**BWB's technical protocols are described in our reports and are strictly adhered to by quality control checks in the field and in the laboratory. BWB only uses UKAS and MCERTS accredited laboratories for all methods used to derive determinant concentrations.**

**BWB operates a quality assurance process under ISO9001:2000 which facilitates rigorous in-house administrative and technical protocols and is assessed externally every 6 months. BWB also initiates a robust health and safety program for each site and are an Investor in People ensuring the regular training of staff in new guidance's and techniques.**

## 1.7 Scope of Work

**It is proposed to undertake a Phase I Environmental Risk Assessment of the site, which will:**

- **Provide background information on past and present uses of the site in the context of its environmental setting;**
- **Determine the nature and potential hazards and physical constraints of the site;**
- **Provide background information on the geology, hydrogeology and hydrology of the site;**
- **Identify receptors (targets), potential sources of contamination and plausible pathways and features of immediate concern;**
- **Make informed decisions about the need for specialist assessment e.g. intrusive investigations, ecological and archaeological; and**
- **Provide information relevant to worker health and safety and protection of the environment during on-site investigations;**

**And comprise of the following elements of work:**

- **A review of existing data;**
- **A site walkover survey undertaken by a qualified geo-environmental engineer;**
- **An interpretative review of historical uses of the site;**

- **An interpretative review of regulatory information;**
- **Interpretation of the environmental setting of the site (geology, hydrology, hydrogeology, etc);**
- **Enquiries of the Local Planning Authority (LPA);**
- **Enquiries of the local Contaminated Land Officer (CLO);**
- **If applicable, enquiries of the local Petroleum Officer (PO);**
- **A qualitative environmental risk based assessment;**
- **Recommendation and subsequent scope of any further intrusive investigation, and**
- **Identify the need to involve statutory or other regulatory bodies during any subsequent exploratory investigation.**

**The results of the Phase I Environmental Risk Assessment will be used to develop a preliminary Conceptual Site Model (CSM) of the nature and extent of any contamination at the site.**

## 2.0 AVAILABLE INFORMATION

**The following sources of available information have been reviewed as part of this desk study:**

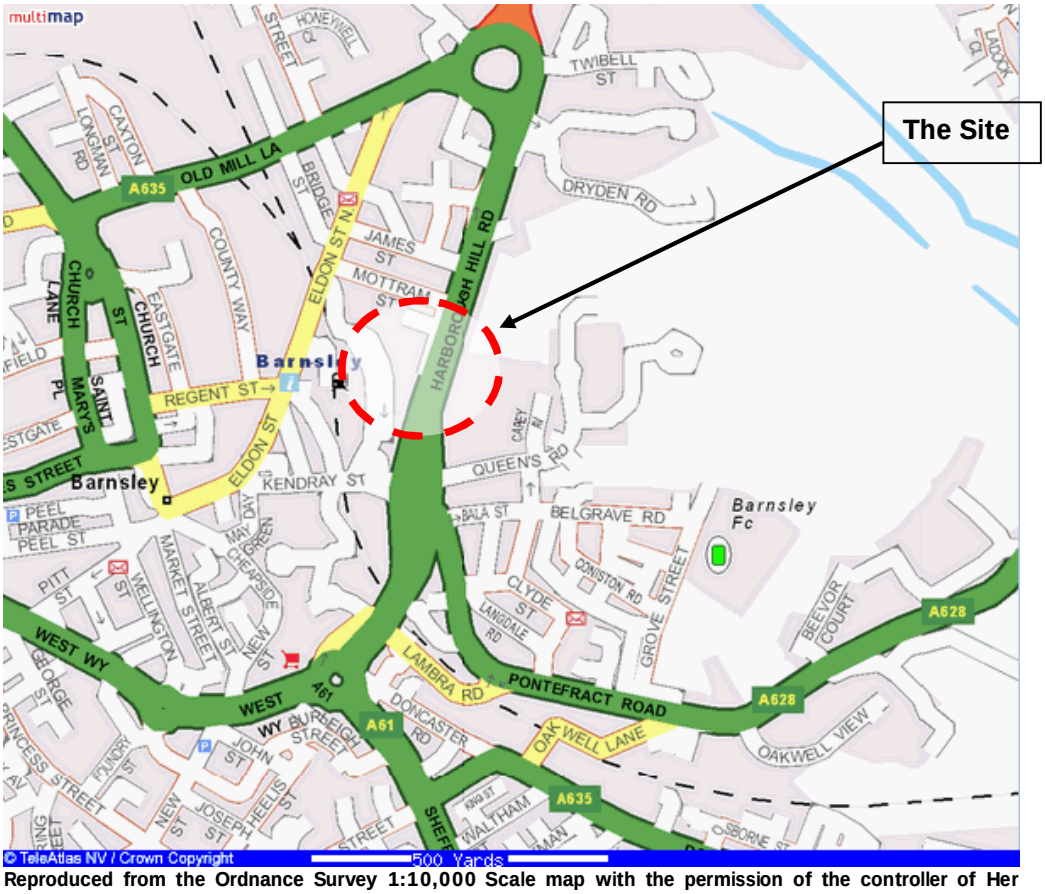
- **Project Report 101009, "Ground Investigation for a Site at Harborough Hill Road Barnsley, South Yorkshire", prepared for Bett Brothers Limited by Soil Mechanics, May 2001.**
- **Project Report Sd01-0058-Rep, "Harborough Hill Road, Barnsley, Mining Report", prepared for Waterman BBT by Wardell Armstrong, June 2001.**
- **Project Report R/EN1906.PS.1.2.1, "Environmental Assessment Yorkshire Electricity Depot, Harborough Hill, Barnsley", prepared for Bett Properties by Waterman Environmental, July 2001.**
- **Project Report ANP/SEF/9211, "DRAFT Summary of The Site Investigation Reports And Assessment Of Abnormal Geotechnical And Contamination Issues At Harborough Hill Road, Barnsley", prepared for Bett Properties by Waterman BBT Consulting Engineers, August 2001.**
- **Envirocheck© Report,19651921-1-1 , "Report on Harborough Hill Road, Barnsley May 2006**
- **1:50,000 scale solid and drift geological map, Sheet 86, published by the Geological Survey of England and Wales, edition.**
- **1:10,000 scale solid and drift geological map, sheet SK37 SE, published by the British Geological Survey, dated 1997.**

## 3.0 THE SITE

### 3.1 Site Location

**The site is located at national grid reference (NGR) 434810, 406640, between Barnsley Bus Station to the west and Harborough Hill Road to the east, on the outskirts of Barnsley Town Centre, as shown in Figure 1 below.**

**Figure 1: Site Location Plan**




Reproduced from the Ordnance Survey 1:10,000 Scale map with the permission of the controller of Her Majesty's Stationery Office crown copyright reserved. OS Licence number 100013665

**The site covers an area of approximately 2.25 Hectares varies in ground level by between 3 and 4 meters (m), (sloping to the north) centred on approximately 100m Above Ordnance Datum (AOD).**

### 3.2 Site Description

**The site is located between Barnsley Bus Station to the west and Harborough Hill Road, a duel carriage to the east. Mottram Street forms the northern boundary of the site with some of its houses numbers 17 - 61 backing onto the site.**

**At the southern boundary of the site are an electricity sub-station and a club. Access to the site is off of the northern bound carriage way of Harborough Hill Road. The site is elevated approximately 4.0m higher than the bus station to its west and slopes gently southwards.**

**The current site layout is provided as Figure 2.**

### 3.3 Site Reconnaissance Visit

**A site walkover was carried out by BWB on Friday 5th May 2006.**

#### 3.3.1 General Site Description:

**The site is shaped as an approximate triangle with one side due north running parallel with a footpath behind the houses of Mottram Street. The Eastern face of the site runs parallel with Harborough Hill Road. The South of the site is bounded by an electricity sub-station, with associated heavy cabling. From the North West corner of the site running half way down the western side of the site the soil has recently been engineered into a sharp ground slope of approximately 45 degrees. This is some eight metres at its highest point. This slope runs from the current site boundary fence down into a newly constructed road way and bus depot that run along the west of the site.**

**Access to the site is from two metal gates situated in the north east corner. These gates connect the site to Harborough Hill Road via a small tarmac car park. The area between Harborough Hill Road up to and including the site is formerly of light industrial and domestic usage.**

**The site surface is predominantly hard standing concrete with some asphalt covering evident to the North. It is surrounded by wire or palisade fencing of 2.5m in height that has required covering with shutter board at the Northwest corner. This fence is intact but for one 3m wide section half way down the western side adjacent to the new bus depot. Within the site boundary above the new slope joining the bus depot, a series of small exploratory holes have been broken into the concrete.**

**These holes suggest that the concrete is reinforces and of circa 30mm in thickness. This area of the site also has had two new manholes fitted adjacent to the site boundary. These manholes may suggest an, as yet, unrecorded drainage pathway on or near the site.**

**Structures on the site include a flower bed that runs along the northern parameter fence that is 3m to 4m in width and contains soft planted herbaceous layer plants and some trees. A large single story building of some 35m square and 10m in height in located centrally within the site. Numerous manholes are dispersed across the site and on a former perimeter road that encircle the central building. A small road island is situated between this building and the flower bed. This island bears some soft plants and shrubs in an ash based soil. The**

**island has situated on it some palisade fencing in a 3m square that houses some old furniture. A lean too shelter exists against the western perimeter fence at or near the same height as the central building.**

**There is an "L" shaped terrace of garage sized storage buildings that delineate the south western corner of the site in front of the sub station. Some small brick built sheds house works associated with the sub-station at the most southern point of the site. North of this and east of the terrace of storage buildings is a bunded tank complex comprising one elevated 4m long barrel shaped tank with associated pipe work. A 1m high bund surrounds this and an adjacent plant room. The site is approximately level but has a slope that runs from the lean too shelter down to the top north west corner at an angle approximately 20%.**

**The site is generally thinly dispersed with domestic rubbish and contains several neat piles of building materials. Just inside the main entrance to the left as one passes through the north east gates are two pallets of new house bricks and looking forward towards the central building a pile of broken glass has been delineated by road cones. Progressing south from these a set of some 10 new concrete drainage pipes of 750mm diameter and 2.50m in length have been put against the wall of the central building. Progressing south still a little further a complete derelict street lamp has been abandoned against the inside of the perimeter fence and towards the farthest extreme of the eastern side a pallet has been left loaded with some 20 or 30 new 100mm PVC pipes of 4m length and associated 200mm soil ducting.**

### 3.3.2 The Oil Tank

**Despite being above ground the tank has no evidence of former covering. It is gray in colour with several visible rust patches. The bund is only of one brick in thickness i.e. (20mm). The integrity of the surrounding bund is not stable with full height cracks on all of its sides. No visible evidence of oil exists, however mildew covered patches possible conceals former precipitate. The adjacent plant room houses rubbish and broken pipes that can be seen to connect to the tank.**

### 3.3.3 The lean too shelter

**This is constructed of metal and concrete and covers a row of three large square manholes suggesting that possibly this was used as an area for servicing vehicles or a machine sump.**

### 3.3.4 The "L" Shaped Terrace Of Garage Sized Storage Buildings

**These are generally in a poor state of repair with cracks in the concrete construction evident. Broken wiring and light fittings cover the surface features and general rubbish and shelving are dispersed throughout. Signage indicates**

**that these were used to store oils and propane gas.**

### 3.3.5 The Central Building

**The central building is approximately 35m square and has an elevated floor of approximately 1.0 to 1.50m above ground level it is brick built with a metal roof that extends half way down the southern wall. The roof is further extended upwards by two building long sky lights of glass and fibreglass. These are commonly broken and the inside of the building while predominantly empty is covered with broken glass, fibreglass and numerous lengths of metal caballing. A small partitioned area exists to the western side of this building that is built from breeze blocks this houses some derelict office furniture and filing cabinets. There is no machinery present but for one redundant photocopier. The building appears to have suffered fire damage. Adjacent to the entrance on the eastern is an area of what appears to be solidified bitumen tar. There are three former points of entry on the northern side and these all have signage that state the building contains asbestos. This exterior wall also has one head high window of some half meter depth with fitted fans and a security grill. The building has a loading bay on its western side.**

**Photographs taken during the site walkover are presented in Appendix 1.**

## 3.4 Proposed Redevelopment

**The proposed redevelopment site layout is provided on Figure 3.**

**This development profile has been used in the human health assessment for this site.**

## 4.0 SITE HISTORY

### 4.1 OS Plans

**All readily available historical Ordnance Survey (OS) mapping for the site area have been obtained and reviewed. The key points of the site development history and the potential environmental impact to soil and groundwater at the site are summarised in Table 1. Copies of historical maps are presented in Appendix 2.**

**Table 1: Key Points of Site Development History**

| Dates | Scale | Detail | |
|---|---|---|---|
| | | *On Site:* | *Surrounding Area:* |
| 1855 | 1:10,560 | The site is occupied open fields and plantations with several small buildings including Harborough cottage. | The site is located on the eastern outskirts of Barnsley town. Barnsley RAILWAY STATION with sidings lies at the western boundary of the site. To the north, east and south are open fields, small buildings and plantations. Harborough Hill Road marks the eastern boundary of the site. |
| 1892 – 1893 | 1:2,500 | The site is occupied by Harborough Hill House with gardens and plantations. | RAILWAY LINES lie along the eastern boundary of the site. An ENGINE SHED is found 40m away. Approximately 100m to the south east are a RAILWAY FOUNDARY AND TIMBER YARD. Located to the south is Harborough House with gardens. Fields occupy the north and east. |
| 1906 | 1:2,500 | There are no significant variations from the previous edition. | There are no significant variations from the previous edition. Apart form the development of houses 35m to the north. |
| 1931 | 1:2,500 | The site is occupied by allotment gardens. An existing small building to the south east of the site is named a club, gardens surround it. | Mottram Street and houses have been developed and mark the northern boundary of the site. Harborough House to the south is marked "club". The RAILWAY FOUNDARY is not marked on the map instead there is an EXCHANGE STATION AND TRAVEL CRANE. Approximately 170m to the east of the site is BORO COLLIERY |

| Dates | Scale | Detail | |
|---|---|---|---|
| | | *On Site:* | *Surrounding Area:* |
| 1955 – 1956 | 1:10,560 | There are no significant variations from the previous edition. | There are no significant variations identified at this scale from the previous edition. Apart form the development of houses on the east side of Harborough Hill Road and the demolition of THE EXCHANGE STATION AND TIMBER YARD. |
| 1961 | 1:1,250 | The site is occupied by open ground a number of small unidentified buildings are found along the northern edge and north west corner of the site. | A BUS STATION occupies the grounds of the former foundry and timber yard to the south east of the site. |
| 1968 to 1972 | 1:1,250 | The site is occupied by the ELECTRICITY BOARD DEPOT. | A bowling club has been developed 30m south of the site. A COAL AND COKE YARD is located approximately 60m to the south west of the site boundary. |
| 1987 | 1:1,250 | There are no significant variations from the previous edition. | Harborough Hill Road has become a duel carriage way. |
| 1991 | 1:1,250 | Several small buildings appear in the south west corner of the site | A BUS STATION is found adjacent to the western boundary of the site. |
| 2004 | 1:10,000 | There are no significant variations from the previous edition. | There are no significant variations from the previous edition. |

**Historical ordnance survey plans show the site remained relatively undeveloped until the late 1960's to early 1970's. The site use up to this period was residential with open gardens and plantations. This was replaced with an electricity board depot the buildings of which still remain today.**

**The surrounding area to the west has been developed since the mid nineteenth century. The land immediately adjacent to the site has been railway land up to about1987 with associated heavy industries existing into the mid twentieth century. Industrial works known to have existed were a foundry and a timber yard. The north, east and south of the site have seen development as a mixed residential and commercial area since the early part of the 1900's. A small colliery "Boro Colliery" existed from the1930's until the 1960's located approximately 150m east of the site. Today the surrounding area is of mixed residential and commercial properties with a bus and railway station's located adjacent to the western boundary of the site.**

## 4.2 Aerial Photographs

**An aerial photograph has been reviewed and is provided as Figure 4.**

**This shows the site in its present layout.**

## 4.3 Previous Investigation Reports

**Previous site investigations undertaken at the site in question of Harborough Hill Road are:**

- **Project Report 101009, "Ground Investigation for a Site at Harborough Hill Road Barnsley, South Yorkshire", prepared for Bett Brothers Limited by Soil Mechanics, May 2001.**
- **Project Report Sd01-0058-Rep, "Harborough Hill Road, Barnsley, Mining Report", prepared for Waterman BBT by Wardell Armstrong, June 2001.**
- **Project Report R/EN1906.PS.1.2.1, "Environmental Assessment Yorkshire Electricity Depot, Harborough Hill, Barnsley", prepared for Bett Properties by Waterman Environmental, July 2001.**
- **Project Report ANP/SEF/9211, "DRAFT Summary of The Site Investigation Reports And Assessment Of Abnormal Geotechnical And Contamination Issues At Harborough Hill Road, Barnsley", prepared for Bett Properties by Waterman BBT Consulting Engineers, August 2001.**

**These have been reviewed in the chronological order in which they are dated.**

**Copies of these reports are not included within this document.**

### 4.3.1 Ground Investigation for a Site at Harborough Hill Road Barnsley, South Yorkshire: Soil Mechanics, May 2001.

**This report was undertaken primarily for geotechnical purposes.**

**In summary this investigation comprised five cable tool boreholes, six deep rotary boreholes by open hole methods, three window sampling holes and nine trial pits. Gas monitoring standpipes were installed in all rotary boreholes.**

**Laboratory geotechnical and chemical testing was undertaken on soil samples obtained during this investigation. This included classification testing, quick undrained triaxial compression testing, compaction tests, and pH and soil sulphate contents. A brief initial soil contaminant screening was undertaken and included inorganic and organic chemical contaminant testing and ground gas analysis. These results were not reviewed as part of this report.**

**This investigation recorded typically < 1.0m of made ground overlying weathered coal measure mudstones with subordinate sandstones, siltstones and coal seams.**

**The made ground comprised sandy gravel sub base material of limestone and sandstone.**

**Deep drilling within the coal measures recorded up to 7 coal seams present beneath the site. They were encountered at depths of between just below the made ground to 60m and ranged in thickness from 0.1 to 1.3m.**

**No evidence of deep or shallow coal mining was recorded during this investigation.**

**Exploratory holes recorded some perched groundwater as seepage over the lower coal measures. Piezometric water levels within the coal measures were recorded between 5.75m and 15.7m bgl.**

**Contamination results were not reviewed as part of this report.**

### 4.3.2 Harborough Hill Road, Barnsley, Mining Report: Wardell Armstrong, June 2001.

**This report covers the potential mining impacts on this site.**

**It indicates the outcropping of two Coal seams beneath the site. The Top Beamshaw and Winter seams and highlights the potential for unrecorded shallow mine workings particularly within the winter seam in the east part of the site.**

### 4.3.3 Environmental Assessment Yorkshire Electricity Depot, Harborough Hill, Barnsley; Waterman Environmental, July 2001.

**The protocols utilised in this assessment are now either redundant (Kellys) or withdrawn (ICRCL). Reference is made to an earlier desk study, but a copy has not been provided. This report falls short of current best practice, but best practice approaches have moved on significantly since this report was written in 2001.**

### 4.3.4 DRAFT Summary of The Site Investigation Reports And Assessment Of Abnormal Geotechnical And Contamination Issues At Harborough Hill Road, Barnsley; Waterman BBT Consulting Engineers, August 2001.

**This report attempts to summarise the preceding documents and offer a dialogue on the impacts these may have on the development of the site. Due to the age of the other reports, this in turn, has no real providence itself.**

## 5.0 REGULATORY REVIEW

### 5.1 Envirocheck® report No. 14081101-1-1

**The factors that could influence the environmental status of a site are described in Table 2 below. A full listing of these factors including discharge consents, pollution incidences and other environmental information is presented in Appendix 3.**

**Table 2: Key Points of Regulatory Review**

| Feature | Nº and distance from site boundary | Closest to site* | Comments |
|---|---|---|---|
| Discharge Consents | There are 5 within 250m of the site | 184m south of the site | Not considered relevant to the site. |
| Water Abstractions | One between 251 and 500m of the site | 391m North East of the site | Not considered relevant to the site. |
| Pollution incident to controlled waters. | There is 1 incident within 250m of the site. | 196m South East of the site. Pollutant oils-Diesel into a fresh water stream. Recorded as a category 3 minor incident | Not considered relevant to the site. |
| Substantiated Pollution Incident Register | One incident between 501 and 1000m of the site | 885m North of the site | Not considered relevant to the site. |
| Registered Fuel Stations | There are 2 within 251 to 500m of the site | 453m north of the site | Not considered relevant to the site. |
| Waste Management Facilities | One recorded on site | | The site was registered as a waste transfer station between 1992 to 1999 |
| Registered Landfill sites | two recorded between 251 and 500m | 316m North West of the site | Not considered relevant to the site. |

***All directions and distances pertain to the site boundary and are approximate.**

**The regulatory review indicates that the land uses immediately surrounding the site present a negligible risk with respect to potential environmental impacts to the site and its environment.**

### 5.2 Local Authority Contaminated Land Team

**A request has been made to Sheffield City Council to review information held by the Environmental Protection Service. Available information relating to the following matters were requested:**

- **Known contamination on the site or the surrounding area.**
- **Council remediation strategies for the site.**
- **Previous contamination investigations, as part of planning applications.**
- **Complaints to the Contaminated Land Team with regards to the site.**
- **Recorded landfill sites on or within the immediate surrounding area.**
- **Process Authorisations or permits, with regards to industrial operations on or within 500 metres of the site?**
- **Consents in force to discharge effluent from the site or the surrounding area.**
- **Pollution incidents on the site or within the immediate surrounding area.**

**At the time of writing, the report has not been received.**

## 5.3 Local Planning Authority

**A request has been made to Sheffield City Council in regards to the following information held by the planning department:**

- **Details of any current planning applications.**
- **Details of any historic planning consents, whether granted or refused.**
- **Details of any restrictions on development of the site or immediate surrounding area.**

**At the time of writing, the report has not been received.**

# 6.0 GROUND CONDITIONS

## 6.1 Geology

**Given the known history of the site it is not anticipated that significant thicknesses of Made Ground will be present on site.**

**The BGS 1:50,000 solid and drift sheet 86 Barnsley, indicates there are no superficial deposits underlying the site and that the solid geology is of Carboniferous Lower Westphalian coal measures.**

**The Envirocheck® report indicates that the solid geology underlying the site is Lower Westphalian productive coal measures.**

**The Envirocheck® report records that there are likely to be moderate hazards from Compressible Ground, no potential Ground Dissolution and low hazards from shrinking/Swelling clays and running sand ground stability.**

## 6.2 Hydrogeology

**The underlying Lower Coal Measures are identified as a Minor Aquifer. These are not generally used for significant abstraction but can be important for local supply and in providing base flow to rivers.**

**No groundwater abstraction points are present within 500m of the site. The site does not lie within a source protection zone.**

**Soils underlying the site are ascribed a high leaching potential with a worst case vulnerability classification (U) until proven otherwise, this rated is given due to the urban nature of the site and the lack of data obtainable from these urban areas.**

**Previous investigative works encountered perched groundwater as seepage over the lower coal measures rockhead. Subsequent groundwater monitoring within the coal measures recorded piezometric levels of between 76.0m AOD and 86.0m AOD.**

## 6.3 Hydrology

**The nearest water course is the River Don, located some 800m north east of the site. The site does not lie within the floodplain of the River Don. Environment Agency flood risk maps indicate that the chance of flooding is less than 0.1%.**

**This is not considered to represent a receptor for any potential on site contamination due to the distance involved.**

## 6.4 Ground Gas

**The NRPB-W26 'Radon Atlas of England and Wales' 2002 edition indicates that less than 1% of homes in the area around the site have recorded radon levels above the recommended action level.**

**BRE211 'Radon: guidance on protective measures for new dwellings' 1999 edition indicates basic radon protection may be required. A geological assessment should be carried out and consideration given to installing basic measures if the assessment shows that they are necessary.**

## 6.5 Mining

**The Envirocheck® report records that the site lies within a zone affected by coal mining. The risk from shallow mining is considered low to moderate.**

**A previous Wardell Armstrong report was undertaken specifically relating to mining issues and this Environmental Risk Assessment defers to that report.**

**A Coal Authority Report has been commissioned by BWB, a copy of which is attached as Appendix 6.**

**The report indicates that the site is not within the zone of influence of past mine workings, however coal is believed to exist under the site, at or close to the surface that may have been worked historically.**

**The site does not lie within the zone of influence of present underground or surface mine working. No licence to extract coal exists for this area, although the reserves of coal present beneath the site could be worked in the future, subject to feasibility, licenses and planning.**

**There are no known shafts or adits within the site or within 20m of the site boundary.**

**No records of faults or other lines of weakness that may affect the stability of the property are kept by the Coal Authority.**

**The Coal Authority holds no records of any damage notice or claim having been made in respects of the property since 1984.**

## 7.0 PHASE I ENVIRONMENTAL RISK ASSESSMENT

**The risk posed by any contaminants in soil or groundwater will depend on the nature of the hazard, the probability of exposure, the pathway by which exposure occurs, and the likely effects on the receptors. A contaminant is defined in the Contaminated Land Exposure Assessment model (CLEA) as a substance that has the potential to cause harm, while a risk is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.**

**The following sections discuss all the identified potential sources, pathways and receptors in the context of the site and plausible pollutant linkages which may represent a risk to human health and/or controlled waters from the data gained from the desk study. At this stage the assessment is qualitative and aimed to determine all pollutant linkages, irrespective of significance or allowing for uncertainty.**

**Three impact potentials exist for any given site, these are:**

- **The site impacting upon itself;**
- **The site impacting on its surroundings, and;**
- **The surroundings impacting on the site.**

**All three impacts need to be considered in a risk assessment.**

### 7.1 Pollutant Sources

**The DoE produced a Consultation Paper in dated May 1991: entitled 'Public Registers of Land which may be Contaminated'. This document provided a schedule of contaminative uses.**

**From this list the following contaminative uses are associated with the site.**

**Sub Station**

**C.3e) Electricity and sub-station.**

**Fuel Tanks**

**C.14c) Dismantling, repairing or maintenance of road transport and road haulage; Garages and filling stations.**

**Demolition**

**C.16c) Demolition of buildings, plant or equipment used for any of the activities included in the schedule.**

**From this list the following contaminative uses are associated with the surrounding area.**

**Colliery & Coal Yard**

**C.2a) Extracting, handling and storage of carbonaceous materials such as coal, lignite, petroleum, natural gas, or bituminous shale (not including the underground workings).**

**Timber Yard**

**C.11a) Chemical treatment and coating of timber and timber products.**

**Railway Land**

**C.14a) Marshalling, dismantling, repairing or maintenance of railway rolling stock.**

**Railway Foundry**

**C.8a) Manufacture of metal goods, including mechanical engineering industrial plant or steelworks, motor vehicles, ships, railway or tramway vehicles, aircraft, aerospace equipment or similar equipment.**

**Bus Depot**

**C.14c) Dismantling, repairing or maintenance of road transport and road haulage; Garages and filling stations.**

**The main sources of contaminants at the site relevant to any assignable pollutant linkages are likely to be associated with demolition of small industries that have previously occupied the site and the adjacent area.**

**In 2002, as part of the CLEA programme, DEFRA produced a series of Contaminated Land Reports (CLRs). CLR8 entitled 'Potential Contaminants for the Assessment of Land' lists the likely contaminants that can be expected from a variety of contaminative industries. The then DoE also produced a series of Industry Profiles. Where such a profile exists, consideration has been given to these documents.**

**This list is not exhaustive, nor is it definitive, that is to say, listed contaminants only have a potential to be present, their presence is not assured, nor does this list exclude other contaminants from being present.**

**From this list the following contaminants have a potential to be encountered:**

**Metals, (Cadmium, Chromium, Copper, Zinc, Mercury, Nickel, Vanadium) semi-metals and non-metals, (Arsenic, and Boron) and inorganic chemicals (free Cyanide, Nitrate, Sulphate and Sulphide). Asbestos may also be associated with the demolition material.**

**Important organic chemicals that may be associated with a previous industrial land use include Phenol, Oil/fuel hydrocarbons, aromatic hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), chlorinated aromatic hydrocarbons (CAH) and polychlorinated biphenyls (PCB's).**

**Any intrusive testing programme should include these contaminants as a minimum requirement.**

## 7.2 Pathways

**Potential pathways by which human and environmental receptors may be impacted upon are identified as follows:**

- **Ingestion**
- **Skin contact**
- **Inhalation**

**These pathways arise through direct contact with contaminated soils, contact with contaminated groundwater or inhalation of airborne dusts, fibres or gases.**

## 7.3 Receptors

**The potential human receptors at the site are:**

- **Current occupiers of the site**
- **Future occupants of the site**
- **Neighbouring residents**
- **Construction workers**
- **Services personnel working in trenches**

**Construction materials may be affected by contaminants. These receptors are:**

- **Plastic water pipes, which may be attacked by organic compounds such as PAH and TPH.**
- **Buried concrete, which may be affected by high levels of sulphate and/or low pH in site soils or groundwater.**

**Potential water receptors include:**

- **Groundwater underlying the site designated a Minor Aquifer.**

**An assessment of these pollutant linkages has been made and is presented in Section 7.4 below.**

## 7.4 Preliminary Conceptual Site Model

**The preliminary CSM is formulated on the basis of potential sources of contamination identified on site, potential receptors that may be the recipient of contamination arising from those sources and any pathways that may exist, thus creating a source-pathway-receptor (target) pollutant linkage.**

**The following pollutant linkages have been identified as being attributed to this CSM and are presented in Table 3 below:**

**Table 3: Pollutant Linkages Associated With The Site**

| | Source | Pathway | Receptor |
|---|---|---|---|
| 1 | Contaminants contained within the made ground. | Vertical migration through site soils | Underlying Minor Aquifer |
| 2 | Contaminants contained within the made ground. | Direct contact | Existing site users |
| 3 | Contaminants contained within the made ground. | Direct contact | Ground workers |
| 4 | Contaminants contained within the made ground. | Surface run off | On and off site drainage system |
| 5 | Contaminants contained within the made ground. | Lateral migration through site soils | Existing buildings on site |

**No significance or uncertainty is attributed to any pollutant linkage identified.**

## 7.5 Hazard Assessment

**The Hazard Assessment has identified the potential presence of contaminants associated with made ground as the most significant hazard associated with the environmental setting of the site, in respect to the potential for direct contact by site users, contamination of the site soils and the contamination of the underlying Aquifer.**

**Additionally asbestos present on site also represent a hazard but of a less significant nature.**

## 7.6 Risk Evaluation

**A simple matrix can provide a consistent basis for decision-making. It should of course be used with caution, recognising the over-simplification that it will normally represent. The probability and consequences are defined according to parameters relevant to the situation; the boundaries of risk acceptability (and tolerability, where relevant) indicated on the matrix provide in Table 4 can be tailored to the factors influencing the significance of the risk. Individual**

**situations are mapped onto the matrix to provide a ready and consistent indication of their acceptability or tolerability.**

**Table 4: Risk Evaluation Matrix**

| | CONSEQUENCES | | | |
|---|---|---|---|---|
| **PROBABILITY** | **Severe** | **Medium** | **Mild** | **Negligible** |
| **High** | **Very High** | **Very High/High** | **Moderate/Low** | **Negligible** |
| **Medium** | **Very High/High** | **Moderate** | **Moderate/Low** | **Negligible** |
| **Slight** | **High/Moderate** | **Moderate/Low** | **Low** | **Negligible** |
| **Negligible** | **High/Moderate** | **Low** | **Low** | **Negligible** |

**These attributes are evaluated qualitatively against individual hazard assessments to determine the likelihood of a given hazard occurring.**

**The following evaluations have therefore been made:**

## 7.7 Risk to Human Health

### 7.7.1 Contamination in the Soils

**Due to the historical use of the site, they have been attributed a MEDIUM probability with MEDIUM consequences resulting in a MODERATE risk.**

### 7.7.2 Contamination in the Surface and Groundwater

**Due to the historical use of the site, they have been attributed a MEDIUM probability with MEDIUM consequences resulting in a MODERATE risk.**

## 7.8 Risk to Controlled Waters

### 7.8.1 Contamination in the Soils

**Due to the historical use of the site, they have been attributed a MEDUIM probability with MEDIUM consequences resulting in a MODERATE risk.**

### 7.8.2 Contamination in the Surface and Ground Water

**Due to the historical use of the site, they have been attributed a MEDUIM probability with MEDIUM consequences resulting in a MODERATE risk.**

## 7.9 Risk to Buildings and Services

### 7.9.1 Contamination in the Soils

**Due to the historical use of the site, they have been attributed a MEDIUM probability with MEDIUM consequences resulting in a MODERATE risk.**

### 7.9.2 Contamination in the Surface and Ground Water

**Due to the historical use of the site, they have been attributed a MEDIUM probability with MILD consequences resulting in a LOW to MODERATE risk.**

## 7.10 Risk Categorisation

**The pollutant linkages assessment combined with the historical use of the site indicates that in its present state the site represents a MODERATE human health risk, a MODERATE risk controlled waters risk and a LOW to MODERATE risk to site structures.**

**During redevelopment the risk to human health will rise to HIGH to MODERATE due to demolition activities associated with earthworks and construction activities over the site.**

**Post development, all risks should be reduced to no greater than LOW.**

**These ratings are set against the following categories provided in Table 5 as defined by, the then, Department of the Environment in CLR2 and subsequently amended.**

**Table 5: DoE Risk Categorisations**

| RATING | DEFINITION |
|---|---|
| Very High Risk | This is a *high probability* that *severe harm* could arise to a designated receptor from an identified hazard at the site without appropriate remedial action. |
| High Risk | *Harm* is likely to arise to a designated receptor from an identified hazard at the site without appropriate remedial action. |
| Moderate Risk | It is possible that without appropriate remedial action *harm* could arise to a designated receptor. It is relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely that such harm would be relatively mild. |
| Low Risk | It is possible that *harm* could arise to a designated receptor from an identified hazard. It is likely that, at worst, if any harm was realised any effect would be mild. |
| Negligible Risk | The presence of an identified hazard does not give rise to the potential to cause *harm* to a designated receptor. |
| No Potential Risk | There is no potential risk if no pollution linkage has been established. |

## 8.0 CONCLUSIONS AND RECOMMENDATIONS

**Although a MODERATE risk rating has been attributed to the site in its present state, it would be prudent to investigate further for specific contaminants and areas of contamination present prior to disturbing the made ground during re-development. A localised small scale intrusive investigation targeted at these potential sources would clarify these matters.**

**Ground/construction workers may be subjected to an elevated risk during ground preparation works. The appropriate use of personal protective equipment (PPE), such as boots and gloves; normal health and safety protocols, such as not eating on site, washing hands, etc; will reduce this risk to acceptable levels.**

**Consideration should be given to the use of appropriate materials should buried services traverse through the area if deleterious contaminants are be identified.**

**Asbestos may be present on site within the made ground and as a result of the demolition of existing buildings. A specialist contractor should assess the risk posed by this potential contaminant source. All recommendations made in the independent asbestos report should be adhered to.**

**It is unlikely that this site would be designated as contaminated land as defined in Part IIA of the EPA and should therefore not appear on any register of contaminated sites.**

**This report should be submitted to the local statutory authorities as part of the planning application.**

**Prior to any redevelopment the site should be investigated further.**

# FIGURES

# FIGURE 2

# CURRENT SITE LAYOUT

# FIGURE 3

# PROPOSED DEVELOPMENT PLAN

# FIGURE 4

# AERIAL PHOTOGRAPH

# APPENDICES

# APPENDIX 1

# SITE PHOTOGRAPHS

# APPENDIX 2

# HISTORICAL MAPS

# APPENDIX 3

# ENVIROCHECK REPORT

# APPENDIX 4

# REGULATOR RESPONSES

# APPENDIX 5

# COAL AUTHORITY REPORT

# Appendix C

# BWB Phase II Report

# ENVIRONMENTAL

Kennet Properties
Harborough Hill Road,
Barnsley Interchange.

Phase II Geo-Environmental Risk Assessment.

BWB Consulting Limited
Prospect House
32 Sovereign St
Leeds
LS1 4BJ

Ref: LDS126/02/v1

Date: September 2006

| | | |
|---|---|---|
| AUTHOR: | C Evans MSc BSc (Hons) FGS | |
| CHECKED: | M Boyer MSc BSc (Hons) FGS | |
| APPROVED: | Eur Ing Andrew Dickinson BScTech (Hons) CEng MIGEM MEI MRICS SiLC | |
| REPORT REF NO: | LDS126/02/v1 | |
| STATUS: | FINAL | |

## EXECUTIVE SUMMARY

| | |
|---|---|
| **Current Site Status** | The site is located approximately at grid reference (NGR) 434810 406640 between Barnsley Bus Station to the west and Harborough Hill Road to the East. The site is on the outskirts of Barnsley town centre and is currently occupied by a large derelict depot comprising one central building approximately 35m by 35m, concrete and asphalt surfaces and several small structures including storage rooms and one above ground storage tank. |
| **Information Sources** | A Phase I "Environmental Risk Assessment" desk study report has been compiled by BWB and is reported in the document, Ref. LDS126/01/V1, dated May 2006. |
| **Soil Profile** | Shallow thicknesses of made ground have been recorded by all exploratory holes overlying either reworked or weathered lower coal measure bedrock directly at depths of between 0.30m and 3.2m.<br><br>The site is known to be located within an area that may have been affected by past mining activities. Two coal seams are known to out-crop beneath the site. It is anticipated that the rock beneath the site will dip approximately towards the southeast.<br><br>Typically between Ground level and 0.30m to 3.2m made ground has been recorded over the site. These soils typically comprise loose fill material overlying stiff clay soils that derive from the reworked natural coal measure mudstone below. |
| **Hydrogeology** | The site comprises a minor aquifer (Variable permeability) These can be fractured or potentially fractured rocks, which do not have a high primary permeability, or other formations of variable permeability including unconsolidated deposits. Although not producing large quantities of water for abstraction, they are important for local supplies and in supplying base flow to rivers.<br><br>The site soils are classified as 'U', Soils of High Leaching Potential. These have little or no resistance to migration of contaminants through the soil matrix. |
| **Hydrology** | The nearest surface water feature is located approximately 160m north of the site boundary.<br><br>The site lies approximately 0.5Km South of the River Dearne and former Barnsley Canal an open and culverted watercourse passing through the centre of Barnsley, in a northwest to southeast direction.<br><br>The site is not deemed susceptible to flooding. |
| **Key Historical Uses** | The site has undergone gradual development from small buildings that were first documented in 1855. A club house and allotments have been developed by 1931 and the first evidence of a depot complex (The Electricity Board Depot) exists from 1968. |
| **Review of Third Party Reports** | This report supersedes information obtained by an earlier Phase I Environmental Risk Assessment (ERA) undertaken by BWB in May 2006. |

| | |
|---|---|
| **Review of Third Party Reports** | Three further reports have been reviewed in relation to an earlier 2001 geo-environmental site investigation at the site as part of this study.<br><br>The providence and protocols used within these earlier reports are believed to be outdated. |
| **Geotechnical issues** | Structures, car parking areas and access roads are currently proposed over parts of the site that are underlain by the zone of potential instability associated with shallow coal mining and will require appropriate remedial measures prior to construction.<br><br>Several options with relation to construction over these particular areas are given these option include; Grouting and Ground Improvement, piled foundations/slab, cellular raft foundations beneath smaller retail units, Incorporation of a high strength geo-textile/grid beneath pavement areas.<br><br>Cut and fill earthworks are proposed in order to accommodate the proposed development formation levels. It has been identified that there is a potential to re-use materials won from these earthworks albeit requiring further modification. |
| **Contamination Issues** | None of the contaminants tested exceeded the relevant screening criteria and therefore presents no risk to human health. Leachate testing indicates that the analysed contaminants are not leachable.<br><br>On the basis of three gas monitoring events, it is concluded that due to the inconsistent profile of CO2 concentration from the boreholes, it is recommended to carryout further gas monitoring of at least 4 rounds to identify the need of any gas protection measures required at the site.<br><br>Slightly elevated levels of PAH have been recorded in localised samples of groundwater and this is analysed to be due to the presents of shallow coal seams that extend below part of the site and are potentially rich in PAH type compounds.<br><br>The processes of natural attenuating, dilution and dispersion will limit PAH contamination of adjacent water courses which are between 500m and 1000m north and east of the site. |
| **Environmental Risk** | As a result of the investigation the site has been given an overall risk rating of NEGLIGIBLE, although this could be reduced further through dQRA work.<br><br>It is considered that the site does not require any remediation prior to the proposed development as the commercial end use.<br><br>No contamination issues have been identified at the site, therefore, no environmental liabilities towards contamination exists. |

This summary should be read in conjunction with BWB's report (ref.LDS126/02/v1) and reflects an assessment of the Site based on information received by BWB at the time of production. The contents and format have been produced to meet the client's needs at the time of production and should not be regarded as a full assessment of Site conditions associated with detailed development proposals. All comments should be regarded as provisional, subject to confirmation by intrusive investigation works.

## CONTENTS PAGE


| | | |
|---|---|---|
| **1.0** | **INTRODUCTION** | **2** |
| 1.1 | Instruction | 2 |
| 1.2 | Objectives | 2 |
| 1.3 | Limitations | 2 |
| 1.4 | Guidance | 3 |
| 1.5 | Judicial Precedents and Legislation | 3 |
| 1.6 | Technical Competence | 4 |
| 1.7 | Scope of Work | 4 |
| **2.0** | **THE SITE** | **6** |
| 2.1 | Site Location | 6 |
| 2.2 | Site Description | 6 |
| 2.3 | Site Reconnaissance Visit | 7 |
| 2.4 | Proposed Redevelopment | 9 |
| **3.0** | **AVAILABLE INFORMATION** | **10** |
| 3.1 | Historical Ordnance Survey Plans | 10 |
| 3.2 | Previous Reports | 10 |
| 3.3 | Regulatory Review | 12 |
| 3.4 | Published Geology | 13 |
| 3.5 | Hydrogeology | 13 |
| 3.6 | Hydrology | 14 |
| 3.7 | Ground Gas | 14 |
| 3.8 | Mining | 14 |
| **4.0** | **PHASE I ENVIRONMENTAL RISK ASSESSMENT** | **16** |
| 4.1 | Pollutant Sources | 16 |
| 4.2 | Pathways | 18 |
| 4.3 | Receptors | 18 |
| 4.4 | Preliminary Conceptual Site Model (CSM) | 19 |
| 4.5 | Hazard Identified by Phase I ERA | 19 |
| 4.6 | Preliminary Risk Evaluation | 20 |
| 4.7 | Risk to Human Health | 20 |
| 4.8 | Risk to Controlled Waters | 20 |
| 4.9 | Risk to Buildings and Services | 21 |
| 4.10 | Risk Categorisation | 21 |

## CONTENTS PAGE


| | | |
|---|---|---|
| **5.0** | **PHASE II GEO-ENVIRONMENTAL SITE INVESTIGATION** | **23** |
| 5.1 | General | 23 |
| 5.2 | Trial Pits | 24 |
| 5.3 | Shell And Auger Boreholes with Rotary Core Drilling Follow on. | 24 |
| 5.4 | Sampling Strategy | 25 |
| 5.5 | Chemical Analysis | 25 |
| 5.6 | Soil Classification Testing | 26 |
| 5.7 | Gas and Groundwater Monitoring | 26 |
| **6.0** | **GROUND CONDITIONS** | **27** |
| 6.1 | General | 27 |
| 6.2 | Pavement Layers | 28 |
| 6.3 | Made Ground | 28 |
| 6.4 | Completely Weathered Mudstone | 29 |
| 6.5 | Weathered Middle Coal Measure Bedrock | 31 |
| 6.6 | Groundwater | 33 |
| 6.7 | Obstructions | 33 |
| 6.8 | Visual and Olfactory Evidence of Contamination | 33 |
| **7.0** | **GENERIC QUANTITATIVE RISK ASSESSMENT** | **34** |
| 7.1 | CLEA Soil Guideline Values | 34 |
| 7.2 | Results of Soil Analysis | 34 |
| 7.3 | Leachate Analysis | 36 |
| 7.4 | Groundwater | 36 |
| 7.5 | Chemical Analysis: Groundwater | 37 |
| 7.6 | Ground Gas | 37 |
| 7.7 | Refined Pollutant Linkages | 39 |
| 7.8 | Revised Conceptual Site Model (CSM) | 40 |
| 7.9 | Outline Remediation Statement | 41 |
| 7.10 | ENVIRONMENTAL LIABILITY ASSESSMENT | 41 |
| **8.0** | **GEOTECHNICAL ASSESSMENT** | **42** |
| 8.1 | Limitations | 42 |
| 8.2 | Mining | 42 |
| 8.3 | Foundations to Structures | 46 |
| 8.4 | Earthworks | 47 |
| 8.5 | Pavements | 48 |
| 8.7 | Excavations | 49 |
| 8.8 | Retaining Structures | 49 |

## CONTENTS PAGE

**9.0 CONCLUSIONS AND RECOMMENDATIONS 52**
9.1 Environmental Issues 52
9.2 Geotechnical Issues 53
9.3 Further Work 54

## CONTENTS PAGE

### TABLES

Table 1 Pollutant linkages Associated with the Site
Table 2 Risk Evaluation Matrix
Table 3 DoE Risk Categorisations
Table 4 Summary of Ground Conditions Recorded By site Investigations to Date.
Table 5 Summary Geotechnical soils Testing – MADE GROUND
Table 6 Summary Geotechnical Soils Testing –WEATHERED MUDSTONE
Table 7 Characteristic Situations and Gas Protection
Table 8 Gas Protection Measures Applicable to each Characteristic Situation
Table 9 Retaining Wall design Parameters

### FIGURES

Figure 1 Site Location Plan (included in main text)
Figure 2 Site Layout and Exploratory Hole Location
Figure 3 Proposed Development Plan (architects drawing)
Figure 4 Proposed cut and Fill Earthworks (preliminary)
Figure 5 Diagrammatic cross section of the underlying strata (included in main test)
Figure 6 Areas of Potential Undermining

### APPENDICES

Appendix 1 Site Photos
Appendix 2 Trial Pit Logs
Appendix 3 Borehole Logs
Appendix 4 Chemical Testing Results
Appendix 5 Soil Classification Testing Results
Appendix 6 Gas and Groundwater Monitoring Sheets

# 1.0 INTRODUCTION

## 1.1 Instruction

BWB Consulting (BWB) was instructed by Kennet Properties (the 'Client') to carry out a Phase II Geo-Environmental Risk Assessment following an earlier Phase I environmental Risk Assessment (ERA) dated May 2006.

## 1.2 Objectives

It is understood that the client is looking to redevelop the site for an extension of the Barnsley Interchange with an associated retail complex.

This second, Phase II, study incorporates intrusive works to determine the soil and groundwater profile and its geotechnical implications with regards to any proposed development. This investigation also aims to target potential sources of contamination suggested by the initial Phase I study.

The objectives of this intrusive investigation are as follows:

- Provide outline design advice with respects to foundations to the proposed development.
- Refine the CSM through chemical assessment of soil conditions.
- Provide preliminary recommendations with respects to potentially contaminated soils and possible outline remedial measures.
- Advise on the need for any further intrusive investigation work which may be considered necessary.

## 1.3 Limitations

All of the comments and opinions contained in this report, including any conclusions, are based on the information obtained by BWB during our investigations. The conclusions drawn by BWB could therefore differ if the information obtained is found to be misrepresentative, inaccurate, or misleading.

Except as otherwise requested by the Client, BWB is not obliged and disclaims any obligation to update the report for events taking place after:

a) the date on which this assessment was undertaken; and

b) The date on which the final report is delivered

BWB makes no representation whatsoever concerning the legal significance of its findings or to other legal matters referred to in the following report.

This investigation is limited to those areas accessible to the chosen investigation method (core drilling and trial pitting) causing the least impact to the current occupation of the site.

## 1.4 Guidance

BWB Consulting Ltd is a registered Engineering Practice and is regulated by the Institute of Civil Engineers.

This report has been prepared in accordance with:

- CLR11 – Model Procedures
- PPS23: Annex 1
- Contamination and Environmental Matters - Their implications for Property Professionals (2nd Edition RICS Nov 2003)
- Brownfields – Managing the development of previously developed land – A client's guide, CIRIA 2002
- DEFRA and Environment Agency publications CLR7 – 10, supported by the TOX guides and SGV guides, dated March 2002
- DETR Circular 02/2000, Contaminated Land: Implementation of Part IIA of the Environmental Protection Act 1990
- Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part IIA of the EPA1990, May 2002

And any other protocols advised by DEFRA and the EA and guidance's prepared by BSI, CERTA, BURA, and other industry advisory bodies including BS5930 and BS10175.

## 1.5 Judicial Precedents and Legislation

The following non-exhaustive list of legislative framework documents has been considered in the compilation of this document.

- The Environment Act (1995)
- The Environment Protection Act (1990)
- The Water Resources Act (1991)
- The Radioactive Substances Act (1993)
- The Pollution Prevention and Control (England and Wales) Regulations (2000)
- The Contaminated Land (England) Act (2000)
- The Environment Act 1995 (Commencement No.16 and Saving Provision) (England) Order (2000)
- The Contaminated Land (England) (Amendment) Regulations (2001)
- The Landfill Regulations (England and Wales) Regulations (2002)
- The Landfill (England and Wales) (Amendment) Regulations (2004)
- Rylands v Fletcher - Private Nuisance, Escape
- Health and Safety at Work Act
- The Building Regulations 1991, Part C of Schedule 1

- The controlled Waste Regulations 1992
- Special Waste Regulations 1996.

Neither the list of guidance documents nor the list of judicial precedents and legislation should be considered exclusive or comprehensive. There are approximately 85 individual items of legislation regulating contaminated land work. BWB makes every effort to ensure that all are adhered to in the preparation and presentation of this report.

## 1.6 Technical Competence

BWB is a leading specialist multi-disciplinary engineering practice working in the contaminated land market. Most of the workload undertaken by BWB is within the commercial property development market dealing with brownfield re-development and associated environmental and geotechnical issues.

Established in 1990, BWB is at the forefront of environmental asset management providing expertise in Environmental Risk Assessments, Environmental Site Investigations, Geotechnical Site Investigations and Remediation Strategies.

BWB's staff come from a wide variety of backgrounds within the geotechnical and environmental sectors and are all degree qualified. Specialists include Geotechnical Engineers, Geologists, Environmental Engineers, IEMA Auditors, Chartered Environmental Surveyors, Chartered Engineers; up to SiLC (Specialist in Land Condition) accreditation.

BWB's technical protocols are described in our reports and are strictly adhered to by quality control checks in the field and in the laboratory. BWB only uses UKAS and MCERTS accredited laboratories for all methods used to derive determinant concentrations.

BWB operates a quality assurance process under ISO9001:2000 which facilitates rigorous in-house administrative and technical protocols and is assessed externally every 6 months. BWB also initiates a robust health and safety program for each site and are an Investor in People ensuring the regular training of staff in new guidance's and techniques.

## 1.7 Scope of Work

The following scope of work has been followed as part of this Phase II Geo-Environmental Risk Assessment:

- Perform a site services survey prior to commencement of field work.
- Excavate, log and photograph 15 No. Trial Pits.

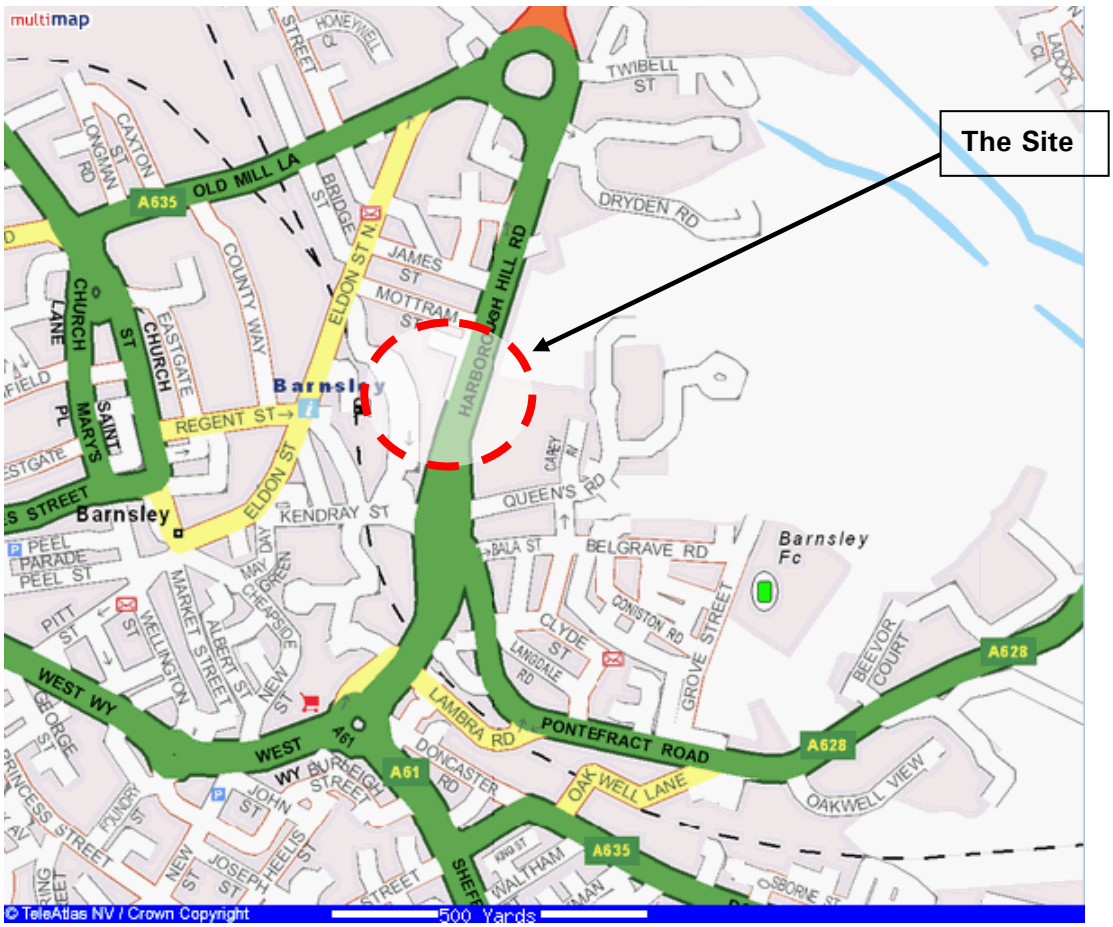
- Advance and log 5 No. boreholes to a depth not exceeding 30m bgl to establish geotechnical conditions of the underlying strata.
- Perform SPT testing in all drilled locations.
- Collect soils samples from 0.5m bgl at 1.0m intervals in the drift deposits, thereafter at 1.0m intervals and/or at changes in strata.
- If no groundwater is present all boreholes will be converted to enable gas monitoring to take place.
- If groundwater is encountered, all boreholes will be converted to combined gas and groundwater monitoring points.
- Select a sub-set of samples for geotechnical laboratory testing as determined by the Site Engineer.
- Select a sub-set of samples for chemical laboratory testing.
- Laboratory chemical analysis to include those potential contaminants identified in the Phase I investigation. A representative sub-set of samples will be pre-screened for asbestos.
- Should ground water be confirmed two return visits will be undertaken for groundwater sampling and levelling to be undertaken.
- Gas sampling will take place over a set of eight visits at approximately weekly intervals.
- Geotechnical assessment using field and laboratory data related to the proposed development.
- Chemical assessment of soil conditions using field and laboratory data related to the proposed development.
- A refined SCM.
- An outline review of contamination remediation.

## 2.0 THE SITE

### 2.1 Site Location

The site is located at National Grid Reference (NGR) 434810, 406640; geographical positioned between Harborough Hill Road to the East and the Barnsley Interchange to the West, as presented in **Figure 1** below.

**Figure 1: Site Location Plan**




Reproduced from the Ordnance Survey 1:10,000 Scale map with the permission of the controller of Her Majesty's Stationery Office crown copyright reserved. **OS Licence number 100013665**

The site covers an area of approximately 2.25 Hectares varies in ground level over the site varies between 92m Above Ordnance Datum (AOD) in the north west to 98m AOD in the south east.

### 2.2 Site Description

The site is located between Barnsley Bus Station to the west and Harborough Hill Road, a duel carriage to the east. Mottram Street forms the northern boundary of the site with some of its houses numbers 17 - 61 backing onto the site.

At the southern boundary of the site are an electricity sub-station and a club. Access to the site is off of the northern bound carriage way of Harborough Hill Road. Barnsley Bus Station is located to the west of the site boundary. The site is elevated approximately 4.0m higher than the bus station.

The current site layout is provided as **Figure 2**.

## 2.3 Site Reconnaissance Visit

A site walkover was carried out by BWB on Friday 5th May 2006. Photographs taken during the site walkover are presented in **Appendix 1**.

The site is approximately triangular with one side due north running parallel with a footpath behind the houses of Mottram Street. The Eastern face of the site runs parallel Harborough Hill Road. The South of the site is bound by an electricity sub-station, with associated heavy cabling. From the North West corner of the site running half way down the western side of the site the soil has recently been engineered as part of a new access road to the adjacent bus station. As a result a sharp slope of approximately 45 degrees and in the order of 2m in height forms the site boundary here.

Access to the site is from two metal gates situated in the north east corner. These gates connect the site to Harborough Hill Road via a small tarmac car park. The area between Harborough Hill Road up to and including the site is formerly of light industrial and domestic usage.

The site surface is predominantly hard stand, concrete with some asphalt covering evident to the North. This pavement has been broken in parts of the site, assumed to relate to the previous site investigation works undertaken in 2001.

These holes suggest that the concrete is reinforced and of circa 30mm in thickness. This area of the site also has had two new manholes fitted adjacent to the site boundary. These manholes may suggest an, as yet, unrecorded drainage pathway on or near the site.

A single story building, approximately 35m x 35m in plan is located centrally within the site. Numerous manholes are dispersed across the site and around the perimeter of the central building. A lean-to shelter is also present on site.

There is an “L” shaped terrace of garage sized storage buildings delineate the south western corner of the site in front of the sub station. Some small brick built sheds house works associated with the sub-station at the most southern point of the site. North of this and east of the terrace of storage buildings is a bunded tank complex comprising one elevated 4m long barrel shaped tank with associated pipework. A 1m high bund surrounds this and an adjacent plant room.

The site is generally thinly dispersed with domestic rubbish and contains several neat piles of building materials.

2.3.1 The above ground storage tank

A diesel above ground storage tank (UST) with secondary containment has been located at the south western part of the site. Visually, several rust patches are evident on the tank. No information is available regarding the presents of any product inside the tanks. The adjacent plant room to the UST which appeared to be the control room consists of broken disused pipe works and several valves systems and an electronic box mounted on the wall. The pipe works and the valves have been found to be connected to the adjacent tanks which may have been used to control the flow of hydrocarbons from the UST to the unknown delivery system at the site.

2.3.2 The lean-to shelter

This is constructed of metal and concrete and covers a row of three large square manholes suggesting that possibly this was used as an area for servicing vehicles or a machine sump.

2.3.3 The "L" Shaped Terrace of Garage Sized Storage Buildings

These are generally in a poor state of repair with cracks in the concrete construction evident. Broken wiring and light fittings cover the surface features and general rubbish and shelving are dispersed throughout. Signage indicates that these were used to store oils and propane gas.

2.3.4 The Central Building

The central building is approximately 35m square and has an elevated floor of approximately 1.0 to 1.50m above ground level it is brick built with a metal roof that extends half way down the southern wall. The roof is further extended upwards by two building long sky lights of glass and fibreglass. These are commonly broken and the inside of the building while predominantly empty is covered with broken glass, fibreglass and numerous lengths of metal caballing. A small partitioned area exists to the western side of this building that is built from breeze blocks this houses some derelict office furniture and filing cabinets. There is no machinery present but for one redundant photocopier. The building appears to have suffered fire damage. Adjacent to the entrance on the eastern side of the building is an area of what appears to be solidified bitumen tar. There are three former points of entry on the northern side of the building and these all have signage that state the building contains asbestos. This exterior wall also has one head high window of some half meter depth with fitted fans and a security grill. The building has a loading bay on its western side.

## 2.4 Proposed Redevelopment

It is currently proposed to develop the site in order to accommodate a 45,000 $ft^2$ retail unit with associated car parking over the majority of the site. A smaller 3,000 $ft^2$ retail/restraint unit is proposed over the south east part of the site.

A plan showing the proposed development is presented as **Figure 3.** It is this layout that has been used for the human health risk assessment.

The existing site structures are to be demolished as part of the proposed development. Proposed cut and fill earthworks are shown on the BWB drawing LDS/126/SK100 rev P1, reproduced as **Figure 4**.

For preliminary purposes, proposed site levels will be created by cutting into existing ground levels over the southern half of the site by up to 1m depth. It is proposed to up fill from existing site levels over the northern part of the site by up to 3m.

The footprint of the larger retail unit is shown to be situated over part cut (<1.2m deep) and part filled ground (<3.4m of fill).

The footprint of the smaller retail unit is shown to be situated entirely over an area of cut (0.6m to 1.0m).

Minor retaining structures up to 1m in height are envisaged over the southern part of the site where it is proposed to cut into the existing ground levels adjacent to the site boundary and Harborough Hill Road.

Retaining structures will be required over northern site boundary to accommodate the proposed up-filling.

At this stage no design loads are known.

# 3.0 AVAILABLE INFORMATION

## 3.1 Historical Ordnance Survey Plans

All readily available historical Ordnance Survey (OS) mapping for the site area have been obtained and reviewed as part of the Phase I ERA.

In summary, the site has undergone gradual development from small buildings that were first documented in 1855. A club house and allotments have been developed by 1931 and the first evidence of a depot complex (The Electricity Board Depot) exists from 1968.

## 3.2 Previous Reports

The following documents have been reviewed as part of this study:

- "Site Investigation for a Site at Harborough hill Road, Barnsley, South Yorkshire", Soil Mechanics for Waterman BBT, report Ref. 101009 Rev 2, May 2001.
- "Mining Report" Wardell Armstrong for Waterman BBT, Ref. SD01-0058-Rep, June 2001.
- "Summary of Site Investigation Reports and Assessment of Abnormal Geotechnical and Contamination Issues at Harborough Hill Road, Barnsley" Waterman BBT for Bett Properties, Ref ANP/SEF/9211 Draft, August 2001.
- Phase 1 Environmental Risk Assessment (Ref. LDS126, BWB, May 2006)

These reports relate to a previous geo-environmental site investigation at the site undertaken in January 2001. These reports should be read in conjunction with this document. The findings of these reports are summarised in the proceeding sections:

### 3.2.1 Soil Mechanics "Site Investigation" Report May 2001

This report documents the factual information obtained as part of the January 2001 site investigation. This investigation comprised the following works:

- 5 No. Shell and Auger boreholes to depths of between 3.3m to 5.0m.
- 6 No. Rotary "open holed" boreholes to depths of between 20.5m to 60m.
- 3 No. Window sampler boreholes to depths of between 1.5m to 2.4m.
- 9 No. Trial Pits to depths of between 1.5m to 2.0m.
- In situ CBR testing.
- Soil classification testing (LL, PL, MC, PSD)
- Soil strength testing (Cu)
- Compaction testing (MDD, OMC)

- Soil sulphate testing (pH, $SO_{4\ (soluble)}$)
- Contaminant testing.

This investigation recorded made ground/pavement layers overlying weathered mudstone and siltstone bedrock at depths of between 0.3m to 3.2m below existing ground level.

Deep drilling into the underlying bedrock recorded up to 7 No. coal seams beneath the site at between 0.1m and 1.3m thickness. No evidence to suggest previous workings was recorded by the investigation.

Exploratory works suggested that the bedrock beneath the site dips between 4° to 5° to the east, in general agreement with published geological maps.

No groundwater was recorded in shallow exploratory holes (trial pits and window sampler boreholes) undertaken to depths of between 1.5m and 3.6m depth. Deep exploratory methods recorded groundwater strikes during drilling of boreholes at depths of between 15.9m and 29.7m below existing ground level.

Subsequent groundwater monitoring recorded water levels within standpipes at between 5.7m and 15.7m depth.

This report concluded that shallow coal seams extend below part of the site that could potentially have been historically mined.

3.2.2 Wardell Armstrong Consulting "Mining Report" June 2001

This report was written on behalf of Waterman BBT in order to address the mining setting on or in the immediate vicinity of the site with a view to redevelopment.

The following sources of information were consulting as part of this study:

- Published geological and Coal Authority Records
- The Soil Mechanics 2001 Site Investigation Report.

This report reinterprets the conjectured sub-crop of two shallow coal seams beneath the site and estimates that bedrock should dip approximately 7° to the east.

The site is considered stable with respects to past deep coal mining.

This report concludes that there is a potential for unrecorded shallow mine workings across the eastern third of the site. Wardell Armstrong recommended that further investigation and stabilisation is carried out by drilling and pressure grouting over the construction footprint and a 3m additional perimeter.

3.2.3 Waterman Environmental "Short Summary of Site Investigations Report" August 2001

This report summarises the findings of the two preceding studies and in particular abnormal geotechnical issues relating to the site.

In summary the report states that:

- Cut and fill earthworks will be required to create a level formation. Weathered mudstone and clays are considered unsuitable for re-use.
- Shallow foundations bearing upon the weathered bedrock, and a minimum of 0.9m below ground, will sustain bearing pressures of150kN/$m^2$. Where bedrock is locally up to 3m in depth, foundations should be over-excavated and backfilled with mass concrete.
- No special precautions are required with regards to sulphate resistant concrete.
- Grouting should be undertaken beneath structure over areas of potential shallow coal mining.
- Coal within 1m of formation level must be removed and replaced with inert blinding as a precaution to the risk of combustion.
- Gas protection membrane should be incorporated beneath the ground slab to buildings as a result of measured radon concentrations within boreholes.

3.2.4 BWB Phase I Environmental Risk Assessment 2006

A Phase I "Environmental Risk Assessment" desk study report has been compiled by BWB and is reported in the document, Ref. LDS126/01/V1, dated May 2006. This study is limited to the data collected from proprietary sources, the contacted Statutory Authorities and observations made during the site walkover.

## 3.3 Regulatory Review

An Enviro**check**® report was commissioned by BWB as part of the initial Phase I study.

In addition, Barnsley County Council's Environmental Health Department and Planning Department were also contacted in relation to records relating to environmental issues at the site. None of this information has been forth coming to date.

Key points of the regulatory review include discharge consents, water abstraction licences, and pollution incidents that are recorded on or near the site.

## 3.4 Published Geology

The following published geological information has been obtained as part of the Phase I study:

- 1:50 000 series solid and drift geological map sheet 86, "Barnsley" published by the British Geological Survey (BGS).
- 1:10,000 scale sheet SE30SW, published by the British Geological Survey (BGS).

The 1:50,000 series geological map of this area indicates that the site is underlain directly mudstones of the Upper Carboniferous Middle Coal Measures.

Two coal seams are shown exposed at the surface, at or around the surface of the site.

The 1:10,000 scale geological plan confirms the geology as suggested by the smaller scale plan. A coal seam is shown bisecting the site and is indicated to be the Winter or Abby Coal. This coal is recorded at thicknesses of between 1.2m and 1.4m in this area. Notes on the map indicate that this coal was previously exposed at the surface nearby. A second coal seam is shown approximately 200m to 300m further west of the site boundary and is indicated as being the Top Beamshaw Coal. This coal seam is present at between 1.2m to 1.4m and is overlain by a sandstone band.

The bedrock in this are is shown dipping to the east.

A colliery is shown to the east of to Harborough Hill Road. The Wardell Armstrong mining report contains further details relating to a Mottram Wood Colliery located similarly to the east of Harborough Hill Road. This colliery is believed to have worked the Winter Coal known to underlie part of the site.

## 3.5 Hydrogeology

The Environment Agency has classified the underlying strata as a Minor Aquifer (Very Permeable). These are formations can be fractured or potentially fractured rocks, which do not have high primary permeability, or other formations of variable permeability including unconsolidated deposits. Although not producing large quantities of water for abstraction, they are important for local supplies and in supplying base flow to rivers.

The site soils are classified as 'U', Soils of High Leaching Potential. These have little or no resistance to migration of contaminants through the soil matrix.

Both the Envirocheck® report states that the site is not located within an Environment Agency designated Source Protection Zone.

There are no recorded groundwater abstractions within 400m of the site.

## 3.6 Hydrology

The nearest surface water feature is located approximately 160m north of the site boundary.

The site lies approximately 0.5Km South of the River Dearne and former Barnsley Canal an open and culverted watercourse passing through the centre of Barnsley, in a northwest to southeast direction.

The site is not deemed susceptible to flooding.

## 3.7 Ground Gas

NRPB-W26, Radon Atlas of England and Wales, identifies the site as being in an area where between 1% and 3% of homes are above the action level for Radon Gas.

BRE211, Radon: guidance on protective measures for new dwellings, identifies the site as overlying an area where basic radon protective measures may be required and that a geological assessment should be made.

A geological assessment involves checking whether a site is on or close to a geological unit with elevated radon potential. This is usually compiled in a Radon Protective Measures (RPM) reports from the British Geological Survey (BGS).

The Radon Protective Measures Geographical Information System (RPM-GIS) dataset held by the BGS is leased by Enviro**check**® and summarised in their report.

The Enviro**check**® report states that basic radon protection measures will be required.

The site was occupied in part by a former registered waist transfer site. There is no recorded input data, but a licence for between 10000 and 25000 tones per year; as such landfill gas may present an elevated risk to any development.

## 3.8 Mining

A Coal Authority Report ref 10193292-06 was commissioned by BWB in May 2006 as part of the Phase I ERA.

The Coal Authority holds records that indicate the site is within the likely zone of influence from the working of four deep seams, at depths of between 50m and 350m although ground movement relating to these workings should now have ceased. This report also states that reserves of coal exist near surface that may have been worked in the past.

The site does not lie within the zone of influence of present underground or surface mine working. No licence to extract coal exists for this area, although the reserves of coal present beneath the site could be worked in the future, subject to feasibility, licenses and planning.

There are no known shafts or adits within the site or within 20m of the site boundary.

No records of faults or other lines of weakness that may affect the stability of the property are kept by the Coal Authority.

The Coal Authority holds no records of any damage notice or claim having been made in respects of the property since 1984.

The Coal Authority report recommends, "*in view of the mining circumstances a prudent developer should seek appropriate technical advice before works are undertaken on site*".

A "Mining Report" was undertaken by Wardell Armstrong (June 2001) specifically relating to mining issues in relation to development of the site. This report concluded that the site is considered stable with respects to past deep coal mining.

This mining report concluded that the shallowest seam is known locally as the Winter (Abdy) and the lower seam is known as the Top Beamshaw. Mine abandonment plans relating to an adjacent colliery indicate that the Winter Seam has been worked as far west as Harborough Hill Road. The Beamshaw seam is not known to have been worked. The mining report concluded that "the Beamshaw Seam(s) are thin, inconsistent and/or poor quality and very unlikely to have been worked beneath the site".

This report concludes that there is a potential for unrecorded shallow mine workings across the eastern third of the site associated with areas underlain by the Winter Seam. Wardell Armstrong recommended that further investigation and stabilisation is carried out by drilling and pressure grouting over the construction footprint and a 3m additional perimeter.

## 4.0 PHASE I ENVIRONMENTAL RISK ASSESSMENT

A Phase I ERA has been previously undertaken and is reported separately in the BWB document Ref. LDS126/01/V1, dated May 2006. This document should be read in conjunction with this report.

The following sections discuss all the identified potential sources, pathways and receptors in the context of the site and plausible pollutant linkages which may represent a risk to human health and/or controlled waters from the data gained from the desk study. At this stage the assessment is qualitative and aimed to determine all pollutant linkages, irrespective of significance or allowing for uncertainty.

Three impact potentials exist for any given site, these are:

- The site impacting upon itself;
- The site impacting on its surroundings, and;
- The surroundings impacting on the site.

All three impacts need to be considered in a risk assessment.

### 4.1 Pollutant Sources

The then Department of the Environment produced a Consultation Paper in dated May 1991: entitled 'Public Registers of Land which may be Contaminated'. This document provided a schedule of contaminative uses.

From this list the following contaminative uses are associated with the site.

Sub Station
C.3e) Electricity and sub-station.

Fuel Tanks
C.14c) Dismantling, repairing or maintenance of road transport and road haulage; Garages and filling stations.

Demolition
C.16c) Demolition of buildings, plant or equipment used for any of the activities included in the schedule.

From this list the following contaminative uses are associated with the surrounding area.

Colliery & Coal Yard

C.2a) Extracting, handling and storage of carbonaceous materials such as coal, lignite, petroleum, natural gas, or bituminous shale (not including the underground workings).

Timber Yard

C.11a) Chemical treatment and coating of timber and timber products.

Railway Land

C.14a) Marshalling, dismantling, repairing or maintenance of railway rolling stock.

Railway Foundry

C.8a) Manufacture of metal goods, including mechanical engineering industrial plant or steelworks, motor vehicles, ships, railway or tramway vehicles, aircraft, aerospace equipment or similar equipment.

Bus Depot

C.14c) Dismantling, repairing or maintenance of road transport and road haulage; Garages and filling stations.

The main sources of contaminants at the site are likely to be associated with the presence of the former waist transfer. The neighbouring properties are not deemed to be of influence to the site.

In 2002, as part of the CLEA programme, DEFRA produced a series of Contaminated Land Reports (CLR's). CLR8 entitled 'Potential Contaminants for the Assessment of Land' lists the likely contaminants that can be expected from a variety of contaminative industries.

There are also a set of documents produced by the then Department of the Environment entitled Industry Profiles. These have also been consulted in determining which contaminants may be associated with these industries.

From these documents the following contaminants associated with the various activities identified above along have a potential to be encountered. These have been combined with a general suite of contaminants that may be encountered form a variety of sources.

This list is not exhaustive, nor is it definitive, that is to say, listed contaminants only have a potential to be present, there presence is not assured, nor does this list exclude other contaminants from being present.

Arsenic, barium, boron, cadmium, chromium, copper, lead, mercury, nickel, vanadium, zinc, cyanide, sulphates, asbestos, phenols, oil/fuel hydrocarbons, PAH's, and total organic carbon. In addition, landfill gas monitoring should be undertaken.

Any intrusive testing programme should include these contaminants as a minimum requirement.

## 4.2 Pathways

Potential pathways by which human receptors may be impacted upon are identified as follows:

- Ingestion
- Skin contact
- Inhalation

These pathways arise through direct contact with contaminated soils, contact with contaminated groundwater or inhalation of airborne dusts, fibres or gases.

Potential pathways that could impact site structures are through direct contact with contaminated soils or contact with contaminated groundwater.

Potential pathways that could impact controlled waters are through direct contact with contaminated soils or percolation of contaminated surface waters.

## 4.3 Receptors

The potential human receptors at the site are:

- Current occupiers of the site
- Future occupants of the site
- Neighbouring residents
- Construction workers
- Services personnel working in trenches

Construction materials may be affected by contaminants. These receptors are:

- Plastic water pipes, which may be attacked by organic compounds such as PAH and TPH
- Buried concrete, which may be affected by high levels of sulphate and/or low pH in site soils or groundwater

Potential water receptors include:

- The local water courses
- The underlying ground water (if present)

An assessment of these pollutant linkages has been made and is presented in **Section 6.4.**

## 4.4 Preliminary Conceptual Site Model (CSM)

The preliminary CSM is formulated on the basis of potential sources of contamination identified on site, potential receptors that may be the recipient of contamination arising from those sources and any pathways that may exist, thus creating a source-pathway-receptor (target) pollutant linkage.

The following pollutant linkages have been identified as being attributed to this CSM.

The preliminary CSM is formulated on the basis of potential sources of contamination identified on site, potential receptors that may be the recipient of contamination arising from those sources and any pathways that may exist, thus creating a source-pathway-receptor (target) pollutant linkage.

The following pollutant linkages have been identified as being attributed to this CSM and are presented in **Table 1** below:

**Table 1: Pollutant Linkages Associated With The Site**

| | Source | Pathway | Receptor |
|---|---|---|---|
| 1 | Contaminants contained within the made ground. | Vertical migration through site soils | Underlying Minor Aquifer |
| 2 | Contaminants contained within the made ground. | Direct contact | Existing site users |
| 3 | Contaminants contained within the made ground. | Direct contact | Ground workers |
| 4 | Contaminants contained within the made ground. | Surface run off | On and off site drainage system |
| 5 | Contaminants contained within the made ground. | Lateral migration through site soils | Existing buildings on site |

No significance or uncertainty is attributed to any pollutant linkage identified.

## 4.5 Hazard Identified by Phase I ERA

The Hazard Assessment has identified two significant hazards associated with the site.

These hazards are:

- Potential contamination associated with the presence of a landfill on site.

- Potential contamination from off-site sources in the site soils.

## 4.6 Preliminary Risk Evaluation

A simple matrix can provide a consistent basis for decision-making. It should of course be used with caution, recognising the over-simplification that it will normally represent. The probability and consequences are defined according to parameters relevant to the situation; the boundaries of risk acceptability (and tolerability, where relevant) indicated on the matrix provide in **Table 2** can be tailored to the factors influencing the significance of the risk. Individual situations are mapped onto the matrix to provide a ready and consistent indication of their acceptability or tolerability.

**Table 2 – Risk Evaluation Matrix**

| | CONSEQUENCES | | | |
|---|---|---|---|---|
| | **Severe** | **Medium** | **Mild** | **Negligible** |
| **PROBABILITY** | | | | |
| **High** | Very High | Very High/High | Moderate/Low | Negligible |
| **Medium** | Very High/High | Moderate | Low | Negligible |
| **Slight** | High/Moderate | Moderate/Low | Low | Negligible |
| **Negligible** | High/Moderate/Low | Moderate/Low | Low | Negligible |

These attributes are evaluated qualitatively against individual hazard assessments to determine the likelihood of a given hazard occurring.

The following evaluations have therefore been made:

## 4.7 Risk to Human Health

### 4.7.1 Contamination in the Soils

Due to the historical use of the site, they have been attributed a MEDIUM probability with MEDIUM consequences resulting in a **MODERATE** risk.

### 4.7.2 Contamination in the Surface and Groundwater

Due to the historical use of the site, they have been attributed a MEDIUM probability with MEDIUM consequences resulting in a **MODERATE** risk.

## 4.8 Risk to Controlled Waters

### 4.8.1 Contamination in the Soils

Due to the historical use of the site, they have been attributed a MEDUIM probability with MEDIUM consequences resulting in a **MODERATE** risk.

4.8.2 Contamination in the Surface and Ground Water

Due to the historical use of the site, they have been attributed a MEDUIM probability with MEDIUM consequences resulting in a **MODERATE** risk.

## 4.9 Risk to Buildings and Services

4.9.1 Contamination in the Soils

Due to the historical use of the site, they have been attributed a MEDIUM probability with MEDIUM consequences resulting in a **MODERATE** risk.

4.9.2 Contamination in the Surface and Ground Water

Due to the historical use of the site, they have been attributed a MEDIUM probability with MILD consequences resulting in a **LOW to MODERATE** risk.

## 4.10 Risk Categorisation

The pollutant linkages assessment combined with the historical use of the site indicates that in its present state the site represents a **MODERATE** human health risk, a **MODERATE** risk controlled waters risk and a **LOW to MODERATE** risk to site structures.

During redevelopment the risk to human health will rise to **HIGH to MODERATE** due to demolition activities associated with earthworks and construction activities over the site.

Post development, all risks should be reduced to no greater than **LOW**.

These ratings are set against the following categories provided in **Table 3** as defined by, the then, Department of the Environment in CLR2 and subsequently amended.

**Table 3: DoE Risk Categorisations**

| RATING | DEFINITION |
|---|---|
| Very High Risk | This is a *high probability* that *severe harm* could arise to a designated receptor from an identified hazard at the site without appropriate remedial action. |
| High Risk | *Harm* is likely to arise to a designated receptor from an identified hazard at the site without appropriate remedial action. |
| Moderate Risk | It is possible that without appropriate remedial action *harm* could arise to a designated receptor. It is relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely that such harm would be relatively mild. |

| RATING | DEFINITION |
|---|---|
| Low Risk | It is possible that *harm* could arise to a designated receptor from an identified hazard. It is likely that, at worst, if any harm was realised any effect would be mild. |
| Negligible Risk | The presence of an identified hazard does not give rise to the potential to cause *harm* to a designated receptor. |
| No Potential Risk | There is no potential risk if no pollution linkage has been established. |

# 5.0 PHASE II GEO-ENVIRONMENTAL SITE INVESTIGATION

## 5.1 General

An intrusive site investigation was undertaken between the 26th June and 04th of July 2006 and comprised of:

- 15 No. trial pits to depths of between 1.5m and 3.4m;
- 5 No. shell and auger boreholes to depths of between 2.0m and 4.0m
- 5 No rotary continuation boreholes from shell and auger borehole depth to 30.00m

Soil samples were collected at regular intervals throughout all exploratory holes and submitted to an MCERTS accredited soils laboratory for further chemical analysis. Further sub-samples of representative soils types were collected and submitted to a UKAS accredited soils laboratory for geotechnical classification testing.

In-situ Standard Penetration Testing (SPT) has been undertaken at regular intervals throughout shell and auger boreholes. These exploratory holes are located adjacent to the footprint of the proposed building and at the extremities of the site.

On completion, shell and auger boreholes and rotary continuation the resulting boreholes were converted to combined gas and water installations.

Subsequently, gas and water monitoring has been undertaken on five separate occasions over a period of two months following completion of the site works.

Groundwater samples were also obtained on two separate visits for further chemical analysis.

The site work was carried out in general accordance with BS5930 (1999) 'Code of Practice for Site Investigations', the Association of Geotechnical and Geo-Environmental Specialist Guidelines for Good Practice in Site Investigations (August 1998) and BS10175 2001 ' Code of Practice for the Investigating of Potentially Contaminated Sites'. The work was supervised by a suitably qualified geo-environmental engineer.

All BWB environmental investigation work is undertaken in accordance with CLR11 Model Procedures.

An exploratory hole location plan is presented as **Figure 2.** Exploratory hole records can be found in **Appendix 2, 3** and **4**. Laboratory chemical analysis and geotechnical soil testing can be found in **Appendix 5**. Gas and groundwater monitoring records can be found in **Appendix 6.**

## 5.2 Trial Pits

Total fifteen trial pits (TP001 to TP015) were excavated using an eight tonne, JCB 3CX backhoe fitted with a 600mm wide bucket fitted with ripping teeth. Pits locations were broken out through hard pavement layers using a hydraulic breaker.

Trial pits where distributed over the entire site and adjacent to areas of potential sources of contamination.

Trial pits were extended to target depths of around 4.0m or until refusal on hard layers. Refusal of the excavator was deemed as slow progress and repeated scraping of the bucket on hard layers.

Trial pits were excavated to depths of between 1.5m and 3.4m.

Samples of soil were taken at regular intervals and representative soil types during excavation. Records were kept that detail soil types, consistency and the absence of water strikes.

Pits were backfilled with arisings on completion. No additional reinstatement measures were requested by the client.

The location of trial pits are shown on **Figure 2**. Trial pit Photographs can be found in **Appendix 1**. Trial pit logs can be found in **Appendix 2**.

## 5.3 Shell And Auger Boreholes with Rotary Core Drilling Follow on.

Five shell and auger boreholes (BH01, BH02, BH03, BH04 and BH05) were bored through superficial soil deposits to effective refusal at depths of between 2.0m and 4.0m. Effective refusal was deemed as chiselling through hard ground with minimal progress for up to 0.5 hour.

These boreholes were positioned in and around the footprint of the proposed building and the extremities of the site. On completion of the shell and auger boreholes where progressed further using rotary follow to a target depth of 30m.

Standard penetration testing (SPT) was undertaken at 1m intervals during shell and auger boring.

Soil samples were collected at regular intervals within this upper layer for further chemical and soil classification laboratory analysis.

Rotary drilling was progressed through bedrock using coring techniques. Typically total core recoveries in excess of 70% were achieved during drilling. A period of no recovery was recorded in borehole BH02 from 29.00 to 30.00m depth as a result of a blocked core barrel.

Rock core was retrieved photographed and logged by a qualified engineering geologist in accordance with BS5930.

A 50mm diameter combined gas and water monitoring standpipes were installed with response zones sealed below superficial deposits.

Borehole logs can be found in **Appendix 3**. Site location plan showing the position of exploratory holes is presented as **Figure 2**.

## 5.4 Sampling Strategy

Soil samples were collected from the trial pits, probe holes and boreholes at 0.5m intervals within the first metre and thereafter at 1.0m intervals thereafter for further chemical laboratory analysis. Samples of representative soil types were also taken for further geotechnical classification testing.

The combined gas and groundwater monitoring installations were installed in BH01, BH02, BH03, BH04 and BH05.

Exploratory holes were positioned adjacent to potential sources of contamination present on site, in addition they were positioned in and around the footprint of the proposed building and the extremities of the site.

This sampling regime was intended to provide an outline indication of the contamination potential of the land. Further, confirmatory sampling and or testing, may be required prior to development.

## 5.5 Chemical Analysis

The potential risks that may be associated with the site relate to human health and buried structures and controlled waters. As such samples were collected for chemical analysis.

A total of 19 No. samples were submitted for the following the general suite of contaminants:

| | |
|---|---|
| Metals and metalloids | Boron (water soluble), arsenic, barium, beryllium, cadmium, chromium, selenium, copper, mercury, nickel, lead, vanadium, and zinc. |
| Inorganic | Sulphate (water soluble), total free and complex cyanide, and pH. |
| Organic | Phenols (total monohydric), FOC, TPH (total) and PAH (total). |

In addition to this general suite, the further following testing has been scheduled on ten samples obtained from exploratory holes distributed over the site.

| | |
|---|---|
| Other | Asbestos |

Water samples were analysed for the same set of determinants. The chemical test results are provided in **Appendix 4**.

## 5.6 Soil Classification Testing

Further soil testing has been undertaken of representative samples of the main soil and types encountered on site to aid soil classification and estimates of the engineering properties of these materials.

In summary soil classification testing included:

- 7 No. soil moisture content determinations (mc).
- 4 No. Atterberg limit determinations (PL, LL, PI).
- 5 No. Particle size determinations (PSD)
- 3 No: 2.5Kg Compaction tests.

The results of the geotechnical testing are presented in **Appendix 5**.

## 5.7 Gas and Groundwater Monitoring

Gas monitoring was undertaken on five separate occasions. Although 8 visits were included in the scope, entry was not gained on the last three attempts to visit site. Readings were taken of $CO_2$, $CH_4$ and $O_2$ levels within the boreholes along with the steady state flow of gas from these installations. The gas and groundwater monitoring results are provided in **Appendix 6**.

## 6.0 GROUND CONDITIONS

### 6.1 General

Ground conditions have been interpreted from the combined exploratory records of the previous Soil Mechanics 2001, site investigation and the supplementary 2006 BWB site investigation.

Typically, between 0.3m and 1.3m of made ground comprising pavement materials and reworked natural soils have been recorded overlying completely to highly weathered Middle Coal Measures mudstone.

A localised area of made ground up to 3.2m depth has been recorded over the north east part of the site comprising gravelly clay with gravel and cobbles of brick, and sandstone and occasional glass, coal, polythene, ash and slag (**see Figure 2**).

Several coal seams have been recorded beneath the site at between 0.4m and 1.5m thickness. Two of these seams are present within 15m of the existing site surface. These seams sub-crop beneath superficial site soils and dip approximately 6˚to 8˚to the east beneath the site. No evidence of workings was recorded in these shallow coal seams by the exploratory holes undertaken to date.

**Table 4: Summary of Ground Conditions Recorded By Investigations to Date**

| Soil Type | Description | Depth encountered (bgl) | Thickness Proven (m) |
|---|---|---|---|
| PAVEMENT | Asphalt/Reinforced Concrete typically over Limestone or brick and sandstone gravel Base. | GL | 0.15m to 0.9m |
| MADE GROUND | Gravelly clay with gravel and cobbles of brick, limestone and sandstone and occasional glass, coal, polythene, ash and slag | 0.15m to 0.6m | NP to 2.7m |
| COMPLETELY WEATHERED MUDSTONE | Firm to very stiff thinly laminated CLAY | 0.3m to 3.2m | NP to 2.3m |
| WEATHERED MIDDLE COAL MEASURES | Very weak to weak thinly laminated mudstones and siltstones with coal seams and sandstone bands at depth. | 0.3m to 5.2m | Proven up to 60m b.g.l |
| | Coal Seam 1 – intact where encountered. | 0.5m to 6.4m | NP to 1.0m |
| | Coal Seam 2 – intact where encountered, split in two by a thin mudstone band. | 5.2m to 18.6m | 0.4m to 1.5m |

| Soil Type | Description | Depth encountered (bgl) | Thickness Proven (m) |
|---|---|---|---|
| | Coal Seam 3 – intact where encountered.<br><br>Coal Seam 4 – BH5/RC3 (soil mechanics 2001) records quick penetration through seam.<br><br>Coal Seam 5 – drillers description only (open holed borehole) | 12.6m to 30.9m<br><br>38.8m (BH5/RC3 only)<br><br>58.4m (BH5/RC3 only) | 0.1m to 1.5m<br><br>Possibly up to 1.2m<br><br>1.3m |
| GROUNDWATER | 1. No groundwater strikes have been recorded by trial pits and window sampler boreholes excavate/driven to depths of between 1.5m and 3.6m depth.<br>2. Minor seepage recorded at or just below pavement base 0.9m to 0.7m (TP1, TP7 and TP8 -2001). Soils described as wet throughout (TP6).<br>3. Deep drilling recorded ground water strikes at between 4.5m and 29.7m depth, rising to 12.9m to 4.4m depth after 20 minutes.<br>4. Subsequent groundwater monitoring has recorded groundwater levels between 5.8m and 20m depth. | | |
| NP = | Not present in all exploratory holes (localised) | | |

## 6.2 Pavement Layers

Pavement layers have been recorded at between 0.15m to 0.9m thickness and comprise asphalt or concrete surfacing overlying limestone of mixed sandstone/brick base materials.

Asphalt and concrete encountered by all exploratory holes over the site at thicknesses of between 0.1m and 0.35m. Concrete pavement is reinforced in areas.

Pavement materials have been recorded overlying base materials are typically recorded as limestone gravel although can be locally sandstone and brick gravel.

Limestone gravel backfill to drainage was encountered by TP07 up to 1.2m depth.

## 6.3 Made Ground

Made ground comprising gravelly clay with gravel and cobbles of brick, limestone and sandstone has been recorded in localised areas of the site underlying pavement materials.

Where encountered, these soils are typically less than 1.2m in thickness. However, a localised area of the northeast part of the site recorded made ground soils up to depths of between 1.3m to 3.2m depth as recorded by TP11, TP12, BH05 (BWB 2006) and TP5, BH02/RC5 and BH03/RC2 (Soil Mechanics 2001).

Made ground soils over this localised area also included; ash, clinker, coal, polythene and glass fragments.

In situ testing in this material recorded SPT N values of between 8 and 109.

Particle size distribution testing on samples of this made ground (TP12 and BH05) recorded silt and clay sized material contents of 38% and 73%.

A summary of the combined laboratory soils testing undertaken to date is presented as **Table 5**.

**Table 5: Summary Geotechnical soils Testing – MADE GROUND**

| Made Ground – Geotechnical Soil Test summary | | | |
|---|---|---|---|
| | **Max** | **Min** | **No. of tests** |
| Natural MC % | 46% | 17% | 4 |
| LL% | 66% | 63% | 2 |
| PL% | 48% | 31% | 2 |
| PI% | 32% | 18% | 2 |
| % silt and clay | 56% | 30% | 4 |
| % sand | 32% | 22% | 4 |
| % gravel | 33% | 22% | 4 |
| % cobbles | 9% | 0% | 4 |
| Bulk Density mg/m$^3$ | 2.26 mg/m$^3$ | 1.98 mg/m$^3$ | 2 |
| ***Sulphate Testing*** | | | |
| pH | 7.9 | 5.9 | 3 |
| SO4 g/l | 0.06 g/l | 0.01 g/l | 3 |
| ***Soil Strength Testing*** | | | |
| Cu ((UUT) | 124 kN/m$^2$ | 62 kN/m$^2$ | 2 |

## 6.4 Completely Weathered Mudstone

Mudstone bedrock was encountered by all exploratory holes at depths of between 0.3m and 3.2m below ground level. However mudstone bedrock is typically encountered over the majority of the site at depths of less than 1.8m.

Locally the underlying bedrock is completely weathered to a firm to very stiff thinly laminated clay.

Shell and Auger boreholes refused within the mudstone at depths of between 2.5m to 4.0m. Boreholes where progressed further by rotary coring (BWB 2006) or open hole boring (Soil Mechanics 2001) techniques.

Standard penetration testing (SPT) within completely weathered mudstone bedrock recorded N300 values of between 7 and refusal. In all cases SPT values increased with depth.

Soil classification testing suggests these soils are of an intermediate to high plasticity. Soil moisture contents vary between 6% and 46% although generally decrease with depth. Typically soil moisture contents are below 18% below 1m depth.

Consolidation testing has been undertaken on a sample of firm laminated clay recovered from BH05 at 2.0m depth. The coefficient of volume compressibility ($m_v$) of 0.18 $m^2$/MN was measured over a pressure increment 100kPa in excess of the assumed affective overburden.

A summary of the combined laboratory soils testing undertaken to date is presented as **Table 6**.

**Table 6: Summary Geotechnical Soils Testing – COMPLETELY WEATHERED MUDSTONE**

| Completely Weathered Mudstone – Geotechnical Soil Test summary | | | |
|---|---|---|---|
| | **Max** | **Min** | **No. of tests** |
| ***Classification testing*** | | | |
| Natural MC % | 46% | 6% | 22 |
| LL% | 66% | 33% | 9 |
| PL% | 48% | 19% | 9 |
| PI% | 34% | 14% | 9 |
| % silt and clay | 91% | 68% | 4 |
| % sand | 22% | 3% | 4 |
| % gravel | 21% | 5% | 4 |
| % cobbles | 0% | 0% | 4 |
| Bulk Density mg/$m^3$ | 2.22 mg/$m^3$ | 1.96 mg/$m^3$ | 3 |
| ***Soil Sulphate Testing*** | | | |
| pH | 7.6 | 4.5 | 6 |
| SO4 g/l | 0.08 g/l | 0.02 g/l | 6 |
| ***Soil Strength Testing*** | | | |
| Cu (UUT) | 133 kN/$m^2$ | 71 kN/$m^2$ | 2 |
| Consolidation Testing | | | |
| $m_v$ (oedometer) | 0.18 $m^2$/MN | - | 1 |
| ***Compaction Testing*** | | | |
| Std MDD mg/m3 | 1.99 mg/$m^3$ | 1.77 mg/$m^3$ | 3 |
| Std OMC | 17% | 12% | 3 |
| HeavyMDD mg/m3 | 2.1 mg/$m^3$ | 2.08 mg/$m^3$ | 2 |
| HeavyOMC | 9.5% | 7.8% | 2 |

## 6.5 Weathered Middle Coal Measure Bedrock

Very weak to moderately weak thinly laminated mudstone bedrock has been recorded at depths of between 0.3m and 5.2m below existing ground level. The underlying Middle Coal Measures bedrock has been proven up to 60.0m bgL.

Shell and auger boreholes were bored through superficial soil deposits/completely weathered mudstone to effective refusal at depths of between 2.0m and 4.0m upon less weathered mudstone bedrock.

In all cases bedrock comprised very weak grey brown thinly laminated mudstone which becomes weak to moderately weak with depth.

Several coal seams were recorded below the site at between 0.4m and 1.5m thickness. Two of these seams are present within 15m of the existing site surface these seams sub-crop beneath thin superficial cover on site. Correlation between boreholes suggests that the bedrock dips approximately 6˚to 8˚to the east beneath the site.
Boreholes BH05 (BWB 2006) and BH3/RC2 (Soil mechanics 2001) were drilled over the anticipated location of the shallowest seam, as suggested by published geological information and correlation with adjacent drilling.

This seam was not encountered in BH05 and only a 0.4m band of coal was recorded by BH03/RC2 at the anticipated depth of the shallowest seam.

Boreholes BH01, BH02, BH03 and BH05 recorded that the second shallowest seam recorded on site (seam 2) was split by a 0.2m to 0.4m mudstone band.

Predominantly sandstone bedrock was encountered beneath the site at depth of between 9m and 26m depth and was proven up to 19.6m thickness in BH04.

A diagrammatic cross section showing the estimated extent of coal seams beneath the site is presented in **Figure 5** (overleaf), **Figure 6** shows the estimated extent of the potential instability caused by mining.

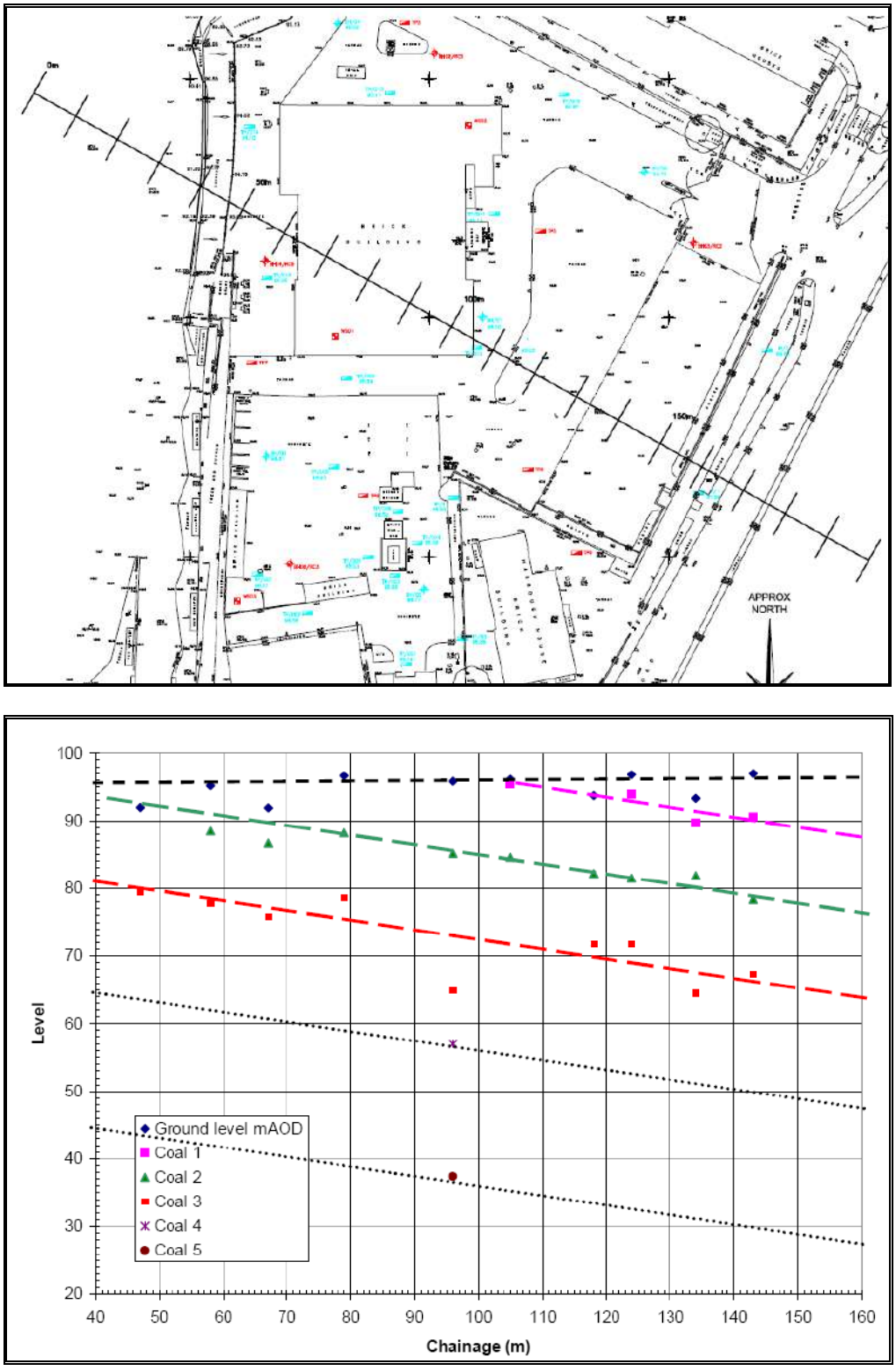
In most cases recovery was good and occasionally coal was recovered intact. No recovered evidence of mine workings, such as; fragments of prop, artificial fill, or grouting recorded during drilling.

All drill progress was reasonably unimpeded with no loss of flush or voids encountered with the exception of Soil Mechanics borehole BH5/RC3 which notes “quick penetration” through ground coincident with coal recorded at 38.8m below ground level.

Standard penetration test $N_{300}$ values of between 66 and in excess of 100 have been recorded. Typically SPT’s refused before achieving full penetration.

Bedrock natural moisture contents were found to be generally less than 10%.

## Figure 5 – Diagrammatic Cross Section through Site



## 6.6 Groundwater

No groundwater strikes have been recorded by trial pits and window sampler boreholes excavate/driven to depths of between 1.5m and 3.6m depth. Only minor seepage recorded at or just below pavement base 0.9m to 0.7m (TP1, TP7 and TP8 -2001). Soils were described as wet throughout (TP6).

Water strikes were recorded in all boreholes. In boreholes BH02, 03, 04 and 05 this was at depths of 12.50m rising to 9.90 and 14.50m rising to 9.60m after 20 minutes, 12.50m rising to 11.90m after one days drilling and 12.90 rising to 14.00m bgl after 20 minutes respectively.

Locally, borehole BH01 recorded a water strike during drilling at 4.50m bgL which rose to 4.10m bgL after 20 minutes. This level was noted to be 4.00m bgL at the end of the day but had fallen to 6.10 by the following day.

## 6.7 Obstructions

In addition several sewer mains and culverts are known to exist upon the site and are known to cross the proposed development area. Utilities drawings and historical Ordnance Survey plans show the approximate position of these structures.

Minor obstructions have been encountered in associated with the presence of backfilled material that is especially present in the north east part of the site. This comprised cobbles and boulders of brick, sandstone, concrete and slag and was documented in trial pits TP012 and TP011 and borehole BH05.

## 6.8 Visual and Olfactory Evidence of Contamination

Backfill material was recorded in three exploratory holes undertaken over the site.

These soils comprise loose clayey gravel and sand, comprising, sandstone, brick, slag, glass, concrete, drain fragments and plastic.

These soils are typically recorded at between 1.5m and 2.0m thickness and are predominantly in the North east part of the site. Trial pit 011 was adjacent to the existing central building and Trial pit TP012 joined the east side of the north perimeter of the site.

An organic odour was noticed between depths of 0.60m and 1.20m bgL in trial pit TP011. This was possibly related to the drain that had been unearthed by this excavation.

# 7.0 GENERIC QUANTITATIVE RISK ASSESSMENT

Chemical test results on soils have been assessed using the CLEA Soil Guideline Values published by the Department for Environment, Food and Rural Affairs (DEFRA) and, where no CLEA soil guideline values are available; reference is made to the BWB generic site assessment criteria (GSAC).

## 7.1 CLEA Soil Guideline Values

The CLEA documents quote soil guideline values (SGVs) for use as generic criteria for assessing risks to human health from exposure to contaminated soil for four potential exposure pathway scenarios. The approach is that provided the sample set is shown statistically to be within the same population and the 95 percentile upper bound of the mean is below the SGV then individual exceedances of the SGV do not cause a problem because the mean exposure will be below the prescribed level of risk. To date guideline values have been derived for arsenic, cadmium, chromium, lead, inorganic mercury, selenium, nickel, phenol, toluene and ethylbenzene. These values have formally replaced the ICRCL trigger concentrations, which have been officially withdrawn by the government and are no longer acceptable for use in assessing land contamination.

For free and complex cyanides, in accordance with the CLEA guidance, screening criteria have been derived by BWB using the Scotland and Northern Ireland Forum for Environmental Research (SNIFFER) framework for acute risk from cyanides as these values are more conservative than the equivalent chronic exposure screening criteria derived by CLEA.

Groundwater samples have been compared to the UK Drinking Water Standards (2000) (UKDWS) and surface water samples to the UK Environmental Quality Standards for Fresh Water (EQS).

Gas protection measures are usually assessed against CIRIA 149 'Protecting Development for Methane'. This offers a series of "Characteristic Situations".

## 7.2 Results of Soil Analysis

### 7.2.1 CLEA Contaminants

The CLEA assessment is made in four stages:

Stage 1 – The site is split into what is known as Averaging Areas, these are those sections of the site as determined by the assessor as being of a similar nature, this can be defined by strata, contaminant impact, location, development zones, etc.

Stage 2 – The samples are determined in a statistical calculation whereby all the samples (per contaminant) are combined to establish whether or not any particular sample is representative or not of the Averaging Area as a whole. This is known as the Maximum Value Test. A sample that is considered as representative of the whole is referred to as an '*inlier*' and one which is considered unrepresentative as an '*outlier*'.

Stage 3 – The samples are determined in a statistical calculation whereby all the samples (per contaminant) are considered against the mean value to determine whether or not the Averaging Area, as a whole meets the CLEA guidance value (known as the SGV). The mean value is considered against the four categories as described in CLEA as to whether or not a risk exists. This is known as the Mean Value Test.

Stage 4 – The outliers in Stage 2 are considered against the mean values in Stage 3 to determine if removing that (or those) samples from the Averaging Area render the balance acceptable from a risk perceptive. Thus indicating that those removed samples represent an Anomalous Zone (or hotspot).

In the first instance the whole site is considered to be one Averaging Area. Following the initial review, redefining of the Averaging Areas on site may be undertaken.

The normalised upper bound concentrations for each determinand have been compared to the relevant soil guideline value. Values for residential with plant uptake end use have been used. The results of soil testing are presented in **Appendix 5**.

**CLEA Contaminants**

The results of the CLEA assessment indicate that the majority of the inorganic compounds pass the mean value test, having normalised upper bound concentrations below the relevant screening criteria.

7.2.2 Non CLEA Metals and Metalloids

Where no SGV exists an assessment has been made against the BWB generic site assessment criteria (GSAC) calculated using the CLEA model.

Contaminants assessed in this way are:

Copper, zinc, beryllium and vanadium.

All contaminants passes the mean value test, having normalised the upper bound concentrations below the relevant screening criteria.

**Non CLEA Inorganic Compounds**

Where no SGV exists an assessment has been made against the SNIFFER GSAC and calculated against the CLEA model.

Contaminants tested in this way are:

Cyanide compounds and sulphur compounds

None of these contaminants exceeded their GSAC and none returned *outlier* results.

7.2.3 Non CLEA Organic Compounds

Where no SGV exists an assessment has been made against the SNIFFER GSAC and calculated against the CLEA model.

**PAH**

Of the organic compounds considered, none of elements of PAH's, exceeded their GSCA, having normalised upper bound concentrations below the relevant screening criteria.

**TPH**

TPH (banded) were tested for hydrocarbon contamination. TPH (banded) were tested in the areas of above ground storage tanks (UST's) and TPH fraction (C6-C40) were generally tested from across the site to delineate it in terms of hydrocarbon contamination. Analysis has indicated that none of the TPH species considered exceed the relevant screening criteria.

Asbestos

No Asbestos fibres were detected from any of the investigation locations.

## 7.3 Leachate Analysis

Results of the leachability testing indicate none of the contaminants tested are leachable.

## 7.4 Groundwater

The nearest watercourse is the River Dearne that becomes the Barnsley canal located approximately 500m north and 1.00Km East of the site.

There are five discharges to surface water within 250m of the site The nearest of these is located at Yorkshire water Services Ltd, Kendray Street and is estimated as 184m from the site to an accuracy of 100m.

There is one recorded groundwater abstractions within 400m of the site. This is located at C Cooper Limited with an unspecified location that is an estimated distance of 391m from the site but this distances is within 100m of accuracy.

Environmental Quality Standards (EQS) have been used as the screening criteria for the assessment of ground quality. Where there are no EQS values available, the UK Drinking Water Standard (DWS) have been used. The analytical results for groundwater samples collected from boreholes BH02, 03, 04 and 05 are presented in **Appendix 4**.

## 7.5 Chemical Analysis: Groundwater

The results of the groundwater assessment has indicated that the slightly elevated level of PAH (0.4 $\mu$g/l) when compared to the drinking water standard (0.1 $\mu$g/l) of PAH was recorded from BH03. considering the nearest watercourse is the River Dearne approximately 500m north and 1.00Km East of the site, it is unlikely that marginally elevated level of PAH will have any effect on these watercourses because of the distance and other natural attenuating processes of dilution and dispersions of contaminants. All other analytes were recorded below the screening criteria of specific element and presents no risk to groundwater and surface water receptors.

## 7.6 Ground Gas

Total three grounds of gas monitoring were carried out during the period of July14 2006 to August 14 2006 from BH01, BH02, BH03, BH04, and BH05. The results of the gas monitoring are presented in **Appendix 6**.

Gas protection measures are usually considered against CIRIA 149 'Protecting Development for Methane'. This offers a series of "Characteristic Situations".

Characteristic Situations 2, 3 and 4 are used to identify the appropriate gas protection measures required for a development. The 'Characteristic Situations' were originally formulated from Table 28 of Construction Industry Research and Information Association (CIRIA) Report 149. However, Table 4 of the 'Wilson and Card' paper, 'Reliability and Risk in Gas Protection Design' re-writes the criteria, which is used to formulate the 'Characteristic Situations'.

Table 28 of CIRIA 149 does not take into account the flow rates of Methane and Carbon Dioxide at levels less than 20% by volume in air. Table 5 'Wilson and Card', reproduced as **Table 7** below, takes into account the flow rate of both Carbon Dioxide and Methane.

**Table 7: Characteristic Situation for Gas Protection**

| Characteristic situation (CIRIA 149) | Partners in Technology gas regime | Limiting borehole gas flow of CH4 or CO2 (litre / hour | Additional limiting factors | Typical source of generation |
|---|---|---|---|---|
| 1 | A | <0.07 | Methane not to exceed 1% by volume and Carbon Dioxide not to exceed 5% by volume | Natural soils with low organic content |
| 2 | B | <0.7 | Borehole air flow rate not to exceed 70 litre/hour otherwise increase to characteristic situation 3 | Natural soil high peat/organic content |
| 3 | C | <35 | | Old landfill, inert waste, mine working flooded |
| 4 | D | <15 | Quantitative risk assessment required to evaluate scope of protective measures | Mine working susceptible to flooding, completed landfill, inert waste (WMP 26b criteria) |
| 5 | E | <70 | | Mine working flooded inactive |
| 6 | F | >70 | | Recent landfill site |

A site which has recorded elevated levels of ground gas with low flow rates poses little risk, however a site which has recorded moderately elevated levels of ground gas with high flow rates poses a much greater risk.

A typical scope of measures for the 'Characteristic Situations' from CIRIA 149 is presented in Table 6 of the Wilson and Card paper, reproduced as **Table 8**.

**Table 8: Gas Protection Measures Applicable to Each Characteristic Situation**

| Characteristic situation (CIRIA 149) | Office / Commercial / Industrial Development |
|---|---|
| 1 | No special precautions |
| 2 | Reinforced concrete cast in-situ ground slab. All joints and penetration sealed. Waterproofing membrane and passively ventilated under floor sub-space. |
| 3 | Reinforced cast in-situ ground slab. All joints and penetration sealed. Possibly waterproofing membrane. Granular layer below slab passively vented to atmosphere with interleaved geo-composite strips or pipes |
| 4 | Reinforced concrete cast in-situ ground slab. All joints and penetration sealed. Gas resistant membrane and passively ventilated under floor sub-space. |
| 5 | Reinforced concrete cast in-situ ground slab. All joints and penetration sealed. Gas resistant membrane and passively ventilated under floor sub-space. In ground venting wells. |
| 6 | Reinforced concrete cast in-situ ground slab. All joints and penetration sealed. Gas resistant membrane and actively ventilated under floor sub-space, with monitoring. In ground venting wells. |

Generally, $CO_2$ was recorded elevated from BH01 in all monitoring events of which maximum of 3.4% was recorded in August 14 monitoring. BH05 and BH04 have recorded elevated of $CO_2$ (>1.5% but <5%) with low to moderate flow rates than the detection limit, no $H_2S$ were detected in any of the boreholes, however carbon monoxide at 25ppm was detected from BH01 in one of the monitoring periods (July 14 2006) only. No methane along with other gases was detected in any of the monitoring periods.

On the basis of the data collected from three monitoring events, it is concluded that due to the inconsistent concentration of $CO_2$ recorded from the boreholes it is recommended to carryout further gas monitoring of at least 4 rounds and on the basis of the results, it will be analysed whether the need of any gas protection measures are required.

## 7.7 Refined Pollutant Linkages

The risk posed by any contaminants in soil or groundwater will depend on the nature of the hazard, the probability of exposure, the pathway by which exposure occurs, and the likely effects on the receptors. A contaminant is defined in the Contaminated Land Exposure Assessment model (CLEA) as a substance that has the potential to cause harm, while a risk is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.

The following sections discuss all the identified sources, pathways and potential receptors in the context of the site and pollutant linkages which may represent a risk to human health and/or controlled waters and the building from the data gained from the Phase I ERA and the Phase II ground investigation.

### 7.7.1 Human Health

No source/sources of contamination have been identified and therefore presents no risk to human health receptors.

### 7.7.2 Buildings

No source of contamination detrimental to the building foundation structures have been identified and therefore present no risk to building receptor.

### 7.7.3 Controlled Waters

No contamination sources were found in exceedance of the environmental quality standard (EQS) for fresh water, or detrimental to the groundwater receptor, indicating no pollution linkages between source, pathway and receptor and presents no risk to controlled water receptor.

## 7.8 Revised Conceptual Site Model (CSM)

The risk from contaminated land [as defined by the Environment Act 1995] is *'that significant harm is being caused or there is a significant possibility of such harm being caused; or pollution of controlled waters is being, or is likely to be caused'*.

Risks presented by contaminated land depend not only on the nature of the potential contaminants, but also on the receptors at risk of pollution or harm, and the pathways by which contaminants may reach such receptors. Harm to human health may be directly or indirectly caused: directly through access to the site and exposure to contaminants; indirectly when contaminants are released or emitted from a site to the surrounding environment.

The environment, particularly water, may be harmed by emissions, discharges or other migration of contaminants in sufficient quantities from a site. A source - pathway - receptor approach should therefore be adopted for the assessment of harm to human health and the environment.

The site remained relatively undeveloped until the late 1960's to early 1970's. The site use up to this period was residential with open gardens and plantations. This was replaced with an electricity board depot the buildings of which still remain today.

The surrounding area to the west has been developed since the mid nineteenth century. The land immediately adjacent to the site has been railway land up to about1987 with associated heavy industries existing into the mid twentieth century. Industrial works known to have existed were a foundry and a timber yard. A small colliery "Boro Colliery" existed from the1930's until the 1960's located approximately 150m east of the site.

The collation of the data obtained from 2006 intrusive investigation have enabled the delineation of the area of the site in terms of potential contamination issues identified in the desk study, the chemical testing and analysis has indicated no presents of such contaminants (organic & inorganic) elevated than the generic site assessment criteria (GSAC) and presents no detrimental risk to the environment and in particular to the future site users as commercial/industrial purposes.

## 7.9 Outline Remediation Statement

It is considered that the site does not require any remediation prior to the proposed development as the commercial end use.

## 7.10 ENVIRONMENTAL LIABILITY ASSESSMENT

No contamination issues have been identified at the site, therefore, no environmental liabilities towards contamination exists.

# 8.0 GEOTECHNICAL ASSESSMENT

## 8.1 Limitations

The following geotechnical assessment may need to be revised if the forms of development or ground conditions are subsequently found to vary from those assumed by this report.

## 8.2 Mining

A Coal Authority report has been commissioned by BWB which indicates that the site lies in an area where coal exists near surface that may have been worked in the past. Published geological information and subsequent site investigation works suggest that two coal seams are present beneath the site within 15m of the existing ground surface.

The Coal Authority holds records that indicate the site is within the likely zone of influence from the working of four deep seams, at depths of between 50m and 350m although ground movement relating to these workings should now have ceased. No records of any mine entries within 20 metres of, the boundary of the property are held by Coal Authority. The Coal Authority report recommends, "in view of the mining circumstances a prudent developer should seek appropriate technical advice before works are undertaken on site".

As a result a "Mining Report" was undertaken by Wardell Armstrong (June 2001) specifically relating to mining issues in relation to development of the site. This report concluded that the site is considered stable with respects to past deep coal mining.

This mining report concluded that the shallowest seam is known locally as the Winter (Abdy) and the lower seam is known as the Top Beamshaw. Mine abandonment plans relating to an adjacent colliery indicate that the Winter Seam has been worked as far west as Harborough Hill Road. The Beamshaw seam is not known to have been worked. The mining report concluded that "the Beamshaw Seam(s) are thin, inconsistent and/or poor quality and very unlikely to have been worked beneath the site".

Site investigation works suggest that the second shallowest seam recorded on site is split in two by a thin mudstone band.

This report concludes that there is a potential for unrecorded shallow mine workings across the eastern third of the site. Wardell Armstrong recommended that further investigation and stabilisation is carried out by drilling and pressure grouting over the construction footprint and a 3m additional perimeter.

The shallowest coal seam (seam 1) as been proven within up to 6.4m (90.6m AOD) of the existing ground surface and has been recorded at between 0.4m to 1.0m thickness.

The site investigations undertaken to date have recorded an over-deepened area of backfilled ground in the northeast of the site (as indicated on **Figure 2**). In addition only a 0.4m thickness layer of coal was proven by one of the two boreholes drilled in this area over the anticipated level of the shallowest coal seam.

In summary:

- There is a high risk of voids migrating to the surface from unrecorded older mine workings is present over areas of the site underlain by the Winter Seam (assumed to be Seam 1).
- There is a low risk of voids migrating to the surface from unrecorded older mine workings is present over areas of the site underlain by the Beamshaw Seam (assumed to be seam 2).
- An area of over-deepened made ground in the north east of the site may represent historical shallow opencast/bell pit excavation associated with the Winter Seam.

The eastern half of the footprint of the proposed 45,000 $ft^2$ retail unit is currently shown to be underlain by a potential zone of instability associated with shallow coal mining of the Winter Seam and an area of over-deepened made ground possibly associated with older mining activities.

The smaller 3,000 $ft^2$ retail/restaurant unit is also positioned over a potential zone of instability associated with the Winter Seam estimated to be between 3m to 6.4m below existing ground level in the area of the building.

In addition site access roads and part of the car parking areas are also shown to be underlain by potential zone of instability associated with shallow coal mining of the Winter Seam and an area of over-deepened made ground possibly associated with older mining activities.

These areas will require appropriate remedial measures prior to construction of pavements and structures.

The following options are available with respects to possible remedial works to these areas:

**45,000 ft$^2$ Retail unit**

| | |
|---|---|
| **Foundation Issues** | • Part Cut (<1m) Part Fill (<3.0m) finished formation level.<br>• Localised area of made ground over eastern part of building footprint (up to 3.2m deep below existing ground level)<br>• Eastern half of building over zone of potential mining instability |
| **Option 1 – Grouting and Ground Improvement**<br>• No piling required<br>• Imported structural fill required.<br>• Deep ground improvement required.<br>• Further investigation required. | • Over-excavate where coal seam present within 2m of existing ground level and backfill with structural fill.<br>• Trial grout remaining area of potential instability below and within 3m of the footprint of the building.<br>• Ground improvement of remaining area of made ground beneath slab.<br>• Up fill beneath building using suitably compacted structural fill.<br>• Ground bearing slab bearing upon improved ground/structural fill.<br>• Large shallow pad foundations bearing upon structural fill/improved ground/weathered mudstone bedrock, with limited bearing pressures. |
| **NB** Further investigations should be undertaken to determine the extent of over-deepened made ground over these areas and depth and thickness of voids over this area in order to provide the most cost effective solution. | |
| **Option 2 – Part Piled Foundations/Slab with transition zone**<br>• No grouting required.<br>• No Deep ground improvement required.<br>• Options to incorporate general bulk fill beneath piled slab. | • Piled columns and slab bored into bedrock below level of coal seam over zone of potential mining instability.<br>• Deep trench/pad foundations bearing onto weathered mudstone bedrock/structural fill material over remaining area.<br>• Transition zone between two areas comprising structural fill and piled slab/columns at larger spacing. |
| **Option 3 – relocate building** | • It may be feasible to relocate the footprint of the proposed structure further west to avoid adverse foundation conditions. |

**3,000 ft$^2$ retail/restaurant unit**

| | |
|---|---|
| **Foundation Issues** | • All cut (< 1m)<br>• All building over zone of potential mining instability within coal seam 3m to 6m below existing ground level. |
| **Option 1 – Grouting**<br>• No piling required<br>• Ground bearing slab. | • Trial grout area of potential instability below and within 3m of the footprint of the building.<br>• Ground bearing slab.<br>• Large shallow pad foundations bearing upon weathered mudstone bedrock. |
| **Option 2 – Part Piled Foundations with cellular raft/ ground beams supporting slab**<br>• No grouting required. | • Piled columns bored into bedrock below level of coal seam over zone of potential mining instability.<br>• Building slab supported of ground beams between piles or a cellular raft construction. |
| **Option 3 – relocate building** | • It may be feasible to relocate the footprint of the proposed structure further west to avoid adverse foundation conditions. |

**Access Roads/Car parking areas**

| | |
|---|---|
| **Foundation Issues** | • over zone of potential mining instability within coal seam 0m to 6m below existing ground level. |
| **Option 1 – Do nothing** | • Accept risk of potential void migration beneath pavement areas. |
| **Option 2 – High strength geotextile/geo-grid.**<br>• Cost effective risk management. | • Incorporate high strength geotextile/geo-grid beneath pavement construction/areas of embankment to prevent sudden catastrophic collapse of ground and allow time for further remedial works to be undertaken. |
| **Option 3 – Grouting**<br>• Limits risk<br>• No further maintenance costs / remedial works required. | • Over-excavate where coal seam present within 2m of existing ground level and backfill with structural fill.<br>• Trial grout over remaining areas of potential instability beneath pavements and access roads. |

## 8.3 Foundations to Structures

No design foundation loads/ required slab bearing pressures are available at the time of writing.

A localised area of made ground comprising gravelly clay with gravel and cobbles of brick, limestone and sandstone with ash, clinker, coal, polythene and glass fragments has been recorded between 1.5m to 3.2m depth over the north east part of the site.

These soils are of a variable composition and consistency and will not be suitable as a founding stratum without further ground improvement.

As outlined in **Section 8.2**, alternate foundation options exist which are primarily driven by the appropriate remedial works adopted over areas of potential mining instability.

Foundations should bear upon natural weathered mudstone soils. Shallow foundations bearing upon firm to stiff clay a minimum of 1m below existing ground level (completely weathered mudstone) should be limited to allowable bearing pressures of less than 150kN/$m^2$ in order to limit estimated total settlements to less than 25mm. higher bearing pressures can be achieved by taking foundations deeper onto very weak mudstone bedrock. Shallow thicknesses (<1m) of made ground soil beneath ground bearing slabs should be suitably improved by compaction.

It may be required to found shallow foundations upon localised areas of over-deepened made ground. These areas of made ground should be suitably improved by deep vibro-compaction or installation of vibro-stone/concrete columns. Consultation with specialist ground improvement contractors should be undertaken in order to establish the appropriate allowable bearing pressures of improved ground. For preliminary purposes an allowable bearing pressures in the order of 80 kN/$m^2$ should be assumed achievable following suitable ground improvement.

The base of shallow foundations should be inspected prior to placement of any concrete and any unsuitable made ground soils should be over excavated and backfilled with mass concrete or suitable compacted structural fill. Buried structures should be over excavated and similarly backfilled beneath footings. Care should be taken to prevent footings becoming wet prior to concreting. Foundation excavations should not be left open overnight they have been previously blinded with lean mix concrete.

Piled foundations may be required to support column loads and piled slabs/ground beams. Piles will be required to be installed to minimum depths below the level of potentially undermined shallow coal seam on site. It is not anticipated that a driven piled solution will be appropriate due to the risk of premature refusal within the mudstone bedrock.

A bored pile solution will be required to achieve the required embedment depths. For preliminary purposes the allowable load capacity of a range of 300mm diameter to 600mm diameter bored piles driven to depths of between 5m to 10m depth can be expected to be between 300 kN to 1000 kN per pile.

Consultation with a specialist piling contractor should be undertaken in order to establish actual pile capacities and settlement tolerances for the chosen method of installation.

## 8.4 Earthworks

Cut and fill earthworks are proposed in order to accommodate the proposed development formation levels.

It is estimated that approximately 50% of material won from areas of cut will comprise asphalt/concrete surface materials and granular limestone/sandstone gravel base materials.

The remaining soils won from excavations are anticipated to comprise completely weathered mudstone bedrock/firm to very stiff clay soils.

In addition a significant amount of demolition material will arise from the subsequent demolition of the exiting buildings.

Subject to any environmental preclusions to their re-use it is anticipated that demolition and pavement material can be crushed and graded and re-incorporated back into the scheme as capping beneath pavements.

A limited amount of soil classification and compaction testing has been undertaken on weathered mudstone soils which indicate that these soils could be classified as Class 2C stony cohesive fill in accordance with DOT, Specification for Highway Works, series 600 document. These soils have recorded optimum moisture contents (OMC) between 12% and 17% under standard (2.5kg) compaction. Heavy compaction (4.5kg) has yielded OMC's of between 8% and 10%. The natural moisture contents measured in these soils ranged between 6% and 46% although generally decrease with depth. Typically soil moisture contents are below 18% below 1m depth.

Soil testing suggests that completely weathered firm to stiff clay soils at shallow depth may be too wet in their current condition to be re-incorporated back into the scheme as bulk general fill.

However these materials could be modified by addition of lime and or spreading and drying prior to use as general bulk fill. These materials should not be used as structural fill materials beneath structures.

Fines contents (less than 63 microns) of between 56% and 90% have been recorded in samples of weathered mudstone. Class 7C and 7D materials, "fill to reinforced earth structures" (DOT SHW, series 600) limits fines contents to less than 45%. This suggests that these soils will be unsuitable for re-use within reinforced earth slopes along the northern boundary of the site. This should be confirmed by consultation with a specialist reinforced earth contractor.

The suitability of earthworks materials has been assessed on the basis of the testing carried out as part of this investigation. The materials encountered on site may vary from those analysed; furthermore, inclement weather or winter working may result in materials being unsuitable for incorporation within the works without modification by lime, cement or other methods .In particular, cohesive soils are very susceptible to 'wet weathering working' and we strongly recommend that consideration should be given to lime and/or cement stabilisation of these materials if the earthworks are undertaken during inclement weather or the winter period.

Stockpiled materials often deteriorate due to water infiltration and they may become unsuitable for incorporation in the works; further testing and re-assessment should be made prior to the finalisation and implementation of the earthworks design.

## 8.5 Pavements

Car parking areas and access roads are shown associated with the proposed development.

Pavements are to be constructed in part upon areas of cut and areas of fill.

In-situ Californian Bearing Ration (CBR) testing has been undertaken on weathered mudstone sub-grade soils as part of the 2001 Soil Mechanics investigation. CBR values of between 4% and 7% were recorded during this investigation.

On consideration of the material properties and groundwater conditions prevalent over the site a preliminary design CBR of 4% has been assessed (in accordance with the Design Manual for Roads and Bridges, Volume 7, Section 2, Part 2) for use in pavement design.

Confirmatory CBR testing should be undertaken on both sub-grade soils and areas of fill prior to finalisation of the pavement design.

Sub-grade soils are predominantly cohesive and will deteriorate if water is allow to collect beneath pavements. All paved areas should have suitable cross falls and appropriate surface drainage incorporated into the pavement design.

Formation levels should be proof rolled prior to pavement construction and placement of fill materials, any soft spots should be over-excavated and replaced with suitably compacted structural fill material.

## 8.6 Buried Concrete

Soil sulphate testing was undertaken as part of the soil Mechanics 2001 and BWB 2006 site investigations.

Water sulphate testing has also been undertaken on samples of groundwater as part of this study.

This information suggests that a design sulphate class for this site of DS-1 would appear to be appropriate to this site, in accordance with BRE special digest 1 (2005) "Concrete in Aggressive Ground".

## 8.7 Excavations

Excavations for services and footings up to 2m depth are anticipated to be within the capacity of typical earthmoving plant through made ground.

Locally, less weathered areas of rock and localised obstructions within the made ground may require breaking and loosening before excavation using a hydraulic pecker or equivalent.

Excavations in excess of 4.00m depth may encounter seepage and/or groundwater inflows. Such excavations are not currently proposed.

Excavations should remain open in the short term although it is not recommended that site personnel enter any excavation deeper than 1.2m without further proprietary support. Continuous support to the face of the excavation will be required to prevent slumping of the pit sides into the excavation.

Earthmoving plant and machinery should be prevented from trafficking within a distance of equivalent to the depth of the excavation.

## 8.8 Retaining Structures

Minor (< 1m) retaining structures are proposed along the southern boundaries of the site where it is proposed to cut into existing ground to create formation levels.

Reinforced concrete/brick cavity walls should be suitable along these areas. The soil mechanics 2001 report gave suggested design parameters to be used in retaining wall design (**Table 9**).

**Table 9 Retaining Wall Design Parameters**

| Preliminary Design Parameter | Mudstone bedrock |
|---|---|
| Shear strength (total stress) | 50kPa increasing to 200kPa directly above bedrock |
| Shear strength (effective stress) | Completely weathered c′ = 0 kPa<br>Ø′ = 28°<br>Bedrock c′ = 0 kPa<br>Ø′ = 35° |
| Bulk density | Completely weathered = 19 kN/m$^2$<br>Bedrock = 21 kN/m$^2$ |
| As recommended in r Soil Mechanics 2001 geotechnical report page, section 7.4 page 13.<br>Values should be confirmed in-situ during or prior to construction once position/type of wall is confirmed. | |

It is proposed to up-fill adjacent to the northern boundary of the site by up to 3.5m. As a result the site will require a retaining structure up to 3.3m in height along the northern boundary of the site.

An existing 2m to 3m high slope currently bounds the north-west part of the site. This slope has been created by cutting into the existing ground level to create side slopes of between 1V:3H to 1V:2H.

The existing surface of this slope surface has been gullied and eroded by water runoff to expose the underlying weathered mudstone bedrock.

The proposed ground level can be retained by one of the following methods:

- Reinforced earth slope.
- Crib /gabion wall
- Reinforced concrete wall.

It may be required to found these structures on or near the crest of the existing slope in the northeast of the site. If so it should be established that the existing slope has sufficient strength to support the proposed structure. Stability analysis of the overall slope plus proposed structure should be undertaken in addition to the local design of the structure itself. This is beyond the scope of this report.

In addition construction/drainage details should be implemented to prevent further erosion of the slope surface and possible undermining of any proposed structure founded above.

As stated in **Section 11.4**, the limited laboratory soils testing undertaken to date suggests that no materials won from cut excavations on site will be suitable as class 7C and 7D materials, "fill to reinforced earth structures" (DOT SHW, series 600). The potential to re-use of site materials within reinforced earth slopes should be explored through consultation with a specialist reinforced earth contractor.

# 9.0 CONCLUSIONS AND RECOMMENDATIONS

## 9.1 Environmental Issues

The Phase I assessment indicates that the site represents a **MODERATE** human health risk, a **LOW** risk to future buried structures and a **LOW** risk controlled waters risk.

The Phase II ground investigation and risk assessment, based upon the source-pathway-receptor has been undertaken in order to identify potential human health contamination issues associated with the proposed redevelopment of the site.

Testing for a range of contaminants was undertaken on the soil samples from trial pits/boreholes located across the site. None of the contaminants tested exceeded the relevant screening criteria. As a result no source/sources of contamination have been identified and therefore presents no risk to human health or building receptors.

Environmental Quality Standards (EQS) have been used as the screening criteria for the assessment of ground quality. Where there are no EQS values available, the UK Drinking Water Standard (DWS) have been used. Slightly elevated levels of PAH (above levels recommended by the drinking water standard recorded from BH03. However, as the nearest water course is approximately 500m north and 1000m east of the site it is considered that natural attenuating processes of dilution and dispersion will limit PAH contamination of these water courses.

Five grounds of gas monitoring were carried out during the period of July14 2006 to August 14 2006. Only slightly elevated $CO_2$ concentrations and flow rates have been recorded corresponding to CIRIA 149 Characteristic Situation 1 is present within the monitoring areas, indicating that no special precautions are required.

It is considered that the site does not require any remediation prior to the proposed development as the commercial end use.

No contamination issues have been identified at the site, therefore, no environmental liabilities towards contamination exists.

The environmental risk assessment has therefore been reduced to an overall rating of NEGLIGIBLE.

A waste criteria assessment should be carried out should any material be identified for disposal off-site.

## 9.2 Geotechnical Issues

The site is known to be located within an area that may have been affected by past mining activities. Two coal seams are known to sub-crop beneath the site. It is anticipated that the rock beneath the site will dip approximately towards the southeast. There is a high risk of voids migrating to the surface from unrecorded older mine workings within the shallowest of these seams known to underlie the eastern part of the site. Furthermore, area of over-deepened made ground in the north east of the site may represent historical shallow opencast/bell pit excavation associated with this seam.

Structures, car parking areas and access roads currently proposed over parts of the site are underlain by this zone of potential instability and will require appropriate remedial measures prior to construction of pavements and structures.

Several options with relation to construction over these particular areas are given, these options include:

- Grouting and Ground Improvement
- Partially piled foundations/slab
- Cellular raft foundations beneath smaller retail units
- Incorporation of a high strength geo-textile/grid beneath pavement areas.

A localised area of made ground has been recorded between 1.5m to 3.2m depth over the north east part of the site overlying weathered mudstones of the underlying Middle Coal Measures rocks.

It is not recommended that foundations to column or conventional ground bearing slabs be constructed directly upon unimproved made ground soils. Shallow foundations should bearing upon natural firm to stiff clay a minimum of 1m below existing ground level (completely weathered mudstone) should be limited to allowable bearing pressures of less than 150kN/$m^2$. Shallow thicknesses (<1m) of made ground soil beneath ground bearing slabs should be suitably improved by compaction.

Deeper areas of made ground may require deep ground improvement such as vibro-compaction or installation of vibro-stone/concrete columns. Consultation with specialist ground improvement contractors should be undertaken in order to establish the appropriate allowable bearing pressures of improved ground.

Piled foundations may be required to support column loads and piled slabs/ground beams. Consultation with a specialist piling contractor should be undertaken in order to establish actual pile capacities and settlement tolerances for the chosen method of installation.

Cut and fill earthworks are proposed in order to accommodate the proposed development formation levels. It is estimated that approximately 50% of material won from areas of cut will comprise asphalt/concrete surface materials and granular limestone/sandstone gravel base materials. The remaining soils won from excavations are anticipated to comprise completely weathered mudstone bedrock/firm to very stiff clay soils.

Subject to any environmental preclusions to their re-use it is anticipated that demolition and pavement material can be crushed and graded and re-incorporated back into the scheme as capping beneath pavements.

Soil testing suggests that completely weathered firm to stiff clay soils at shallow depth may be too wet in their current condition to be re-incorporated back into the scheme as bulk general fill.

However these materials could be modified by addition of lime and or spreading and drying prior to use as general bulk fill. These materials should not be used as structural fill materials beneath structures.

Excessive fines contents (less than 63 microns) of have been recorded in samples of weathered mudstone compared with the requirements reinforced earth fill (Class 7C and 7D materials, DOT SHW, series 600). The re-use of this material as reinforced earth fill should only be considered following consultation with a specialist reinforced earth contractor.

Sub-grade soils are predominantly cohesive and will deteriorate if water is allow to collect beneath pavements. All paved areas should have suitable cross falls and appropriate surface drainage incorporated into the pavement design.

Soil sulphate testing suggests that a design sulphate class for this site of DS-1 would appear to be appropriate to this site, in accordance with BRE special digest 1 (2005) “Concrete in Aggressive Ground”.

It is proposed to up-fill adjacent to the northern boundary of the site by up to 3.5m. As a result the site will require a retaining structure up to 3.3m in height along the northern boundary of the site. Stability analysis of the overall slope plus proposed structure should be undertaken in addition to the local design of the structure itself. This is beyond the scope of this report.

In addition construction/drainage details should be implemented to prevent further erosion of the slope surface and possible undermining of any proposed structure founded above.

## 9.3 Further Work

- Options to relocate proposed buildings should be explored.

- Further confirmatory drilling to determine the potential for worked coal seams beneath the footprint of the proposed building should be undertaken prior to any development.
- Further trial pitting should be undertaken to determine the extent of the localised area of made ground over the north east of the site.
- Global stability of retaining structures overlying existing slopes along the northwest boundary should be undertaken.
- Consultation with specialist contractors should be undertaken to establish the potential to re-use won materials within reinforced earth structures.
- Consultation with specialist bored pile contractors should be undertaken to establish pile capacities and settlement tolerances if piled foundations required.
- Trial grouting/further open hole drilling may be required beneath areas where it is proposed to stabilise potential mine workings.

.

# FIGURES

# FIGURE 2

# SITE LAYOUT PLAN

NOTES

1. DO NOT SCALE THIS DRAWING. ALL DIMENSIONS MUST BE CHECKED/ VERIFIED ON SITE. IF IN DOUBT ASK.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL LEVELS IN METRES UNLESS NOTED OTHERWISE.
4. ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

# LEGEND

BWB Geoenvironmental Site Investigation 2006

- BOREHOLE/PIEZOMETER
- TRIAL PIT
- INSPECTION PIT

Soil Mechanics Site Investigation 2001 (Approximate Positions Only)

- BOREHOLE/PIEZOMETER
- TRIAL PIT
- WINDOW SAMPLER

| Rev | Date | Description | Drawn | Auth'd |
|---|---|---|---|---|

AMENDMENTS


BWB CONSULTING

**Integrated Engineering and Environmental Consultants**

Whitehall Waterfront 2 Riverside Way Leeds LS1 4EH
**T** 0113 233 8000 **F** 0113 245 0654 **W** bwbconsulting.com

environmental | water | transportation | civil | structural | highways | infrastructure


Client

**KENNET PROPERTIES**

Project Title

HARBOROUGH HILL ROAD
BARNSLEY

Drawing Title

EXPLORATORY HOLE
EXISTING SITE LAYOUT
PLAN

| Scale | Date | Drawn | Authorised |
|---|---|---|---|
| NTS | 01.01.02 | MVB | |

Drawing Status

DRAFT

Drawing No: FIGURE 2

Revision

Y:\Shmcl\ABC\ABC

A3

© Copyright BWB Consulting Ltd

# FIGURE 3

# PROPOSED DEVELOPMENT PLAN

THIS DRAWING IS COPYRIGHT AND MAY NOT BE REPRODUCED
IN WHOLE OR PART WITHOUT WRITTEN AUTHORTY
DO NOT SCALE OFF THIS DRAWING

REVISIONS

A. Revised to include latest highways amendments 29.11.04 CAB
B. Amended footbridge to harborough hill road and parking configuration 13.12.04 CAB
C. Vehicle entrance moved to Harborough Hill Road and Parking Configuration Revised 15.04.05 DJM
D. Revised to suit latest CPO information 09.05.05 CAB
E. Removed Parking from Network Rail Site 06.06.05 CAB
F. Modified alternative entrance from Harborough Hill Road. 20.06.05 DW
G. Revised Red Line and site area 30.06.05 CAB

PLANNING ISSUE

H. Included development option to NHS Site 22.03.06 CAB
J. Increased scheme to 45K 07.04.06 CAB

Land owned by Network Rail. Possible parking facility for owner of site to be accessed through the application site. Secure gated access would maintain private parking

New Interchange proposes bridge Link across Interchange Way. Possible External Vertical circulation core to egress into site subject to design and construction by others

Green Sprint Link to Town Centre

Existing sub station retained with existing access/egress and enhanced landscaping to perimeter

151 Parking Spaces

1in30 ramp from entrance to sub station access

Sub Station

3,000 sqft unit for retail/ restaurant
FFL +97.50

Vehicle manouvre area

Service area to retail unit with perimeter acoustic fence and enhanced landsape treatment to housing

45,000ft²/ 4180.6m² Retail Unit, Divisible FFL. 95.65

Freeform canopy roof over new retail unit

Service out only

Harborough Hill Road

95.97 EXISTING LEVELS
95.50 PROPOSED LEVELS

EXTENT OF SITE
18,550m²
4.85 Acres
1.85 Hectares

As part of the Green Sprint concept by the council a footbridge is proposed over Harborough Hill Road. The Footbridge indicated on the drawing is Indicative only and will be designed and constructed by others at a future date. What is drawn does not represent an image of a final structure.

MOTRAM HALL
MOTTRAM STREET
OTTAWA STREET

STATUS
DESIGN

PROJECT & LOCATION
PROPOSED DEVELOPMENT
HARBOROUGH HILL ROAD
BARNSLEY

CLIENT
THAMES WATER PROPERTY

DRAWING TITLE
SITEPLAN

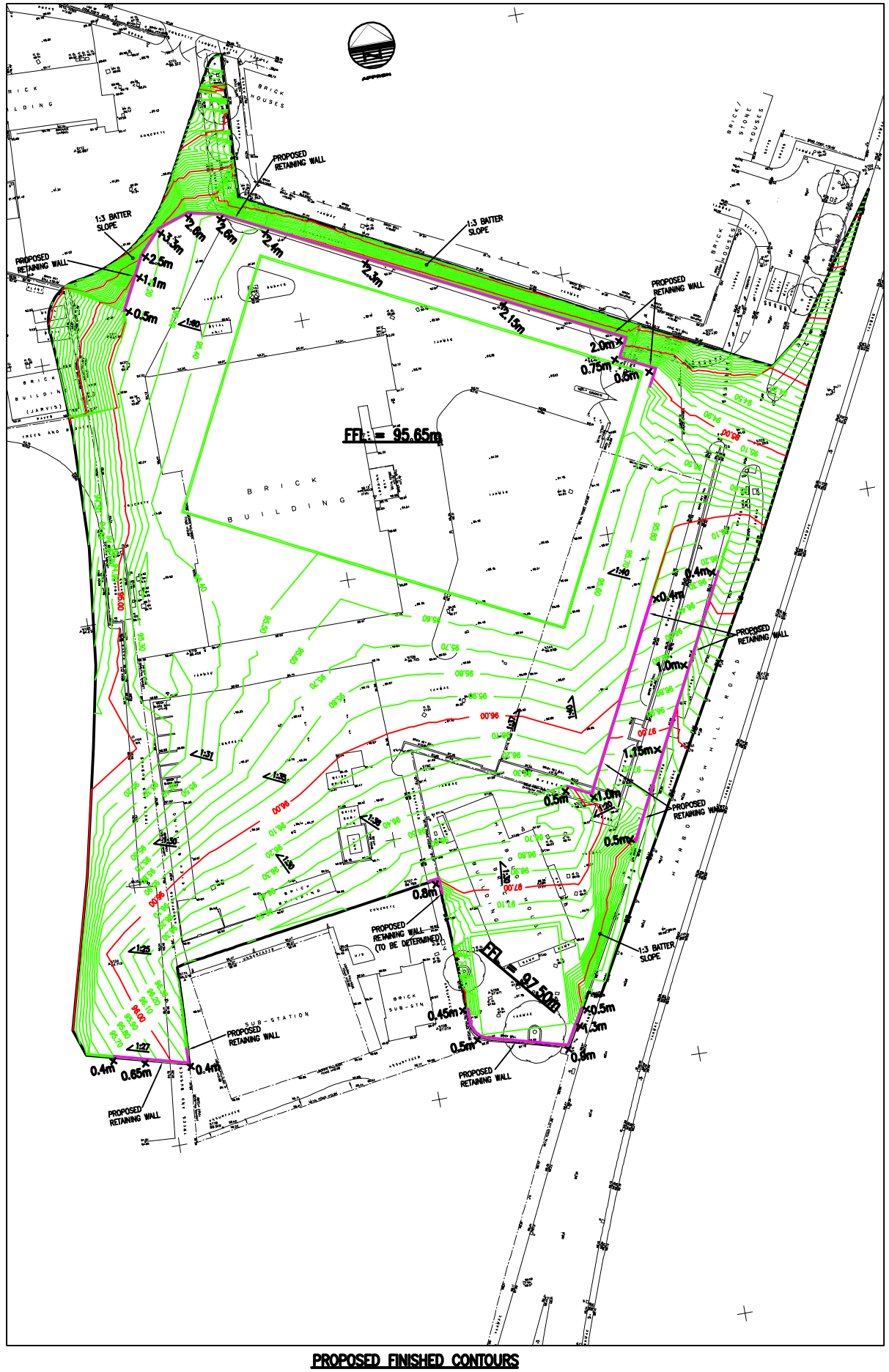
| JOB No | DWG No | REV | SCALE | DATE |
|---|---|---|---|---|
| 6935 | 105 | J | 1:500 @ A2 | NOV 04 |

CAD FILE REF: J:\PROJECT\6001-7000-6935
DRAWN: CAB

ARCHITECTS
PROJECT MANAGERS
2 St. JOHNS NORTH
WAKEFIELD WF1 3QA
TEL. 0192 429 1800
FAX. 0192 429 0072
email: cartbrelm@harrispartnership.com
Wakefield : Newport Pagnell : Manchester
THE HARRIS PARTNERSHIP

# FIGURE 4

# PROPOSED CUT AND FILL EARTHWORKS




PROPOSED FINISHED CONTOURS




CUT/FILL ISOPACHYTES
PROPOSED FORMATION LEVELS TO EXISTING SITE STRIP

| PROPOSED DEVELOPMENT – HARBOROUGH HILLS ROAD – BARNSLEY VOLUMETRIC ANALYSIS (13.04.06) | | | |
|---|---|---|---|
| EXISTING HARD PAVED SITE STRIP AT 300mm (MATERIAL TO BE CRUSHED AND REUSED AS 6F2 CAPPING. DEPTH AND MATERIALS TO BE VERIFIED) | | | |
| HARD PAVED STRIP AREA: 14501m²<br>HARD PAVED STRIP VOLUME: 4350m³ | | | |
| CUT/FILL VOLUMES | | CUT (m³) | FILL (m³) |
| PROPOSED FORMATION LEVELS TO EXISTING GROUND LEVELS. | GROSS | 7459 | 8271 |
| | NETT | | 812 |

NOTES

1. DO NOT SCALE THIS DRAWING. ALL DIMENSIONS MUST BE CHECKED/ VERIFIED ON SITE. IF IN DOUBT ASK.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL LEVELS IN METRES UNLESS NOTED OTHERWISE.
4. ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
5. BWB PROPOSED EARTHWORKS ANALYSIS, INCLUDING SITE STRIP, IS INDICATIVE ONLY. IT IS BASED ON THIRD PARTY INFORMATION AND GENERAL ASSUMPTIONS AND SHOULD BE READ IN CONJUNCTION WITH THE BWB EARTHWORKS SPECIFICATION DOCUMENT.
6. BWB DO NOT ACCEPT RESPONSIBILITY FOR VARIATIONS IN THE ACTUAL DEPTH OF SITE STRIP OR ANY OTHER ON SITE EARTHWORKS WHICH MAY EFFECT THE RESULTING VOLUMES. THE CONTRACTOR SHALL UNDERTAKE AN INDEPENDENT ANALYSIS OF PROPOSED EARTHWORKS TO SATISFY HIMSELF AS TO THE VALIDITY OF THE INFORMATION PROVIDED.
7. THE SPECIFICATION FOR HIGHWAY WORKS (SHW) SERIES 600 (1998) PUBLISHED BY HMSO SHALL FORM THE BASE SPECIFICATION FOR ALL EARTHWORKS AND THE CONTRACTOR SHALL BE RESPONSIBLE FOR CLASSIFICATION, TESTING, PLACING AND COMPACTION OF MATERIAL IN ACCORDANCE WITH CLAUSES 601, 602, 603, 608, 612 AND 613.
8. ISOPACHYTE CONTOURS/VOLUMETRIC ANALYSIS REPRESENT APPROXIMATE CUT AND FILL VOLUMES BETWEEN THE PROPOSED FORMATION LEVELS AND THE EXISTING GROUND AFTER STRIPPING OFF 300mm SITE STRIP.
9. APPROXIMATE EARTHWORK VOLUMES HAVE BEEN DETERMINED BASED ON THE FOLLOWING ASSUMPTIONS/CAVEATS: –
   (i) SITE STRIP IS ASSUMED TO BE 300mm.
   (ii) FORMATION LEVEL OF CARRIAGEWAY, FOOTWAY, VERGE, BATTERS AND EXTERNAL WORKS ASSUMED TO BE 450mm BELOW FINISHED CONSTRUCTION LEVEL.
   (iii) FORMATION LEVEL OF BUILDINGS ASSUMED TO BE 450mm BELOW FINISHED FLOOR LEVEL.
   (iv) NO BULKING FACTORS HAVE BEEN CONSIDERED.
   (v) ARISINGS FROM DRAINAGE AND FOUNDATION EXCAVATIONS NOT CONSIDERED.
10. EXISTING GROUND AS TOPOGRAPHICAL SURVEY UNDERTAKEN BY ELLAM LAND SURVEYS DATED OCTOBER 2003. (FURTHER SURVEY WORK REQUIRED AS INDICATED)
11. PLOT BOUNDARIES AND BUILDING AND EXTERNAL WORKS FOOTPRINTS SHOWN ON THIS DRAWING ARE INDICATIVE ONLY, BASED ON THE LATEST MASTERPLAN DRAWING.

KEY

- 83.00 — FINISHED MAJOR CONTOUR LEVEL
- 82.80 — FINISHED MINOR CONTOUR LEVEL
- 1.00 — DENOTES DEPTH OF FILL
- 0.80 — DENOTES DEPTH OF FILL
- -1.00 — DENOTES DEPTH OF CUT
- -0.80 — DENOTES DEPTH OF CUT
- 0.00 — DENOTES DEPTH OF ZERO CUT/FILL
- ×2.0m — PROPOSED RETAINING WALL AND PROPOSED HEIGHT

| Rev | Date | Description | Drawn | Authrd |
|---|---|---|---|---|
| P1 | 13.04.06 | PRELIMINARY ISSUE | SLT | SC |

AMENDMENTS

BWB CONSULTING
Integrated Engineering and Environmental Consultants
Prospect House 32 Sovereign Street Leeds LS1 4BJ
T 0113 336 6000 F 0113 389 1150 W bwbconsulting.com
environmental | water | transportation | civil | structural | highways | infrastructure

Client: THAMES WATER PROPERTY

Project Title: PROPOSED DEVELOPMENT HARBOROUGH HILL ROAD BARNSLEY

Drawing Title: PROPOSED EARTHWORKS INFORMATION

| Scale | Date | Drawn | Authorised |
|---|---|---|---|
| NTS | APR '06 | SLT | SC |

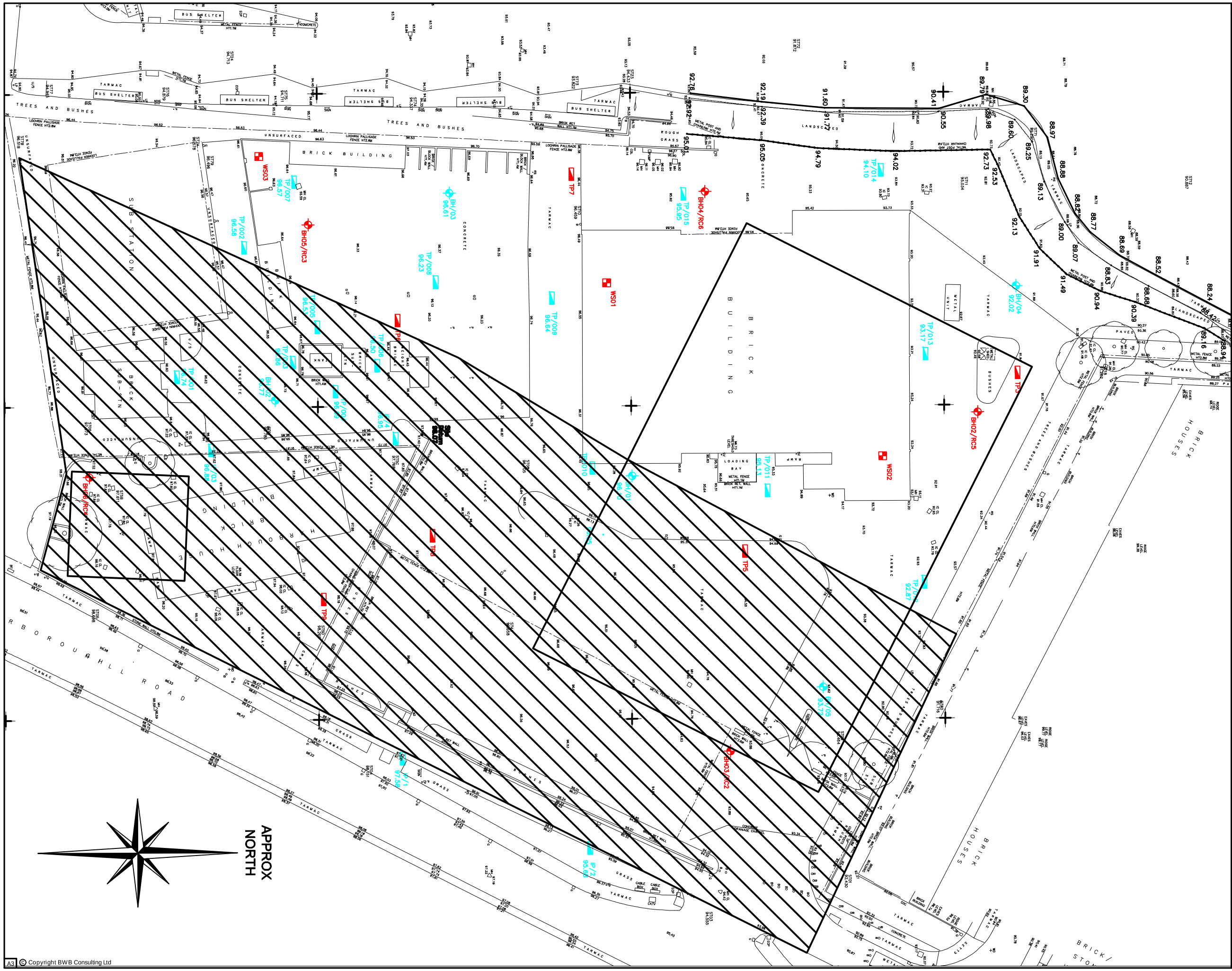
Drawing Status: PRELIMINARY

| Drawing No: | Revision |
|---|---|
| FIGURE 4 | P1 |

A1 © Copyright BWB Consulting Ltd

# FIGURE 6

# ESTIMATED EXTENT OF POTENTIAL INSTABILITY




NOTES

1. DO NOT SCALE THIS DRAWING. ALL DIMENSIONS MUST BE CHECKED/ VERIFIED ON SITE. IF IN DOUBT ASK.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL LEVELS IN METRES UNLESS NOTED OTHERWISE.
4. ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

# LEGEND

BWB Geoenvironmental Site Investigation 2006

- BOREHOLE/PIEZOMETER
- TRIAL PIT
- INSPECTION PIT

Soil Mechanics Site Investigation 2001 (Approximate Positions Only)

- BOREHOLE/PIEZOMETER
- TRIAL PIT
- WINDOW SAMPLER

PROPOSED BUILDING OUTLINE (APPROX)

ZONE OF POTENTIAL INSTABILITY ASSOCIATED WITH SHALLOW MINING

| Rev | Date | Description | Drawn | Authrd |
|---|---|---|---|---|

AMENDMENTS

BWB CONSULTING

**Integrated Engineering and Environmental Consultants**

Whitehall Waterfront 2 Riverside Way Leeds LS1 4EH
T 0113 233 8000 F 0113 245 0654 W bwbconsulting.com
environmental | water | transportation | civil | structural | highways | infrastructure

Client

**KENNET PROPERTIES**

Project Title

HARBOROUGH HILL ROAD BARNSLEY

Drawing Title

ZONE OF POTENTIAL INSABILITY ASSOCIATED WITH SHALLOW COAL MINING

| Scale | Date | Drawn | Authorised |
|---|---|---|---|
| NTS | 01.01.02 | MVB | |

Drawing Status: DRAFT

Drawing No: FIGURE 5

Revision

A3 © Copyright BWB Consulting Ltd

Y:/Series/ABC/ABC

# APPENDICES




Plate 1 – Centre of Site facing north.




Plate 2 – View from site facing Harbour Hill Road




Plate 3 – South of the site with outbuildings and derelict tank.




Plate 4- Derelict buildings in the south of the site.




Plate 5 – Redundant tank close up with electricity sub-station in the background.




Plate 6 – The south of the site viewing from the west.




Plate 7 – West of the site between central building and perimeter with bus depot.




Plate 8 – North of the site behind central building viewing east.

Considerations of Slope Stability




Plate 9 – Slope behind the south west corner of the site and the new road.




Plate 10 – Fractures in the roadway above the slope.




Plate 11 - Fractures in the roadway above the slope.




Plate 12 – Outwash from the slope below.




Plate 13 – Fractured bedrock immediately under the slope surface.




Plate 14 – Outwash was at frequent intervals along the slope.

Trial Pit and Inspection Pit Photographs

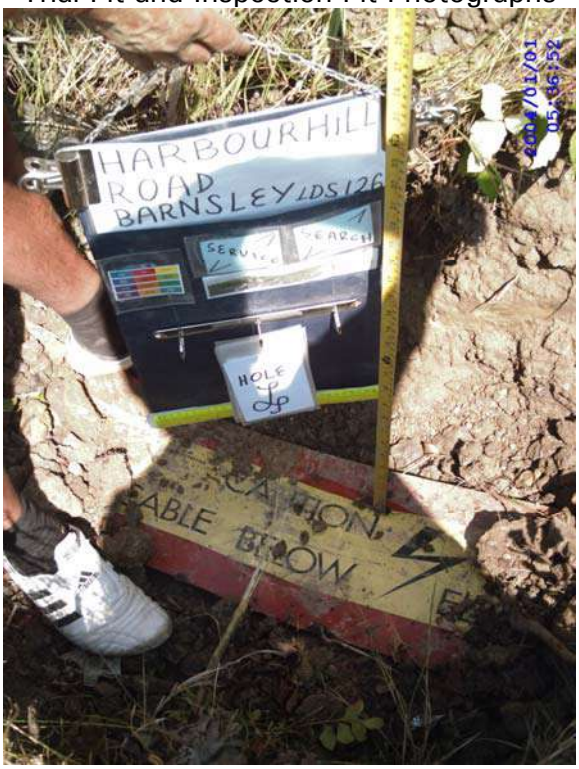



Plate 15 – Inspection Pit 4 where services were less than 0.50m from ground level.




Plate 16 – Trial Pit 6 For much of the site pavement consisted of reinforced concrete above a plastic sheet and limestone or sandstone fill.




Plate 17 – Drain chamber unearthed at the side of face A Trial Pit 7 The area was unfilled with pavement material.




Plate 18 – Made ground of cobbles and boulders to 1.50m bgL and sandy gravely clay to 2.00m bgL. This contained brick glass and fragments of polyethylene.



Plate 19 – Trial Pit 11 Made ground from faces A and D angular cobbles and boulders of sandstone and rare concrete to 1.90m bgL.




Plate 20 – Made ground was commonly above rockhead.



Plate 21 – Trial Pit 2 – Organic clay below made ground.

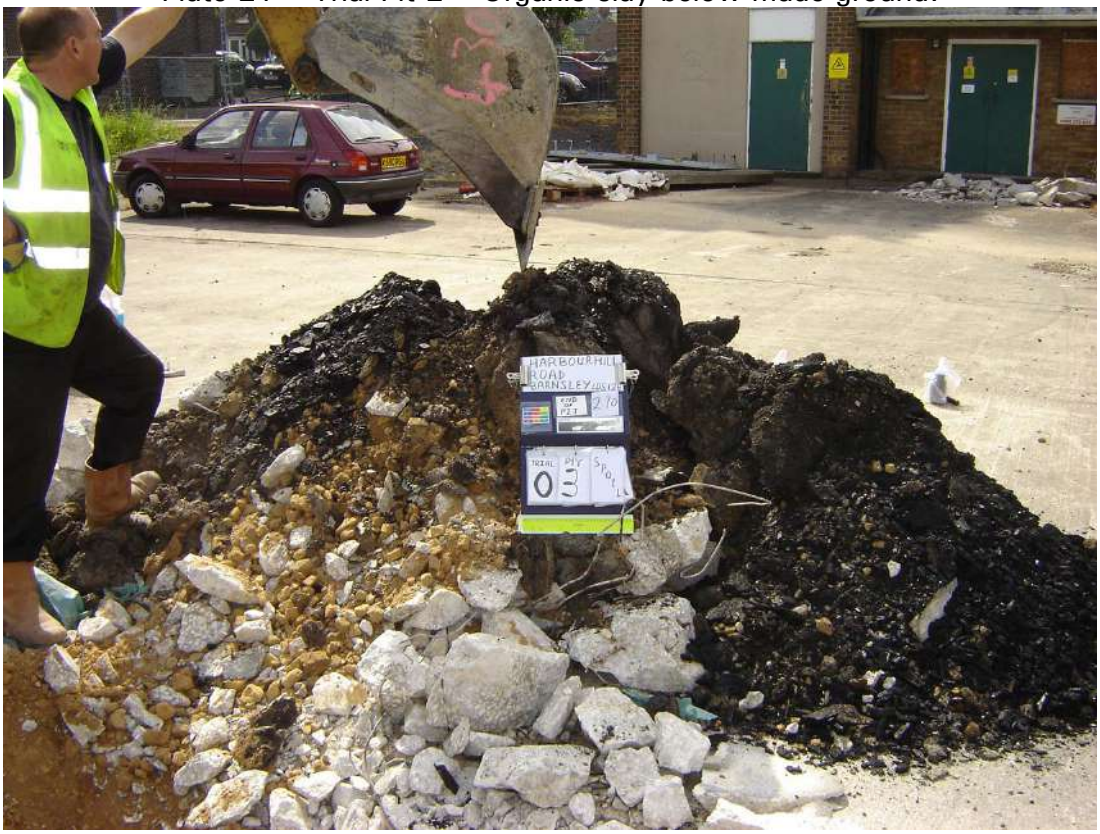



Plate 22 – Near surface coal extracted from Trial Pit 3




Plate 23 – Intact Coal in Trial Pit 6




Plate 24 – Near surface rockhead Trial Pit 14. The pit was complete at 2.40m bgL.

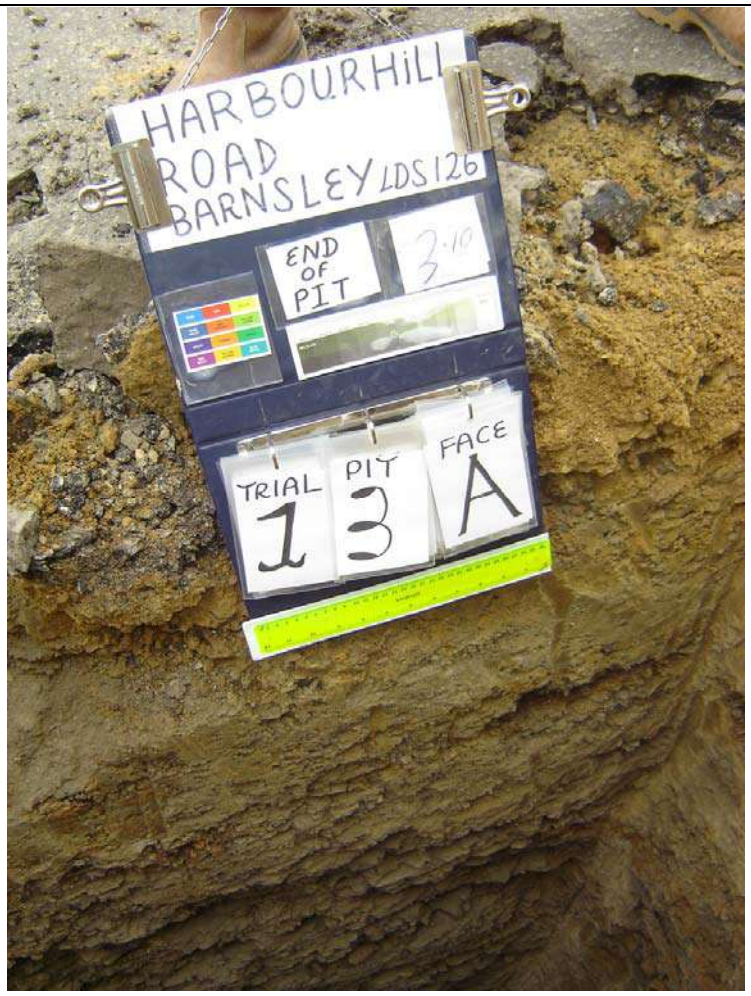



Plate 25 – Near surface rockhead Trial Pit 13. The pit was complete at 3.10m bgL.



Plate 26 – Bedrock recovered as sandy gravely cobbles of MUDSTONE.




Plate 27 – Near surface rockhead Trial Pit 08. The pit was complete at 1.50m bgL.

Core Logs




Plate 28 – BH01 Core Run 3.50 to 7.50 Box 1 of 9




Plate 29 – BH01 Core Run 6.00 to 10.00 Box 2 of 9




Plate 30 – BH01 Core Run 10.00 to 14.00 Box 3 of 9




Plate 31 – BH01 Core Run 12.50 to 18.50 Box 4 of 9




Plate 32 – BH01 Core Run 15.50 to 20.50 Box 5 of 9




Plate 33 – BH01 Core run 18.50 to 24.50 Box 6 of 9




Plate 34 – BH01 Core Run 20.50 to 24.50 Box 7 of 9




Plate 35 – BH01 Core Run 26.50 to 29.50 Box 8 of 9




Plate 36 – BH01 Core Run 29.50 to 30.50Box 9 of 9




Plate 37 – BH02 Core Run 3.50 to 6.50 Box 1 of 8




Plate 38 – BH02 Core Run 6.50 to 9.50 Box 2 of 8




Plate 39 – BH02 Core Run 9.50 to 14.00 Box 3 of 8




Plate 40 – BH02 Core Run 12.50 – 17.00 Box 4 of 8




Plate 41 – BH02 Core Run 15.50 to 20.00 Box 5 of 8




Plate 42 – BH02 Core Run 15.50 to 23.00 Box 6 of 8




Plate 43 – BH02 Core Run 20.00 to 27.00 Box 7 of 8




Plate 44 – BH02 Core Run 25.00 to 29.00 Box 8 of 8




Plate 45 – BH03 Core Run 2.50 to 6.50 Box 1 of 9




Plate 46 – BH03 Core run 5.00 to 10.00 Box 2 of 9




Plate 47 – BH03 Core Run 8.50 to 13.00 Box 3 of 9




Plate 48 – BH03 Core Run 13.00 to 16.00 Box 4 of 9




Plate 49 – BH03 Core Run 16.00 to 19.00 Box 5 of 9




Plate 50 – BH03 Core Run 19.00 to 23.00 Box 6 of 9




Plate 51 – BH03 Core Run 23.00 to 26.00 Box 7 of 9




Plate 52 – BH03 Core Run 24.50 to 29.00 Box 8 of 9




Plate 53 – BH03 Core Run 27.50 to 30.50 Box 9 of 9




Plate 54 – BH04 Core Run 4.00 to 8.00 Box 1 of 9




Plate 55 – BH04 Core Run 6.50 to 11.00 Box 2 of 9




Plate 56 – BH04 Core run 9.50 to 14.00 Box 3 of 9




Plate 57 – BH04 Core run 12.50 to 17.00 Box 4 of 9




Plate 58 – BH04 Core Run 17.00 to 20.00 Box 5 of 9




Plate 59 – BH04 Core Run 20.00 to 23.00 Box 6 of 9




Plate 60 – BH04 Core Run 23.00 to 26.00 Box 7 of 9




Plate 61 – BH04 Core Run 26.00 to 29.00 Box 8 of 9




Plate 62 – BH04 Core Run 29.00 to 30.00 Box 9 of 9




Plate 63 – BH05 Core Run 4.00 to 8.00 Box 1 of 8




Plate 64 – BH05 Core Run 5.50 to 11.50 Box 2 of 8




Plate 65 – BH05 Core Run 11.50 to 15.50 Box 3 of 8




Plate 66 – BH05 Core Run 14.00 to 18.50 Box 4 of 8




Plate 67 – BH05 Core Run 17.00 to 21.50 Box 5 of 8




Plate 68 – BH05 Core Run 18.50 to 24.50 Box 6 of 8




Plate 69 – BH05 Core Run 23.50 to 27.50 Box 7 of 8




Plate 70 – BH05 Core Run 24.50 to 30.00 Box 8 of 8

# APPENDIX 1

# SITE PHOTOGRAPHS

# APPENDIX 2

# TRIAL PIT LOGS

| **PROJECT** Harbourhill Road (Barnsley) | **TP No.** 004 |
|---|---|
| **CLIENT** Kennet Properties | **DATE** 27/06/2006 |
| **METHOD** JCB 3CX | **PROJ No.** LDS126 |

| Depth (m) | Description of Strata | Level (mAOD) | Legend | Samples Type | Samples Depth From | Samples Depth To | In-situ Shear Vane Testing Depth (m) | In-situ Shear Vane Testing Result |
|---|---|---|---|---|---|---|---|---|
| 0.30 | MADE GROUND (Reinforced CONCRETE) With blue plastic sheet below. | | | | | | | |
| 0.60 | MADE GROUND(Yellow very sandy gravel. Gravel is fine to coarse, angular to sub-angular and predominantly consists of limestone)(Base layer) | | | C | 0.60 | | | |
| | | | | C | 1.10 | | | |
| 1.50 | Stiff thinly laminated Gravelly CLAY. Gravel is fine to coarse sub-rounded to rounded and consists of mudstone sandstone and quartzite. | | | | | | | |
| 2.20 | Very weak thinly laminated gray brown MUDSTONE. Recovered as fine to medium angular and tabular clay gravel. (Strata becomes organic cerca 1.90m bgL) | | | C | 2.10 | | | |
| 2.40 | Black COAL with lustre. | | | | | | | |
| | End of Trial Pit at 2.40 m (Maximum depth) | | | | | | | |

**REMARKS**

Shoring / support (None),
Stability (Slight spawling througout),
Groundwater (Pit dry) Sample
C = 1X Vial 1X Glass Jar 1X Plastic Tub

**KEY**

**SAMPLE TYPE :**
D - Disturbed
B - Bulk
U - Undisturbed
J - Glass Jar
V - Septum Vial

**WATER LEVEL :**
▽ Water Strike

**IN-SITU TESTS :**
SV - Hand Shear Vane
PP - Pocket Penetrometer

| EASTING | NORTHING | GROUND LEVEL |
|---|---|---|
| - | - | 96.690 |
| **LOGGED BY** | **SCALE** | **SHEET** |
| CE | 1:50 | Sheet 1 of 1 |

BWB CONSULTING

| **PROJECT** Harbourhill Road (Barnsley) | **TP No.** 003 |
|---|---|
| **CLIENT** Kennet Properties | **DATE** 27/06/2006 |
| **METHOD** JCB 3CX | **PROJ No.** LDS126 |

| Depth (m) | Description of Strata | Level (mAOD) | Legend | Samples Type | Samples Depth From | Samples Depth To | In-situ Shear Vane Testing Depth (m) | In-situ Shear Vane Testing Result |
|---|---|---|---|---|---|---|---|---|
| 0.20 | MADE GROUND (Reinforced CONCRETE) With blue plastic sheet at the base. | | | | | | | |
| 0.70 | Made Ground (Yellow very sandy gravel. Gravel is fine to coarse angular to sub angular and predominantly consists of limestone)(Base layer). | | | C | 0.80 | | | |
| 1.20 | Very Stiff thinly laminated grey brown CLAY.(Weathered mudstone) | | | C | 1.60 | | | |
| 2.00 | Very weak thinly laminated grey brown MUDSTONE becoming very organic from 1.60m bgL. | | | C | 2.00 | | | |
| 2.10 | Black COAL with lustre. | | | | | | | |
| | End of Trial Pit at 2.10 m (Maximum depth) | | | | | | | |

**REMARKS**

Shoring / support (None), Stability (Good), Groundwater (Pit Dry), Sample C = 1X Vial 1X Glass Jar 1X Plastic Tub

**KEY**

**SAMPLE TYPE :**
D - Disturbed
B - Bulk
U - Undisturbed
J - Glass Jar
V - Septum Vial

**WATER LEVEL :**
▽ Water Strike

**IN-SITU TESTS :**
SV - Hand Shear Vane
PP - Pocket Penetrometer

| EASTING | NORTHING | GROUND LEVEL |
|---|---|---|
| - | - | 96.860 |
| **LOGGED BY** | **SCALE** | **SHEET** |
| CE | 1:50 | Sheet 1 of 1 |

BWB CONSULTING

| **PROJECT** Harbourhill Road (Barnsley) | **TP No.** 005 |
|---|---|
| **CLIENT** Kennet Properties | **DATE** 27/06/2006 |
| **METHOD** JCB 3CX | **PROJ No.** LDS126 |

| Depth (m) | Description of Strata | Level (mAOD) | Legend | Samples Type | Samples Depth From | Samples Depth To | In-situ Shear Vane Testing Depth (m) | In-situ Shear Vane Testing Result |
|---|---|---|---|---|---|---|---|---|
| 0.30 | MADE GROUND (Reinforced Concrete) With blue plastic sheet at the base. | | | C | 0.50 | | | |
| 0.90 | MADE GROUND ( Yellow very sandy gravel. Gravel is fine to coarse angular to sub-angular and predominantly consists of limestone)(Base layer). | | | C | 1.00 | | | |
| | Very weak thinly laminated grey brown MUDSTONE highly and compleetly weathered above 1.30. Moderatly or highly weathered below 1.30 with destinct orange mottling. Becoming organic below 2.20. | | | C | 2.00 | | | |
| 2.40 | Black COAL with lustre. | | | | | | | |
| 2.80 | | | | | | | | |
| 3.10 | Weak thinly laminated grey brown MUDSTONE moderatly weathered. Recovered as: angular, tabular cobbles. | | | C | 3.00 | | | |
| | End of Trial Pit at 3.10 m (Maximum depth) | | | | | | | |

**REMARKS**

Shoring / support (None),
Stability (Poor), Groundwater (Slight seepage 0.70 m bgL),
Sample C = 1X Vial 1X Glass Jar 1X Plastic Tub

**KEY**

**SAMPLE TYPE :**
D - Disturbed
B - Bulk
U - Undisturbed
J - Glass Jar
V - Septum Vial

**WATER LEVEL :**
▽ Water Strike

**IN-SITU TESTS :**
SV - Hand Shear Vane
PP - Pocket Penetrometer

| EASTING | NORTHING | GROUND LEVEL |
|---|---|---|
| - | - | 96.530 |
| **LOGGED BY** | **SCALE** | **SHEET** |
| CE | 1:50 | Sheet 1 of 1 |

BWB CONSULTING

| **PROJECT** Harbourhill Road (Barnsley) | **TP No.** 002 |
|---|---|
| **CLIENT** Kennet Properties | **DATE** 27/06/2006 |
| **METHOD** JCB 3CX | **PROJ No.** LDS126 |

| Depth (m) | Description of Strata | Level (mAOD) | Legend | Samples Type | Samples Depth From | Samples Depth To | In-situ Shear Vane Testing Depth (m) | In-situ Shear Vane Testing Result |
|---|---|---|---|---|---|---|---|---|
| 0.26 | MADE GROUND (Reinforced CONCRETE) With blue plastic sheet at the base. | | | B<br>D | 0.30 | 0.30 | | |
| 0.46 | MADE GROUND ( Yellow very sandy Gravel. Gravel is fine to coarse angular to sub-angular and predominantly consists of limestone.)(Base Layer). | | | B<br>C<br>D | 0.70 | | | |
| 0.80 | | | | | | | | |
| 1.40 | Firm thinly laminated gray brown slightly organic CLAY.(Weathered mudstone) | | | B<br>C<br>D | 1.50 | | | |
| 2.00 | Black COAL with lustre. | | | | | | | |
| | Very weak thinly laminated grey brown MUDSTONE highly and compleetly weathered recovered as a sandy gravel. | | | | | | | |
| | End of Trial Pit at 2.00 m (Maximum depth) | | | | | | | |

**REMARKS**

Shoring / Support (None), Stability (Good), Groundwater (Dry), Sample C = 1XVial, 1XGlass Jar, 1X Plastic Tub

**KEY**

**SAMPLE TYPE :**
D - Disturbed
B - Bulk
U - Undisturbed
J - Glass Jar
V - Septum Vial

**WATER LEVEL :**
▽ Water Strike

**IN-SITU TESTS :**
SV - Hand Shear Vane
PP - Pocket Penetrometer

| EASTING | NORTHING | GROUND LEVEL |
|---|---|---|
| - | - | 96.580 |
| **LOGGED BY** | **SCALE** | **SHEET** |
| CE | 1:50 | Sheet 1 of 1 |

BWB CONSULTING

| **PROJECT** Harbourhill Road (Barnsley) | **TP No.** 001 |
|---|---|
| **CLIENT** Kennet Properties | **DATE** 27/06/2006 |
| **METHOD** JCB 3CX | **PROJ No.** LDS126 |

| Depth (m) | Description of Strata | Level (mAOD) | Legend | Samples Type | Samples Depth From | Samples Depth To | In-situ Shear Vane Testing Depth (m) | In-situ Shear Vane Testing Result |
|---|---|---|---|---|---|---|---|---|
| 0.25 | MADE GROUND (Reinforced Concrete) | | | | | | | |
| 0.50 | MADE GROUND ( Red Brown and yellow clay VERY SANDY VERY GRAVELY COBBLES AND BOULDERS. Gravel is fine to coarse angular to subangular and consists of brick sandstone and land drain fragments. Cobbles / Boulders angular brick, sandstone and land drain)(Base and Capping layer). | | | C<br>B<br>D | 0.60<br>0.70 | | | |
| 1.10 | Stiff yellow brown CLAY(Completley weathered mudstone) | | | C<br>B<br>D | 1.20<br>1.40 | | | |
| 2.90 | Very weak thinly laminated grey brown MUDSTONE highly and compleetly weathered down to 2.00m bgL recovered as fine to medium angular gravel. Below 2.00 moderatly or highly weathered compitent rock becoming organic from 2.60m bgL with traces of coal from 2.80m bgL | | | C<br>B<br>D | 2.20<br>2.40 | | | |
| | End of Trial Pit at 2.90 m (Maximum depth) | | | | | | | |

**REMARKS**

Shoring / support (None)
Stability (Slight spawling throughout) Groundwater (Dry)
Sample C = 1Xvial 1X Glass Jar 1X Plastic Tub

**KEY**

**SAMPLE TYPE :**
D - Disturbed
B - Bulk
U - Undisturbed
J - Glass Jar
V - Septum Vial

**WATER LEVEL :**
▽ Water Strike

**IN-SITU TESTS :**
SV - Hand Shear Vane
PP - Pocket Penetrometer

| EASTING | NORTHING | GROUND LEVEL |
|---|---|---|
| 0.00 | - | 96.740 |
| **LOGGED BY** | **SCALE** | **SHEET** |
| CE | 1:50 | Sheet 1 of 1 |

BWB CONSULTING

| | |
|---|---|
| **PROJECT** Harbourhill Road (Barnsley) | **TP No.** 006 |
| **CLIENT** Kennet Properties | **DATE** 27/06/2006 |
| **METHOD** JCB 3CX | **PROJ No.** LDS126 |

| Depth (m) | Description of Strata | Level (mAOD) | Legend | Samples Type | Samples Depth From | Samples Depth To | In-situ Shear Vane Testing Depth (m) | In-situ Shear Vane Testing Result |
|---|---|---|---|---|---|---|---|---|
| 0.22 | MADE GROUND(Reinforced conrete) | | | C | 0.00 | 2.90 | | |
| | MADE GROUND Yellow very sandy gravel. gravel was fine to coarse angular to sub-angular and predominantly consisted of limestone.(Base layer) | | | C | 0.50 | | | |
| 0.70 | | | | C | 0.80 | | | |
| 1.10 | Stiff grey brown CLAY on the south side of the pit. Ground as above on the North side of the pit. | | | | | | | |
| 1.80 | Black COAL with lustre. cerca 1.70m bgL Pit was widened to define previous trial pit that went to 1.80m bgL. | | | C | 1.70 | | | |
| | Weak thinly laminated MUDSTONE moderatly weathered. | | | | | | | |
| 3.20 | End of Trial Pit at 3.20 m (Maximum depth) | | | | | | | |

## REMARKS

Shoring / Support (None)
Stability (Spawling throught)
Ground Water (Strata wet from ground level) Sample C = 1X Vial 1X Glass Jar 1X Plastic Tub
Former trial pit backfilled to 1.80m bgL adjacent to TP006

## KEY

**SAMPLE TYPE :**
D - Disturbed
B - Bulk
U - Undisturbed
J - Glass Jar
V - Septum Vial

**WATER LEVEL :**
▽ Water Strike

**IN-SITU TESTS :**
SV - Hand Shear Vane
PP - Pocket Penetrometer

| EASTING | NORTHING | GROUND LEVEL |
|---|---|---|
| 0.00 | - | 96.500 |
| **LOGGED BY** | **SCALE** | **SHEET** |
| CE | 1:50 | Sheet 1 of 1 |

BWB CONSULTING

| **PROJECT** Harbourhill Road (Barnsley) | **TP No.** 007 |
|---|---|
| **CLIENT** Kennet Properties | **DATE** 27/06/2006 |
| **METHOD** JCB 3CX | **PROJ No.** LDS126 |

| Depth (m) | Description of Strata | Level (mAOD) | Legend | Samples Type | Samples Depth From | Samples Depth To | In-situ Shear Vane Testing Depth (m) | In-situ Shear Vane Testing Result |
|---|---|---|---|---|---|---|---|---|
| 0.30 | MADE GROUND (Reinforced concrete) With blue plastic sheet at the base. | | | | | | | |
| 0.60 | MADE GROUND (Yellow sandy gravel.Gravel is fine to coarse angular to sub-angular and predominantly consists of limestone with occasional brick)(Base layer). This layer extended down to 1.20m bgL adjacent to concrete chambour that was located in the east side of the trial pit.. | | | C | 0.70 | | | |
| 1.20 | | | | C | 1.30 | | | |
| 2.10 | Very weak grey brown MUDSTONE highly to compleetly weathered. | | | | | | | |
| | Very weak grey brown MUDSTONE moderatly or highly weathered. | | | | | | | |
| | End of Trial Pit at 2.10 m (Maximum depth) | | | | | | | |

**REMARKS**

Shoring / Support (None) Stability (Poor) Ground Water (Dry) Sample C = 1X Vial, 1X Glass Jar, 1 X Plastic Tub. The trial pit unearthed a concrete chambour on the east side that was located below a ground level manhole.

**KEY**

**SAMPLE TYPE :**
D - Disturbed
B - Bulk
U - Undisturbed
J - Glass Jar
V - Septum Vial

**WATER LEVEL :**
▽ Water Strike

**IN-SITU TESTS :**
SV - Hand Shear Vane
PP - Pocket Penetrometer

| EASTING | NORTHING | GROUND LEVEL |
|---|---|---|
| - | - | 96.570 |
| **LOGGED BY** | **SCALE** | **SHEET** |
| CE | 1:50 | Sheet 1 of 1 |

BWB CONSULTING

| **PROJECT** Harbourhill Road (Barnsley) | **TP No.** 008 |
|---|---|
| **CLIENT** Kennet Properties | **DATE** 27/06/2006 |
| **METHOD** JCB 3CX | **PROJ No.** LDS126 |

| Depth (m) | Description of Strata | Level (mAOD) | Legend | Samples Type | Samples Depth From | Samples Depth To | In-situ Shear Vane Testing Depth (m) | In-situ Shear Vane Testing Result |
|---|---|---|---|---|---|---|---|---|
| 0.20 | MADE GROUND (Reinforced concrete) With blue plastic sheet below) | | | | | | | |
| 0.50 | MADE GROUND(Yellow very sandy gravel. Gravel is fine to coarse angular to sub-angular and predominantly consists of limestone)(Base layer) | | | B<br>C<br>D | 0.60 | 0.60 | | |
| 1.50 | Weak thinly laminated gray brown MUDSTONE moderatley or highly weathered. Recovered as angular and tabular gravely cobbles. | | | B<br>C<br>D | 1.10 | | | |
| | End of Trial Pit at 1.50 m (Maximum depth) | | | | | | | |

**REMARKS**

Shoring / Support (None)
Stability (Good) Groundwater (Dry) Sample C = 1X Vial 1X Glass Jar 1X Plastic Tub

**KEY**

**SAMPLE TYPE :**
D - Disturbed
B - Bulk
U - Undisturbed
J - Glass Jar
V - Septum Vial

**WATER LEVEL :**
▽ Water Strike

**IN-SITU TESTS :**
SV - Hand Shear Vane
PP - Pocket Penetrometer

| EASTING | NORTHING | GROUND LEVEL |
|---|---|---|
| - | - | 96.230 |
| **LOGGED BY** | **SCALE** | **SHEET** |
| CE | 1:50 | Sheet 1 of 1 |

BWB CONSULTING

| **PROJECT** Harbourhill Road (Barnsley) | **TP No.** 009 |
|---|---|
| **CLIENT** Kennet Properties | **DATE** 27/06/2006 |
| **METHOD** JCB 3CX | **PROJ No.** LDS126 |

| Depth (m) | Description of Strata | Level (mAOD) | Legend | Samples Type | Samples Depth From | Samples Depth To | In-situ Shear Vane Testing Depth (m) | In-situ Shear Vane Testing Result |
|---|---|---|---|---|---|---|---|---|
| 0.05 | MADE GROUND(Tarmac) | | | | | | | |
| 0.15 | | | | | | | | |
| 0.30 | MADE GROUND( Yellow very sandy gravel. Gravel is fine to coarse angular to subangular and predominantly consists of limestone)(Base layer). | | | C | 0.50 | | | |
| | | | | C | 1.00 | | | |
| | MADE GROUND ( Firm gray brown VERY GRAVELY CLAY WITH OCCASIONAL COBBLES. Gravel is fine to coarse angular to subangular and consists of limestone sandstone and brick. Cobbles angular brick or sandstone)(Capping layer). | | | C | 2.00 | | | |
| | Weak thinly laminated gray brown MUDSTONE moderatly weatered with ironstaining throught. | | | C | 3.00 | | | |
| 3.40 | End of Trial Pit at 3.40 m (Maximum depth) | | | | | | | |

**REMARKS**

Shoring Support (None), Stability (Good), Groundwater (Dry), Sample C = 1X Vial, 1X Glass Jar, 1X Plastic Tub

**KEY**

**SAMPLE TYPE :**
D - Disturbed
B - Bulk
U - Undisturbed
J - Glass Jar
V - Septum Vial

**WATER LEVEL :**
▽ Water Strike

**IN-SITU TESTS :**
SV - Hand Shear Vane
PP - Pocket Penetrometer

| EASTING | NORTHING | GROUND LEVEL |
|---|---|---|
| - | - | 96.640 |
| **LOGGED BY** | **SCALE** | **SHEET** |
| CE | 1:50 | Sheet 1 of 1 |

BWB CONSULTING

| **PROJECT** Harbourhill Road (Barnsley) | **TP No.** 015 |
|---|---|
| **CLIENT** Kennet Properties | **DATE** 27/06/2006 |
| **METHOD** JCB 3CX | **PROJ No.** LDS126 |

| Depth (m) | Description of Strata | Level (mAOD) | Legend | Samples | | | In-situ Shear Vane Testing | |
|---|---|---|---|---|---|---|---|---|
| | | | | Type | Depth From | To | Depth (m) | Result |
| 0.15 | MADE GROUND (Reinforced concrete) with blue plastic sheeet below. | | | | | | | |
| 0.50 | MADE GROUND(Brown very sandy gravel with many cobbles and some boulders. Gravel is fine to coarse angular to sub-angular and predominantly consist of sandstone. Cobbles/Boulders sub-angular sandstone)(Base layer). | | | C | 0.60 | | | |
| | | | | C | 1.10 | | | |
| 1.70 | Weak thinly laminated grey brown MUDSTONE moderatly or highly weathered. Recovered as angular gravel with many cobbles and boulders. | | | | | | | |
| | End of Trial Pit at 1.70 m (Maximum depth) | | | | | | | |

**REMARKS**

Shoring support (None), Stability (Good), Groundwater (Dry), Sample C = 1XVial, 1X Glass Jar, 1X Plastic Tub,

**KEY**

**SAMPLE TYPE :**
D - Disturbed
B - Bulk
U - Undisturbed
J - Glass Jar
V - Septum Vial

**WATER LEVEL :**
▽ Water Strike

**IN-SITU TESTS :**
SV - Hand Shear Vane
PP - Pocket Penetrometer

| EASTING | NORTHING | GROUND LEVEL |
|---|---|---|
| - | - | 95.950 |
| **LOGGED BY** | **SCALE** | **SHEET** |
| CE | 1:50 | Sheet 1 of 1 |

BWB CONSULTING

| **PROJECT** Harbourhill Road (Barnsley) | **TP No.** 014 |
|---|---|
| **CLIENT** Kennet Properties | **DATE** 27/06/2006 |
| **METHOD** JCB 3CX | **PROJ No.** LDS126 |

| Depth (m) | Description of Strata | Level (mAOD) | Legend | Samples | | | In-situ Shear Vane Testing | |
|---|---|---|---|---|---|---|---|---|
| | | | | Type | Depth From | To | Depth (m) | Result |
| 0.14 | MADE GROUND(Concrete with blue plastic sheet below) | | | | | | | |
| 0.50 | MADE GROUND(Brown very sandy gravel with some cobbles. Gravel is fine to coarse angular to sub-angular and consists of brick and sandstone. Cobbles angular brick and sandstone)(Base layer). | | | C | 0.60 | | | |
| | | | | C | 1.00 | | | |
| | Very weak thinly laminated grey brown MUDSTONE highly or compleetly weathered). | | | C | 2.00 | | | |
| 2.40 | End of Trial Pit at 2.40 m (Maximum depth) | | | | | | | |

**REMARKS**

Shoring / support (None), Stability (Good), Groundwater (Dry), Sample C = 1X vial, 1X Glass Jar, 1X Plastic Tub

**KEY**

**SAMPLE TYPE :**
D - Disturbed
B - Bulk
U - Undisturbed
J - Glass Jar
V - Septum Vial

**WATER LEVEL :**
▽ Water Strike

**IN-SITU TESTS :**
SV - Hand Shear Vane
PP - Pocket Penetrometer

| EASTING | NORTHING | GROUND LEVEL |
|---|---|---|
| - | - | 94.100 |
| **LOGGED BY** | **SCALE** | **SHEET** |
| CE | 1:50 | Sheet 1 of 1 |

BWB CONSULTING

| **PROJECT** Harbourhill Road (Barnsley) | **TP No.** 010 |
|---|---|
| **CLIENT** Kennet Properties | **DATE** 27/06/2006 |
| **METHOD** JCB 3CX | **PROJ No.** LDS126 |

| Depth (m) | Description of Strata | Level (mAOD) | Legend | Samples Type | Samples Depth From | Samples Depth To | In-situ Shear Vane Testing Depth (m) | In-situ Shear Vane Testing Result |
|---|---|---|---|---|---|---|---|---|
| 0.15 | MADE GROUND(Tarmac) | | | | | | | |
| 0.60 | MADE GROUND (Yellow very sandy gravel. Gravel is fine to coarse angular to sub-angular and predominantly consts of limestone)(Base layer). | | | B<br>C | 0.50<br>0.70 | | | |
| 0.80 | | | | D<br>C | | | | |
| 1.10 | MADE GROUND (Brown CLAY BOUND COBBLES AND BOULDERS. Cobbles/boulders angular sandstone with rare brick)(Capping layer) | | | B<br>C<br>D | 1.20 | | | |
| | Stiff gray brown mottled CLAY (Weathered mudstone) | | | | | | | |
| 2.50 | Very weak thinly laminated grey brown MUDSTONE highly or compleetly weathered. Recovered as fine to medium angular gravel. Below 2.30m bgL becoming very organic. | | | B<br>C<br>D | 2.20 | | | |
| 2.60 | Black COAL with lustre. | | | | | | | |
| | End of Trial Pit at 2.60 m (Maximum depth) | | | | | | | |

**REMARKS**

Shoring / support (None), Stability (Good), Groundwater (Dry), Sample C = 1X Vial, 1X Glass jar, 1X Plastic Tub,

**KEY**

**SAMPLE TYPE :**
D - Disturbed
B - Bulk
U - Undisturbed
J - Glass Jar
V - Septum Vial

**WATER LEVEL :**
▽ Water Strike

**IN-SITU TESTS :**
SV - Hand Shear Vane
PP - Pocket Penetrometer

| EASTING | NORTHING | GROUND LEVEL |
|---|---|---|
| - | - | 96.050 |
| **LOGGED BY** | **SCALE** | **SHEET** |
| CE | 1:50 | Sheet 1 of 1 |

BWB CONSULTING

| **PROJECT** Harbourhill Road (Barnsley) | **TP No.** 011 |
|---|---|
| **CLIENT** Kennet Properties | **DATE** 27/06/2006 |
| **METHOD** JCB 3CX | **PROJ No.** LDS126 |

| Depth (m) | Description of Strata | Level (mAOD) | Legend | Samples | | | In-situ Shear Vane Testing | |
|---|---|---|---|---|---|---|---|---|
| | | | | Type | Depth From | To | Depth (m) | Result |
| 0.09 | MADE GROUND(Tarmac) | | | C | 0.20 | | | |
| 0.30 | MADE GROUND (Yellow very sandy gravel. gravel is fine to coarse angular to sub-angular and predominantly consists of limestone)(Base layer). | | | C | 0.80 | | | |
| 0.60 | MADE GROUND(Stiff dark grey SANDY GRAVELY CLAY with many cobbles and boulders. Gravel is fine to coarse angular to subangular and consists of brick sandstone ash and slag.Cobbles / boulders angular brick and sandstone). | | | C | 1.40 | | | |
| 1.20 | MADE GROUND(Stiff dark grey sandy gravely clay. Gravel is fine to coarse angular to subangular and consists of brick sandstone ash and slag. Strata has an organic odour). | | | C | 2.00 | | | |
| 1.90 | MADE GROUND(Faces B and C only Very weak thinly laminated grey brown mudstone highly and completely weathered to gravely clay. Faces A and D angular cobbles and boulders of sandstone with rare concrete). Cerca 1.10 to 1.20m bgL in face A located at 0.5m in from the corner with face B one number drain pipe ran into the pit its exit was unlocated. see photograph. | | | | | | | |
| 2.10 | Weak thinly laminated grey brown MUDSTONE Highly weathered. | | | | | | | |
| | End of Trial Pit at 2.10 m (Maximum depth) | | | | | | | |

**REMARKS**

Shoring / support (None)
Stability (Heavey spawling throught) Groundwater (Dry)
Sample C = 1X vial 1X Glass jar 1X Plastic Tub

**KEY**

**SAMPLE TYPE :**
D - Disturbed
B - Bulk
U - Undisturbed
J - Glass Jar
V - Septum Vial

**WATER LEVEL :**
▽ Water Strike

**IN-SITU TESTS :**
SV - Hand Shear Vane
PP - Pocket Penetrometer

| EASTING | NORTHING | GROUND LEVEL |
|---|---|---|
| - | - | 95.130 |
| **LOGGED BY** | **SCALE** | **SHEET** |
| CE | 1:50 | Sheet 1 of 1 |

BWB CONSULTING

| **PROJECT** Harbourhill Road (Barnsley) | **TP No.** 012 |
|---|---|
| **CLIENT** Kennet Properties | **DATE** 27/06/2006 |
| **METHOD** JCB 3CX | **PROJ No.** LDS126 |

| Depth (m) | Description of Strata | Level (mAOD) | Legend | Samples Type | Samples Depth From | Samples Depth To | In-situ Shear Vane Testing Depth (m) | In-situ Shear Vane Testing Result |
|---|---|---|---|---|---|---|---|---|
| 0.07 | MADE GROUND(Tarmac) | | | | | | | |
| 0.15 | MADE GROUND (Yellow very sandy gravel. Gravel is fine to coarse angular to sub-angular and predominantly consists of limestone)(Base layer). | | | B C D | 0.50 | 0.50 | | |
| 1.00 | MADE GROUND ( Cobbles and boulders with much sand and gravel and gravel sized clasts of sandy clay. Gravel is fine to coarse angular to sub-angular and consists of brick sandstone slag and fragments of polythene. Cobbles boulders angular sandstone with rare bricks). | | | B C D | 1.10 | | | |
| 1.50 | | | | B C D | 1.70 | | | |
| 2.00 | MADE GROUND(Firm dark grey sandy gravely clay. Gravel is fine to coarse angular to sub-angular and consists of sandstone, mudstone, glass, brick). | | | B C D | 2.30 | | | |
| 3.10 | Stiff fissured grey brown mottled orangesandy gravely CLAY. Gravel is fine to coarse angular and predominantly consists of mudstone. | | | | | | | |
| | Very weak thinly laminated grey brown MUDSTONE with organic traces occuring on laminations highly and compleetly weathered. | | | | | | | |
| | End of Trial Pit at 3.10 m (Maximum depth) | | | | | | | |

**REMARKS**

Shoring / support (None), Stability (Spawling throught), Groundwater (Dry), Sample C = 1X Vial , 1X Glass Jar, 1X Plastic Tub,

**KEY**

**SAMPLE TYPE :**
D - Disturbed
B - Bulk
U - Undisturbed
J - Glass Jar
V - Septum Vial

**WATER LEVEL :**
▽ Water Strike

**IN-SITU TESTS :**
SV - Hand Shear Vane
PP - Pocket Penetrometer

| EASTING | NORTHING | GROUND LEVEL |
|---|---|---|
| - | - | 92.870 |
| **LOGGED BY** | **SCALE** | **SHEET** |
| CE | 1:50 | Sheet 1 of 1 |

BWB CONSULTING

| | |
|---|---|
| **PROJECT** Harbourhill Road (Barnsley) | **TP No.** 013 |
| **CLIENT** Kennet Properties | **DATE** 27/06/2006 |
| **METHOD** JCB 3CX | **PROJ No.** LDS126 |

| Depth (m) | Description of Strata | Level (mAOD) | Legend | Samples Type | Samples Depth From | Samples Depth To | In-situ Shear Vane Testing Depth (m) | In-situ Shear Vane Testing Result |
|---|---|---|---|---|---|---|---|---|
| 0.06 | MADE GROUND(Tarmac) | | | | | | | |
| 0.35 | MADE GROUND( Dark brown slightly sandy gravel with rare gravel sized pockets of firm clay. Gravel is fine to coarse and predominantly consists of sandstone)(Base layer). | | | C | 0.50 | | | |
| | | | | C | 1.00 | | | |
| | Very weak thinly laminated grey brown MUDSTONE moderately or highly weathered with occasional subrounded carstones situated interstitialy within laminations. | | | C | 2.00 | | | |
| 3.10 | End of Trial Pit at 3.10 m (Maximum depth) | | | | | | | |

**REMARKS**

Shoring / support (None), Stability (Good), Groundwater (Dry), Sample C = 1 X Vial, 1X Glass Jar, 1X Plastic Tub,

**KEY**

**SAMPLE TYPE :**
D - Disturbed
B - Bulk
U - Undisturbed
J - Glass Jar
V - Septum Vial

**WATER LEVEL :**
▽ Water Strike

**IN-SITU TESTS :**
SV - Hand Shear Vane
PP - Pocket Penetrometer

| EASTING | NORTHING | GROUND LEVEL |
|---|---|---|
| - | - | 93.170 |
| **LOGGED BY** | **SCALE** | **SHEET** |
| CE | 1:50 | Sheet 1 of 1 |

BWB CONSULTING

# APPENDIX 3

# BOREHOLE LOGS

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **04** |

| Project No | Start | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | 10/07/2006 | 92.020 | - | - |
| | End 10/07/2006 | | | Sheet 1 of 4 |

| Drilling Records Depth From | To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | % SCR | % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Installation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0.08 | MADE GROUND(Tarmac) | (91.94) | | | | | | | |
| | | | 0.40 | MADE GROUND(Yellow brown fine to coarse angular to sub-angular limestone)(Base Layer) | (91.62) | | | | | | | |
| 0.50 | 0.50 | C | | | | | | | | | | |
| 0.60 | 0.90 | B | | | | | | | | | | |
| 1.00 | 1.30 | 50 (25 for 41mm/41,9 for 19mm) G | | Very weak gray brown MUDSTONE highly to compleetly weathered. 4.00 to 9.50 With much orange iron staining. 2.50 to 4.00 No Recovery | | | | | | | | |
| 1.80 | 2.00 | 50 (25 for 44mm/50 for 70mm) G | | | | | | | | | | |
| 4.00 | 5.00 | | | Fractures are Extreemly and very close rough planar and irregular open andclosed claen breccia filled and iron stained discontinuities. 5.00 to 5.28 / 5.83 to 5.87 / 6.35 to 6.50 Non Intact. | | 70 | 28 | 0 | | 12 | | |
| 5.00 | 6.50 | | | | | 87 | 63 | 53 | | | | |
| 6.50 | 8.00 | | | Fractures are: Extreemly and very closely spaced rough planar and irregular open and closed clean, breccia filled and irontained discontinuities. | | 99 | 50 | 42 | | NI | | |
| | | | | | | | | | | 16 | | |
| 8.00 | 9.50 | | | Continued next sheet | | 84 | 12 | 0 | | NI | | |

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 04/07/2006 | | 2.00 | 1.50 | | - |
| 10/07/2006 | | 30.00 | 3.50 | | 11.90 |

## General Remarks

C = One sample containing
1 X Phial 1 X Glass Amber Jar 1 X Plastic Tub
G = Sample taken from SPT
Water depth is that after 20 minutes standing.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | Sa Follow by Rotary | GB + CJ | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **04** |

| Project No | Start | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | 10/07/2006 | 92.020 | - | - |
| | End 10/07/2006 | | | Sheet 2 of 4 |

| Drilling Records Depth From | To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | % SCR | % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Instillation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Very weak gray brown MUDSTONE highly to compleetly weathered.<br>4.00 to 9.50 With much orange iron staining.<br>2.50 to 4.00 No Recovery<br>Fractures are: Very closely and closely spaced rough planar and irregular open and closed clean breccia filled and iron stained discontinuities.<br>9.80 to 9.89 / 9.95 to 10.00 / 10.12 to 10.27 Non Intact | | | | | | | |
| 9.50 | 11.00 | | | Fractures are: Extremely and very close rough planar and irregular open and closed clean and breccia filled discontinuities. 10.38 to 10.42 / 10.54 to 10.74 / 10.85 to 11.00 / 11.17 to 11.21 / 11.31 to 11.41 / 11.63 to 11.68 Non Intact.<br>11.00 to 11.41 One number planar closed discontinuity<br>12.07 to 12.32 One number planar closed discontinuity. | | 97 | 50 | 37 | | 9 | | |
| 11.00 | 12.50 | | | | | 93 | 80 | 39 | | 14 | 11.90 | |
| | | | 12.58 | Black COAL with lustre (Recovered Intact) | (79.44) | | | | | | 12.50 | |
| 12.50 | 14.00 | | | | | 47 | 16 | 13 | | NI | | |
| | | | 14.08 | Very weak thinly laminated grey slightly sandy MUDSTONE highly or compleetly weathered.<br>Fractures are: Very closely to medium spaced rough planar and irregular open and closed clean breccia filled and iron stained discontinuities.<br>14.34 15.57 One number impersistant irregular closed discontinuity 15.14 to 15.20 / 15.26 to 15.40 / 16.80 to 16.90 / Non intact. | (77.94) | | | | | | | |
| 14.00 | 15.50 | | | | | 98 | 74 | 62 | | 8 | | |
| 15.50 | 17.00 | | | | | 95 | 76 | 57 | | | | |
| | | | | Continued next sheet | | | | | | NI | | |

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 04/07/2006 | | 2.00 | 1.50 | | - |
| 10/07/2006 | | 30.00 | 3.50 | | 11.90 |

## General Remarks

C = One sample containing
1 X Phial 1 X Glass Amber Jar 1 X Plastic Tub
G = Sample taken from SPT
Water depth is that after 20 minutes standing.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | Sa Follow by Rotary | GB + CJ | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **04** |

| Project No | Start | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | 10/07/2006 | 92.020 | - | - |
| | End 10/07/2006 | | | Sheet 3 of 4 |

| Drilling Records Depth From | To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | % SCR | % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Instillation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Very weak thinly laminated grey slightly sandy MUDSTONE highly or compleetly weathered. | | | | | | | | |
| | | | 17.87 | | (74.15) | | | | | | | |
| 17.00 | 20.00 | | | Moderately weak thinly laminated grey slightly sandy in places MUDSTONE moderatly or highly weathered.<br>Fractures are: Extremely and very closely spaced planar and irregular open and closed clay filled discontinuities. | | 99 | 49 | 30 | | 12 | | |
| | | | | | | | | | | NI | | |
| | | | | Fractures are: Medium and closely spaced planar and irregular open and closed clean breccia filled ironstained and clay filled discontinuities.<br>20.23 to 20.36 / 20.50 to 20.60 / 22.49 to 22.53 / 23.24 to 23.47 / 24.32 to 24.38<br>Non Intact.<br>24.78 to 24.89 One number impersistant irregular open breccia filled discontinuity. | | | | | | | | |
| | | | 20.36 | | (71.66) | | | | | | | |
| | | | | Moderatly weak thinly laminated grey brown slightly micacious SANDSTONE moderatly or highly weathered. | | | | | | | | |
| 20.00 | 23.00 | | | | | 92 | 82 | 70 | | | | |
| 23.00 | 26.00 | | | | | 94 | 84 | 50 | | 5 | | |

Continued next sheet

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 04/07/2006 | | 2.00 | 1.50 | | - |
| 10/07/2006 | | 30.00 | 3.50 | | 11.90 |

## General Remarks

C = One sample containing
1 X Phial 1 X Glass Amber Jar 1 X Plastic Tub
G = Sample taken from SPT
Water depth is that after 20 minutes standing.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | Sa Follow by Rotary | GB + CJ | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **04** |

| Project No | Start / End | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | Start 10/07/2006<br>End 10/07/2006 | 92.020 | - | - |

Sheet 4 of 4

| Drilling Records Depth From | Drilling Records Depth To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | Mechanical Log % SCR | Mechanical Log % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Installation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Moderatly weak thinly laminated grey brown slightly micacious SANDSTONE moderatly or highly weathered. | | | | | | | | |
| 26.00 | 29.00 | | | | | 99 | 90 | 71 | | | | |
| | | | | Fracture is: Planar open clean. | | | | | | | | |
| 29.00 | 30.00 | | | | | 90 | 90 | 84 | | 1 | | |
| | | | 30.00 | End of Borehole at 30.00 m | (62.02) | | | | | | | |

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 04/07/2006 | | 2.00 | 1.50 | | - |
| 10/07/2006 | | 30.00 | 3.50 | | 11.90 |

## General Remarks

C = One sample containing
1 X Phial 1 X Glass Amber Jar 1 X Plastic Tub
G = Sample taken from SPT
Water depth is that after 20 minutes standing.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | Sa Follow by Rotary | GB + CJ | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **05** |

| Project No | Start / End | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | Start 27/06/2006<br>End 27/06/2006 | 93.720 | - | - |

Sheet 1 of 4

| Drilling Records Depth From | To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | % SCR | % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Installation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MADE GROUND ( Reinforced Concrete) | | | | | | | | |
| | | | 0.30 | | (93.42) | | | | | | | |
| 0.50 | | C | 0.50 | MADE GROUND ( Yellow brown fine to coarse dominantly coarse angular to subangular limestone gravel)(Base Layer) | (93.22) | | | | | | | |
| 0.60 | 0.90 | B | | | | | | | | | | |
| | | | | MADE GROUND( Firm brown sandy very GRAVELY CLAY. Gravel is fine to coarse angular to subangular and predominantly consists of sandstone with rare brick fragments)(Capping layer). | | | | | | | | |
| 1.00 | 1.45 | N=8 (1,2/2,1,2,3)<br>G | | | | | | | | | | |
| 1.50 | | C | | | | | | | | | | |
| 2.00 | 2.45 | U | 2.00 | Firm grey brow Sandy CLAY | (91.72) | | | | | | | |
| 2.50 | | D | 2.50 | | (91.22) | | | | | | | |
| 2.60 | | B | | Very weak grey brown slightly sandy in places MUDSTONE highly and compleetly weathered Occasionally interbedded with thin bands (cerca 20mm) of moderatly weak yellow brown iron stained sandstone mderately or highly weathered. | | | | | | | |
| 3.00 | 3.45 | N=45 (2,4/6,10,13,16)<br>G<br>B | | | | | | | | | | |
| 3.50 | | C | | | | | | | | | | |
| 3.80 | 4.00 | 50 (10,15/35,15 for 29mm)<br>G | | | | | | | | | | |
| 4.00 | | () | | | | | | | | | | |
| 4.00 | 5.00 | | | | | 90 | 15 | 0 | | NI | | |
| 5.00 | 8.00 | | | Fractures are: Closely spaced rough planar and irregular open and closed iron stained discontinuities.<br>7.00 to 7.76 No recovery. | | 74 | 31 | 16 | | 8 | | |
| 8.00 | 9.00 | | | | | 88 | 26 | 16 | | | | |

Continued next sheet

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 05/06/2006 | 0000 | 5.00 | - | | - |
| 03/07/2006 | 0000 | 4.00 | 3.00 | | 0.00 |
| 03/07/2006 | 0000 | 10.00 | 4.00 | | - |
| 04/07/2006 | 0130 | 14.00 | 4.00 | | 12.90 |

## General Remarks

C = One sample containing
1X Phial 1 X Glass Amber Jar 1 X Plastic Tub
G = Sample taken from SPT
Water depth is that after 20 minutes standing.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | SA Folloe by Rotary | GB +CJ | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **05** |

| Project No | Start / End | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | Start 27/06/2006<br>End 27/06/2006 | 93.720 | - | - |

Sheet 2 of 4

| Drilling Records Depth From | Drilling Records Depth To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | % SCR | % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Installation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Very weak grey brown slightly sandy in places MUDSTONE highly and compleetly weathered Occasionally interbedded with thin bands (cerca 20mm) of moderatly weak yellow brown iron stained sandstone mderately or highly weathered. | | | | | | | | |
| 9.00 | 10.00 | | | | | 34 | 0 | 0 | | | | |
| 10.00 | 11.50 | | | | | 80 | 10 | 10 | | NI | | |
| | | | 11.50 | Black COAL with lustre. | (82.22) | | | | | | | |
| 11.50 | 12.50 | | 11.95 | Compleetly weathered grey MUDSTONE Recovered as clay. | (81.77) | 88 | 0 | 0 | | | | |
| | | | 12.30 | Black COAL with lustre. | (81.42) | | | | | | | |
| | | | 12.50 | Very weak thinly laminated sandy in places MUDSTONE moderately or highly weathered. Fractures are: Medium spaced rough planar and irregular open and closed clean and breccia filled discontinuities. | (81.22) | | | | | | 12.90 ▽ | |
| 12.50 | 14.00 | | | | | 83 | 61 | 54 | | 5 | | |
| 14.00 | 15.50 | | | Fractures are: Very closely to medium spaced rough planar and irregular open and closed clean, breccia filled and iron stained discontinuities. 14.00 to 14.10 / 14.26 to 14.30 / 14.90 to 14.98 Non intact. 15.15 to 15.25 One number sub-verticle irregular open iron coated discontinuity. (Iron coating cerca 2mm in thickness) 15.58 to 15.64 Non intact. 15.68 to 15.80 Two number sub-verticle smooth planar 10* open iron coated dicontinuities. (Iron coating cerca 2mm in thickness) 15.80 to 15.90 / 16.13 to 16.23 / 17.00 to 17.45 Non intact 17.51 to 17.58 One number sub verticle closed discontinuity. 17.95 to 18.25 Non intact. | | 98 | 81 | 33 | | | 14.00 ▽ | |
| 15.50 | 17.00 | | | | | 99 | 81 | 44 | | 9 | | |

Continued next sheet

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 05/06/2006 | 0000 | 5.00 | - | | - |
| 03/07/2006 | 0000 | 4.00 | 3.00 | | 0.00 |
| 03/07/2006 | 0000 | 10.00 | 4.00 | | - |
| 04/07/2006 | 0130 | 14.00 | 4.00 | | 12.90 |

## General Remarks

Casing in all cases was 150mm diameter.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | SA Folloe by Rotary | GB +CJ | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| Harbourhill Road (Barnsley) | Kennet Properties | 05 |

| Project No | Start / End | Ground Level | Co ordinates | |
|---|---|---|---|---|
| LDS126 | Start 27/06/2006<br>End 27/06/2006 | 93.720 | - | - |

Sheet 3 of 4

| Drilling Records Depth From | Drilling Records Depth To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | Mechanical Log % SCR | Mechanical Log % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Instillation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17.00 | 18.50 | | | Very weak thinly laminated sandy in places MUDSTONE moderately or highly weathered. | | 80 | 49 | 35 | | | | |
| | | | | Fractures are: Closely to medium spaced rough planar and irregular open and closed clean and breccia filled discontinuities. 19.15 to 21.00 One number impersistant sub-verticle irregular open clean discontinuity. 20.24 to 20.37 Non intact. | | 99 | 72 | 54 | | NI<br>6 | | |
| 18.50 | 21.50 | | | | | | | | | | | |
| | | | 21.90 | Where intact: Fractures are: Open and closed clean breccia filled and iron stained discontinuities. 24.88 to 25.02 One number verticle planar open clean discontinuity. 25.25 to 26.00 One number sub-virticle impersistant rough irregular open iron stained and breccia filled discontinuity. | (71.82) | | | | | | | |
| | | | 22.25 | | (71.47) | | | | | | | |
| 21.50 | 23.50 | | 22.55 | Black COAL with lustre. | (71.17) | 99 | 18 | 15 | | NI | | |
| | | | | Compleetly weathered MUDSTONE. Recovered as very soft grey clay. | | | | | | | | |
| | | | | Very weak grey brown MUDSTONE highly and compleetly weathered. | | | | | | | | |
| 23.50 | 24.50 | | | | | 97 | 13 | 0 | | | | |
| 24.50 | 27.50 | | | | | 99 | 56 | 30 | | | | |

Continued next sheet

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 05/06/2006 | 0000 | 5.00 | - | | - |
| 03/07/2006 | 0000 | 4.00 | 3.00 | | 0.00 |
| 03/07/2006 | 0000 | 10.00 | 4.00 | | - |
| 04/07/2006 | 0130 | 14.00 | 4.00 | | 12.90 |

## General Remarks

C = One sample containing
1X Phial 1 X Glass Amber Jar 1 X Plastic Tub
G = Sample taken from SPT
Water depth is that after 20 minutes standing.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | SA Folloe by Rotary | GB +CJ | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **05** |

| Project No | Start / End | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | Start 27/06/2006<br>End 27/06/2006 | 93.720 | - | - |

Sheet 4 of 4

| Drilling Records Depth From | Drilling Records Depth To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | Mechanical Log % SCR | Mechanical Log % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Installation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Very weak grey brown MUDSTONE highly and compleetly weathered. | | | | | | 5 | | |
| | | | 27.42 | Fractures are: Medium spaced rough planar and irregular open and closed clean, breccia filled and iron stained discontionuities. 26.20 to 27.00 One number impersistant sub-verticle irregular iron stained and breccia filled dicontinuity. 27.28 to 27.35 One number planar 40* open clean discontinuity. 27.28 to 27.35 One number sub-verticle planar 40* open clean discontinuity. | (66.30) | | | | | NI | |
| 27.50 | 30.00 | | | Very weak thinly laminated grey brown slightly sandy MUDSTONE highly or compleetly weathered. Fractures are: Closely to medium spaced planar and irregular open and closed clean breccia filled and iron stained discontinuities. 28.30 to 28.80 One number sub-verticle undulating tight breccia filled and iron stained discontinuity. | | 98 | 66 | 42 | | 6 | | |
| | | | 30.00 | End of Borehole at 30.00 m | (63.72) | | | | | NI | | |

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 05/06/2006 | 0000 | 5.00 | - | | - |
| 03/07/2006 | 0000 | 4.00 | 3.00 | | 0.00 |
| 03/07/2006 | 0000 | 10.00 | 4.00 | | - |
| 04/07/2006 | 0130 | 14.00 | 4.00 | | 12.90 |

## General Remarks

Casing in all cases was 150mm diameter.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | SA Folloe by Rotary | GB +CJ | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **01** |

| Project No | Start / End | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | Start 03/07/2006<br>End 05/07/2006 | 96.100 | - | - |

Sheet 1 of 4

| Drilling Records Depth From | To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | % SCR | % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Instillation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0.08 | MADE GROUND( Tarmac) | (96.02) | | | | | | | |
| | | | 0.30 | MADE GROUND( Yellow brown fine to coarse angular to sub-angular limestone)(Base layer) | (95.80) | | | | | | | |
| 0.50 | 0.50 | C | | | | | | | | | | |
| 0.60 | | B | 0.70 | MADE GROUND(Brown SANDY GRAVELY CLAY. Gravel is fine to coarse angular to sub-angular and consists of sandstone limestone and brick)(Capping layer) | (95.40) | | | | | | | |
| 1.00 | | C | | | | | | | | | | |
| 1.10 | | N=22 (3,3/3,5,6,8)<br>G<br>B | | Black COAL desicated and recovered as medium dense sand. | | | | | | | | |
| 1.70 | | C | 1.70 | | (94.40) | | | | | | | |
| 2.00 | | N=35 (4,6/7,8,9,11)<br>G<br>B | | Very weak grey brown slightly sandy in places MUDSTONE highly and compleetly weathered.<br>With heavy orange iron staining cerca 3.50 to 4.50. and Slight orange iron staining cerca 4.50 to 9.00.<br>Cerca 5.80 to 6.00 Moderately weak thinly laminated grey SANDSTONE moderately weathered | | | | | | | | |
| 3.00 | | 50 (13,12 for 51mm/30,20 for 33mm)<br>G | | | | | | | | | | |
| 3.50 | 4.50 | | | | | 90 | 15 | 11 | | NI | 4.10 ▽ 4.50 | |
| 4.50 | 6.00 | | | Fractures are Wide and midiumly spaced rough planar open and clean discontinuities. | | 80 | 53 | 53 | | 3 | | |
| 6.00 | 7.50 | | | Fractures are: Very closely and closely spaced rough planar and irregulor open and closed clean and breccia filled discontinuities. 6.00 to 6.65 / 6.84 to 6.90 / 7.13 to 7.27 Non intact. | | 25 | 43 | 23 | | 12 | | |
| 7.50 | 9.00 | | | Where intact: Fractures are rough planar and irregular open and closed clean breccia filled and iron stained discontinuities. | | 92 | 23 | 9 | | | | |

Continued next sheet

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 03/07/2006 | | 3.30 | 1.50 | | - |
| 04/07/2006 | | 10.00 | 3.50 | | 4.00 |
| 05/07/2006 | | 30.50 | 3.50 | | 5.90 |

## General Remarks

C = One sample containing.
1 X Phial 1 X Glass Amber Jar 1 X Plastic Tub.
G = Sample taken from SPT.
Water depth is that after 20 minutes standing.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | SA Follow by Rotary | GB + C J | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **01** |

| Project No | Start / End | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | Start 03/07/2006<br>End 05/07/2006 | 96.100 | - | - |



| Drilling Records Depth From | To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | % SCR | % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Installation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Very weak grey brown slightly sandy in places MUDSTONE highly and compleetly weathered.<br>With heavy orange iron staining cerca 3.50 to 4.50. and Slight orange iron staining cerca 4.50 to 9.00.<br>Cerca 5.80 to 6.00 Moderately weak thinly laminated grey SANDSTONE moderately weathered | | | | | | | | |
| 9.00 | 10.00 | | | | | 97 | 17 | 10 | | NI | | |
| 10.00 | 11.00 | | | | | 69 | 8 | 0 | | | | |
| | | | 11.46 | Fractures are: Medium and closely spaced rough planar and irregular open and closed clean and breccia filled discontinuities. 12.16 to 12.94 Non intact. | (84.64) | | | | | | | |
| 11.00 | 12.50 | | 11.82 | Black COAL with lustre. (Recovered intact) | (84.28) | 99 | 59 | 30 | | 6 | | |
| | | | 12.16 | Compleetly weathered grey MUDSTONE Recovered as clay. | (83.94) | | | | | | | |
| | | | | Black COAL with lustre. | | | | | | | | |
| | | | 12.60 | | (83.50) | | | | | | | |
| 12.50 | 14.00 | | | Very weak grey brown slightly sandy in places MUDSTONE highly and compleetly weathered<br>Occasionaly interbedded with thin bands (cerca 200mm) of moderatly weak thinly laminated grey SANDSTONE moderately weathered.<br>Fractures are: Medium and closely spaced rough planar and irregular open and closed clean and breccia filled discontinuities. 13.82 to 13.92 / 14.90 to 15.00 / 15.99 to 16.07 Non intact. | | 71 | 50 | 29 | | | | |
| 14.00 | 15.50 | | | | | 87 | 73 | 13 | | 8 | | |
| 15.50 | 18.50 | | | Fractures are: Medium and closely spaced rough planar and irregular open and closed clean breccia filled and iron stained discontinuities. | | 99 | 93 | 67 | | | | |

Continued next sheet

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 03/07/2006 | | 3.30 | 1.50 | | - |
| 04/07/2006 | | 10.00 | 3.50 | | 4.00 |
| 05/07/2006 | | 30.50 | 3.50 | | 5.90 |

## General Remarks

Casing in all cases was 150 mm diameter.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | SA Follow by Rotary | GB + C J | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **01** |

| Project No | Start / End | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | Start 03/07/2006<br>End 05/07/2006 | 96.100 | - | - |



| Drilling Records Depth From | Drilling Records Depth To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | Mechanical Log % SCR | Mechanical Log % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Installation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Remaining Detail : 16.80m - 18.50m : 15.40 to 15.48 Non Intact. 17.72 to 17.90 One number verticle planar iron stained discontinuitiy. 17.97 to 18.05 Non Intact. 18.37 to 18.50 One number verticle planar open iron stained discontinuity. | | | | | | 6 | | |
| 18.50 | 20.50 | | | | | 83 | 36 | 20 | | | | |
| | | | 20.50 | Black COAL with lustre. | (75.60) | | | | | NI | | |
| 20.50 | 22.50 | | | | | 82 | 3 | 0 | | | | |
| | | | 21.74 | MUDSTONE (As above 12.60 to 20.50) | (74.36) | | | | | | | |
| | | | | Fractures are Medium and closely spaced planar and irregular open breccia filled discontinuities. 23.09 to 23.22 Non intact. | | | | | | 6 | | |
| 22.50 | 24.50 | | | | | 82 | 36 | 22 | | | | |
| | | | | | | | | | | NI | | |
| 24.50 | 26.50 | | | | | 99 | 60 | 29 | | | | |

Continued next sheet

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 03/07/2006 | | 3.30 | 1.50 | | - |
| 04/07/2006 | | 10.00 | 3.50 | | 4.00 |
| 05/07/2006 | | 30.50 | 3.50 | | 5.90 |

## General Remarks

C = One sample containing.
1 X Phial 1 X Glass Amber Jar 1 X Plastic Tub.
G = Sample taken from SPT.
Water depth is that after 20 minutes standing.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | SA Follow by Rotary | GB + C J | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **01** |

| Project No | Start / End | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | Start 03/07/2006<br>End 05/07/2006 | 96.100 | - | - |



| Drilling Records Depth From | Drilling Records Depth To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | Mechanical Log % SCR | Mechanical Log % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Installation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 26.50 | Remaining Detail : 25.94m - 28.50m : Fractures are: Medium and closely spaced rough planar and irregular open and closed clean, breccia filled and clay filled discontinuities. 27.66 to 27.87 Non intact. 27.31 29.50 One number planar verticle open iron stained discontinuity. 28.04 to 28.09 Non Intact. | (69.60) | | | | | | | |
| 26.50 | 27.50 | | | Moderatly weak thinly laminated in places grey slightly micacious SANDSTONE moderately in places highly weathered. | | 99 | 98 | 48 | | 8 | | |
| 27.50 | 29.50 | | | Fractures are: Medium spaced rough planar and irregular open and closed clean and breccia filled discontinuities. | | 96 | 82 | 48 | | 4 | | |
| 29.50 | 30.50 | | 30.00 | End of Borehole at 30.50 m | (66.10) | 100 | 98 | 98 | | | | |

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 03/07/2006 | | 3.30 | 1.50 | | - |
| 04/07/2006 | | 10.00 | 3.50 | | 4.00 |
| 05/07/2006 | | 30.50 | 3.50 | | 5.90 |

## General Remarks

Casing in all cases was 150 mm diameter.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | SA Follow by Rotary | GB + C J | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **03** |

| Project No | Start / End | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | Start 04/07/2006<br>End 07/07/2006 | 96.610 | - | - |

Sheet 1 of 4

| Drilling Records Depth From | To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | % SCR | % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Installation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MADE GROUND(Reinforced Concrete) | | | | | | | | |
| | | | 0.30 | | (96.31) | | | | | | | |
| 0.50 | | C | 0.40 | MADE GROUND(Yellow brown fine to coarse angular slightly sandy gravel that predominantly consists of limestone)(Base Layer). | (96.21) | | | | | | | |
| 0.60 | | B | | | | | | | | | | |
| 1.00 | 1.45 | N=49 (5,7/9,11,13,16)<br>G<br>B | 1.00 | Very weak gray brown MUDSTONE completely weathered to stiff clay. | (95.61) | | | | | | | |
| 1.50 | | C | | Weak thinly laminated grey brown MUDSTONE highly and completely weathered. occasionaly interbedded with thin measures (Cerca 200mm) of weak thinly laminated grey brown slightly micacious fine grained SANDSTONE moderatly or highly weathered. | | | | | | | | |
| 2.00 | | 50 (25 for 67mm/50 for 70mm)<br>G | | | | | | | | | | |
| | | | | Where intact: Fractures are. Planar and irregular open and closed clean and breccia filled. | | | | | | | | |
| 2.50 | 3.50 | | | | | 87 | 27 | 0 | | | | |
| 3.50 | 5.00 | | | | | 79 | 26 | 8 | | | | |
| 5.00 | 6.50 | | | | | 78 | 24 | 12 | | | | |
| 6.50 | 7.00 | | | | | 16 | 0 | 0 | | NI | | |
| 7.00 | 8.50 | | | | | 83 | 24 | 15 | | | | |
| | | | 8.40 | Black COAL with lustre. | (88.21) | | | | | | | |
| | | | | Continued next sheet | | | | | | | | |

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 04/07/2006 | | 2.20 | 1.50 | | - |
| 06/07/2006 | | 16.00 | 2.50 | | 16.00 |
| 07/07/2006 | | 30.50 | 2.50 | | 14.60 |

## General Remarks

C = One sample containing
1 x Phial 1 X Glass Amber Jar 1 X Plastic Tub
G = Sample taken from SPT
Water depth is that after 20 minutes standing.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | SA Follow by Rotary | GB +CJ | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **03** |

| Project No | Start / End | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | Start 04/07/2006<br>End 07/07/2006 | 96.610 | - | - |



| Drilling Records Depth From | To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | % SCR | % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Installation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Black COAL with lustre. | | | | | | | | |
| 8.50 | 10.00 | | 9.23 | | (87.38) | 81 | 41 | 15 | | | | |
| | | | 9.40 | Highly weathered MUDSTONE recovered as dark grey clay. | (87.21) | | | | | | | |
| | | | | Black COAL with lustre. (Recovered intact) | | | | | | | 9.60 | |
| | | | 9.95 | | (86.66) | | | | | | | |
| 10.00 | 11.50 | | | Very weak thinly laminated in places grey brown MUDSTONE highly or completely weathered.<br>Cerca 17.50 Rock is stained black and organic<br><br>Fractures are: Medium to very closely spaced planar and irregular open and closed clean, breccia filled and iron stained discontinuities.<br>10.61 to 10.68 Non Intact.<br>11.02 to 11.08 One number sub-verticle irregular closed discontinuity.<br>11.69 to 11.87 One number sub-verticle irregular closed discontinuity.<br>11.87 to 11.92 Non-intact.<br>12.58 to 12.80 One number impersistant sub-verticle planar open breccia filled discontinuity.<br>13.54 to 13.60 Non intact<br>1400 to 14.28 one number sub-verticle irregular open breccia filled discontinuity.<br>14.32 to 14.45 One number impersistant sub - verticle planar 20* closed discontinuity.<br>14.45 to 14.50 / 14.97 to 15.00 / 15.48 to 15.51 / 15.60 to 15.63 / 15.93 to 16.20Non intact | | 79 | 38 | 30 | | | | |
| 11.50 | 13.00 | | | | | 87 | 83 | 81 | | | | |
| 13.00 | 14.50 | | | | | 82 | 75 | 62 | | 4 | 14.50 | |
| 14.50 | 16.00 | | | | | 95 | 83 | 58 | | | | |
| 16.00 | 17.50 | | | Fractures are very closely to medium spaced planar and irregular open and closed clean, breccia filled and iron stained discontinuities. 16.35 to 16.39 / 16.48 to 16.52 / 16.60 to 16.73 / 16.96 to 17.06 / 17.50 to 17.68 / 17.80 to 18.02 / 19.00 to 19.10 / 20.00 to 20.08 / 20.43 to 20.46 / 21.50 to 21.60 Non intact.<br>21.83 to 21.93 one number sub-verticle undulating open iron stained discontinuity.<br>19.77 to 20.00 one number sub-verticle irregular open and closed clean discontinuity. | | 96 | 73 | 48 | | | | |

Continued next sheet

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 04/07/2006 | | 2.20 | 1.50 | | - |
| 06/07/2006 | | 16.00 | 2.50 | | 16.00 |
| 07/07/2006 | | 30.50 | 2.50 | | 14.60 |

## General Remarks

C = One sample containing
1 x Phial 1 X Glass Amber Jar 1 X Plastic Tub
G = Sample taken from SPT
Water depth is that after 20 minutes standing.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | SA Follow by Rotary | GB +CJ | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **03** |

| Project No | Start / End | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | Start 04/07/2006<br>End 07/07/2006 | 96.610 | - | - |

Sheet 3 of 4

| Drilling Records Depth From | To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | % SCR | % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Instillation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Remaining Detail : 15.95m - 26.00m : 20.86 to 20.90 Non intact 21.18 to 21.28 One number sub-verticle undulating open clean discontinuity. 21.28 to 21.33 Non intact 22.15 to 22.20 One number sub-verticle planar 45* open iron stained discontinuity. 23.33 to 23.38 / 23.68 to 23.84 non intact 23.84 to 24.28 One number impersistant irregular open breccia filled discontinuity. 24.28 to 24.34 non intact. 25.30 to 25.66 One number sub-verticle irregular open breccia filled discontinuity. 25.90 to 26.00 Non intact. | | | | | | | | |
| 17.50 | 19.00 | | 18.03 | | (78.58) | 97 | 70 | 69 | | | | |
| | | | 18.59 | Black COAL with lustre (Recovered intact) | (78.02) | | | | | | | |
| 19.00 | 20.00 | | | MUDSTONE(AS above 9.95 to 18.03) | | 100 | 90 | 90 | | | | |
| 20.00 | 21.50 | | | | | 97 | 84 | 77 | | 6 | | |
| 21.50 | 23.00 | | | | | 99 | 89 | 67 | | | | |
| 23.00 | 24.50 | | | | | 96 | 78 | 29 | | | | |
| 24.50 | 26.00 | | 25.00 | Moderately weak thinly laminated grey brown SANDSTONE moderately or highly weathered. | (71.61) | 99 | 85 | 55 | | | | |

Continued next sheet

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 04/07/2006 | | 2.20 | 1.50 | | - |
| 06/07/2006 | | 16.00 | 2.50 | | 16.00 |
| 07/07/2006 | | 30.50 | 2.50 | | 14.60 |

## General Remarks

C = One sample containing
1 x Phial 1 X Glass Amber Jar 1 X Plastic Tub
G = Sample taken from SPT
Water depth is that after 20 minutes standing.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | SA Follow by Rotary | GB +CJ | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **03** |

| Project No | Start / End | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | Start 04/07/2006<br>End 07/07/2006 | 96.610 | - | - |

Sheet 4 of 4

| Drilling Records Depth From | Drilling Records Depth To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | Mechanical Log % SCR | Mechanical Log % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Installation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26.00 | 27.50 | | | Remaining Detail : 26.00m - 30.00m : Fractures are: Medium spaced planar and irregular open clean discontinuities 26.00 to 26.26 One number verticle planar open iron stained discontinuity. 27.63 to 28.00 One number impersistant verticle planar open clean discontinuity | | 98 | 98 | 98 | | | | |
| 27.50 | 29.00 | | | | | 98 | 98 | 87 | | 3 | | |
| 29.00 | 30.50 | | | | | 98 | 98 | 69 | | | | |
| | | | | Rock is dark stained and slightly organic: Fractures are: Very closely spaced planar and irregular open clean discontinuities. | | | | | | 14 | | |
| | | | 30.50 | End of Borehole at 30.50 m | (66.11) | | | | | | | |

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 04/07/2006 | | 2.20 | 1.50 | | - |
| 06/07/2006 | | 16.00 | 2.50 | | 16.00 |
| 07/07/2006 | | 30.50 | 2.50 | | 14.60 |

## General Remarks

C = One sample containing
1 x Phial 1 X Glass Amber Jar 1 X Plastic Tub
G = Sample taken from SPT
Water depth is that after 20 minutes standing.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | SA Follow by Rotary | GB +CJ | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **02** |

| Project No | Start / End | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | Start 04/07/2006<br>End 07/07/2006 | 96.770 | - | - |

Sheet 1 of 4

| Drilling Records Depth From | To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | % SCR | % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Installation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MADE GROUND(Reinforced concrete) | | | | | | | | |
| | | | 0.30 | | (96.47) | | | | | | | |
| 0.50 | | C | 0.50 | MADE GROUND(Yellow brown sandy gravel. gravel is fine to coarse angular to subangular and predominantly consists of limestone)(Base layer). | (96.27) | | | | | | | |
| 0.60 | | B | | | | | | | | | | |
| 1.00 | | N=25 (2,3/5,6,7,7)<br>D<br>G<br>B | 1.00 | MADE GROUND(Light brown SANDY GRAVEL. Gravel is fine to coarse angular to subangular and predominantly consists of sandstone with occasional limestone)(Capping layer). | (95.77) | | | | | | | |
| | | | | Very weak grey brown MUDSTONE compleetly weathered to clay. | | | | | | | | |
| 2.00 | | N=35 (4,5/7,8,9,11)<br>C<br>G<br>B | | | | | | | | | | |
| | | | 2.90 | | (93.87) | | | | | | | |
| | | | | Black COAL with lustre. | | | | | | | | |
| 3.20 | | 50 (25 for 61mm/33,17 for 27mm)<br>G | | | | | | | | | | |
| | | | 3.68 | | (93.09) | | | | | | | |
| | | | | Very weak grey MUDSTONE highly weathered. | | | | | | | | |
| 3.50 | 5.00 | | | | | 82 | 23 | 16 | | NI | | |
| | | | 4.76 | | (92.01) | | | | | | | |
| | | | | Black coal with lustre COAL recovered intact. | | | | | | | | |
| | | | 5.00 | | (91.77) | | | | | | | |
| | | | | MUDSTONE( As above 3.68 to 4.76) | | | | | | | | |
| | | | 5.36 | | (91.41) | | | | | | | |
| | | | | Weak grey brown MUDSTONE highly and completely weathered thinly interbedded with much, Weak thinly laminated in places grey brown slightly micacious SANDSTONE moderatly or highly weathered.<br>Fractures are: Closely spaced planar and irregular open and closed clean , breccia filled and iron stained discontinuities. 5.48 to 5.52 / 5.72 to 5.75 Non intact. | | | | | | | | |
| 5.00 | 6.50 | | | | | 95 | 42 | 35 | | 4 | | |
| 6.50 | 8.00 | | | | | 77 | 33 | 27 | | NI | | |
| 8.00 | 9.50 | | | | | 85 | 13 | 9 | | | | |

Continued next sheet

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 04/07/2006 | | 3.50 | 1.50 | | - |
| 05/07/2006 | | 17.00 | 3.50 | | 10.20 |
| 06/07/2006 | | 30.00 | 3.50 | | 9.90 |

## General Remarks

C = One sample containing
1X Phial 1 X Glass Amber Jar 1 X Plastic Tub
G = sample taken from SPT
Water depth is that after 20 minutes standing.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | SA follow by Rotary | GB + CJ | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **02** |

| Project No | Start / End | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | Start 04/07/2006<br>End 07/07/2006 | 96.770 | - | - |



| Drilling Records Depth From | To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | % SCR | % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Instillation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Weak grey brown MUDSTONE highly and completely weathered thinly interbedded with much, Weak thinly laminated in places grey brown slightly micacious SANDSTONE moderatly or highly weathered. | | | | | | | | |
| 9.50 | 11.00 | | | Fractures are: Closely and very closely spaced planar and irregular open and closed clean breccia filled and iron stained discontinuities.<br>10.45 to 10.75 One number impersistant sub-verticle undulating open iron stained discontinuity.<br>10.85 to 11.45 / 11.63 to 11.79 / 11.99 to 12.04 / 12.11 to 12.33 Non intact<br>13.20 to 13.34 One number verticle planar open clean discontinuity. 14.34 to 14.39 / 14.68 to 14.75 / 14.85 to 14.90 Non intact 14.90 to 15.02 One number verticle planar closed discontinuity. | | 91 | 45 | 31 | | | 9.90 | |
| 11.00 | 12.50 | | | | | 78 | 35 | 15 | | | 12.50 | |
| 12.50 | 14.00 | | | | | 88 | 64 | 38 | | 8 | | |
| 14.00 | 15.50 | | | | | 91 | 65 | 40 | | | | |
| | | | 15.25 | Black COAL with lustre | (81.52) | | | | | | | |
| | | | 16.00 | | (80.77) | | | | | | | |
| 15.50 | 17.00 | | | Very weak dark grey MUDSTONE highly weathered. | | 93 | 23 | 15 | | | | |
| | | | 16.20 | | (80.57) | | | | | | | |
| | | | | Black COAL with lustre. | | | | | | NI | | |
| | | | 16.76 | | (80.01) | | | | | | | |
| | | | | Very weak grey brown MUDSTONE highly and completely weathered occasionaly thinly interbedded with Weak thinly laminated in places grey brown slightly micacious SANDSTONE | | | | | | | | |

Continued next sheet

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 04/07/2006 | | 3.50 | 1.50 | | - |
| 05/07/2006 | | 17.00 | 3.50 | | 10.20 |
| 06/07/2006 | | 30.00 | 3.50 | | 9.90 |

## General Remarks

C = One sample containing
1X Phial 1 X Glass Amber Jar 1 X Plastic Tub
G = sample taken from SPT
Water depth is that after 20 minutes standing.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | SA follow by Rotary | GB + CJ | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **02** |

| Project No | Start / End | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | Start 04/07/2006<br>End 07/07/2006 | 96.770 | - | - |



| Drilling Records Depth From | Drilling Records Depth To | Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log % TCR | % SCR | % RQD | Legend | FI Min | FI Average | FI Max (mm) | Water Strikes | Instillation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | highly weathered. | | | | | | | | | | |
| 17.00 | 20.00 | | | Fractures are: Medium to very closely spaced planar and irregular open and closed clean and breccia filled discontinuities. 18.45 to 18.67 / 18.92 to 18.96 / 19.38 to 19.50 Non intact. | | 90 | 55 | 39 | | | | 6 | | |
| 20.00 | 23.00 | | | Where intact: Fractures are, closely and very closely spaced planar and irregular open and closed clean, breccia and clay filled. 22.40 to 22.64 One number imopersistant sub-verticle irregular closed discontinuity. | | 97 | 42 | 30 | | | | | | |
| 23.00 | 25.00 | | | | | 85 | 7 | 7 | | | | NI | | |
| | | | 25.00 | Black COAL with lustre. | (71.77) | | | | | | | | | |
| | | | 25.83 | MUDSTONE (As above 16.76 to 25.00) | (70.94) | | | | | | | | | |

Continued next sheet

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 04/07/2006 | | 3.50 | 1.50 | | - |
| 05/07/2006 | | 17.00 | 3.50 | | 10.20 |
| 06/07/2006 | | 30.00 | 3.50 | | 9.90 |

## General Remarks

C = One sample containing
1X Phial 1 X Glass Amber Jar 1 X Plastic Tub
G = sample taken from SPT
Water depth is that after 20 minutes standing.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | SA follow by Rotary | GB + CJ | CE | |

# ROTARY LOG

| Project | Client | Borehole |
|---|---|---|
| **Harbourhill Road (Barnsley)** | **Kennet Properties** | **02** |

| Project No | Start / End | Ground Level | Co ordinates | |
|---|---|---|---|---|
| **LDS126** | Start 04/07/2006<br>End 07/07/2006 | 96.770 | - | - |



| Drilling Records: Depth From | Drilling Records: Depth To | Drilling Records: Samples/In-situ Tests | Depth (m) | Description of Strata | (Level) mAOD | Mechanical Log: % TCR | Mechanical Log: % SCR | Mechanical Log: % RQD | Legend | FI Min Average Max (mm) | Water Strikes | Installation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MUDSTONE (As above 16.76 to 25.00)<br><br>Fractures are: Medium to closely spaced planar and irregular open and closed clean breccia and clay filled discontinuities. 27.45 to 27.59 / 28.62 to 28.70 / 28.80 to 28.85 Non intact | | | | | | 5 | | |
| | | | 29.00 | End of Borehole at 30.00 m | (67.77) | | | | | NR | | |

## Drilling Progress and Water Observations

| Date | Time | Borehole Depth | Casing Depth | Casing Diameter | Water Depth |
|---|---|---|---|---|---|
| 04/07/2006 | | 3.50 | 1.50 | | - |
| 05/07/2006 | | 17.00 | 3.50 | | 10.20 |
| 06/07/2006 | | 30.00 | 3.50 | | 9.90 |

## General Remarks

C = One sample containing
1X Phial 1 X Glass Amber Jar 1 X Plastic Tub
G = sample taken from SPT
Water depth is that after 20 minutes standing.

| Scale | Method | Drilled By | Logged By | Checked By |
|---|---|---|---|---|
| 1:50 | SA follow by Rotary | GB + CJ | CE | |

# APPENDIX 4

# CHEMICAL TESTING RESULTS

# ALcontrol Geochem - Table Of Results

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Job Number:** | 06/10818/02/01 | | | | | | | | | |
| **Client:** | BWB Consulting | | | | | | | | | |
| **Client Ref:** | LDS126 | | | | | | | | | |
| **Matrix:** | SOLID | | | | | | | | | |
| | **All results expressed on a dry weight basis.** | | | | | | | | | |
| | | | **Sample Identity** | TP01 | TP02 | TP03 | TP03 | TP04 | TP04 | TP05 |
| | | | **Depth** | 0.60 | 0.70 | 0.80 | 2.00 | 0.60 | 2.10 | 1.00 |
| | | | **Sample Type** | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL |
| | | | **Sample Received Date** | 28/06/2006 | 28/06/2006 | 28/06/2006 | 28/06/2006 | 28/06/2006 | 28/06/2006 | 28/06/2006 |
| | | | **Sampled Date** | | | | | | | |
| | | | **Batch** | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | **Sample Number(s)** | 1-2 | 9-11 | 16-18 | 22-24 | 26-28 | 32-34 | 37-39 |
| | **Method** | **Units** | **Method Detection Limit** | | | | | | | |
| Boron Water Soluble | TM129 | mg/kg | <1 | 4 | 1 | <1 | <1 | <1 | <1 | <1 |
| Arsenic | TM129 | mg/kg | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Barium | TM129 | mg/kg | <2 | <2 | <2 | 5 | <2 | <2 | <2 | <2 |
| Beryllium | TM129 | mg/kg | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Cadmium | TM129 | mg/kg | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Chromium | TM129 | mg/kg | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Copper | TM129 | mg/kg | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Lead | TM129 | mg/kg | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Mercury | TM129 | mg/kg | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 |
| Nickel | TM129 | mg/kg | <1 | <1 | <1 | 1 | <1 | <1 | <1 | <1 |
| Selenium | TM129 | mg/kg | <3 | <3 | <3 | <3 | <3 | <3 | <3 | <3 |
| Vanadium | TM129 | mg/kg | <1 | <1 | 2 | <1 | <1 | <1 | <1 | <1 |
| Zinc | TM129 | mg/kg | <1 | 1 | <1 | 2 | <1 | 2 | 2 | <1 |
| Water Soluble Sulphate as SO4 2:1 Extra | TM098 | g/l | <0.003 | 0.076 | 0.088 | 0.187 | 0.010 | 0.033 | 0.010 | <0.003 |
| Phenols Monohydric | TM062 | mg/kg | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Total Cyanide | TM153 | mg/kg | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Free Cyanide | TM153 | mg/kg | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Complex Cyanide | TM153 | mg/kg | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Asbestos Presence Screen | TM001 | NONE | | No Fibres Detec | Fibres Detec | Fibres Detec | - | Fibres Detec | - | - |
| Fraction of Organic Carbon | TM050 | NONE | <0.001 | 0.004 | 0.039 | 0.004 | 0.765 | 0.006 | 0.006 | 0.028 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| pH Value | TM133 | pH Units | <1.00 | 6.78 | 5.73 | 6.98 | 4.88 | 7.83 | 7.31 | 7.70 |
| GRO (C4-C12) | TM089 | ug/kg | <10 | - | - | <10 | <10 | <10 | <10 | <10 |
| MTBE | TM089 | ug/kg | <10 | - | - | <10 | <10 | <10 | <10 | <10 |
| Benzene | TM089 | ug/kg | <10 | - | - | <10 | <10 | <10 | <10 | <10 |
| Toluene | TM089 | ug/kg | <10 | - | - | <10 | <10 | <10 | <10 | <10 |
| Ethyl benzene | TM089 | ug/kg | <10 | - | - | <10 | <10 | <10 | <10 | <10 |
| m & p Xylene | TM089 | ug/kg | <10 | - | - | <10 | <10 | <10 | <10 | <10 |
| o Xylene | TM089 | ug/kg | <10 | - | - | <10 | <10 | <10 | <10 | <10 |
| Aliphatics C5-C6 | TM089 | ug/kg | <10 | - | - | <10 | <10 | <10 | <10 | <10 |
| Aliphatics >C6-C8 | TM089 | ug/kg | <10 | - | - | <10 | <10 | <10 | <10 | <10 |
| Aliphatics >C8-C10 | TM089 | ug/kg | <10 | - | - | <10 | <10 | <10 | <10 | <10 |
| Aliphatics >C10-C12 | TM089 | ug/kg | <10 | - | - | <10 | <10 | <10 | <10 | <10 |
| Aliphatics >C12-C16 | TM061 | ug/kg | <100 | - | - | 3391 | 66346 | 147 | 1297 | 2743 |
| Aliphatics >C16-C21 | TM061 | ug/kg | <100 | - | - | 116 | 24269 | <100 | 2150 | <100 |
| Aliphatics >C21-C35 | TM061 | ug/kg | <100 | - | - | 171 | 32267 | <100 | 3830 | 104 |
| Total Aliphatics C5-C35 | TM61/89 | ug/kg | <100 | - | - | 3678 | 122882 | 147 | 7277 | 2847 |
| Aromatics C6-C7 | TM089 | ug/kg | <10 | - | - | <10 | <10 | <10 | <10 | <10 |
| Aromatics >C7-C8 | TM089 | ug/kg | <10 | - | - | <10 | <10 | <10 | <10 | <10 |
| Aromatics >EC8-EC10 | TM089 | ug/kg | <10 | - | - | <10 | <10 | <10 | <10 | <10 |
| Aromatics >EC10-EC12 | TM089 | ug/kg | <10 | - | - | <10 | <10 | <10 | <10 | <10 |
| Aromatics >EC12-EC16 | TM061 | ug/kg | <100 | - | - | <100 | 27913 | <100 | 235 | 1110 |
| Aromatics >EC16-EC21 | TM061 | ug/kg | <100 | - | - | 186 | 80334 | <100 | <100 | 484 |
| Aromatics >EC21-EC35 | TM061 | ug/kg | <100 | - | - | <100 | 136752 | <100 | <100 | <100 |
| Total Aromatics C6-C35 | TM61/89 | ug/kg | <100 | - | - | 186 | 244999 | <100 | 235 | 1594 |
| TPH (Aliphatics and Aromatics C5-C35) | TM61/89 | ug/kg | <100 | - | - | 3864 | 367881 | 147 | 7512 | 4441 |
| | | | | | | | | | | |
| **Rapid Assessment Package** | | | | | | | | | | |
| Total Extractable Hydrocarbons | TM154 | mg/kg | <10 | <10 | - | <10 | - | <10 | <10 | <10 |
| Aliphatics >C6-C8 | TM154 | mg/kg | <10 | <10 | - | <10 | - | <10 | <10 | <10 |
| Aliphatics >C8-C10 | TM154 | mg/kg | <10 | <10 | - | <10 | - | <10 | <10 | <10 |
| Aliphatics >C10-C12 | TM154 | mg/kg | <10 | <10 | - | <10 | - | <10 | <10 | <10 |
| Aliphatics >C12-C16 | TM154 | mg/kg | <10 | <10 | - | <10 | - | <10 | <10 | <10 |
| Aliphatics >C16-C21 | TM154 | mg/kg | <10 | <10 | - | <10 | - | <10 | <10 | <10 |
| Aliphatics >C21-C35 | TM154 | mg/kg | <10 | <10 | - | <10 | - | <10 | <10 | <10 |
| Aliphatics >C35-C40 | TM154 | mg/kg | <10 | <10 | - | <10 | - | <10 | <10 | <10 |
| Total Aliphatics >C6-C40 (Min Oils) | TM154 | mg/kg | <10 | <10 | - | <10 | - | <10 | <10 | <10 |
| Aromatics >C6-C7 | TM154 | mg/kg | <10 | <10 | - | <10 | - | <10 | <10 | <10 |
| Aromatics >C7-C8 | TM154 | mg/kg | <10 | <10 | - | <10 | - | <10 | <10 | <10 |
| Aromatics >C8-C10 | TM154 | mg/kg | <10 | <10 | - | <10 | - | <10 | <10 | <10 |
| Aromatics >C10-C12 | TM154 | mg/kg | <10 | <10 | - | <10 | - | <10 | <10 | <10 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Aromatics >C12-C16 | TM154 | mg/kg | <10 | <10 | - | <10 | - | <10 | <10 | <10 |
| Aromatics >C16-C21 | TM154 | mg/kg | <10 | <10 | - | <10 | - | <10 | <10 | <10 |
| Aromatics >C21-C40 | TM154 | mg/kg | <10 | <10 | - | <10 | - | <10 | <10 | <10 |
| Total Aromatics >C6-C40 | TM154 | mg/kg | <10 | <10 | - | <10 | - | <10 | <10 | <10 |
| Total TPH >C6-C40 | TM154 | mg/kg | <10 | <10 | - | <10 | - | <10 | <10 | <10 |
| TPH C6-40 | TM154 | mg/kg | <10 | <10 | 82 | <10 | 1093 | <10 | <10 | <10 |
| | | | | | | | | | | |
| **PAH by GC-FID** | | | | | | | | | | |
| Naphthalene | TM142 | mg/kg | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Acenaphthylene | TM142 | mg/kg | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Acenaphthene | TM142 | mg/kg | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Fluorene | TM142 | mg/kg | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Phenanthrene | TM142 | mg/kg | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Anthracene | TM142 | mg/kg | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Fluoranthene | TM142 | mg/kg | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Pyrene | TM142 | mg/kg | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Benz(a)anthracene | TM142 | mg/kg | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Chrysene | TM142 | mg/kg | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Benzo(b)fluoranthene | TM142 | mg/kg | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Benzo(k)fluoranthene | TM142 | mg/kg | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Benzo(a)pyrene | TM142 | mg/kg | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Indeno(123cd)pyrene | TM142 | mg/kg | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Dibenzo(ah)anthracene | TM142 | mg/kg | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Benzo(ghi)perylene | TM142 | mg/kg | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| PAH 16 Total | TM142 | mg/kg | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| TP05 | TP05 | TP06 | TP06 | TP07 | TP10 | TP11 | TP11 | TP11 | TP13 | TP15 | TP15 |
| 2.00 | 3.00 | 0.5 | 2.9 | 0.7 | 0.5 | 0.2 | 0.8 | 1.4 | 0.5 | 0.6 | 1.1 |
| | | | | | | | | | | | |
| SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL |
| 28/06/2006 | 28/06/2006 | 29/06/2006 | 29/06/2006 | 29/06/2006 | 29/06/2006 | 29/06/2006 | 29/06/2006 | 29/06/2006 | 29/06/2006 | 29/06/2006 | 29/06/2006 |
| | | 28/06/2006 | 28/06/2006 | 28/06/2006 | 28/06/2006 | 28/06/2006 | 28/06/2006 | 28/06/2006 | 28/06/2006 | 28/06/2006 | 28/06/2006 |
| 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 40-42 | 43-45 | 46-48 | 55-57 | 58-60 | 81-83 | 94-95,141 | 96-98 | 99-101 | 118-120 | 135-137 | 138-140 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| <1 | <1 | <1 | <1 | 2 | <1 | - | 1 | <1 | 3 | <1 | 4 |
| <1 | <1 | <1 | 4 | 1 | <1 | - | 26 | 6 | 5 | 5 | 5 |
| <2 | <2 | 80 | 73 | 79 | 92 | - | 182 | 95 | 74 | 56 | 61 |
| <1 | <1 | <1 | <1 | <1 | <1 | - | 2 | <1 | <1 | <1 | <1 |
| <1 | <1 | <1 | <1 | <1 | <1 | - | <1 | <1 | <1 | <1 | <1 |
| <1 | <1 | 7 | 14 | 14 | 4 | - | 21 | 21 | 21 | 23 | 20 |
| <1 | <1 | 1 | 20 | 10 | 4 | - | 60 | 9 | 26 | 29 | 20 |
| <1 | <1 | 11 | 17 | 13 | 26 | - | 205 | 21 | 16 | 22 | 20 |
| <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | - | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 |
| <1 | <1 | 1 | 19 | 22 | 2 | - | 25 | 14 | 32 | 32 | 26 |
| <3 | <3 | <3 | <3 | <3 | <3 | - | <3 | <3 | <3 | <3 | <3 |
| <1 | <1 | 4 | 17 | 15 | 5 | - | 37 | 26 | 17 | 19 | 20 |
| 2 | <1 | 27 | 50 | 74 | 72 | - | 216 | 67 | 91 | 99 | 84 |
| 0.035 | 0.059 | 0.026 | 0.027 | 0.006 | 0.011 | - | 0.410 | 0.010 | 0.031 | 0.008 | 0.032 |
| <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | - | 0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| <1 | <1 | <1 | <1 | <1 | <1 | - | <1 | <1 | <1 | <1 | <1 |
| <1 | <1 | <1 | <1 | <1 | <1 | - | <1 | <1 | <1 | <1 | <1 |
| <1 | <1 | <1 | <1 | <1 | <1 | - | <1 | <1 | <1 | <1 | <1 |
| - | - | - | - | Fibres Detec | Fibres Detec | Fibres Detec | - | - | Fibres Detec | Fibres Detec | - |
| 0.008 | 0.077 | 0.005 | 0.137 | 0.002 | 0.001 | - | 0.104 | 0.008 | 0.003 | 0.004 | 0.003 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 7.76 | 5.05 | 10.41 | 7.89 | 8.43 | 9.04 | - | 7.28 | 8.23 | 7.79 | 8.05 | 8.70 |
| - | <10 | <10 | <10 | - | - | - | - | - | - | - | - |
| - | <10 | <10 | <10 | - | - | - | - | - | - | - | - |
| - | <10 | <10 | <10 | - | - | - | - | - | - | - | - |
| - | <10 | <10 | <10 | - | - | - | - | - | - | - | - |
| - | <10 | <10 | <10 | - | - | - | - | - | - | - | - |
| - | <10 | <10 | <10 | - | - | - | - | - | - | - | - |
| - | <10 | <10 | <10 | - | - | - | - | - | - | - | - |
| - | <10 | <10 | <10 | - | - | - | - | - | - | - | - |
| - | <10 | <10 | <10 | - | - | - | - | - | - | - | - |
| - | <10 | <10 | <10 | - | - | - | - | - | - | - | - |
| - | <10 | <10 | <10 | - | - | - | - | - | - | - | - |
| - | 24289 | 2346 | 74802 | - | - | - | - | - | - | - | - |
| - | 16012 | 469 | 71338 | - | - | - | - | - | - | - | - |
| - | 112 | 138 | 84177 | - | - | - | - | - | - | - | - |
| - | 40413 | 2953 | 230317 | - | - | - | - | - | - | - | - |
| - | <10 | <10 | <10 | - | - | - | - | - | - | - | - |
| - | <10 | <10 | <10 | - | - | - | - | - | - | - | - |
| - | <10 | <10 | <10 | - | - | - | - | - | - | - | - |
| - | <10 | <10 | <10 | - | - | - | - | - | - | - | - |
| - | 4935 | 2151 | 12507 | - | - | - | - | - | - | - | - |
| - | 16842 | 4475 | 38154 | - | - | - | - | - | - | - | - |
| - | 35314 | 43186 | 109617 | - | - | - | - | - | - | - | - |
| - | 57091 | 49812 | 160278 | - | - | - | - | - | - | - | - |
| - | 97504 | 52765 | 390595 | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| <10 | 28 | 22 | 576 | - | - | - | 377 | - | - | 17 | - |
| <10 | <10 | <10 | <10 | - | - | - | <10 | - | - | <10 | - |
| <10 | <10 | <10 | <10 | - | - | - | <10 | - | - | <10 | - |
| <10 | <10 | <10 | <10 | - | - | - | <10 | - | - | <10 | - |
| <10 | <10 | <10 | <10 | - | - | - | <10 | - | - | <10 | - |
| <10 | <10 | <10 | 14 | - | - | - | <10 | - | - | <10 | - |
| <10 | <10 | <10 | 30 | - | - | - | <10 | - | - | <10 | - |
| <10 | <10 | <10 | <10 | - | - | - | <10 | - | - | <10 | - |
| <10 | <10 | <10 | 44 | - | - | - | <10 | - | - | <10 | - |
| <10 | <10 | <10 | <10 | - | - | - | <10 | - | - | <10 | - |
| <10 | <10 | <10 | <10 | - | - | - | <10 | - | - | <10 | - |
| <10 | <10 | <10 | <10 | - | - | - | <10 | - | - | <10 | - |
| <10 | <10 | <10 | <10 | - | - | - | <10 | - | - | <10 | - |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| <10 | <10 | <10 | <10 | - | - | - | <10 | - | - | <10 | - |
| <10 | <10 | <10 | 30 | - | - | - | 14 | - | - | <10 | - |
| <10 | <10 | <10 | 157 | - | - | - | 99 | - | - | <10 | - |
| <10 | <10 | <10 | 187 | - | - | - | 113 | - | - | <10 | - |
| <10 | <10 | <10 | 230 | - | - | - | 113 | - | - | <10 | - |
| <10 | 28 | 22 | 576 | <10 | 423 | - | 377 | <10 | <10 | 17 | <10 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| <0.05 | 0.66 | <0.05 | 0.91 | <0.05 | <0.05 | - | 0.30 | <0.05 | <0.05 | <0.05 | <0.05 |
| <0.05 | <0.05 | <0.05 | 0.21 | <0.05 | <0.05 | - | 0.11 | <0.05 | <0.05 | <0.05 | <0.05 |
| <0.05 | <0.05 | <0.05 | 0.25 | <0.05 | <0.05 | - | 0.18 | <0.05 | <0.05 | <0.05 | <0.05 |
| <0.05 | <0.05 | <0.05 | 0.23 | <0.05 | <0.05 | - | 0.57 | <0.05 | <0.05 | <0.05 | <0.05 |
| <0.05 | <0.05 | <0.05 | 3.55 | <0.05 | <0.05 | - | 5.00 | <0.05 | <0.05 | <0.05 | <0.05 |
| <0.05 | <0.05 | <0.05 | 0.70 | <0.05 | <0.05 | - | 1.26 | <0.05 | <0.05 | <0.05 | <0.05 |
| <0.05 | <0.05 | <0.05 | 0.84 | <0.05 | <0.05 | - | 7.14 | <0.05 | <0.05 | <0.05 | <0.05 |
| <0.05 | <0.05 | <0.05 | 0.50 | <0.05 | <0.05 | - | 5.35 | <0.05 | <0.05 | <0.05 | <0.05 |
| <0.05 | <0.05 | <0.05 | 0.38 | <0.05 | <0.05 | - | 3.11 | <0.05 | <0.05 | <0.05 | <0.05 |
| <0.05 | <0.05 | <0.05 | 0.37 | <0.05 | <0.05 | - | 3.52 | <0.05 | <0.05 | <0.05 | <0.05 |
| <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | 2.47 | <0.05 | <0.05 | <0.05 | <0.05 |
| <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | 0.84 | <0.05 | <0.05 | <0.05 | <0.05 |
| <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | 2.58 | <0.05 | <0.05 | <0.05 | <0.05 |
| <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | 1.21 | <0.05 | <0.05 | <0.05 | <0.05 |
| <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | 0.30 | <0.05 | <0.05 | <0.05 | <0.05 |
| <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | 1.17 | <0.05 | <0.05 | <0.05 | <0.05 |
| <0.05 | 0.66 | <0.05 | 7.94 | <0.05 | <0.05 | - | 35.11 | <0.05 | <0.05 | <0.05 | <0.05 |

# ALcontrol Geochem Analytical Services
# Sample Descriptions

**Job Number:** 06/10818/02/01
**Client:** BWB Consulting
**Client Ref :** LDS126

**Grain sizes**

| | |
|---|---|
| <0.063mm | Very Fine |
| 0.1mm - 0.063mm | Fine |
| 0.1mm - 2mm | Medium |
| 2mm - 10mm | Coarse |
| >10mm | Very Coarse |

| Sample Identity | Depth (m) | Colour | Grain Size | Description | Batch |
|---|---|---|---|---|---|
| TP01 | 0.60 | Brown | <0.063mm | Silty Clay | 1 |
| TP02 | 0.70 | Grey | <0.063mm | Silty Clay | 1 |
| TP03 | 0.80 | Brown | <0.063mm | Silty Clay with some Stones | 1 |
| TP03 | 2.00 | Dark Brown | 0.1mm - 2mm | Top Soil with some Stones | 1 |
| TP04 | 0.60 | Dark Grey | <0.063mm | Silty Clay | 1 |
| TP04 | 2.10 | Dark Grey | 0.1mm - 0.063mm | Clay | 1 |
| TP05 | 1.00 | Dark Grey | 0.1mm - 0.063mm | Sandy Clay with some Stones | 1 |
| TP05 | 2.00 | Grey | 0.1mm - 0.063mm | Clay with some Stones | 1 |
| TP05 | 3.00 | Green | 0.1mm - 0.063mm | Clay | 1 |
| TP06 | 0.5 | Light Brown | <0.063mm | Sandy Clay with some Stones | 2 |
| TP06 | 2.9 | Dark Grey | <0.063mm | Sludge/Sediment with some Stones | 2 |
| TP07 | 0.7 | Brown | <0.063mm | Sandy Clay with some Stones | 2 |
| TP10 | 0.5 | Cream | <0.063mm | Silty Clay with some Stones | 2 |
| TP11 | 0.8 | Brown | <0.063mm | Silty Clay | 2 |
| TP11 | 1.4 | Brown | <0.063mm | Silty Clay with some Stones | 2 |
| TP13 | 0.5 | Grey | <0.063mm | Silty Clay with some Stones | 2 |
| TP15 | 0.6 | Dark Brown | <0.063mm | Silt | 2 |
| TP15 | 1.1 | Brown | <0.063mm | Sand with some Stones | 2 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

* 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 occurring 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.
[1] Sample Description supplied by client

**Validated** ✓
**Preliminary**

# ALcontrol Geochem Analytical Services
# Table Of Results

[#] ISO 17025 accredited
[M] MCERTS accredited
* Subcontracted test
» Shown on prev. report

**Job Number:** 06/10818/02/01 **Matrix:** SOLID
**Client:** BWB Consulting **Location:** HARBOUR HILL ROAD
**Client Ref. No.:** LDS126 **Client Contact:** Chris Evans

| Sample Identity | TP01 | TP02 | TP03 | TP03 | TP04 | TP04 | TP05 | TP05 | TP05 | Method Code | LoD/Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Depth (m)** | 0.60 | 0.70 | 0.80 | 2.00 | 0.60 | 2.10 | 1.00 | 2.00 | 3.00 | | |
| **Sample Type** | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | | |
| **Sampled Date** | | | | | | | | | | | |
| **Sample Received Date** | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | | |
| **Batch** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| **Sample Number(s)** | **1-2** | **9-11** | **16-18** | **22-24** | **26-28** | **32-34** | **37-39** | **40-42** | **43-45** | | |
| Boron Water Soluble | 4 | 1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | TM129[#M] | <1 mg/kg |
| Arsenic | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | TM129[#M] | <1 mg/kg |
| Barium | <2 | <2 | 5 | <2 | <2 | <2 | <2 | <2 | <2 | TM129[#M] | <2 mg/kg |
| Beryllium | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | TM129[#M] | <1 mg/kg |
| Cadmium | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | TM129[#M] | <1 mg/kg |
| Chromium | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | TM129[#M] | <1 mg/kg |
| Copper | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | TM129[#M] | <1 mg/kg |
| Lead | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | TM129[#M] | <1 mg/kg |
| Mercury | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | <1.2 | TM129[#M] | <1.2 mg/kg |
| Nickel | <1 | <1 | 1 | <1 | <1 | <1 | <1 | <1 | <1 | TM129[#M] | <1 mg/kg |
| Selenium | <3 | <3 | <3 | <3 | <3 | <3 | <3 | <3 | <3 | TM129[#M] | <3 mg/kg |
| Vanadium | <1 | 2 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | TM129[#M] | <1 mg/kg |
| Zinc | 1 | <1 | 2 | <1 | 2 | 2 | <1 | 2 | <1 | TM129[#M] | <1 mg/kg |
| Water Soluble Sulphate as SO4 2:1 Extract | 0.076 | 0.088 | 0.187 | 0.010 | 0.033 | 0.010 | <0.003 | 0.035 | 0.059 | TM098[#M] | <0.003 g/l |
| Phenols Monohydric | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | TM062 | <0.01 mg/kg |
| Total Cyanide | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | TM153[#M] | <1 mg/kg |
| Free Cyanide | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | TM153[#M] | <1 mg/kg |
| Complex Cyanide | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | TM153[#M] | <1 mg/kg |
| Asbestos Presence Screen | No Fibres Detected | No Fibres Detected | No Fibres Detected | - | No Fibres Detected | - | - | - | - | TM001 | NONE |
| Fraction of Organic Carbon | 0.004 | 0.039 | 0.004 | 0.765 | 0.006 | 0.006 | 0.028 | 0.008 | 0.077 | TM050[#] | <0.001 NONE |
| pH Value | 6.78 | 5.73 | 6.98 | 4.88 | 7.83 | 7.31 | 7.70 | 7.76 | 5.05 | TM133[#M] | <1.00 pH Units |

**All results expressed on a dry weight basis.**

**Date** 07.09.2006

**Validated** ✓
**Preliminary**

# ALcontrol Geochem Analytical Services
# Table Of Results

[#] ISO 17025 accredited
[M] MCERTS accredited
* Subcontracted test
» Shown on prev. report

**Job Number:** 06/10818/02/01 **Matrix:** SOLID
**Client:** BWB Consulting **Location:** HARBOUR HILL ROAD
**Client Ref. No.:** LDS126 **Client Contact:** Chris Evans

| Sample Identity | TP01 | TP02 | TP03 | TP03 | TP04 | TP04 | TP05 | TP05 | TP05 | Method Code | LoD/Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | 0.60 | 0.70 | 0.80 | 2.00 | 0.60 | 2.10 | 1.00 | 2.00 | 3.00 | | |
| Sample Type | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | | |
| Sampled Date | | | | | | | | | | | |
| Sample Received Date | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | | |
| Batch | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| Sample Number(s) | 1-2 | 9-11 | 16-18 | 22-24 | 26-28 | 32-34 | 37-39 | 40-42 | 43-45 | | |
| GRO (C4-C12) | - | - | <10 | <10 | <10 | <10 | <10 | - | <10 | TM089#M | <10 ug/kg |
| MTBE | - | - | <10 | <10 | <10 | <10 | <10 | - | <10 | TM089# | <10 ug/kg |
| Benzene | - | - | <10 | <10 | <10 | <10 | <10 | - | <10 | TM089#M | <10 ug/kg |
| Toluene | - | - | <10 | <10 | <10 | <10 | <10 | - | <10 | TM089#M | <10 ug/kg |
| Ethyl benzene | - | - | <10 | <10 | <10 | <10 | <10 | - | <10 | TM089#M | <10 ug/kg |
| m & p Xylene | - | - | <10 | <10 | <10 | <10 | <10 | - | <10 | TM089#M | <10 ug/kg |
| o Xylene | - | - | <10 | <10 | <10 | <10 | <10 | - | <10 | TM089#M | <10 ug/kg |
| Aliphatics C5-C6 | - | - | <10 | <10 | <10 | <10 | <10 | - | <10 | TM089 | <10 ug/kg |
| Aliphatics >C6-C8 | - | - | <10 | <10 | <10 | <10 | <10 | - | <10 | TM089 | <10 ug/kg |
| Aliphatics >C8-C10 | - | - | <10 | <10 | <10 | <10 | <10 | - | <10 | TM089 | <10 ug/kg |
| Aliphatics >C10-C12 | - | - | <10 | <10 | <10 | <10 | <10 | - | <10 | TM089 | <10 ug/kg |
| Aliphatics >C12-C16 | - | - | 3391 | 66346 | 147 | 1297 | 2743 | - | 24289 | TM061# | <100 ug/kg |
| Aliphatics >C16-C21 | - | - | 116 | 24269 | <100 | 2150 | <100 | - | 16012 | TM061# | <100 ug/kg |
| Aliphatics >C21-C35 | - | - | 171 | 32267 | <100 | 3830 | 104 | - | 112 | TM061# | <100 ug/kg |
| Total Aliphatics C5-C35 | - | - | 3678 | 122882 | 147 | 7277 | 2847 | - | 40413 | TM61/89 | <100 ug/kg |
| Aromatics C6-C7 | - | - | <10 | <10 | <10 | <10 | <10 | - | <10 | TM089#M | <10 ug/kg |
| Aromatics >C7-C8 | - | - | <10 | <10 | <10 | <10 | <10 | - | <10 | TM089#M | <10 ug/kg |
| Aromatics >EC8-EC10 | - | - | <10 | <10 | <10 | <10 | <10 | - | <10 | TM089 | <10 ug/kg |
| Aromatics >EC10-EC12 | - | - | <10 | <10 | <10 | <10 | <10 | - | <10 | TM089 | <10 ug/kg |
| Aromatics >EC12-EC16 | - | - | <100 | 27913 | <100 | 235 | 1110 | - | 4935 | TM061# | <100 ug/kg |
| Aromatics >EC16-EC21 | - | - | 186 | 80334 | <100 | <100 | 484 | - | 16842 | TM061# | <100 ug/kg |
| Aromatics >EC21-EC35 | - | - | <100 | 136752 | <100 | <100 | <100 | - | 35314 | TM061# | <100 ug/kg |
| Total Aromatics C6-C35 | - | - | 186 | 244999 | <100 | 235 | 1594 | - | 57091 | TM61/89 | <100 ug/kg |
| TPH (Aliphatics and Aromatics C5-C35) | - | - | 3864 | 367881 | 147 | 7512 | 4441 | - | 97504 | TM61/89 | <100 ug/kg |

**All results expressed on a dry weight basis.**

**Date** 07.09.2006

**Validated** ✓
**Preliminary**

# ALcontrol Geochem Analytical Services
# Table Of Results

[#] ISO 17025 accredited
[M] MCERTS accredited
* Subcontracted test
» Shown on prev. report

**Job Number:** 06/10818/02/01 **Matrix:** SOLID
**Client:** BWB Consulting **Location:** HARBOUR HILL ROAD
**Client Ref. No.:** LDS126 **Client Contact:** Chris Evans

| Sample Identity | TP01 | TP02 | TP03 | TP03 | TP04 | TP04 | TP05 | TP05 | TP05 | Method Code | LoD/Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | 0.60 | 0.70 | 0.80 | 2.00 | 0.60 | 2.10 | 1.00 | 2.00 | 3.00 | | |
| Sample Type | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | | |
| Sampled Date | | | | | | | | | | | |
| Sample Received Date | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | | |
| Batch | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| Sample Number(s) | **1-2** | **9-11** | **16-18** | **22-24** | **26-28** | **32-34** | **37-39** | **40-42** | **43-45** | | |
| **Rapid Assessment Package** | | | | | | | | | | | |
| Total Extractable Hydrocarbons | <10 | - | <10 | - | <10 | <10 | <10 | <10 | 28 | TM154[#] | <10 mg/kg |
| Aliphatics >C6-C8 | <10 | - | <10 | - | <10 | <10 | <10 | <10 | <10 | TM154[#] | <10 mg/kg |
| Aliphatics >C8-C10 | <10 | - | <10 | - | <10 | <10 | <10 | <10 | <10 | TM154[#] | <10 mg/kg |
| Aliphatics >C10-C12 | <10 | - | <10 | - | <10 | <10 | <10 | <10 | <10 | TM154[#] | <10 mg/kg |
| Aliphatics >C12-C16 | <10 | - | <10 | - | <10 | <10 | <10 | <10 | <10 | TM154[#] | <10 mg/kg |
| Aliphatics >C16-C21 | <10 | - | <10 | - | <10 | <10 | <10 | <10 | <10 | TM154[#] | <10 mg/kg |
| Aliphatics >C21-C35 | <10 | - | <10 | - | <10 | <10 | <10 | <10 | <10 | TM154[#] | <10 mg/kg |
| Aliphatics >C35-C40 | <10 | - | <10 | - | <10 | <10 | <10 | <10 | <10 | TM154[#] | <10 mg/kg |
| Total Aliphatics >C6-C40 (Min Oils) | <10 | - | <10 | - | <10 | <10 | <10 | <10 | <10 | TM154[#] | <10 mg/kg |
| Aromatics >C6-C7 | <10 | - | <10 | - | <10 | <10 | <10 | <10 | <10 | TM154[#] | <10 mg/kg |
| Aromatics >C7-C8 | <10 | - | <10 | - | <10 | <10 | <10 | <10 | <10 | TM154[#] | <10 mg/kg |
| Aromatics >C8-C10 | <10 | - | <10 | - | <10 | <10 | <10 | <10 | <10 | TM154[#] | <10 mg/kg |
| Aromatics >C10-C12 | <10 | - | <10 | - | <10 | <10 | <10 | <10 | <10 | TM154[#] | <10 mg/kg |
| Aromatics >C12-C16 | <10 | - | <10 | - | <10 | <10 | <10 | <10 | <10 | TM154[#] | <10 mg/kg |
| Aromatics >C16-C21 | <10 | - | <10 | - | <10 | <10 | <10 | <10 | <10 | TM154[#] | <10 mg/kg |
| Aromatics >C21-C40 | <10 | - | <10 | - | <10 | <10 | <10 | <10 | <10 | TM154[#] | <10 mg/kg |
| Total Aromatics >C6-C40 | <10 | - | <10 | - | <10 | <10 | <10 | <10 | <10 | TM154[#] | <10 mg/kg |
| Total TPH >C6-C40 | <10 | - | <10 | - | <10 | <10 | <10 | <10 | <10 | TM154[#] | <10 mg/kg |
| | | | | | | | | | | | |
| TPH C6-40 | <10 | 82 | <10 | 1093 | <10 | <10 | <10 | <10 | 28 | TM154[#] | <10 mg/kg |
| | | | | | | | | | | | |
| **PAH by GC-FID** | | | | | | | | | | | |
| Naphthalene | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | 0.66 | TM142 | <0.05 mg/kg |
| Acenaphthylene | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Acenaphthene | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Fluorene | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Phenanthrene | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Anthracene | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Fluoranthene | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Pyrene | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |

**All results expressed on a dry weight basis.**

**Date** 07.09.2006

**Validated** ✓
**Preliminary**

# ALcontrol Geochem Analytical Services
# Table Of Results

[#] ISO 17025 accredited
[M] MCERTS accredited
* Subcontracted test
» Shown on prev. report

**Job Number:** 06/10818/02/01 **Matrix:** SOLID
**Client:** BWB Consulting **Location:** HARBOUR HILL ROAD
**Client Ref. No.:** LDS126 **Client Contact:** Chris Evans

| Sample Identity | TP01 | TP02 | TP03 | TP03 | TP04 | TP04 | TP05 | TP05 | TP05 | Method Code | LoD/Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | 0.60 | 0.70 | 0.80 | 2.00 | 0.60 | 2.10 | 1.00 | 2.00 | 3.00 | | |
| Sample Type | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | | |
| Sampled Date | | | | | | | | | | | |
| Sample Received Date | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | | |
| Batch | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| Sample Number(s) | **1-2** | **9-11** | **16-18** | **22-24** | **26-28** | **32-34** | **37-39** | **40-42** | **43-45** | | |
| **PAH by GC-FID (cont)** | | | | | | | | | | | |
| Benz(a)anthracene | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Chrysene | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Benzo(b)fluoranthene | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Benzo(k)fluoranthene | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Benzo(a)pyrene | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Indeno(123cd)pyrene | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Dibenzo(ah)anthracene | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Benzo(ghi)perylene | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| PAH 16 Total | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | 0.66 | TM142 | <0.05 mg/kg |

**All results expressed on a dry weight basis.**

**Date** 07.09.2006

**Validated** ✓
**Preliminary**

# ALcontrol Geochem Analytical Services
# Table Of Results

[#] ISO 17025 accredited
[M] MCERTS accredited
* Subcontracted test
» Shown on prev. report

**Job Number:** 06/10818/02/01 **Matrix:** SOLID
**Client:** BWB Consulting **Location:** HARBOUR HILL ROAD
**Client Ref. No.:** LDS126 **Client Contact:** Chris Evans

| Sample Identity | TP06 | TP06 | TP07 | TP10 | TP11 | TP11 | TP11 | TP13 | TP15 | Method Code | LoD/Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Depth (m)** | 0.5 | 2.9 | 0.7 | 0.5 | 0.2 | 0.8 | 1.4 | 0.5 | 0.6 | | |
| **Sample Type** | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | | |
| **Sampled Date** | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | | |
| **Sample Received Date** | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | | |
| **Batch** | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | |
| **Sample Number(s)** | **46-48** | **55-57** | **58-60** | **81-83** | **94-95,141** | **96-98** | **99-101** | **118-120** | **135-137** | | |
| Boron Water Soluble | <1 | <1 | 2 | <1 | - | 1 | <1 | 3 | <1 | TM129[#M] | <1 mg/kg |
| Arsenic | <1 | 4 | 1 | <1 | - | 26 | 6 | 5 | 5 | TM129[#M] | <1 mg/kg |
| Barium | 80 | 73 | 79 | 92 | - | 182 | 95 | 74 | 56 | TM129[#M] | <2 mg/kg |
| Beryllium | <1 | <1 | <1 | <1 | - | 2 | <1 | <1 | <1 | TM129[#M] | <1 mg/kg |
| Cadmium | <1 | <1 | <1 | <1 | - | <1 | <1 | <1 | <1 | TM129[#M] | <1 mg/kg |
| Chromium | 7 | 14 | 14 | 4 | - | 21 | 21 | 21 | 23 | TM129[#M] | <1 mg/kg |
| Copper | 1 | 20 | 10 | 4 | - | 60 | 9 | 26 | 29 | TM129[#M] | <1 mg/kg |
| Lead | 11 | 17 | 13 | 26 | - | 205 | 21 | 16 | 22 | TM129[#M] | <1 mg/kg |
| Mercury | <1.2 | <1.2 | <1.2 | <1.2 | - | <1.2 | <1.2 | <1.2 | <1.2 | TM129[#M] | <1.2 mg/kg |
| Nickel | 1 | 19 | 22 | 2 | - | 25 | 14 | 32 | 32 | TM129[#M] | <1 mg/kg |
| Selenium | <3 | <3 | <3 | <3 | - | <3 | <3 | <3 | <3 | TM129[#M] | <3 mg/kg |
| Vanadium | 4 | 17 | 15 | 5 | - | 37 | 26 | 17 | 19 | TM129[#M] | <1 mg/kg |
| Zinc | 27 | 50 | 74 | 72 | - | 216 | 67 | 91 | 99 | TM129[#M] | <1 mg/kg |
| Water Soluble Sulphate as SO4 2:1 Extract | 0.026 | 0.027 | 0.006 | 0.011 | - | 0.410 | 0.010 | 0.031 | 0.008 | TM098[#M] | <0.003 g/l |
| Phenols Monohydric | <0.01 | <0.01 | <0.01 | <0.01 | - | 0.01 | <0.01 | <0.01 | <0.01 | TM062 | <0.01 mg/kg |
| Total Cyanide | <1 | <1 | <1 | <1 | - | <1 | <1 | <1 | <1 | TM153[#M] | <1 mg/kg |
| Free Cyanide | <1 | <1 | <1 | <1 | - | <1 | <1 | <1 | <1 | TM153[#M] | <1 mg/kg |
| Complex Cyanide | <1 | <1 | <1 | <1 | - | <1 | <1 | <1 | <1 | TM153[#M] | <1 mg/kg |
| Asbestos Presence Screen | - | - | No Fibres Detected | No Fibres Detected | No Fibres Detected | - | - | No Fibres Detected | No Fibres Detected | TM001 | NONE |
| Fraction of Organic Carbon | 0.005 | 0.137 | 0.002 | 0.001 | - | 0.104 | 0.008 | 0.003 | 0.004 | TM050[#] | <0.001 NONE |
| pH Value | 10.41 | 7.89 | 8.43 | 9.04 | - | 7.28 | 8.23 | 7.79 | 8.05 | TM133[#M] | <1.00 pH Units |

**All results expressed on a dry weight basis.**

**Date** 07.09.2006

**Validated** ✓
**Preliminary**

# ALcontrol Geochem Analytical Services
# Table Of Results

[#] ISO 17025 accredited
[M] MCERTS accredited
* Subcontracted test
» Shown on prev. report

**Job Number:** 06/10818/02/01 **Matrix:** SOLID
**Client:** BWB Consulting **Location:** HARBOUR HILL ROAD
**Client Ref. No.:** LDS126 **Client Contact:** Chris Evans

| Sample Identity | TP06 | TP06 | TP07 | TP10 | TP11 | TP11 | TP11 | TP13 | TP15 | Method Code | LoD/Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | 0.5 | 2.9 | 0.7 | 0.5 | 0.2 | 0.8 | 1.4 | 0.5 | 0.6 | | |
| Sample Type | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | | |
| Sampled Date | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | | |
| Sample Received Date | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | | |
| Batch | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | |
| Sample Number(s) | 46-48 | 55-57 | 58-60 | 81-83 | 94-95,141 | 96-98 | 99-101 | 118-120 | 135-137 | | |
| GRO (C4-C12) | <10 | <10 | - | - | - | - | - | - | - | TM089[#M] | <10 ug/kg |
| MTBE | <10 | <10 | - | - | - | - | - | - | - | TM089[#] | <10 ug/kg |
| Benzene | <10 | <10 | - | - | - | - | - | - | - | TM089[#M] | <10 ug/kg |
| Toluene | <10 | <10 | - | - | - | - | - | - | - | TM089[#M] | <10 ug/kg |
| Ethyl benzene | <10 | <10 | - | - | - | - | - | - | - | TM089[#M] | <10 ug/kg |
| m & p Xylene | <10 | <10 | - | - | - | - | - | - | - | TM089[#M] | <10 ug/kg |
| o Xylene | <10 | <10 | - | - | - | - | - | - | - | TM089[#M] | <10 ug/kg |
| Aliphatics C5-C6 | <10 | <10 | - | - | - | - | - | - | - | TM089 | <10 ug/kg |
| Aliphatics >C6-C8 | <10 | <10 | - | - | - | - | - | - | - | TM089 | <10 ug/kg |
| Aliphatics >C8-C10 | <10 | <10 | - | - | - | - | - | - | - | TM089 | <10 ug/kg |
| Aliphatics >C10-C12 | <10 | <10 | - | - | - | - | - | - | - | TM089 | <10 ug/kg |
| Aliphatics >C12-C16 | 2346 | 74802 | - | - | - | - | - | - | - | TM061[#] | <100 ug/kg |
| Aliphatics >C16-C21 | 469 | 71338 | - | - | - | - | - | - | - | TM061[#] | <100 ug/kg |
| Aliphatics >C21-C35 | 138 | 84177 | - | - | - | - | - | - | - | TM061[#] | <100 ug/kg |
| Total Aliphatics C5-C35 | 2953 | 230317 | - | - | - | - | - | - | - | TM61/89 | <100 ug/kg |
| Aromatics C6-C7 | <10 | <10 | - | - | - | - | - | - | - | TM089[#M] | <10 ug/kg |
| Aromatics >C7-C8 | <10 | <10 | - | - | - | - | - | - | - | TM089[#M] | <10 ug/kg |
| Aromatics >EC8-EC10 | <10 | <10 | - | - | - | - | - | - | - | TM089 | <10 ug/kg |
| Aromatics >EC10-EC12 | <10 | <10 | - | - | - | - | - | - | - | TM089 | <10 ug/kg |
| Aromatics >EC12-EC16 | 2151 | 12507 | - | - | - | - | - | - | - | TM061[#] | <100 ug/kg |
| Aromatics >EC16-EC21 | 4475 | 38154 | - | - | - | - | - | - | - | TM061[#] | <100 ug/kg |
| Aromatics >EC21-EC35 | 43186 | 109617 | - | - | - | - | - | - | - | TM061[#] | <100 ug/kg |
| Total Aromatics C6-C35 | 49812 | 160278 | - | - | - | - | - | - | - | TM61/89 | <100 ug/kg |
| TPH (Aliphatics and Aromatics C5-C35) | 52765 | 390595 | - | - | - | - | - | - | - | TM61/89 | <100 ug/kg |

**All results expressed on a dry weight basis.**

**Date** 07.09.2006

**Validated** ✓
**Preliminary**

# ALcontrol Geochem Analytical Services
# Table Of Results

[#] ISO 17025 accredited
[M] MCERTS accredited
* Subcontracted test
» Shown on prev. report

**Job Number:** 06/10818/02/01 **Matrix:** SOLID
**Client:** BWB Consulting **Location:** HARBOUR HILL ROAD
**Client Ref. No.:** LDS126 **Client Contact:** Chris Evans

| Sample Identity | TP06 | TP06 | TP07 | TP10 | TP11 | TP11 | TP11 | TP13 | TP15 | Method Code | LoD/Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | 0.5 | 2.9 | 0.7 | 0.5 | 0.2 | 0.8 | 1.4 | 0.5 | 0.6 | | |
| Sample Type | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | | |
| Sampled Date | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | | |
| Sample Received Date | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | | |
| Batch | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | |
| Sample Number(s) | **46-48** | **55-57** | **58-60** | **81-83** | **94-95,141** | **96-98** | **99-101** | **118-120** | **135-137** | | |
| **Rapid Assessment Package** | | | | | | | | | | | |
| Total Extractable Hydrocarbons | 22 | 576 | - | - | - | 377 | - | - | 17 | TM154[#] | <10 mg/kg |
| Aliphatics >C6-C8 | <10 | <10 | - | - | - | <10 | - | - | <10 | TM154[#] | <10 mg/kg |
| Aliphatics >C8-C10 | <10 | <10 | - | - | - | <10 | - | - | <10 | TM154[#] | <10 mg/kg |
| Aliphatics >C10-C12 | <10 | <10 | - | - | - | <10 | - | - | <10 | TM154[#] | <10 mg/kg |
| Aliphatics >C12-C16 | <10 | <10 | - | - | - | <10 | - | - | <10 | TM154[#] | <10 mg/kg |
| Aliphatics >C16-C21 | <10 | 14 | - | - | - | <10 | - | - | <10 | TM154[#] | <10 mg/kg |
| Aliphatics >C21-C35 | <10 | 30 | - | - | - | <10 | - | - | <10 | TM154[#] | <10 mg/kg |
| Aliphatics >C35-C40 | <10 | <10 | - | - | - | <10 | - | - | <10 | TM154[#] | <10 mg/kg |
| Total Aliphatics >C6-C40 (Min Oils) | <10 | 44 | - | - | - | <10 | - | - | <10 | TM154[#] | <10 mg/kg |
| Aromatics >C6-C7 | <10 | <10 | - | - | - | <10 | - | - | <10 | TM154[#] | <10 mg/kg |
| Aromatics >C7-C8 | <10 | <10 | - | - | - | <10 | - | - | <10 | TM154[#] | <10 mg/kg |
| Aromatics >C8-C10 | <10 | <10 | - | - | - | <10 | - | - | <10 | TM154[#] | <10 mg/kg |
| Aromatics >C10-C12 | <10 | <10 | - | - | - | <10 | - | - | <10 | TM154[#] | <10 mg/kg |
| Aromatics >C12-C16 | <10 | <10 | - | - | - | <10 | - | - | <10 | TM154[#] | <10 mg/kg |
| Aromatics >C16-C21 | <10 | 30 | - | - | - | 14 | - | - | <10 | TM154[#] | <10 mg/kg |
| Aromatics >C21-C40 | <10 | 157 | - | - | - | 99 | - | - | <10 | TM154[#] | <10 mg/kg |
| Total Aromatics >C6-C40 | <10 | 187 | - | - | - | 113 | - | - | <10 | TM154[#] | <10 mg/kg |
| Total TPH >C6-C40 | <10 | 230 | - | - | - | 113 | - | - | <10 | TM154[#] | <10 mg/kg |
| | | | | | | | | | | | |
| TPH C6-40 | 22 | 576 | <10 | 423 | - | 377 | <10 | <10 | 17 | TM154[#] | <10 mg/kg |
| | | | | | | | | | | | |
| **PAH by GC-FID** | | | | | | | | | | | |
| Naphthalene | <0.05 | 0.91 | <0.05 | <0.05 | - | 0.30 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Acenaphthylene | <0.05 | 0.21 | <0.05 | <0.05 | - | 0.11 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Acenaphthene | <0.05 | 0.25 | <0.05 | <0.05 | - | 0.18 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Fluorene | <0.05 | 0.23 | <0.05 | <0.05 | - | 0.57 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Phenanthrene | <0.05 | 3.55 | <0.05 | <0.05 | - | 5.00 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Anthracene | <0.05 | 0.70 | <0.05 | <0.05 | - | 1.26 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Fluoranthene | <0.05 | 0.84 | <0.05 | <0.05 | - | 7.14 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Pyrene | <0.05 | 0.50 | <0.05 | <0.05 | - | 5.35 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |

**All results expressed on a dry weight basis.**

**Date** 07.09.2006

**Validated** ✓
**Preliminary**

# ALcontrol Geochem Analytical Services
# Table Of Results

[#] ISO 17025 accredited
[M] MCERTS accredited
* Subcontracted test
» Shown on prev. report

**Job Number:** 06/10818/02/01 **Matrix:** SOLID
**Client:** BWB Consulting **Location:** HARBOUR HILL ROAD
**Client Ref. No.:** LDS126 **Client Contact:** Chris Evans

| Sample Identity | TP06 | TP06 | TP07 | TP10 | TP11 | TP11 | TP11 | TP13 | TP15 | Method Code | LoD/Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | 0.5 | 2.9 | 0.7 | 0.5 | 0.2 | 0.8 | 1.4 | 0.5 | 0.6 | | |
| Sample Type | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | | |
| Sampled Date | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | | |
| Sample Received Date | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | 29.06.06 | | |
| Batch | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | |
| Sample Number(s) | **46-48** | **55-57** | **58-60** | **81-83** | **94-95,141** | **96-98** | **99-101** | **118-120** | **135-137** | | |
| **PAH by GC-FID (cont)** | | | | | | | | | | | |
| Benz(a)anthracene | <0.05 | 0.38 | <0.05 | <0.05 | - | 3.11 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Chrysene | <0.05 | 0.37 | <0.05 | <0.05 | - | 3.52 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Benzo(b)fluoranthene | <0.05 | <0.05 | <0.05 | <0.05 | - | 2.47 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Benzo(k)fluoranthene | <0.05 | <0.05 | <0.05 | <0.05 | - | 0.84 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Benzo(a)pyrene | <0.05 | <0.05 | <0.05 | <0.05 | - | 2.58 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Indeno(123cd)pyrene | <0.05 | <0.05 | <0.05 | <0.05 | - | 1.21 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Dibenzo(ah)anthracene | <0.05 | <0.05 | <0.05 | <0.05 | - | 0.30 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| Benzo(ghi)perylene | <0.05 | <0.05 | <0.05 | <0.05 | - | 1.17 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |
| PAH 16 Total | <0.05 | 7.94 | <0.05 | <0.05 | - | 35.11 | <0.05 | <0.05 | <0.05 | TM142 | <0.05 mg/kg |

**All results expressed on a dry weight basis.**

**Date** 07.09.2006

**Validated** ✓
**Preliminary**

# ALcontrol Geochem Analytical Services
# Table Of Results

[#] ISO 17025 accredited
[M] MCERTS accredited
* Subcontracted test
» Shown on prev. report

**Job Number:** 06/10818/02/01 **Matrix:** SOLID
**Client:** BWB Consulting **Location:** HARBOUR HILL ROAD
**Client Ref. No.:** LDS126 **Client Contact:** Chris Evans

| Sample Identity | TP15 | | | | | | | | | Method Code | LoD/Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | 1.1 | | | | | | | | | | |
| Sample Type | SOIL | | | | | | | | | | |
| Sampled Date | 28.06.06 | | | | | | | | | | |
| Sample Received Date | 29.06.06 | | | | | | | | | | |
| Batch | 2 | | | | | | | | | | |
| Sample Number(s) | 138-140 | | | | | | | | | | |
| Boron Water Soluble | 4 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Arsenic | 5 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Barium | 61 | | | | | | | | | TM129[#M] | <2 mg/kg |
| Beryllium | <1 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Cadmium | <1 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Chromium | 20 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Copper | 20 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Lead | 20 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Mercury | <1.2 | | | | | | | | | TM129[#M] | <1.2 mg/kg |
| Nickel | 26 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Selenium | <3 | | | | | | | | | TM129[#M] | <3 mg/kg |
| Vanadium | 20 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Zinc | 84 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Water Soluble Sulphate as SO4 2:1 Extract | 0.032 | | | | | | | | | TM098[#M] | <0.003 g/l |
| Phenols Monohydric | <0.01 | | | | | | | | | TM062 | <0.01 mg/kg |
| Total Cyanide | <1 | | | | | | | | | TM153[#M] | <1 mg/kg |
| Free Cyanide | <1 | | | | | | | | | TM153[#M] | <1 mg/kg |
| Complex Cyanide | <1 | | | | | | | | | TM153[#M] | <1 mg/kg |
| Asbestos Presence Screen | - | | | | | | | | | TM001 | NONE |
| Fraction of Organic Carbon | 0.003 | | | | | | | | | TM050[#] | <0.001 NONE |
| pH Value | 8.70 | | | | | | | | | TM133[#M] | <1.00 pH Units |

**All results expressed on a dry weight basis.**

**Date** 07.09.2006

**Validated** ✓
**Preliminary**

# ALcontrol Geochem Analytical Services
# Table Of Results

[#] ISO 17025 accredited
[M] MCERTS accredited
[*] Subcontracted test
[»] Shown on prev. report

**Job Number:** 06/10818/02/01 **Matrix:** SOLID
**Client:** BWB Consulting **Location:** HARBOUR HILL ROAD
**Client Ref. No.:** LDS126 **Client Contact:** Chris Evans

| Sample Identity | TP15 | | | | | | | | | Method Code | LoD/Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | 1.1 | | | | | | | | | | |
| Sample Type | SOIL | | | | | | | | | | |
| Sampled Date | 28.06.06 | | | | | | | | | | |
| Sample Received Date | 29.06.06 | | | | | | | | | | |
| Batch | 2 | | | | | | | | | | |
| Sample Number(s) | 138-140 | | | | | | | | | | |
| **Rapid Assessment Package** | | | | | | | | | | | |
| Total Extractable Hydrocarbons | - | | | | | | | | | TM154[#] | <10 mg/kg |
| Aliphatics >C6-C8 | - | | | | | | | | | TM154[#] | <10 mg/kg |
| Aliphatics >C8-C10 | - | | | | | | | | | TM154[#] | <10 mg/kg |
| Aliphatics >C10-C12 | - | | | | | | | | | TM154[#] | <10 mg/kg |
| Aliphatics >C12-C16 | - | | | | | | | | | TM154[#] | <10 mg/kg |
| Aliphatics >C16-C21 | - | | | | | | | | | TM154[#] | <10 mg/kg |
| Aliphatics >C21-C35 | - | | | | | | | | | TM154[#] | <10 mg/kg |
| Aliphatics >C35-C40 | - | | | | | | | | | TM154[#] | <10 mg/kg |
| Total Aliphatics >C6-C40 (Min Oils) | - | | | | | | | | | TM154[#] | <10 mg/kg |
| Aromatics >C6-C7 | - | | | | | | | | | TM154[#] | <10 mg/kg |
| Aromatics >C7-C8 | - | | | | | | | | | TM154[#] | <10 mg/kg |
| Aromatics >C8-C10 | - | | | | | | | | | TM154[#] | <10 mg/kg |
| Aromatics >C10-C12 | - | | | | | | | | | TM154[#] | <10 mg/kg |
| Aromatics >C12-C16 | - | | | | | | | | | TM154[#] | <10 mg/kg |
| Aromatics >C16-C21 | - | | | | | | | | | TM154[#] | <10 mg/kg |
| Aromatics >C21-C40 | - | | | | | | | | | TM154[#] | <10 mg/kg |
| Total Aromatics >C6-C40 | - | | | | | | | | | TM154[#] | <10 mg/kg |
| Total TPH >C6-C40 | - | | | | | | | | | TM154[#] | <10 mg/kg |
| | | | | | | | | | | | |
| TPH C6-40 | <10 | | | | | | | | | TM154[#] | <10 mg/kg |
| | | | | | | | | | | | |
| **PAH by GC-FID** | | | | | | | | | | | |
| Naphthalene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Acenaphthylene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Acenaphthene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Fluorene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Phenanthrene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Anthracene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Fluoranthene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Pyrene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |

**All results expressed on a dry weight basis.**

**Date** 07.09.2006

**Validated** ✓
**Preliminary**

# ALcontrol Geochem Analytical Services
# Table Of Results

[#] ISO 17025 accredited
[M] MCERTS accredited
[*] Subcontracted test
[»] Shown on prev. report

**Job Number:** 06/10818/02/01 **Matrix:** SOLID
**Client:** BWB Consulting **Location:** HARBOUR HILL ROAD
**Client Ref. No.:** LDS126 **Client Contact:** Chris Evans

| Sample Identity | TP15 | | | | | | | | | Method Code | LoD/Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | 1.1 | | | | | | | | | | |
| Sample Type | SOIL | | | | | | | | | | |
| Sampled Date | 28.06.06 | | | | | | | | | | |
| Sample Received Date | 29.06.06 | | | | | | | | | | |
| Batch | 2 | | | | | | | | | | |
| Sample Number(s) | 138-140 | | | | | | | | | | |
| **PAH by GC-FID (cont)** | | | | | | | | | | | |
| Benz(a)anthracene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Chrysene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Benzo(b)fluoranthene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Benzo(k)fluoranthene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Benzo(a)pyrene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Indeno(123cd)pyrene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Dibenzo(ah)anthracene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Benzo(ghi)perylene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| PAH 16 Total | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |

**All results expressed on a dry weight basis.**

**Date** 07.09.2006

**Validated** ✓
**Preliminary**

# ALcontrol Geochem Analytical Services
# Table Of Results

[#] ISO 17025 accredited
[M] MCERTS accredited
* Subcontracted test
» Shown on prev. report

**Job Number:** 06/10818/02/01 **Matrix:** LEACHATE
**Client:** BWB Consulting **Location:** HARBOUR HILL ROAD
**Client Ref. No.:** LDS126 **Client Contact:** Chris Evans

| Sample Identity | TP03 | TP03 | TP04 | TP04 | TP05 | TP05 | TP06 | TP06 | | Method Code | LoD/Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Depth (m)** | 0.80 | 2.00 | 0.60 | 2.10 | 1.00 | 3.00 | 0.5 | 2.9 | | | |
| **Sample Type** | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | | | |
| **Sampled Date** | | | | | | | 28.06.06 | 28.06.06 | | | |
| **Sample Received Date** | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 28.06.06 | 29.06.06 | 29.06.06 | | | |
| **Batch** | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | | | |
| **Sample Number(s)** | **16-18** | **22-24** | **26-28** | **32-34** | **37-39** | **43-45** | **46-48** | **55-57** | | | |
| Arsenic Dissolved (NRA) (ICP-MS) | <1 | 2 | <1 | <1 | <1 | <1 | <1 | <1 | | TM152 | <1 ug/l |
| Barium Dissolved (NRA) (ICP-MS) | 6 | 15 | 14 | 5 | 10 | 4 | 10 | 13 | | TM152 | <1 ug/l |
| Beryllium Dissolved (NRA) (ICP-MS) | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | | TM152 | <1 ug/l |
| Boron Dissolved (NRA) (ICP-MS) | <10 | 56 | 24 | 20 | <10 | <10 | <10 | <10 | | TM152 | <10 ug/l |
| Cadmium Dissolved (NRA) (ICP-MS) | <0.4 | 1.2 | <0.4 | 0.5 | <0.4 | 0.8 | 1.0 | 1.9 | | TM152 | <0.4 ug/l |
| Chromium Dissolved (NRA) (ICP-MS) | 1 | 2 | 2 | <1 | 1 | 1 | <1 | <1 | | TM152 | <1 ug/l |
| Copper Dissolved (NRA) (ICP-MS) | <1 | <1 | 2 | <1 | 3 | <1 | 25 | <1 | | TM152 | <1 ug/l |
| Lead Dissolved (NRA) (ICP-MS) | 6 | 6 | 6 | 5 | 6 | 6 | <1 | <1 | | TM152 | <1 ug/l |
| Nickel Dissolved (NRA) (ICP-MS) | <1 | 2 | <1 | <1 | <1 | <1 | <1 | <1 | | TM152 | <1 ug/l |
| Selenium Dissolved (NRA) (ICP-MS) | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | | TM152 | <1 ug/l |
| Vanadium Dissolved (NRA) (ICP-MS) | <1 | 3 | 2 | <1 | 2 | <1 | <1 | <1 | | TM152 | <1 ug/l |
| Zinc Dissolved (NRA) (ICP-MS) | <3 | <3 | <3 | <3 | <3 | <3 | <3 | <3 | | TM152 | <3 ug/l |
| Mercury Dissolved (NRA) (CVAA) | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | | TM127 | <0.05 ug/l |
| Sulphate (NRA) | 19 | <3 | 9 | 4 | <3 | 13 | <3 | <3 | | TM098 | <3 mg/l |
| Total Cyanide (NRA) | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | | TM153 | <0.05 mg/l |
| pH (NRA) | 7.24 | 7.75 | 8.02 | 7.46 | 8.27 | 6.81 | 8.19 | 8.14 | | TM133 | <1.00 pH Units |

**Date** 07.09.2006

# ALcontrol Geochem Analytical Services
# Table Of Results - Appendix

**Job Number:** 06/10818/02/01
**Client:** BWB Consulting
**Client Ref. No.:** LDS126

## Report Key :

Results expressed as (e.g.) 1.03E-07 is equivalent to $1.03 \times 10^{-7}$

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

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

## Summary of Method Codes contained within report :

| Method No. | Reference | Description | ISO 17025 Accredited | MCERTS Accredited | Wet/Dry Sample [1] | Surrogate Corrected |
|---|---|---|---|---|---|---|
| **TM001** | In - house Method | Screening of Soils for Fibres | | | WET | |
| **TM050** | Method 5310B, AWWA/APHA, 20th Ed., 1999 / DIN EN 13137 | Total Organic Carbon determination by combustion method | ✓ | | DRY | |
| **TM061** | Method for the Determination of EPH,Massachusetts Dept.of EP, 1998 | Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40) | ✓ | | DRY | |
| **TM062** | MEWAM BOOK 124 1988.HMSO/ Method 17.7, Second Site property, March 2003 | Determination of Phenolic compounds by HPLC with electro-chemical detection | | | WET | |
| **TM089** | Modified: US EPA Methods 8020 & 602 | Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12) | | | WET | |
| **TM089** | Modified: US EPA Methods 8020 & 602 | Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12) | ✓ | | WET | |
| **TM089** | Modified: US EPA Methods 8020 & 602 | Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12) | ✓ | ✓ | WET | |
| **TM098** | Method 4500E, AWWA/APHA, 20th Ed., 1999 | Determination of Sulphate using the Kone Analyser | | | NA | |
| **TM098** | Method 4500E, AWWA/APHA, 20th Ed., 1999 | Determination of Sulphate using the Kone Analyser | ✓ | ✓ | DRY | |
| **TM127** | Method 3112B, AWWA/APHA, 20th Ed., 1999 | The Determination of Trace Level Mercury in Aqueous Media and Soil Extracts by Atomic Absorption Spectroscopy | | | NA | |
| **TM129** | Method 3120B, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 3050B | Determination of Metal Cations by IRIS Emission Spectrometer | ✓ | ✓ | DRY | |
| **TM133** | BS 1377: Part 3 1990 | Determination of pH in Soil and Water using the GLpH pH Meter | | | NA | |
| **TM133** | BS 1377: Part 3 1990 | Determination of pH in Soil and Water using the GLpH pH Meter | ✓ | ✓ | WET | |
| **TM142** | In house method | Analysis of Polynuclear Aromatic Hydrocarbons (PAH) by GC-FID | | | DRY | |

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

# ALcontrol Geochem Analytical Services
# Table Of Results - Appendix

**Job Number:** 06/10818/02/01
**Client:** BWB Consulting
**Client Ref. No.:** LDS126

## Report Key :

Results expressed as (e.g.) 1.03E-07 is equivalent to $1.03 \times 10^{-7}$

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

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

## Summary of Method Codes contained within report :

| Method No. | Reference | Description | ISO 17025 Accredited | MCERTS Accredited | Wet/Dry Sample [1] | Surrogate Corrected |
|---|---|---|---|---|---|---|
| **TM152** | Method 3125B, AWWA/APHA, 20th Ed., 1999 | Analysis of Aqueous Samples by ICP-MS | | | NA | |
| **TM153** | Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999 | Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the "Skalar SANS+ System" Segmented Flow Analyser | | | NA | |
| **TM153** | Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999 | Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the "Skalar SANS+ System" Segmented Flow Analyser | ✓ | ✓ | WET | |
| **TM154** | In - house Method | Determination of Petroleum Hydrocarbons by EZ Flash GC-FID in the Carbon range C6- C40 | ✓ | | WET | |
| **TM61/89** | | see TM061 and TM089 for details | | | WET | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

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

# ALcontrol Geochem Analytical Services
# Table Of Results - Appendix

**Job Number:** 06/10818/02/01
**Client:** BWB Consulting
**Client Ref. No.:** LDS126

**Summary of Coolbox temperatures**

| Batch No. | Coolbox Temperature (°C) |
|---|---|
| **1** | 19 |
| **2** | 13 |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

# ALcontrol Geochem - Table Of Results

| | | | | | |
|---|---|---|---|---|---|
| **Job Number:** | 06/11378/02/01 | | | | |
| **Client:** | BWB Consulting | | | | |
| **Client Ref:** | LDS126 | | | | |
| **Matrix:** | SOLID | | | | |
| | | **All results expressed on a dry weight basis.** | | | |
| | | | **Sample Identity** | BH5 | |
| | | | **Depth** | 0.50 | |
| | | | | | |
| | | | **Sample Type** | SOLID | |
| | | | **Sample Received Date** | 05/07/2006 | |
| | | | **Sampled Date** | | |
| | | | **Batch** | 1 | |
| | | | **Sample Number(s)** | 28-30 | |
| | | | | | |
| | **Method** | **Units** | **Method Detection Limit** | | |
| Boron Water Soluble | TM129 | mg/kg | <1 | <1 | |
| Arsenic | TM129 | mg/kg | <1 | <1 | |
| Barium | TM129 | mg/kg | <2 | 70 | |
| Beryllium | TM129 | mg/kg | <1 | <1 | |
| Cadmium | TM129 | mg/kg | <1 | <1 | |
| Chromium | TM129 | mg/kg | <1 | 12 | |
| Copper | TM129 | mg/kg | <1 | <1 | |
| Lead | TM129 | mg/kg | <1 | 8 | |
| Mercury | TM129 | mg/kg | <1.2 | <1.2 | |
| Nickel | TM129 | mg/kg | <1 | 11 | |
| Selenium | TM129 | mg/kg | <3 | <3 | |
| Vanadium | TM129 | mg/kg | <1 | 9 | |
| Zinc | TM129 | mg/kg | <1 | 19 | |
| Water Soluble Sulphate as SO4 2:1 Extra | TM098 | g/l | <0.003 | 0.008 | |
| Phenols Monohydric | TM062 | mg/kg | <0.01 | <0.01 | |
| Total Cyanide | TM153 | mg/kg | <1 | <1 | |
| Free Cyanide | TM153 | mg/kg | <1 | <1 | |
| Complex Cyanide | TM153 | mg/kg | <1 | <1 | |
| Asbestos Presence Screen | TM001 | NONE | No Fibres Detected | | |
| Fraction of Organic Carbon | TM050 | NONE | <0.001 | 0.001 | |

| | | | | | |
|---|---|---|---|---|---|
| pH Value | TM133 | pH Units | <1.00 | 8.75 | |
| TPH C6-40 | TM154 | mg/kg | <10 | 81 | |
| | | | | | |
| **PAH by GC-FID** | | | | | |
| Naphthalene | TM142 | mg/kg | <0.05 | <0.05 | |
| Acenaphthylene | TM142 | mg/kg | <0.05 | <0.05 | |
| Acenaphthene | TM142 | mg/kg | <0.05 | <0.05 | |
| Fluorene | TM142 | mg/kg | <0.05 | <0.05 | |
| Phenanthrene | TM142 | mg/kg | <0.05 | <0.05 | |
| Anthracene | TM142 | mg/kg | <0.05 | <0.05 | |
| Fluoranthene | TM142 | mg/kg | <0.05 | <0.05 | |
| Pyrene | TM142 | mg/kg | <0.05 | <0.05 | |
| Benz(a)anthracene | TM142 | mg/kg | <0.05 | <0.05 | |
| Chrysene | TM142 | mg/kg | <0.05 | <0.05 | |
| Benzo(b)fluoranthene | TM142 | mg/kg | <0.05 | <0.05 | |
| Benzo(k)fluoranthene | TM142 | mg/kg | <0.05 | <0.05 | |
| Benzo(a)pyrene | TM142 | mg/kg | <0.05 | <0.05 | |
| Indeno(123cd)pyrene | TM142 | mg/kg | <0.05 | <0.05 | |
| Dibenzo(ah)anthracene | TM142 | mg/kg | <0.05 | <0.05 | |
| Benzo(ghi)perylene | TM142 | mg/kg | <0.05 | <0.05 | |
| PAH 16 Total | TM142 | mg/kg | <0.05 | <0.05 | |

# ALcontrol Geochem Analytical Services
# Sample Descriptions

**Job Number:** 06/11378/02/01
**Client:** BWB Consulting
**Client Ref :** LDS126

**Grain sizes**

| | |
|---|---|
| <0.063mm | Very Fine |
| 0.1mm - 0.063mm | Fine |
| 0.1mm - 2mm | Medium |
| 2mm - 10mm | Coarse |
| >10mm | Very Coarse |

| Sample Identity | Depth (m) | Colour | Grain Size | Description | Batch |
|---|---|---|---|---|---|
| BH5 | 0.50 | Light Brown | 0.1mm - 0.063mm | Sandy Clay with some Stones | 1 |

* 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 occurring 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.
[1] Sample Description supplied by client

**Validated** ✓
**Preliminary**

# ALcontrol Geochem Analytical Services
# Table Of Results

[#] ISO 17025 accredited
[M] MCERTS accredited
* Subcontracted test
» Shown on prev. report

**Job Number:** 06/11378/02/01 **Matrix:** SOLID
**Client:** BWB Consulting **Location:** HARBOROUGH ROAD, BARNSLEY
**Client Ref. No.:** LDS126 **Client Contact:** Chris Evans

| Sample Identity | BH5 | | | | | | | | | Method Code | LoD/Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | 0.50 | | | | | | | | | | |
| Sample Type | SOLID | | | | | | | | | | |
| Sampled Date | | | | | | | | | | | |
| Sample Received Date | 05.07.06 | | | | | | | | | | |
| Batch | 1 | | | | | | | | | | |
| Sample Number(s) | 28-30 | | | | | | | | | | |
| Boron Water Soluble | <1 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Arsenic | <1 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Barium | 70 | | | | | | | | | TM129[#M] | <2 mg/kg |
| Beryllium | <1 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Cadmium | <1 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Chromium | 12 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Copper | <1 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Lead | 8 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Mercury | <1.2 | | | | | | | | | TM129[#M] | <1.2 mg/kg |
| Nickel | 11 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Selenium | <3 | | | | | | | | | TM129[#M] | <3 mg/kg |
| Vanadium | 9 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Zinc | 19 | | | | | | | | | TM129[#M] | <1 mg/kg |
| Water Soluble Sulphate as SO4 2:1 Extract | 0.008 | | | | | | | | | TM098[#M] | <0.003 g/l |
| Phenols Monohydric | <0.01 | | | | | | | | | TM062 | <0.01 mg/kg |
| Total Cyanide | <1 | | | | | | | | | TM153[#M] | <1 mg/kg |
| Free Cyanide | <1 | | | | | | | | | TM153[#M] | <1 mg/kg |
| Complex Cyanide | <1 | | | | | | | | | TM153[#M] | <1 mg/kg |
| Asbestos Presence Screen | No Fibres Detected | | | | | | | | | TM001 | NONE |
| Fraction of Organic Carbon | 0.001 | | | | | | | | | TM050[#] | <0.001 NONE |
| pH Value | 8.75 | | | | | | | | | TM133[#M] | <1.00 pH Units |
| TPH C6-40 | 81 | | | | | | | | | TM154[#] | <10 mg/kg |
| | | | | | | | | | | | |
| **PAH by GC-FID** | | | | | | | | | | | |
| Naphthalene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Acenaphthylene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Acenaphthene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Fluorene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Phenanthrene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Anthracene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Fluoranthene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |

**All results expressed on a dry weight basis.**

**Date** 07.09.2006

**Validated** ✓
**Preliminary**

# ALcontrol Geochem Analytical Services
# Table Of Results

[#] ISO 17025 accredited
[M] MCERTS accredited
[*] Subcontracted test
[»] Shown on prev. report

**Job Number:** 06/11378/02/01 **Matrix:** SOLID
**Client:** BWB Consulting **Location:** HARBOROUGH ROAD, BARNSLEY
**Client Ref. No.:** LDS126 **Client Contact:** Chris Evans

| **Sample Identity** | BH5 | | | | | | | | | **Method Code** | **LoD/Units** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Depth (m)** | 0.50 | | | | | | | | | | |
| **Sample Type** | SOLID | | | | | | | | | | |
| **Sampled Date** | | | | | | | | | | | |
| **Sample Received Date** | 05.07.06 | | | | | | | | | | |
| **Batch** | 1 | | | | | | | | | | |
| **Sample Number(s)** | **28-30** | | | | | | | | | | |
| **PAH by GC-FID (cont)** | | | | | | | | | | | |
| Pyrene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Benz(a)anthracene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Chrysene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Benzo(b)fluoranthene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Benzo(k)fluoranthene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Benzo(a)pyrene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Indeno(123cd)pyrene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Dibenzo(ah)anthracene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| Benzo(ghi)perylene | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |
| PAH 16 Total | <0.05 | | | | | | | | | TM142 | <0.05 mg/kg |

**All results expressed on a dry weight basis.**

**Date** 07.09.2006

# ALcontrol Geochem Analytical Services
# Table Of Results - Appendix

**Job Number:** 06/11378/02/01
**Client:** BWB Consulting
**Client Ref. No.:** LDS126

## Report Key :

Results expressed as (e.g.) 1.03E-07 is equivalent to $1.03 \times 10^{-7}$

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

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

## Summary of Method Codes contained within report :

| Method No. | Reference | Description | ISO 17025 Accredited | MCERTS Accredited | Wet/Dry Sample [1] | Surrogate Corrected |
|---|---|---|---|---|---|---|
| **TM001** | In - house Method | Screening of Soils for Fibres | | | WET | |
| **TM050** | Method 5310B, AWWA/APHA, 20th Ed., 1999 / DIN EN 13137 | Total Organic Carbon determination by combustion method | ✓ | | DRY | |
| **TM062** | MEWAM BOOK 124 1988.HMSO/ Method 17.7, Second Site property, March 2003 | Determination of Phenolic compounds by HPLC with electro-chemical detection | | | WET | |
| **TM098** | Method 4500E, AWWA/APHA, 20th Ed., 1999 | Determination of Sulphate using the Kone Analyser | ✓ | ✓ | DRY | |
| **TM129** | Method 3120B, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 3050B | Determination of Metal Cations by IRIS Emission Spectrometer | ✓ | ✓ | DRY | |
| **TM133** | BS 1377: Part 3 1990 | Determination of pH in Soil and Water using the GLpH pH Meter | ✓ | ✓ | WET | |
| **TM142** | In house method | Analysis of Polynuclear Aromatic Hydrocarbons (PAH) by GC-FID | | | DRY | |
| **TM153** | Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999 | Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the "Skalar SANS+ System" Segmented Flow Analyser | ✓ | ✓ | WET | |
| **TM154** | In - house Method | Determination of Petroleum Hydrocarbons by EZ Flash GC-FID in the Carbon range C6- C40 | ✓ | | WET | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

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

# ALcontrol Geochem Analytical Services
# Table Of Results - Appendix

**Job Number:** 06/11378/02/01
**Client:** BWB Consulting
**Client Ref. No.:** LDS126

**Summary of Coolbox temperatures**

| Batch No. | Coolbox Temperature (°C) |
|---|---|
| **1** | 18 |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

# ALcontrol Geochem - Table Of Results

| | |
|---|---|
| **Job Number:** | 06/12451/02/01 |
| **Client:** | BWB Consulting |
| **Client Ref:** | LDS126 |
| **Matrix:** | LIQUID |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | **Sample Identity** | BH02 | BH03 | BH04 | BH05 |
| | | | **Depth** | - | - | - | - |
| | | | **Sample Type** | LIQUID | LIQUID | LIQUID | LIQUID |
| | | | **Sample Received Date** | 22/07/2006 | 22/07/2006 | 22/07/2006 | 22/07/2006 |
| | | | **Sampled Date** | 21/07/2006 | 21/07/2006 | 21/07/2006 | 21/07/2006 |
| | | | **Batch** | 1 | 1 | 1 | 1 |
| | | | **Sample Number(s)** | 1-2 | 3-4 | 5-6 | 7-8 |
| | **Method** | **Units** | **Method Detection Limit** | | | | |
| Arsenic Dissolved (ICP-MS) | TM152 | ug/l | <1 | <1 | <1 | 1 | <1 |
| Barium Dissolved (ICP-MS) | TM152 | ug/l | <1 | 50 | 41 | 26 | 32 |
| Beryllium Dissolved (ICP-MS) | TM152 | ug/l | <1 | <1 | <1 | <1 | <1 |
| Boron Dissolved (ICP-MS) | TM152 | ug/l | <10 | 49 | 66 | 67 | 47 |
| Cadmium Dissolved (ICP-MS) | TM152 | ug/l | <0.4 | <0.4 | 0.7 | <0.4 | <0.4 |
| Chromium Dissolved (ICP-MS) | TM152 | ug/l | <1 | <1 | <1 | <1 | <1 |
| Copper Dissolved (ICP-MS) | TM152 | ug/l | <1 | <1 | 1 | <1 | <1 |
| Lead Dissolved (ICP-MS) | TM152 | ug/l | <1 | <1 | <1 | <1 | <1 |
| Nickel Dissolved (ICP-MS) | TM152 | ug/l | <1 | 28 | 46 | 11 | 12 |
| Selenium Dissolved (ICP-MS) | TM152 | ug/l | <1 | <1 | <1 | 3 | <1 |
| Vanadium Dissolved (ICP-MS) | TM152 | ug/l | <1 | <1 | 4 | <1 | <1 |
| Zinc Dissolved (ICP-MS) | TM152 | ug/l | <3 | 7 | 5 | 5 | 7 |
| Mercury Dissolved (CVAA) | TM127 | ug/l | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Conductivity (at 25 deg.C) | TM120 | mS/cm | <0.014 | 1.327 | 1.912 | 1.200 | 1.102 |
| Sulphate (soluble) | TM098 | mg/l | <3 | 181 | 290 | 227 | 214 |
| Ammoniacal Nitrogen as N | TM099 | mg/l | <0.2 | 0.3 | <0.2 | <0.2 | <0.2 |
| Phenols Monohydric | TM062 | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Total Cyanide | TM153 | mg/l | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| pH Value | TM133 | pH Units | <1.00 | 8.01 | 8.30 | 8.12 | 8.25 |
| EPH (DRO) (C10-C40) | TM061 | ug/l | <10 | <10 | <10 | <10 | <10 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PAH by GCMS** | | | | | | | |
| Naphthalene | TM074 | ng/l | <10 | 109 | 210 | 126 | <10 |
| Acenaphthylene | TM074 | ng/l | <10 | <10 | <10 | <10 | <10 |
| Acenaphthene | TM074 | ng/l | <10 | <10 | 47 | <10 | <10 |
| Fluorene | TM074 | ng/l | <10 | <10 | 42 | <10 | <10 |
| Phenanthrene | TM074 | ng/l | <10 | <10 | 98 | <10 | <10 |
| Anthracene | TM074 | ng/l | <10 | <10 | <10 | <10 | <10 |
| Fluoranthene | TM074 | ng/l | <10 | <10 | 15 | <10 | <10 |
| Pyrene | TM074 | ng/l | <10 | <10 | 15 | <10 | <10 |
| Benz(a)anthracene | TM074 | ng/l | <10 | <10 | <10 | <10 | <10 |
| Chrysene | TM074 | ng/l | <10 | <10 | 10 | <10 | <10 |
| Benzo(b)fluoranthene | TM074 | ng/l | <10 | <10 | <10 | <10 | <10 |
| Benzo(k)fluoranthene | TM074 | ng/l | <10 | <10 | <10 | <10 | <10 |
| Benzo(a)pyrene | TM074 | ng/l | <10 | <10 | <10 | <10 | <10 |
| Indeno(123cd)pyrene | TM074 | ng/l | <10 | <10 | <10 | <10 | <10 |
| Dibenzo(ah)anthracene | TM074 | ng/l | <10 | <10 | <10 | <10 | <10 |
| Benzo(ghi)perylene | TM074 | ng/l | <10 | <10 | <10 | <10 | <10 |
| PAH 16 Total | TM074 | ng/l | <10 | 109 | 437 | 126 | <10 |

**Validated** ✓
**Preliminary**

# ALcontrol Geochem Analytical Services
# Table Of Results

[#] ISO 17025 accredited
[M] MCERTS accredited
* Subcontracted test
» Shown on prev. report

**Job Number:** 06/12451/02/01 **Matrix:** LIQUID
**Client:** BWB Consulting **Location:** HARBOROUGH HILL
**Client Ref. No.:** LDS126 **Client Contact:** Simon Steel

| Sample Identity | BH02 | BH03 | BH04 | BH05 | | | | | | Method Code | LoD/Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | - | - | - | - | | | | | | | |
| Sample Type | LIQUID | LIQUID | LIQUID | LIQUID | | | | | | | |
| Sampled Date | 21.07.06 | 21.07.06 | 21.07.06 | 21.07.06 | | | | | | | |
| Sample Received Date | 22.07.06 | 22.07.06 | 22.07.06 | 22.07.06 | | | | | | | |
| Batch | 1 | 1 | 1 | 1 | | | | | | | |
| Sample Number(s) | **1-2** | **3-4** | **5-6** | **7-8** | | | | | | | |
| Arsenic Dissolved (ICP-MS) | <1 | <1 | 1 | <1 | | | | | | TM152[#] | <1 ug/l |
| Barium Dissolved (ICP-MS) | 50 | 41 | 26 | 32 | | | | | | TM152[#] | <1 ug/l |
| Beryllium Dissolved (ICP-MS) | <1 | <1 | <1 | <1 | | | | | | TM152[#] | <1 ug/l |
| Boron Dissolved (ICP-MS) | 49 | 66 | 67 | 47 | | | | | | TM152[#] | <10 ug/l |
| Cadmium Dissolved (ICP-MS) | <0.4 | 0.7 | <0.4 | <0.4 | | | | | | TM152[#] | <0.4 ug/l |
| Chromium Dissolved (ICP-MS) | <1 | <1 | <1 | <1 | | | | | | TM152[#] | <1 ug/l |
| Copper Dissolved (ICP-MS) | <1 | 1 | <1 | <1 | | | | | | TM152[#] | <1 ug/l |
| Lead Dissolved (ICP-MS) | <1 | <1 | <1 | <1 | | | | | | TM152[#] | <1 ug/l |
| Nickel Dissolved (ICP-MS) | 28 | 46 | 11 | 12 | | | | | | TM152[#] | <1 ug/l |
| Selenium Dissolved (ICP-MS) | <1 | <1 | 3 | <1 | | | | | | TM152[#] | <1 ug/l |
| Vanadium Dissolved (ICP-MS) | <1 | 4 | <1 | <1 | | | | | | TM152[#] | <1 ug/l |
| Zinc Dissolved (ICP-MS) | 7 | 5 | 5 | 7 | | | | | | TM152[#] | <3 ug/l |
| Mercury Dissolved (CVAA) | <0.05 | <0.05 | <0.05 | <0.05 | | | | | | TM127[#] | <0.05 ug/l |
| Conductivity (at 25 deg.C) | 1.327 | 1.912 | 1.200 | 1.102 | | | | | | TM120[#] | <0.014 mS/cm |
| Sulphate (soluble) | 181 | 290 | 227 | 214 | | | | | | TM098[#] | <3 mg/l |
| Ammoniacal Nitrogen as N | 0.3 | <0.2 | <0.2 | <0.2 | | | | | | TM099[#] | <0.2 mg/l |
| Phenols Monohydric | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | TM062 | <0.01 mg/l |
| Total Cyanide | <0.05 | <0.05 | <0.05 | <0.05 | | | | | | TM153[#] | <0.05 mg/l |
| pH Value | 8.01 | 8.30 | 8.12 | 8.25 | | | | | | TM133[#] | <1.00 pH Units |
| EPH (DRO) (C10-C40) | <10 | <10 | <10 | <10 | | | | | | TM061 | <10 ug/l |

**Date** 07.09.2006

**Validated** ✓
**Preliminary**

# ALcontrol Geochem Analytical Services
# Table Of Results

[#] ISO 17025 accredited
[M] MCERTS accredited
[*] Subcontracted test
[»] Shown on prev. report

**Job Number:** 06/12451/02/01 **Matrix:** LIQUID
**Client:** BWB Consulting **Location:** HARBOROUGH HILL
**Client Ref. No.:** LDS126 **Client Contact:** Simon Steel

| Sample Identity | BH02 | BH03 | BH04 | BH05 | | | | | | Method Code | LoD/Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | - | - | - | - | | | | | | | |
| Sample Type | LIQUID | LIQUID | LIQUID | LIQUID | | | | | | | |
| Sampled Date | 21.07.06 | 21.07.06 | 21.07.06 | 21.07.06 | | | | | | | |
| Sample Received Date | 22.07.06 | 22.07.06 | 22.07.06 | 22.07.06 | | | | | | | |
| Batch | 1 | 1 | 1 | 1 | | | | | | | |
| Sample Number(s) | **1-2** | **3-4** | **5-6** | **7-8** | | | | | | | |
| **PAH by GCMS** | | | | | | | | | | | |
| Naphthalene | 109 | 210 | 126 | <10 | | | | | | TM074 | <10 ng/l |
| Acenaphthylene | <10 | <10 | <10 | <10 | | | | | | TM074 | <10 ng/l |
| Acenaphthene | <10 | 47 | <10 | <10 | | | | | | TM074 | <10 ng/l |
| Fluorene | <10 | 42 | <10 | <10 | | | | | | TM074 | <10 ng/l |
| Phenanthrene | <10 | 98 | <10 | <10 | | | | | | TM074 | <10 ng/l |
| Anthracene | <10 | <10 | <10 | <10 | | | | | | TM074 | <10 ng/l |
| Fluoranthene | <10 | 15 | <10 | <10 | | | | | | TM074 | <10 ng/l |
| Pyrene | <10 | 15 | <10 | <10 | | | | | | TM074 | <10 ng/l |
| Benz(a)anthracene | <10 | <10 | <10 | <10 | | | | | | TM074 | <10 ng/l |
| Chrysene | <10 | 10 | <10 | <10 | | | | | | TM074 | <10 ng/l |
| Benzo(b)fluoranthene | <10 | <10 | <10 | <10 | | | | | | TM074 | <10 ng/l |
| Benzo(k)fluoranthene | <10 | <10 | <10 | <10 | | | | | | TM074 | <10 ng/l |
| Benzo(a)pyrene | <10 | <10 | <10 | <10 | | | | | | TM074 | <10 ng/l |
| Indeno(123cd)pyrene | <10 | <10 | <10 | <10 | | | | | | TM074 | <10 ng/l |
| Dibenzo(ah)anthracene | <10 | <10 | <10 | <10 | | | | | | TM074 | <10 ng/l |
| Benzo(ghi)perylene | <10 | <10 | <10 | <10 | | | | | | TM074 | <10 ng/l |
| PAH 16 Total | 109 | 437 | 126 | <10 | | | | | | TM074 | <10 ng/l |

**Date** 07.09.2006

# ALcontrol Geochem Analytical Services
# Table Of Results - Appendix

**Job Number:** 06/12451/02/01
**Client:** BWB Consulting
**Client Ref. No.:** LDS126

## Report Key :

Results expressed as (e.g.) 1.03E-07 is equivalent to $1.03 \times 10^{-7}$

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

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

## Summary of Method Codes contained within report :

| Method No. | Reference | Description | ISO 17025 Accredited | MCERTS Accredited | Wet/Dry Sample [1] | Surrogate Corrected |
|---|---|---|---|---|---|---|
| **TM061** | Method for the Determination of EPH,Massachusetts Dept.of EP, 1998 | Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40) | | | NA | |
| **TM062** | MEWAM BOOK 124 1988.HMSO/ Method 17.7, Second Site property, March 2003 | Determination of Phenolic compounds by HPLC with electro-chemical detection | | | NA | |
| **TM074** | Modified: US EPA Method 8100 | Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS. MCERTS Accreditation on Soils for Naphthalene except when Kerosene present. | | | NA | |
| **TM098** | Method 4500E, AWWA/APHA, 20th Ed., 1999 | Determination of Sulphate using the Kone Analyser | ✓ | | NA | |
| **TM099** | BS 2690: Part 7:1968 / BS 6068: Part2.11:1984 | Determination of Ammonium in Water Samples using the Kone Analyser | ✓ | | NA | |
| **TM120** | Method 2510B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part 9:1970 | Determination of Electrical Conductivity using a Conductivity Meter | ✓ | | NA | |
| **TM127** | Method 3112B, AWWA/APHA, 20th Ed., 1999 | The Determination of Trace Level Mercury in Aqueous Media and Soil Extracts by Atomic Absorption Spectroscopy | ✓ | | NA | |
| **TM133** | BS 1377: Part 3 1990 | Determination of pH in Soil and Water using the GLpH pH Meter | ✓ | | NA | |
| **TM152** | Method 3125B, AWWA/APHA, 20th Ed., 1999 | Analysis of Aqueous Samples by ICP-MS | ✓ | | NA | |
| **TM153** | Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999 | Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the "Skalar SANS+ System" Segmented Flow Analyser | ✓ | | NA | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

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

# ALcontrol Geochem Analytical Services
# Table Of Results - Appendix

**Job Number:** 06/12451/02/01
**Client:** BWB Consulting
**Client Ref. No.:** LDS126

**Summary of Coolbox temperatures**

| Batch No. | Coolbox Temperature (°C) |
|---|---|
| **1** | 12 |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

# ALcontrol Geochem - Table Of Results

| | |
|---|---|
| **Job Number:** | 06/14307/02/01 |
| **Client:** | BWB Consulting |
| **Client Ref:** | LDS126 |
| **Matrix:** | LIQUID |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | **Sample Identity** | BH01 | BH02 | BH03 | BH04 |
| | | | **Depth** | | | | |
| | | | **Sample Type** | LIQUID | LIQUID | LIQUID | LIQUID |
| | | | **Sample Received Date** | 22/08/2006 | 22/08/2006 | 22/08/2006 | 22/08/2006 |
| | | | **Sampled Date** | 21/08/2006 | 21/08/2006 | 21/08/2006 | 21/08/2006 |
| | | | **Batch** | 1 | 1 | 1 | 1 |
| | | | **Sample Number(s)** | 1 | 2-3 | 4-5 | 6-7 |
| | **Method** | **Units** | **Method Detection Limit** | | | | |
| Arsenic Dissolved (ICP-MS) | TM152 | ug/l | <1 | | | | |
| Barium Dissolved (ICP-MS) | TM152 | ug/l | <1 | | | | |
| Beryllium Dissolved (ICP-MS) | TM152 | ug/l | <1 | | | | |
| Boron Dissolved (ICP-MS) | TM152 | ug/l | <10 | | | | |
| Cadmium Dissolved (ICP-MS) | TM152 | ug/l | <0.4 | | | | |
| Chromium Dissolved (ICP-MS) | TM152 | ug/l | <1 | | | | |
| Copper Dissolved (ICP-MS) | TM152 | ug/l | <1 | | | | |
| Lead Dissolved (ICP-MS) | TM152 | ug/l | <1 | | | | |
| Nickel Dissolved (ICP-MS) | TM152 | ug/l | <1 | | | | |
| Selenium Dissolved (ICP-MS) | TM152 | ug/l | <1 | | | | |
| Vanadium Dissolved (ICP-MS) | TM152 | ug/l | <1 | | | | |
| Zinc Dissolved (ICP-MS) | TM152 | ug/l | <3 | | | | |
| Mercury Dissolved (CVAA) | TM127 | ug/l | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Conductivity (at 25 deg.C) | TM120 | mS/cm | <0.014 | 0.322 | 1.070 | 1.594 | 1.213 |
| Sulphate (soluble) | TM098 | mg/l | <3 | 52 | 190 | 253 | 211 |
| Ammoniacal Nitrogen as N | TM099 | mg/l | <0.2 | <0.2 | 0.2 | <0.2 | 0.5 |
| Phenols Monohydric | TM062 | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Total Cyanide | TM153 | mg/l | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| pH Value | TM133 | pH Units | <1.00 | 7.66 | 7.25 | 7.61 | 7.20 |
| EPH (DRO) (C10-C40) | TM061 | ug/l | <10 | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PAH by GCMS** | | | | | | | |
| Naphthalene | TM074 | ng/l | <10 | | | | |
| Acenaphthylene | TM074 | ng/l | <10 | | | | |
| Acenaphthene | TM074 | ng/l | <10 | | | | |
| Fluorene | TM074 | ng/l | <10 | | | | |
| Phenanthrene | TM074 | ng/l | <10 | | | | |
| Anthracene | TM074 | ng/l | <10 | | | | |
| Fluoranthene | TM074 | ng/l | <10 | | | | |
| Pyrene | TM074 | ng/l | <10 | | | | |
| Benz(a)anthracene | TM074 | ng/l | <10 | | | | |
| Chrysene | TM074 | ng/l | <10 | | | | |
| Benzo(b)fluoranthene | TM074 | ng/l | <10 | | | | |
| Benzo(k)fluoranthene | TM074 | ng/l | <10 | | | | |
| Benzo(a)pyrene | TM074 | ng/l | <10 | | | | |
| Indeno(123cd)pyrene | TM074 | ng/l | <10 | | | | |
| Dibenzo(ah)anthracene | TM074 | ng/l | <10 | | | | |
| Benzo(ghi)perylene | TM074 | ng/l | <10 | | | | |
| PAH 16 Total | TM074 | ng/l | <10 | | | | |

**Validated** ✓
**Preliminary**

# ALcontrol Geochem Analytical Services
# Table Of Results

[#] ISO 17025 accredited
[M] MCERTS accredited
[*] Subcontracted test
[»] Shown on prev. report

**Job Number:** 06/14307/02/01 **Matrix:** LIQUID
**Client:** BWB Consulting **Location:** BARNSLEY
**Client Ref. No.:** LDS126 **Client Contact:** Chris Evans

| Sample Identity | BH01 | BH02 | BH03 | BH04 | | | | | | Method Code | LoD/Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | | | | | | | | | | | |
| Sample Type | LIQUID | LIQUID | LIQUID | LIQUID | | | | | | | |
| Sampled Date | 21.08.06 | 21.08.06 | 21.08.06 | 21.08.06 | | | | | | | |
| Sample Received Date | 22.08.06 | 22.08.06 | 22.08.06 | 22.08.06 | | | | | | | |
| Batch | 1 | 1 | 1 | 1 | | | | | | | |
| Sample Number(s) | **1** | **2-3** | **4-5** | **6-7** | | | | | | | |
| Arsenic Dissolved (ICP-MS) | | | | | | | | | | TM152[#] | <1 ug/l |
| Barium Dissolved (ICP-MS) | | | | | | | | | | TM152[#] | <1 ug/l |
| Beryllium Dissolved (ICP-MS) | | | | | | | | | | TM152[#] | <1 ug/l |
| Boron Dissolved (ICP-MS) | | | | | | | | | | TM152[#] | <10 ug/l |
| Cadmium Dissolved (ICP-MS) | | | | | | | | | | TM152[#] | <0.4 ug/l |
| Chromium Dissolved (ICP-MS) | | | | | | | | | | TM152[#] | <1 ug/l |
| Copper Dissolved (ICP-MS) | | | | | | | | | | TM152[#] | <1 ug/l |
| Lead Dissolved (ICP-MS) | | | | | | | | | | TM152[#] | <1 ug/l |
| Nickel Dissolved (ICP-MS) | | | | | | | | | | TM152[#] | <1 ug/l |
| Selenium Dissolved (ICP-MS) | | | | | | | | | | TM152[#] | <1 ug/l |
| Vanadium Dissolved (ICP-MS) | | | | | | | | | | TM152[#] | <1 ug/l |
| Zinc Dissolved (ICP-MS) | | | | | | | | | | TM152[#] | <3 ug/l |
| Mercury Dissolved (CVAA) | <0.05 | <0.05 | <0.05 | <0.05 | | | | | | TM127[#] | <0.05 ug/l |
| Conductivity (at 25 deg.C) | 0.322 | 1.070 | 1.594 | 1.213 | | | | | | TM120[#] | <0.014 mS/cm |
| Sulphate (soluble) | 52 | 190 | 253 | 211 | | | | | | TM098[#] | <3 mg/l |
| Ammoniacal Nitrogen as N | <0.2 | 0.2 | <0.2 | 0.5 | | | | | | TM099[#] | <0.2 mg/l |
| Phenols Monohydric | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | TM062 | <0.01 mg/l |
| Total Cyanide | <0.05 | <0.05 | <0.05 | <0.05 | | | | | | TM153[#] | <0.05 mg/l |
| pH Value | 7.66 | 7.25 | 7.61 | 7.20 | | | | | | TM133[#] | <1.00 pH Units |
| EPH (DRO) (C10-C40) | | | | | | | | | | TM061 | <10 ug/l |

**Date** 07.09.2006

**Validated** ✓
**Preliminary**

# ALcontrol Geochem Analytical Services
# Table Of Results

[#] ISO 17025 accredited
[M] MCERTS accredited
[*] Subcontracted test
[»] Shown on prev. report

**Job Number:** 06/14307/02/01 **Matrix:** LIQUID
**Client:** BWB Consulting **Location:** BARNSLEY
**Client Ref. No.:** LDS126 **Client Contact:** Chris Evans

| Sample Identity | BH01 | BH02 | BH03 | BH04 | | | | | | Method Code | LoD/Units |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | | | | | | | | | | | |
| Sample Type | LIQUID | LIQUID | LIQUID | LIQUID | | | | | | | |
| Sampled Date | 21.08.06 | 21.08.06 | 21.08.06 | 21.08.06 | | | | | | | |
| Sample Received Date | 22.08.06 | 22.08.06 | 22.08.06 | 22.08.06 | | | | | | | |
| Batch | 1 | 1 | 1 | 1 | | | | | | | |
| Sample Number(s) | **1** | **2-3** | **4-5** | **6-7** | | | | | | | |
| **PAH by GCMS** | | | | | | | | | | | |
| Naphthalene | | | | | | | | | | TM074 | <10 ng/l |
| Acenaphthylene | | | | | | | | | | TM074 | <10 ng/l |
| Acenaphthene | | | | | | | | | | TM074 | <10 ng/l |
| Fluorene | | | | | | | | | | TM074 | <10 ng/l |
| Phenanthrene | | | | | | | | | | TM074 | <10 ng/l |
| Anthracene | | | | | | | | | | TM074 | <10 ng/l |
| Fluoranthene | | | | | | | | | | TM074 | <10 ng/l |
| Pyrene | | | | | | | | | | TM074 | <10 ng/l |
| Benz(a)anthracene | | | | | | | | | | TM074 | <10 ng/l |
| Chrysene | | | | | | | | | | TM074 | <10 ng/l |
| Benzo(b)fluoranthene | | | | | | | | | | TM074 | <10 ng/l |
| Benzo(k)fluoranthene | | | | | | | | | | TM074 | <10 ng/l |
| Benzo(a)pyrene | | | | | | | | | | TM074 | <10 ng/l |
| Indeno(123cd)pyrene | | | | | | | | | | TM074 | <10 ng/l |
| Dibenzo(ah)anthracene | | | | | | | | | | TM074 | <10 ng/l |
| Benzo(ghi)perylene | | | | | | | | | | TM074 | <10 ng/l |
| PAH 16 Total | | | | | | | | | | TM074 | <10 ng/l |

**Date** 07.09.2006

# ALcontrol Geochem Analytical Services
# Table Of Results - Appendix

**Job Number:** 06/14307/02/01
**Client:** BWB Consulting
**Client Ref. No.:** LDS126

## Report Key :

Results expressed as (e.g.) 1.03E-07 is equivalent to $1.03 \times 10^{-7}$

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

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

## Summary of Method Codes contained within report :

| Method No. | Reference | Description | ISO 17025 Accredited | MCERTS Accredited | Wet/Dry Sample [1] | Surrogate Corrected |
|---|---|---|---|---|---|---|
| **TM061** | Method for the Determination of EPH,Massachusetts Dept.of EP, 1998 | Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40) | | | NA | |
| **TM062** | MEWAM BOOK 124 1988.HMSO/ Method 17.7, Second Site property, March 2003 | Determination of Phenolic compounds by HPLC with electro-chemical detection | | | NA | |
| **TM074** | Modified: US EPA Method 8100 | Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS. MCERTS Accreditation on Soils for Naphthalene except when Kerosene present. | | | NA | |
| **TM098** | Method 4500E, AWWA/APHA, 20th Ed., 1999 | Determination of Sulphate using the Kone Analyser | ✓ | | NA | |
| **TM099** | BS 2690: Part 7:1968 / BS 6068: Part2.11:1984 | Determination of Ammonium in Water Samples using the Kone Analyser | ✓ | | NA | |
| **TM120** | Method 2510B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part 9:1970 | Determination of Electrical Conductivity using a Conductivity Meter | ✓ | | NA | |
| **TM127** | Method 3112B, AWWA/APHA, 20th Ed., 1999 | The Determination of Trace Level Mercury in Aqueous Media and Soil Extracts by Atomic Absorption Spectroscopy | ✓ | | NA | |
| **TM133** | BS 1377: Part 3 1990 | Determination of pH in Soil and Water using the GLpH pH Meter | ✓ | | NA | |
| **TM152** | Method 3125B, AWWA/APHA, 20th Ed., 1999 | Analysis of Aqueous Samples by ICP-MS | ✓ | | NA | |
| **TM153** | Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999 | Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the "Skalar SANS+ System" Segmented Flow Analyser | ✓ | | NA | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

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

# ALcontrol Geochem Analytical Services
# Table Of Results - Appendix

**Job Number:** 06/14307/02/01
**Client:** BWB Consulting
**Client Ref. No.:** LDS126

**Summary of Coolbox temperatures**

| Batch No. | Coolbox Temperature (°C) |
|---|---|
| **1** | 15 |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

# APPENDIX 5

# SOIL CLASSIFICATION TESTING

NORWEST HOLST
SOIL ENGINEERING

# TEST REPORT

UKAS TESTING
1265

Serial number: LT949 | Date of issue: 08/08/2006 | 

Issued by Norwest Holst Limited - Soil Engineering Division,
Parkside Lane,
Dewsbury Road,
Leeds
LS11 5SX.
Tel: 0113 2711111
Fax: 0113 2760472
Email: soils@norwest.co.uk

Authorised signatory

M. J. Baldwin (Technical Manager)
R. J. Rogers (Principal Engineer)
S. Kirk (Laboratory Manager)
S. K. Sharda (Assistant Laboratory Manager)

Customer name: BWB Consulting LTD
Address: Prospect House
32 Sovereign Street
Leeds
LS1 4BJ

Contract name: Harbourhill Road, Barnsley
Your reference: ELRL06259

Dates of receipt of samples: 20/07/2006

Dates of testing: 20/07/2006 to 08/08/2006

Testing was performed to the standard named on individual test results.

Sampling was not performed by the Laboratory of Norwest Holst Soil Engineering.

Testing was performed on 24 number of samples received in fair condition.

Opinions and interpretations expressed herein are outside the scope of our UKAS accreditation.

Results reported relate only to the samples tested.

Tests marked 'Not UKAS' in this report are not included in the UKAS accreditation schedule for our laboratory. These results will appear in italics on any summary of tests.

Samples will be retained for 28 days from date of issue of this report and then be disposed of, unless we receive written instruction to the contrary

Some samples were of insufficient size to perform compaction tests. Bags were combined or tests cancelled as requested.

Quality Control Check performed by K. A. Walker (Laboratory Quality Manager)

This test report shall not be reproduced except in full without the written permission of Norwest Holst Soil Engineering.

# Key to Laboratory Summary Sheets

| | | | | |
|---|---|---|---|---|
| **Common to all summaries** | | | | |
| Sample Type | U | Undisturbed sample | D | Small disturbed sample |
| | P | Piston sample | B | Bulk disturbed sample |
| | TW | Thin walled sample | BLK | Block sample |
| | L | Liner sample | C | Rock core |
| | AMAL | Amalgamated sample | | |
| Test status | Any result in *italics* indicates a test that is not within the scope of the UKAS accreditation for this laboratory. | | | |
| **Summary of Laboratory Soil Tests: Index / Classification Tests** | | | | |
| Particle density | p | Small pyknometer method | g | Gas jar method |
| Plastic index | N/P | Non plastic, although liquid limit will have been determined if requested | | |
| Particle size (PSD) | ' | Following value in silt column denotes combined clay and silt fraction | | |
| | p | Following value in clay column denotes sedimentation by pipette, else sedimentation is by hydrometer. | | |
| **Summary of Laboratory Soil Tests: Strength and Permeability Tests** | | | | |
| Triaxial | UU | Single stage unconsolidated quick undrained | UUM | Multi stage unconsolidated quick undrained |
| | UU3 | Set of 3 unconsolidated quick undrained | CU | Single stage consolidated undrained |
| | CUM | Multi stage consolidated undrained | CU3 | Set of 3 consolidated undrained |
| | CD | Single stage consolidated drained | CDM | Multi stage consolidated drained |
| | CD3 | Set of 3 consolidated drained | | |
| | Note that single stage tests are reported assuming f = 0 for total stress and c' = 0 for effective stress | | | |
| Consol | Oed | One-dimensional oedometer | Hyd | Hydraulic cell consolidation |
| | $m_v$ | coefficient of compressibility quoted for p0 to p0 + 100kPa, where determined | | |
| Permeability | C | Constant head permeability | T | Triaxial permeability |
| Shearbox | SSB | Small shear box | LSB | Large shear box |
| | p | Peak value | r | Residual value |
| | RS | Ring shear | | |
| **Summary of Laboratory Soil Re-Use Test** | | | | |
| MCV | s | MCV value at natural or specified moisture content | int | Intercept of calibration line in MCV calibration |
| **Summary of Laboratory Rock Strength Tests** | | | | |
| Point Load Type (Combination of) | D | Diametral | A | Axial |
| | I | Irregular lump | B | Block |
| | L | Test performed parallel to planes of weakness | | |
| | P | Test performed perpendicular to planes of weakness | | |
| | X | Invalid failure of point load (not broken between points of load application) | | |
| **Summary of Laboratory Rock Materials Tests** | | | | |
| Ten% fines | w | Soaked test | d | Dry test |
| **Point Load Index Result** | | | | |
| Point Load Type (Combination of) | D | Diametral | A | Axial |
| | I | Irregular lump | B | Block |
| | L | Parallel to planes of weakness | P | Perpendicular to planes of weakness |
| | X | Invalid failure of point load (not broken between points of load application) | | |
| Dimensions | W | Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump | | |
| | D | Distance between platens when just in contact with specimen | | |
| | D' | Distance between platens at point of failure | | |
| | De | Equivalent core diameter | Is | $P/De^2$ |
| | Is(50) | F x Is | F | $(De/50)^{0.45}$ |
| | Is(50) point load strength index corrected for a diametral test of core diameter 50mm | | | |
| | For Axial/Lump tests $De^2 = (4/Pi) \times (W \times D')$ | | For Diametral tests $De^2 = D \times D'$ | |

Important note: summary sheets are provided for convenience and in no way replace individual test result sheets which shall, without exception, be regarded as the definitive result.

| Project Name | Harbourhill Road, Barnsley |
|---|---|
| Project No. | LT949 |
| Engineer | Christopher Evans |
| Client | BWB Consulting LTD |

# Classification Tests Summary

| Hole ID | Sample depth m | Sample no. | Sample type | Specimen depth m | Specimen no. | Moisture Content | Bulk Density | Dry Density | Particle Density | Liquid Limit | Plastic Limit | Plastic Index | Passing 425µm | Linear Shrinkage | Particle size | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Clay | Silt | Sand | Gravel | Cobbles |
| | | | | | | % | Mg/m³ | | | % | % | | % | % | % | % | % | % | % |
| BH01 | 1.10 | | B | 1.10 | 01 | | | | | | | | | | 27 | 29 | 22 | 22 | 0 |
| BH01 | 1.10 | | D | 1.10 | 01 | 46 | | | | 66 | 48 | 18 | 72 | | | | | | |
| BH02 | 1.00 | | D | 1.00 | 01 | 13 | | | | 55 | 21 | 34 | 100 | | | | | | |
| BH02 | 2.00 | | B | 2.00 | 01 | | | | | | | | | | 42 | 26 | 15 | 17 | 0 |
| BH02 | 2.00 | | D | 2.00 | 01 | 14 | | | | | | | | | | | | | |
| BH03 | 1.00 | | D | 1.00 | 01 | 16 | | | | 40 | 21 | 19 | 100 | | | | | | |
| BH03 | 2.00 | | D | 2.00 | 01 | 7.8 | | | | | | | | | | | | | |
| BH04 | 0.60 | 002 | B | 0.60 | 01 | | | | | | | | | | 40 | 32 | 7 | 21 | 0 |
| BH04 | 1.00 | | D | 1.00 | 01 | 9.7 | | | | 34 | 19 | 15 | 100 | | | | | | |
| BH05 | 2.50 | | D | 2.50 | 01 | 33 | | | | | | | | | | | | | |
| BH05 | 2.60 | | B | 2.60 | 01 | | | | | | | | | | 34 | 39 | 22 | 5 | 0 |
| TP12 | 1.10 | | B | 1.10 | 01 | | | | | | | | | | 14 | 24 | 32 | 23 | 7 |
| | | | | | | | End | | | | | | | | | | | | |

| | |
|---|---|
| Project Name | Harbourhill Road, Barnsley |
| Project No. | LT949 |
| Engineer | Christopher Evans |
| Client | BWB Consulting LTD |

# Strength and Permeability Summary

| Hole ID | Sample depth m | Sample no. | Sample type | Specimen depth m | Specimen no. | Moisture Content % | Bulk Density Mg/m³ | Triaxial Type | Triaxial c kPa | Triaxial Ø ° | Consol Type | Consol $m_v$ m²/MN | Permeability Type | Permeability K m/s | Shearbox Type | Shearbox c kPa | Shearbox Ø ° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BH05 | 2.00 | | U | 2.04 | 1 | 27 | 1.96 | | | | Oed | 0.18 | | | | | |
| | | | | | | | | End | | | | | | | | | |

| | | | |
|---|---|---|---|
| Approved by: Stuart Kirk | Leeds Laboratory | Report No.: LT949 | NORWEST HOLST SOIL ENGINEERING |
| | Page 4 of 19 | Print date 08/08/2006 | |
| Revision No. 2.01 | Issue Date 08/08/2006 | | |

| | |
|---|---|
| Project Name | Harbourhill Road, Barnsley |
| Project No. | LT949 |
| Engineer | Christopher Evans |
| Client | BWB Consulting LTD |

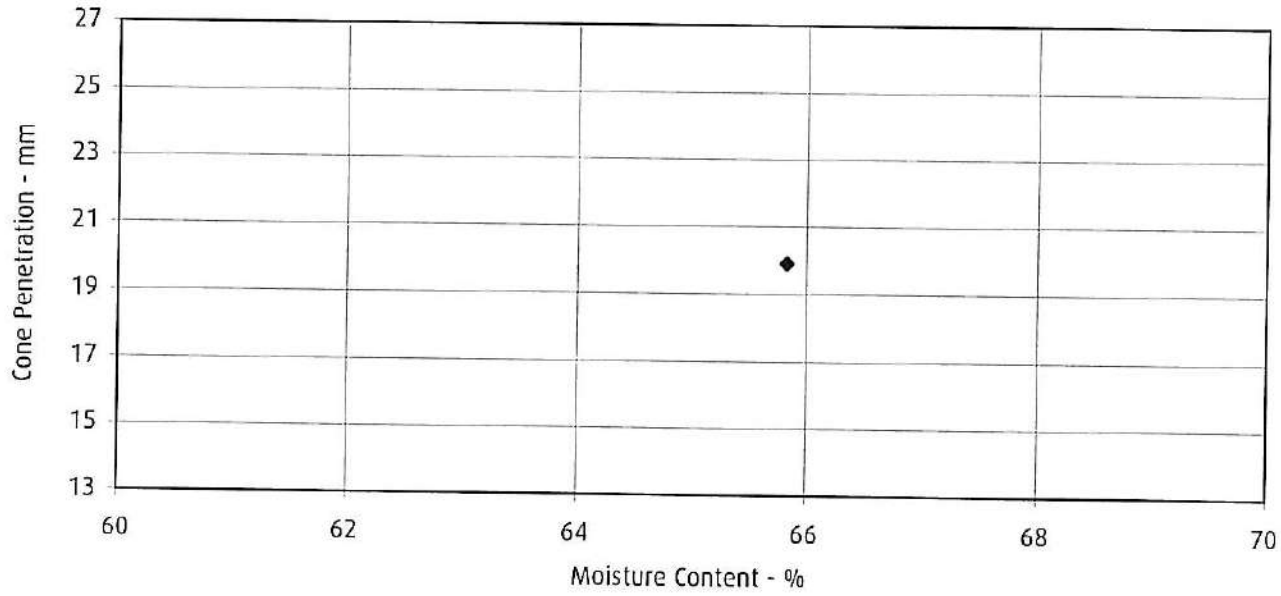
# Summary Of Laboratory Soil Re-Use Tests

| Hole ID | Sample depth m | Sample no. | Sample type | Specimen depth m | Specimen no. | Moisture Content % | Bulk Density Mg/m³ | Compaction OMC % | Compaction Max DD Mg/m³ | MCV | CBR Top % | CBR Base % | Pinhole Dispersion | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TP02 | 0.70 | 002 | AMAL | 0.70 | 01 | | | 17 | 1.77 | | | | | |
| TP10 | 1.20 | 003 | AMAL | 1.20 | 01 | | | 15 | 1.79 | | | | | |
| TP13 | 1.00 | 002 | AMAL | 1.00 | 01 | | | 12 | 1.99 | | | | | |
| | | | | | | | | End | | | | | | |

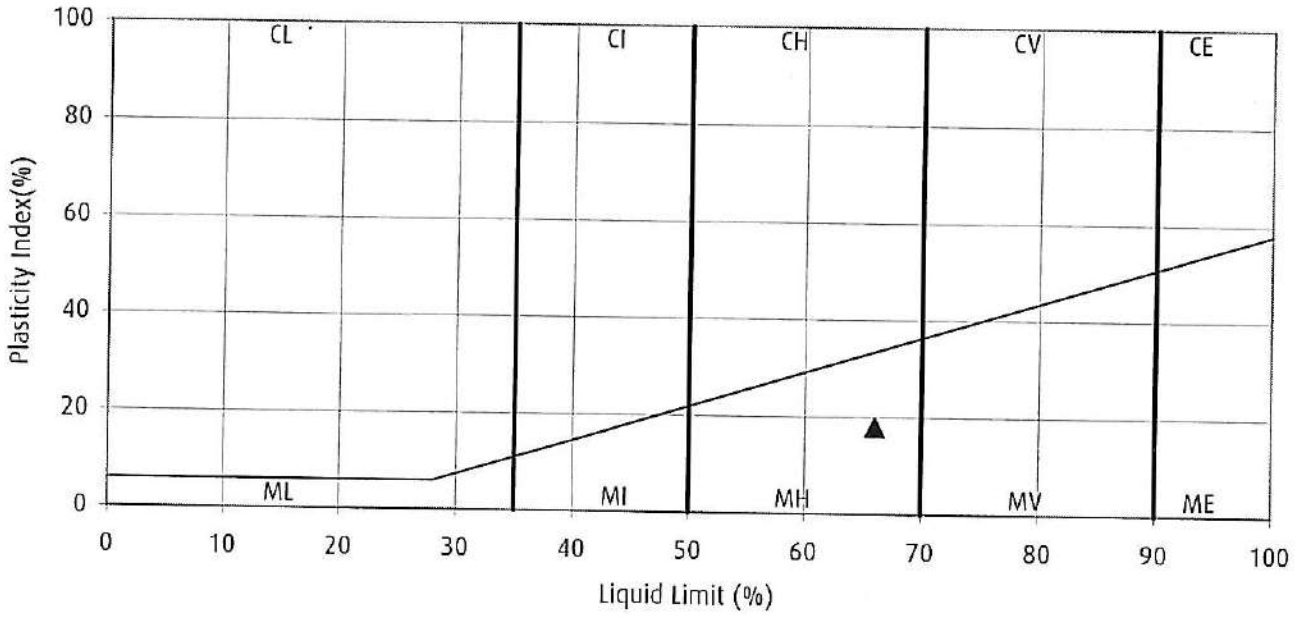
| | | | |
|---|---|---|---|
| Project Name | Harbourhill Road, Barnsley | **Moisture Content** | |
| Project No. | LT949 | | |
| Engineer | Christopher Evans | | |
| Client | BWB Consulting LTD | BS1377: Part 2: 1990: 3 | |

| Hole ID | Sample depth m | Sample no. | Sample type | Specimen depth m | Specimen no. | Description | Remarks | Moisture Content % |
|---|---|---|---|---|---|---|---|---|
| BH02 | 2.00 | | D | 2.00 | 01 | Grey CLAY. | | 14 |
| BH03 | 2.00 | | D | 2.00 | 01 | Light brown CLAY. | | 7.8 |
| BH05 | 2.50 | | D | 2.50 | 01 | Brown CLAY. | | 33 |
| | | | | | | End | | |

| | | | |
|---|---|---|---|
| Project Name | Harbourhill Road, Barnsley | **Liquid And Plastic Limit Test** | Hole ID BH01 |
| Project No. | LT949 | | Sample Depth 1.10m |
| Engineer | Christopher Evans | | Sample Number |
| Client | BWB Consulting LTD | Test Method: BS1377: Part 2: 1990: Clause 4.4 and 5 | Sample Type D |
| Description | Dark brown slightly gravelly CLAY | | Specimen Depth 1.10m |
| | | | Specimen Number 1 |



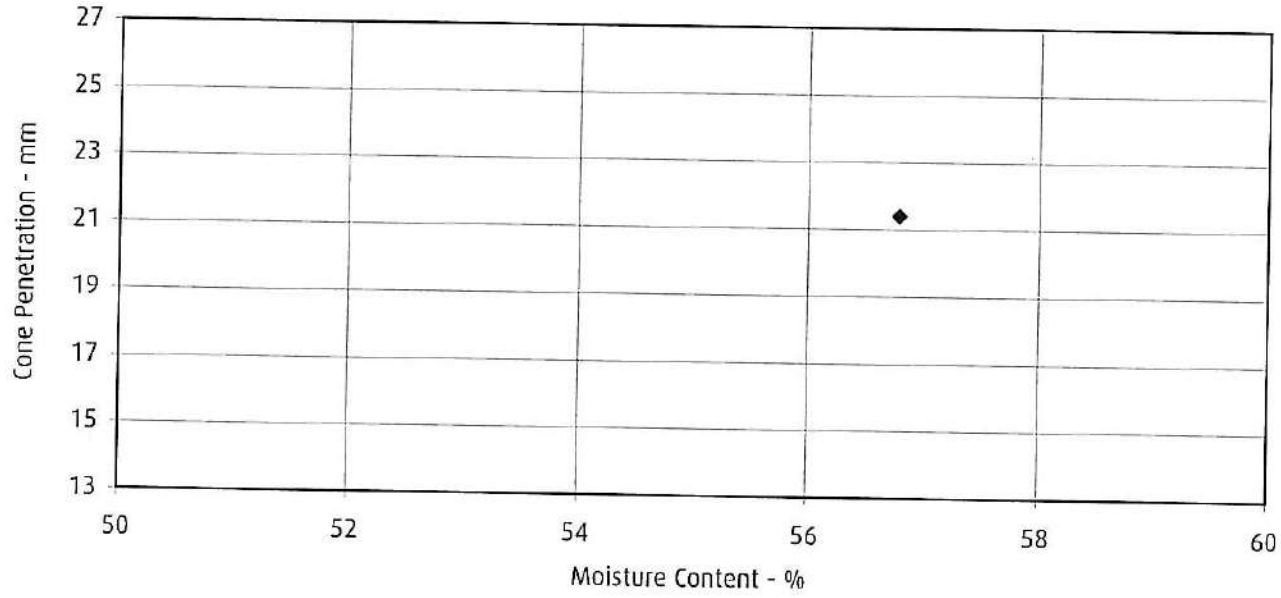

| | | | |
|---|---|---|---|
| Natural moisture content: | 46 | Estimated percentage retained on 425µm sieve: | 28.3 |
| Liquid limit: | 66 | Preparation of sample: Wet sieve | |
| Plastic limit: | 48 | Remarks: Insufficient specimen to perform 4 point test. | |
| Plasticity index: | 18 | | |
| Moisture content of soil passing 425µm | 64 | | |
| Liquidity index: | 0.89 | | |



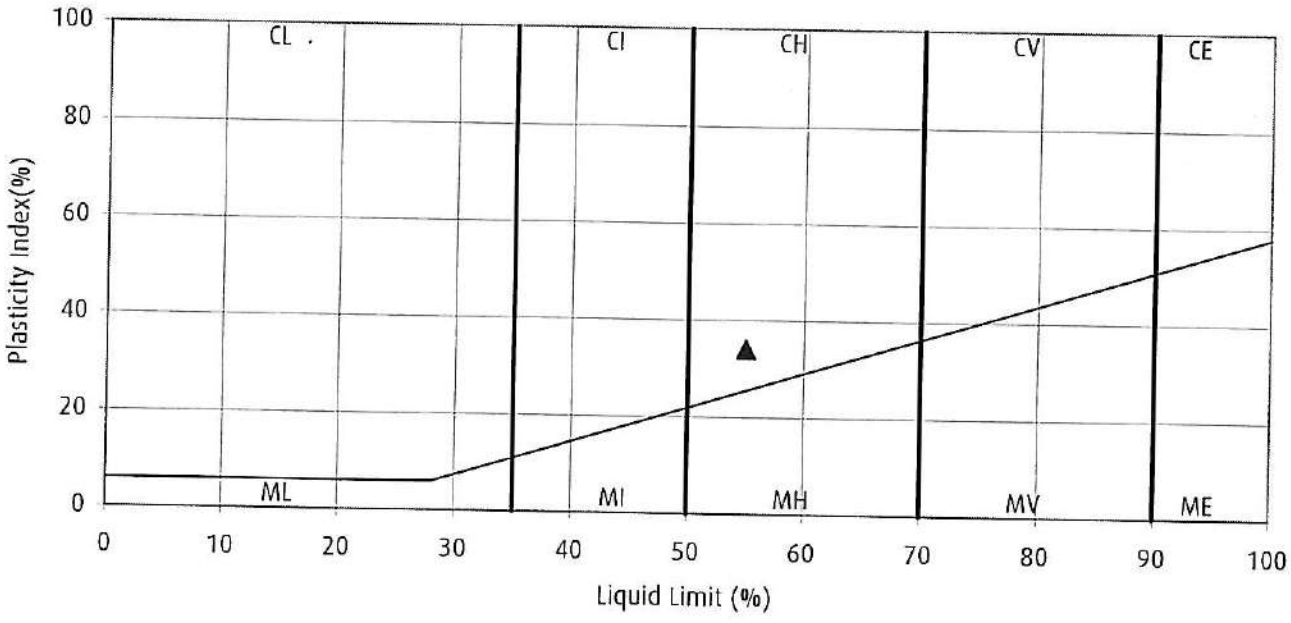

| | | | |
|---|---|---|---|
| Approved by: | Leeds Laboratory | | Report No.: LT949 |
| Stuart Kirk | | Page 7 of 19 | Print date 08/09/2006 |
| | Revision No. 2.01 | Issue Date 27/03/2006 | |

NORWEST HOLST SOIL ENGINEERING

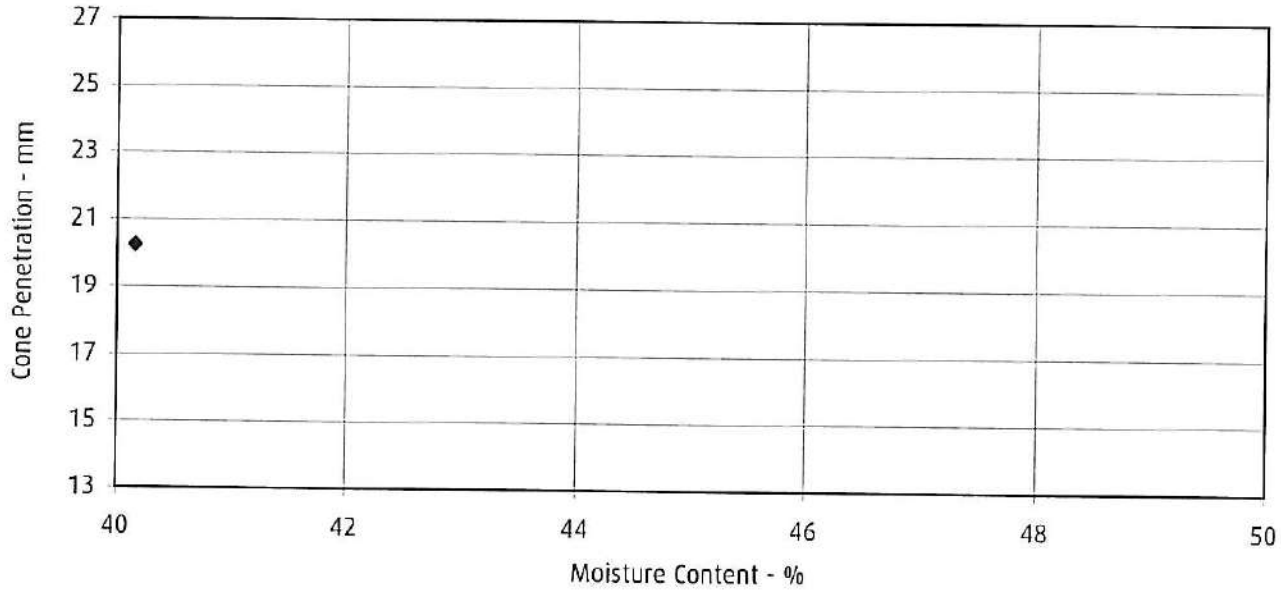
| | | | |
|---|---|---|---|
| Project Name | Harbourhill Road, Barnsley | **Liquid And Plastic Limit Test** | Hole ID BH02 |
| Project No. | LT949 | | Sample Depth 1.00m |
| Engineer | Christopher Evans | | Sample Number |
| Client | BWB Consulting LTD | Test Method: BS1377: Part 2: 1990: Clause 4.4 and 5 | Sample Type D |
| Description | Grey CLAY. | | Specimen Depth 1.00m |
| | | | Specimen Number 1 |



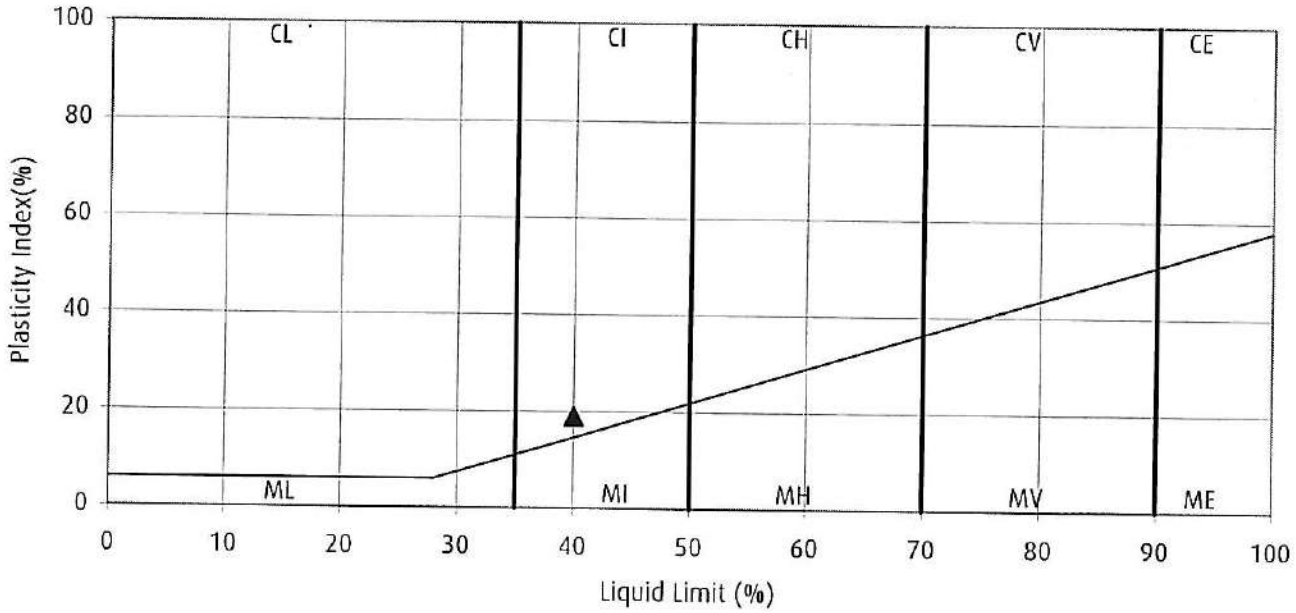

| | | | |
|---|---|---|---|
| Natural moisture content: | 13 | Estimated percentage retained on 425µm sieve: | 0.0 |
| Liquid limit: | 55 | Preparation of sample: Natural | |
| Plastic limit: | 21 | Remarks: Insufficient specimen to perform 4 point test. | |
| Plasticity index: | 34 | | |
| Moisture content of soil passing 425µm | 13 | | |
| Liquidity index: | -0.24 | | |



| | | | |
|---|---|---|---|
| Project Name | Harbourhill Road, Barnsley | **Liquid And Plastic Limit Test** | Hole ID BH03 |
| Project No. | LT949 | | Sample Depth 1.00m |
| Engineer | Christopher Evans | | Sample Number |
| Client | BWB Consulting LTD | Test Method: BS1377: Part 2: 1990: Clause 4.4 and 5 | Sample Type D |
| Description | Brown CLAY. | | Specimen Depth 1.00m |
| | | | Specimen Number 1 |



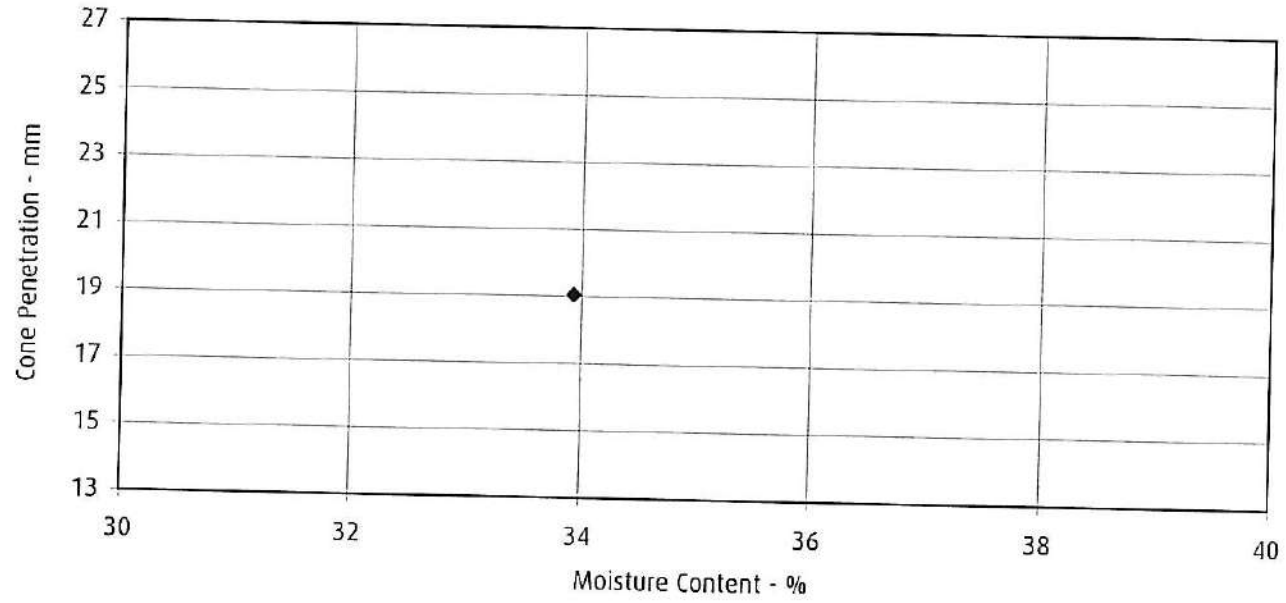

| | | | |
|---|---|---|---|
| Natural moisture content: | 16 | Estimated percentage retained on 425µm sieve: | 0.0 |
| Liquid limit: | 40 | Preparation of sample: Natural | |
| Plastic limit: | 21 | Remarks: Insufficient specimen to perform 4 point test. | |
| Plasticity index: | 19 | | |
| Moisture content of soil passing 425µm | 16 | | |
| Liquidity index: | -0.26 | | |



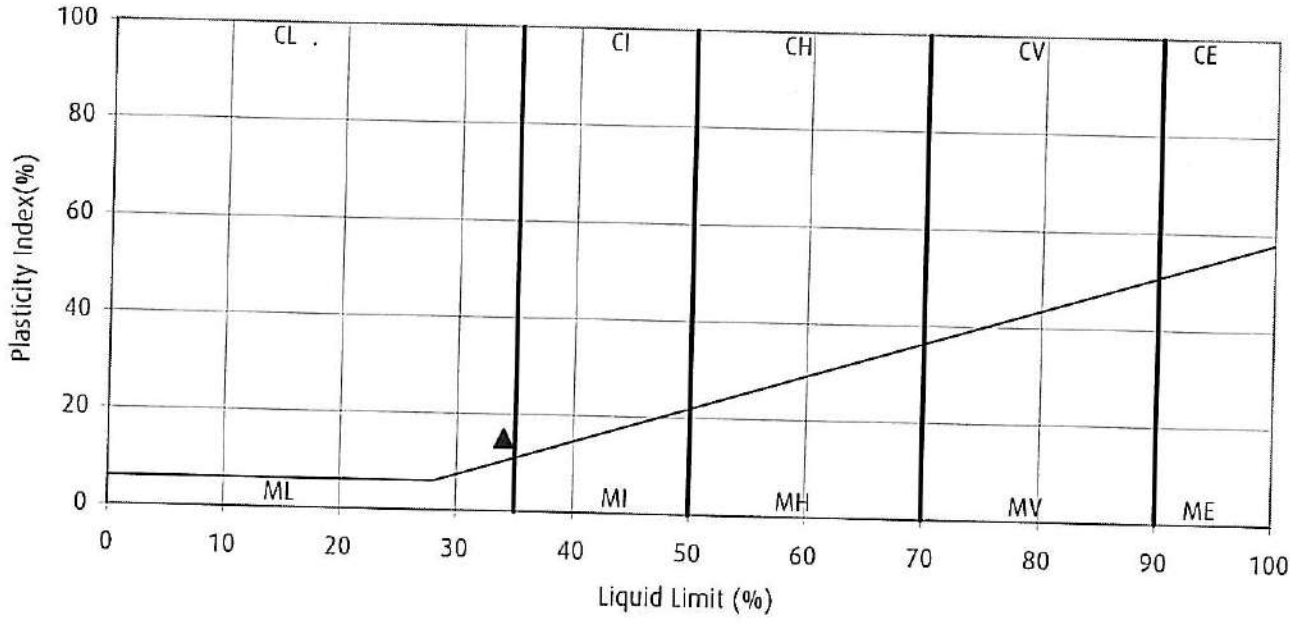

| | | | |
|---|---|---|---|
| Approved by: | Leeds Laboratory | | Report No.: LT949 |
| Sushil Sharda | | Page 9 of 19 | Print date 08/08/2006 |
| | Revision No. 2.01 | Issue Date 27/03/2006 | |

NORWEST HOLST
SOIL ENGINEERING

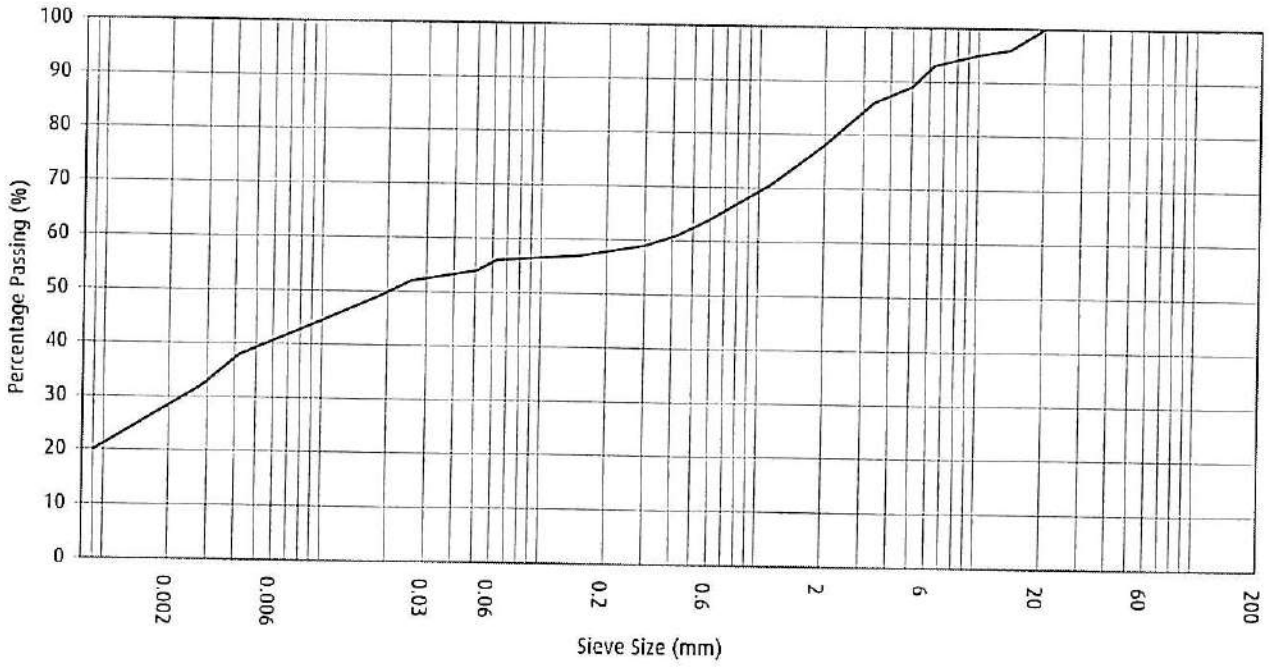
| | | | |
|---|---|---|---|
| Project Name | Harbourhill Road, Barnsley | **Liquid And Plastic Limit Test** | Hole ID BH04 |
| Project No. | LT949 | | Sample Depth 1.00m |
| Engineer | Christopher Evans | | Sample Number |
| Client | BWB Consulting LTD | Test Method: BS1377: Part 2: 1990: Clause 4.4 and 5 | Sample Type D |
| Description | Brown CLAY. | | Specimen Depth 1.00m |
| | | | Specimen Number 1 |




| | | | |
|---|---|---|---|
| Natural moisture content: | 9.7 | Estimated percentage retained on 425µm sieve: | 0.0 |
| Liquid limit: | 34 | Preparation of sample: Natural | |
| Plastic limit: | 19 | Remarks: Insufficient specimen to perform 4 point test. | |
| Plasticity index: | 15 | | |
| Moisture content of soil passing 425µm | 9.7 | | |
| Liquidity index: | -0.62 | | |



| | | | |
|---|---|---|---|
| Project Name | Harbourhill Road, Barnsley | **Particle Size Distribution** | Hole ID: BH01 |
| Project No. | LT949 | | Sample Depth: 1.10m |
| Engineer | Christopher Evans | | Sample Number: |
| Client | BWB Consulting LTD | BS 1377: Part 2: 1990: 9.2, 9.5 | Sample type: B |
| Description | Dark brown slightly sandy gravelly CLAY. | | Specimen Depth: 1.10m |
| | | | Specimen No.: 1 |




| PARTICLE SIZE | % |
|---|---|
| Clay: | 27 |
| Silt: | 29 |
| Sand: | 22 |
| Gravel: | 22 |
| Cobbles: | 0 |

General remarks

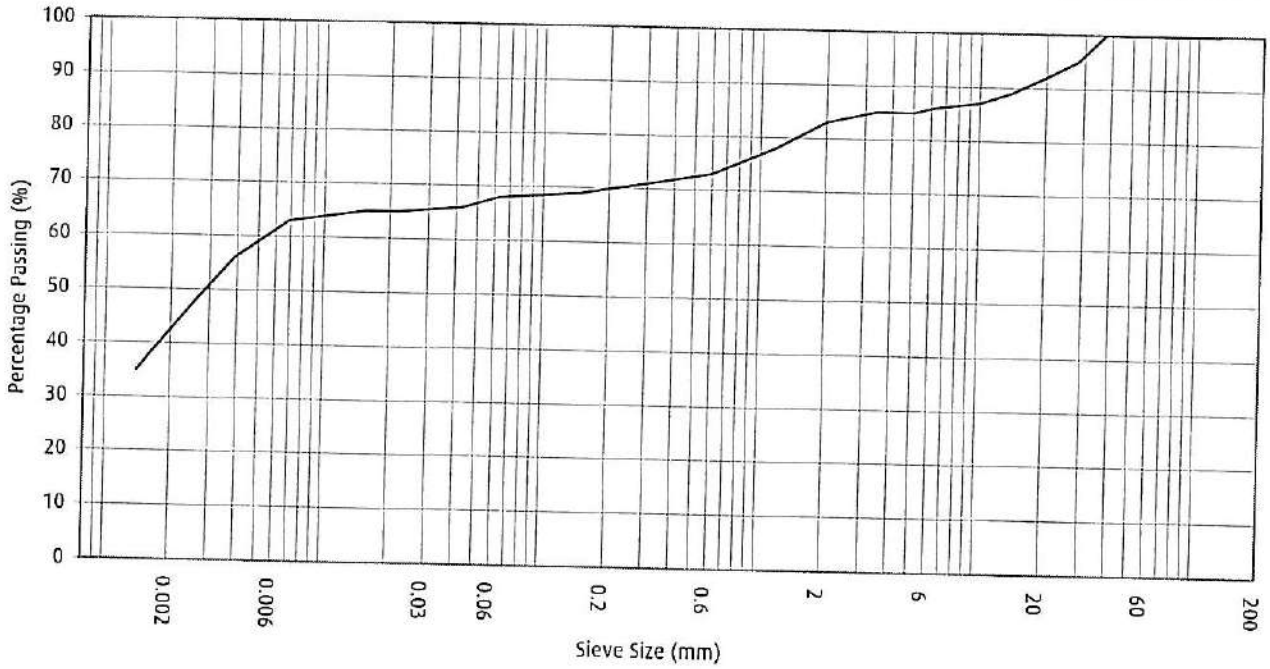
Particle density: 2.65Mg/m³ Assumed

| WET SIEVE DATA | | | | SEDIMENTATION DATA | |
|---|---|---|---|---|---|
| Sieve size mm | Cumulative % passing | Sieve size mm | Cumulative % passing | Equivalent particle diameter | Cumulative % passing |
| | | 14.0 | 96 | | |
| | | 10.0 | 95 | 0.0509 | 54 |
| | | 6.3 | 93 | 0.0256 | 52 |
| 125.0 | 100 | 5.0 | 89 | 0.0182 | 49 |
| 100.0 | 100 | 3.35 | 86 | 0.0083 | 43 |
| 75.0 | 100 | 2.00 | 78 | 0.0042 | 38 |
| 63.0 | 100 | 1.18 | 71 | 0.0028 | 32 |
| 50.0 | 100 | 0.600 | 64 | 0.0009 | 20 |
| 37.5 | 100 | 0.425 | 61 | | |
| 28.0 | 100 | 0.300 | 59 | | |
| 20.0 | 100 | 0.212 | 58 | | |
| | | 0.150 | 57 | | |
| | | 0.063 | 56 | | |



NORWEST HOLST SOIL ENGINEERING

| | | | |
|---|---|---|---|
| Project Name | Harbourhill Road, Barnsley | **Particle Size Distribution** | Hole ID BH02 |
| Project No. | LT949 | | Sample Depth 2.00m |
| Engineer | Christopher Evans | | Sample Number |
| Client | BWB Consulting LTD | BS 1377: Part 2: 1990: 9.2, 9.5 | Sample type B |
| Description | Grey sandy CLAY with mudstone gravel. | | Specimen Depth 2.00m |
| | | | Specimen No. 1 |




| PARTICLE SIZE | % |
|---|---|
| Clay: | 42 |
| Silt: | 26 |
| Sand: | 15 |
| Gravel: | 17 |
| Cobbles: | 0 |

General remarks

Particle density: 2.65Mg/m³ Assumed

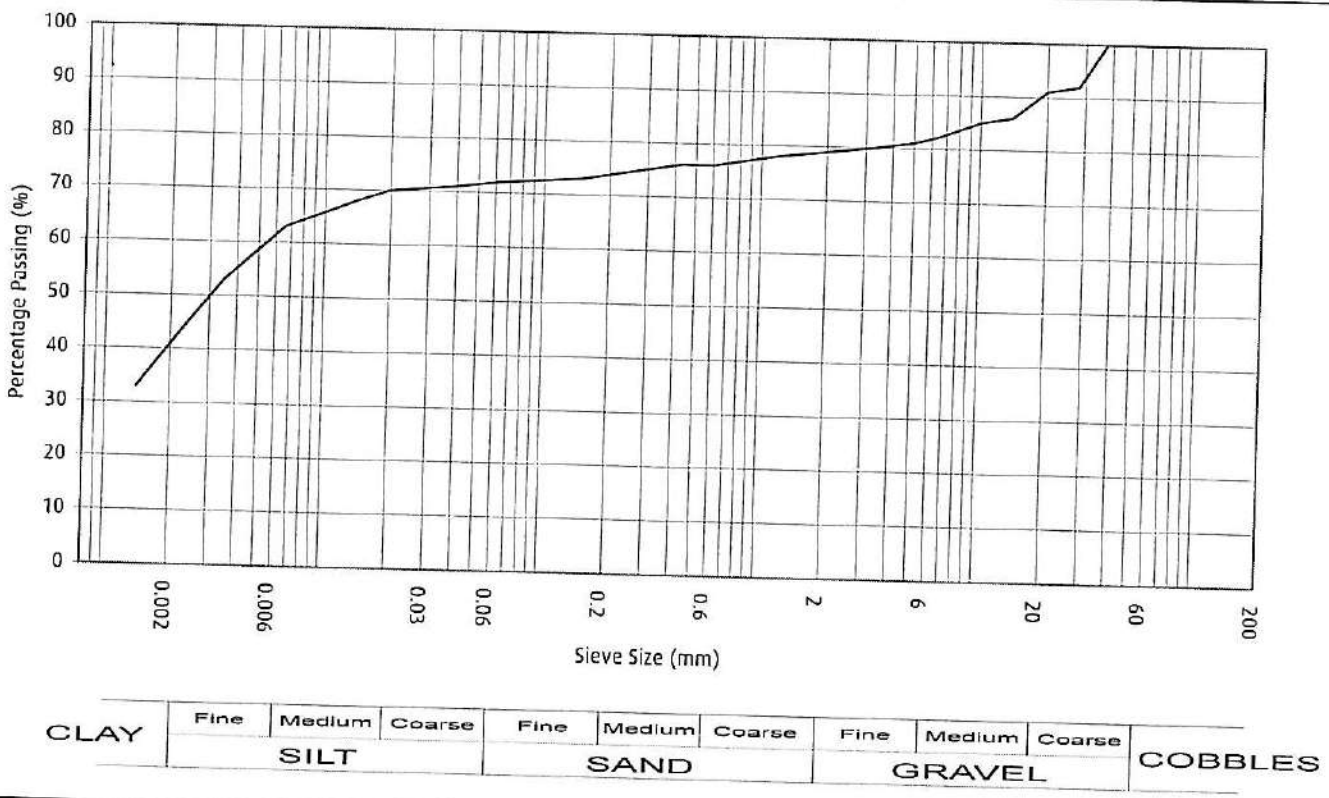
**WET SIEVE DATA**

| Sieve size mm | Cumulative % passing | Sieve size mm | Cumulative % passing |
|---|---|---|---|
| | | 14.0 | 89 |
| | | 10.0 | 87 |
| | | 6.3 | 86 |
| 125.0 | 100 | 5.0 | 85 |
| 100.0 | 100 | 3.35 | 85 |
| 75.0 | 100 | 2.00 | 83 |
| 63.0 | 100 | 1.18 | 78 |
| 50.0 | 100 | 0.600 | 73 |
| 37.5 | 100 | 0.425 | 72 |
| 28.0 | 95 | 0.300 | 71 |
| 20.0 | 92 | 0.212 | 70 |
| | | 0.150 | 69 |
| | | 0.063 | 68 |

**SEDIMENTATION DATA**

| Equivalent particle diameter | Cumulative % passing |
|---|---|
| 0.0428 | 66 |
| 0.0215 | 65 |
| 0.0153 | 65 |
| 0.0069 | 63 |
| 0.0039 | 56 |
| 0.0026 | 48 |
| 0.0014 | 35 |

| | | | |
|---|---|---|---|
| Project Name | Harbourhill Road, Barnsley | **Particle Size Distribution** | Hole ID BH04 |
| Project No. | LT949 | | Sample Depth 0.60m |
| Engineer | Christopher Evans | | Sample Number 002 |
| Client | BWB Consulting LTD | BS 1377: Part 2: 1990: 9.2, 9.5 | Sample type B |
| Description | Brown slightly sandy slightly gravelly CLAY. | | Specimen Depth 0.60m |
| | | | Specimen No. 1 |




| PARTICLE SIZE | % |
|---|---|
| Clay: | 40 |
| Silt: | 32 |
| Sand: | 7 |
| Gravel: | 21 |
| Cobbles: | 0 |

General remarks
Sample size was insufficient to be representative of particle size

Particle density: 2.65Mg/m³ Assumed

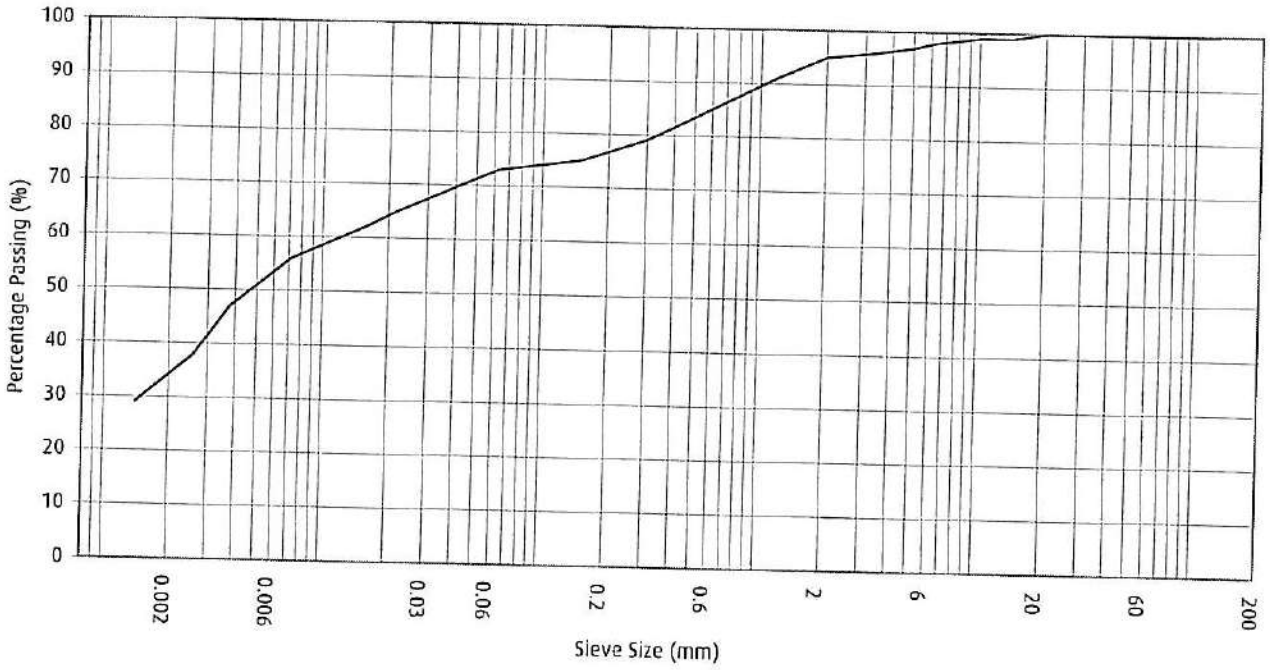
**WET SIEVE DATA**

| Sieve size mm | Cumulative % passing | Sieve size mm | Cumulative % passing |
|---|---|---|---|
| | | 14.0 | 86 |
| | | 10.0 | 85 |
| | | 6.3 | 82 |
| 125.0 | 100 | 5.0 | 81 |
| 100.0 | 100 | 3.35 | 80 |
| 75.0 | 100 | 2.00 | 79 |
| 63.0 | 100 | 1.18 | 78 |
| 50.0 | 100 | 0.600 | 76 |
| 37.5 | 100 | 0.425 | 76 |
| 28.0 | 92 | 0.300 | 75 |
| 20.0 | 91 | 0.212 | 74 |
| | | 0.150 | 73 |
| | | 0.063 | 72 |

**SEDIMENTATION DATA**

| Equivalent particle diameter | Cumulative % passing |
|---|---|
| 0.0392 | 71 |
| 0.0198 | 70 |
| 0.0141 | 68 |
| 0.0066 | 63 |
| 0.0035 | 53 |
| 0.0024 | 45 |
| 0.0014 | 33 |

| | | | |
|---|---|---|---|
| Project Name | Harbourhill Road, Barnsley | **Particle Size Distribution** | Hole ID BH05 |
| Project No. | LT949 | | Sample Depth 2.60m |
| Engineer | Christopher Evans | | Sample Number |
| Client | BWB Consulting LTD | BS 1377: Part 2: 1990: 9.2, 9.5 | Sample type B |
| Description | Brown slightly sandy slightly gravelly CLAY. | | Specimen Depth 2.60m |
| | | | Specimen No. 1 |




| PARTICLE SIZE | % |
|---|---|
| Clay: | 34 |
| Silt: | 39 |
| Sand: | 22 |
| Gravel: | 5 |
| Cobbles: | 0 |

General remarks

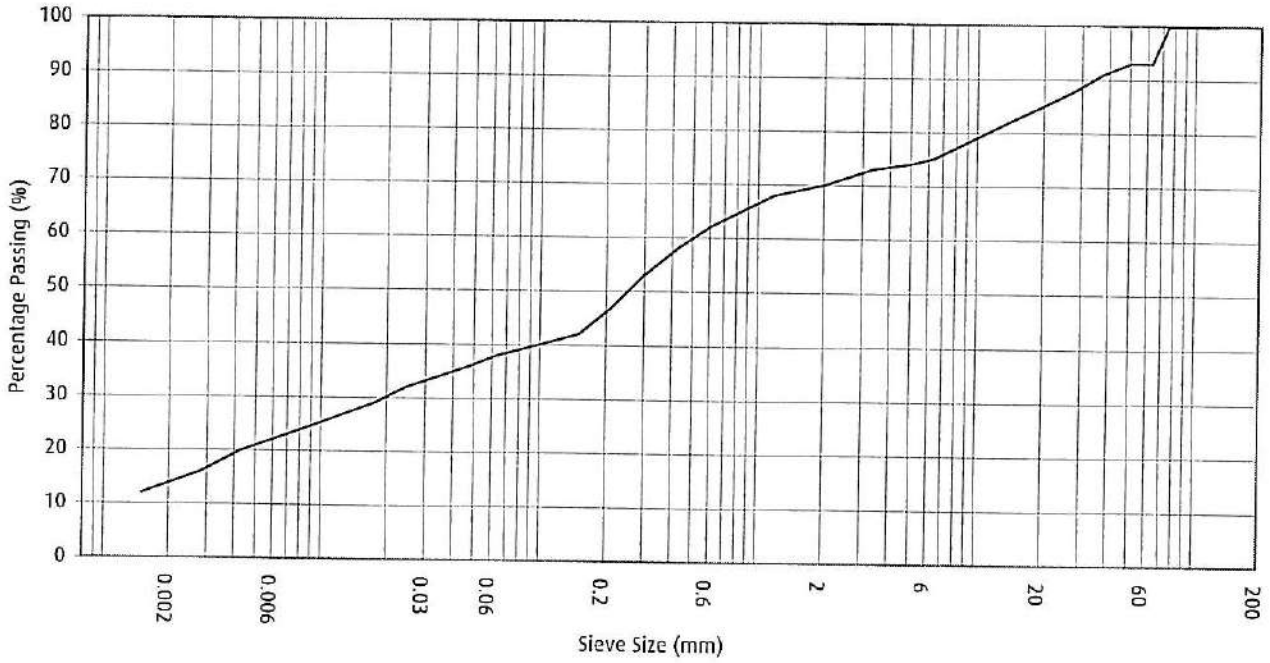
Particle density: 2.65Mg/m³ Assumed

| WET SIEVE DATA | | | | SEDIMENTATION DATA | |
|---|---|---|---|---|---|
| Sieve size mm | Cumulative % passing | Sieve size mm | Cumulative % passing | Equivalent particle diameter | Cumulative % passing |
| | | 14.0 | 99 | | |
| | | 10.0 | 99 | 0.0423 | 70 |
| | | 6.3 | 98 | 0.0218 | 65 |
| 125.0 | 100 | 5.0 | 97 | 0.0157 | 62 |
| 100.0 | 100 | 3.35 | 96 | 0.0072 | 56 |
| 75.0 | 100 | 2.00 | 95 | 0.0038 | 47 |
| 63.0 | 100 | 1.18 | 91 | 0.0026 | 38 |
| 50.0 | 100 | 0.600 | 85 | 0.0014 | 29 |
| 37.5 | 100 | 0.425 | 82 | | |
| 28.0 | 100 | 0.300 | 79 | | |
| 20.0 | 100 | 0.212 | 77 | | |
| | | 0.150 | 75 | | |
| | | 0.063 | 73 | | |



NORWEST HOLST SOIL ENGINEERING

| | | | |
|---|---|---|---|
| Project Name | Harbourhill Road, Barnsley | **Particle Size Distribution** | Hole ID TP12 |
| Project No. | LT949 | | Sample Depth 1.10m |
| Engineer | Christopher Evans | | Sample Number |
| Client | BWB Consulting LTD | BS 1377: Part 2: 1990: 9.2, 9.5 | Sample type B |
| Description | MADE GROUND: Dark brown sandy gravelly clay with brick and glass fragments. | | Specimen Depth 1.10m |
| | | | Specimen No. 1 |




| PARTICLE SIZE | % |
|---|---|
| Clay: | 14 |
| Silt: | 24 |
| Sand: | 32 |
| Gravel: | 23 |
| Cobbles: | 7 |

General remarks

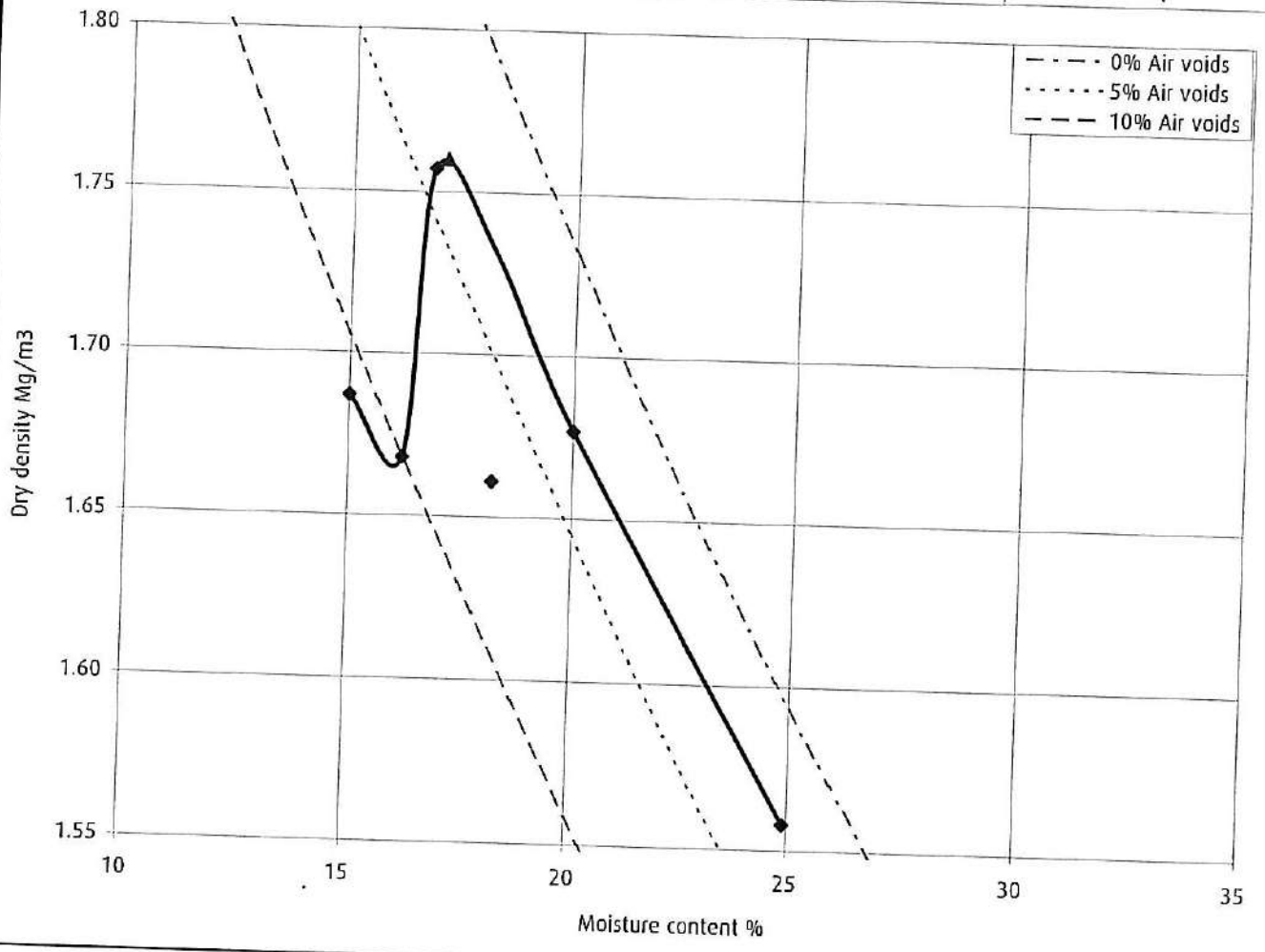
Particle density: 2.65Mg/m³ Assumed

| WET SIEVE DATA | | | | SEDIMENTATION DATA | |
|---|---|---|---|---|---|
| Sieve size mm | Cumulative % passing | Sieve size mm | Cumulative % passing | Equivalent particle diameter | Cumulative % passing |
| | | 14.0 | 82 | | |
| | | 10.0 | 79 | 0.0479 | 36 |
| | | 6.3 | 75 | 0.0245 | 32 |
| 125.0 | 100 | 5.0 | 74 | 0.0176 | 29 |
| 100.0 | 100 | 3.35 | 73 | 0.0081 | 24 |
| 75.0 | 100 | 2.00 | 70 | 0.0043 | 20 |
| 63.0 | 93 | 1.18 | 68 | 0.0028 | 16 |
| 50.0 | 93 | 0.600 | 62 | 0.0015 | 12 |
| 37.5 | 91 | 0.425 | 58 | | |
| 28.0 | 88 | 0.300 | 53 | | |
| 20.0 | 85 | 0.212 | 47 | | |
| | | 0.150 | 42 | | |
| | | 0.063 | 38 | | |



NORWEST HOLST SOIL ENGINEERING

| | | | |
|---|---|---|---|
| Project Name | Harbourhill Road, Barnsley | **Dry Density / Moisture Content Relationship** | Hole ID: TP02 |
| Project No. | LT949 | | Sample Depth: 0.70m |
| Engineer | Christopher Evans | | Sample Number: 002 |
| Client | BWB Consulting LTD | BS1377: Part 4: 1990: Clause 3 | Sample Type: AMAL |
| Description | Light and dark brown slightly gravelly sandy CLAY | | Specimen Depth: 0.70m |
| Amalgamation: TP02,002,B,0.70m + TP02,003,B,1.50m. | | | Specimen Number: 1 |



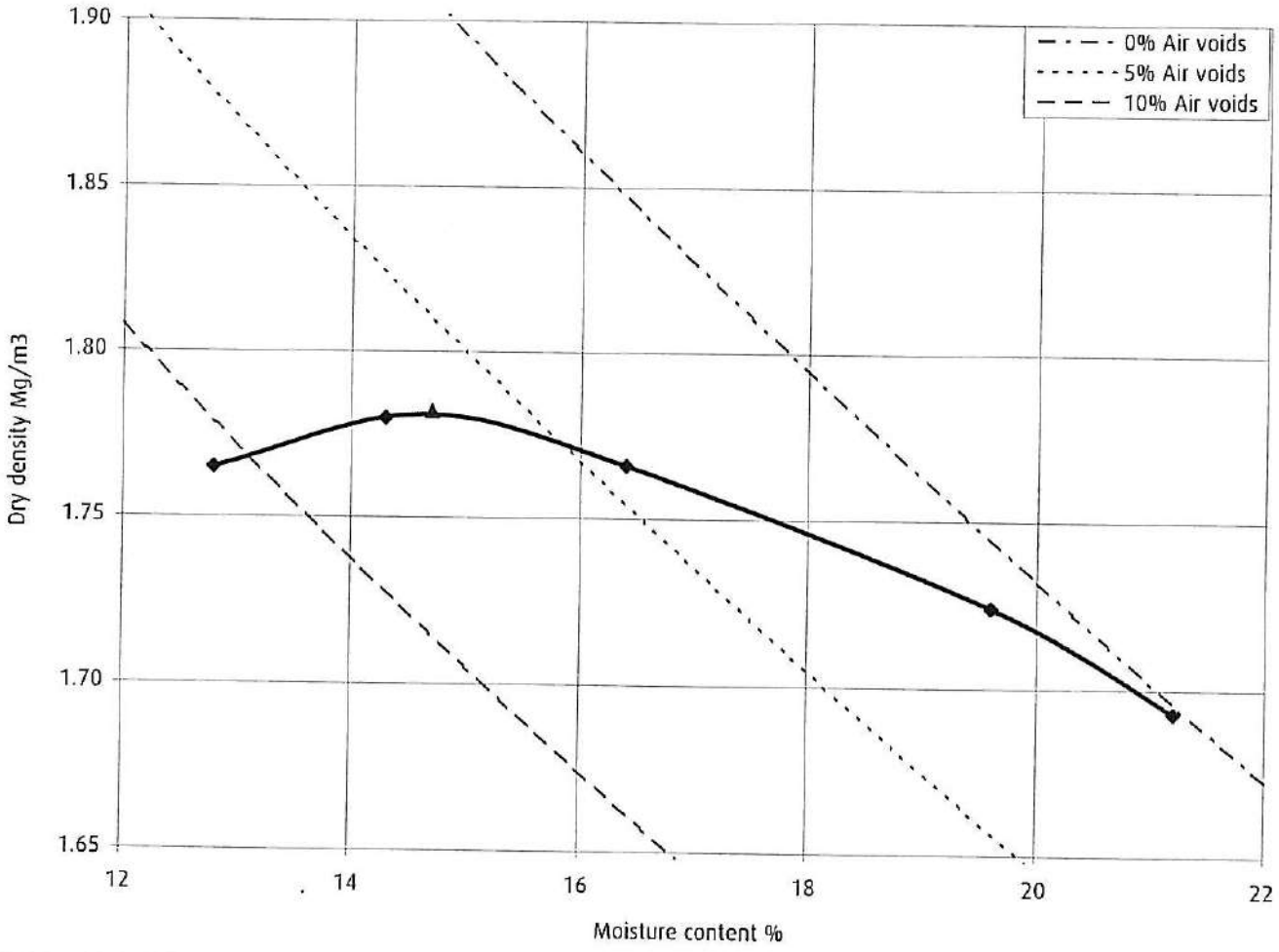

| | |
|---|---|
| Maximum dry density | 1.76Mg/m³ |
| Optimum moisture content | 17% |
| Corrected maximum dry density for removal of gravel | 1.77Mg/m³ |
| Method of compaction | 2.5kg Rammer |
| Batches tested | Separate batches tested. |
| Particle density Assumed | 2.65Mg/m³ |
| Gravel retained on 20mm sieve | 2% |
| Gravel retained on 37.5mm sieve | 1% |

Experimental points

| | Moisture content % | Dry Density Mg/m³ |
|---|---|---|
| | 15.0 | 1.69 |
| | 16.2 | 1.67 |
| | 16.8 | 1.76 |
| | 18.2 | 1.66 |
| Nat | 20.0 | 1.68 |
| | 24.9 | 1.56 |

General remarks: Test performed on specimen unsuitable due to gravel content.

| | | | |
|---|---|---|---|
| Project Name | Harbourhill Road, Barnsley | **Dry Density / Moisture Content Relationship** | Hole ID: TP10 |
| Project No. | LT949 | | Sample Depth: 1.20m |
| Engineer | Christopher Evans | | Sample Number: 003 |
| Client | BWB Consulting LTD | BS1377: Part 4: 1990: Clause 3 | Sample Type: AMAL |
| Description | Brown slightly gravelly CLAY. | | Specimen Depth: 1.20m |
| Amalgamation: TP10,003,B,1.20m + TP10,004,B,2.20m. | | | Specimen Number: 1 |



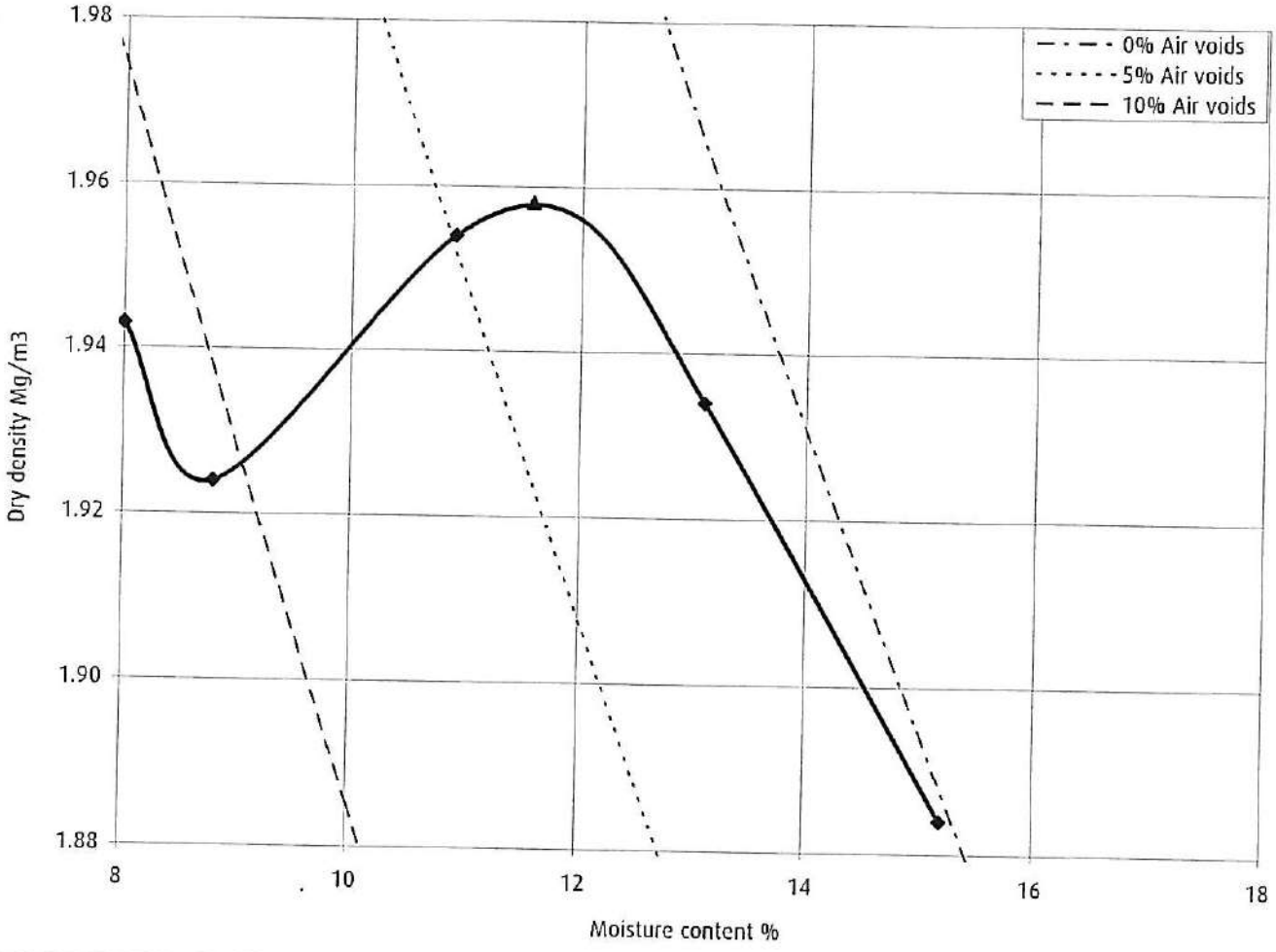

| | |
|---|---|
| Maximum dry density | 1.78Mg/m³ |
| Optimum moisture content | 15% |
| Corrected maximum dry density for removal of gravel | 1.79Mg/m³ |
| Method of compaction | 2.5kg Rammer |
| Batches tested | Single specimen. |
| Particle density Assumed | 2.65Mg/m³ |
| Gravel retained on 20mm sieve | 2% |
| Gravel retained on 37.5mm sieve | 1% |

Experimental points

| | Moisture content % | Dry Density Mg/m³ |
|---|---|---|
| | 12.8 | 1.77 |
| | 14.3 | 1.78 |
| | 16.4 | 1.77 |
| Nat | 19.6 | 1.72 |
| | 21.2 | 1.69 |

General remarks: Test performed on specimen unsuitable due to gravel content.

| | | | |
|---|---|---|---|
| Project Name | Harbourhill Road, Barnsley | **Dry Density / Moisture Content Relationship** | Hole ID: TP13 |
| Project No. | LT949 | | Sample Depth: 1.00m |
| Engineer | Christopher Evans | | Sample Number: 002 |
| Client | BWB Consulting LTD | BS1377: Part 4: 1990: Clause 3 | Sample Type: AMAL |
| Description | Brown gravelly sandy CLAY with mudstone fragments. | | Specimen Depth: 1.00m |
| Amalgamation: TP13,002,B,1.00m + TP13,003,B,2.00m + BH04,002,B,0.60m. | | | Specimen Number: 1 |




| | |
|---|---|
| Maximum dry density | 1.96Mg/m³ |
| Optimum moisture content | 12% |
| Corrected maximum dry density for removal of gravel | 1.99Mg/m³ |
| Method of compaction | 2.5kg Rammer |
| Batches tested | Single specimen. |
| Particle density Assumed | 2.65Mg/m³ |
| Gravel retained on 20mm sieve | 6% |
| Gravel retained on 37.5mm sieve | 2% |

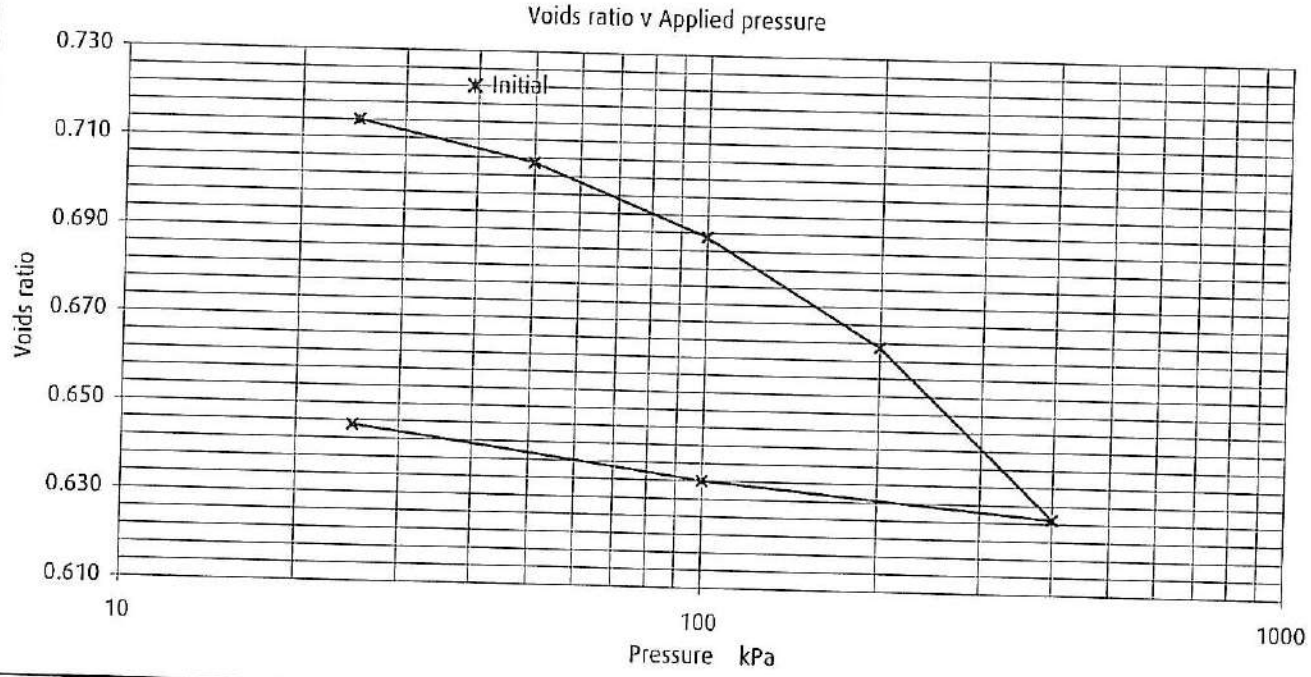
Experimental points

| | Moisture content % | Dry Density Mg/m³ |
|---|---|---|
| | 8.0 | 1.94 |
| | 8.8 | 1.92 |
| | 10.9 | 1.95 |
| Nat | 12.0 | 1.87 |
| | 13.1 | 1.93 |
| | 15.2 | 1.88 |

General remarks: Test performed on specimen unsuitable due to gravel content.

| | | | |
|---|---|---|---|
| Project Name | Harbourhill Road, Barnsley | Oedometer Consolidation | Hole ID BH05 |
| Project No. | LT949 | | Sample Depth 2.00m |
| Engineer | Christopher Evans | | Sample Number |
| Client | BWB Consulting LTD | BS1377: Part 5: 1990: 3.0 | Sample Type U |
| Description | Mottled brown slightly gravelly CLAY. | | Specimen Depth 2.04m |
| | | | Specimen Number 1 |

Voids ratio v Applied pressure




Specimen details

| | | |
|---|---|---|
| Trimmings moisture content | 25 | % |
| Diameter | 75.0 | mm |
| Height | 18.95 | mm |
| Bulk density | 1.96 | $Mg/m^3$ |
| Dry density | 1.54 | $Mg/m^3$ |
| Initial moisture content | 27 | % |
| Initial voids ratio | 0.722 | |
| Saturation | 100 | % |
| Particle density Assumed | 2.65 | $Mg/m^3$ |
| Specimen depth | 2.04 | m |
| Specimen ref. | 01 | |
| Final moisture content | 26 | % |

Coefficient of volume compressibility for a pressure increment of 100kPa in excess of the present effective overburden pressure: 0.18 $m^2/MN$

Laboratory coefficients

| Pressure kPa | Compressibility $m_v$ $m^2/MN$ | Consolidation $c_v$ $m^2/year$ log time | Consolidation $c_v$ $m^2/year$ root time | Voids ratio |
|---|---|---|---|---|
| 25 | 0.19 | 6.9 | 8.4 | 0.714 |
| 50 | 0.22 | 2.8 | 2.7 | 0.705 |
| 100 | 0.19 | 3.9 | 3.1 | 0.689 |
| 200 | 0.14 | 5.4 | 8.6 | 0.665 |
| 400 | 0.11 | 6.5 | 4.9 | 0.627 |
| 100 | | | | 0.634 |
| 25 | | | | 0.645 |

Specimen prepared as per BS1377: Part 1: 1990: Clause 8.6 Test performed at an average temperature of 23°C (Results corrected for 20°C)
Specimen cut and tested with longest axis in an horizontal orientation.

# APPENDIX 6

# GAS AND GROUNDWATER MONITORING

# BWB GAS AND GROUNDWATER MONITORING

| | |
|---|---|
| **SITE** | Harbourhill Road (Barnsley) |
| **CLIENT** | Kennett Properties |
| **JOB No** | LDS126 |
| **DATE** | 27/07/2006 |
| **START TIME/FINNISH TIME** | 8.30-9.10 |
| **ENGINEER** | C Evans |
| **INSTALLATION DETAILS** | 50mm stand pipe |
| **MONITORING EQUIPMENT** | GA2000 Gas analyser, flow pod electronic dipmeter |

| **WEATHER CONDITIONS** | **START** | | **FINISH** |
|---|---|---|---|
| **Dry/raining etc** | DRY | | - |
| **Cloud Cover** | 6/8 | | - |
| **Wind strength and direction** | Slight | | - |
| **Temperature ($^{o}$C)** | | | - |
| **Barometric Pressure (mb)** | 1006 | | |

| **Ref** | **Base of Response Zone (m)** | **Depth to water (m)** | **Methane** | | **Carbon Dioxide (%v/v)** | **Carbon Monoxide (ppm)** | **Hydrogen Sulphide (ppm)** | **Oxygen (%v/v)** | **Temp ($^{o}$C)** | **Flow (l/hr)** | **Notes** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **(%v/v)** | **(%LEL)** | | | | | | | |
| BH01 | 10.00 | 8.93 | N.D | N.D | 2.1 | 0.0 | N.D | 10.5 | N.R | -0.2 to -0.7 | |
| BH02 | 19.00 | 6.49 | N.D | N.D | N.D | N.D | N.D | 20.4 | N.R | -0.1 to -0.3 | |
| BH03 | 30.00 | 8.94 | N.D | N.D | 0.7 | N.D | N.D | 18.7 | N.R | -0.6 to -0.2 | |
| BH04 | 19.00 | 17.38 | N.D | N.D | 0.9 | N.D | N.D | 18.6 | N.R | -2.7 to -2.8 | Blocked on arrival |
| BH05 | 20.00 | 20.05 | N.D | N.D | 1.6 | N.D | N.D | 13.4 | N.R | -1.8 to - 2.1 | |

LEL Lower Explosive limit (100% LEL = 5% Flammable gas)
N.D. Value below detection limit of equipment used
N.R. Not recorded

# BWB GAS AND GROUNDWATER MONITORING

| | |
|---|---|
| **SITE** | Harbourhill Road (Barnsley) |
| **CLIENT** | Kennett Properties |
| **JOB No** | LDS126 |
| **DATE** | 21/07/2006 |
| **START TIME/FINNISH TIME** | 10.10 - 10.40 |
| **ENGINEER** | S Steel |
| **INSTALLATION DETAILS** | 50mm stand pipe |
| **MONITORING EQUIPMENT** | GA2000 Gas analyser, flow pod electronic dipmeter |

| **WEATHER CONDITIONS** | **START** | | **FINISH** |
|---|---|---|---|
| **Dry/raining etc** | DRY | | - |
| **Cloud Cover** | 8/8 | | - |
| **Wind strength and direction** | Slight | | - |
| **Temperature ($^{o}$C)** | N.R | | - |
| **Barometric Pressure (mb)** | 1009 | | |

| **Ref** | **Base of Response Zone (m)** | **Depth to water (m)** | **Methane** | | **Carbon Dioxide (%v/v)** | **Carbon Monoxide (ppm)** | **Hydrogen Sulphide (ppm)** | **Oxygen (%v/v)** | **Temp ($^{o}$C)** | **Flow (l/hr)** | **Notes** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **(%v/v)** | **(%LEL)** | | | | | | | |
| BH01 | 10.00 | DRY | N.D | N.D | 2.9 | N.D | N.D | 9.9 | N.R | 0.4 to 0.9 | |
| BH02 | 19.00 | 5.79 | N.D | N.D | N.D | N.D | N.D | 20.4 | N.R | 0.2 to -0.1 | |
| BH03 | 30.00 | 7.97 | N.D | N.D | N.D | N.D | N.D | 20.2 | N.R | -0.2 to -0.5 | |
| BH04 | 19.00 | 17.68 | N.D | N.D | 1.7 | N.D | N.D | 17.5 | N.R | -1.6 to -1.7 | |
| BH05 | 20.00 | 19.93 | N.D | N.D | 0.8 | N.D | N.D | 16.6 | N.R | -2.9 | |

LEL Lower Explosive limit (100% LEL = 5% Flammable gas)
N.D. Value below detection limit of equipment used
N.R. Not recorded

# BWB GAS AND GROUNDWATER MONITORING

| | |
|---|---|
| SITE | Harbourhill Road (Barnsley) |
| CLIENT | Kennett Properties |
| JOB No | LDS126 |
| DATE | 14/07/2006 |
| START TIME/FINNISH TIME | 8.30-9.10 |
| ENGINEER | S Steel |
| INSTALLATION DETAILS | 50mm stand pipe |
| MONITORING EQUIPMENT | GA2000 Gas analyser, flow pod electronic dipmeter |

| WEATHER CONDITIONS | START | | FINISH |
|---|---|---|---|
| Dry/raining etc | DRY | | - |
| Cloud Cover | 1/8 | | - |
| Wind strength and direction | Slight | | - |
| Temperature ($^{o}$C) | 17* | | - |
| Barometric Pressure (mb) | 1024 | | |

| Ref | Base of Response Zone (m) | Depth to water (m) | Methane (%v/v) | Methane (%LEL) | Carbon Dioxide (%v/v) | Carbon Monoxide (ppm) | Hydrogen Sulphide (ppm) | Oxygen (%v/v) | Temp ($^{o}$C) | Flow (l/hr) | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BH01 | 10.00 | DRY | N.D | N.D | 2.8 | 25.0 | N.D | 11.8 | N.R | 0.2 to -0.5 | |
| BH02 | 19.00 | 5.67 | N.D | N.D | N.D | N.D | N.D | 20.2 | N.R | 0.1 to -0.2 | |
| BH03 | 30.00 | 8.00 | N.D | N.D | N.D | N.D | N.D | 20.1 | N.R | -0.9 to -1.2 | |
| BH04 | 19.00 | 17.52 | N.D | N.D | 0.2 | N.D | N.D | 19.7 | N.R | -1.9 | |
| BH05 | 20.00 | 19.78 | N.D | N.D | 1.8 | N.D | N.D | 13.1 | N.R | -2.2 to - 2.3 | Full of slurry at base |

LEL Lower Explosive limit (100% LEL = 5% Flammable gas)
N.D. Value below detection limit of equipment used
N.R. Not recorded

PDF created with pdfFactory Pro trial version www.pdffactory.com

## BWB GAS AND GROUNDWATER MONITORING

| | |
|---|---|
| SITE | Harbourhill Road (Barnsley) |
| CLIENT | Kennett Properties |
| JOB No | LDS126 |
| DATE | 21/08/2006 |
| START TIME/FINNISH TIME | 10.10 - 10.40 |
| ENGINEER | C Evans |
| INSTALLATION DETAILS | 50mm stand pipe |
| MONITORING EQUIPMENT | GA2000 Gas analyser, flov electronic dipmeter |

| WEATHER CONDITIONS | START |
|---|---|
| Dry/raining etc | DRY |
| Cloud Cover | 1/8 |
| Wind strength and direction | Very windy |
| Temperature ($^{o}$C) | N.R |
| Barometric Pressure (mb) | 1003 |

| Ref | Base of Response Zone (m) | Depth to water (m) | Methane (%v/v) | Methane (%LEL) | Carbon Dioxide (%v/v) | Carbon Monoxide (ppm) | Hydrogen Sulphide (ppm) | Oxygen (%v/v) | Temp ($^{o}$C) | Flow (l/hr) |
|---|---|---|---|---|---|---|---|---|---|---|
| Background | N.R | N.R | N.D | N.D | N.D | N.D | N.D | 20.4 | N.R | N.R |
| BH01 | 10.00 | 6.51 | N.D | N.D | 0.6 | N.D | N.D | 17.2 | N.R | 0.0 to 0.3 |
| BH02 | 19.00 | 6.10 | N.D | N.D | N.D | N.D | N.D | 20.5 | N.R | 0.4 to -0.4 |
| BH03 | 30.00 | 8.80 | N.D | N.D | 0.2 | N.D | N.D | 19.0 | N.R | -0.1 to 0.1 |
| BH04 | 19.00 | 17.44 | N.D | N.D | 4.1 | N.D | N.D | 19.6 | N.R | -2.4 to -0.8 |
| BH05 | 20.75 | 20.09 | N.D | N.D | 0.7 | N.D | N.D | 16.7 | N.R | -1.2 to -0.4 |

| | |
|---|---|
| LEL | Lower Explosive limit (100% LEL = 5% Flammable gas) |
| N.D. | Value below detection limit of equipment used |
| N.R. | Not recorded |

**Notes**

Borehole BH01 Instalation below level of run off water on arrival required to remove bung before monitoring

Borehole BH04 Instalation below level of run off water on arrival required to remove bung before monitoring

PDF created with pdfFactory Pro trial version www.pdffactory.com

# BWB GAS AND GROUNDWATER MONITORING

| | |
|---|---|
| **SITE** | Harbourhill Road (Barnsley) |
| **CLIENT** | Kennett Properties |
| **JOB No** | LDS126 |
| **DATE** | 14/08/2006 |
| **START TIME/FINNISH TIME** | 10.10 - 10.40 |
| **ENGINEER** | C Evans |
| **INSTALLATION DETAILS** | 50mm stand pipe |
| **MONITORING EQUIPMENT** | GA2000 Gas analyser, flow pod electronic dipmeter |

| **WEATHER CONDITIONS** | **START** | **FINISH** |
|---|---|---|
| **Dry/raining etc** | DRY | - |
| **Cloud Cover** | 1/8 | - |
| **Wind strength and direction** | Very windy | - |
| **Temperature ($^{o}$C)** | N.R | - |
| **Barometric Pressure (mb)** | 1003 | |

| **Ref** | **Base of Response Zone (m)** | **Depth to water (m)** | **Methane** | | **Carbon Dioxide (%v/v)** | **Carbon Monoxide (ppm)** | **Hydrogen Sulphide (ppm)** | **Oxygen (%v/v)** | **Temp ($^{o}$C)** | **Flow (l/hr)** | **Notes** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **(%v/v)** | **(%LEL)** | | | | | | | |
| Background | N.R | N.R | N.D | N.D | N.D | N.D | N.D | 20.4 | N.R | N.R | |
| BH01 | 10.00 | 8.94 | N.D | N.D | 3.4 | N.D | N.D | 3.8 | N.R | 0.0 to 1.7 | |
| BH02 | 19.00 | 6.59 | N.D | N.D | N.D | N.D | N.D | 19.8 | N.R | 0.4 to -0.4 | |
| BH03 | 30.00 | 8.91 | N.D | N.D | 0.8 | N.D | N.D | 17.9 | N.R | -0.1 to 0.1 | |
| BH04 | 19.00 | 17.44 | N.D | N.D | 4.1 | N.D | N.D | 13.2 | N.R | -0.4 to -2.7 | |
| BH05 | 20.00 | 20.01 | N.D | N.D | 1.6 | N.D | N.D | 12.9 | N.R | 2.7 to 0.5 | |

LEL Lower Explosive limit (100% LEL = 5% Flammable gas)
N.D. Value below detection limit of equipment used
N.R. Not recorded

# Appendix D

# EnviroInsight Report

Hamson Barron Smith Ltd

16 CENTRAL AVENUE, ST. ANDREWS BUSINESS PARK,
NORWICH, NR7 0HR

| | |
|---|---|
| Groundsure Reference: | GS-5235675 |
| Your Reference: | Schwabisch_Gmund_Way_PO23003026 |
| Report Date | 13 Jul 2018 |
| Report Delivery Method: | Email - pdf |

## Enviro Insight

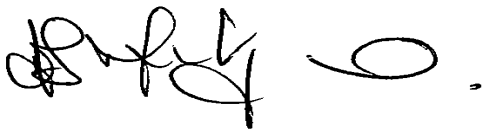
Address: Schwabisch Gmund Way, S71 1BP

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Enviro Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above Groundsure reference number.

Yours faithfully,



Managing Director
Groundsure Limited

Enc.
Groundsure Enviroinsight

# Enviro Insight

| | |
|---|---|
| **Address:** | **Schwabisch Gmund Way, S71 1BP** |
| **Date:** | **13 Jul 2018** |
| **Reference:** | **GS-5235675** |
| **Client:** | **Hamson Barron Smith Ltd** |

NW N NE



W E

SW S SE

| | |
|---|---|
| Aerial Photograph Capture date: | 07-Jun-2013 |
| Grid Reference: | 434810,406621 |
| Site Size: | 1.61ha |

Report Reference: GS-5235675
Client Reference: Schwabisch_Gmund_Way_PO23003026

# Contents Page


Contents Page 3
Overview of Findings 6
Using this report 10
1. Historical Land Use 11
1. Historical Industrial Sites 12
1.1 Potentially Contaminative Uses identified from 1:10,000 scale Mapping....12
1.2 Additional Information – Historical Tank Database....18
1.3 Additional Information – Historical Energy Features Database....19
1.4 Additional Information – Historical Petrol and Fuel Site Database....21
1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database....21
1.6 Potentially Infilled Land....22
2. Environmental Permits, Incidents and Registers Map 25
2. Environmental Permits, Incidents and Registers 26
2.1 Industrial Sites Holding Licences and/or Authorisations....26
2.1.1 Records of historic IPC Authorisations within 500m of the study site:....26
2.1.2 Records of Part A(1) and IPPC Authorised Activities within 500m of the study site:....26
2.1.3 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site:....30
2.1.4 Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site:....30
2.1.5 Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site:....30
2.1.6 Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site: ....30
2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations:....31
2.1.8 Records of Licensed Discharge Consents within 500m of the study site:....31
2.1.9 Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site: ....33
2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site:....33
2.2 Dangerous or Hazardous Sites....33
2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents....34
2.3.1 Records of National Incidents Recording System, List 2 within 500m of the study site:....34
2.3.2 Records of National Incidents Recording System, List 1 within 500m of the study site:....34
2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990....34
3. Landfill and Other Waste Sites Map 35
3. Landfill and Other Waste Sites 36
3.1 Landfill Sites....36
3.1.1 Records from Environment Agency/Natural Resources Wales landfill data within 1000m of the study site: ....36
3.1.2 Records of Environment Agency/Natural Resources Wales historic landfill sites within 1500m of the study site: ....36
3.1.3 Records of BGS/DoE non-operational landfill sites within 1500m of the study site:....39
3.1.4 Records of Landfills from Local Authority and Historical Mapping Records within 1500m of the study site:....39
3.2 Other Waste Sites....40
3.2.1 Records of waste treatment, transfer or disposal sites within 500m of the study site: ....40
3.2.2 Records of Environment Agency/Natural Resources Wales licensed waste sites within 1500m of the study site: ....40
4. Current Land Use Map 43
4. Current Land Uses 44
4.1 Current Industrial Data....44
4.2 Petrol and Fuel Sites....45
4.3 National Grid High Voltage Underground Electricity Transmission Cables....46
4.4 National Grid High Pressure Gas Transmission Pipelines....46

5. Geology 47
5.1 Artificial Ground and Made Ground 47
5.2 Superficial Ground and Drift Geology 47
5.3 Bedrock and Solid Geology 47
6 Hydrogeology and Hydrology 48
6a. Aquifer Within Superficial Geology 48
6b. Aquifer Within Bedrock Geology and Abstraction Licenses 49
6c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses 50
6d. Hydrogeology – Source Protection Zones within confined aquifer 51
6e. Hydrology – Watercourse Network and River Quality 52
6.Hydrogeology and Hydrology 53
6.1 Aquifer within Superficial Deposits 53
6.2 Aquifer within Bedrock Deposits 53
6.3 Groundwater Abstraction Licences 53
6.4 Surface Water Abstraction Licences 54
6.5 Potable Water Abstraction Licences 55
6.6 Source Protection Zones 56
6.7 Source Protection Zones within Confined Aquifer 56
6.8 Groundwater Vulnerability and Soil Leaching Potential 56
6.9 River Quality 56
6.9.1 Biological Quality: 56
6.9.2 Chemical Quality: 57
6.10 Ordnance Survey MasterMap Water Network 57
6.11 Surface Water Features 58
7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea) 59
7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS) Map 60
7 Flooding 61
7.1 River and Coastal Zone 2 Flooding 61
7.2 River and Coastal Zone 3 Flooding 61
7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating 61
7.4 Flood Defences 61
7.5 Areas benefiting from Flood Defences 61
7.6 Areas benefiting from Flood Storage 62
7.7 Groundwater Flooding Susceptibility Areas 62
7.8 Groundwater Flooding Confidence Areas 62
8. Designated Environmentally Sensitive Sites Map 63
8. Designated Environmentally Sensitive Sites 64
8.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site: 64
8.2 Records of National Nature Reserves (NNR) within 2000m of the study site: 64
8.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site: 64
8.4 Records of Special Protection Areas (SPA) within 2000m of the study site: 64
8.5 Records of Ramsar sites within 2000m of the study site: 64
8.6 Records of Ancient Woodland within 2000m of the study site: 65
8.7 Records of Local Nature Reserves (LNR) within 2000m of the study site: 65
8.8 Records of World Heritage Sites within 2000m of the study site: 65
8.9 Records of Environmentally Sensitive Areas within 2000m of the study site: 65
8.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site: 65
8.11 Records of National Parks (NP) within 2000m of the study site: 65
8.12 Records of Nitrate Sensitive Areas within 2000m of the study site: 66
8.13 Records of Nitrate Vulnerable Zones within 2000m of the study site: 66

8.14 Records of Green Belt land within 2000m of the study site:.....66
9. Natural Hazards Findings 67
9.1 Detailed BGS GeoSure Data.....67
9.1.1 Shrink Swell.....67
9.1.2 Landslides.....67
9.1.3 Soluble Rocks.....67
9.1.4 Compressible Ground.....68
9.1.5 Collapsible Rocks.....68
9.1.6 Running Sand.....68
9.2 Radon.....69
9.2.1 Radon Affected Areas.....69
9.2.2 Radon Protection.....69
10. Mining 70
10.1 Coal Mining.....70
10.2 Non-Coal Mining.....70
10.3 Brine Affected Areas .....70
Contact Details 71
Standard Terms and Conditions 73

# Overview of Findings

For further details on each dataset, please refer to each individual section in the main report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

| Section 1: Historical Industrial Sites | On-site | 0-50 | 51-250 | 251-500 |
|---|---|---|---|---|
| 1.1 Potentially Contaminative Uses identified from 1:10,000 scale mapping | 19 | 20 | 110 | 102 |
| 1.2 Additional Information – Historical Tank Database | 2 | 0 | 15 | 11 |
| 1.3 Additional Information – Historical Energy Features Database | 1 | 2 | 29 | 55 |
| 1.4 Additional Information – Historical Petrol and Fuel Site Database | 0 | 0 | 0 | 0 |
| 1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database | 0 | 0 | 6 | 30 |
| 1.6 Potentially Infilled Land | 0 | 0 | 29 | 52 |

| Section 2: Environmental Permits, Incidents and Registers | On-site | 0-50m | 51-250 | 251-500 |
|---|---|---|---|---|
| 2.1 Industrial Sites Holding Environmental Permits and/or Authorisations | | | | |
| 2.1.1 Records of historic IPC Authorisations | 0 | 0 | 0 | 0 |
| 2.1.2 Records of Part A(1) and IPPC Authorised Activities | 0 | 0 | 0 | 28 |
| 2.1.3 Records of Red List Discharge Consents | 0 | 0 | 0 | 0 |
| 2.1.4 Records of List 1 Dangerous Substances Inventory sites | 0 | 0 | 0 | 0 |
| 2.1.5 Records of List 2 Dangerous Substances Inventory sites | 0 | 0 | 0 | 0 |
| 2.1.6 Records of Part A(2) and Part B Activities and Enforcements | 0 | 0 | 1 | 3 |
| 2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations | 0 | 0 | 0 | 0 |
| 2.1.8 Records of Licensed Discharge Consents | 0 | 0 | 3 | 9 |
| 2.1.9 Records of Water Industry Referrals | 0 | 0 | 0 | 0 |
| 2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site | 0 | 0 | 0 | 0 |
| 2.2 Records of COMAH and NIHHS sites | 0 | 0 | 0 | 1 |
| 2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents | | | | |
| 2.3.1 National Incidents Recording System, List 2 | 0 | 0 | 0 | 2 |
| 2.3.2 National Incidents Recording System, List 1 | 0 | 0 | 0 | 0 |
| 2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990 | 0 | 0 | 0 | 0 |

| Section 3: Landfill and Other Waste Sites | On-site | 0-50m | 51-250 | 251-500 | 501-1000 | 1000-1500 |
|---|---|---|---|---|---|---|
| 3.1 Landfill Sites | | | | | | |
| 3.1.1 Environment Agency/Natural Resources Wales Registered Landfill Sites | 0 | 0 | 0 | 0 | 0 | Not searched |
| 3.1.2 Environment Agency/Natural Resources Wales Historic Landfill Sites | 0 | 0 | 0 | 2 | 9 | 10 |
| 3.1.3 BGS/DoE Landfill Site Survey | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.1.4 Records of Landfills in Local Authority and Historical Mapping Records | 0 | 0 | 0 | 0 | 3 | 2 |
| 3.2 Landfill and Other Waste Sites Findings | | | | | | |
| 3.2.1 Operational and Non-Operational Waste Treatment, Transfer and Disposal Sites | 0 | 0 | 3 | 1 | Not searched | Not searched |
| 3.2.2 Environment Agency/Natural Resources Wales Licensed Waste Sites | 1 | 0 | 0 | 0 | 4 | 5 |

| Section 4: Current Land Use | On-site | 0-50m | 51-250 | 251-500 |
|---|---|---|---|---|
| 4.1 Current Industrial Sites Data | 0 | 2 | 28 | Not searched |
| 4.2 Records of Petrol and Fuel Sites | 0 | 0 | 0 | 1 |
| 4.3 National Grid Underground Electricity Cables | 0 | 0 | 0 | 0 |
| 4.4 National Grid Gas Transmission Pipelines | 0 | 0 | 0 | 0 |

| Section 5: Geology | |
|---|---|
| 5.1 Records of Artificial Ground and Made Ground present beneath the study site | None identified |
| 5.2 Records of Superficial Ground and Drift Geology present beneath the study site | None identified |
| 5.3 For records of Bedrock and Solid Geology beneath the study site see the detailed findings section. | |

| Section 6: Hydrogeology and Hydrology | 0-500m |
|---|---|
| 6.1 Records of Strata Classification in the Superficial Geology within 500m of the study site | None identified |
| 6.2 Records of Strata Classification in the Bedrock Geology within 500m of the study site | Identified |

| | On-site | 0-50m | 51-250 | 251-500 | 501-1000 | 1000-2000 |
|---|---|---|---|---|---|---|
| 6.3 Groundwater Abstraction Licences (within 2000m of the study site) | 0 | 0 | 0 | 1 | 0 | 4 |
| 6.4 Surface Water Abstraction Licences (within 2000m of the study site) | 0 | 0 | 0 | 0 | 4 | 0 |
| 6.5 Potable Water Abstraction Licences (within 2000m of the study site) | 0 | 0 | 0 | 0 | 0 | 4 |
| 6.6 Source Protection Zones (within 500m of the study site) | 0 | 0 | 0 | 0 | Not searched | Not searched |
| 6.7 Source Protection Zones within Confined Aquifer | 0 | 0 | 0 | 0 | Not searched | Not searched |
| 6.8 Groundwater Vulnerability and Soil Leaching Potential (within 500m of the study site) | 1 | 0 | 0 | 0 | Not searched | Not searched |

## Section 6: Hydrogeology and Hydrology

| | 0-500m | | | | | |
|---|---|---|---|---|---|---|
| | On-site | 0-50m | 51-250 | 251-500 | 501-1000 | 1000-1500 |
| 6.9 Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site | No | No | No | No | Yes | No |
| 6.10 Ordnance Survey MasterMap Water Network entries within 500m of the site | 0 | 0 | 4 | 6 | Not searched | Not searched |
| 6.11 Surface water features within 250m of the study site | No | No | Yes | Not searched | Not searched | Not searched |

## Section 7: Flooding

| | |
|---|---|
| 7.1 Enviroment Agency Zone 2 floodplains within 250m of the study site | None identified |
| 7.2 Environment Agency/Natural Resources Wales Zone 3 floodplains within 250m of the study site | None identified |
| 7.3 Risk of flooding from Rivers and the Sea (RoFRaS) rating for the study site | Very Low |
| 7.4 Flood Defences within 250m of the study site | None identified |
| 7.5 Areas benefiting from Flood Defences within 250m of the study site | None identified |
| 7.6 Areas used for Flood Storage within 250m of the study site | None identified |
| 7.7 Maximum BGS Groundwater Flooding susceptibility within 50m of the study site | Potential at Surface |
| 7.8 BGS confidence rating for the Groundwater Flooding susceptibility areas | Low |

## Section 8: Designated Environmentally Sensitive Sites

| | On-site | 0-50m | 51-250 | 251-500 | 501-1000 | 1000-2000 |
|---|---|---|---|---|---|---|
| 8.1 Records of Sites of Special Scientific Interest (SSSI) | 0 | 0 | 0 | 0 | 0 | 0 |
| 8.2 Records of National Nature Reserves (NNR) | 0 | 0 | 0 | 0 | 0 | 0 |
| 8.3 Records of Special Areas of Conservation (SAC) | 0 | 0 | 0 | 0 | 0 | 0 |
| 8.4 Records of Special Protection Areas (SPA) | 0 | 0 | 0 | 0 | 0 | 0 |
| 8.5 Records of Ramsar sites | 0 | 0 | 0 | 0 | 0 | 0 |
| 8.6 Records of Ancient Woodlands | 0 | 0 | 0 | 0 | 0 | 0 |
| 8.7 Records of Local Nature Reserves (LNR) | 0 | 0 | 0 | 0 | 1 | 0 |
| 8.8 Records of World Heritage Sites | 0 | 0 | 0 | 0 | 0 | 0 |
| 8.9 Records of Environmentally Sensitive Areas | 0 | 0 | 0 | 0 | 0 | 0 |

## Section 8: Designated Environmentally Sensitive Sites

| | On-site | 0-50m | 51-250 | 251-500 | 501-1000 | 1000-2000 |
|---|---|---|---|---|---|---|
| 8.10 Records of Areas of Outstanding Natural Beauty (AONB) | 0 | 0 | 0 | 0 | 0 | 0 |
| 8.11 Records of National Parks | 0 | 0 | 0 | 0 | 0 | 0 |
| 8.12 Records of Nitrate Sensitive Areas | 0 | 0 | 0 | 0 | 0 | 0 |
| 8.13 Records of Nitrate Vulnerable Zones | 1 | 0 | 0 | 0 | 0 | 0 |
| 8.14 Records of Green Belt land | 0 | 0 | 0 | 0 | 1 | 1 |

## Section 9: Natural Hazards

| | |
|---|---|
| 9.1 Maximum risk of natural ground subsidence | Very Low |
| 9.1.1 Maximum Shrink-Swell hazard rating identified on the study site | Very Low |
| 9.1.2 Maximum Landslides hazard rating identified on the study site | Low |
| 9.1.3 Maximum Soluble Rocks hazard rating identified on the study site | Negligible |
| 9.1.4 Maximum Compressible Ground hazard rating identified on the study site | Negligible |
| 9.1.5 Maximum Collapsible Rocks hazard rating identified on the study site | Very Low |
| 9.1.6 Maximum Running Sand hazard rating identified on the study site | Negligible |
| 9.2 Radon | |
| 9.2.1 Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? | The site is not in a Radon Affected Area, as less than 1% of properties are above the Action Level. |
| 9.2.2 Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment? | No radon protective measures are necessary. |

## Section 10: Mining

| | |
|---|---|
| 10.1 Coal mining areas within 75m of the study site | Identified |
| 10.2 Non-Coal Mining areas within 50m of the study site boundary | Identified |
| 10.3 Brine affected areas within 75m of the study site | None identified |

# Using this report

The following report is designed by Environmental Consultants for Environmental Professionals bringing together the most up-to-date market leading environmental data. This report is provided under and subject to the Terms & Conditions agreed between Groundsure and the Client. The document contains the following sections:

### 1. Historical Industrial Sites

Provides information on past land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. Potentially Infilled Land features are also included. This search is conducted using radii of up to 500m.

### 2. Environmental Permits, Incidents and Registers

Provides information on Regulated Industrial Activities and Pollution Incidents as recorded by Regulatory Authorities, and sites determined as Contaminated Land. This search is conducted using radii up to 500m.

### 3. Landfills and Other Waste Sites

Provides information on landfills and other waste sites that may pose a risk to the study site. This search is conducted using radii up to 1500m.

### 4. Current Land Uses

Provides information on current land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. These searches are conducted using radii of up to 500m. This includes information on potentially contaminative industrial sites, petrol stations and fuel sites as well as high pressure gas pipelines and underground electricity transmission lines.

### 5. Geology

Provides information on artificial and superficial deposits and bedrock beneath the study site.

### 6. Hydrogeology and Hydrology

Provides information on productive strata within the bedrock and superficial geological layers, abstraction licenses, Source Protection Zones (SPZs) and river quality. These searches are conducted using radii of up to 2000m.

### 7. Flooding

Provides information on river and coastal flooding, flood defences, flood storage areas and groundwater flood areas. This search is conducted using radii of up to 250m.

### 8. Designated Environmentally Sensitive Sites

Provides information on the Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar sites, Local Nature Reserves (LNR), Areas of Outstanding Natural Beauty (AONB), National Parks (NP), Environmentally Sensitive Areas, Nitrate Sensitive Areas, Nitrate Vulnerable Zones and World Heritage Sites and Scheduled Ancient Woodland. These searches are conducted using radii of up to 2000m.

### 9. Natural Hazards

Provides information on a range of natural hazards that may pose a risk to the study site. These factors include natural ground subsidence and radon..

### 10. Mining

Provides information on areas of coal and non-coal mining and brine affected areas.

### 11. Contacts

This section of the report provides contact points for statutory bodies and data providers that may be able to provide further information on issues raised within this report. Alternatively, Groundsure provide a free Technical Helpline (08444 159000) for further information and guidance.

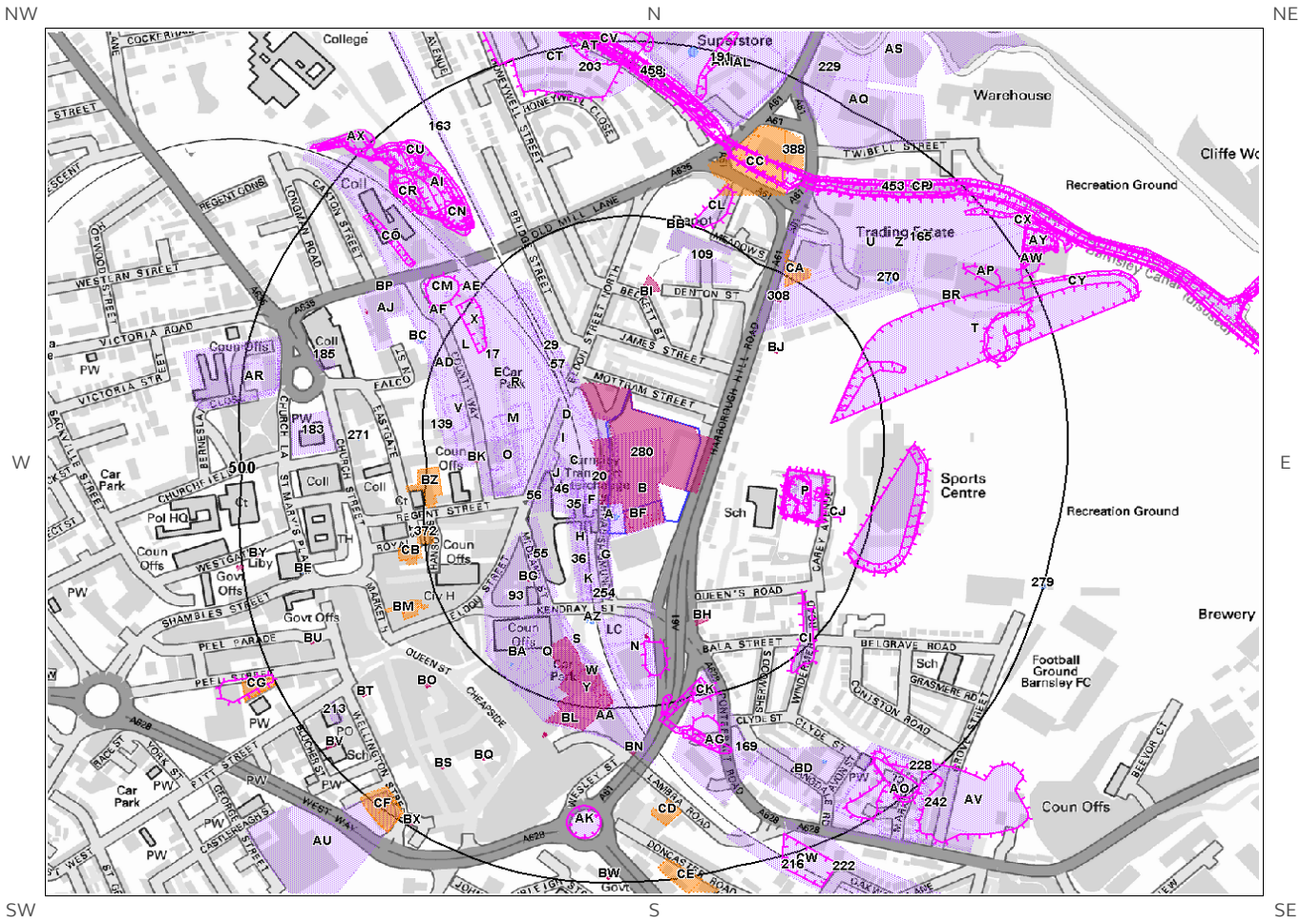
### Note: Maps

Only certain features are placed on the maps within the report. All features represented on maps found within this search are given an identification number. This number identifies the feature on the mapping and correlates it to the additional information provided below. This identification number precedes all other information and takes the following format -Id: 1, Id: 2, etc. Where numerous features on the same map are in such close proximity that the numbers would obscure each other a letter identifier is used instead to represent the features. (e.g. Three features which overlap may be given the identifier “A” on the map and would be identified separately as features 1A, 3A, 10A on the data tables provided).

Where a feature is reported in the data tables to a distance greater than the map area, it is noted in the data table as “Not Shown”.

All distances given in this report are in Metres (m). Directions are given as compass headings such as N: North, E: East, NE: North East from the nearest point of the study site boundary.

# 1. Historical Land Use




© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.

Site Outline

250
500
Search Buffers (m)

Historical 1:10,000 and 1:10,560 scale mapping

Industrial Land Use

Potentially Infilled Land

Historical 1:2,500, 1:1,250 and 1:500 scale mapping

Energy Features

Petrol Stations

Tanks

Garages

# 1. Historical Industrial Sites

## 1.1 Potentially Contaminative Uses identified from 1:10,000 scale Mapping

The systematic analysis of data extracted from standard 1:10,560 and 1:10,000 scale historical maps provides the following information:

Records of sites with a potentially contaminative past land use within 500m of the search boundary: 251

| ID | Distance [m] | Direction | Use | Date |
|---|---|---|---|---|
| 1A | 0 | On Site | Railway Building | 1948 |
| 2A | 0 | On Site | Railway Building | 1951 |
| 3A | 0 | On Site | Unspecified Tank | 1904 |
| 4A | 0 | On Site | Railway Building | 1966 |
| 5A | 0 | On Site | Railway Building | 1973 |
| 6C | 0 | On Site | Railway Sidings | 1890 |
| 7B | 0 | On Site | Unspecified Tank | 1890 |
| 8B | 0 | On Site | Unspecified Depot | 1993 |
| 9B | 0 | On Site | Unspecified Depot | 1973 |
| 10B | 0 | On Site | Unspecified Depot | 1982 |
| 11C | 0 | On Site | Railway Sidings | 1904 |
| 12C | 0 | On Site | Railway Sidings | 1948 |
| 13D | 0 | On Site | Railway Sidings | 1982 |
| 14D | 0 | On Site | Railway Sidings | 1973 |
| 15E | 0 | On Site | Railway Sidings | 1951 |
| 16E | 0 | On Site | Railway Sidings | 1966 |
| 17 | 0 | On Site | Railway Sidings | 1938 |
| 18 | 0 | On Site | Railway Sidings | 1850 |
| 19A | 0 | On Site | Railway Buildings | 1938 |
| 20 | 9 | W | Railway Building | 1904 |
| 21F | 13 | W | Railway Building | 1951 |
| 22F | 17 | W | Railway Building | 1890 |
| 23G | 17 | S | Railway Building | 1973 |
| 24G | 17 | S | Railway Building | 1966 |
| 25F | 20 | W | Railway Station | 1850 |
| 26F | 22 | W | Railway Building | 1904 |
| 27F | 22 | W | Railway Building | 1948 |
| 28F | 29 | W | Railway Station | 1966 |
| 29 | 30 | W | Railway Sidings | 1993 |
| 30F | 30 | W | Railway Station | 1993 |
| 31F | 30 | W | Railway Station | 1982 |
| 32F | 30 | W | Railway Station | 1973 |
| 33H | 36 | W | Railway Station | 1951 |
| 34H | 39 | W | Railway Station | 1938 |

| | | | | |
|---|---|---|---|---|
| 35 | 39 | W | Railway Station | 1890 |
| 36 | 42 | SW | Bus Station | 1982 |
| 37H | 45 | W | Railway Station | 1904 |
| 38H | 45 | W | Railway Station | 1948 |
| 39K | 48 | SW | Railway Sidings | 1850 |
| 40I | 55 | W | Railway Building | 1982 |
| 41I | 55 | W | Railway Building | 1973 |
| 42I | 55 | W | Railway Building | 1966 |
| 43J | 57 | W | Railway Buildings | 1951 |
| 44J | 57 | W | Railway Buildings | 1966 |
| 45J | 58 | W | Railway Buildings | 1938 |
| 46 | 58 | W | Railway Building | 1948 |
| 47J | 64 | W | Railway Building | 1890 |
| 48J | 64 | W | Railway Building | 1904 |
| 49J | 64 | W | Railway Building | 1948 |
| 50K | 67 | S | Railway Building | 1904 |
| 51R | 78 | W | Railway Sidings | 1850 |
| 52L | 79 | W | Railway Sidings | 1948 |
| 53L | 79 | W | Railway Sidings | 1890 |
| 54L | 79 | W | Railway Sidings | 1904 |
| 55 | 87 | W | Railway Buildings | 1966 |
| 56 | 97 | W | Railway Building | 1948 |
| 57 | 97 | W | Railway Building | 1948 |
| 58M | 100 | W | Railway Buildings | 1890 |
| 59M | 100 | W | Railway Building | 1951 |
| 60M | 100 | W | Railway Building | 1966 |
| 61N | 101 | S | Lamp Works | 1951 |
| 62M | 101 | W | Railway Building | 1938 |
| 63N | 104 | S | Lamp Works | 1948 |
| 64M | 106 | W | Railway Building | 1904 |
| 65M | 106 | W | Railway Building | 1948 |
| 66Q | 110 | W | Unspecified Commercial/Industrial | 1948 |
| 67O | 111 | W | Railway Station | 1951 |
| 68O | 111 | W | Railway Station | 1966 |
| 69O | 112 | W | Railway Station | 1890 |
| 70O | 115 | W | Railway Station | 1938 |
| 71N | 116 | S | Unspecified Works | 1982 |
| 72N | 116 | S | Unspecified Works | 1993 |
| 73O | 117 | W | Railway Station | 1948 |
| 74O | 118 | W | Railway Station | 1904 |
| 75M | 122 | W | Railway Building | 1850 |
| 76P | 125 | E | Colliery | 1951 |
| 77P | 126 | E | Colliery | 1948 |
| 78P | 126 | E | Colliery | 1938 |
| 79P | 126 | E | Colliery | 1938 |

| | | | | |
|---|---|---|---|---|
| 80Q | 127 | SW | Unspecified Commercial/Industrial | 1951 |
| 81P | 129 | E | Refuse Heap | 1951 |
| 82S | 131 | SW | Railway Sidings | 1951 |
| 83P | 131 | E | Refuse Heap | 1948 |
| 84P | 131 | E | Unspecified Heap | 1982 |
| 85P | 131 | E | Unspecified Heap | 1966 |
| 86P | 131 | E | Unspecified Heap | 1992 |
| 87P | 131 | E | Unspecified Heap | 1974 |
| 88Q | 132 | SW | Unspecified Commercial/Industrial | 1938 |
| 89P | 132 | E | Refuse Heaps | 1938 |
| 90P | 132 | E | Refuse Heaps | 1938 |
| 91M | 133 | W | Railway Building | 1904 |
| 92 | 135 | SW | Unspecified Commercial/Industrial | 1904 |
| 93 | 136 | SW | Unspecified Tanks | 1948 |
| 94R | 137 | W | Railway Building | 1966 |
| 95P | 140 | E | Unspecified Tank | 1948 |
| 96P | 143 | E | Unspecified Tank | 1938 |
| 97S | 145 | SW | Railway Sidings | 1948 |
| 98N | 147 | S | Lamp Works | 1938 |
| 99P | 152 | E | Railway Sidings | 1951 |
| 100P | 152 | E | Railway Sidings | 1938 |
| 101P | 153 | E | Railway Sidings | 1948 |
| 102U | 153 | NE | Glass Works | 1904 |
| 103E | 156 | NW | Railway Building | 1938 |
| 104N | 156 | S | Unspecified Heap | 1904 |
| 105P | 171 | E | Disused Air Shaft | 1966 |
| 106P | 171 | E | Drift | 1938 |
| 107P | 171 | E | Drift | 1938 |
| 108P | 171 | E | Unspecified Drift | 1948 |
| 109 | 173 | NE | Unspecified Depot | 1993 |
| 110T | 179 | E | Unspecified Heap | 1938 |
| 111T | 179 | E | Unspecified Heap | 1938 |
| 112Y | 183 | S | Unspecified Commercial/Industrial | 1890 |
| 113U | 185 | NE | Unspecified Works | 1966 |
| 114V | 187 | W | Railway Building | 1966 |
| 115V | 187 | W | Railway Building | 1951 |
| 116W | 190 | S | Unspecified Tank | 1951 |
| 117V | 190 | W | Railway Building | 1938 |
| 118CH | 191 | E | Unspecified Ground Workings | 1904 |
| 119BA | 193 | SW | Unspecified Tanks | 1948 |
| 120W | 193 | S | Unspecified Tank | 1938 |
| 121Z | 194 | NE | Glass Works | 1951 |

| | | | | |
|---|---|---|---|---|
| 122CI | 194 | SE | Unspecified Quarry | 1890 |
| 123V | 195 | W | Railway Building | 1890 |
| 124V | 195 | W | Railway Building | 1948 |
| 125V | 195 | W | Railway Building | 1904 |
| 126X | 195 | NW | Cuttings | 1890 |
| 127W | 197 | S | Unspecified Tank | 1890 |
| 128W | 197 | S | Unspecified Tank | 1948 |
| 129W | 197 | S | Unspecified Tank | 1904 |
| 130X | 200 | NW | Railway Buildings | 1948 |
| 131CJ | 201 | E | Unspecified Drift | 1951 |
| 132X | 201 | NW | Railway Buildings | 1938 |
| 133Y | 210 | S | Unspecified Tanks | 1890 |
| 134AA | 212 | S | Unspecified Works | 1973 |
| 135AG | 214 | S | Unspecified Works | 1982 |
| 136X | 214 | NW | Railway Building | 1904 |
| 137Z | 216 | NE | Glass Works | 1938 |
| 138AA | 219 | S | Cuttings | 1850 |
| 139 | 220 | W | Railway Building | 1890 |
| 140AC | 225 | S | Unspecified Ground Workings | 1904 |
| 141AD | 228 | W | Railway Building | 1938 |
| 142Y | 229 | S | Unspecified Tank | 1904 |
| 143AB | 232 | E | Unspecified Ground Workings | 1948 |
| 144AB | 232 | E | Unspecified Heap | 1938 |
| 145AB | 232 | E | Unspecified Heap | 1938 |
| 146CK | 236 | S | Refuse Heap | 1890 |
| 147AC | 239 | S | Unspecified Ground Workings | 1973 |
| 148AD | 249 | W | Railway Building | 1890 |
| 149AE | 249 | NW | Railway Building | 1966 |
| 150CL | 254 | NE | Unspecified Pit | 1951 |
| 151AE | 258 | NW | Railway Building | 1904 |
| 152AE | 258 | NW | Railway Building | 1890 |
| 153AE | 258 | NW | Railway Building | 1948 |
| 154AF | 265 | NW | Railway Building | 1966 |
| 155CM | 272 | NW | Unspecified Heap | 1993 |
| 156BC | 276 | NW | Unspecified Tanks | 1904 |
| 157AE | 278 | NW | Railway Building | 1938 |
| 158AF | 278 | NW | Unspecified Tank | 1938 |
| 159AE | 280 | NW | Railway Building | 1890 |
| 160AE | 280 | NW | Railway Building | 1904 |
| 161AE | 280 | NW | Railway Building | 1948 |
| 162AC | 281 | S | Unspecified Pit | 1890 |
| 163 | 288 | NW | Railway Sidings | 1890 |
| 164AG | 293 | S | Unspecified Ground Workings | 1966 |

| | | | | |
|---|---|---|---|---|
| 165 | 305 | NE | Glass Works | 1948 |
| 166AH | 306 | NW | Unspecified Ground Workings | 1850 |
| 167AJ | 309 | NW | Telephone Exchange | 1993 |
| 168Z | 311 | NE | Colliery | 1850 |
| 169 | 312 | S | Unspecified Works | 1993 |
| 170AH | 313 | NW | Unspecified Ground Workings | 1938 |
| 171AH | 313 | NW | Unspecified Ground Workings | 1938 |
| 172AH | 315 | NW | Unspecified Ground Workings | 1951 |
| 173CN | 318 | NW | Unspecified Heap | 1982 |
| 174AI | 318 | NW | Unspecified Heap | 1966 |
| 175AI | 318 | NW | Unspecified Heap | 1973 |
| 176AH | 320 | NW | Unspecified Quarry | 1890 |
| 177AJ | 321 | NW | Unspecified Tank | 1951 |
| 178AH | 324 | NW | Unspecified Ground Workings | 1904 |
| 179AH | 324 | NW | Unspecified Ground Workings | 1948 |
| 180BD | 329 | S | Metal Works | 1904 |
| 181CO | 344 | NW | Unspecified Ground Workings | 1973 |
| 182CQ | 366 | NE | Disused Canal | 1966 |
| 183 | 366 | W | Police Station | 1966 |
| 184AH | 375 | NW | Unspecified Pit | 1951 |
| 185 | 377 | W | Rescue Station | 1938 |
| 186CR | 390 | NW | Unspecified Pit | 1890 |
| 187AK | 391 | S | Unspecified Pit | 1982 |
| 188AK | 391 | S | Unspecified Pit | 1993 |
| 189CS | 391 | N | Disused Canal | 1966 |
| 190AL | 399 | N | Paper Works | 1904 |
| 191 | 400 | N | Paper Works | 1948 |
| 192AL | 401 | N | Paper Works | 1938 |
| 193AM | 402 | N | Unspecified Mill | 1973 |
| 194AM | 402 | N | Unspecified Mill | 1982 |
| 195AN | 403 | E | Unspecified Quarry | 1904 |
| 196AL | 404 | N | Unspecified Mill | 1966 |
| 197AN | 405 | NE | Sandstone Quarry | 1850 |
| 198AL | 405 | N | Tannery | 1890 |
| 199AL | 405 | N | Paper Works | 1951 |
| 200AN | 407 | E | Unspecified Quarry | 1890 |
| 201AO | 412 | SE | Unspecified Depot | 1974 |
| 202AO | 422 | SE | Sanitary Depot | 1951 |
| 203 | 423 | N | Dock Yard | 1850 |
| 204CT | 423 | N | Dock | 1948 |
| 205AO | 424 | SE | Sanitary Depot | 1938 |

| | | | | |
|---|---|---|---|---|
| 206AO | 424 | SE | Unspecified Quarry | 1890 |
| 207AO | 427 | SE | Sanitary Depot | 1948 |
| 208AP | 427 | NE | Unspecified Ground Workings | 1966 |
| 209AP | 427 | NE | Unspecified Ground Workings | 1974 |
| 210AM | 428 | N | Refuse Heap | 1904 |
| 211AO | 432 | SE | Unspecified Heap | 1904 |
| 212CU | 435 | NW | Unspecified Heap | 1982 |
| 213 | 443 | SW | Hospital | 1993 |
| 214AQ | 443 | NE | Unspecified Mills | 1982 |
| 215AQ | 443 | NE | Unspecified Mill | 1992 |
| 216 | 447 | S | Cuttings | 1850 |
| 217AR | 448 | W | Hospital | 1890 |
| 218AR | 448 | W | Hospital | 1951 |
| 219AO | 448 | SE | Unspecified Depot | 1982 |
| 220AR | 449 | W | Hospital | 1966 |
| 221AR | 449 | W | Hospital | 1973 |
| 222 | 450 | S | Railway Sidings | 1966 |
| 223AR | 450 | W | Hospital | 1938 |
| 224AR | 451 | W | Hospital | 1948 |
| 225AR | 453 | W | Hospital | 1904 |
| 226AS | 456 | NE | Unspecified Commercial/Industrial | 1948 |
| 227AS | 456 | NE | Gas Works | 1904 |
| 228 | 457 | SE | Sandstone Quarry | 1850 |
| 229 | 463 | NE | Unspecified Works | 1966 |
| 230CV | 468 | N | Dock | 1951 |
| 231CW | 470 | S | Cuttings | 1966 |
| 232AT | 471 | N | Dock Works | 1938 |
| 233AT | 472 | N | Dock Works | 1948 |
| 234AU | 474 | SW | Unspecified Works | 1982 |
| 235AU | 474 | SW | Unspecified Works | 1973 |
| 236CX | 476 | NE | Unspecified Ground Workings | 1974 |
| 237AT | 477 | N | Dock Works | 1951 |
| 238AT | 478 | N | Unspecified Works | 1966 |
| 239CY | 480 | NE | Unspecified Ground Workings | 1904 |
| 240AV | 486 | SE | Unspecified Quarry | 1890 |
| 241AV | 488 | SE | Unspecified Depot | 1992 |
| 242 | 490 | SE | Unspecified Depot | 1966 |
| 243AW | 490 | NE | Unspecified Heap | 1966 |
| 244AW | 490 | NE | Unspecified Heap | 1974 |
| 245AX | 495 | NW | Unspecified Ground Workings | 1951 |
| 246AX | 495 | NW | Unspecified Heap | 1948 |
| 247AX | 495 | NW | Unspecified Heap | 1904 |

| | | | | |
|---|---|---|---|---|
| 248AY | 496 | NE | Refuse Heap | 1938 |
| 249AY | 496 | NE | Refuse Heap | 1938 |
| 250AY | 496 | NE | Refuse Heap | 1948 |
| 251AY | 497 | NE | Refuse Heap | 1951 |

## 1.2 Additional Information – Historical Tank Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical tanks within 500m of the search boundary: 28

| ID | Distance (m) | Direction | Use | Date |
|---|---|---|---|---|
| 252A | 0 | On Site | Unspecified Tank | 1906 |
| 253A | 0 | On Site | Unspecified Tank | 1893 |
| 254 | 89 | S | Unspecified Tank | 1977 |
| 255AZ | 122 | S | Unspecified Tank | 1960 |
| 256AZ | 123 | S | Unspecified Tank | 1961 |
| 257AZ | 126 | S | Unspecified Tank | 1906 |
| 258Y | 188 | S | Gas Works | 1906 |
| 259Y | 188 | S | Gas Works | 1893 |
| 260W | 196 | S | Gasometer | 1906 |
| 261W | 196 | S | Gasometer | 1893 |
| 262Y | 216 | S | Gasometer | 1893 |
| 263BA | 227 | SW | Unspecified Tank | 1906 |
| 264Y | 230 | S | Gasometer | 1906 |
| 265Y | 230 | S | Gasometer | 1893 |
| 266BB | 239 | N | Unspecified Tank | 1986 |
| 267BB | 240 | N | Unspecified Tank | 1987 |
| 268BB | 240 | N | Unspecified Tank | 1972 |
| 269BC | 274 | NW | Tanks | 1906 |
| 270 | 329 | NE | Unspecified Tank | 1892 |
| 271 | 335 | W | Unspecified Tank | 1893 |
| 272U | 353 | NE | Unspecified Tank | 1892 |
| 273BD | 395 | SE | Unspecified Tank | 1892 |
| 274BE | 417 | W | Unspecified Tank | 1993 |
| 275BE | 417 | W | Unspecified Tank | 1984 |
| 276AM | 486 | N | Unspecified Tank | 1970 |
| 277AM | 486 | N | Unspecified Tank | 1960 |
| 278AM | 486 | N | Unspecified Tank | 1960 |
| 279 | 496 | E | Unspecified Tank | 1999 |

## 1.3 Additional Information – Historical Energy Features Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical energy features within 500m of the search boundary: 87

| ID | Distance (m) | Direction | Use | Date |
|---|---|---|---|---|
| 280 | 0 | On Site | Electricity Board Depot | 1972 |
| 281BF | 1 | S | Electricity Substation | 1987 |
| 282BF | 6 | W | Electricity Substation | 1986 |
| 283BG | 125 | SW | Electricity Substation | 1977 |
| 284BG | 125 | SW | Electricity Substation | 1996 |
| 285BG | 126 | SW | Electricity Substation | 1991 |
| 286BG | 126 | SW | Electricity Substation | 1987 |
| 287BH | 135 | S | Electricity Substation | 1977 |
| 288BI | 135 | N | Electricity Substation | 1986 |
| 289BH | 137 | S | Electricity Substation | 1996 |
| 290BH | 137 | S | Electricity Substation | 1991 |
| 291BH | 137 | S | Electricity Substation | 1987 |
| 292BI | 144 | N | Electricity Substation | 1987 |
| 293N | 147 | S | Gas Governor | 1996 |
| 294N | 147 | S | Gas Governor | 1991 |
| 295N | 147 | S | Gas Governor | 1987 |
| 296N | 148 | S | Gas Governor | 1977 |
| 297BJ | 150 | NE | Electricity Substation | 1986 |
| 298BJ | 151 | NE | Electricity Substation | 1987 |
| 299BJ | 151 | NE | Electricity Substation | 1972 |
| 300S | 158 | S | Electricity Works | 1906 |
| 301BK | 179 | W | Electricity Substation | 1972 |
| 302BK | 179 | W | Electricity Substation | 1987 |
| 303BK | 180 | W | Electricity Substation | 1986 |
| 304Y | 188 | S | Gas Works | 1906 |
| 305Y | 188 | S | Gas Works | 1893 |
| 306W | 196 | S | Gasometer | 1893 |
| 307W | 196 | S | Gasometer | 1906 |
| 308 | 211 | NE | Electricity Substation | 1987 |
| 309Y | 216 | S | Gasometer | 1893 |
| 310Y | 230 | S | Gasometer | 1893 |
| 311Y | 230 | S | Gasometer | 1906 |
| 312BL | 273 | S | Electricity Substation | 1996 |
| 313BL | 297 | S | Electricity Substation | 1996 |
| 314BL | 298 | S | Electricity Substation | 1991 |
| 315BL | 298 | S | Electricity Substation | 1987 |
| 316BM | 299 | W | Electricity Substation | 1993 |

| | | | | |
|---|---|---|---|---|
| 317BM | 299 | W | Electricity Substation | 1968 |
| 318BM | 299 | W | Electricity Substation | 1984 |
| 319BM | 300 | W | Electricity Substation | 1981 |
| 320BM | 300 | W | Electricity Substation | 1991 |
| 321BM | 300 | W | Electricity Substation | 1982 |
| 322BL | 301 | S | Electricity Substation | 1977 |
| 323BN | 304 | S | Gas Governor | 1996 |
| 324BN | 304 | S | Gas Governor | 1987 |
| 325BN | 304 | S | Gas Governor | 1991 |
| 326BN | 305 | S | Electricity Substation | 1977 |
| 327BO | 325 | SW | Electricity Substation | 1987 |
| 328BO | 325 | SW | Electricity Substation | 1991 |
| 329BO | 325 | SW | Electricity Substation | 1996 |
| 330BO | 326 | SW | Electricity Substation | 1977 |
| 331BP | 355 | NW | Gas Governor | 1988 |
| 332BP | 356 | NW | Gas Governor | 1986 |
| 333AJ | 360 | NW | Electricity Substation | 1988 |
| 334BQ | 363 | SW | Electricity Substation | 1996 |
| 335BQ | 364 | SW | Electricity Substation | 1987 |
| 336BQ | 364 | SW | Electricity Substation | 1991 |
| 337BQ | 364 | SW | Electricity Substation | 1977 |
| 338BR | 389 | NE | Electricity Substation | 1990 |
| 339BR | 389 | NE | Electricity Substation | 1989 |
| 340BS | 399 | SW | Electricity Substation | 1996 |
| 341BS | 400 | SW | Electricity Substation | 1987 |
| 342BS | 400 | SW | Electricity Substation | 1991 |
| 343BS | 400 | SW | Electricity Substation | 1977 |
| 344BT | 402 | SW | Electricity Substation | 1991 |
| 345BT | 402 | SW | Electricity Substation | 1993 |
| 346BU | 429 | W | Electricity Substation | 1968 |
| 347BU | 429 | W | Electricity Substation | 1991 |
| 348BU | 429 | W | Electricity Substation | 1982 |
| 349BU | 429 | W | Electricity Substation | 1981 |
| 350BU | 429 | W | Electricity Substation | 1984 |
| 351BU | 430 | W | Electricity Substation | 1993 |
| 352BV | 470 | SW | Electricity Substation | 1993 |
| 353BY | 476 | W | Electricity Substation | 1968 |
| 354BV | 485 | SW | Electricity Substation | 1981 |
| 355BV | 485 | SW | Electricity Substation | 1991 |
| 356BV | 485 | SW | Electricity Substation | 1982 |
| 357BV | 485 | SW | Electricity Substation | 1984 |
| 358BV | 485 | SW | Electricity Substation | 1968 |
| 359BW | 487 | S | Electricity Substation | 1977 |
| 360BW | 487 | S | Electricity Substation | 1996 |
| 361BW | 488 | S | Electricity Substation | 1987 |
| 362BW | 488 | S | Electricity Substation | 1991 |

| | | | | |
|---|---|---|---|---|
| 363BX | 492 | SW | Electricity Substation | 1993 |
| 364BX | 493 | SW | Electricity Substation | 1991 |
| 365BY | 498 | W | Electricity Substation | 1982 |
| 366BY | 498 | W | Electricity Substation | 1981 |

## 1.4 Additional Information – Historical Petrol and Fuel Site Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical petrol stations and fuel sites within 500m of the search boundary: 0

Database searched and no data found.

## 1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical garage and motor vehicle repair sites within 500m of the search boundary: 36

| ID | Distance (m) | Direction | Use | Date |
|---|---|---|---|---|
| 367BZ | 226 | W | Garage | 1961 |
| 368BZ | 226 | W | Garage | 1972 |
| 369BZ | 227 | W | Garage | 1960 |
| 370CA | 235 | NE | Garage | 1983 |
| 371CA | 236 | NE | Garage | 1989 |
| 372 | 237 | W | Garage | 1972 |
| 373CB | 256 | W | Garage | 1960 |
| 374CB | 261 | W | Garage | 1993 |
| 375CB | 261 | W | Garage | 1984 |
| 376CB | 261 | W | Garage | 1961 |
| 377CB | 261 | W | Garage | 1968 |
| 378CB | 261 | W | Garage | 1991 |
| 379CB | 261 | W | Garage | 1982 |
| 380CB | 261 | W | Garage | 1981 |
| 381BM | 266 | W | Garage | 1960 |
| 382BM | 272 | W | Garage | 1961 |
| 383BM | 277 | W | Garage | 1961 |
| 384BM | 277 | W | Garage | 1960 |
| 385CC | 304 | NE | Garage | 1970 |
| 386CC | 361 | NE | Garage | 1979 |
| 387CC | 361 | NE | Garage | 1981 |
| 388 | 379 | NE | Garage | 1973 |

| | | | | |
|---|---|---|---|---|
| 389CD | 385 | S | Garage | 1961 |
| 390CD | 386 | S | Garage | 1960 |
| 391CE | 469 | S | Garage | 1960 |
| 392CE | 470 | S | Garage | 1961 |
| 393CF | 470 | SW | Garage | 1960 |
| 394CF | 470 | SW | Garage | 1961 |
| 395CF | 480 | SW | Garage | 1968 |
| 396CF | 480 | SW | Garage | 1981 |
| 397CF | 480 | SW | Garage | 1982 |
| 398CG | 500 | SW | Garage | 1993 |
| 399CG | 500 | SW | Garage | 1960 |
| 400CG | 500 | SW | Garage | 1991 |
| 401CG | 500 | SW | Garage | 1981 |
| 402CG | 500 | SW | Garage | 1982 |

## 1.6 Potentially Infilled Land

Records of Potentially Infilled Features from 1:10,000 scale mapping within 500m of the study site: 81

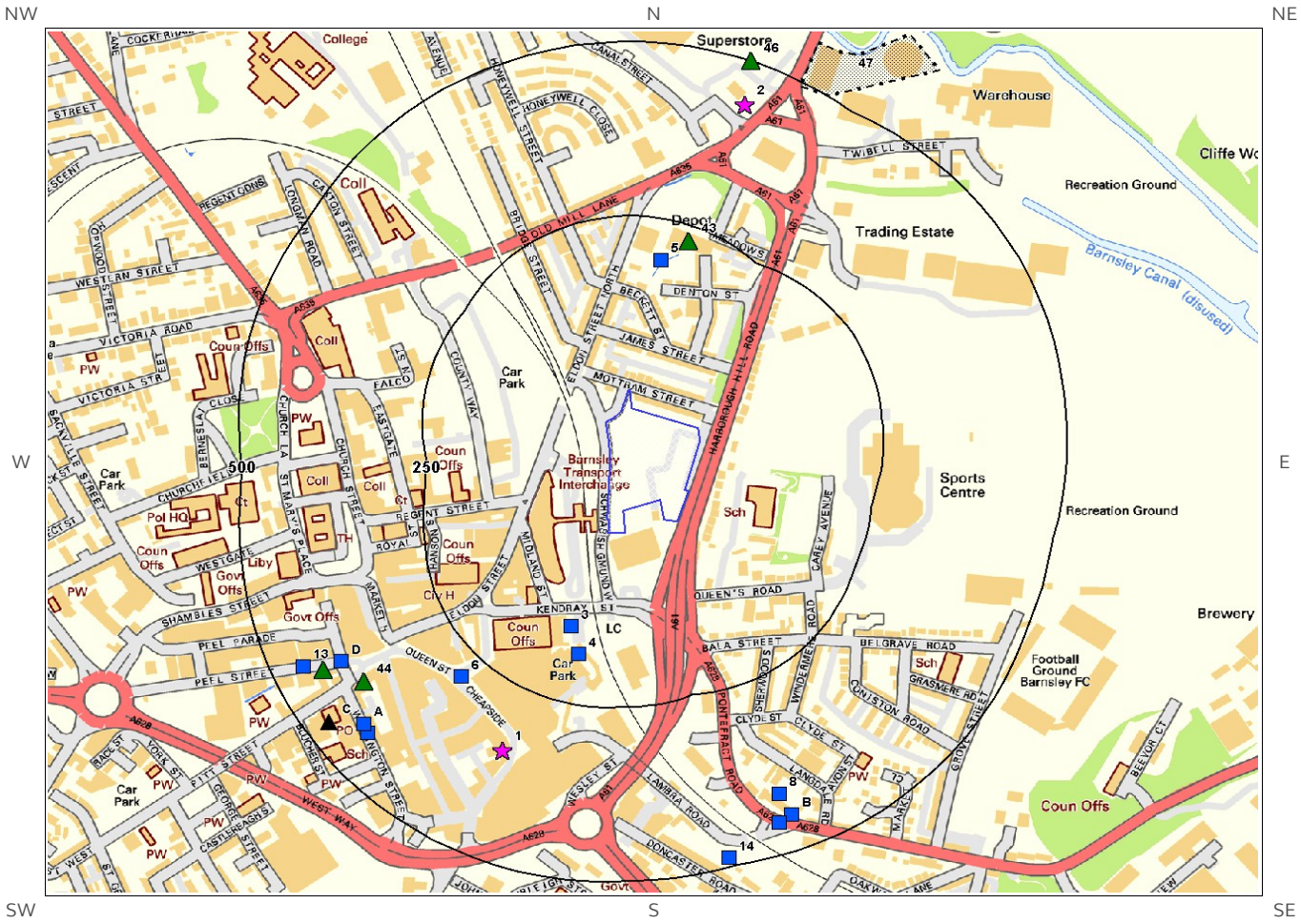
The following Historical Potentially Infilled Features derived from the Historical Mapping information is provided by Groundsure:

| ID | Distance(m) | Direction | Use | Date |
|---|---|---|---|---|
| 403P | 125 | E | Colliery | 1951 |
| 404P | 126 | E | Colliery | 1948 |
| 405P | 126 | E | Colliery | 1938 |
| 406P | 126 | E | Colliery | 1938 |
| 407P | 129 | E | Refuse Heap | 1951 |
| 408P | 131 | E | Refuse Heap | 1948 |
| 409P | 131 | E | Unspecified Heap | 1992 |
| 410P | 131 | E | Unspecified Heap | 1966 |
| 411P | 131 | E | Unspecified Heap | 1974 |
| 412P | 131 | E | Unspecified Heap | 1982 |
| 413P | 132 | E | Refuse Heaps | 1938 |
| 414P | 132 | E | Refuse Heaps | 1938 |
| 415N | 156 | S | Unspecified Heap | 1904 |
| 416P | 171 | E | Disused Air Shaft | 1966 |
| 417P | 171 | E | Drift | 1938 |
| 418P | 171 | E | Drift | 1938 |
| 419P | 171 | E | Unspecified Drift | 1948 |
| 420T | 179 | E | Unspecified Heap | 1938 |
| 421T | 179 | E | Unspecified Heap | 1938 |
| 422CH | 191 | E | Unspecified Ground Workings | 1904 |
| 423CI | 194 | SE | Unspecified Quarry | 1890 |
| 424X | 195 | NW | Cuttings | 1890 |
| 425CJ | 201 | E | Unspecified Drift | 1951 |

| | | | | |
|---|---|---|---|---|
| 426AC | 225 | S | Unspecified Ground Workings | 1904 |
| 427AB | 232 | E | Unspecified Ground Workings | 1948 |
| 428AB | 232 | E | Unspecified Heap | 1938 |
| 429AB | 232 | E | Unspecified Heap | 1938 |
| 430CK | 236 | S | Refuse Heap | 1890 |
| 431AC | 239 | S | Unspecified Ground Workings | 1973 |
| 432CL | 254 | NE | Unspecified Pit | 1951 |
| 433CM | 272 | NW | Unspecified Heap | 1993 |
| 434AC | 281 | S | Unspecified Pit | 1890 |
| 435AG | 293 | S | Unspecified Ground Workings | 1966 |
| 436AI | 313 | NW | Unspecified Ground Workings | 1938 |
| 437AI | 313 | NW | Unspecified Ground Workings | 1938 |
| 438AI | 315 | NW | Unspecified Ground Workings | 1951 |
| 439CN | 318 | NW | Unspecified Heap | 1982 |
| 440AI | 318 | NW | Unspecified Heap | 1973 |
| 441AI | 318 | NW | Unspecified Heap | 1966 |
| 442AH | 320 | NW | Unspecified Quarry | 1890 |
| 443AI | 324 | NW | Unspecified Ground Workings | 1948 |
| 444AI | 324 | NW | Unspecified Ground Workings | 1904 |
| 445CO | 344 | NW | Unspecified Ground Workings | 1973 |
| 446CP | 355 | NE | Canal | 1904 |
| 447CP | 355 | NE | Canal | 1948 |
| 448CP | 357 | NE | Canal | 1890 |
| 449 | 359 | NE | Canal | 1938 |
| 450CQ | 366 | NE | Canal | 1951 |
| 451CQ | 366 | NE | Disused Canal | 1966 |
| 452AH | 375 | NW | Unspecified Pit | 1951 |
| 453 | 380 | NE | Pond | 1974 |
| 454CR | 390 | NW | Unspecified Pit | 1890 |
| 455AK | 391 | S | Unspecified Pit | 1993 |
| 456AK | 391 | S | Unspecified Pit | 1982 |
| 457CS | 391 | N | Disused Canal | 1966 |
| 458 | 393 | N | Ponds | 1973 |
| 459AN | 403 | E | Unspecified Quarry | 1904 |
| 460AN | 407 | E | Unspecified Quarry | 1890 |
| 461CT | 423 | N | Dock | 1948 |
| 462AO | 424 | SE | Unspecified Quarry | 1890 |
| 463AP | 427 | NE | Unspecified Ground Workings | 1966 |

| | | | | |
|---|---|---|---|---|
| 464AP | 427 | NE | Unspecified Ground Workings | 1974 |
| 465AM | 428 | N | Refuse Heap | 1904 |
| 466AO | 432 | SE | Unspecified Heap | 1904 |
| 467CU | 435 | NW | Unspecified Heap | 1982 |
| 468CV | 468 | N | Dock | 1951 |
| 469CW | 470 | S | Cuttings | 1966 |
| 470CX | 476 | NE | Unspecified Ground Workings | 1974 |
| 471CY | 480 | NE | Unspecified Ground Workings | 1904 |
| 472AV | 486 | SE | Unspecified Quarry | 1890 |
| 473CV | 486 | N | Ponds | 1890 |
| 474AW | 490 | NE | Unspecified Heap | 1966 |
| 475AW | 490 | NE | Unspecified Heap | 1974 |
| 476AX | 495 | NW | Unspecified Ground Workings | 1951 |
| 477AX | 495 | NW | Unspecified Heap | 1904 |
| 478AX | 495 | NW | Unspecified Heap | 1948 |
| 479AY | 496 | NE | Refuse Heap | 1938 |
| 480AY | 496 | NE | Refuse Heap | 1938 |
| 481AY | 496 | NE | Refuse Heap | 1948 |
| 482AY | 497 | NE | Refuse Heap | 1951 |
| 483CG | 500 | SW | Ponds | 1890 |

# 2. Environmental Permits, Incidents and Registers Map




© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.

- Site Outline
- Search Buffers (m) — 250 — 500
- Recorded Pollution Incident
- Dangerous Substances (List 1)
- Dangerous Substances (List 2)
- Water Industry Referrals
- Licenced Discharge Consents
- Red List Discharge Consents
- RAS 3 & 4 Authorisations
- Part A(1) Authorised Processes and Historic IPC Authorisations
- Part A(2) and Part B Authorised Processes
- COMAH / NIHHS Sites
- Sites Determined as Contaminated Land
- Hazardous Substance Consents and Enforcements

# 2. Environmental Permits, Incidents and Registers

## 2.1 Industrial Sites Holding Licences and/or Authorisations

Searches of information provided by the Environment Agency/Natural Resources Wales and Local Authorities reveal the following information:

### 2.1.1 Records of historic IPC Authorisations within 500m of the study site:

0

Database searched and no data found.

### 2.1.2 Records of Part A(1) and IPPC Authorised Activities within 500m of the study site:

28

The following Part A(1) and IPPC Authorised Activities are represented as points on the Environmental Permits, Incidents and Registers Map:

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| 48C | 469 | SW | 434380 406240 | Operator: Monckton Coke & Chemical Company Ltd<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: ORGANIC CHEMICALS; HYDROCARBONS EG AROMATICS | Permit Number: MP3636SN<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 16/12/2005<br>Effective Date: 16/12/2005 00:00:00<br>Last date noted as effective: 2018-03-01<br>Status: Superceded |
| 49C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: OTHER MINERAL ACTIVITIES; CRUSHING ETC OF COAL ETC (UNLESS EXEMPT LOCATION) | Permit Number: YP3934UX<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 11/10/2007<br>Effective Date: 11/10/2007 00:00:00<br>Last date noted as effective: 2018-03-01<br>Status: Superceded |
| 50C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: INORGANIC CHEMICALS; BASES EG AMMONIUM HYDROXIDE | Permit Number: HP3239EW<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 17/1/2014<br>Effective Date: 17/1/2014 00:00:00<br>Last date noted as effective: 2018-03-01<br>Status: Effective |

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| 51C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: COMBUSTION; ANY FUEL =>20MW BUT <50MW (UNLESS 1.1 A(1) B) | Permit Number: HP3239EW<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 17/1/2014<br>Effective Date: 17/1/2014 00:00:00<br>Last date noted as effective: 2015-07-01<br>Status: Effective |
| 52C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Eaeprbk3441iav010<br>Process: ORGANIC CHEMICALS; HYDROCARBONS EG AROMATICS | Permit Number: PP3639KE<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 22/6/2009<br>Effective Date: 22/7/2009 00:00:00<br>Last date noted as effective: 2018-03-01<br>Status: Superceded |
| 53C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Eaeprbk3441iav010<br>Process: COMBUSTION; ANY FUEL =>20MW BUT <50MW (UNLESS 1.1 A(1) B) | Permit Number: PP3639KE<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 22/6/2009<br>Effective Date: 22/7/2009 00:00:00<br>Last date noted as effective: 2018-03-01<br>Status: Superceded |
| 54C | 469 | SW | 434380 406240 | Operator: Monckton Coke & Chemical Company Ltd<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: COMBUSTION; ANY FUEL =>20MW BUT <50MW (UNLESS 1.1 A(1) B) | Permit Number: MP3636SN<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 16/12/2005<br>Effective Date: 16/12/2005 00:00:00<br>Last date noted as effective: 2018-03-01<br>Status: Superceded |
| 55C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: GASIFICATION, LIQUIFAC. AND REFINING | Permit Number: HP3239EW<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 17/1/2014<br>Effective Date: 17/1/2014 00:00:00<br>Last date noted as effective: 2018-03-01<br>Status: Effective |
| 56C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: INORGANIC CHEMICALS; BASES EG AMMONIUM HYDROXIDE | Permit Number: NP3934VD<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: -<br>Effective Date: -<br>Last date noted as effective: 2015-01-01<br>Status: Determination |
| 57C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: INORGANIC CHEMICALS; BASES EG AMMONIUM HYDROXIDE | Permit Number: YP3934UX<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 11/10/2007<br>Effective Date: 11/10/2007 00:00:00<br>Last date noted as effective: 2018-03-01<br>Status: Superceded |
| 58C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: ORGANIC CHEMICALS; HYDROCARBONS EG AROMATICS | Permit Number: NP3934VD<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: -<br>Effective Date: -<br>Last date noted as effective: 2015-01-01<br>Status: Determination |

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| 59C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: OTHER MINERAL ACTIVITIES; CRUSHING ETC OF COAL ETC (UNLESS EXEMPT LOCATION) | Permit Number: AP3135GS<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: -<br>Effective Date: -<br>Last date noted as effective: 2018-03-01<br>Status: Refused |
| 60C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: ORGANIC CHEMICALS; HYDROCARBONS EG AROMATICS | Permit Number: AP3135GS<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: -<br>Effective Date: -<br>Last date noted as effective: 2018-03-01<br>Status: Refused |
| 61C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: Operating coke ovens > 250 tonnes | Permit Number: HP3239EW<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 17/1/2014<br>Effective Date: 17/1/2014 00:00:00<br>Last date noted as effective: 2018-03-01<br>Status: Effective |
| 62C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: OTHER MINERAL ACTIVITIES; CRUSHING ETC OF COAL ETC (UNLESS EXEMPT LOCATION) | Permit Number: HP3239EW<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 17/1/2014<br>Effective Date: 17/1/2014 00:00:00<br>Last date noted as effective: 2018-03-01<br>Status: Effective |
| 63C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: OTHER MINERAL ACTIVITIES; CRUSHING ETC OF COAL ETC (UNLESS EXEMPT LOCATION) | Permit Number: NP3934VD<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: -<br>Effective Date: -<br>Last date noted as effective: 2015-01-01<br>Status: Determination |
| 64C | 469 | SW | 434380 406240 | Operator: Monckton Coke & Chemical Company Ltd<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: INORGANIC CHEMICALS; BASES EG AMMONIUM HYDROXIDE | Permit Number: MP3636SN<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 16/12/2005<br>Effective Date: 16/12/2005 00:00:00<br>Last date noted as effective: 2018-03-01<br>Status: Superceded |
| 65C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: ORGANIC CHEMICALS; HYDROCARBONS EG AROMATICS | Permit Number: HP3239EW<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 17/1/2014<br>Effective Date: 17/1/2014 00:00:00<br>Last date noted as effective: 2018-03-01<br>Status: Effective |
| 66C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: COMBUSTION; ANY FUEL =>20MW BUT <50MW (UNLESS 1.1 A(1) B) | Permit Number: YP3934UX<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 11/10/2007<br>Effective Date: 11/10/2007 00:00:00<br>Last date noted as effective: 2018-03-01<br>Status: Superceded |

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| 67C | 469 | SW | 434380 406240 | Operator: Monckton Coke & Chemical Company Ltd<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: OTHER MINERAL ACTIVITIES; CRUSHING ETC OF COAL ETC (UNLESS EXEMPT LOCATION) | Permit Number: MP3636SN<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 16/12/2005<br>Effective Date: 16/12/2005 00:00:00<br>Last date noted as effective: 2018-03-01<br>Status: Superceded |
| 68C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd Eaeprbk3441iav010<br>Process: OTHER MINERAL ACTIVITIES; CRUSHING ETC OF COAL ETC (UNLESS EXEMPT LOCATION) | Permit Number: PP3639KE<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 22/6/2009<br>Effective Date: 22/7/2009 00:00:00<br>Last date noted as effective: 2018-03-01<br>Status: Superceded |
| 69C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: ORGANIC CHEMICALS; HYDROCARBONS EG AROMATICS | Permit Number: HP3239EW<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 17/1/2014<br>Effective Date: 17/1/2014 00:00:00<br>Last date noted as effective: 2015-07-01<br>Status: Effective |
| 70C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: COMBUSTION; ANY FUEL =>20MW BUT <50MW (UNLESS 1.1 A(1) B) | Permit Number: NP3934VD<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: -<br>Effective Date: -<br>Last date noted as effective: 2015-01-01<br>Status: Determination |
| 71C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: COMBUSTION; ANY FUEL =>20MW BUT <50MW (UNLESS 1.1 A(1) B) | Permit Number: HP3239EW<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 17/1/2014<br>Effective Date: 17/1/2014 00:00:00<br>Last date noted as effective: 2018-03-01<br>Status: Effective |
| 72C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: COMBUSTION; ANY FUEL =>20MW BUT <50MW (UNLESS 1.1 A(1) B) | Permit Number: AP3135GS<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: -<br>Effective Date: -<br>Last date noted as effective: 2018-03-01<br>Status: Refused |
| 73C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd Eaeprbk3441iav010<br>Process: INORGANIC CHEMICALS; BASES EG AMMONIUM HYDROXIDE | Permit Number: PP3639KE<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 22/6/2009<br>Effective Date: 22/7/2009 00:00:00<br>Last date noted as effective: 2018-03-01<br>Status: Superceded |
| 74C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: ORGANIC CHEMICALS; HYDROCARBONS EG AROMATICS | Permit Number: YP3934UX<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: 11/10/2007<br>Effective Date: 11/10/2007 00:00:00<br>Last date noted as effective: 2018-03-01<br>Status: Superceded |

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| 75C | 469 | SW | 434380 406240 | Operator: Monckton Coke And Chemical Company Limited<br>Installation Name: The Monckton Coke And Chemical Co Ltd<br>Process: INORGANIC CHEMICALS; BASES EG AMMONIUM HYDROXIDE | Permit Number: AP3135GS<br>Original Permit Number: BK3441IA<br>EPR Reference: -<br>Issue Date: -<br>Effective Date: -<br>Last date noted as effective: 2018-03-01<br>Status: Refused |

### 2.1.3 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site:

0

Database searched and no data found.

### 2.1.4 Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site:

0

Database searched and no data found.

### 2.1.5 Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site:

0

Database searched and no data found.

### 2.1.6 Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site:

4

The following Part A(2) and Part B Activities are represented as points on the Environmental Permits, Incidents and Registers Map:

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| 43 | 226 | N | 434869 406931 | Address: Walter Fisher Ltd, Meadow St, Barnsley, S71 1DE<br>Process: waste oil burning process<br>Status: New Legislation Applies<br>Permit Type: Part B | Enforcement: No Enforcements Notified<br>Date of Enforcement: No Enforcements Notified<br>Comment: No Enforcements Notified |
| 44 | 397 | SW | 434427 406299 | Address: Johnson Dry Cleaners, 14 Peel Square, Barnsley, S70 1YA<br>Process: Dry Cleaning<br>Status: Historical Permit<br>Permit Type: Part B | Enforcement: No Enforcement Notified<br>Date of Enforcement: No Enforcement Notified<br>Comment: No Enforcement Notified |

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| 45D | 436 | SW | 434372 406315 | Address: Hunningley Lane MOT, Hunningley Lane, Stairfoot, Barnsley, S70 3DT<br>Process: Waste Oil Burner <0.4MW<br>Status: New Legislation Applies<br>Permit Type: Part B | Enforcement: No Enforcement Notified<br>Date of Enforcement: No Enforcement Notified<br>Comment: No Enforcement Notified |
| 46 | 497 | N | 434954 407189 | Address: Asda Petrol Filling Station, Old Mill Lane, Barnsley, S71 1LN<br>Process: Unloading of Petrol into Storage at Service Stations<br>Status: Current Permit<br>Permit Type: Part B | Enforcement: No Enforcement Notified<br>Date of Enforcement: No Enforcement Notified<br>Comment: No Enforcement Notified |

### 2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations:

0

Database searched and no data found.

### 2.1.8 Records of Licensed Discharge Consents within 500m of the study site:

12

The following Licensed Discharge Consents records are represented as points on the Environmental Permits, Incidents and Registers Map:

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| 3 | 143 | S | 434710 406380 | Address: UNDEFINED SITE, SEE OUTLET NGR OR COMMENTS, FOR MORE INFO ABOUT THE SITE, (DO NOT CHANGE THESE DETAILS), ., NK<br>Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY<br>Permit Number: S/CB/8<br>Permit Version: 1 | Receiving Water: VARIES WITH OUTLET<br>Status: TRANSFERRED FROM R(PP)A 1951-1961<br>Issue date: 29/05/1963<br>Effective Date: 29-May-1963<br>Revocation Date: 31/03/2005 |
| 4 | 178 | S | 434720 406340 | Address: UNDEFINED SITE, SEE OUTLET NGR OR COMMENTS, FOR MORE INFO ABOUT THE SITE, (DO NOT CHANGE THESE DETAILS), ., NK<br>Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY<br>Permit Number: S/CB/8<br>Permit Version: 1 | Receiving Water: VARIES WITH OUTLET<br>Status: TRANSFERRED FROM R(PP)A 1951-1961<br>Issue date: 29/05/1963<br>Effective Date: 29-May-1963<br>Revocation Date: 31/03/2005 |
| 5 | 191 | N | 434832 406906 | Address: REGENT STREET, BARNSLEY, SOUTH YORKSHIRE<br>Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY<br>Permit Number: YWUCD2/4<br>Permit Version: 1 | Receiving Water: TRIB OF RIVER DEARNE<br>Status: NEW CONSENT (WRA 91, S88 & SCHED 10 AS AMENDED BY<br>Issue date: 12/11/1997<br>Effective Date: 12-Nov-1997<br>Revocation Date: - |

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| 6 | 287 | SW | 434560 406308 | Address: UNDEFINED SITE, SEE OUTLET NGR OR COMMENTS, FOR MORE INFO ABOUT THE SITE, (DO NOT CHANGE THESE DETAILS), ., NK<br>Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY<br>Permit Number: S/CB/8<br>Permit Version: 1 | Receiving Water: VARIES WITH OUTLET<br>Status: TRANSFERRED FROM R(PP)A 1951-1961<br>Issue date: 29/05/1963<br>Effective Date: 29-May-1963<br>Revocation Date: 31/03/2005 |
| 7D | 407 | SW | 434397 406330 | Address: UNDEFINED SITE, SEE OUTLET NGR OR COMMENTS, FOR MORE INFO ABOUT THE SITE, (DO NOT CHANGE THESE DETAILS), ., NK<br>Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY<br>Permit Number: S/CB/8<br>Permit Version: 1 | Receiving Water: VARIES WITH OUTLET<br>Status: TRANSFERRED FROM R(PP)A 1951-1961<br>Issue date: 29/05/1963<br>Effective Date: 29-May-1963<br>Revocation Date: 31/03/2005 |
| 8 | 415 | S | 434992 406140 | Address: UNDEFINED SITE, SEE OUTLET NGR OR COMMENTS, FOR MORE INFO ABOUT THE SITE, (DO NOT CHANGE THESE DETAILS), ., NK<br>Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY<br>Permit Number: S/CB/8<br>Permit Version: 1 | Receiving Water: VARIES WITH OUTLET<br>Status: TRANSFERRED FROM R(PP)A 1951-1961<br>Issue date: 29/05/1963<br>Effective Date: 29-May-1963<br>Revocation Date: 31/03/2005 |
| 9A | 431 | SW | 434427 406240 | Address: UNDEFINED SITE, SEE OUTLET NGR OR COMMENTS, FOR MORE INFO ABOUT THE SITE, (DO NOT CHANGE THESE DETAILS), ., NK<br>Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY<br>Permit Number: S/CB/8<br>Permit Version: 1 | Receiving Water: VARIES WITH OUTLET<br>Status: TRANSFERRED FROM R(PP)A 1951-1961<br>Issue date: 29/05/1963<br>Effective Date: 29-May-1963<br>Revocation Date: 31/03/2005 |
| 10A | 435 | SW | 434433 406227 | Address: UNDEFINED SITE, SEE OUTLET NGR OR COMMENTS, FOR MORE INFO ABOUT THE SITE, (DO NOT CHANGE THESE DETAILS), ., NK<br>Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY<br>Permit Number: S/CB/8<br>Permit Version: 1 | Receiving Water: VARIES WITH OUTLET<br>Status: TRANSFERRED FROM R(PP)A 1951-1961<br>Issue date: 29/05/1963<br>Effective Date: 29-May-1963<br>Revocation Date: 31/03/2005 |
| 11B | 449 | S | 435010 406110 | Address: LAMBRA ROAD CSO, LAMBRA ROAD, BARNSLEY, SOUTH YORKSHIRE, .<br>Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY<br>Permit Number: WRA7491<br>Permit Version: 1 | Receiving Water: SOUGH DYKE (CULVERT)<br>Status: NEW CONSENT (WRA 91, S88 & SCHED 10 AS AMENDED BY<br>Issue date: 16/02/1999<br>Effective Date: 16-Feb-1999<br>Revocation Date: - |
| 12B | 455 | S | 434993 406098 | Address: UNDEFINED SITE, SEE OUTLET NGR OR COMMENTS, FOR MORE INFO ABOUT THE SITE, (DO NOT CHANGE THESE DETAILS), ., NK<br>Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY<br>Permit Number: S/CB/8<br>Permit Version: 1 | Receiving Water: VARIES WITH OUTLET<br>Status: TRANSFERRED FROM R(PP)A 1951-1961<br>Issue date: 29/05/1963<br>Effective Date: 29-May-1963<br>Revocation Date: 31/03/2005 |

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| 13 | 457 | SW | 434345 406323 | Address: UNDEFINED SITE, SEE OUTLET NGR OR COMMENTS, FOR MORE INFO ABOUT THE SITE, (DO NOT CHANGE THESE DETAILS), ., NK<br>Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY<br>Permit Number: S/CB/8<br>Permit Version: 1 | Receiving Water: VARIES WITH OUTLET<br>Status: TRANSFERRED FROM R(PP)A 1951-1961<br>Issue date: 29/05/1963<br>Effective Date: 29-May-1963<br>Revocation Date: 31/03/2005 |
| 14 | 487 | S | 434924 406048 | Address: UNDEFINED SITE, SEE OUTLET NGR OR COMMENTS, FOR MORE INFO ABOUT THE SITE, (DO NOT CHANGE THESE DETAILS), ., NK<br>Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY<br>Permit Number: S/CB/8<br>Permit Version: 1 | Receiving Water: VARIES WITH OUTLET<br>Status: TRANSFERRED FROM R(PP)A 1951-1961<br>Issue date: 29/05/1963<br>Effective Date: 29-May-1963<br>Revocation Date: 31/03/2005 |

### 2.1.9 Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site:

0

Database searched and no data found.

### 2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site:

0

Database searched and no data found.

## 2.2 Dangerous or Hazardous Sites

Records of COMAH & NIHHS sites within 500m of the study site: 1

The following COMAH & NIHHS Authorisation records provided by the Health and Safety Executive are represented as polygons or buffered points on the Environmental Permits, Incidents and Registers Map:

| ID | Distance (m) | Direction | Company | Address | Operational Status | Tier |
|---|---|---|---|---|---|---|
| 47 | 494 | NE | British Gas | British Gas, Old Mill Lane, Barnsley, S71 1LT | Historical NIHHS Site | - |

## 2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents

### 2.3.1 Records of National Incidents Recording System, List 2 within 500m of the study site:

2

The following NIRS List 2 records are represented as points on the Environmental Permits, Incidents and Registers Map:

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| 1 | 344 | SW | 434616<br>406202 | Incident Date: 01-Dec-2001<br>Incident Identification: 45948<br>Pollutant: Pollutant Not Identified<br>Pollutant Description: Not Identified | Water Impact: Category 4 (No Impact)<br>Land Impact: Category 4 (No Impact)<br>Air Impact: Category 3 (Minor) |
| 2 | 438 | N | 434945<br>407129 | Incident Date: 22-Nov-2001<br>Incident Identification: 44308<br>Pollutant: Oils and Fuel<br>Pollutant Description: Petrol | Water Impact: Category 4 (No Impact)<br>Land Impact: Category 4 (No Impact)<br>Air Impact: Category 4 (No Impact) |

### 2.3.2 Records of National Incidents Recording System, List 1 within 500m of the study site:

0

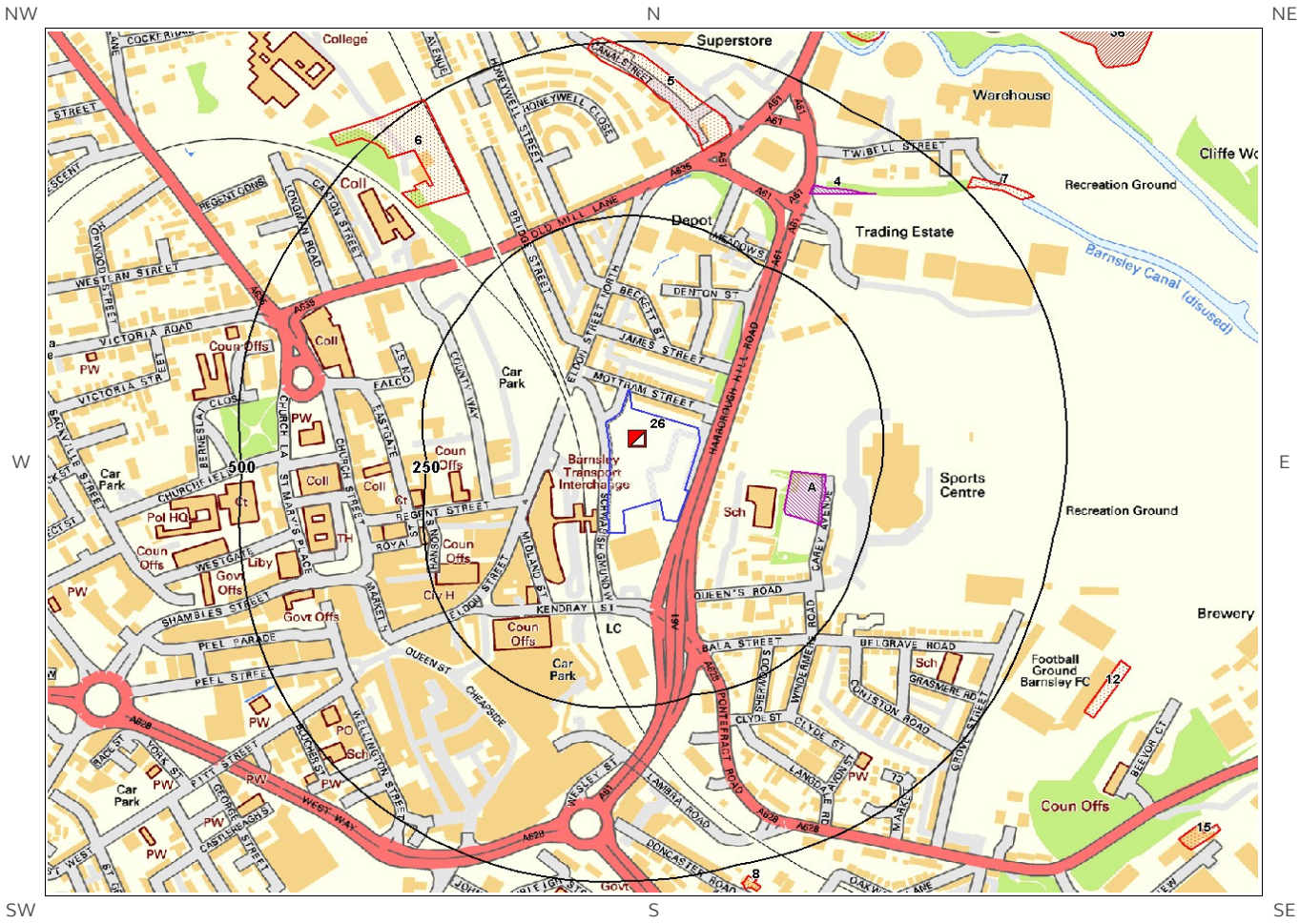
Database searched and no data found.

## 2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990

Records of sites determined as contaminated land under Section 78R of the Environmental Protection Act 1990 are there within 500m of the study site 0

Database searched and no data found.

# 3. Landfill and Other Waste Sites Map




© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.

# 3. Landfill and Other Waste Sites

## 3.1 Landfill Sites

### 3.1.1 Records from Environment Agency/Natural Resources Wales landfill data within 1000m of the study site:

0

Database searched and no data found.

---

### 3.1.2 Records of Environment Agency/Natural Resources Wales historic landfill sites within 1500m of the study site:

21

The following landfill records are represented as either points or polygons on the Landfill and Other Waste Sites map:

| ID | Distance (m) | Direction | NGR | Details |
|---|---|---|---|---|
| 5 | 357 | N | | Site Address: Disused Canal, Old Mill Lane, Barnsley<br>Waste Licence: -<br>Site Reference: 4400/(22)<br>Waste Type: Inert<br>Environmental Permitting Regulations (Waste) Reference: -<br>Licence Issue:<br>Licence Surrendered:<br>Licence Holder Address: -<br>Operator: Barnsley Metropolitan Borough Council<br>Licence Holder: Barnsley Metropolitan Borough Council<br>First Recorded: -<br>Last Recorded: - |
| 6 | 358 | NW | | Site Address: Land off Old Mill Lane, Town Centre, Barnsley<br>Waste Licence: Yes<br>Site Reference: WD20 B446<br>Waste Type: Inert, Commercial<br>Environmental Permitting Regulations (Waste) Reference: -<br>Licence Issue: 14-Nov-1984<br>Licence Surrendered: 30-Mar-1994<br>Licence Holder Address: c/o Twibell Plant Limited, Twibell Street, Barnsley<br>Operator: Mr M White<br>Licence Holder: White and Peace<br>First Recorded: 30-Nov-1984<br>Last Recorded: 31-Dec-1989 |
| 7 | 504 | NE | | Site Address: Canal to the rear of Twibell Street, Barnsley<br>Waste Licence: Yes<br>Site Reference: WD20 B369, 4400/B369, 20B369(83)<br>Waste Type: Inert<br>Environmental Permitting Regulations (Waste) Reference: -<br>Licence Issue: 16-Sep-1982<br>Licence Surrendered: 06-Jun-1988<br>Licence Holder Address: 8A, Eastgate, Barnsley<br>Operator: Barnsley Trades Council<br>Licence Holder: Barnsley Trades Council<br>First Recorded: 30-Sep-1982<br>Last Recorded: 06-Jun-1988 |

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| 8 | 517 | S | | Site Address: The Old Vicarage, Doncaster Road, Barnsley<br>Waste Licence: Yes<br>Site Reference: WD20 B812, 20B812<br>Waste Type: Commercial<br>Environmental Permitting Regulations (Waste) Reference: - | Licence Issue: 17-Jul-1991<br>Licence Surrendered: 17-Jan-1994<br>Licence Holder Address: Oak House, Doncaster Road, Barnsley<br>Operator: -<br>Licence Holder: Mr K Sykes - Aytee Portable Equiptment Limited<br>First Recorded: -<br>Last Recorded: - |
| 9 | 591 | NE | | Site Address: Emgas Depot, Old Mill Lane, Barnsley<br>Waste Licence: Yes<br>Site Reference: WD20 B187, 4400/B187, 20B187(71)<br>Waste Type: Inert<br>Environmental Permitting Regulations (Waste) Reference: - | Licence Issue: 11-Jan-1978<br>Licence Surrendered: 11-May-1984<br>Licence Holder Address: PO Box 145, De Montfort Street, Leicester<br>Operator: East Midlands Gas<br>Licence Holder: East Midlands Gas<br>First Recorded: 31-Jan-1978<br>Last Recorded: 11-May-1984 |
| Not shown | 595 | N | | Site Address: Star Paper Limited, Old Mill Lane, Barnsley<br>Waste Licence: Yes<br>Site Reference: WD20 B4(i), 4400/B4<br>Waste Type: Inert, Liquid sludge<br>Environmental Permitting Regulations (Waste) Reference: - | Licence Issue: 11-Jan-1978<br>Licence Surrendered: 25-Feb-1982<br>Licence Holder Address: -<br>Operator: Star Paper Limited<br>Licence Holder: Star Paper Mills<br>First Recorded: 31-Jan-1978<br>Last Recorded: 25-Feb-1982 |
| Not shown | 609 | N | | Site Address: Star Paper Mill, Barnsley<br>Waste Licence: -<br>Site Reference: 4400/B59, WD20/B4(ii)<br>Waste Type: Inert<br>Environmental Permitting Regulations (Waste) Reference: - | Licence Issue:<br>Licence Surrendered:<br>Licence Holder Address: -<br>Operator: Star Paper Mill<br>Licence Holder: Star Paper Mills<br>First Recorded: 31-Jan-1978<br>Last Recorded: 31-Dec-1990 |
| 12 | 617 | SE | | Site Address: Barnsley Football Ground, Oakwell Road, Barnsley<br>Waste Licence: -<br>Site Reference: 4400/(164)<br>Waste Type: -<br>Environmental Permitting Regulations (Waste) Reference: - | Licence Issue:<br>Licence Surrendered:<br>Licence Holder Address: -<br>Operator: Mowlem Construction<br>Licence Holder: Mowlem Construction<br>First Recorded: 01-Jun-1995<br>Last Recorded: 31-Aug-1995 |
| Not shown | 695 | N | | Site Address: The Fleets Dam, Off Smithies Lane, Barnsley<br>Waste Licence: Yes<br>Site Reference: WD20 B774, 4400/B774, 20B774<br>Waste Type: Inert, Commercial<br>Environmental Permitting Regulations (Waste) Reference: - | Licence Issue: 05-Sep-1990<br>Licence Surrendered:<br>Licence Holder Address: Stainborough Fisheries, The Wickets, Low Lane, Stainborough, Barnsley<br>Operator: -<br>Licence Holder: Mr A Hanson<br>First Recorded: 30-Sep-1990<br>Last Recorded: 31-Dec-1994 |
| Not shown | 758 | SW | | Site Address: Spring Street, Barnsley<br>Waste Licence: -<br>Site Reference: 4400/(159), (159)B, WD24 B343, WD34.16.16<br>Waste Type: -<br>Environmental Permitting Regulations (Waste) Reference: - | Licence Issue:<br>Licence Surrendered:<br>Licence Holder Address: -<br>Operator: Mr A J Shaw<br>Licence Holder: Mr A J Shaw<br>First Recorded: 31-Dec-1993<br>Last Recorded: 31-Dec-1993 |
| 15 | 820 | SE | | Site Address: Mount Osborne Industrial Park, Barnsley, South Yorkshire<br>Waste Licence: Yes<br>Site Reference: 4400/B62<br>Waste Type: Inert<br>Environmental Permitting Regulations (Waste) Reference: - | Licence Issue: 11-Jul-1995<br>Licence Surrendered:<br>Licence Holder Address: -<br>Operator: -<br>Licence Holder: Barnsey Group<br>First Recorded: -<br>Last Recorded: - |

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| Not shown | 1021 | E | | Site Address: Former Wood Brothers Tip, Glasstip, Railway Cutting, Beevor Street, Hoyle Mill, Barnsley<br>Waste Licence: Yes<br>Site Reference: WD20 B353, 4400/B353, 20B353, WD20 B353a<br>Waste Type: Commercial, Special<br>Environmental Permitting Regulations (Waste) Reference: - | Licence Issue: 22-Mar-1982<br>Licence Surrendered: 09-May-1984<br>Licence Holder Address: High Holborn Road, Codnor Gate Industrial Estate, Ripley, Derbyshire<br>Operator: -<br>Licence Holder: Nuttall Lighting Limited<br>First Recorded: -<br>Last Recorded: - |
| Not shown | 1032 | E | | Site Address: Land to the rear of Chapel Street-Beever Street, Glasstip, Railway Cutting, Beevor Street<br>Waste Licence: Yes<br>Site Reference: WD20 B6(I), 4400/B6, 20B6(38), 4400/0573<br>Waste Type: Inert, Industrial, Special<br>Environmental Permitting Regulations (Waste) Reference: - | Licence Issue: 05-Dec-1977<br>Licence Surrendered: 31-Dec-1984<br>Licence Holder Address: Borough Flint Glassworks, Barnsley, South Yorkshire<br>Operator: Barnsley Metropolitan Borough Council<br>Licence Holder: Wood Brothers Glass Company Limited<br>First Recorded: 05-Dec-1977<br>Last Recorded: 31-Dec-1984 |
| Not shown | 1051 | N | | Site Address: Star Paper Limited, Old Mill Lane, Barnsley<br>Waste Licence: Yes<br>Site Reference: WD20 B4(i), 4400/B4<br>Waste Type: Inert, Liquid sludge<br>Environmental Permitting Regulations (Waste) Reference: - | Licence Issue: 11-Jan-1978<br>Licence Surrendered: 25-Feb-1982<br>Licence Holder Address: -<br>Operator: Star Paper Limited<br>Licence Holder: Star Paper Mills<br>First Recorded: 31-Jan-1978<br>Last Recorded: 25-Feb-1982 |
| Not shown | 1107 | N | | Site Address: Smithy Green Tip, Smithies Lane, Barnsley, Yorkshire<br>Waste Licence: -<br>Site Reference: -<br>Waste Type: Industrial<br>Environmental Permitting Regulations (Waste) Reference: - | Licence Issue:<br>Licence Surrendered:<br>Licence Holder Address: -<br>Operator: Barnsley County Borough Council<br>Licence Holder: -<br>First Recorded: 31-Dec-1948<br>Last Recorded: - |
| Not shown | 1115 | N | | Site Address: Wakefield Road, Barnsley<br>Waste Licence: Yes<br>Site Reference: 20B320(79), WD20 B320, 4400/B320<br>Waste Type: Industrial, Commercial<br>Environmental Permitting Regulations (Waste) Reference: - | Licence Issue: 28-Jul-1981<br>Licence Surrendered: 09-May-1988<br>Licence Holder Address: c/c C E Smith and Son, 14 Regent Street, Barnsley<br>Operator: Booth Excavations Limited<br>Licence Holder: Booth Excavations Limited<br>First Recorded: 28-Jul-1981<br>Last Recorded: 09-May-1988 |
| Not shown | 1234 | SE | | Site Address: South East Corner Cemetery Road, Barnsley Cemetery, Barnsley<br>Waste Licence: -<br>Site Reference: 4400/(148)<br>Waste Type: -<br>Environmental Permitting Regulations (Waste) Reference: - | Licence Issue:<br>Licence Surrendered:<br>Licence Holder Address: -<br>Operator: Barnsley Metropolitan Borough Council<br>Licence Holder: Barnsley Metropolitan Borough Council<br>First Recorded: 31-Dec-1964<br>Last Recorded: - |
| Not shown | 1381 | N | | Site Address: Smithies Tip, Smithies Tip, Off Smithies Lane, Barnsley<br>Waste Licence: -<br>Site Reference: 4400/(141)<br>Waste Type: -<br>Environmental Permitting Regulations (Waste) Reference: - | Licence Issue:<br>Licence Surrendered:<br>Licence Holder Address: -<br>Operator: -<br>Licence Holder: -<br>First Recorded: -<br>Last Recorded: - |

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| Not shown | 1432 | W | | Site Address: Land West of Summer Lane Dairy, Stocks Lane, Barnsley, South Yorkshire<br>Waste Licence: Yes<br>Site Reference: 20B38(61), 4400/B19, 4400/B38, WD20 B38<br>Waste Type: Inert, Industrial, Commercial<br>Environmental Permitting Regulations (Waste) Reference: - | Licence Issue: 18-Nov-1982<br>Licence Surrendered: 03-Jun-1988<br>Licence Holder Address: Wellington Street, Barnsley<br>Operator: Co-op Retail Services<br>Licence Holder: Co-op Retail Services Limited, Yorkshire Region<br>First Recorded: 30-Nov-1982<br>Last Recorded: 03-Jun-1988 |
| Not shown | 1472 | W | | Site Address: Allotment Gardens, Pogmoor<br>Waste Licence: -<br>Site Reference: 4400/B197<br>Waste Type: -<br>Environmental Permitting Regulations (Waste) Reference: - | Licence Issue:<br>Licence Surrendered:<br>Licence Holder Address: -<br>Operator: -<br>Licence Holder: -<br>First Recorded: -<br>Last Recorded: - |
| Not shown | 1478 | SE | | Site Address: Monument Field, Measborough Hill, Doncaster Road, Barnsley<br>Waste Licence: Yes<br>Site Reference: WD20 B37, 4400/B37, 20B37(41)<br>Waste Type: Industrial<br>Environmental Permitting Regulations (Waste) Reference: - | Licence Issue: 07-Sep-1979<br>Licence Surrendered: 14-May-1982<br>Licence Holder Address: 22 Hunningley Lane, Stairfoot, Barnsley<br>Operator: Frank Green and Sons Limited<br>Licence Holder: Frank Green and Sons Limited<br>First Recorded: -<br>Last Recorded: - |

### 3.1.3 Records of BGS/DoE non-operational landfill sites within 1500m of the study site:

0

Database searched and no data found.

### 3.1.4 Records of Landfills from Local Authority and Historical Mapping Records within 1500m of the study site:

5

The following landfill records are represented as points or polygons on the Landfill and Other Waste Sites map:

| ID | Distance (m) | Direction | NGR | Site Address | Source | Data Type |
|---|---|---|---|---|---|---|
| 36 | 753 | NE | 435419 407268 | Refuse Tip | 1972 mapping | Polygon |
| Not shown | 828 | SW | 434273 405813 | Spring Street | Barnsley Metropolitan Borough Council | Point |
| Not shown | 900 | E | 435798 406428 | Refuse Tip | 1970 mapping | Polygon |
| Not shown | 1115 | N | 434789 407894 | Refuse Tip | 1970 mapping | Polygon |
| Not shown | 1496 | N | 434625 408347 | Refuse Tip | 1970 mapping | Polygon |

## 3.2 Other Waste Sites

### 3.2.1 Records of waste treatment, transfer or disposal sites within 500m of the study site:

4

The following waste treatment, transfer or disposal sites records are represented as points on the Landfill and Other Waste Sites map:

| ID | Distance (m) | Direction | NGR | Details | | |
|---|---|---|---|---|---|---|
| 1A | 132 | E | 435027<br>406564 | Type of Site: Scrap Yard<br>Site Address: N/A | Planning Application Reference: N/A<br>Date: 1983 | Further Details: N/A<br>Data Source: Historic Mapping<br>Data Type: Polygon |
| 2A | 132 | E | 435027<br>406564 | Type of Site: Scrap Yard<br>Site Address: N/A | Planning Application Reference: N/A<br>Date: 1990 | Further Details: N/A<br>Data Source: Historic Mapping<br>Data Type: Polygon |
| 3A | 132 | E | 435027<br>406564 | Type of Site: Scrap Yard<br>Site Address: N/A | Planning Application Reference: N/A<br>Date: 1989 | Further Details: N/A<br>Data Source: Historic Mapping<br>Data Type: Polygon |
| 4 | 369 | NE | 435080<br>407006 | Type of Site: Scrap Metal Yard<br>Site Address: N/A | Planning Application Reference: N/A<br>Date: 1972 | Further Details: N/A<br>Data Source: Historic Mapping<br>Data Type: Polygon |

### 3.2.2 Records of Environment Agency/Natural Resources Wales licensed waste sites within 1500m of the study site:

10

The following waste treatment, transfer or disposal sites records are represented as points on the Landfill and Other Waste Sites map:

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| 26 | 0 | On Site | 434800<br>406650 | Site Address: Harborough Hill Road, Harborough, Barnsley, South Yorkshire, S71 1BD<br>Type: -<br>Size: < 25000 tonnes<br>Environmental Permitting Regulations (Waste) Licence Number: YOR005<br>EPR reference: EA/EPR/JP3390ZX/S002<br>Operator: Yorkshire Electricity<br>Waste Management licence No: 60598<br>Annual Tonnage: 0.0 | Issue Date: 14/09/1992<br>Effective Date: -<br>Modified: -<br>Surrendered Date: 13/05/1999<br>Expiry Date: -<br>Cancelled Date: -<br>Status: Surrendered<br>Site Name: -<br>Correspondence Address: - |

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| Not shown | 711 | NE | 435200 407300 | Site Address: Old Mill Lane, Barnsley, South Yorkshire<br>Type: Household, Commercial & Industrial Waste T Stn<br>Size: < 25000 tonnes<br>Environmental Permitting Regulations (Waste) Licence Number: TRA002<br>EPR reference: EA/EPR/WP3790ZL/S002<br>Operator: British Gas Transco Plc<br>Waste Management licence No: 60545<br>Annual Tonnage: 316.0 | Issue Date: 15/07/1993<br>Effective Date: -<br>Modified: -<br>Surrendered Date: 06/09/2000<br>Expiry Date: -<br>Cancelled Date: -<br>Status: Surrendered<br>Site Name: Barnsley Depot<br>Correspondence Address: - |
| Not shown | 841 | NE | 435123 407492 | Site Address: Unit 7, Peel Place, Barnsley, South Yorkshire, S71 1LU<br>Type: Treatment of waste to produce soil <75,000 tpy<br>Size: < 25000 tonnes<br>Environmental Permitting Regulations (Waste) Licence Number: DUN001<br>EPR reference: EA/EPR/EB3509CF/A001<br>Operator: G M M Multi Utilities Limited<br>Waste Management licence No: 403601<br>Annual Tonnage: 75.0 | Issue Date: 24/10/2016<br>Effective Date: -<br>Modified: -<br>Surrendered Date: -<br>Expiry Date: -<br>Cancelled Date: -<br>Status: Issued<br>Site Name: Unit 7<br>Correspondence Address: - |
| Not shown | 891 | SE | 435650 406130 | Site Address: Unit 5, Oakwell Business Centre, Oakwell View, Barnsley, South Yorkshire, S71 1HX<br>Type: Household, Commercial & Industrial Waste T Stn<br>Size: < 25000 tonnes<br>Environmental Permitting Regulations (Waste) Licence Number: SRW001<br>EPR reference: -<br>Operator: S R Waste Recycling Ltd<br>Waste Management licence No: 100239<br>Annual Tonnage: 0.0 | Issue Date: 12/03/2008<br>Effective Date: -<br>Modified: -<br>Surrendered Date: -<br>Expiry Date: -<br>Cancelled Date: -<br>Status: Issued<br>Site Name: S R Waste Recycling Ltd<br>Correspondence Address: 5, Oakwell Business Centre, Oakwell View, Barnsley, South Yorks, S71 1HX |
| Not shown | 891 | SE | 435650 406130 | Site Address: Unit 5, Oakwell Business Centre, Oakwell View, Barnsley, South Yorkshire, S71 1HX<br>Type: 75kte WEEE Treatment Facility<br>Size: < 25000 tonnes<br>Environmental Permitting Regulations (Waste) Licence Number: SRW001<br>EPR reference: EA/EPR/BP3598EY/A001<br>Operator: S R Waste Recycling Ltd<br>Waste Management licence No: 100239<br>Annual Tonnage: 4999.0 | Issue Date: 12/03/2008<br>Effective Date: -<br>Modified: -<br>Surrendered Date: -<br>Expiry Date: -<br>Cancelled Date: -<br>Status: Revoked<br>Site Name: S R Waste Recycling Ltd<br>Correspondence Address: - |
| Not shown | 1373 | N | 434870 408090 | Site Address: Smithies Lane Civic Amenity Site, Smithies Lane, Smithies, Barnsley, South Yorkshire, S71 1NL<br>Type: Household Waste Amenity Site<br>Size: < 25000 tonnes<br>Environmental Permitting Regulations (Waste) Licence Number: WAS067<br>EPR reference: EA/EPR/DP3992LS/T001<br>Operator: Waste Recycling Ltd<br>Waste Management licence No: 60609<br>Annual Tonnage: 24999.0 | Issue Date: 14/06/1993<br>Effective Date: 26/01/2009<br>Modified: -<br>Surrendered Date: -<br>Expiry Date: -<br>Cancelled Date: -<br>Status: Transferred<br>Site Name: Smithies Lane H W R C Site<br>Correspondence Address: - |

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| Not shown | 1373 | N | 434870 408090 | Site Address: Smithies Lane, Smithies, Barnsley, S Yorks<br>Type: Household, Commercial & Industrial Waste T Stn<br>Size: < 25000 tonnes<br>Environmental Permitting Regulations (Waste) Licence Number: REG006<br>EPR reference: -<br>Operator: Regional Waste Recycling Plc<br>Waste Management licence No: 60609<br>Annual Tonnage: 5000.0 | Issue Date: 14/06/1993<br>Effective Date: 08/12/2006<br>Modified: -<br>Surrendered Date: -<br>Expiry Date: -<br>Cancelled Date: -<br>Status: Transferred<br>Site Name: Smithies Lane Civic Amenity Site<br>Correspondence Address: 2 Cecil Court, 49-55, London Road, Enfield, Middlesex, EN2 6DE |
| Not shown | 1373 | N | 434870 408090 | Site Address: Smithies Lane H W R C, Smithies Lane, Smithies, Barnsley, South Yorkshire, S71 1NL<br>Type: Household Waste Amenity Site<br>Size: < 25000 tonnes<br>Environmental Permitting Regulations (Waste) Licence Number: WAS067<br>EPR reference: EA/EPR/DP3992LS/V002<br>Operator: F C C Recycling ( U K ) Limited<br>Waste Management licence No: 60609<br>Annual Tonnage: 24999.0 | Issue Date: 14/06/1993<br>Effective Date: 26/01/2009<br>Modified: 23/11/2012<br>Surrendered Date: -<br>Expiry Date: -<br>Cancelled Date: -<br>Status: Modified<br>Site Name: Smithies Lane Household Waste Recycling Centre<br>Correspondence Address: - |
| Not shown | 1373 | N | 434870 408090 | Site Address: Smithies Lane, Smithies, Barnsley, S Yorks<br>Type: Household, Commercial & Industrial Waste T Stn<br>Size: < 25000 tonnes<br>Environmental Permitting Regulations (Waste) Licence Number: BDR013<br>EPR reference: -<br>Operator: South Herts Waste Management Ltd<br>Waste Management licence No: 60609<br>Annual Tonnage: 0.0 | Issue Date: 14/06/1993<br>Effective Date: -<br>Modified: -<br>Surrendered Date: -<br>Expiry Date: -<br>Cancelled Date: -<br>Status: Issued<br>Site Name: Smithies Lane Civic Amenity Site<br>Correspondence Address: 48, Cardigan Road, Stanion, Northants, NN14 1BY |
| Not shown | 1373 | N | 434870 408090 | Site Address: Smithies Lane Civic Amenity Site, Smithies Lane, Smithies, Barnsley, South Yorkshire, S71 1NL<br>Type: Household, Commercial & Industrial Waste T Stn<br>Size: < 25000 tonnes<br>Environmental Permitting Regulations (Waste) Licence Number: WAS067<br>EPR reference: EA/EPR/DP3992LS/T001<br>Operator: Waste Recycling Ltd<br>Waste Management licence No: 60609<br>Annual Tonnage: 24999.0 | Issue Date: 14/06/1993<br>Effective Date: 26/01/2009<br>Modified: -<br>Surrendered Date: -<br>Expiry Date: -<br>Cancelled Date: -<br>Status: Transferred<br>Site Name: Smithies Lane H W R C Site<br>Correspondence Address: Ground Floor West, 900, Pavilion Drive, Northampton Business Park, Northampton, NN4 7RG |

# 4. Current Land Use Map




© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.

Site Outline

Search Buffers (m)
250
500

Current Industrial Sites

Petrol & Fuel Sites

Electricity Transmission Cables

Gas Transmission Pipelines

# 4. Current Land Uses

## 4.1 Current Industrial Data

Records of potentially contaminative industrial sites within 250m of the study site: 30

The following records are represented as points on the Current Land Uses map.

| ID | Distance (m) | Direction | Company | NGR | Address | Activity | Category |
|---|---|---|---|---|---|---|---|
| 1 | 9 | W | Electricity Sub Station | 434825 406541 | S71 | Electrical Features | Infrastructure and Facilities |
| 2 | 31 | W | Barnsley Rail Station | 434728 406535 | S71 | Railway Stations, Junctions and Halts | Public Transport, Stations and Infrastructure |
| 3A | 55 | N | Works | 434771 406771 | S71 | Unspecified Works Or Factories | Industrial Features |
| 4A | 69 | N | Autofix Garage Services | 434770 406786 | 5, James Street, Barnsley, S71 1BL | Vehicle Repair, Testing and Servicing | Repair and Servicing |
| 5B | 86 | NW | I M P UK Ltd | 434752 406797 | 23-25, Eldon Street North, Barnsley, S71 1LF | New Vehicles | Motoring |
| 6B | 86 | NW | Moto Direct UK | 434752 406797 | 25, Eldon Street North, Barnsley, S71 1LF | New Vehicles | Motoring |
| 7 | 87 | W | Bus Station | 434672 406525 | S70 | Bus and Coach Stations, Depots and Companies | Public Transport, Stations and Infrastructure |
| 8 | 100 | W | S Y P T E Barnsley Interchange | 434660 406559 | Barnsley Transport Interchange, Midland Street, Barnsley, S70 1SE | Bus and Coach Stations, Depots and Companies | Public Transport, Stations and Infrastructure |
| 9 | 129 | NE | Depot | 434855 406831 | S71 | Container and Storage | Transport, Storage and Delivery |
| 10 | 135 | W | Queens Court Business Centre | 434624 406546 | Regent Street, Barnsley, S70 2EG | Business Parks and Industrial Estates | Industrial Features |
| 11 | 138 | S | Electricity Sub Station | 434883 406396 | S71 | Electrical Features | Infrastructure and Facilities |
| 12 | 140 | N | Electricity Sub Station | 434813 406858 | S71 | Electrical Features | Infrastructure and Facilities |
| 13 | 145 | SW | Stagecoach Yorkshire | 434629 406451 | 4, Eldon Arcade, Barnsley, S70 2JP | Bus and Coach Stations, Depots and Companies | Public Transport, Stations and Infrastructure |
| 14 | 151 | S | Gas Governor Station | 434813 406366 | S71 | Gas Features | Infrastructure and Facilities |
| 15 | 155 | W | Tom Henry & Associates | 434606 406633 | Digital Media Centre, County Way, Barnsley, S70 2JW | Structural Engineers | Engineering Services |
| 16 | 156 | NE | Electricity Sub Station | 434994 406774 | S71 | Electrical Features | Infrastructure and Facilities |
| 17 | 170 | SE | A & P - M O T Centre | 434979 406415 | 25, Queens Road, Barnsley, S71 1AN | Vehicle Repair, Testing and Servicing | Repair and Servicing |
| 18 | 184 | N | Topp Carpets & Vinyls | 434717 406888 | 8, Honeywell Street, Barnsley, S71 1PR | Construction Completion Services | Construction Services |

| ID | Distance (m) | Direction | Company | NGR | Address | Activity | Category |
|---|---|---|---|---|---|---|---|
| 19 | 193 | S | Chimney | 434732 406323 | S70 | Chimneys | Industrial Features |
| 20 | 200 | W | Electricity Sub Station | 434563 406616 | S70 | Electrical Features | Infrastructure and Facilities |
| 21 | 215 | NE | Enterprise Rent-A-Car | 434990 406849 | Harborough Hill Service Station, Harborough Hill Road, Barnsley, S71 1BQ | Vehicle Hire and Rental | Hire Services |
| 22 | 215 | NE | Mick Gardner Racing | 435044 406806 | Unit 2 The Old Bakery, Harborough Hill Road, Barnsley, S71 1BQ | Motorsport Services | Sport and Entertainment Support Services |
| 23 | 220 | W | The Inclusion Zone Ltd | 434549 406452 | The Civic Building, Eldon Street, Barnsley, S70 2HZ | Vehicles | Industrial Products |
| 24 | 232 | NE | Depot | 435022 406850 | S71 | Container and Storage | Transport, Storage and Delivery |
| 25C | 233 | N | Beds Plus | 434854 406943 | Unit A, Meadow Street, Barnsley, S71 1DR | Beds and Bedding | Consumer Products |
| 26 | 233 | W | Electricity Sub Stations | 434528 406495 | S70 | Electrical Features | Infrastructure and Facilities |
| 27 | 241 | SW | Tom Hall Fish Merchants | 434640 406305 | 10, Upper May Day Green Arcade, Barnsley, S70 1SY | Fish, Meat and Poultry Products | Foodstuffs |
| 28 | 242 | W | Electricity Sub Station | 434524 406736 | S70 | Electrical Features | Infrastructure and Facilities |
| 29C | 244 | N | Tank | 434859 406954 | S71 | Tanks (Generic) | Industrial Features |
| 30 | 249 | SE | Works | 435053 406381 | S71 | Unspecified Works Or Factories | Industrial Features |

## 4.2 Petrol and Fuel Sites

Records of petrol or fuel sites within 500m of the study site: 1

The following petrol or fuel site records provided by Catalist are represented as points on the Current Land Use map:

| ID | Distance (m) | Direction | NGR | Company | Address | LPG | Status |
|---|---|---|---|---|---|---|---|
| 31 | 497 | SE | 435061 406079 | Texaco | Oakwell Service Station, Pontefract Road, Pontefract Road, Barnsley, South Yorkshire, S71 1HA | Not Applicable | Obsolete |

## 4.3 National Grid High Voltage Underground Electricity Transmission Cables

This dataset identifies the high voltage electricity transmission lines running between generating power plants and electricity substations. The dataset does not include the electricity distribution network (smaller, lower voltage cables distributing power from substations to the local user network). This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high voltage underground electricity transmission cables within 500m of the study site: 0

Database searched and no data found.

---

## 4.4 National Grid High Pressure Gas Transmission Pipelines

This dataset identifies high-pressure, large diameter pipelines which carry gas between gas terminals, power stations, compressors and storage facilities. The dataset does not include the Local Transmission System (LTS) which supplies gas directly into homes and businesses. This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high pressure gas transmission pipelines within 500m of the study site: 0

Database searched and no data found.

---

# 5. Geology

## 5.1 Artificial Ground and Made Ground

Database searched and no data found.

The database has been searched on site, including a 50m buffer.

## 5.2 Superficial Ground and Drift Geology

Database searched and no data found.

The database has been searched on site, including a 50m buffer.

## 5.3 Bedrock and Solid Geology

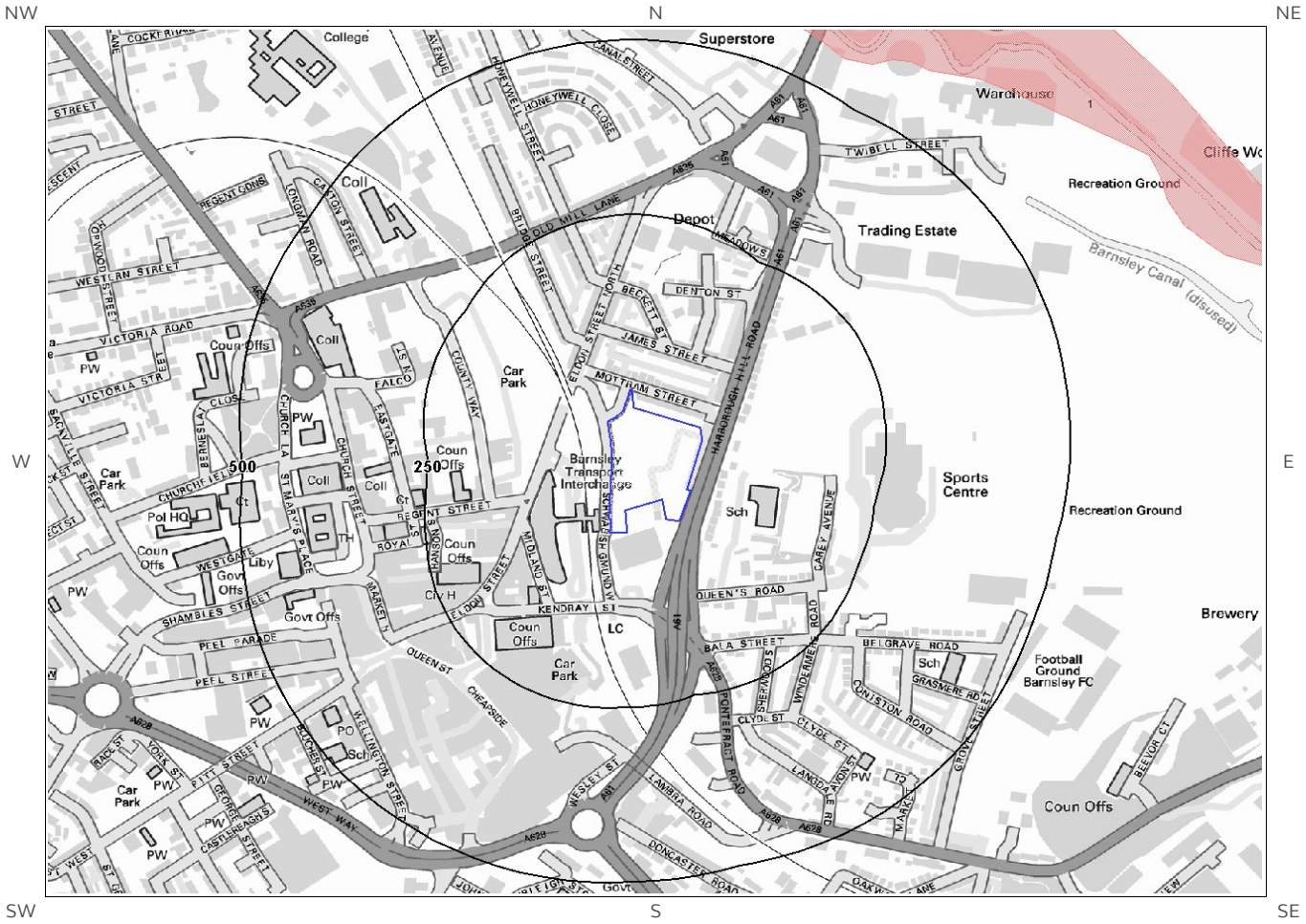
The database has been searched on site, including a 50m buffer.

| Lex Code | Description | Rock Type |
|---|---|---|
| PMCM-MDSS | PENNINE MIDDLE COAL MEASURES FORMATION | MUDSTONE, SILTSTONE AND SANDSTONE |
| PMCM-SDST | PENNINE MIDDLE COAL MEASURES FORMATION | SANDSTONE |

(Derived from the BGS 1:50,000 Digital Geological Map of Great Britain)

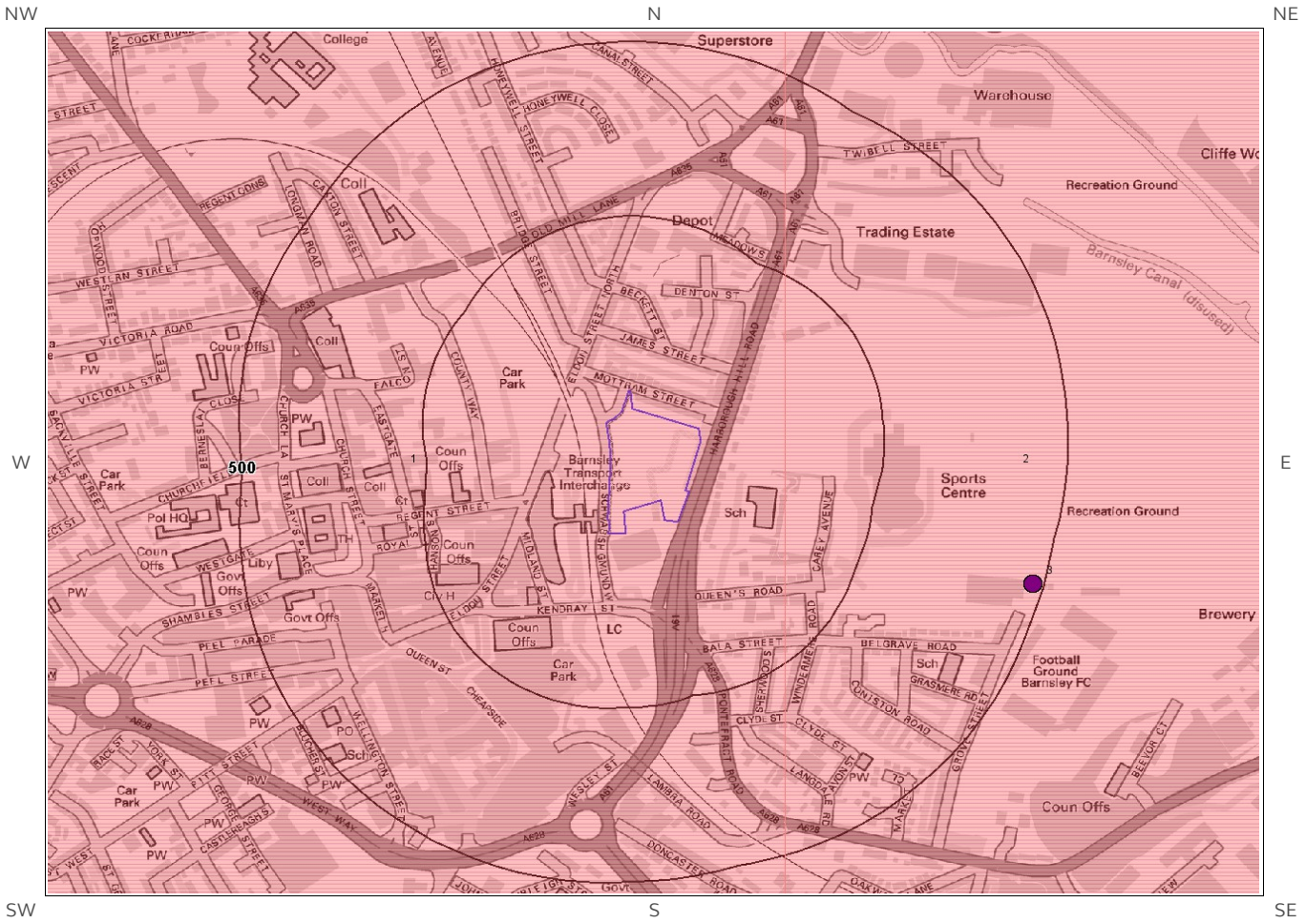
# 6 Hydrogeology and Hydrology

## 6a. Aquifer Within Superficial Geology




© Crown copyright and database rights 2018
Ordnance Survey license 100035207.

# 6b. Aquifer Within Bedrock Geology and Abstraction Licenses




© Crown copyright and database rights 2018
Ordnance Survey license 100035207.

Site Outline

250

500

Search Buffers (m)

Principal Aquifer

Secondary (A) Aquifer - Permeable Layers

Secondary (B) Aquifer - Lower Permeability Layers

Groundwater Abstraction Licence

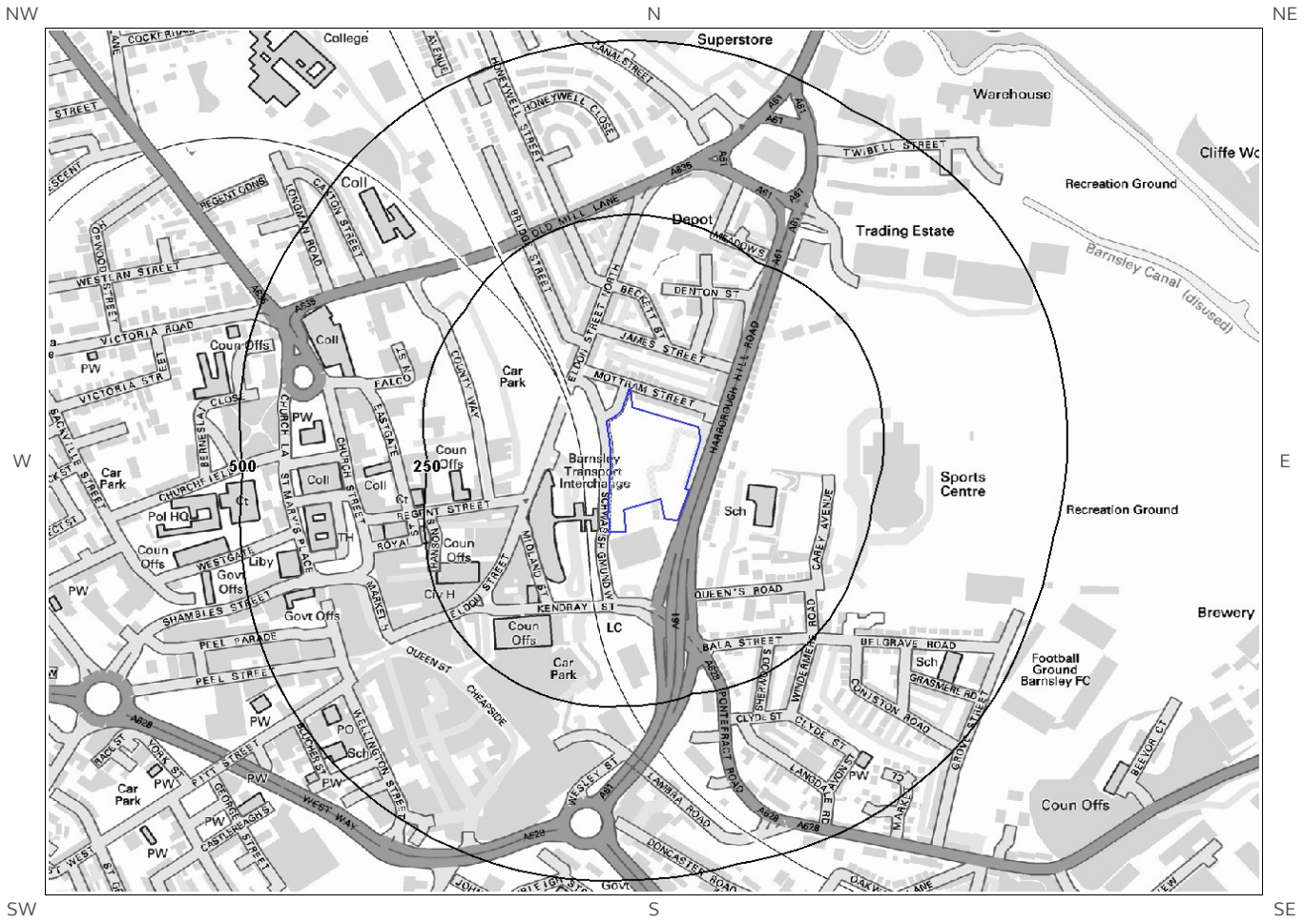
Secondary Aquifer - Undifferentiated Layers

Unproductive

Unknown (lakes and landslip)

Surface Water Abstraction Licence

# 6c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses




© Crown copyright and database rights 2018
Ordnance Survey license 100035207.

Site Outline

250
500
Search Buffers (m)

Source Protection Zone 1 - Inner Catchment

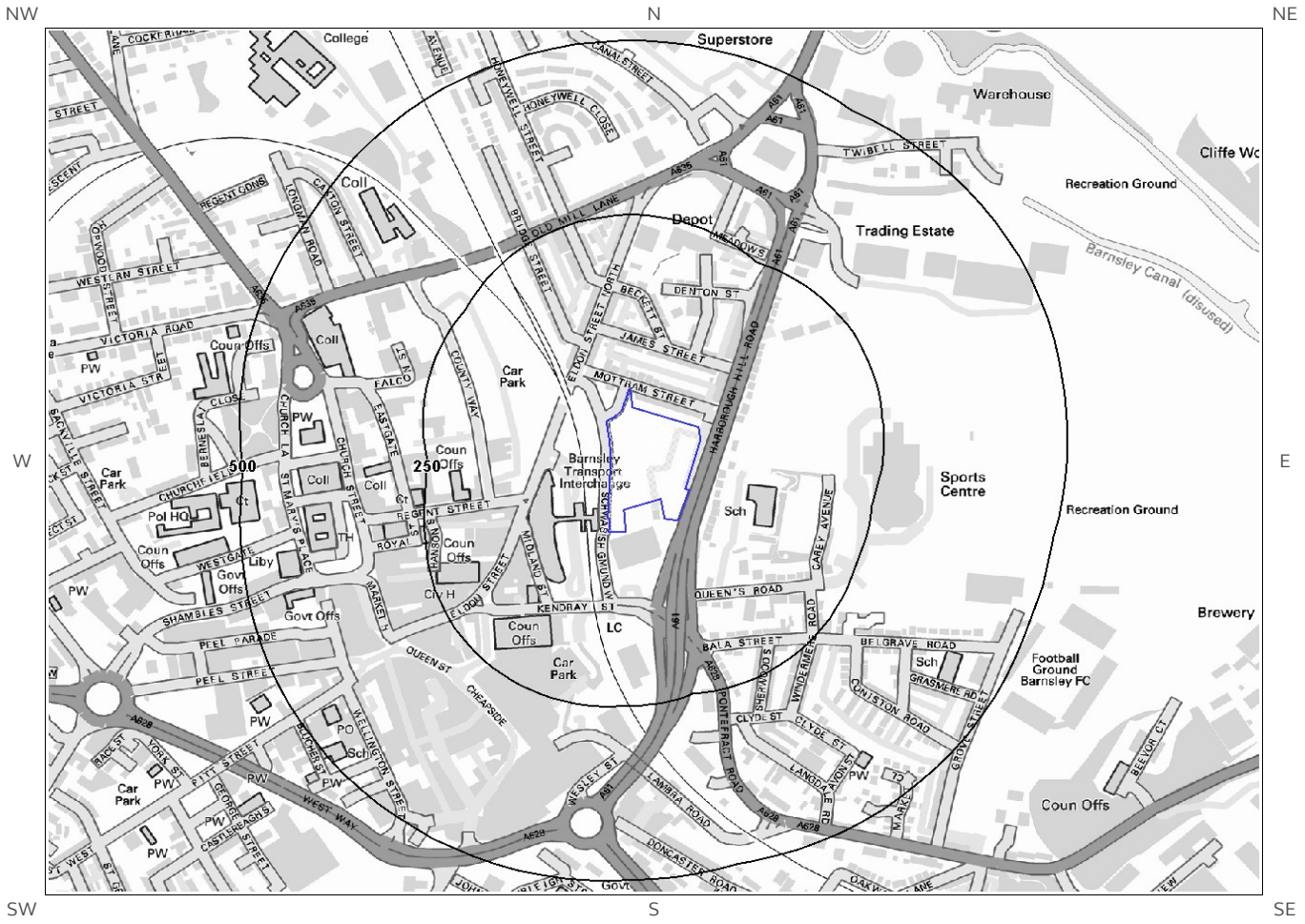
Source Protection Zone 2 - Outer Catchment

Source Protection Zone 3 - Total Catchment

Source Protection Zone 4 - Zone of Special Interest

Potable Water Abstraction Licence

# 6d. Hydrogeology – Source Protection Zones within confined aquifer



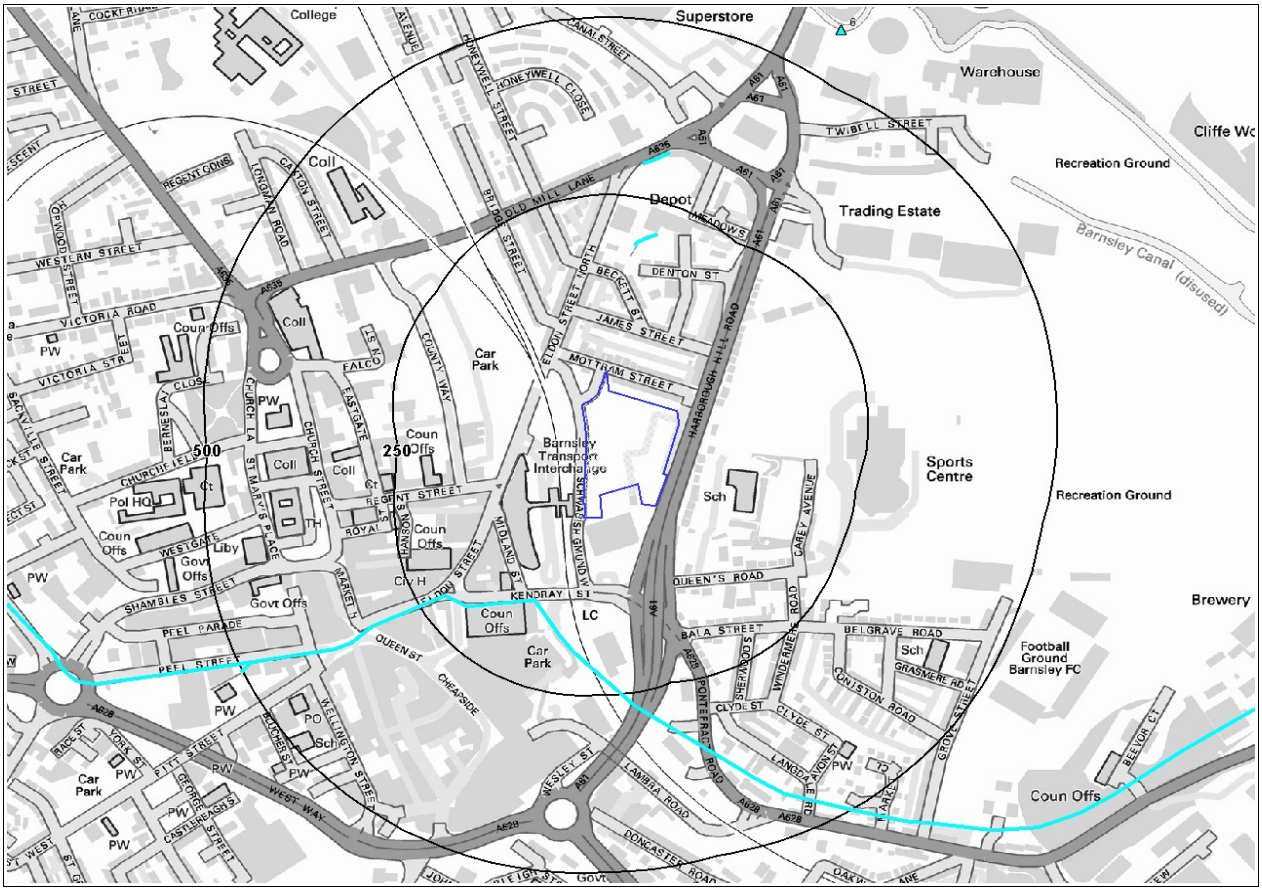

© Crown copyright and database rights 2018
Ordnance Survey license 100035207.

# 6e. Hydrology – Watercourse Network and River Quality

NW N NE

W E

SW S SE




© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.

# 6.Hydrogeology and Hydrology

## 6.1 Aquifer within Superficial Deposits

Records of strata classification within the superficial geology at or in proximity to the property No

Database searched and no data found.

From 1 April 2010, the Environment Agency/Natural Resources Wales's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

## 6.2 Aquifer within Bedrock Deposits

Records of strata classification within the bedrock geology at or in proximity to the property Yes

From 1 April 2010, the Environment Agency/Natural Resources Wales's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Bedrock Geology Map (6b):

| ID | Distance (m) | Direction | Designation | Description |
|---|---|---|---|---|
| 1 | 0 | On Site | Secondary A | Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers |
| 2 | 115 | E | Secondary A | Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers |

## 6.3 Groundwater Abstraction Licences

Groundwater Abstraction Licences within 2000m of the study site Identified

The following Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (6b):

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| 3 | 485 | E | 435336 406441 | Status: Active<br>Licence No: NE/027/0008/014<br>Details: Spray Irrigation - Direct<br>Direct Source: Groundwaters<br>Point: Borehole - Coal Measures - Oakwell Road - Barnsley<br>Data Type: Point<br>Name: Barnsley Football Club 2002 Ltd | Annual Volume ($m^3$): 21400<br>Max Daily Volume ($m^3$): 100<br>Original Application No: NPS/WR/016056<br>Original Start Date: 29/6/2015<br>Expiry Date: 31/3/2029<br>Issue No: 1<br>Version Start Date: 29/6/2015<br>Version End Date: |

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| Not shown | 1153 | SW | 433700 406060 | Status: Historical<br>Licence No: 2/27/08/133<br>Details: Water Bottling<br>Direct Source: Groundwaters<br>Point: Spring-sandstone/middle Coal Measures-shaw Lane<br>Data Type: Point<br>Name: SHELDALE DEVELOPMENTS LTD | Annual Volume ($m^3$): -<br>Max Daily Volume ($m^3$): -<br>Original Application No: 08082<br>Original Start Date: 1/1/2004<br>Expiry Date: 31/3/2017<br>Issue No: 1<br>Version Start Date: 1/1/2004<br>Version End Date: |
| Not shown | 1153 | SW | 433700 406060 | Status: Historical<br>Licence No: 2/27/08/133<br>Details: Water Bottling<br>Direct Source: Groundwaters<br>Point: Spring - Sandstone&middle Coal Measures - Barnsley<br>Data Type: Point<br>Name: SHELDALE DEVELOPMENTS LTD | Annual Volume ($m^3$): 350000<br>Max Daily Volume ($m^3$): 1400<br>Original Application No: 8082<br>Original Start Date: 1/1/2004<br>Expiry Date: 31/3/2017<br>Issue No: 1<br>Version Start Date: 1/1/2004<br>Version End Date: |
| Not shown | 1178 | SW | 433700 406000 | Status: Historical<br>Licence No: 2/27/08/110<br>Details: Water Bottling<br>Direct Source: Groundwaters<br>Point: Well/spring - Sandstone/middle Coal Measures - Shaw Lane<br>Data Type: Point<br>Name: SHELDALE WATER LIMITED | Annual Volume ($m^3$): -<br>Max Daily Volume ($m^3$): -<br>Original Application No: 6598<br>Original Start Date: 23/3/1994<br>Expiry Date: 31/12/2003<br>Issue No: 100<br>Version Start Date: 1/12/1999<br>Version End Date: |
| Not shown | 1178 | SW | 433700 406000 | Status: Historical<br>Licence No: 2/27/08/110<br>Details: Water Bottling<br>Direct Source: Groundwaters<br>Point: Spring-sandstone/middle Coal Measures-shaw Lane<br>Data Type: Point<br>Name: SHELDALE DEVELOPMENTS LTD | Annual Volume ($m^3$): -<br>Max Daily Volume ($m^3$): -<br>Original Application No: 6598<br>Original Start Date: 23/3/1994<br>Expiry Date: 31/12/2003<br>Issue No: 101<br>Version Start Date: 8/4/2003<br>Version End Date: |

## 6.4 Surface Water Abstraction Licences

Surface Water Abstraction Licences within 2000m of the study site Identified

The following Surface Water Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (6b):

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| Not shown | 841 | E | 435704 406846 | Status: Active<br>Licence No: 2/27/08/141/R01<br>Details: Make-Up Or Top Up Water<br>Direct Source: Surface Water<br>Point: River Dearne At Dearne Valley Country Park<br>Data Type: Point<br>Name: BARNSLEY METROPOLITAN BOROUGH COUNCIL | Annual Volume ($m^3$): 5850<br>Max Daily Volume ($m^3$): 86.6<br>Application No: NPS/WR/021590<br>Original Start Date: 12/4/2017<br>Expiry Date: 31/3/2029<br>Issue No: 1<br>Version Start Date: 12/4/2017<br>Version End Date: |
| Not shown | 848 | E | 435710 406850 | Status: Historical<br>Licence No: 2/27/08/141<br>Details: Make-Up Or Top Up Water<br>Direct Source: Surface Water<br>Point: River Dearne<br>Data Type: Point<br>Name: BARNSLEY METROPOLITAN BOROUGH COUNCIL | Annual Volume ($m^3$): 7800<br>Max Daily Volume ($m^3$): 86.6<br>Application No: 8254<br>Original Start Date: 13/3/2007<br>Expiry Date: 31/3/2017<br>Issue No: 1<br>Version Start Date: 1/4/2008<br>Version End Date: |

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| Not shown | 848 | E | 435710 406850 | Status: Historical<br>Licence No: 2/27/08/122<br>Details: Make-Up or Top Up Water<br>Direct Source: Surface Water<br>Point: River Dearne<br>Data Type: Point<br>Name: BARNSLEY METROPOLITAN BOROUGH COUNCIL | Annual Volume ($m^3$): 7800<br>Max Daily Volume ($m^3$): 86.6<br>Application No: 6891<br>Original Start Date: 7/10/1998<br>Expiry Date: 31/10/2006<br>Issue No: 101<br>Version Start Date: 1/8/2002<br>Version End Date: |
| Not shown | 848 | E | 435710 406850 | Status: Historical<br>Licence No: 2/27/08/122<br>Details: Make-Up or Top Up Water<br>Direct Source: Surface Water<br>Point: River Dearne<br>Data Type: Point<br>Name: BARNSLEY METROPOLITAN BOROUGH COUNCIL | Annual Volume ($m^3$): -<br>Max Daily Volume ($m^3$): -<br>Application No: 6891<br>Original Start Date: 7/10/1998<br>Expiry Date: 31/10/2006<br>Issue No: 101<br>Version Start Date: 1/8/2002<br>Version End Date: |

## 6.5 Potable Water Abstraction Licences

Potable Water Abstraction Licences within 2000m of the study site — Identified

The following Potable Water Abstraction Licences records are represented as points, lines and regions on the SPZ and Potable Water Abstraction Licences Map (6c):

| ID | Distance (m) | Direction | NGR | Details | |
|---|---|---|---|---|---|
| Not shown | 1153 | SW | 433700 406060 | Status: Historical<br>Licence No: 2/27/08/133<br>Details: Water Bottling<br>Direct Source: Groundwaters<br>Point: Spring - Sandstone&middle Coal Measures - Barnsley<br>Data Type: Point<br>Name: SHELDALE DEVELOPMENTS LTD | Annual Volume ($m^3$): 350000<br>Max Daily Volume ($m^3$): 1400<br>Original Application No: 8082<br>Original Start Date: 1/1/2004<br>Expiry Date: 31/3/2017<br>Issue No: 1<br>Version Start Date:<br>Version End Date: |
| Not shown | 1153 | SW | 433700 406060 | Status: Historical<br>Licence No: 2/27/08/133<br>Details: Water Bottling<br>Direct Source: Groundwaters<br>Point: Spring-sandstone/middle Coal Measures-shaw Lane<br>Data Type: Point<br>Name: SHELDALE DEVELOPMENTS LTD | Annual Volume ($m^3$): -<br>Max Daily Volume ($m^3$): -<br>Original Application No: 08082<br>Original Start Date: 1/1/2004<br>Expiry Date: 31/3/2017<br>Issue No: 1<br>Version Start Date:<br>Version End Date: |
| Not shown | 1178 | SW | 433700 406000 | Status: Historical<br>Licence No: 2/27/08/110<br>Details: Water Bottling<br>Direct Source: Groundwaters<br>Point: Spring-sandstone/middle Coal Measures-shaw Lane<br>Data Type: Point<br>Name: SHELDALE DEVELOPMENTS LTD | Annual Volume ($m^3$): -<br>Max Daily Volume ($m^3$): -<br>Original Application No: 6598<br>Original Start Date: 23/3/1994<br>Expiry Date: 31/12/2003<br>Issue No: 101<br>Version Start Date:<br>Version End Date: |
| Not shown | 1178 | SW | 433700 406000 | Status: Historical<br>Licence No: 2/27/08/110<br>Details: Water Bottling<br>Direct Source: Groundwaters<br>Point: Well/spring - Sandstone/middle Coal Measures - Shaw Lane<br>Data Type: Point<br>Name: SHELDALE WATER LIMITED | Annual Volume ($m^3$): -<br>Max Daily Volume ($m^3$): -<br>Original Application No: 6598<br>Original Start Date: 23/3/1994<br>Expiry Date: 31/12/2003<br>Issue No: 100<br>Version Start Date:<br>Version End Date: |

## 6.6 Source Protection Zones

Source Protection Zones within 500m of the study site — None identified

Database searched and no data found.

## 6.7 Source Protection Zones within Confined Aquifer

Source Protection Zones within the Confined Aquifer within 500m of the study site — None identified

Historically, Source Protection Zone maps have been focused on regulation of activities which occur at or near the ground surface, such as prevention of point source pollution and bacterial contamination of water supplies. Sources in confined aquifers were often considered to be protected from these surface pressures due to the presence of a low permeability confining layer (e.g. glacial till, clay). The increased interest in subsurface activities such as onshore oil and gas exploration, ground source heating and cooling requires protection zones for confined sources to be marked on SPZ maps where this has not already been done.

Database searched and no data found.

## 6.8 Groundwater Vulnerability and Soil Leaching Potential

Environment Agency/Natural Resources Wales information on groundwater vulnerability and soil leaching potential within 500m of the study site — Identified

| Distance (m) | Direction | Classification | Soil Vulnerability Category | Description |
|---|---|---|---|---|
| 0 | On Site | Minor Aquifer/High Leaching Potential | HU | Soil information for urban areas and restored mineral workings. These soils are therefore assumed to be highly permeable in the absence of site-specific information. |

## 6.9 River Quality

Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site — Identified

### 6.9.1 Biological Quality:

Database searched and no data found.

### 6.9.2 Chemical Quality:

Chemical quality data is based on the General Quality Assessment Headline Indicators scheme (GQAHI). In England, each chemical sample is measured for ammonia and dissolved oxygen. In Wales, the samples are measured for biological oxygen demand (BOD), ammonia and dissolved oxygen. The results are graded from A ('Very Good') to F ('Bad').

The following Chemical Quality records are shown on the Hydrology Map (6e):

| | | | | | Chemical Quality Grade | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ID | Distance (m) | Direction | NGR | River Quality Grade | 2005 | 2006 | 2007 | 2008 | 2009 |
| 6 | 572 | NE | 435100 407200 | River Name: River Dearne<br>Reach: New Lodge Old Mill<br>End/Start of Stretch: Sample Point NGR | D | B | C | C | D |
| Not shown | 870 | NE | 435673 407028 | River Name: River Dearne<br>Reach: New Lodge Old Mill<br>End/Start of Stretch: End of Stretch NGR | D | B | C | C | D |

## 6.10 Ordnance Survey MasterMap Water Network

Ordnance Survey MasterMap Water Network entries within 500m of the study site

This watercourse information is provided by Ordnance Survey MasterMap Water Network. The data provides a detailed centre line following the curve of the waterway precisely, so all distances provided in the report should be understood as measurements to the centreline rather than a measurement to the nearest point of the watercourse. Underground watercourses are inferred from entry and exit points so caution is advised in using these to indicate precise locations of underground watercourses when planning site investigation and development.

The following Ordnance Survey MasterMap Water Network records are represented on the Hydrology Map (6e):

| ID | Distance/ Direction | Name | Type of Watercourse | Additional Details |
|---|---|---|---|---|
| 1 | 133<br>SW | Sough Dike<br>Alternative Name: - | Inland river not influenced by normal tidal action. | Catchment Area: Don and Rother<br>Relationship to Ground Level: On ground surface<br>Permanence: Unclassified.<br>Average Width in Watercourse Section (m): Not Provided |
| 12 | 133<br>SW | Sough Dike<br>Alternative Name: - | Inland river not influenced by normal tidal action. | Catchment Area: Don and Rother<br>Relationship to Ground Level: On ground surface<br>Permanence: Unclassified.<br>Average Width in Watercourse Section (m): Not Provided |
| 2 | 182<br>N | -<br>Alternative Name: - | Inland river not influenced by normal tidal action. | Catchment Area: Don and Rother<br>Relationship to Ground Level: On ground surface<br>Permanence: Unclassified.<br>Average Width in Watercourse Section (m): Not Provided |
| 13 | 182<br>N | -<br>Alternative Name: - | Inland river not influenced by normal tidal action. | Catchment Area: Don and Rother<br>Relationship to Ground Level: On ground surface<br>Permanence: Unclassified.<br>Average Width in Watercourse Section (m): Not Provided |
| 3 | 297<br>N | -<br>Alternative Name: - | Inland river not influenced by normal tidal action. | Catchment Area: Don and Rother<br>Relationship to Ground Level: On ground surface<br>Permanence: Unclassified.<br>Average Width in Watercourse Section (m): 1.3 |

| ID | Distance/ Direction | Name | Type of Watercourse | Additional Details |
|---|---|---|---|---|
| Not shown | 297<br>N | -<br>Alternative Name: - | Inland river not influenced by normal tidal action. | Catchment Area: Don and Rother<br>Relationship to Ground Level: On ground surface<br>Permanence: Unclassified.<br>Average Width in Watercourse Section (m): 1.3 |
| 4 | 485<br>SW | -<br>Alternative Name: - | Inland river not influenced by normal tidal action. | Catchment Area: Don and Rother<br>Relationship to Ground Level: On ground surface<br>Permanence: Unclassified.<br>Average Width in Watercourse Section (m): Not Provided |
| 5 | 485<br>SW | Sough Dike<br>Alternative Name: - | Inland river not influenced by normal tidal action. | Catchment Area: Don and Rother<br>Relationship to Ground Level: On ground surface<br>Permanence: Unclassified.<br>Average Width in Watercourse Section (m): Not Provided |
| Not shown | 485<br>SW | -<br>Alternative Name: - | Inland river not influenced by normal tidal action. | Catchment Area: Don and Rother<br>Relationship to Ground Level: On ground surface<br>Permanence: Unclassified.<br>Average Width in Watercourse Section (m): Not Provided |
| Not shown | 485<br>SW | Sough Dike<br>Alternative Name: - | Inland river not influenced by normal tidal action. | Catchment Area: Don and Rother<br>Relationship to Ground Level: On ground surface<br>Permanence: Unclassified.<br>Average Width in Watercourse Section (m): Not Provided |

## 6.11 Surface Water Features

Surface water features within 250m of the study site Identified

The following surface water records are not represented on mapping:

| Distance (m) | Direction |
|---|---|
| 166 | N |

# 7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)

NW N NE

W




E

SW S SE

© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.

Site Outline

100
250
Search Buffers (m)

Zone 2 Floodplain

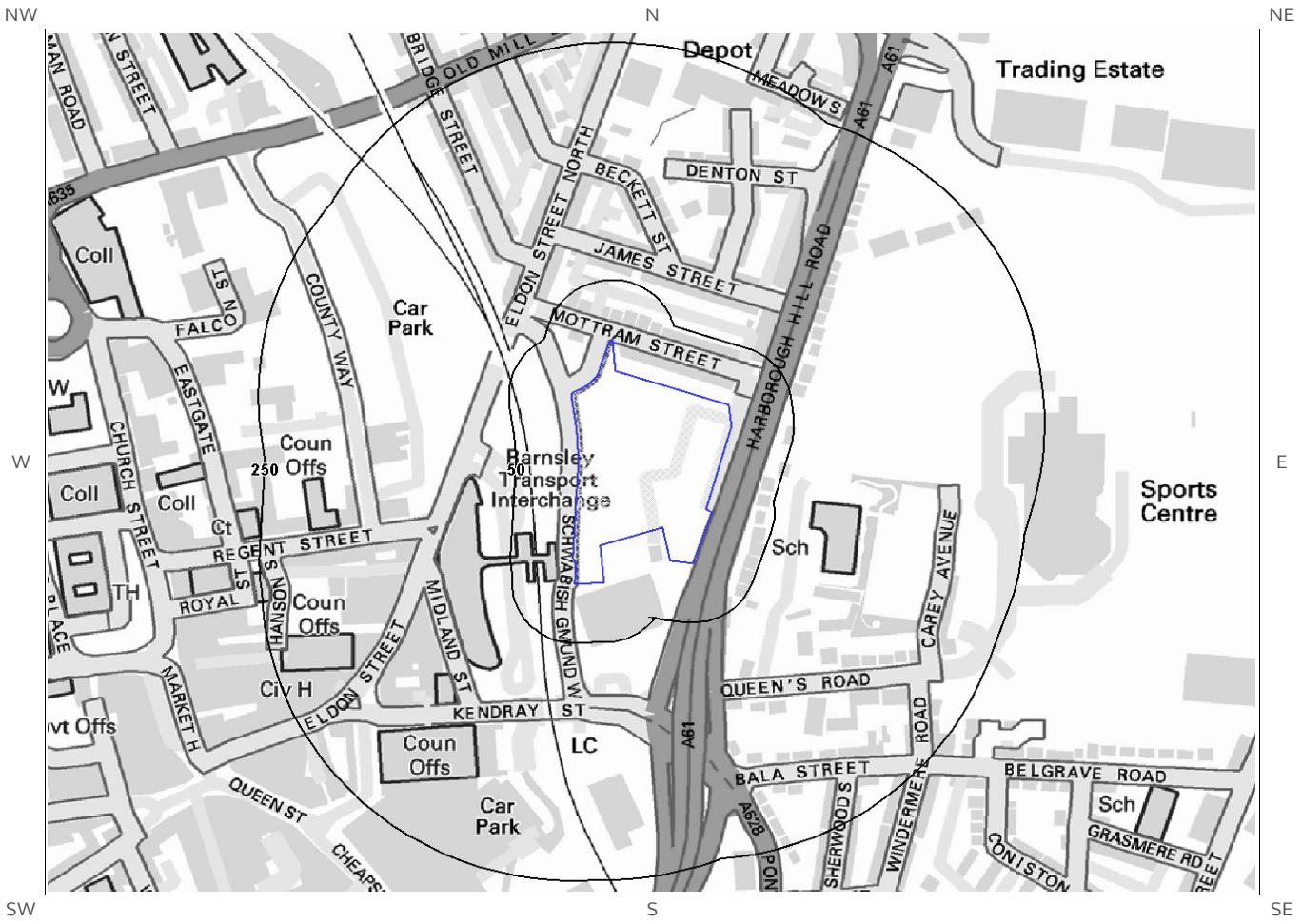
Zone 3 Floodplain

Flood Defences

Area used for Flood Storage

Area Benefiting from Flood Defences

# 7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS) Map




© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.

Site Outline

100
250
Search Buffers (m)

RoFRaS Rating

- Very Low
- Low
- Medium
- High

# 7 Flooding

## 7.1 River and Coastal Zone 2 Flooding

Environment Agency/Natural Resources Wales Zone 2 floodplain within 250m — None identified

Environment Agency/Natural Resources Wales Zone 2 floodplains estimate the annual probability of flooding as between 1 in 1000 (0.1%) and 1 in 100 (1%) from rivers and between 1 in 1000 (0.1%) and 1 in 200 (0.5%) from the sea. Any relevant data is represented on Map 7a – Flood Map for Planning:

Database searched and no data found.

## 7.2 River and Coastal Zone 3 Flooding

Environment Agency/Natural Resources Wales Zone 3 floodplain within 250m — None identified

Zone 3 shows the extent of a river flood with a 1 in 100 (1%) or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year. Any relevant data is represented on Map 7a – Flood Map for Planning.

Database searched and no data found.

## 7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating

Highest risk of flooding onsite — Very Low

The Environment Agency/Natural Resources Wales RoFRaS database provides an indication of river and coastal flood risk at a national level on a 50m grid with the flood rating at the centre of the grid calculated and given above. The data considers the probability that the flood defences will overtop or breach by considering their location, type, condition and standard of protection.

RoFRaS data for the study site indicates the property is in an area with a Very Low (less than 1 in 1000) chance of flooding in any given year.

## 7.4 Flood Defences

Flood Defences within 250m of the study site — None identified

Database searched and no data found.

## 7.5 Areas benefiting from Flood Defences

Areas benefiting from Flood Defences within 250m of the study site — None identified

## 7.6 Areas benefiting from Flood Storage

| | |
|---|---|
| Areas used for Flood Storage within 250m of the study site | None identified |

## 7.7 Groundwater Flooding Susceptibility Areas

| | |
|---|---|
| 7.7.1 British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site | Identified |
| Clearwater Flooding or Superficial Deposits Flooding | Clearwater Flooding |

Notes: Groundwater flooding may either be associated with shallow unconsolidated sedimentary aquifers which overlie unproductive aquifers (Superficial Deposits Flooding), or with unconfined aquifers (Clearwater Flooding).

7.7.2 Highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions

Potential at Surface

Where potential for groundwater flooding to occur at surface is indicated, this means that given the geological conditions in the area groundwater flooding hazard should be considered in all land-use planning decisions. It is recommended that other relevant information e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information be investigated in order to establish relative, but not absolute, risk of groundwater flooding.

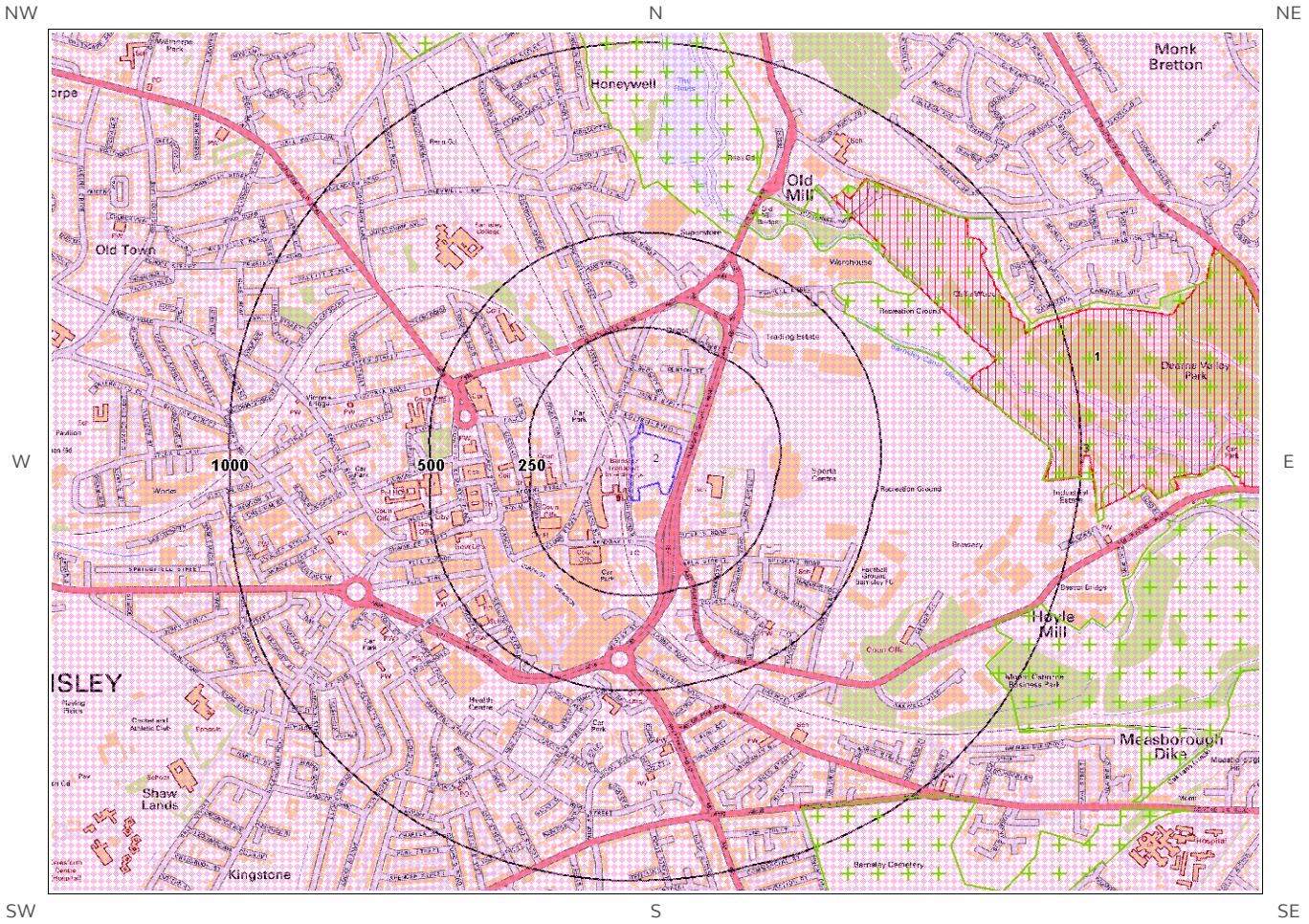
## 7.8 Groundwater Flooding Confidence Areas

| | |
|---|---|
| British Geological Survey confidence rating in this result | Low |

Notes: Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

The confidence rating is on a threefold scale - Low, Moderate and High. This provides a relative indication of the BGS confidence in the accuracy of the susceptibility result for groundwater flooding. This is based on the amount and precision of the information used in the assessment. In areas with a relatively lower level of confidence the susceptibility result should be treated with more caution. In other areas with higher levels of confidence the susceptibility result can be used with more confidence.

# 8. Designated Environmentally Sensitive Sites Map




© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.

# 8. Designated Environmentally Sensitive Sites

| Designated Environmentally Sensitive Sites within 2000m of the study site | Identified |
|---|---|

## 8.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:

0

Database searched and no data found.

## 8.2 Records of National Nature Reserves (NNR) within 2000m of the study site:

0

Database searched and no data found.

## 8.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site:

0

Database searched and no data found.

## 8.4 Records of Special Protection Areas (SPA) within 2000m of the study site:

0

Database searched and no data found.

## 8.5 Records of Ramsar sites within 2000m of the study site:

0

Database searched and no data found.

## 8.6 Records of Ancient Woodland within 2000m of the study site:

0

Database searched and no data found.

## 8.7 Records of Local Nature Reserves (LNR) within 2000m of the study site:

1

The following Local Nature Reserve (LNR) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

| ID | Distance (m) | Direction | LNR Name | Data Source |
|---|---|---|---|---|
| 1 | 708 | NE | Dearne Valley Park | Natural England |

## 8.8 Records of World Heritage Sites within 2000m of the study site:

0

Database searched and no data found.

## 8.9 Records of Environmentally Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

## 8.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site:

0

Database searched and no data found.

## 8.11 Records of National Parks (NP) within 2000m of the study site:

0

Database searched and no data found.

## 8.12 Records of Nitrate Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

## 8.13 Records of Nitrate Vulnerable Zones within 2000m of the study site:

1

The following Nitrate Vulnerable Zone records produced by DEFRA are represented as polygons on the Designated Environmentally Sensitive Sites Map:

| ID | Distance (m) | Direction | NVZ Name | Data Source |
|---|---|---|---|---|
| 2 | 0 | On Site | Existing | DEFRA |

## 8.14 Records of Green Belt land within 2000m of the study site:

2

Green Belt data contains Ordnance Survey data © Crown copyright and database right [2015].

| ID | Distance | Direction | Green Belt Name | Local Authority Name |
|---|---|---|---|---|
| 3 | 535 | NE | Liverpool, Manchester and West Yorks Greenbelt | Barnsley District (B) |
| Not shown | 1692 | S | Liverpool, Manchester and West Yorks Greenbelt | Barnsley District (B) |

# 9. Natural Hazards Findings

## 9.1 Detailed BGS GeoSure Data

BGS GeoSure Data has been searched to 50m. The data is included in tabular format. If you require further information on geology and ground stability, please obtain a Groundsure Geo Insight, available from our website. The following information has been found:

### 9.1.1 Shrink Swell

Maximum Shrink-Swell* hazard rating identified on the study site — Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

| Hazard |
|---|
| Ground conditions predominantly low plasticity. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with shrink-swell clays. |

### 9.1.2 Landslides

Maximum Landslide* hazard rating identified on the study site — Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

| Hazard |
|---|
| Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property no significant increase in insurance risk due to natural slope instability problems. |

### 9.1.3 Soluble Rocks

Maximum Soluble Rocks* hazard rating identified on the study site — Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

| Hazard |
|---|
| Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks. |

* This indicates an automatically generated 50m buffer and site.

### 9.1.4 Compressible Ground

Maximum Compressible Ground* hazard rating identified on the study site — Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

| Hazard |
| --- |
| No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits. |

### 9.1.5 Collapsible Rocks

Maximum Collapsible Rocks* hazard rating identified on the study site — Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

| Hazard |
| --- |
| Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits. |

### 9.1.6 Running Sand

Maximum Running Sand** hazard rating identified on the study site — Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

| Hazard |
| --- |
| No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand. |

* This indicates an automatically generated 50m buffer and site.

## 9.2 Radon

### 9.2.1 Radon Affected Areas

Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? The site is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.

The radon data in this report is supplied by the BGS/Public Health England and is the definitive map of Radon Affected Areas in Great Britain and Northern Ireland. The dataset was created using long-term radon measurements in over 479,000 homes across Great Britain and 23,000 homes across Northern Ireland, combined with geological data. The dataset is considered accurate to 50m to allow for the margin of error in geological lines, and the findings of this report supercede any answer given in the less accurate Indicative Atlas of Radon in Great Britain, which simplifies the data to give the highest risk within any given 1km grid square. As such, the radon atlas is considered indicative, whereas the data given in this report is considered definitive.

---

### 9.2.2 Radon Protection

Is the property in an area where Radon Protection are required for new properties or extensions to existing
ones as described in publication BR211 by the Building Research Establishment? No radon protective measures are necessary.

# 10. Mining

## 10.1 Coal Mining

Coal mining areas within 75m of the study site — Identified

The following coal mining information provided by the Coal Authority is not represented on Mapping:

| Distance (m) | Direction | Details |
|---|---|---|
| 0 | On Site | The study site is located within the specified search distance of an identified mining area. Further details concerning this can be obtained from the Coal Authority Helpline on 0845 762 6848. |

## 10.2 Non-Coal Mining

Non-Coal Mining areas within 50m of the study site boundary — Identified

The following non-coal mining information is provided by the BGS:

| Distance (m) | Direction | Name | Commodity | Assessment of likelihood |
|---|---|---|---|---|
| 0.0 | On Site | Not available | Iron Ore (Bedded) | Localised small scale underground mining may have occurred. Potential for difficult ground conditions are unlikely or localised and are at a level where they need not be considered |

Past underground mine workings may occur. The rock types present in these areas are such that small mineral veins may be present on which it is possible that small scale mining has been undertaken and/or it is possible that limited underground extraction of other materials may have occurred. All such occurrences are likely to be of minor localised extent and infrequent. It should be noted, however, that there is always the possibility of the existence of other sub-surface excavations, such as wells, cess pits, follies, air raid shelters/bunkers and other military structures etc. that could affect surface ground stability but which are outside the scope of this dataset. However, if in a coalfield area you should still consider a Coal Authority mining search for the area of interest.

## 10.3 Brine Affected Areas

Brine affected areas within 75m of the study site — None identified
Guidance: No Guidance Required.

# Contact Details

**Groundsure Helpline**
Telephone: 08444 159 000
info@groundsure.com

**British Geological Survey Enquiries**
Kingsley Dunham Centre
Keyworth, Nottingham NG12 5GG
Tel: 0115 936 3143.
Fax: 0115 936 3276.
Email:
Web:**www.bgs.ac.uk**
BGS Geological Hazards Reports and general geological enquiries:
**enquiries@bgs.ac.uk**

**Environment Agency**
National Customer Contact Centre, PO Box 544
Rotherham, S60 1BY
Tel: 03708 506 506
Web: **www.environment-agency.gov.uk**
Email: enquiries@environment-agency.gov.uk

**Public Health England**
Public information access office
Public Health England, Wellington House
133-155 Waterloo Road, London, SE1 8UG
www.gov.uk/phe
Email:**enquiries@phe.gov.uk**
Main switchboard**: 020 7654 8000**

**The Coal Authority**
200 Lichfield Lane
Mansfield
Notts NG18 4RG
Tel: 0345 7626 848
DX 716176 Mansfield 5
**www.coal.gov.uk**

**Ordnance Survey**
Adanac Drive, Southampton
SO16 0AS
Tel: 08456 050505

**Local Authority**
Authority: Barnsley Metropolitan Borough Council
Phone: 01226 770770
Web: http://www.barnsley.gov.uk/
Address: PO Box 634, Barnsley, South Yorkshir, S70 9GG

**Gemapping PLC**
Virginia Villas, High Street, Hartley Witney,
Hampshire RG27 8NW
Tel: 01252 845444

Acknowledgements: Site of Special Scientific Interest, National Nature Reserve, Ramsar Site, Special Protection Area, Special Area of Conservation data is provided by, and used with the permission of, Natural England/Natural Resources Wales who retain the Copyright and Intellectual Property Rights for the data.
PointX © Database Right/Copyright, Thomson Directories Limited © Copyright Link Interchange Network Limited © Database Right/Copyright and Ordnance Survey © Crown Copyright and/or Database Right. All Rights Reserved. Licence Number [03421028].
This report has been prepared in accordance with the Groundsure Ltd standard Terms and Conditions of business for work of this nature.

# Standard Terms and Conditions

Groundsure's Terms and Conditions can be viewed online at this link:

https://www.groundsure.com/terms-and-conditions-may25-2018

# Appendix E

# GeoInsight Report

Groundsure
LOCATION INTELLIGENCE

Hamson Barron Smith Ltd

16 CENTRAL AVENUE, ST. ANDREWS BUSINESS PARK,
NORWICH, NR7 0HR

| | |
|---|---|
| Groundsure Reference: | GS-5235676 |
| Your Reference: | Schwabisch_Gmund_Way_PO23003026 |
| Report Date | 13 Jul 2018 |
| Report Delivery Method: | Email - pdf |

## Geo Insight

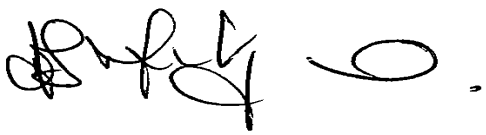
Address: Schwabisch Gmund Way, S71 1BP

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Geo Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above Groundsure reference number.

Yours faithfully,



Managing Director
Groundsure Limited

Enc.
Groundsure Geo Insight

# Geo Insight

| | |
|---|---|
| **Address:** | **Schwabisch Gmund Way, S71 1BP** |
| **Date:** | **13 Jul 2018** |
| **Reference:** | **GS-5235676** |
| **Client:** | **Hamson Barron Smith Ltd** |

NW N NE

W E



SW S SE

| | |
|---|---|
| Aerial Photograph Capture date: | 07-Jun-2013 |
| Grid Reference: | 434810,406621 |
| Site Size: | 1.61ha |

Groundsure
LOCATION INTELLIGENCE

# Contents Page


Contents Page ... 3
Overview of Findings ... 5
1:10,000 Scale Availability ... 8
Availability of 1:10,000 Scale Geology Mapping ... 9
1 Geology (1:10,000 scale) ... 10
1.1 Artificial Ground map (1:10,000 scale) ... 10
1. Geology 1:10,000 scale ... 11
1.1 Artificial Ground ... 11
1.2 Superficial Deposits and Landslips map (1:10,000 scale) ... 12
1.2 Superficial Deposits and Landslips ... 13
1.2.1 Superficial Deposits/ Drift Geology ... 13
1.2.2 Landslip ... 13
1.3 Bedrock and linear features map (1:10,000 scale) ... 14
1.3 Bedrock and linear features ... 15
1.3.1 Bedrock/ Solid Geology ... 15
1.3.2 Linear features ... 16
2 Geology 1:50,000 Scale ... 18
2.1 Artificial Ground map ... 18
2. Geology 1:50,000 scale ... 19
2.1 Artificial Ground ... 19
2.1.1 Artificial/ Made Ground ... 19
2.1.2 Permeability of Artificial Ground ... 19
2.2 Superficial Deposits and Landslips map (1:50,000 scale) ... 20
2.2 Superficial Deposits and Landslips ... 21
2.2.1 Superficial Deposits/ Drift Geology ... 21
2.2.2 Permeability of Superficial Ground ... 21
2.2.3 Landslip ... 21
2.2.4 Landslip Permeability ... 21
2.3 Bedrock and linear features map (1:50,000 scale) ... 22
2.3 Bedrock, Solid Geology & linear features ... 23
2.3.1 Bedrock/Solid Geology ... 23
2.3.2 Permeability of Bedrock Ground ... 23
2.3.3 Linear features ... 23
3 Radon Data ... 25
3.1 Radon Affected Areas ... 25
3.2 Radon Protection ... 25
4 Ground Workings map ... 26
4 Ground Workings ... 27
4.1 Historical Surface Ground Working Features derived from Historical Mapping ... 27
4.2 Historical Underground Working Features derived from Historical Mapping ... 28
4.3 Current Ground Workings ... 29
5 Mining, Extraction & Natural Cavities ... 31
5.1 Historical Mining ... 31
5.2 Coal Mining ... 32
5.3 Johnson Poole and Bloomer ... 32
5.4 Non-Coal Mining ... 32
5.5 Non-Coal Mining Cavities ... 33
5.6 Natural Cavities ... 33
5.7 Brine Extraction ... 33
5.8 Gypsum Extraction ... 33
5.9 Tin Mining ... 34
5.10 Clay Mining ... 34
6 Natural Ground Subsidence ... 35
6.1 Shrink-Swell Clay map ... 35
6.2 Landslides map ... 36
6.3 Ground Dissolution of Soluble Rocks map ... 37
6.4 Compressible Deposits map ... 38
6.5 Collapsible Deposits map ... 39
6.6 Running Sand map ... 40

6 Natural Ground Subsidence ..... 41
6.1 Shrink-Swell Clays ..... 41
6.2 Landslides ..... 41
6.3 Ground Dissolution of Soluble Rocks ..... 42
6.4 Compressible Deposits ..... 42
6.5 Collapsible Deposits ..... 42
6.6 Running Sands ..... 42
7 Borehole Records ..... 44
8 Estimated Background Soil Chemistry ..... 47
9 Railways and Tunnels map ..... 48
9 Railways and Tunnels ..... 49
9.1 Tunnels ..... 49
9.2 Historical Railway and Tunnel Features ..... 49
9.3 Historical Railways ..... 51
9.4 Active Railways ..... 51
9.5 Railway Projects ..... 52

# Overview of Findings

The Groundsure Geo Insight provides high quality geo-environmental information that allows geo-environmental professionals and their clients to make informed decisions and be forewarned of potential ground instability problems that may affect the ground investigation, foundation design and possibly remediation options that could lead to possible additional costs.

The report is based on the BGS 1:50,000 and 1:10,000 Digital Geological Map of Great Britain, BGS Geosure data; BRITPITS database; Non-coal mining data and Borehole Records, Coal Authority data including brine extraction areas, PBA non-coal mining and natural cavities database, Johnson Poole and Bloomer mining data and Groundsure's unique database including historical surface ground and underground workings.

For further details on each dataset, please refer to each individual section in the report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

| Section 1: Geology 1:10,000 Scale | | |
|---|---|---|
| 1.1 Artificial Ground | 1.1 Is there any Artificial Ground/ Made Ground present beneath the study site at 1:10,000 scale? | No |
| 1.2 Superficial Geology and Landslips | 1.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site at 1:10,000 scale?* | No |
| | 1.2.2 Are there any records of landslip within 500m of the study site boundary at 1:10,000 scale? | No |
| 1.3 Bedrock, Solid Geology and linear features | 1.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section. | |
| | 1.3.2 Are there any records of linear features within 500m of the study site boundary at 1:10,000 scale? | Yes |

| Section 2: Geology 1:50,000 Scale | | |
|---|---|---|
| 2.1 Artificial Ground | 2.1.1 Is there any Artificial Ground/ Made Ground present beneath the study site? | No |
| | 2.1.2 Are there any records relating to permeability of artificial ground within the study site*boundary? | No |
| 2.2 Superficial Geology and Landslips | 2.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site?* | No |
| | 2.2.2 Are there any records of permeability of superficial ground within 500m of the study site? | No |
| | 2.2.3 Are there any records of landslip within 500m of the study site boundary? | No |
| | 2.2.4 Are there any records relating to permeability of landslips within the study site* boundary? | No |

## Section 2: Geology 1:50,000 Scale

| | | |
|---|---|---|
| 2.3 Bedrock, Solid Geology and linear features | 2.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section. | |
| | 2.3.2 Are there any records relating to permeability of bedrock ground within the study site boundary? | Yes |
| | 2.3.3 Are there any records of linear features within 500m of the study site boundary? | Yes |

## Section 3: Radon

| | | |
|---|---|---|
| 3. Radon | 3.1Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? | The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level. |
| | 3.2Radon Protection | No radon protective measures are necessary. |

| Section 4: Ground Workings | On-site | 0-50m | 51-250 | 251-500 | 501-1000 |
|---|---|---|---|---|---|
| 4.1 Historical Surface Ground Working Features from Small Scale Mapping | 0 | 0 | 18 | Not Searched | Not Searched |
| 4.2 Historical Underground Workings from Small Scale Mapping | 0 | 0 | 5 | 0 | 10 |
| 4.3 Current Ground Workings | 0 | 0 | 0 | 3 | 10 |

| Section 5: Mining, Extraction & Natural Cavities | On-site | 0-50m | 51-250 | 251-500 | 501-1000 |
|---|---|---|---|---|---|
| 5.1 Historical Mining | 0 | 0 | 5 | 0 | 10 |
| 5.2 Coal Mining | 1 | 0 | 0 | 0 | 0 |
| 5.3 Johnson Poole and Bloomer Mining Area | 0 | 0 | 0 | 0 | 0 |
| 5.4 Non-Coal Mining* | 1 | 0 | 5 | 2 | 1 |
| 5.5 Non–Coal Mining Cavities | 0 | 0 | 0 | 0 | 0 |
| 5.5 Natural Cavities | 0 | 0 | 0 | 0 | 0 |

| Section 5: Mining, Extraction & Natural Cavities | On-site | 0-50m | 51-250 | 251-500 | 501-1000 |
|---|---|---|---|---|---|
| 5.6 Brine Extraction | 0 | 0 | 0 | 0 | 0 |
| 5.7 Gypsum Extraction | 0 | 0 | 0 | 0 | 0 |
| 5.8 Tin Mining | 0 | 0 | 0 | 0 | 0 |
| 5.9 Clay Mining | 0 | 0 | 0 | 0 | 0 |

| Section 6: Natural Ground Subsidence | On-site |
|---|---|
| 6.1 Shrink-Swell Clay | Very Low |
| 6.2 Landslides | Low |
| 6.3 Ground Dissolution of Soluble Rocks | Negligible |
| 6.4 Compressible Deposits | Negligible |
| 6.5 Collapsible Deposits | Very Low |
| 6.5 Running Sand | Negligible |

| Section 7: Borehole Records | On-site | 0-50m | 51-250 |
|---|---|---|---|
| 7 BGS Recorded Boreholes | 0 | 0 | 45 |

| Section 8: Estimated Background Soil Chemistry | On-site | 0-50m | 51-250 |
|---|---|---|---|
| 8 Records of Background Soil Chemistry | 1 | 1 | 0 |

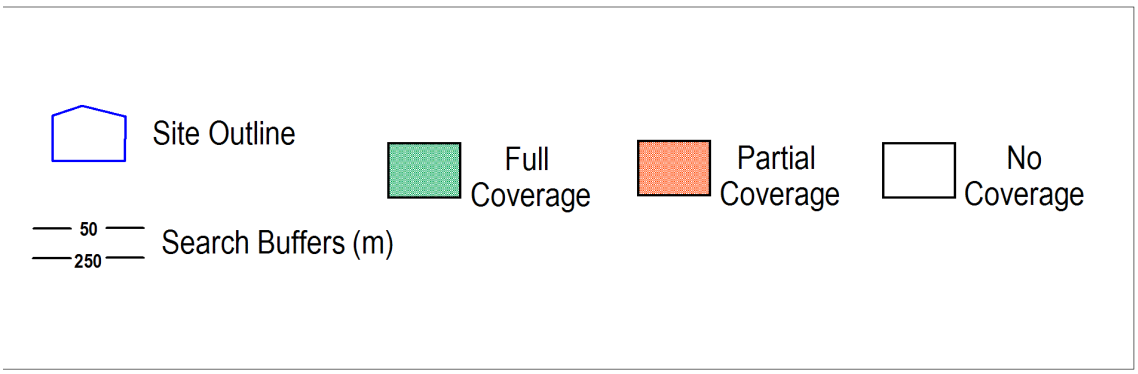
| Section 9: Railways and Tunnels | On-site | 0-50m | 51-250 | 250-500 |
|---|---|---|---|---|
| 9.1 Tunnels | 0 | 0 | 0 | Not Searched |
| 9.2 Historical Railway and Tunnel Features | 15 | 10 | 26 | Not Searched |
| 9.3 Historical Railways | 0 | 0 | 0 | Not Searched |
| 9.4 Active Railways | 0 | 6 | 16 | Not Searched |
| 9.5 Railway Projects | 0 | 0 | 0 | 0 |

# 1:10,000 Scale Availability




1_10,000 Availability Legend

© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.



# Availability of 1:10,000 Scale Geology Mapping

The following information represents the availability of the key components of the 1:10,000 scale geological data.

| ID | Distance | Artificial Coverage | Superficial Coverage | Bedrock Coverage | Mass Movement Coverage |
|---|---|---|---|---|---|
| 1 | 0.0 | Some deposits are mapped | Full | Full | Some deposits are mapped |
| 2 | 115.0 | Some deposits are mapped | Full | Full | No coverage |
| N3 | 1514.0 | Some deposits are mapped | Full | Full | Some deposits are mapped |
| N4 | 1530.0 | Some deposits are mapped | Full | Full | Some deposits are mapped |

Guidance: The 1:10,000 scale geological interpretation is the most detailed generally available from BGS and is the scale at which most geological surveying is carried out in the field. The database is presented as four types of geology (artificial, mass movement, superficial and bedrock), although not all themes are mapped or available on every map sheet. Therefore a coverage layer showing the availability of the four themes is presented above.

The definitions of coverage are as follows:

| Geology | Full Coverage | Partial Coverage | No Coverage |
|---|---|---|---|
| Bedrock | The whole tile has been mapped | Some but not all the tile has been mapped | No coverage |
| Superficial | The whole tile has been mapped | Some but not all of the tile has been mapped | No coverage |
| Artificial | Some deposits are mapped on this tile | - | No deposits are mapped |
| Mass Movement | Some deposits are mapped on this tile | - | No coverage |

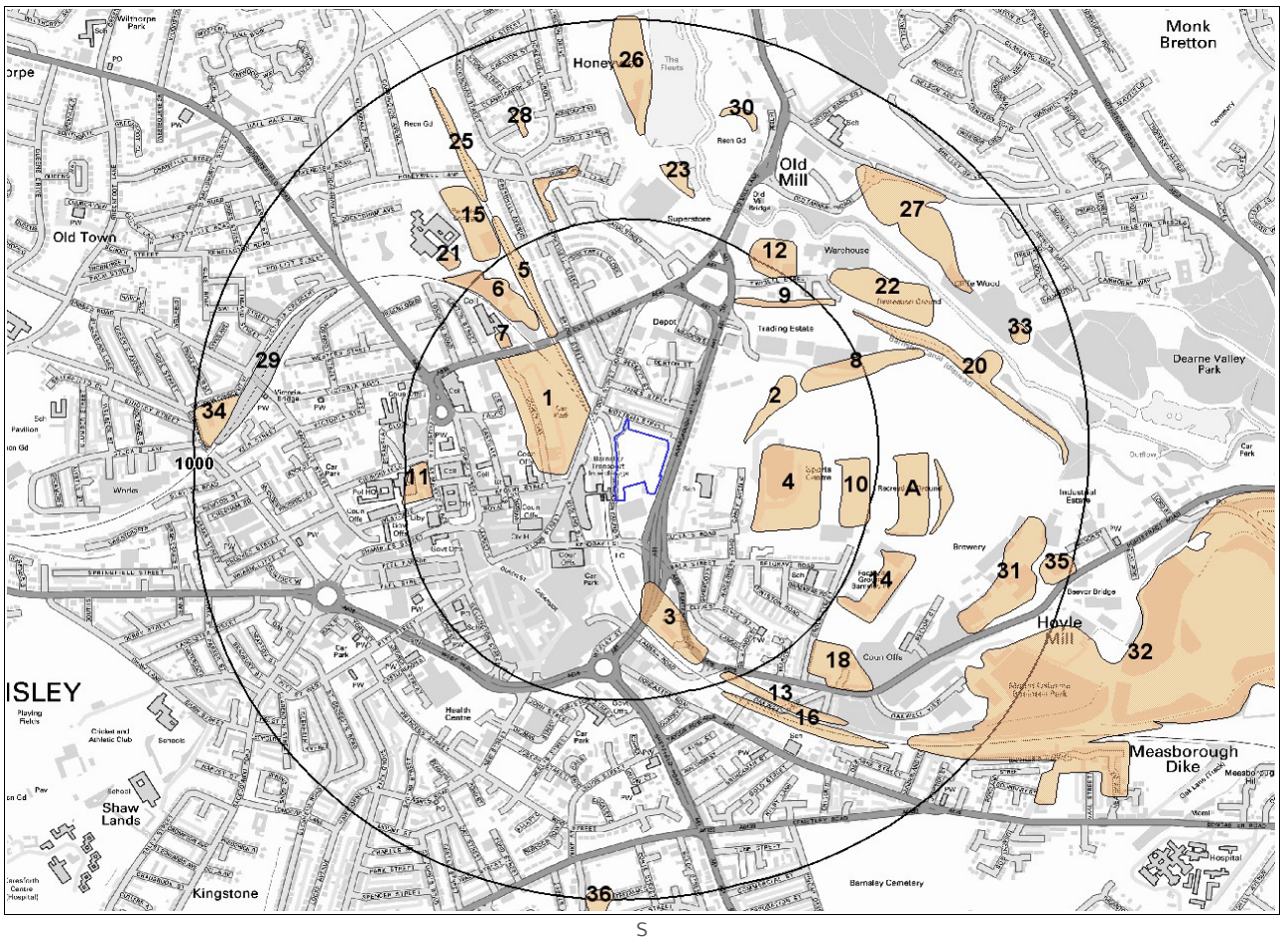
# 1 Geology (1:10,000 scale).

# 1.1 Artificial Ground map (1:10,000 scale)

NW N NE

W E

SW S SE




**Artificial Ground Legend**

© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.

Site Outline

500
1000
Search Buffers (m)

Made Ground (undivided)

Disturbed Ground (undivided)

Worked Ground (undivided)

Landscaped Ground (undivided)

Infilled Ground

Reclaimed Ground

# 1. Geology 1:10,000 scale

## 1.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

Are there any records of Artificial/ Made Ground within 500m of the study site boundary at 1:10,000 scale? Yes

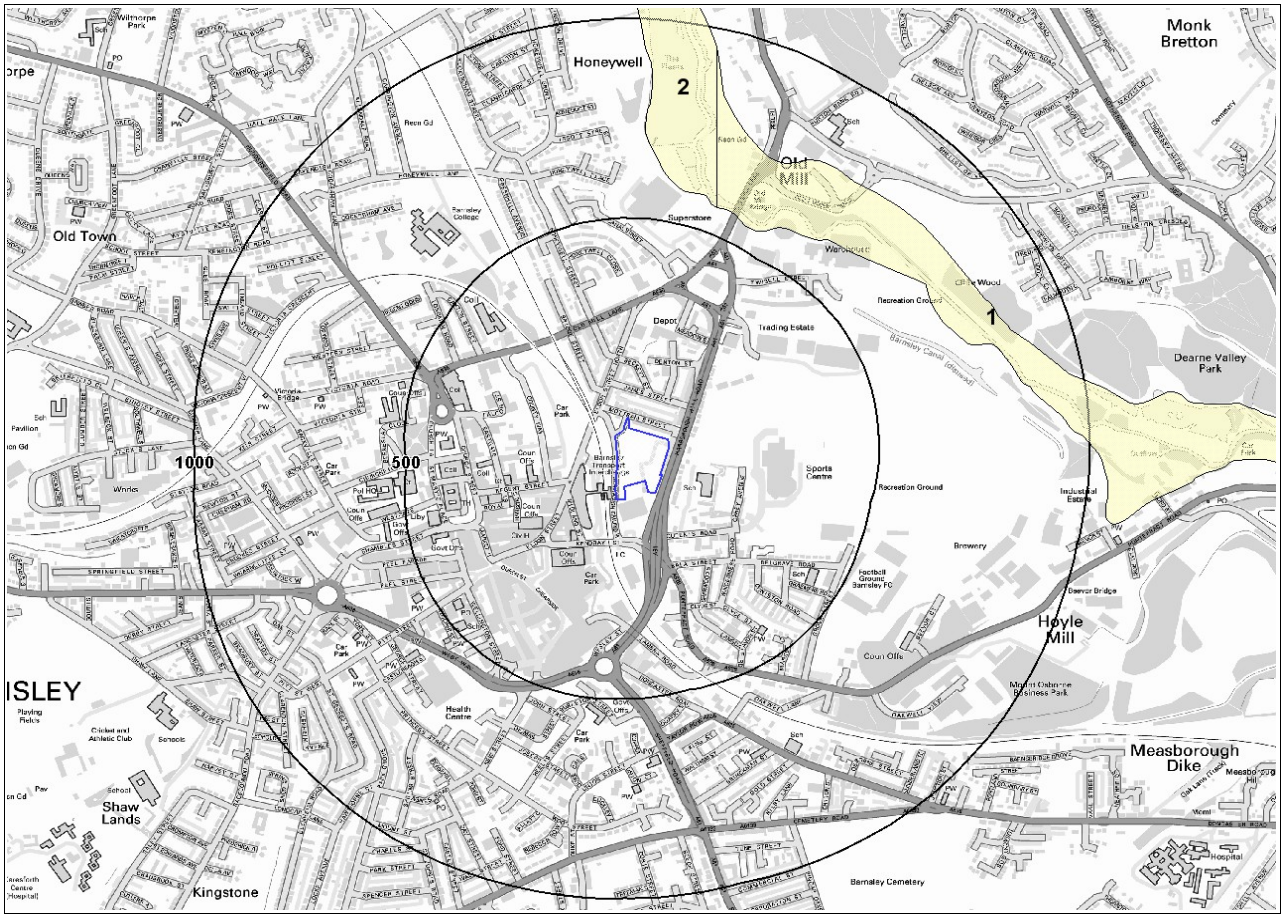
| ID | Distance | Direction | LEX Code | Description | Rock Description |
|---|---|---|---|---|---|
| 1 | 76.0 | W | MGR-ARTDP | Made Ground (Undivided) | Artificial Deposit |
| 2 | 182.0 | E | MGR-ARTDP | Made Ground (Undivided) | Artificial Deposit |
| 3 | 210.0 | S | MGR-ARTDP | Made Ground (Undivided) | Artificial Deposit |
| 4 | 222.0 | E | MGR-ARTDP | Made Ground (Undivided) | Artificial Deposit |
| 5 | 268.0 | NW | MGR-ARTDP | Made Ground (Undivided) | Artificial Deposit |
| 6 | 310.0 | NW | MGR-ARTDP | Made Ground (Undivided) | Artificial Deposit |
| 7 | 330.0 | NW | MGR-ARTDP | Made Ground (Undivided) | Artificial Deposit |
| 8 | 347.0 | NE | MGR-ARTDP | Made Ground (Undivided) | Artificial Deposit |
| 9 | 382.0 | NE | MGR-ARTDP | Made Ground (Undivided) | Artificial Deposit |
| 10 | 398.0 | E | MGR-ARTDP | Made Ground (Undivided) | Artificial Deposit |
| 11 | 432.0 | W | MGR-ARTDP | Made Ground (Undivided) | Artificial Deposit |
| 12 | 475.0 | NE | MGR-ARTDP | Made Ground (Undivided) | Artificial Deposit |
| 13 | 476.0 | S | MGR-ARTDP | Made Ground (Undivided) | Artificial Deposit |

# 1.2 Superficial Deposits and Landslips map (1:10,000 scale)

NW N NE

W E

SW S SE




**Artificial Ground Legend**

© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.

Site Outline

500
1000
Search Buffers (m)

# 1.2 Superficial Deposits and Landslips

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping

## 1.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary at 1:10,000 scale? No

Database searched and no data found.

---

## 1.2.2 Landslip

Are there any records of Landslip within 500m of the study site boundary at 1:10,000 scale?

No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:10,000 scale

This Geology shows the main components as discrete layers, these are: Artificial / Made Ground, Superficial / Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

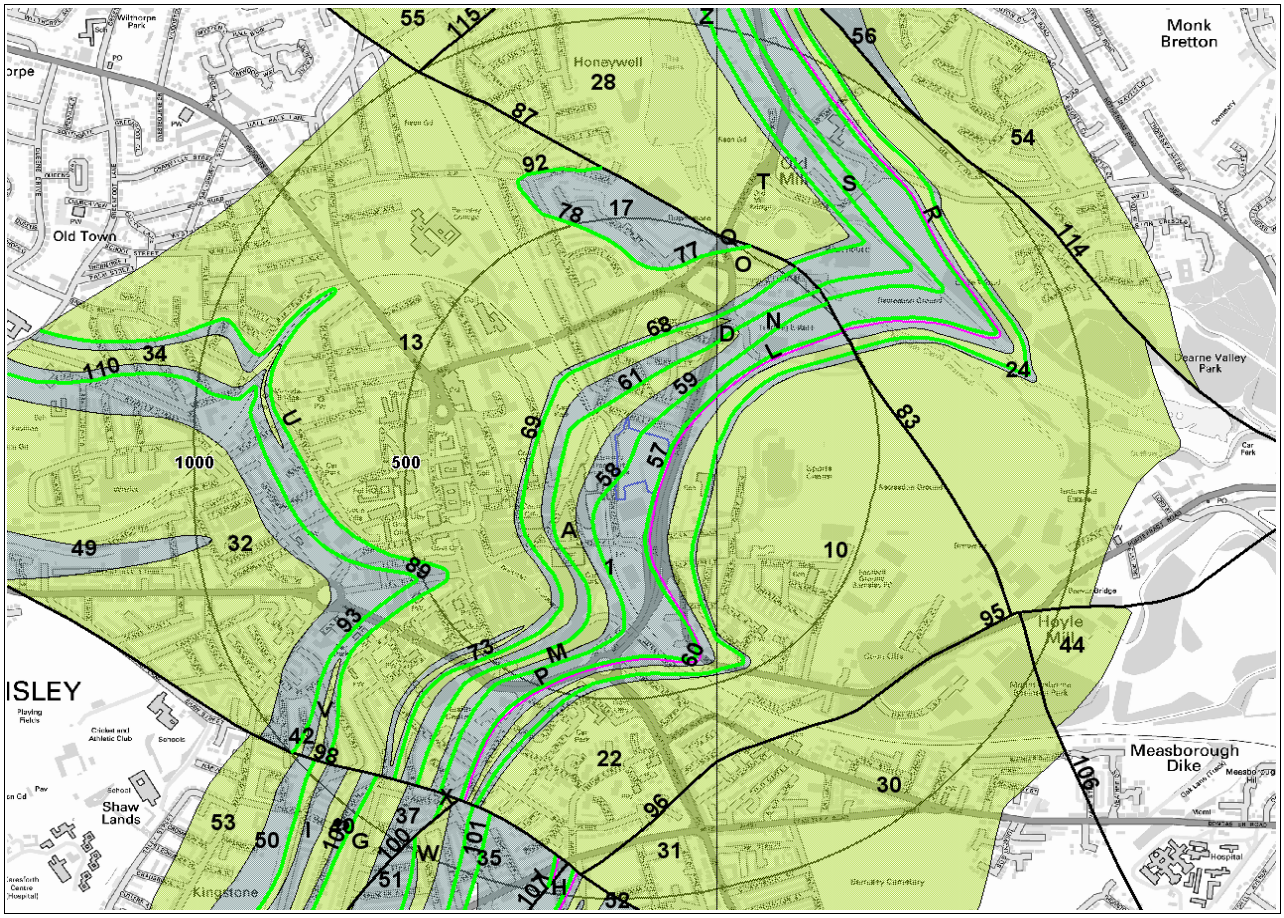
---

# 1.3 Bedrock and linear features map (1:10,000 scale)

NW N NE

W E

SW S SE




**Bedrock and linear features Legend**

© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.

Site Outline

500
1000
Search Buffers (m)

# 1.3 Bedrock and linear features

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

## 1.3.1 Bedrock/ Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary at 1:10,000 scale.

| ID | Distance (m) | Direction | LEX Code | Description | Rock Age |
|---|---|---|---|---|---|
| 1 | 0.0 | On Site | PMCM-MDSS | Pennine Middle Coal Measures Formation - Mudstone, Siltstone And Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 2A | 4.0 | NW | PMCM-SDST | Pennine Middle Coal Measures Formation - Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 3J | 44.0 | E | PMCM-SDST | Pennine Middle Coal Measures Formation - Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 4A | 54.0 | NW | PMCM-MDSS | Pennine Middle Coal Measures Formation - Mudstone, Siltstone And Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 5C | 111.0 | E | PMCM-MDSS | Pennine Middle Coal Measures Formation - Mudstone, Siltstone And Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 6B | 115.0 | E | PMCM-MDSS | Pennine Middle Coal Measures Formation - Mudstone, Siltstone And Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 7B | 115.0 | E | PMCM-SDST | Pennine Middle Coal Measures Formation - Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 8K | 115.0 | NW | PMCM-SDST | Pennine Middle Coal Measures Formation - Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 9C | 123.0 | E | WE-SDST | Woolley Edge Rock - Sandstone | Duckmantian Sub-age |
| 10 | 123.0 | E | WE-SDST | Woolley Edge Rock - Sandstone | Duckmantian Sub-age |
| 11N | 139.0 | NE | PMCM-MDSS | Pennine Middle Coal Measures Formation - Mudstone, Siltstone And Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 12 | 159.0 | NW | PMCM-MDSS | Pennine Middle Coal Measures Formation - Mudstone, Siltstone And Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 13 | 172.0 | NW | KNR-SDST | Kent's Rock - Sandstone | Duckmantian Sub-age |
| 14D | 243.0 | NE | PMCM-SDST | Pennine Middle Coal Measures Formation - Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 15D | 307.0 | N | PMCM-SDST | Pennine Middle Coal Measures Formation - Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 16O | 341.0 | NE | KNR-SDST | Kent's Rock - Sandstone | Duckmantian Sub-age |
| 17 | 378.0 | N | PMCM-MDSS | Pennine Middle Coal Measures Formation - Mudstone, Siltstone And Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 18E | 379.0 | SE | PMCM-MDSS | Pennine Middle Coal Measures Formation - Mudstone, Siltstone And Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 19E | 396.0 | S | PMCM-SDST | Pennine Middle Coal Measures Formation - Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 20 | 439.0 | S | PMCM-MDSS | Pennine Middle Coal Measures Formation - Mudstone, Siltstone And Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 21 | 440.0 | SW | PMCM-MDSS | Pennine Middle Coal Measures Formation - Mudstone, Siltstone And Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 22 | 454.0 | S | WE-SDST | Woolley Edge Rock - Sandstone | Duckmantian Sub-age |

| ID | Distance (m) | Direction | LEX Code | Description | Rock Age |
|---|---|---|---|---|---|
| 23Q | 463.0 | NE | PMCM-MDSS | Pennine Middle Coal Measures Formation - Mudstone, Siltstone And Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 24 | 496.0 | NE | WE-SDST | Woolley Edge Rock - Sandstone | Duckmantian Sub-age |
| 25F | 496.0 | NE | PMCM-MDSS | Pennine Middle Coal Measures Formation - Mudstone, Siltstone And Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 26F | 496.0 | NE | PMCM-SDST | Pennine Middle Coal Measures Formation - Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |
| 27S | 497.0 | NE | PMCM-MDSS | Pennine Middle Coal Measures Formation - Mudstone, Siltstone And Sandstone | Bolsovian Sub-age - Duckmantian Sub-age |

### 1.3.2 Linear features

Are there any records of linear features within 500m of the study site boundary at 1:10,000 scale? Yes

| ID | Distance (m) | Direction | Category Description | Feature Description |
|---|---|---|---|---|
| 57 | 0.0 | On Site | ROCK | Coal seam, inferred |
| 58 | 0.0 | On Site | ROCK | Coal seam, observed |
| 59 | 0.0 | On Site | ROCK | Coal seam, inferred |
| 60 | 5.0 | E | FOSSIL_HORIZON | Fossil horizon, marine band |
| 61 | 54.0 | NW | ROCK | Coal seam, inferred |
| 62M | 93.0 | SW | ROCK | Coal seam, inferred |
| 63J | 101.0 | SE | ROCK | Coal seam, observed |
| 64C | 111.0 | E | ROCK | Coal seam, inferred |
| 65K | 115.0 | W | ROCK | Coal seam, observed |
| 66B | 115.0 | E | ROCK | Coal seam, inferred coincident with bedrock geology boundary |
| 67L | 158.0 | NE | FOSSIL_HORIZON | Fossil horizon, marine band |
| 68 | 159.0 | NW | ROCK | Coal seam, inferred |
| 69 | 160.0 | NW | ROCK | Coal seam, observed |
| 70L | 164.0 | NE | ROCK | Coal seam, inferred |
| 71M | 178.0 | SW | ROCK | Coal seam, inferred |
| 72N | 207.0 | NE | ROCK | Coal seam, inferred |
| 73 | 233.0 | SW | ROCK | Coal seam, inferred |
| 74N | 269.0 | NE | ROCK | Coal seam, inferred |
| 75O | 328.0 | NE | ROCK | Coal seam, inferred |
| 76P | 343.0 | S | ROCK | Coal seam, inferred |
| 77 | 378.0 | N | ROCK | Coal seam, inferred |
| 78 | 390.0 | N | ROCK | Coal seam, observed |
| 79E | 396.0 | S | ROCK | Coal seam, inferred |
| 80P | 439.0 | S | ROCK | Coal seam, inferred |
| 81U | 440.0 | SW | ROCK | Coal seam, inferred |
| 82Q | 463.0 | NE | ROCK | Coal seam, inferred |
| 83 | 496.0 | NE | FAULT | Normal fault, inferred |
| 84F | 496.0 | NE | ROCK | Coal seam, inferred coincident with bedrock geology boundary |
| 85R | 498.0 | NE | FOSSIL_HORIZON | Fossil horizon, marine band |
| 86R | 499.0 | NE | ROCK | Coal seam, inferred |

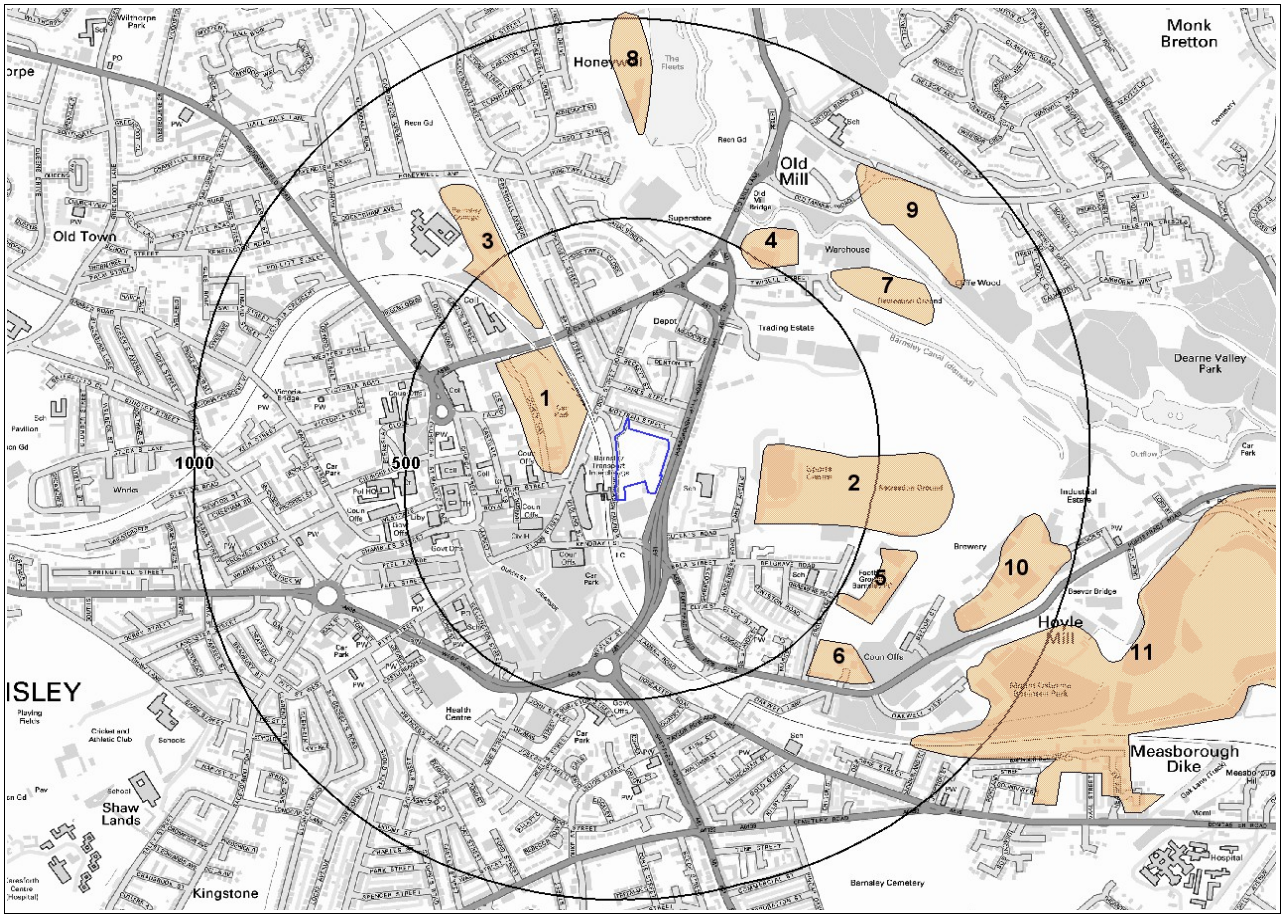
The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of great Britain at 1:10,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/ Solid Geology and linear features such as faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

# 2 Geology 1:50,000 Scale

## 2.1 Artificial Ground map

NW N NE




W E

SW S SE

© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.

Site Outline

500
1000
Search Buffers (m)

Made Ground (undivided)

Disturbed Ground (undivided)

Worked Ground (undivided)

Landscaped Ground (undivided)

Infilled Ground

Reclaimed Ground

# 2. Geology 1:50,000 scale

## 2.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 087

### 2.1.1 Artificial/ Made Ground

Are there any records of Artificial/ Made Ground within 500m of the study site boundary? Yes

| ID | Distance (m) | Direction | LEX Code | Description | Rock Description |
|---|---|---|---|---|---|
| 1 | 82.0 | W | MGR-ARTDP | MADE GROUND (UNDIVIDED) | ARTIFICIAL DEPOSIT |
| 2 | 225.0 | E | MGR-ARTDP | MADE GROUND (UNDIVIDED) | ARTIFICIAL DEPOSIT |
| 3 | 303.0 | NW | MGR-ARTDP | MADE GROUND (UNDIVIDED) | ARTIFICIAL DEPOSIT |
| 4 | 475.0 | NE | MGR-ARTDP | MADE GROUND (UNDIVIDED) | ARTIFICIAL DEPOSIT |

### 2.1.2 Permeability of Artificial Ground

Are there any records relating to permeability of artificial ground within the study site boundary? No

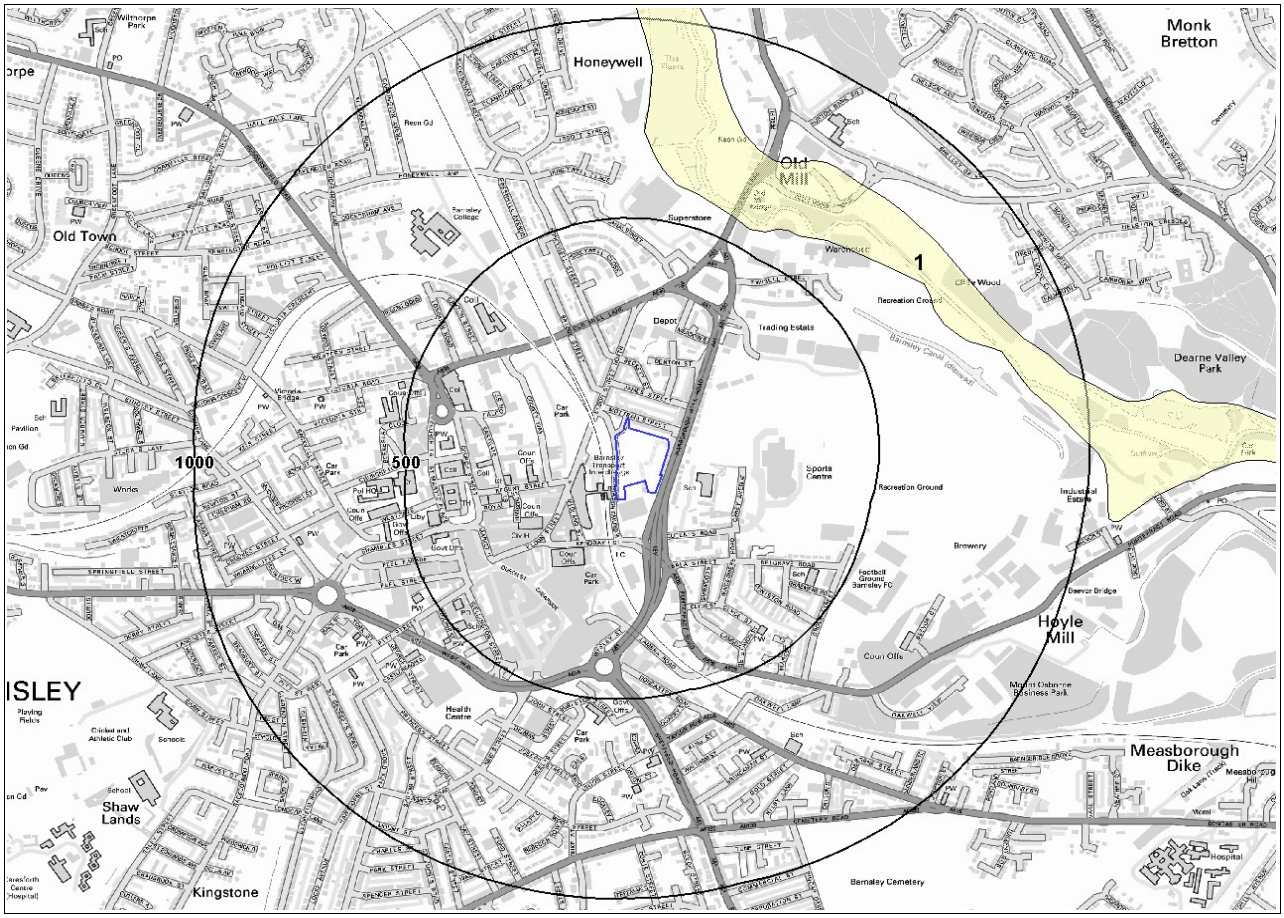
Database searched and no data found.

# 2.2 Superficial Deposits and Landslips map (1:50,000 scale)

NW N NE

W E

SW S SE




© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.

Site Outline

500
1000
Search Buffers (m)

# 2.2 Superficial Deposits and Landslips

## 2.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary? No

Database searched and no data found.

---

## 2.2.2 Permeability of Superficial Ground

Are there any records relating to permeability of superficial ground within the study site boundary? No

Database searched and no data found.

---

## 2.2.3 Landslip

Are there any records of Landslip within 500m of the study site boundary? No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, there are: Artificial/ Made Ground, Superficial/ Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

---

## 2.2.4 Landslip Permeability

Are there any records relating to permeability of landslips within the study site boundary? No

Database searched and no data found.

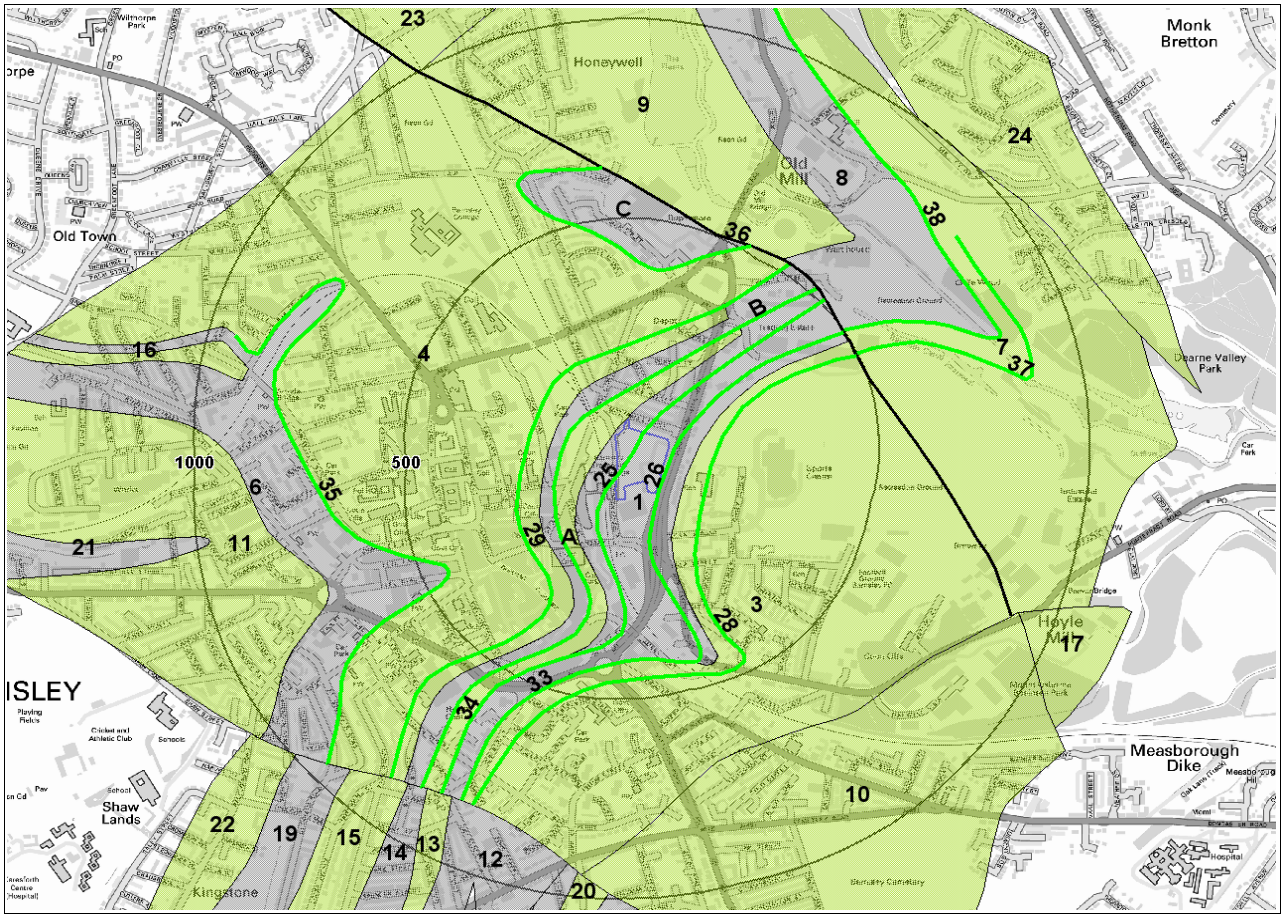
---

# 2.3 Bedrock and linear features map (1:50,000 scale)

NW N NE

W E

SW S SE




© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.

Site Outline

500
1000
Search Buffers (m)

# 2.3 Bedrock, Solid Geology & linear features

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 087

## 2.3.1 Bedrock/Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary:

| ID | Distance | Direction | LEX Code | Rock Description | Rock Age |
|---|---|---|---|---|---|
| 1 | 0.0 | On Site | PMCM-MDSS | PENNINE MIDDLE COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE | WESTPHALIAN |
| 2A | 1.0 | NW | PMCM-SDST | PENNINE MIDDLE COAL MEASURES FORMATION - SANDSTONE | WESTPHALIAN |
| 3 | 55.0 | E | WE-SDST | WOOLLEY EDGE ROCK - SANDSTONE | WESTPHALIAN |
| 4 | 117.0 | NW | KNR-SDST | KENT'S ROCK - SANDSTONE | WESTPHALIAN |
| 5C | 376.0 | N | PMCM-MDSS | PENNINE MIDDLE COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE | WESTPHALIAN |
| 6 | 435.0 | SW | PMCM-MDSS | PENNINE MIDDLE COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE | WESTPHALIAN |
| 7 | 496.0 | NE | WE-SDST | WOOLLEY EDGE ROCK - SANDSTONE | WESTPHALIAN |
| 8 | 498.0 | NE | PMCM-MDSS | PENNINE MIDDLE COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE | WESTPHALIAN |

## 2.3.2 Permeability of Bedrock Ground

Are there any records relating to permeability of bedrock ground within the study site boundary? Yes

| Distance | Direction | Flow Type | Maximum Permeability | Minimum Permeability |
|---|---|---|---|---|
| 0.0 | On Site | Fracture | Moderate | Low |
| 1.0 | NW | Fracture | High | Moderate |

## 2.3.3 Linear features

Are there any records of linear features within 500m of the study site boundary? Yes

| ID | Distance | Direction | Category Description | Feature Description |
|---|---|---|---|---|
| 25 | 0.0 | On Site | ROCK | Coal seam, inferred |
| 26 | 5.0 | E | ROCK | Coal seam, inferred |
| 27A | 59.0 | NW | ROCK | Coal seam, inferred |
| 28 | 108.0 | E | ROCK | Coal seam, inferred |

| ID | Distance | Direction | Category Description | Feature Description |
|---|---|---|---|---|
| 29 | 170.0 | N | ROCK | Coal seam, inferred |
| 30B | 331.0 | NE | ROCK | Coal seam, inferred |
| 31B | 361.0 | NE | ROCK | Coal seam, inferred |
| 32C | 376.0 | N | ROCK | Coal seam, inferred |
| 33 | 403.0 | S | ROCK | Coal seam, inferred |
| 34 | 422.0 | S | ROCK | Coal seam, inferred |
| 35 | 435.0 | SW | ROCK | Coal seam, inferred |
| 36 | 496.0 | NE | FAULT | Fault, inferred |
| 37 | 496.0 | NE | ROCK | Coal seam, inferred |
| 38 | 498.0 | NE | ROCK | Coal seam, inferred |

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/Solid Geology and linear features such as faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nation wide coverage.

# 3 Radon Data

## 3.1 Radon Affected Areas

Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.

The radon data in this report is supplied by the BGS/Public Health England and is the definitive map of Radon Affected Areas in Great Britain and Northern Ireland. The dataset was created using long-term radon measurements in over 479,000 homes across Great Britain and 23,000 homes across Northern Ireland, combined with geological data. The dataset is considered accurate to 50m to allow for the margin of error in geological lines, and the findings of this report supercede any answer given in the less accurate Indicative Atlas of Radon in Great Britain, which simplifies the data to give the highest risk within any given 1km grid square. As such, the radon atlas is considered indicative, whereas the data given in this report is considered definitive.

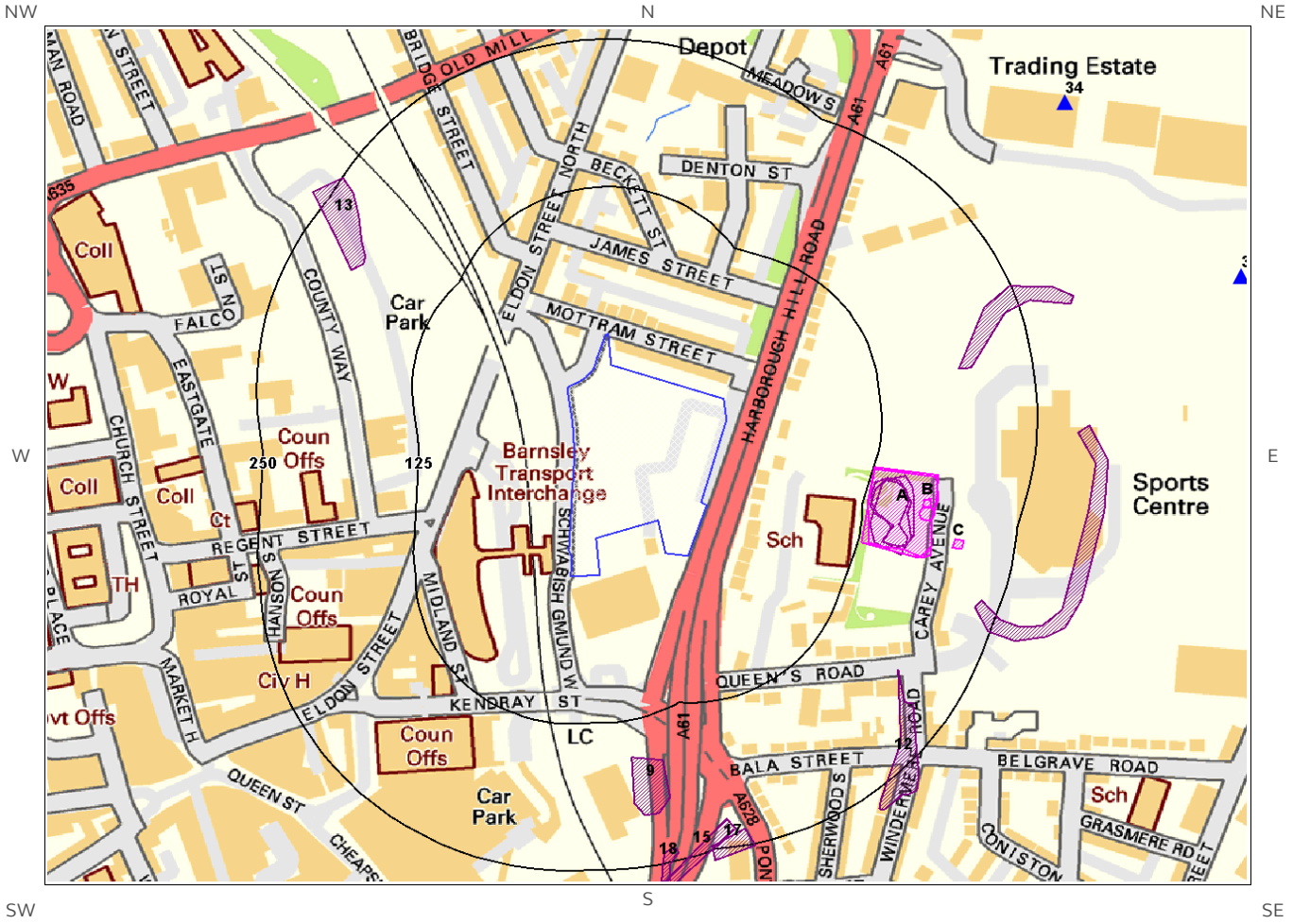
---

## 3.2 Radon Protection

Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment? No radon protective measures are necessary.

---

# 4 Ground Workings map




**Ground Workings Legend**

© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.

Site Outline

125
250
Search Buffers (m)

Historic Surface Ground Workings

Historic Underground Workings

Current Ground Workings

# 4 Ground Workings

## 4.1 Historical Surface Ground Working Features derived from Historical Mapping

This dataset is based on Groundsure's unique Historical Land Use Database derived from 1:10,560 and 1:10,000 scale historical mapping

Are there any Historical Surface Ground Working Features within 250m of the study site boundary? Yes

| ID | Distance (m) | Direction | NGR | Use | Date |
|---|---|---|---|---|---|
| 1A | 125.0 | E | 435027 406568 | Colliery | 1951 |
| 2A | 126.0 | E | 435025 406567 | Colliery | 1948 |
| 3A | 129.0 | E | 435018 406568 | Refuse Heap | 1951 |
| 4A | 131.0 | E | 435017 406566 | Refuse Heap | 1948 |
| 5A | 131.0 | E | 435018 406565 | Unspecified Heap | 1992 |
| 6A | 131.0 | E | 435018 406565 | Unspecified Heap | 1966 |
| 7A | 131.0 | E | 435018 406565 | Unspecified Heap | 1982 |
| 8A | 131.0 | E | 435018 406565 | Unspecified Heap | 1974 |
| 9 | 156.0 | S | 434826 406336 | Unspecified Heap | 1904 |
| 10B | 171.0 | E | 435046 406575 | Unspecified Drift | 1948 |
| 11 | 191.0 | E | 435094 406725 | Unspecified Ground Workings | 1904 |
| 12 | 194.0 | SE | 435031 406375 | Unspecified Quarry | 1890 |
| 13 | 195.0 | NW | 434574 406813 | Cuttings | 1890 |
| 14C | 201.0 | E | 435072 406541 | Unspecified Drift | 1951 |
| 15 | 225.0 | S | 434843 406258 | Unspecified Ground Workings | 1904 |
| 16 | 232.0 | E | 435178 406550 | Unspecified Ground Workings | 1948 |
| 17 | 236.0 | S | 434891 406286 | Refuse Heap | 1890 |
| 18 | 239.0 | S | 434840 406269 | Unspecified Ground Workings | 1973 |

## 4.2 Historical Underground Working Features derived from Historical Mapping

This data is derived from the Groundsure unique Historical Land Use Database. It contains data derived from 1:10,000 and 1:10,560 historical Ordnance Survey Mapping and includes some natural topographical features (Shake Holes for example) as well as manmade features that may have implications for ground stability. Underground and mining features have been identified from surface features such as shafts. The distance that these extend underground is not shown.

Are there any Historical Underground Working Features within 1000m of the study site boundary? Yes

The following Historical Underground Working Features are provided by Groundsure:

| ID | Distance (m) | Direction | NGR | Use | Date |
|---|---|---|---|---|---|
| 19A | 125.0 | E | 435027 406568 | Colliery | 1951 |
| 20A | 126.0 | E | 435025 406567 | Colliery | 1948 |
| 21B | 171.0 | E | 435046 406567 | Disused Air Shaft | 1966 |
| 22B | 171.0 | E | 435046 406575 | Unspecified Drift | 1948 |
| 23C | 201.0 | E | 435072 406541 | Unspecified Drift | 1951 |
| Not shown | 728.0 | NE | 435410 407214 | Colliery | 1948 |
| Not shown | 765.0 | SW | 434408 405657 | Colliery | 1890 |
| Not shown | 840.0 | NE | 435647 407021 | Unspecified Drift | 1948 |
| Not shown | 902.0 | E | 435764 406872 | Unspecified Old Shaft | 1904 |
| Not shown | 902.0 | E | 435764 406872 | Unspecified Old Shaft | 1948 |
| Not shown | 907.0 | E | 435767 406877 | Unspecified Old Shaft | 1951 |
| Not shown | 912.0 | E | 435776 406870 | Unspecified Disused Shaft | 1992 |
| Not shown | 912.0 | E | 435776 406870 | Unspecified Disused Shaft | 1982 |
| Not shown | 912.0 | E | 435776 406870 | Unspecified Disused Shaft | 1974 |
| Not shown | 995.0 | N | 434987 407892 | Colliery | 1890 |

## 4.3 Current Ground Workings

This dataset is derived from the BGS BRITPITS database covering active; inactive mines; quarries; oil wells; gas wells and mineral wharves; and rail deposits throughout the British Isles.

Are there any BGS Current Ground Workings within 1000m of the study site boundary? Yes

The following Current Ground Workings information is provided by British Geological Survey:

| ID | Distance (m) | Direction | NGR | Commodity Produced | Pit Name | Type of working | Status |
|---|---|---|---|---|---|---|---|
| 34 | 372.0 | NE | 435157 406916 | Coal, Deep | Mount Osborne Colliery | Working is wholly underground, access by shaft, adit or drift. Working may be termed Colliery, Mine, Drift Mine, Slant, Level, Adit or Ingoing Eye (Ingaun Ee - Scots) | Ceased |
| 35 | 428.0 | E | 435298 406768 | Sandstone | Eaming Wood | A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site | Ceased |
| Not shown | 462.0 | SE | 435173 406196 | Sandstone | Oakwell | A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site | Ceased |
| Not shown | 545.0 | S | 434897 405981 | Sandstone | Taylor Row | A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site | Ceased |
| Not shown | 576.0 | SE | 435298 406164 | Sandstone | Beevor Hall | A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site | Ceased |
| Not shown | 630.0 | S | 434754 405884 | Sandstone | Union Street | A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site | Ceased |
| Not shown | 638.0 | NW | 434177 406937 | Coal, Deep | Barnsley Colliery | Working is wholly underground, access by shaft, adit or drift. Working may be termed Colliery, Mine, Drift Mine, Slant, Level, Adit or Ingoing Eye (Ingaun Ee - Scots) | Ceased |
| Not shown | 648.0 | NW | 434467 407282 | Coal, Deep | Honey Well Colliery | Working is wholly underground, access by shaft, adit or drift. Working may be termed Colliery, Mine, Drift Mine, Slant, Level, Adit or Ingoing Eye (Ingaun Ee - Scots) | Ceased |
| Not shown | 759.0 | NE | 435443 407176 | Coal, Deep | Mottram Wood Colliery | Working is wholly underground, access by shaft, adit or drift. Working may be termed Colliery, Mine, Drift Mine, Slant, Level, Adit or Ingoing Eye (Ingaun Ee - Scots) | Ceased |
| Not shown | 827.0 | SE | 435560 406100 | Sandstone | Mount Osborne | A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site | Ceased |
| Not shown | 858.0 | E | 435716 406431 | Sandstone | Mount Osborne | A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site | Ceased |
| Not shown | 880.0 | SE | 435579 406032 | Sandstone | Mount Osborne | A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site | Ceased |
| Not shown | 941.0 | NE | 435585 407290 | Sandstone | Old Shep Cote Gate Quarry | A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site | Ceased |

# 5 Mining, Extraction & Natural Cavities map




**Mining, Extraction and Natural Cavities Legend**

© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.

Site Outline

Search Buffers (m)
250
500

Historical Mining

Non-Coal Mining Cavities

Natural Cavities (point data)

Natural Cavities (polygon data)

Non-Coal Mining

Highly likely

Likely

Unlikely

Highly unlikely

Rare

# 5 Mining, Extraction & Natural Cavities

## 5.1 Historical Mining

This dataset is derived from Groundsure unique Historical Land-use Database that are indicative of mining or extraction activities.

Are there any Historical Mining areas within 1000m of the study site boundary? Yes

The following Historical Mining information is provided by Groundsure:

| ID | Distance (m) | Direction | NGR | Details | Date |
|---|---|---|---|---|---|
| 10A | 125.0 | E | 435027 406568 | Colliery | 1951 |
| 11A | 126.0 | E | 435025 406567 | Colliery | 1948 |
| 12A | 171.0 | E | 435046 406567 | Disused Air Shaft | 1966 |
| 13A | 171.0 | E | 435046 406575 | Unspecified Drift | 1948 |
| 14 | 201.0 | E | 435072 406541 | Unspecified Drift | 1951 |
| 15 | 728.0 | NE | 435410 407214 | Colliery | 1948 |
| Not shown | 765.0 | SW | 434408 405657 | Colliery | 1890 |
| 17 | 840.0 | NE | 435647 407021 | Unspecified Drift | 1948 |
| Not shown | 902.0 | E | 435764 406872 | Unspecified Old Shaft | 1948 |
| Not shown | 902.0 | E | 435764 406872 | Unspecified Old Shaft | 1904 |
| Not shown | 907.0 | E | 435767 406877 | Unspecified Old Shaft | 1951 |
| Not shown | 912.0 | E | 435776 406870 | Unspecified Disused Shaft | 1992 |
| Not shown | 912.0 | E | 435776 406870 | Unspecified Disused Shaft | 1982 |
| Not shown | 912.0 | E | 435776 406870 | Unspecified Disused Shaft | 1974 |
| Not shown | 995.0 | N | 434987 407892 | Colliery | 1890 |

## 5.2 Coal Mining

This dataset provides information as to whether the study site lies within a known coal mining affected area as defined by the coal authority.

Are there any Coal Mining areas within 1000m of the study site boundary? Yes

The following Coal Mining information provided by the Coal Authority is not represented on Mapping:

| Distance (m) | Direction | Details |
|---|---|---|
| 0.0 | On Site | The study site is located within the specified search distance of an identified mining area. Further details concerning this can be obtained from the Coal Authority Helpline on 0845 762 6848. |

## 5.3 Johnson Poole and Bloomer

This dataset provides information as to whether the study site lies within an area where JPB hold information relating to mining.

Are there any JPB Mining areas within 1000m of the study site boundary? No

The following information provided by JPB is not represented on mapping: Database searched and no data found.

## 5.4 Non-Coal Mining

This dataset provides information as to whether the study site lies within an area which may have been subject to non-coal historic mining.

Are there any Non-Coal Mining areas within 1000m of the study site boundary? Yes

The following non-coal mining information is provided by the BGS:

| ID | Distance (m) | Direction | Name | Commodity | Assessment of likelihood |
|---|---|---|---|---|---|
| 1 | 0.0 | On Site | Not available | Iron Ore (Bedded) | Localised small scale underground mining may have occurred. Potential for difficult ground conditions are unlikely or localised and are at a level where they need not be considered |
| 2 | 115.0 | E | Not available | Iron Ore (Bedded) | Localised small scale underground mining may have occurred. Potential for difficult ground conditions are unlikely or localised and are at a level where they need not be considered |
| 3 | 118.0 | E | Sheffield Area | Vein Mineral/Iron ore | Localised small scale underground mining may have occurred. Potential for difficult ground conditions are unlikely or localised and are at a level where they need not be considered |
| 4 | 122.0 | E | Sheffield Area | Vein Mineral/Iron ore | Localised small scale underground mining may have occurred. Potential for difficult ground conditions are unlikely or localised and are at a level where they need not be considered |
| 5 | 159.0 | NW | Sheffield Area | Vein Mineral/Iron ore | Localised small scale underground mining may have occurred. Potential for difficult ground conditions are unlikely or localised and are at a level where they need not be considered |
| 6 | 200.0 | SE | Not available | Iron Ore (Bedded) | Localised small scale underground mining may have occurred. Potential for difficult ground conditions are unlikely or localised and are at a level where they need not be considered |
| 7 | 419.0 | S | Sheffield Area | Vein Mineral/Iron ore | Localised small scale underground mining may have occurred. Potential for difficult ground conditions are unlikely or localised and are at a level where they need not be considered |

| ID | Distance (m) | Direction | Name | Commodity | Assessment of likelihood |
|---|---|---|---|---|---|
| 8 | 458.0 | NE | Sheffield Area | Vein Mineral/Iron ore | Localised small scale underground mining may have occurred. Potential for difficult ground conditions are unlikely or localised and are at a level where they need not be considered |
| 9 | 853.0 | NE | Sheffield Area | Vein Mineral/Iron ore | Localised small scale underground mining may have occurred. Potential for difficult ground conditions are unlikely or localised and are at a level where they need not be considered |

## 5.5 Non-Coal Mining Cavities

This dataset provides information from the Peter Brett Associates (PBA) mining cavities database (compiled for the national study entitled "Review of mining instability in Great Britain, 1990" PBA has also continued adding to this database) on mineral extraction by mining.

Are there any Non-Coal Mining cavities within 1000m of the study site boundary? No

Database searched and no data found.

## 5.6 Natural Cavities

This dataset provides information based on the Peter Brett Associates natural cavities database. The dataset is made up of points and polygons. Where polygons are used these represent an area in which it is expected the cavities could be found. It does not indicate that cavities are present everywhere within the polygon, and caution should be used in the interpretation of this data.

Are there any Natural Cavities within 1000m of the study site boundary? No

Database searched and no data found.

## 5.7 Brine Extraction

This data provides information from the Coal Authority issued on behalf of the Cheshire Brine Subsidence Compensation Board.

Are there any Brine Extraction areas within 1000m of the study site boundary? No

Database searched and no data found.

## 5.8 Gypsum Extraction

This dataset provides information on Gypsum extraction from British Gypsum records.

Are there any Gypsum Extraction areas within 1000m of the study site boundary? No

Database searched and no data found.

## 5.9 Tin Mining

This dataset provides information on tin mining areas and is derived from tin mining records. This search is based upon postcode information to a sector level..

| | |
|---|---|
| Are there any Tin Mining areas within 1000m of the study site boundary? | No |

Database searched and no data found.

---

## 5.10 Clay Mining

This dataset provides information on Kaolin and Ball Clay mining from relevant mining records.

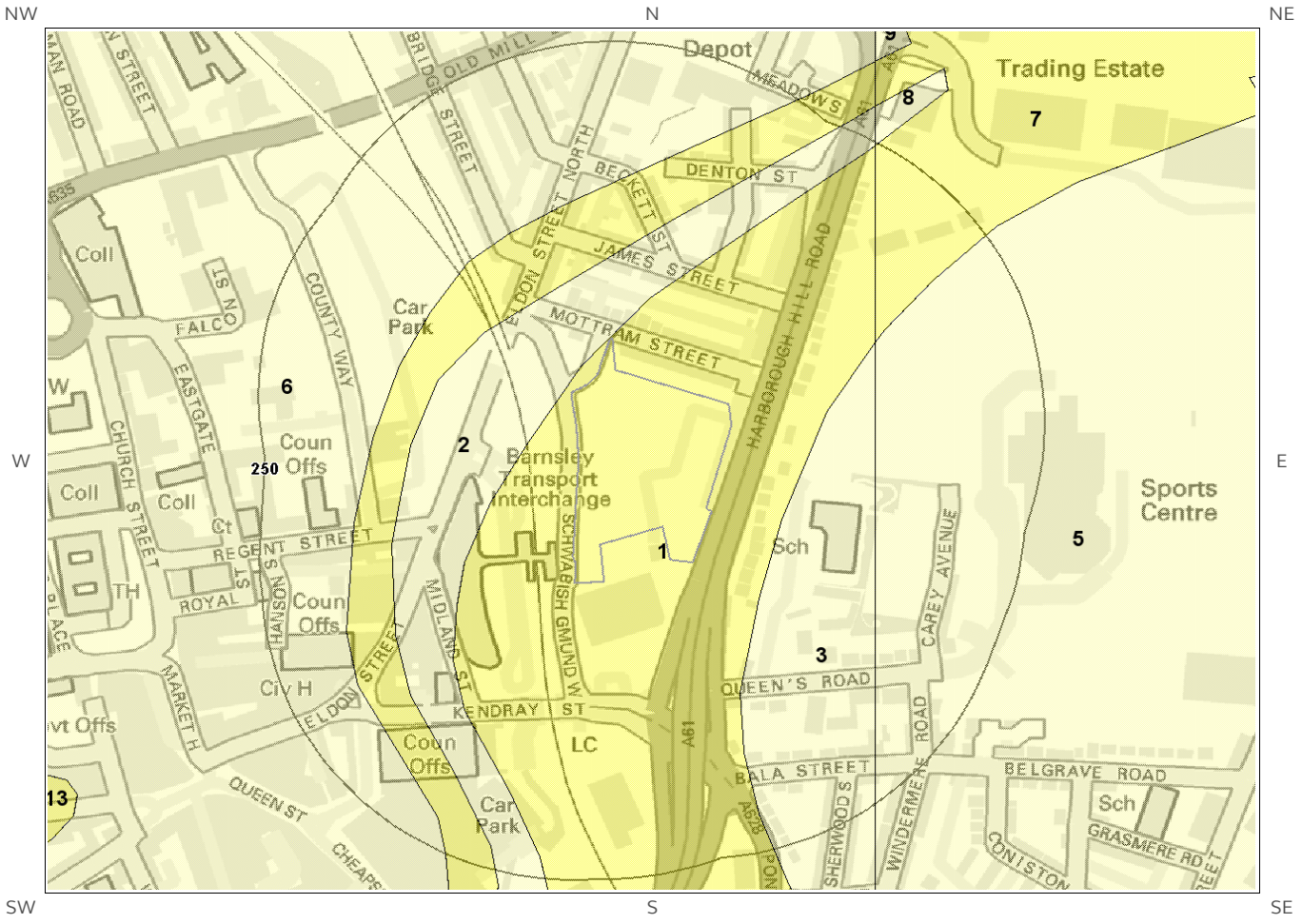
| | |
|---|---|
| Are there any Clay Mining areas within 1000m of the study site boundary? | No |

Database searched and no data found.

---

# 6 Natural Ground Subsidence

## 6.1 Shrink-Swell Clay map

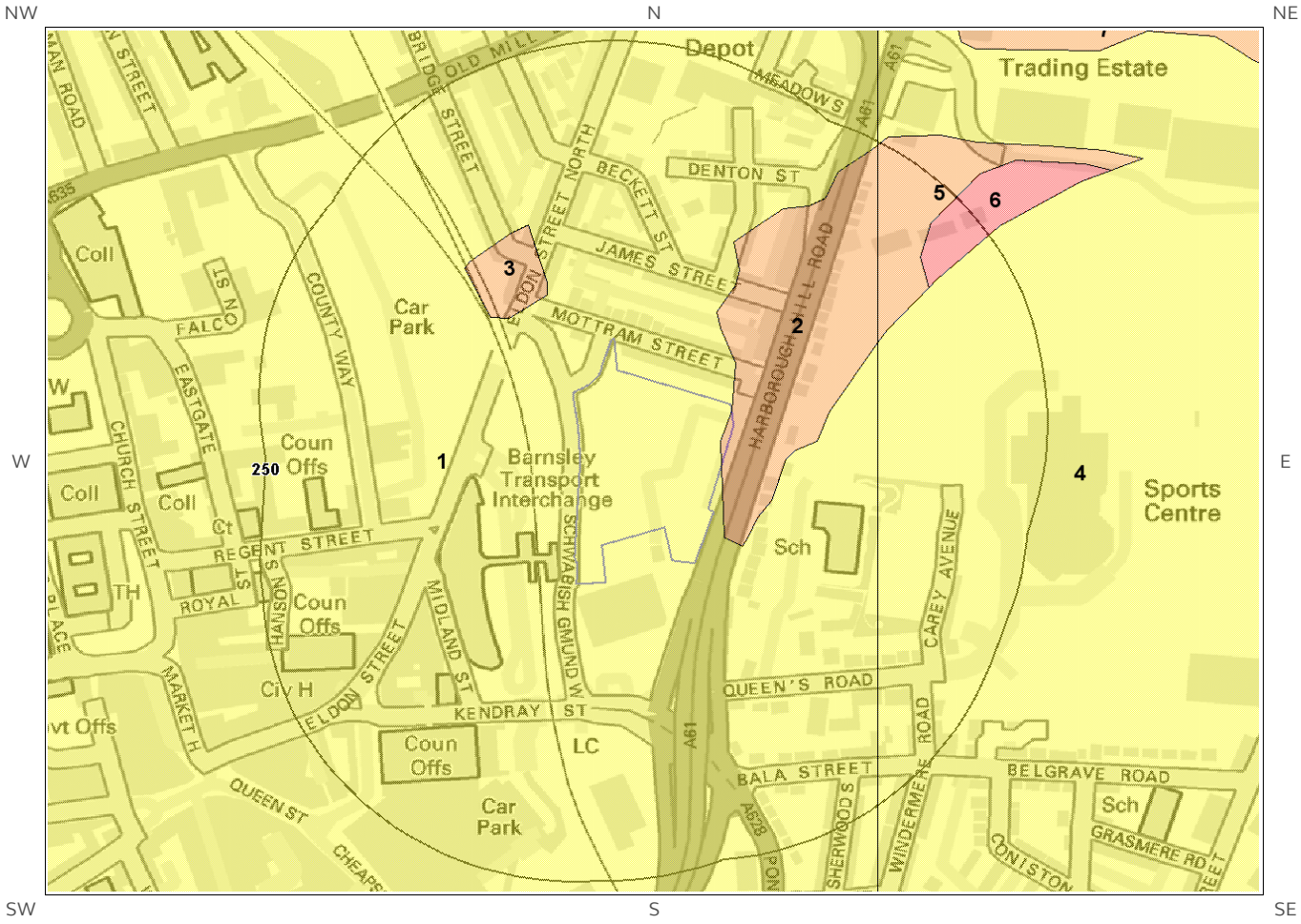



**Shrink Swell Clay Legend**

© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.



# 6.2 Landslides map




**Landslides Legend**

© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.

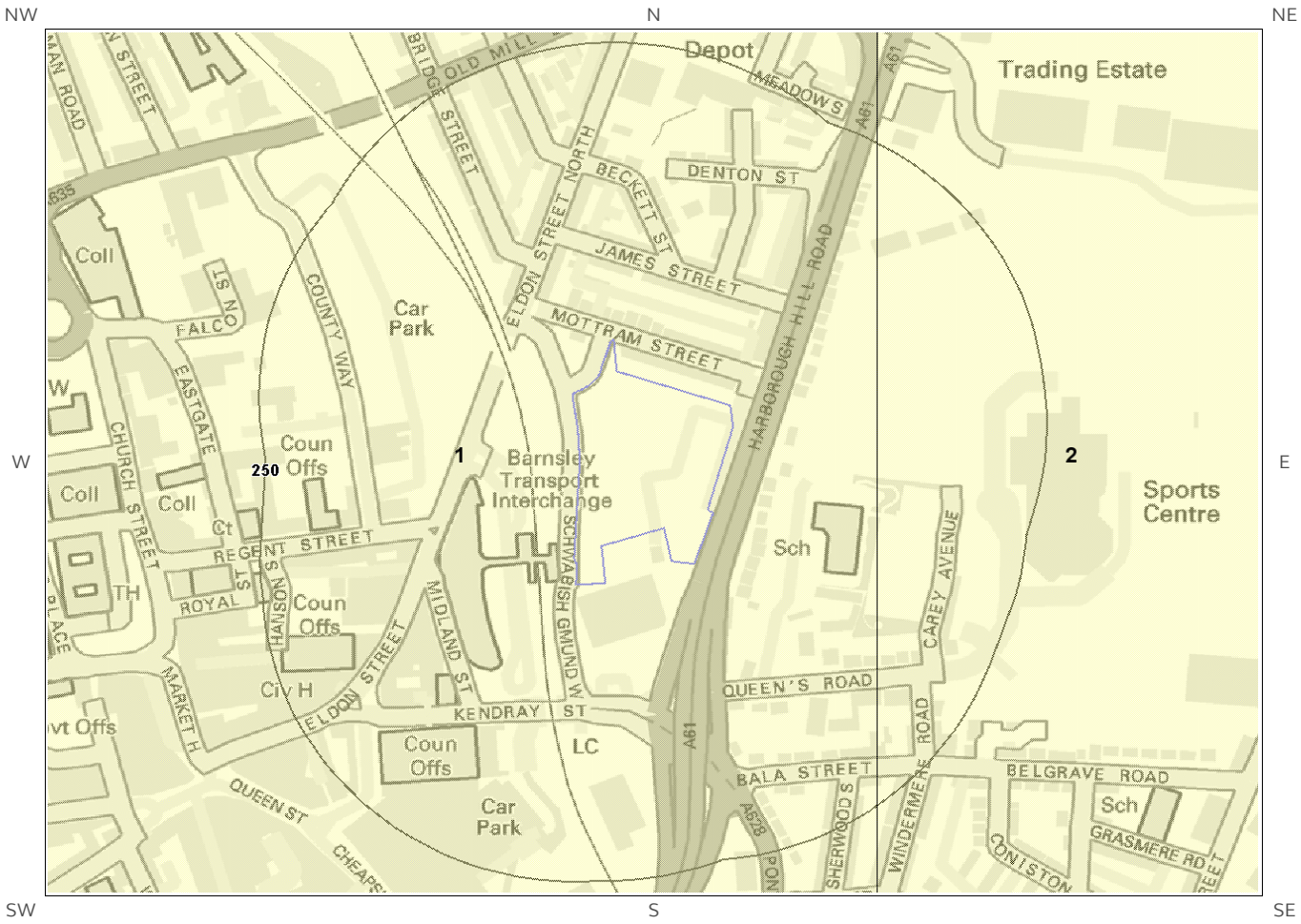
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

# 6.3 Ground Dissolution of Soluble Rocks map

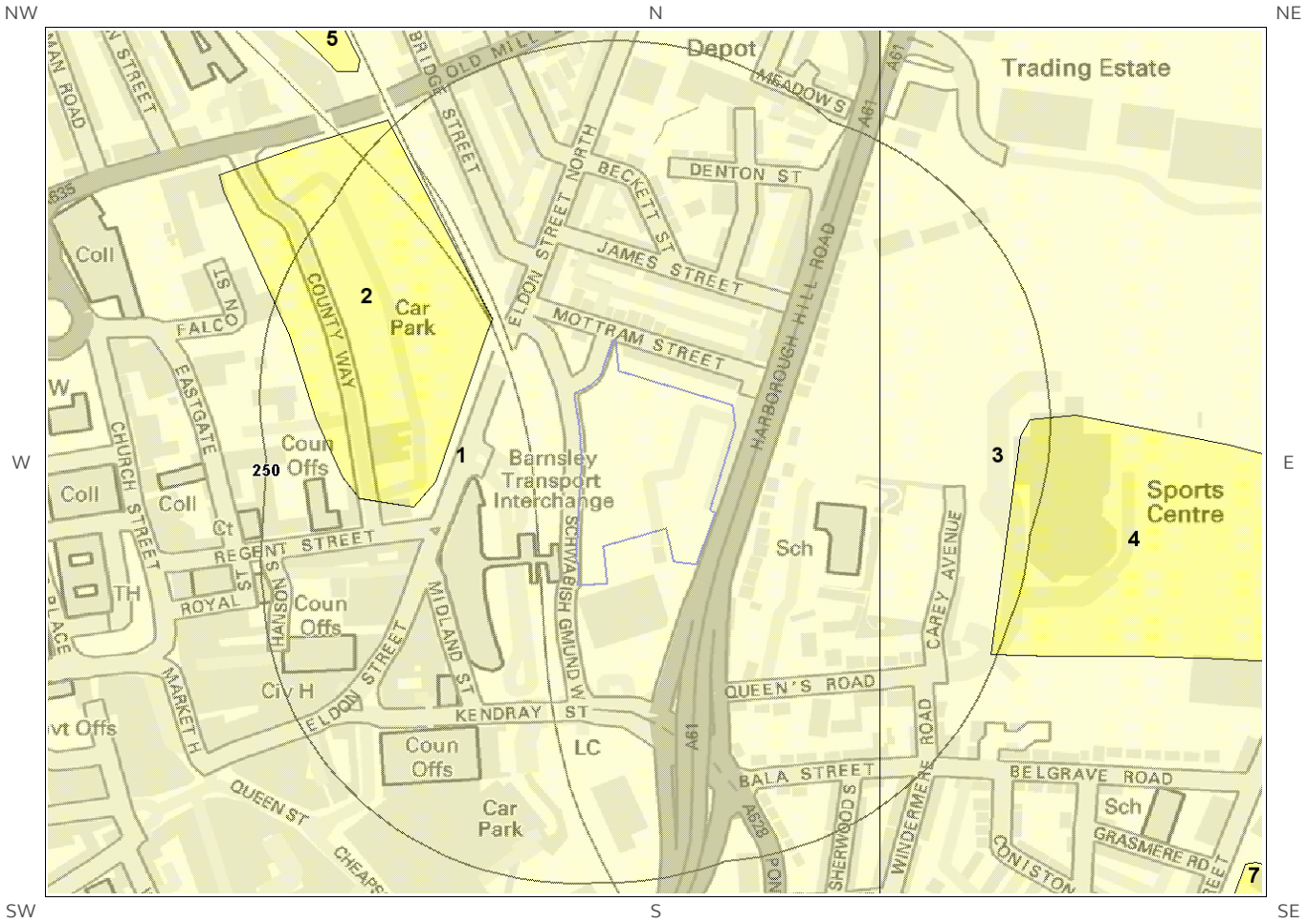



**Ground Dissolution Soluble Rocks Legend**

© Crown copyright and database rights 2018. Ordnance Survey license 100035207.



# 6.4 Compressible Deposits map

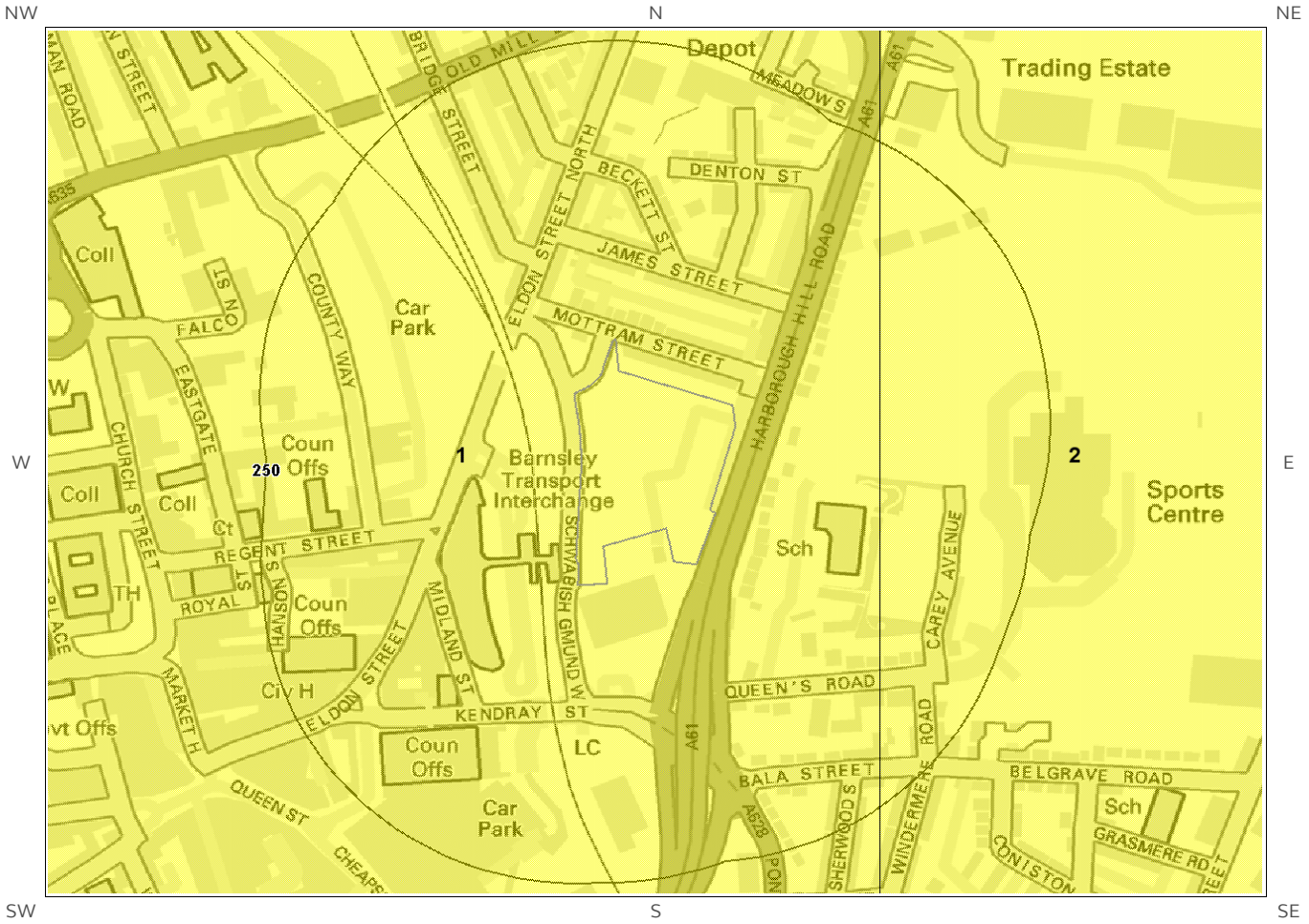



**Compressible Deposits Legend**

© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.



# 6.5 Collapsible Deposits map

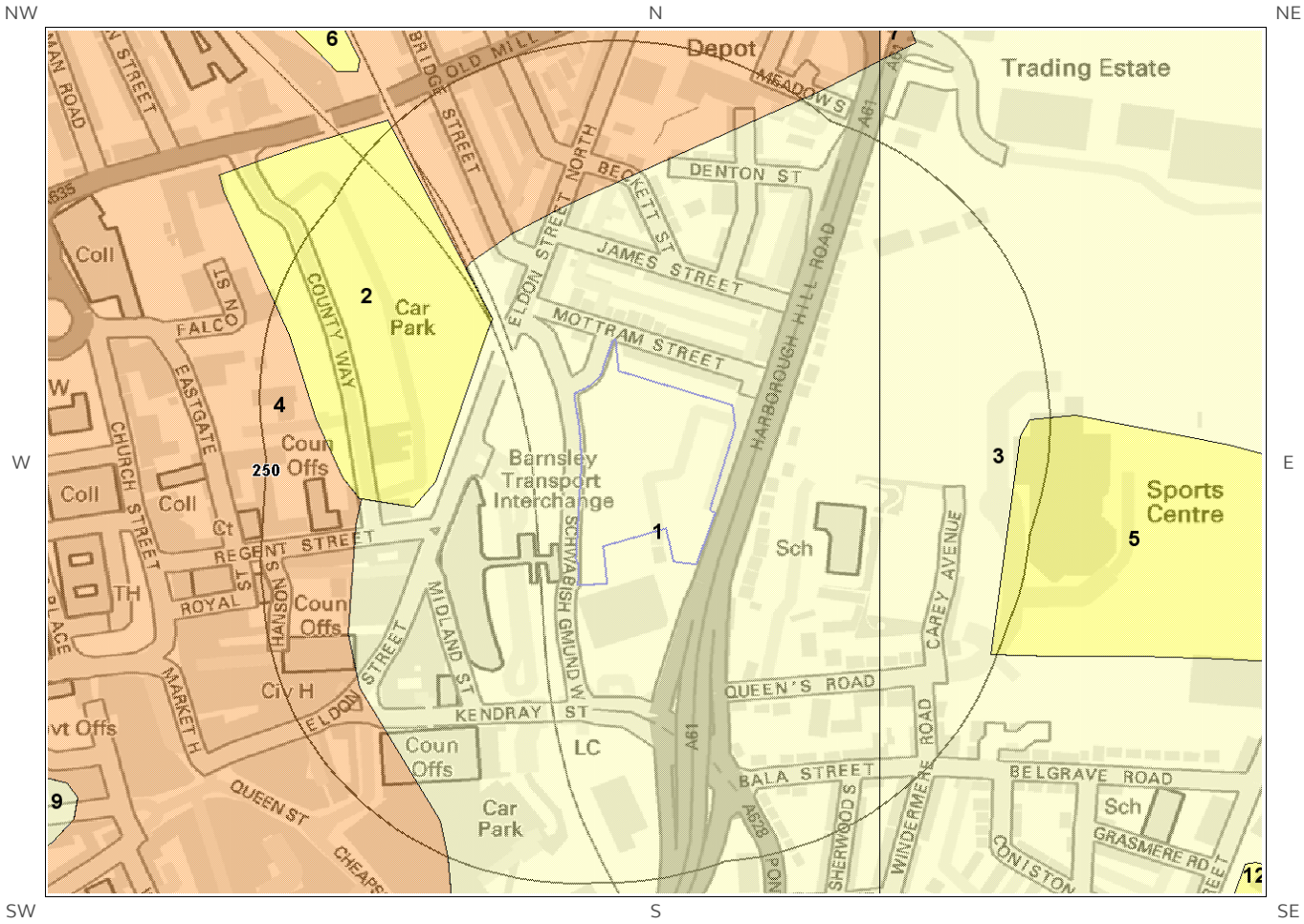



**Collapsible Deposits Legend**

© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.



# 6.6 Running Sand map




**Running Sand Legend**

© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.



# 6 Natural Ground Subsidence

The National Ground Subsidence rating is obtained through the 6 natural ground stability hazard datasets, which are supplied by the British Geological Survey (BGS).

The following GeoSure data represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

What is the maximum hazard rating of natural subsidence within the study site*[*] boundary? Low

## 6.1 Shrink-Swell Clays

The following Shrink Swell information provided by the British Geological Survey:

| ID | Distance (m) | Direction | Hazard Rating | Details |
|---|---|---|---|---|
| 1 | 0.0 | On Site | Very Low | Ground conditions predominantly low plasticity. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with shrink-swell clays. |
| 2 | 1.0 | NW | Negligible | Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays. |

## 6.2 Landslides

The following Landslides information provided by the British Geological Survey:

| ID | Distance (m) | Direction | Hazard Rating | Details |
|---|---|---|---|---|
| 1 | 0.0 | On Site | Very Low | Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides. |
| 2 | 0.0 | On Site | Low | Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems. |

* This includes an automatically generated 50m buffer zone around the site

## 6.3 Ground Dissolution of Soluble Rocks

The following Ground Dissolution information provided by the British Geological Survey:

| ID | Distance (m) | Direction | Hazard Rating | Details |
|---|---|---|---|---|
| 1 | 0.0 | On Site | Negligible | Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks. |

## 6.4 Compressible Deposits

The following Compressible Deposits information provided by the British Geological Survey:

| ID | Distance (m) | Direction | Hazard Rating | Details |
|---|---|---|---|---|
| 1 | 0.0 | On Site | Negligible | No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits. |

## 6.5 Collapsible Deposits

The following Collapsible Rocks information provided by the British Geological Survey:

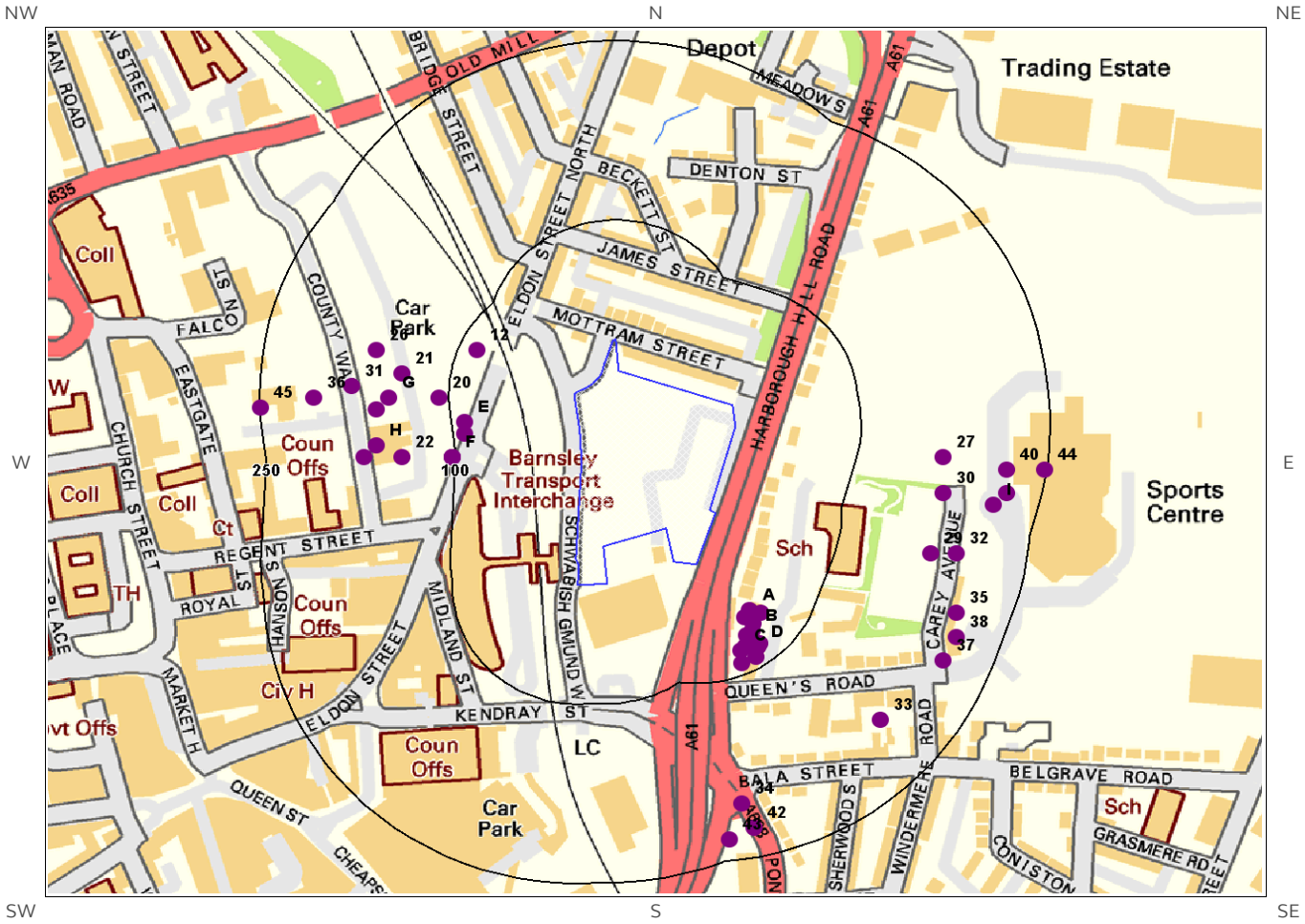
| ID | Distance (m) | Direction | Hazard Rating | Details |
|---|---|---|---|---|
| 1 | 0.0 | On Site | Very Low | Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits. |

## 6.6 Running Sands

The following Running Sands information provided by the British Geological Survey:

| ID | Distance (m) | Direction | Hazard Rating | Details |
|---|---|---|---|---|
| 1 | 0.0 | On Site | Negligible | No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand. |

# 7 Borehole Records map




**Borehole Records Legend**

© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.

Site Outline

Borehole Locations

125
250
Search Buffers (m)

# 7 Borehole Records

The systematic analysis of data extracted from the BGS Borehole Records database provides the following information.

Records of boreholes within 250m of the study site boundary: 45

| ID | Distance (m) | Direction | NGR | BGS Reference | Drilled Length | Borehole Name |
|---|---|---|---|---|---|---|
| 1A | 57.0 | SE | 434896 406492 | SE30NW956 | -1.0 | LAND AT REAR OF 32 QUEENS ROAD BARNSLEY WS108 |
| 2A | 59.0 | SE | 434892 406486 | SE30NW955 | -1.0 | LAND AT REAR OF 32 QUEENS ROAD BARNSLEY WS107 |
| 3A | 62.0 | SE | 434897 406486 | SE30NW948 | -1.0 | LAND AT REAR OF 32 QUEENS ROAD BARNSLEY 2 |
| 4A | 65.0 | SE | 434905 406490 | SE30NW957 | -1.0 | LAND AT REAR OF 32 QUEENS ROAD BARNSLEY WS109 |
| 5A | 67.0 | SE | 434899 406481 | SE30NW958 | -1.0 | LAND AT REAR OF 32 QUEENS ROAD BARNSLEY WS110 |
| 6B | 71.0 | SE | 434898 406475 | SE30NW959 | -1.0 | LAND AT REAR OF 32 QUEENS ROAD BARNSLEY WS111 |
| 7B | 72.0 | SE | 434894 406471 | SE30NW949 | -1.0 | LAND AT REAR OF 32 QUEENS ROAD BARNSLEY WS101 |
| 8B | 79.0 | SE | 434893 406462 | SE30NW950 | -1.0 | LAND AT REAR OF 32 QUEENS ROAD BARNSLEY WS102 |
| 9C | 81.0 | SE | 434889 406458 | SE30NW954 | -1.0 | LAND AT REAR OF 32 QUEENS ROAD BARNSLEY WS106 |
| 10B | 84.0 | SE | 434904 406464 | SE30NW951 | -1.0 | LAND AT REAR OF 32 QUEENS ROAD BARNSLEY WS103 |
| 11D | 85.0 | SE | 434903 406461 | SE30NW947 | -1.0 | LAND AT REAR OF 32 QUEENS ROAD BARNSLEY 1 |
| 12 | 86.0 | NW | 434680 406710 | SE30NW714 | -1.0 | COURTHOUSE DEVELOPMENT BARNSLEY BH1 |
| 13E | 90.0 | W | 434670 406650 | SE30NW719 | -1.0 | COURTHOUSE DEVELOPMENT BARNSLEY RP5 |
| 14C | 91.0 | SE | 434890 406448 | SE30NW953 | -1.0 | LAND AT REAR OF 32 QUEENS ROAD BARNSLEY WS105 |
| 15D | 91.0 | SE | 434901 406453 | SE30NW952 | -1.0 | LAND AT REAR OF 32 QUEENS ROAD BARNSLEY WS104 |

| ID | Distance (m) | Direction | NGR | BGS Reference | Drilled Length | Borehole Name |
|---|---|---|---|---|---|---|
| 16E | 91.0 | W | 434670 406640 | SE30NW720 | -1.0 | COURTHOUSE DEVELOPMENT BARNSLEY RP6 |
| 17F | 103.0 | W | 434660 406620 | SE30NW721 | -1.0 | COURTHOUSE DEVELOPMENT BARNSLEY RP7 |
| 18F | 103.0 | W | 434660 406620 | SE30NW722 | -1.0 | COURTHOUSE DEVELOPMENT BARNSLEY RP8 |
| 19F | 103.0 | W | 434660 406620 | SE30NW715 | -1.0 | COURTHOUSE DEVELOPMENT BARNSLEY BH2 |
| 20 | 108.0 | W | 434650 406670 | SE30NW718 | -1.0 | COURTHOUSE DEVELOPMENT BARNSLEY BH5 |
| 21 | 139.0 | W | 434620 406690 | SE30NW716 | -1.0 | COURTHOUSE DEVELOPMENT BARNSLEY BH3 |
| 22 | 143.0 | W | 434620 406620 | SE30NW717 | -1.0 | COURTHOUSE DEVELOPMENT BARNSLEY BH4 |
| 23G | 148.0 | W | 434610 406670 | SE30NW802 | -1.0 | COUNTY WAY BARNSLEY 7A |
| 24G | 158.0 | W | 434600 406660 | SE30NW804 | -1.0 | COUNTY WAY BARNSLEY 9 |
| 25H | 162.0 | W | 434600 406630 | SE30NW805 | -1.0 | COUNTY WAY BARNSLEY 10 |
| 26 | 162.0 | W | 434600 406710 | SE30NW801 | -1.0 | COUNTY WAY BARNSLEY 6 |
| 27 | 167.0 | E | 435050 406620 | SE30NE249 | 15.0 | QUEENS GROUND BH20 |
| 28H | 173.0 | W | 434590 406620 | SE30NW806 | -1.0 | COUNTY WAY BARNSLEY 11 |
| 29 | 174.0 | E | 435040 406540 | SE30NE253 | 19.0 | QUEENS GROUND BH26/26A |
| 30 | 174.0 | E | 435050 406590 | SE30NE251 | 17.0 | QUEENS GROUND BH23 |
| 31 | 178.0 | W | 434580 406680 | SE30NW803 | -1.0 | COUNTY WAY BARNSLEY 8 |
| 32 | 193.0 | E | 435060 406540 | SE30NE254 | 22.0 | QUEENS GROUND BH27A/27B |
| 33 | 196.0 | SE | 435000 406400 | SE30NE702 | 128.0 | ELECTRICITY WORKS BARNSLEY |
| 34 | 204.0 | S | 434890 406330 | SE30NW641 | 30.0 | MALTHOUSE LANE/PONTEFRACT ROAD 7/7R |
| 35 | 208.0 | E | 435060 406490 | SE30NE255 | 20.0 | QUEENS GROUND BH29 |
| 36 | 208.0 | W | 434550 406670 | SE30NW807 | -1.0 | COUNTY WAY BARNSLEY 12 |
| 37 | 212.0 | SE | 435050 406450 | SE30NE257 | 21.0 | QUEENS GROUND BH31 |
| 38 | 214.0 | E | 435060 406470 | SE30NE256 | 21.0 | QUEENS GROUND BH30 |
| 39I | 215.0 | E | 435090 406580 | SE30NE252 | 19.0 | QUEENS GROUND BH25 |
| 40 | 218.0 | E | 435100 406610 | SE30NE250 | 21.0 | QUEENS GROUND BH22A |
| 41I | 222.0 | E | 435100 406590 | SE30NE244 | 1.0 | QUEENS GROUND BHD |

| ID | Distance (m) | Direction | NGR | BGS Reference | Drilled Length | Borehole Name |
|---|---|---|---|---|---|---|
| 42 | 226.0 | S | 434900 406310 | SE30NW640 | 23.0 | MALTHOUSE LANE/PONTEFRACT ROAD 6 |
| 43 | 233.0 | S | 434880 406300 | SE30NW639 | 21.0 | MALTHOUSE LANE/PONTEFRACT ROAD 5 |
| 44 | 248.0 | E | 435130 406610 | SE30NE245 | 1.0 | QUEENS GROUND BHE |
| 45 | 250.0 | W | 434508 406662 | SE30NW41/A | 26.0 | COURT HOUSE SITE 1 |

The borehole records are available using the hyperlinks below: Please note that if the donor of the borehole record has requested the information be held as commercial-in-confidence, the additional data will be held separately by the BGS and a formal request must be made for its release.

#27: scans.bgs.ac.uk/sobi_scans/boreholes/83765
#29: scans.bgs.ac.uk/sobi_scans/boreholes/83769
#30: scans.bgs.ac.uk/sobi_scans/boreholes/83767
#32: scans.bgs.ac.uk/sobi_scans/boreholes/83770
#33: scans.bgs.ac.uk/sobi_scans/boreholes/18527990
#34: scans.bgs.ac.uk/sobi_scans/boreholes/15938781
#35: scans.bgs.ac.uk/sobi_scans/boreholes/83771
#37: scans.bgs.ac.uk/sobi_scans/boreholes/83773
#38: scans.bgs.ac.uk/sobi_scans/boreholes/83772
#39I: scans.bgs.ac.uk/sobi_scans/boreholes/83768
#40: scans.bgs.ac.uk/sobi_scans/boreholes/83766
#41I: scans.bgs.ac.uk/sobi_scans/boreholes/83760
#42: scans.bgs.ac.uk/sobi_scans/boreholes/15938780
#43: scans.bgs.ac.uk/sobi_scans/boreholes/15938779
#44: scans.bgs.ac.uk/sobi_scans/boreholes/83761
#45: scans.bgs.ac.uk/sobi_scans/boreholes/83902

# 8 Estimated Background Soil Chemistry

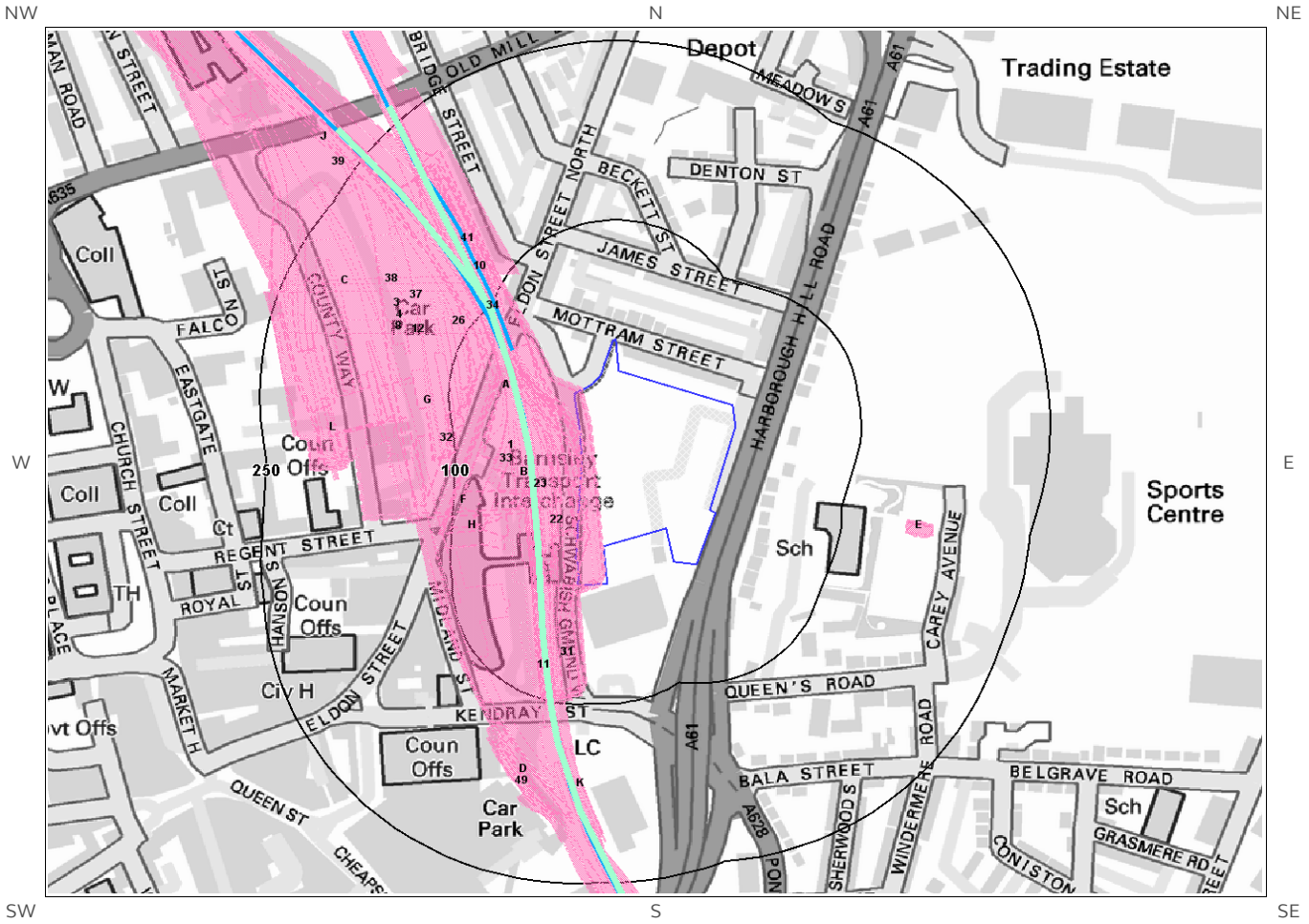
Records of background estimated soil chemistry within 250m of the study site boundary: 2

For further information on how this data is calculated and limitations upon its use, please see the Groundsure Geo Insight User Guide, available on request.

| Distance (m) | Direction | Sample Type | Arsenic (As) | Cadmium (Cd) | Chromium (Cr) | Nickel (Ni) | Lead (Pb) |
|---|---|---|---|---|---|---|---|
| 0.0 | On Site | RuralSoil | 15 - 25 mg/kg | <1.8 mg/kg | 90 - 120 mg/kg | 30 - 45 mg/kg | 100 - 200 mg/kg |
| 14.0 | S | RuralSoil | 15 - 25 mg/kg | <1.8 mg/kg | 90 - 120 mg/kg | 30 - 45 mg/kg | <100 mg/kg |

*As this data is based upon underlying 1:50,000 scale geological information, a 50m buffer has been added to the search radius.

# 9 Railways and Tunnels map




**Railways and Tunnels Legend**

© Crown copyright and database rights 2018.
Ordnance Survey license 100035207.
© OpenStreetMapContributors

- Site Outline
- Search Buffers (m) — 250 — 500
- Underground or Partially Underground Railway / Subway System
- Railway Tunnel (OS Mapping)
- Abandoned or Dismantled Railway (OpenStreetMap)
- Railway Track (OS Mapping)
- Railway Track (OpenStreetMap)
- High Speed 2
- High Speed 2 Revised Proposed Route
- Crossrail 1
- Railway and/or Tunnel Feature from Historical Mapping

# 9 Railways and Tunnels

## 9.1 Tunnels

This data is derived from OpenStreetMap and provides information on the possible locations of underground railway systems in the UK - the London Underground, the Tyne & Wear Metro and the Glasgow Subway.

Have any underground railway lines been identified within the study site boundary? No

Have any underground railway lines been identified within 250m of the study site boundary? No

Database searched and no data found.

*Any records that have been identified are represented on the Railways and Tunnels map.*

This data is derived from Ordnance Survey mapping and provides information on the possible locations of railway tunnels forming part of the UK overground railway network.

Have any other railway tunnels been identified within the site boundary? No

Have any other railway tunnels been identified within 250m of the site boundary? No

Database searched and no data found.

*Any records that have been identified are represented on the Railways and Tunnels map.*

## 9.2 Historical Railway and Tunnel Features

This data is derived from Groundsure's unique Historical Land-use Database and contains features relating to tunnels, railway tracks or associated works that have been identified from historical Ordnance Survey mapping.

Have any historical railway or tunnel features been identified within the study site boundary? Yes

Have any historical railway or tunnel features been identified within 250m of the study site boundary? Yes

| ID | Distance (m) | Direction | NGR | Details | Date |
|---|---|---|---|---|---|
| 1 | 0 | On Site | 434733 406639 | Railway Sidings | 1904 |
| 2B | 0 | On Site | 434705 406642 | Railway Sidings | 1948 |
| 3 | 0 | On Site | 434559 406744 | Railway Sidings | 1938 |
| 4 | 0 | On Site | 434581 406739 | Railway Sidings | 1966 |
| 5A | 0 | On Site | 434698 406683 | Railway Sidings | 1973 |
| 6A | 0 | On Site | 434698 406683 | Railway Sidings | 1982 |

| ID | Distance (m) | Direction | NGR | Details | Date |
|---|---|---|---|---|---|
| 7 | 0 | On Site | 434754 406623 | Railway Sidings | 1850 |
| 8 | 0 | On Site | 434580 406736 | Railway Sidings | 1951 |
| 9B | 0 | On Site | 434685 406577 | Railway Sidings | 1890 |
| 21F | 0 | On Site | n/a | Railway | 1929 |
| 22 | 0 | On Site | 434744 406567 | Railway Sidings | 1960 |
| 23 | 0 | On Site | 434738 406632 | Railway Sidings | 1929 |
| 24F | 0 | On Site | n/a | Railway | 1906 |
| 25H | 0 | On Site | n/a | Railway | 1893 |
| 26 | 0 | On Site | 434635 406750 | Railway Sidings | 1961 |
| 27G | 1 | W | 434560 406640 | Railway Sidings | 1893 |
| 28G | 1 | W | 434675 406640 | Railway Sidings | 1906 |
| 29I | 14 | W | 434686 406750 | Railway Sidings | 1987 |
| 30 | 14 | W | 434687 406750 | Railway Sidings | 1972 |
| 31 | 14 | S | 434753 406460 | Railway Sidings | 1961 |
| 32 | 18 | W | n/a | Railway | 1932 |
| 10 | 30 | W | 434681 406778 | Railway Sidings | 1993 |
| 33 | 38 | W | 434699 406625 | Railway Sidings | 1960 |
| 34 | 40 | W | 434693 406747 | Railway Sidings | 1986 |
| 11 | 48 | SW | 434732 406444 | Railway Sidings | 1850 |
| 35H | 72 | W | 434682 406567 | Railway Sidings | 1961 |
| 12 | 78 | W | 434629 406725 | Railway Sidings | 1850 |
| 13C | 79 | W | 434527 406817 | Railway Sidings | 1948 |
| 14C | 79 | W | 434527 406817 | Railway Sidings | 1904 |
| 15C | 79 | W | 434527 406817 | Railway Sidings | 1890 |
| 36I | 79 | NW | 434677 406749 | Railway Sidings | 1986 |
| 37 | 81 | W | 434613 406755 | Railway Sidings | 1960 |
| 38 | 84 | W | 434591 406821 | Railway Sidings | 1929 |
| 39 | 92 | NW | n/a | Railway | 1888 |
| 40 | 94 | W | 434584 406723 | Railway Sidings | 1961 |
| 41 | 102 | NW | 434672 406802 | Railway Sidings | 1960 |
| 16D | 131 | SW | 434711 406360 | Railway Sidings | 1951 |

| ID | Distance (m) | Direction | NGR | Details | Date |
|---|---|---|---|---|---|
| 42K | 133 | S | 434764 406343 | Railway Sidings | 1961 |
| 43J | 135 | NW | n/a | Railway | 1904 |
| 44J | 135 | NW | n/a | Railway | 1929 |
| 45K | 137 | S | 434765 406341 | Railway Sidings | 1960 |
| 46 | 138 | SW | 434796 406240 | Railway Sidings | 1960 |
| 47 | 139 | SW | 434812 406239 | Railway Sidings | 1961 |
| 48 | 144 | W | 434534 406807 | Railway Sidings | 1960 |
| 17D | 145 | SW | 434717 406352 | Railway Sidings | 1948 |
| 49 | 151 | SW | 434719 406347 | Railway Sidings | 1929 |
| 18E | 152 | E | 435031 406561 | Railway Sidings | 1951 |
| 19E | 152 | E | 435032 406560 | Railway Sidings | 1938 |
| 20E | 153 | E | 435033 406559 | Railway Sidings | 1948 |
| 50L | 188 | W | 434565 406643 | Railway Sidings | 1961 |
| 51L | 194 | W | 434560 406642 | Railway Sidings | 1906 |

*Any records that have been identified are represented on the Railways and Tunnels map.*

## 9.3 Historical Railways

This data is derived from OpenStreetMap and provides information on the possible alignments of abandoned or dismantled railway lines in proximity to the study site.

Have any historical railway lines been identified within the study site boundary? No

Have any historical railway lines been identified within 250m of the study site boundary? No

Database searched and no data found.

Multiple sections of the same track may be listed in the detail above
*Any records that have been identified are represented on the Railways and Tunnels map.*

## 9.4 Active Railways

These datasets are derived from Ordnance Survey mapping and OpenStreetMap and provide information on the possible locations of active railway lines in proximity to the study site.

Have any active railway lines been identified within the study site boundary? No

Have any active railway lines been identified within 250m of the study site boundary? Yes

| Distance (m) | Direction | Name | Type |
|---|---|---|---|
| 29 | W | Not given | Multi Track |
| 29 | W | Not given | Multi Track |

| Distance (m) | Direction | Name | Type |
|---|---|---|---|
| 30 | W | Not given | Rail |
| 30 | W | Not given | Multi Track |
| 30 | W | Not given | Multi Track |
| 30 | W | Not given | Rail |
| 55 | W | Not given | Rail |
| 55 | W | Not given | Rail |
| 62 | NW | Not given | Multi Track |
| 62 | NW | Not given | Multi Track |
| 88 | NW | Not given | Multi Track |
| 88 | NW | Not given | Multi Track |
| 88 | NW | Not given | Multi Track |
| 88 | NW | Not given | Multi Track |
| 93 | NW | Penistone Line | Rail |
| 93 | NW | Penistone Line | Rail |
| 95 | NW | Not given | Rail |
| 95 | NW | Not given | Rail |
| 118 | NW | Penistone Line | Rail |
| 118 | NW | Penistone Line | Rail |
| 212 | NW | Not given | Multi Track |
| 212 | NW | Not given | Multi Track |

Multiple sections of the same track may be listed in the detail above
*Any records that have been identified are represented on the Railways and Tunnels map.*

## 9.5 Railway Projects

These datasets provide information on the location of large scale railway projects High Speed 2 and Crossrail 1 .

Is the study site within 5km of the route of the High Speed 2 rail project? Yes

Is the study site within 500m of the route of the Crossrail 1 rail project? No

*Further information on proximity to these routes, the project construction status and associated works can be obtained through the purchase of a Groundsure HS2 and Crossrail 1 Report.*

The route data has been digitised from publicly available maps by Groundsure. The route as provided relates to the Crossrail 1 project only, and does not include any details of the Crossrail 2 project, as final details of the route for Crossrail 2 are still under consultation.

Please note that this assessment takes account of both the original Phase 2b proposed route and the amended route proposed in 2016. As the Phase 2b route is still under consultation, Groundsure are providing information on both options until the final route is formally confirmed. Practitioners should take account of this uncertainty when advising clients.

# Contact Details

**Groundsure Helpline**

**Telephone: 08444 159 000**
**info@groundsure.com**

**British Geological Survey Enquiries**

Kingsley Dunham Centre
Keyworth, Nottingham NG12 5GG
Tel: 0115 936 3143.
Fax: 0115 936 3276.
Email:**enquiries@bgs.ac.uk**
Web:**www.bgs.ac.uk**
BGS Geological Hazards Reports and general geological enquiries

**British Gypsum**

British Gypsum Ltd
East Leake
Loughborough
Leicestershire
LE12 6HX

**The Coal Authority**

200 Lichfield Lane
Mansfield
Notts NG18 4RG
Tel: 0345 7626 848
DX 716176 Mansfield 5
**www.coal.gov.uk**

**Public Health England**

Public information access office
Public Health England, Wellington House
133-155 Waterloo Road, London, SE1 8UG
**https://www.gov.uk/government/organisations/public-health-england**
Email: **enquiries@phe.gov.uk**
Main switchboard: 020 7654 8000

**Johnson Poole & Bloomer Limited**

Harris and Pearson Building, Brettel Lane
Brierley Hill, West Midlands
DY5 3LH
Tel: +44 (0) 1384 262 000
Email:**enquiries.gs@jpb.co.uk**
Website: **www.jpb.co.uk**

**Ordnance Survey**

Adanac Drive, Southampton
SO16 0AS

Tel: 08456 050505
**Website: http://www.ordnancesurvey.co.uk/**

**Getmapping PLC**

Virginia Villas, High Street, Hartley Witney,
Hampshire RG27 8NW
Tel: 01252 845444
Website:**http://www1.getmapping.com/**

**Peter Brett Associates**
Caversham Bridge House
Waterman Place
Reading
Berkshire RG1 8DN
Tel: +44 (0)118 950 0761 E-mail:**reading@pba.co.uk**
Website:**http://www.peterbrett.com/home**

Acknowledgements: Ordnance Survey © Crown Copyright and/or Database Right. All Rights Reserved. Licence Number [03421028]. This report has been prepared in accordance with the Groundsure Ltd standard Terms and Conditions of business for work of this nature.

# Standard Terms and Conditions

Groundsure's Terms and Conditions can be viewed online at this link:
https://www.groundsure.com/terms-and-conditions-may25-2018

# Appendix F

# Historical Plans




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

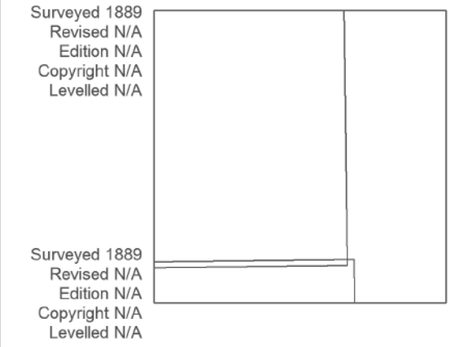
**Map Name:** County Series Town Plan

**Map date:** **1889**

**Scale:** 1:500

**Printed at:** 1:1,000

N
W E
S



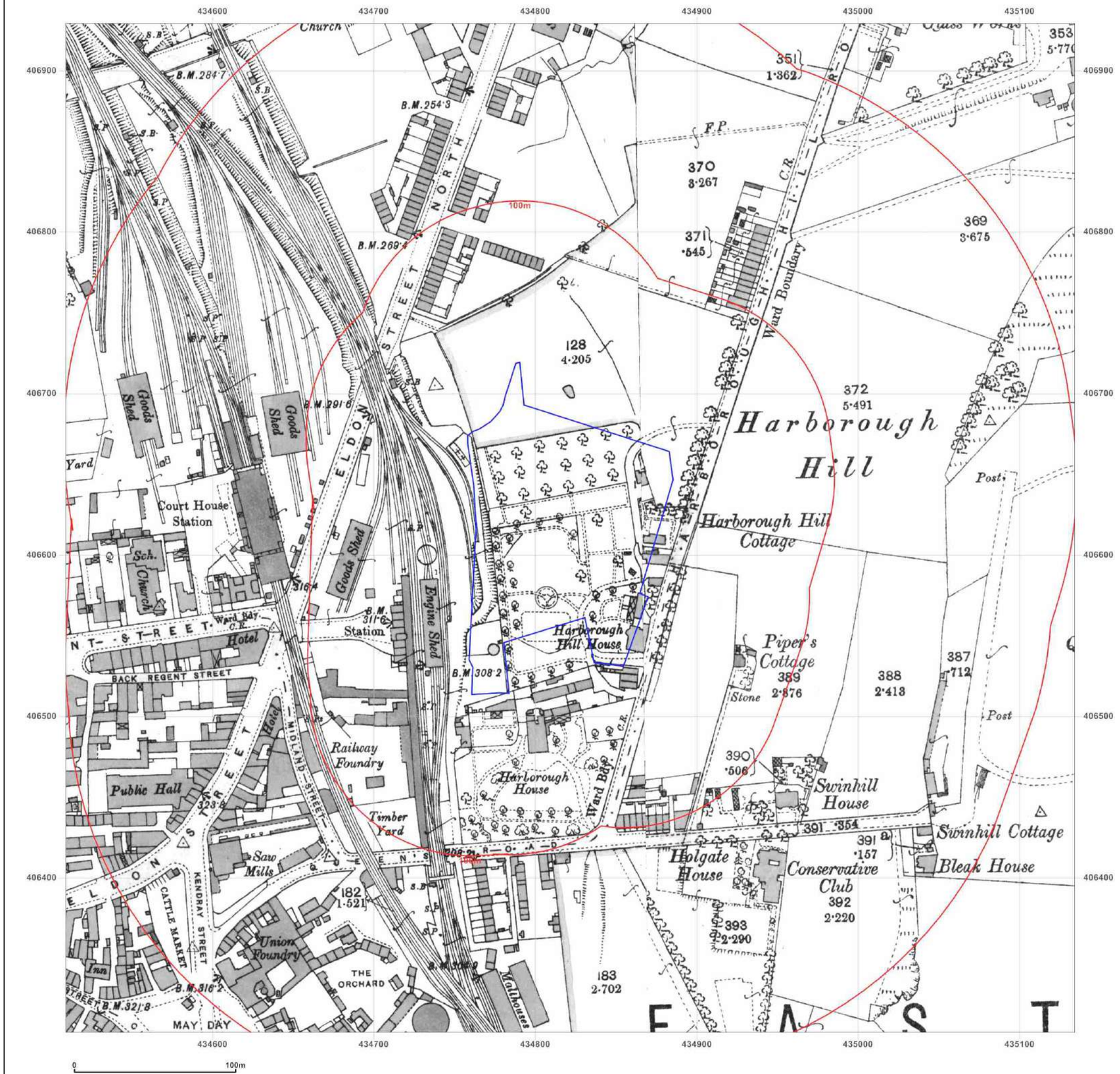

Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

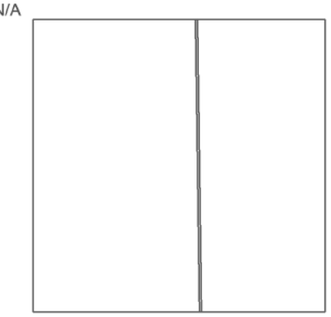
**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** County Series
**Map date:** **1892-1893**
**Scale:** 1:2,500
**Printed at:** 1:2,500

N
W E
S

Surveyed 1893
Revised 1893
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1892
Revised N/A
Edition 1892
Copyright N/A
Levelled N/A



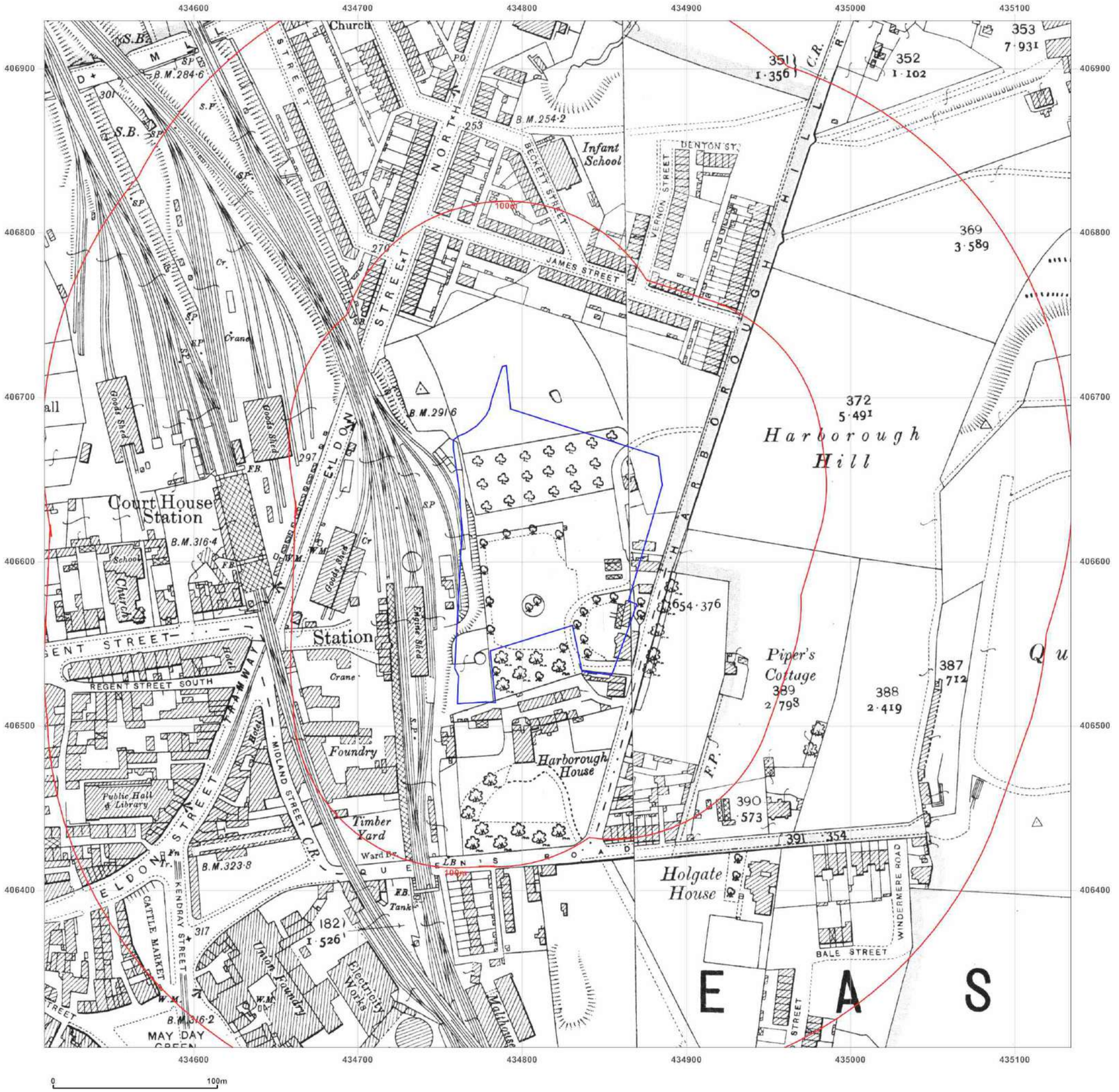
Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** County Series

**Map date:** **1906**

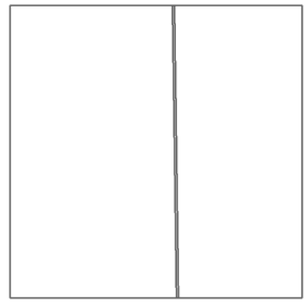
**Scale:** 1:2,500

**Printed at:** 1:2,500

N
W E
S

Surveyed 1906
Revised 1906
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1890
Revised 1904
Edition N/A
Copyright N/A
Levelled N/A



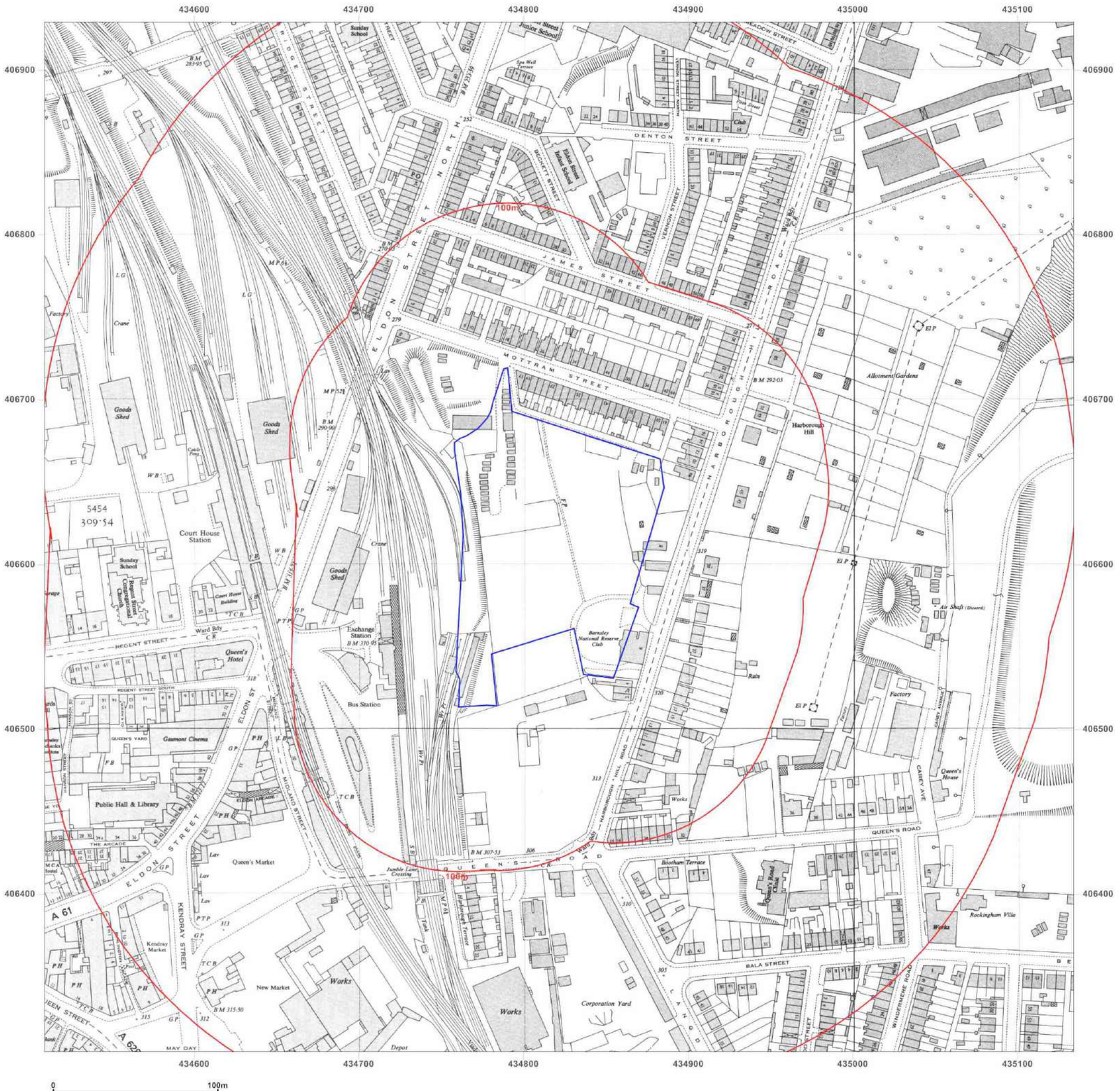
Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** National Grid

**Map date:** **1960**

**Scale:** 1:2,500

**Printed at:** 1:2,500

N
W E
S

Surveyed 1960
Revised 1960
Edition N/A
Copyright 1962
Levelled 1930

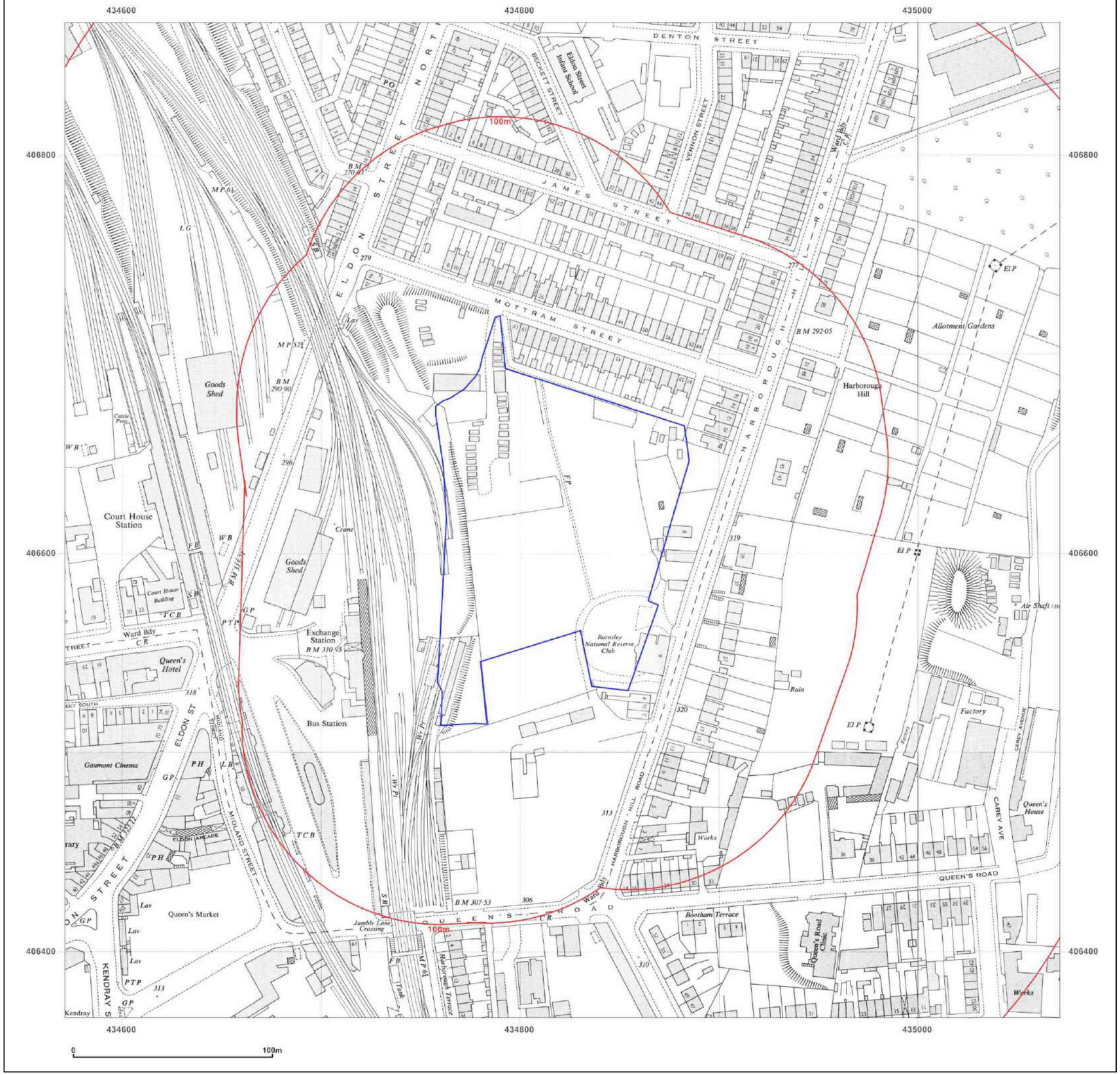
Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** National Grid

**Map date:** **1961**

**Scale:** 1:1,250

**Printed at:** 1:2,000

N
W E
S

| | |
|---|---|
| ~~Surveyed 1960~~<br>Revised 1960<br>Edition N/A<br>Copyright 1961<br>Levelled 1930 | Surveyed 1960<br>Revised 1960<br>Edition N/A<br>Copyright 1961<br>Levelled 1930 |
| Surveyed 1960<br>Revised 1960<br>Edition N/A<br>Copyright 1961<br>Levelled 1930 | Surveyed 1960<br>Revised 1960<br>Edition N/A<br>Copyright 1961<br>Levelled 1930 |

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** National Grid

**Map date:** **1962**

**Scale:** 1:2,500

**Printed at:** 1:2,500

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

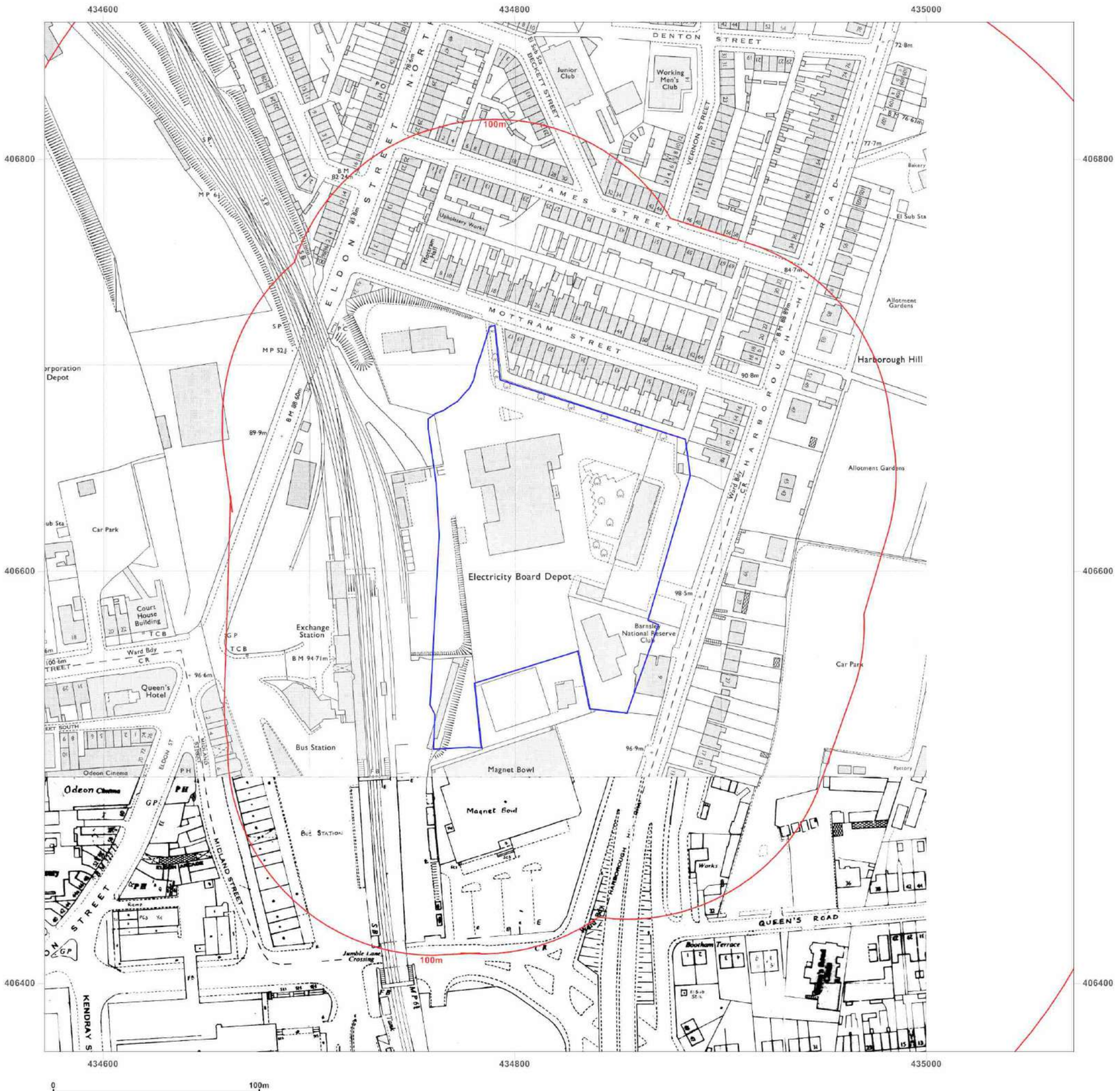
Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** National Grid

**Map date:** **1972-1975**

**Scale:** 1:1,250

**Printed at:** 1:2,000

N
W E
S

~~Surveyed 1960~~
Revised 1971
Edition N/A
Copyright 1972
Levelled 1963

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

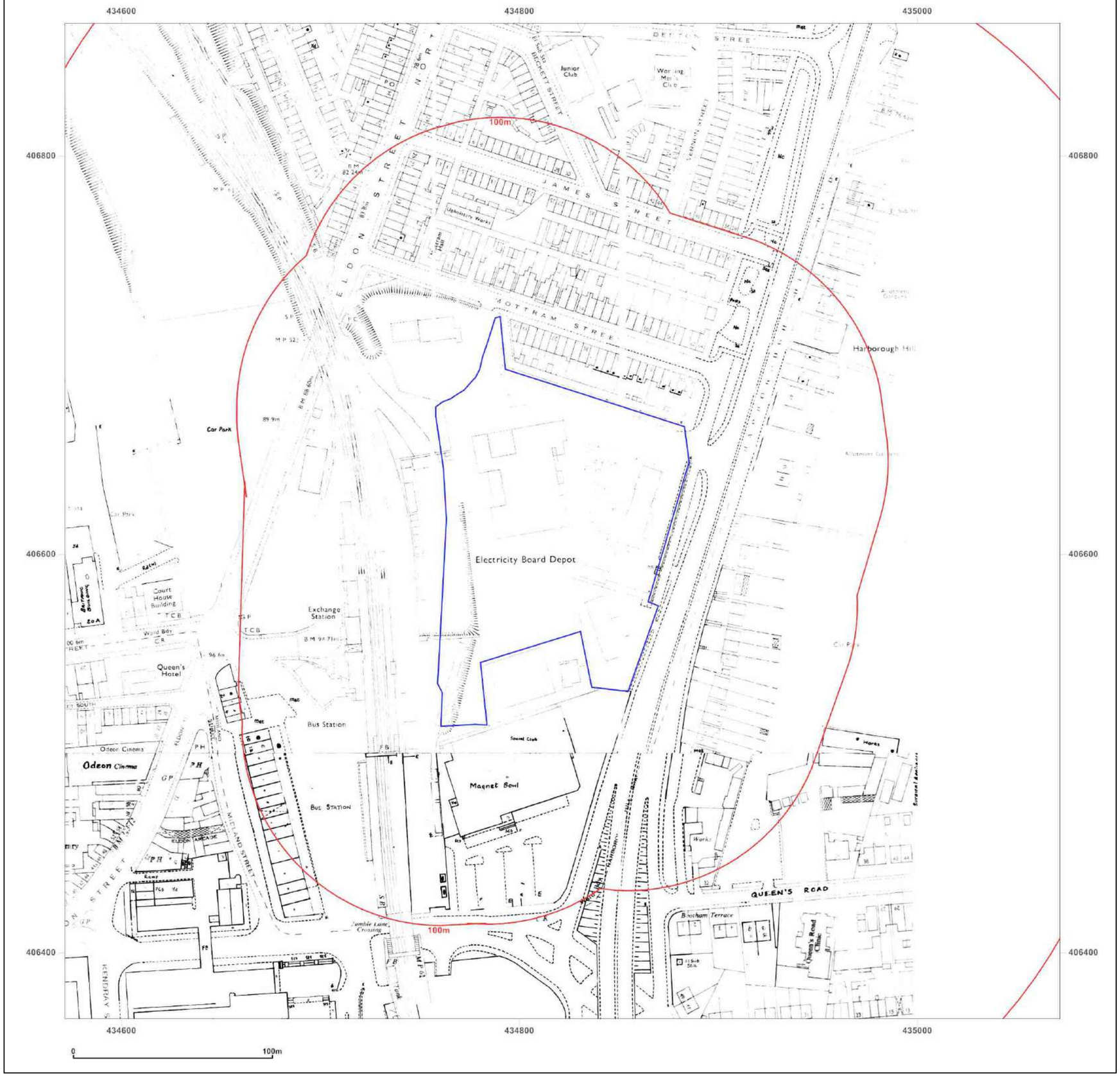
Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** National Grid

**Map date:** **1975-1977**

**Scale:** 1:1,250

**Printed at:** 1:2,000

N
W E
S

~~Surveyed N/A~~
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

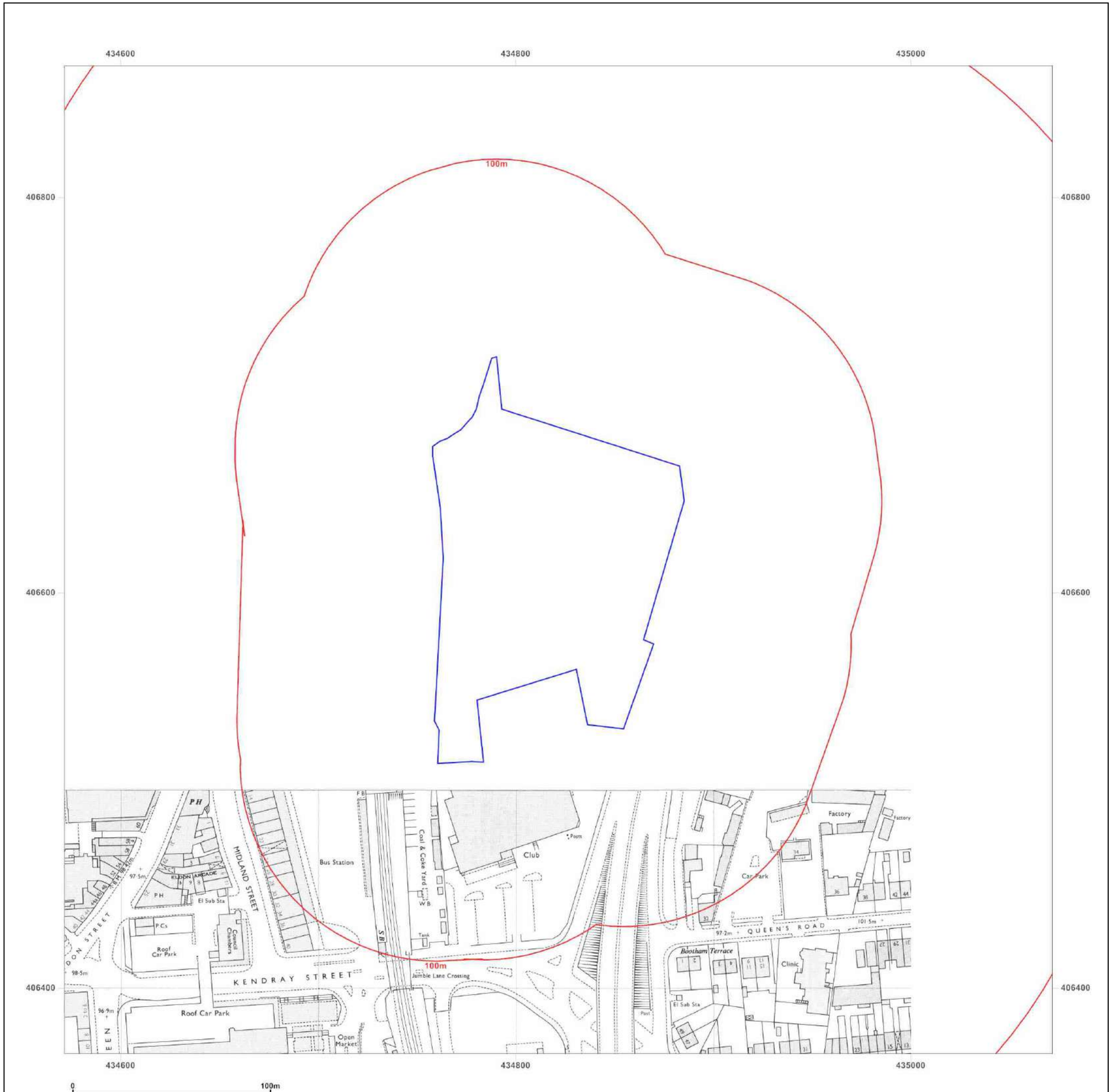
Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

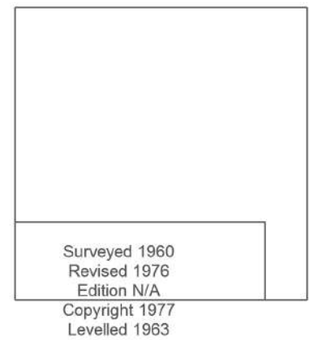
**Map Name:** National Grid

**Map date:** **1977**

**Scale:** 1:1,250

**Printed at:** 1:2,000

N
W E
S




Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** National Grid
**Map date:** **1985-1989**
**Scale:** 1:1,250
**Printed at:** 1:2,000

N
W E
S

| | |
|---|---|
| ~~Surveyed 1960~~<br>Revised 1986<br>Edition N/A<br>Copyright N/A<br>Levelled 1963 | Surveyed 1963<br>Revised 1989<br>Edition N/A<br>Copyright 1989<br>Levelled 1963 |
| Surveyed 1963<br>Revised 1987<br>Edition N/A<br>Copyright 1987<br>Levelled 1963 | Surveyed 1963<br>Revised 1985<br>Edition N/A<br>Copyright 1985<br>Levelled 1963 |

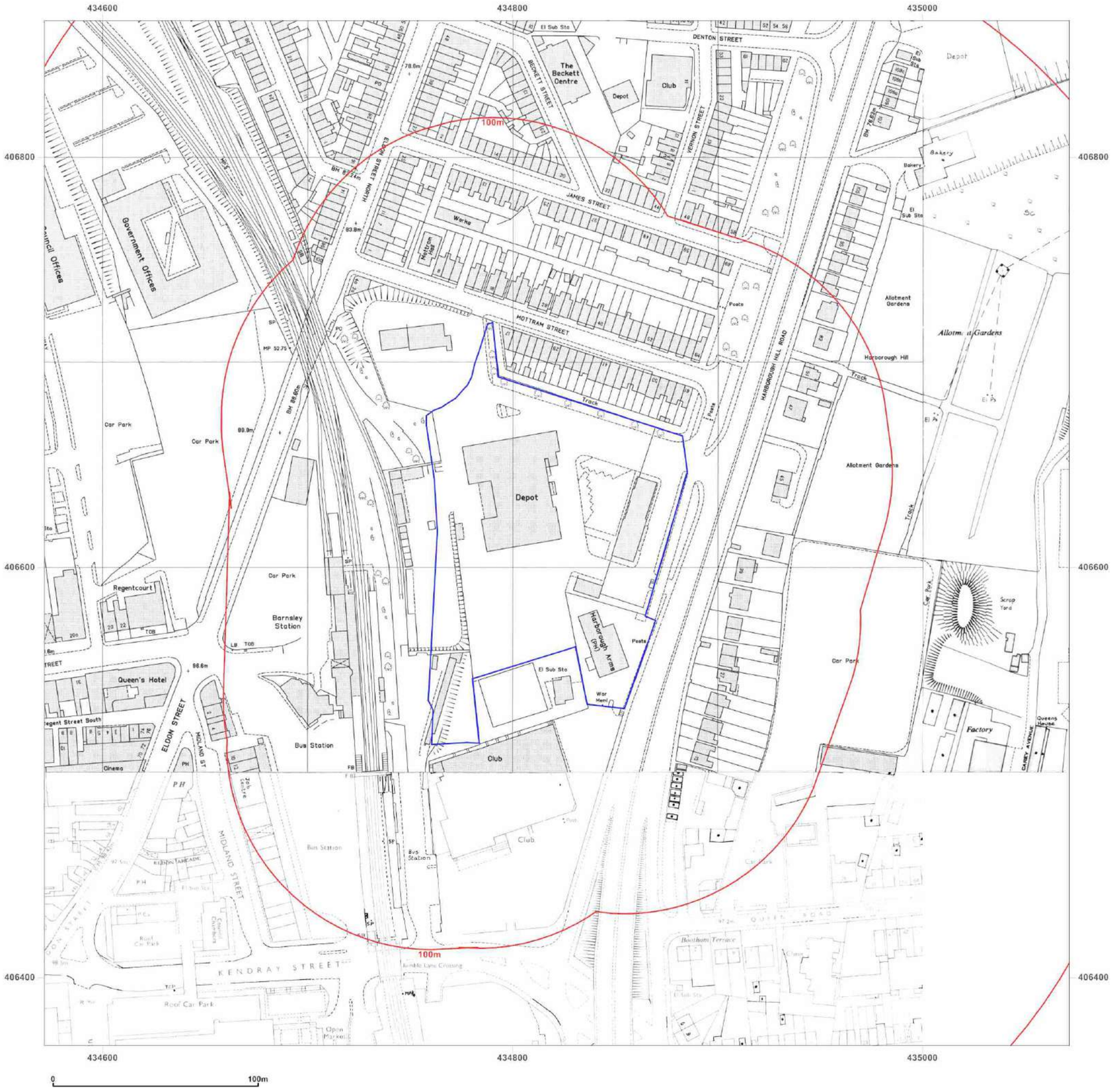
Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** National Grid
**Map date:** **1987-1991**
**Scale:** 1:1,250
**Printed at:** 1:2,000

N
W E
S

| | |
|---|---|
| ~~Surveyed 1960~~<br>Revised 1986<br>Edition N/A<br>Copyright 1987<br>Levelled 1963 | Surveyed 1963<br>Revised 1990<br>Edition N/A<br>Copyright 1990<br>Levelled 1963 |
| Surveyed N/A<br>Revised N/A<br>Edition N/A<br>Copyright 1991<br>Levelled 1963 | |

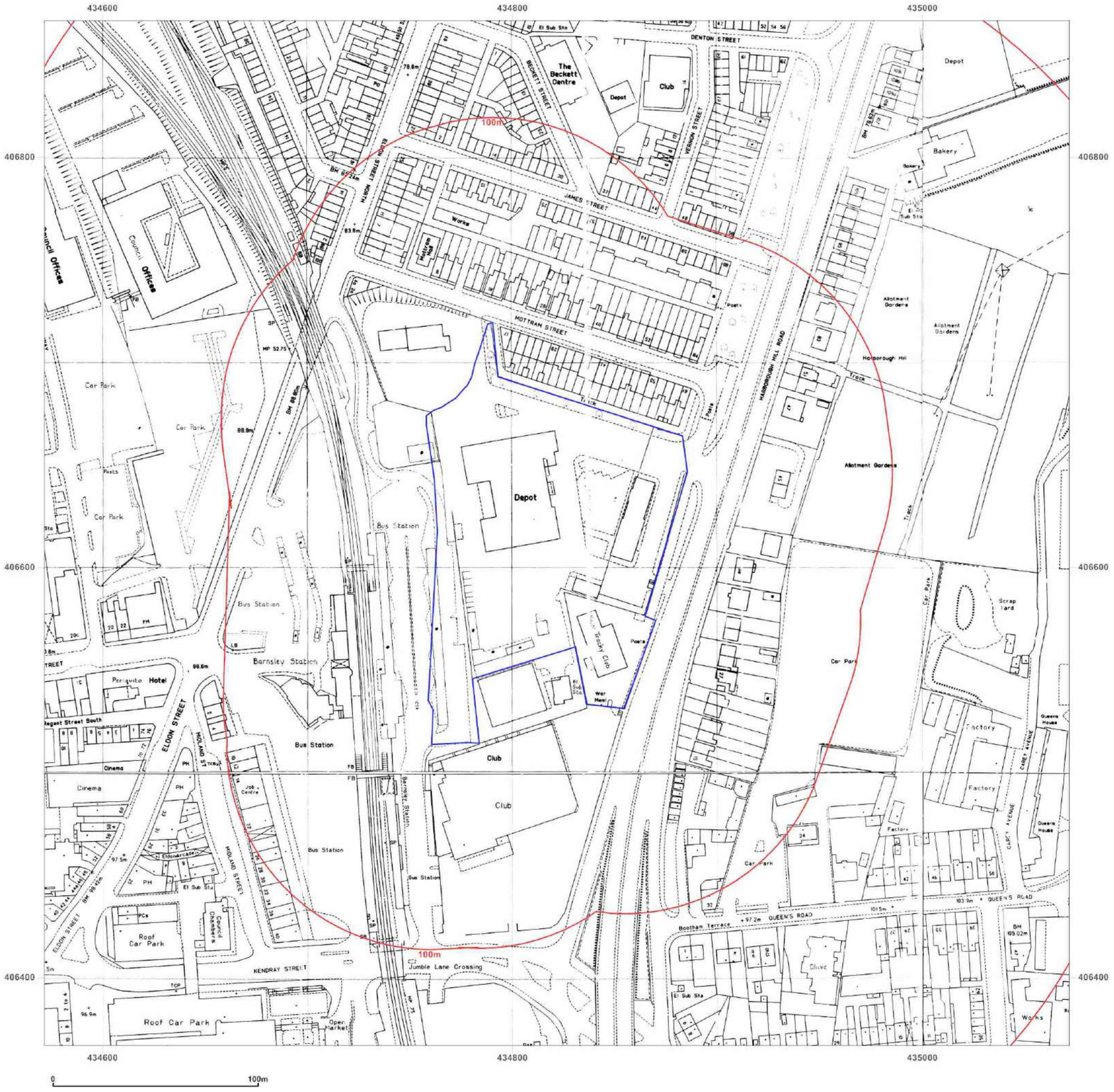
Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** National Grid

**Map date:** **1991-1993**

**Scale:** 1:1,250

**Printed at:** 1:2,000

N
W E
S

| | |
|---|---|
| ~~Surveyed N/A~~<br>Revised N/A<br>Edition N/A<br>Copyright N/A<br>Levelled N/A | Surveyed N/A<br>Revised N/A<br>Edition N/A<br>Copyright 1993<br>Levelled N/A |
| Surveyed 1993<br>Revised N/A<br>Edition N/A<br>Copyright 1993<br>Levelled N/A | Surveyed 1993<br>Revised N/A<br>Edition N/A<br>Copyright 1993<br>Levelled N/A |

Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** National Grid

**Map date:** **1993**

**Scale:** 1:1,250

**Printed at:** 1:2,000

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1993
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1993
Levelled N/A

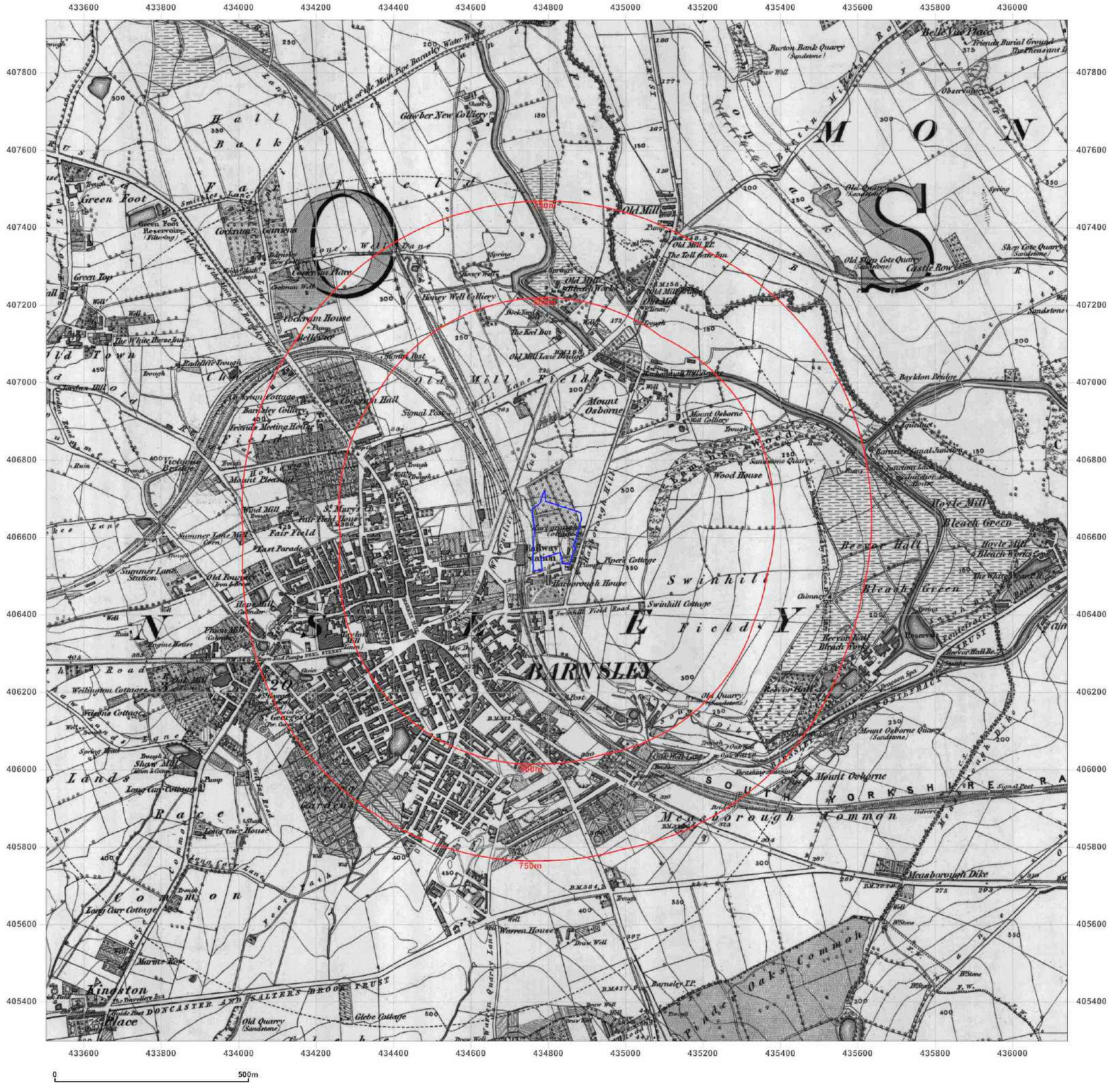
Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** County Series

**Map date:** **1850**

**Scale:** 1:10,560

**Printed at:** 1:10,560

N
W E
S

Surveyed 1851
Revised N/A
Edition 1850
Copyright N/A
Levelled N/A

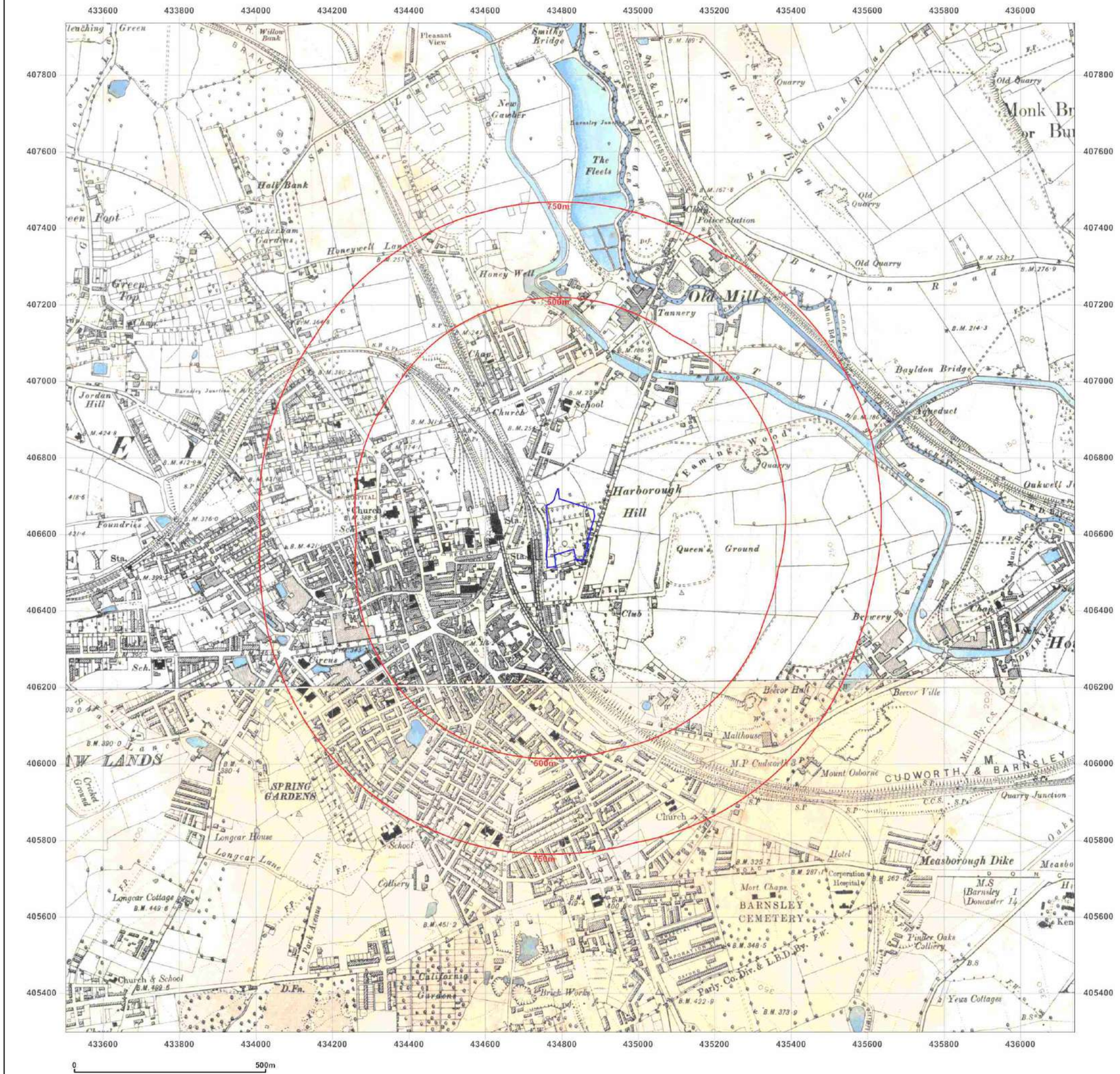
Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** County Series

**Map date:** **1890**

**Scale:** 1:10,560

**Printed at:** 1:10,560

N
W E
S

Surveyed 1890
Revised 1890
Edition 1890
Copyright N/A
Levelled N/A

Surveyed 1890
Revised 1890
Edition 1890
Copyright N/A
Levelled N/A

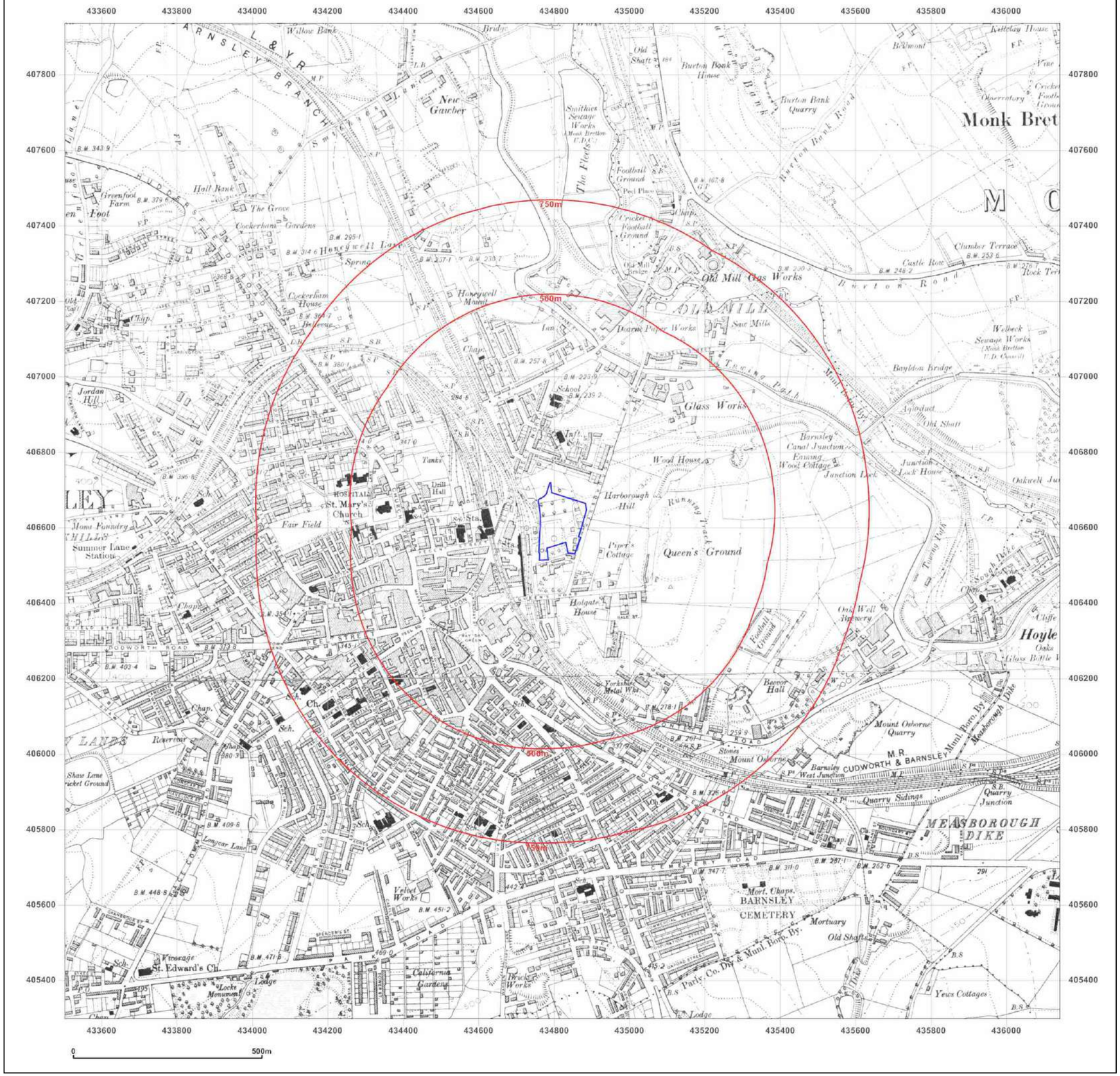
Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** County Series

**Map date:** **1904**

**Scale:** 1:10,560

**Printed at:** 1:10,560

N
W E
S

Surveyed 1891
Revised 1904
Edition 1904
Copyright N/A
Levelled N/A

Surveyed 1890
Revised 1904
Edition 1904
Copyright N/A
Levelled N/A

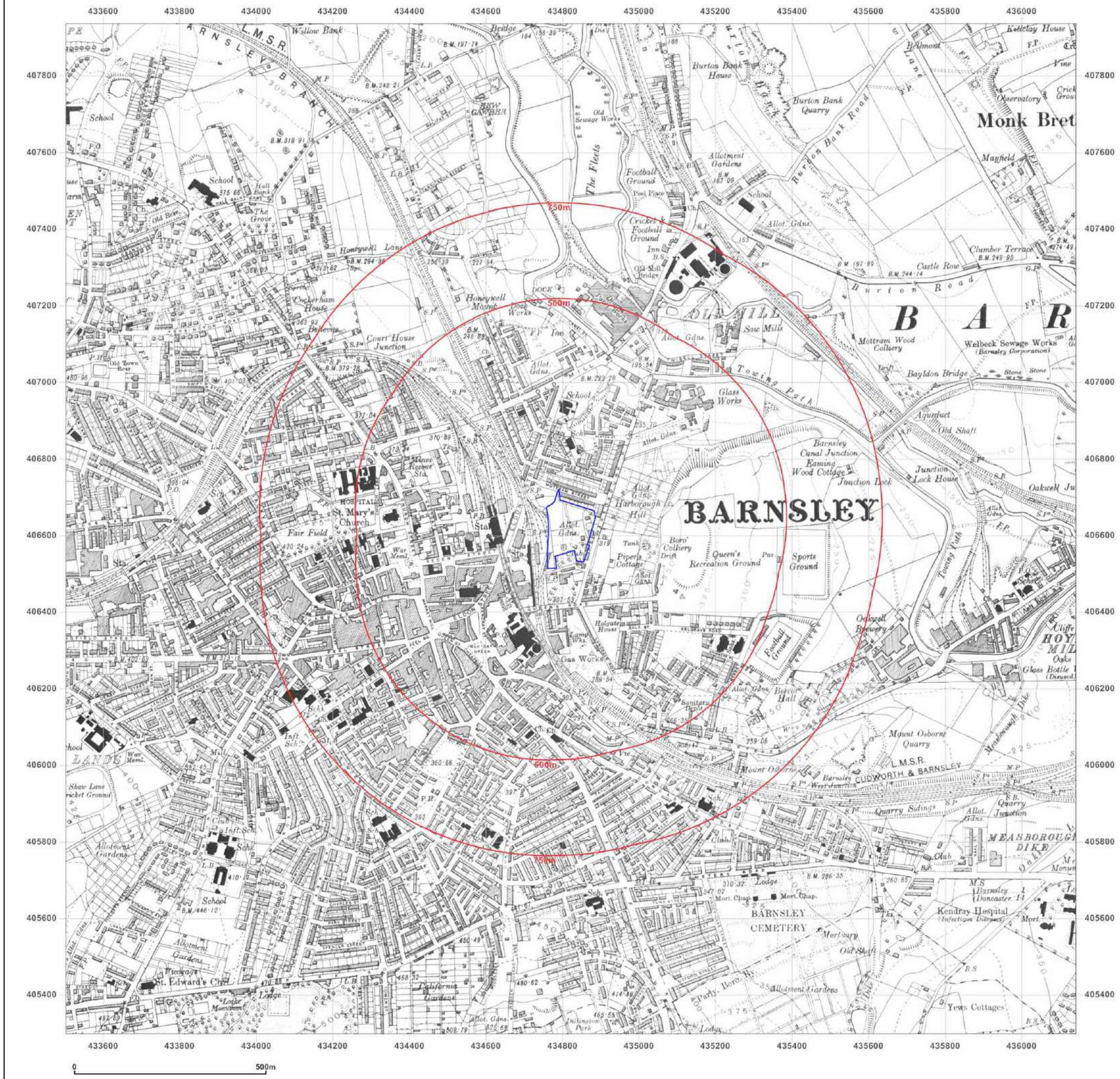
Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** County Series

**Map date:** **1929**

**Scale:** 1:10,560

**Printed at:** 1:10,560

N
W E
S

Surveyed 1851
Revised 1929
Edition 1929
Copyright N/A
Levelled 1915

Surveyed 1851
Revised 1929
Edition 1929
Copyright N/A
Levelled 1915

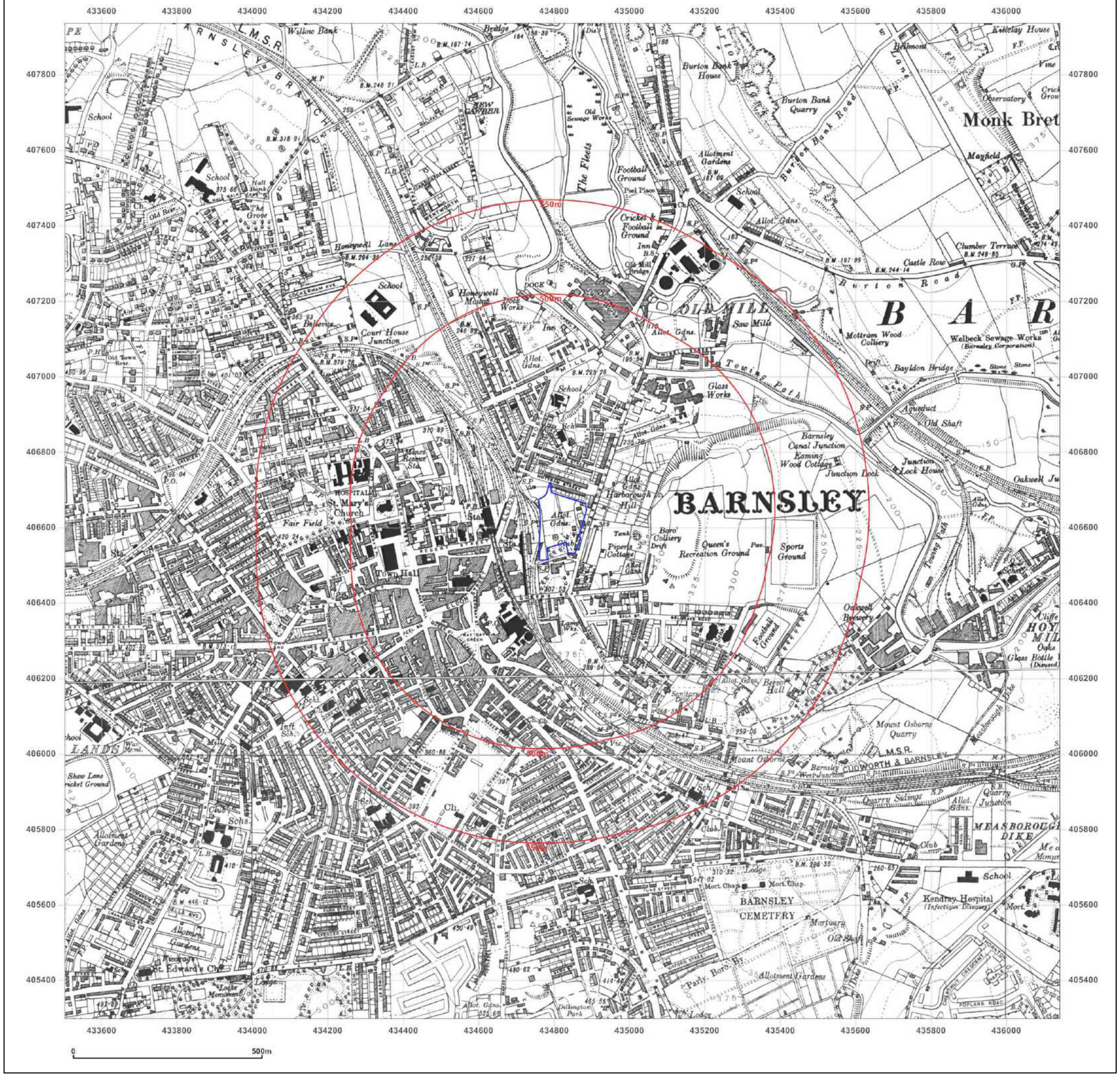
Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** County Series

**Map date:** **1938**

**Scale:** 1:10,560

**Printed at:** 1:10,560

N
W E
S

Surveyed 1851
Revised 1938
Edition 1938
Copyright N/A
Levelled 1929

Surveyed 1851
Revised 1938
Edition 1938
Copyright N/A
Levelled 1929

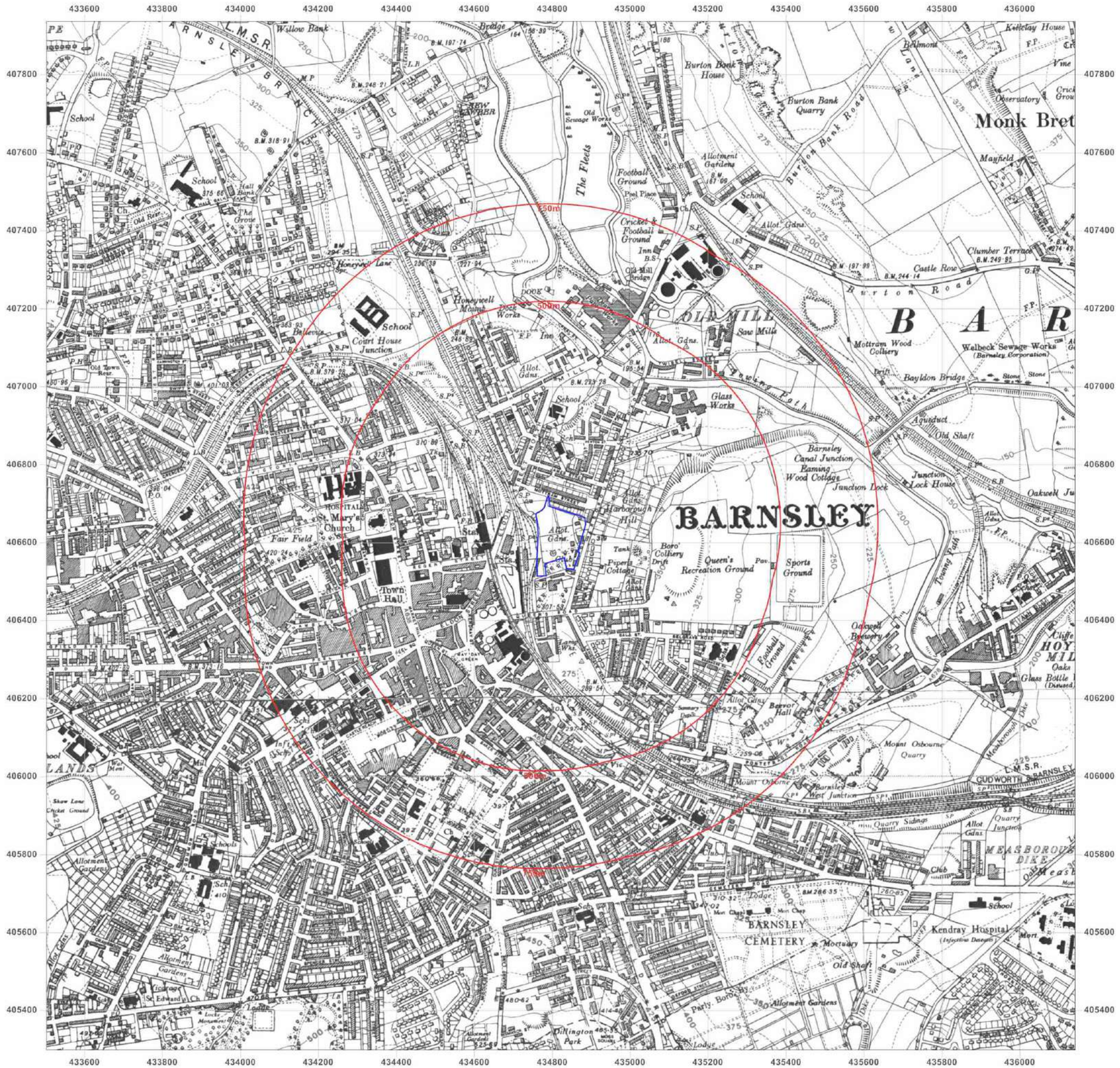
Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** County Series

**Map date:** **1948**

**Scale:** 1:10,560

**Printed at:** 1:10,560

N
W E
S

Surveyed 1851
Revised 1948
Edition 1948
Copyright N/A
Levelled 1929

Surveyed 1851
Revised 1948
Edition 1948
Copyright N/A
Levelled 1929

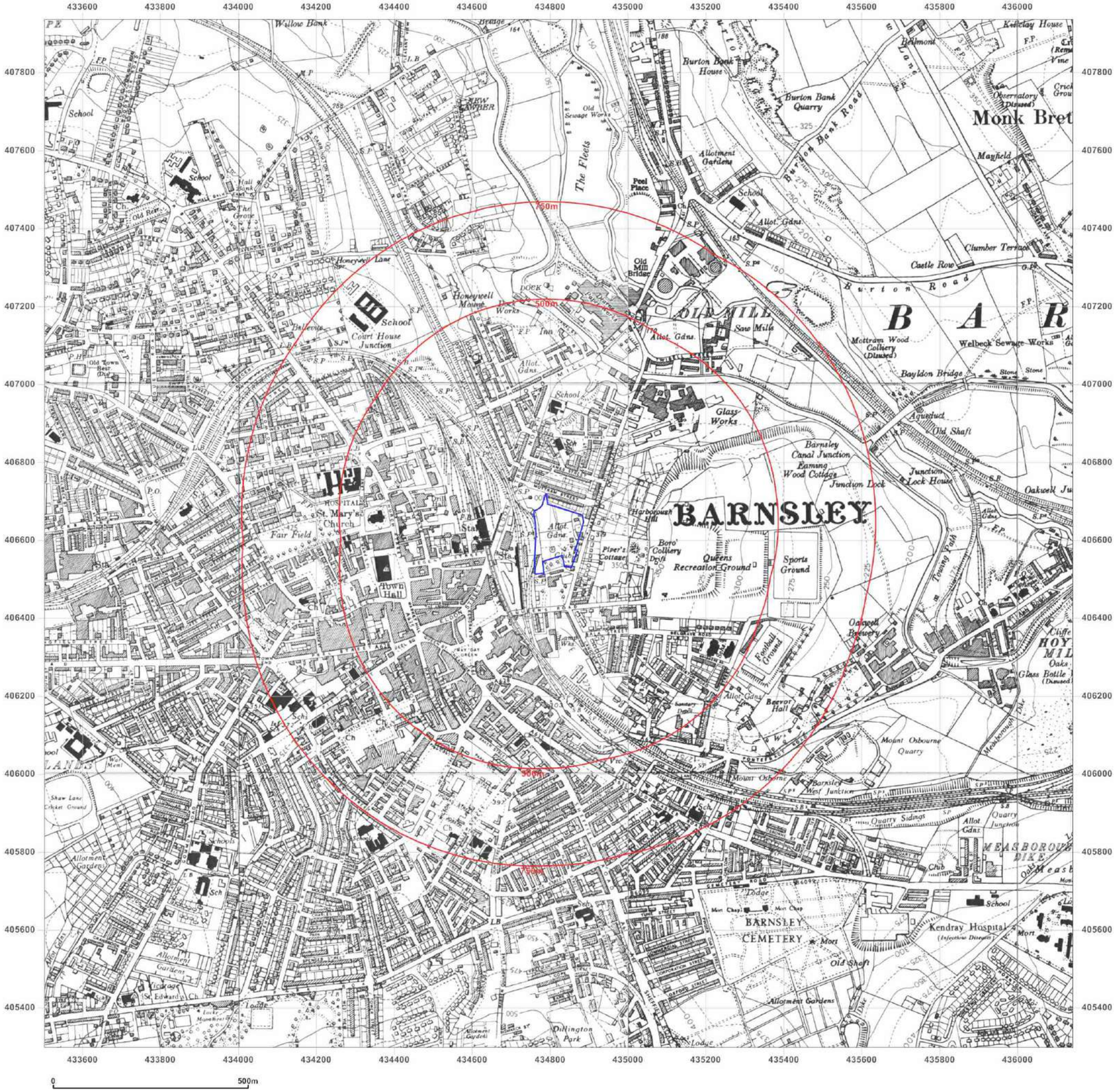
Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** Provisional

**Map date:** **1955-1956**

**Scale:** 1:10,560

**Printed at:** 1:10,560

N
W E
S

Surveyed N/A
Revised 1955
Edition N/A
Copyright 1956
Levelled N/A

Surveyed N/A
Revised 1955
Edition N/A
Copyright 1955
Levelled N/A

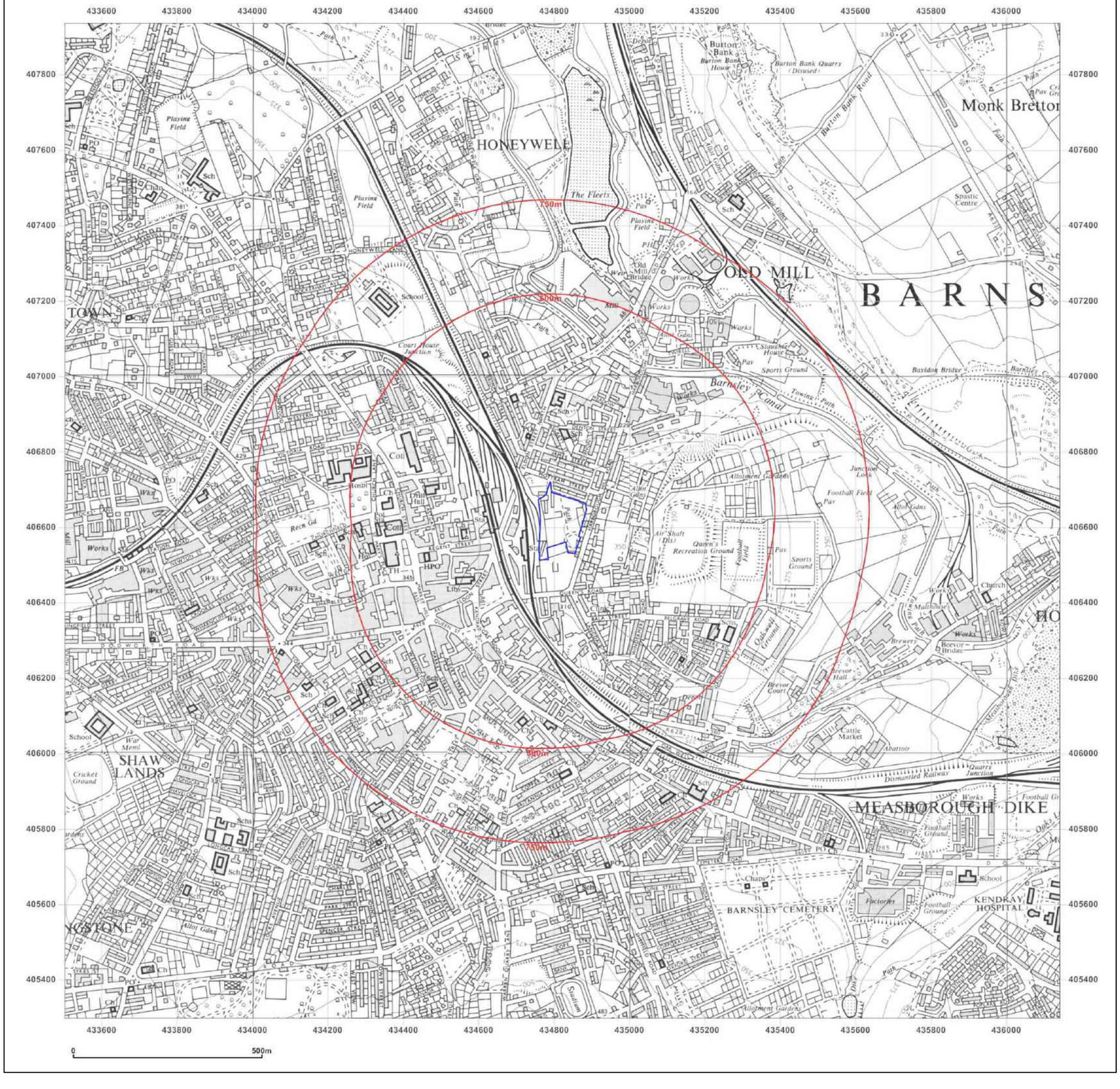
Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** Provisional

**Map date:** **1966**

**Scale:** 1:10,560

**Printed at:** 1:10,560

N
W E
S

Surveyed 1966
Revised 1966
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1966
Revised 1966
Edition N/A
Copyright 1966
Levelled N/A

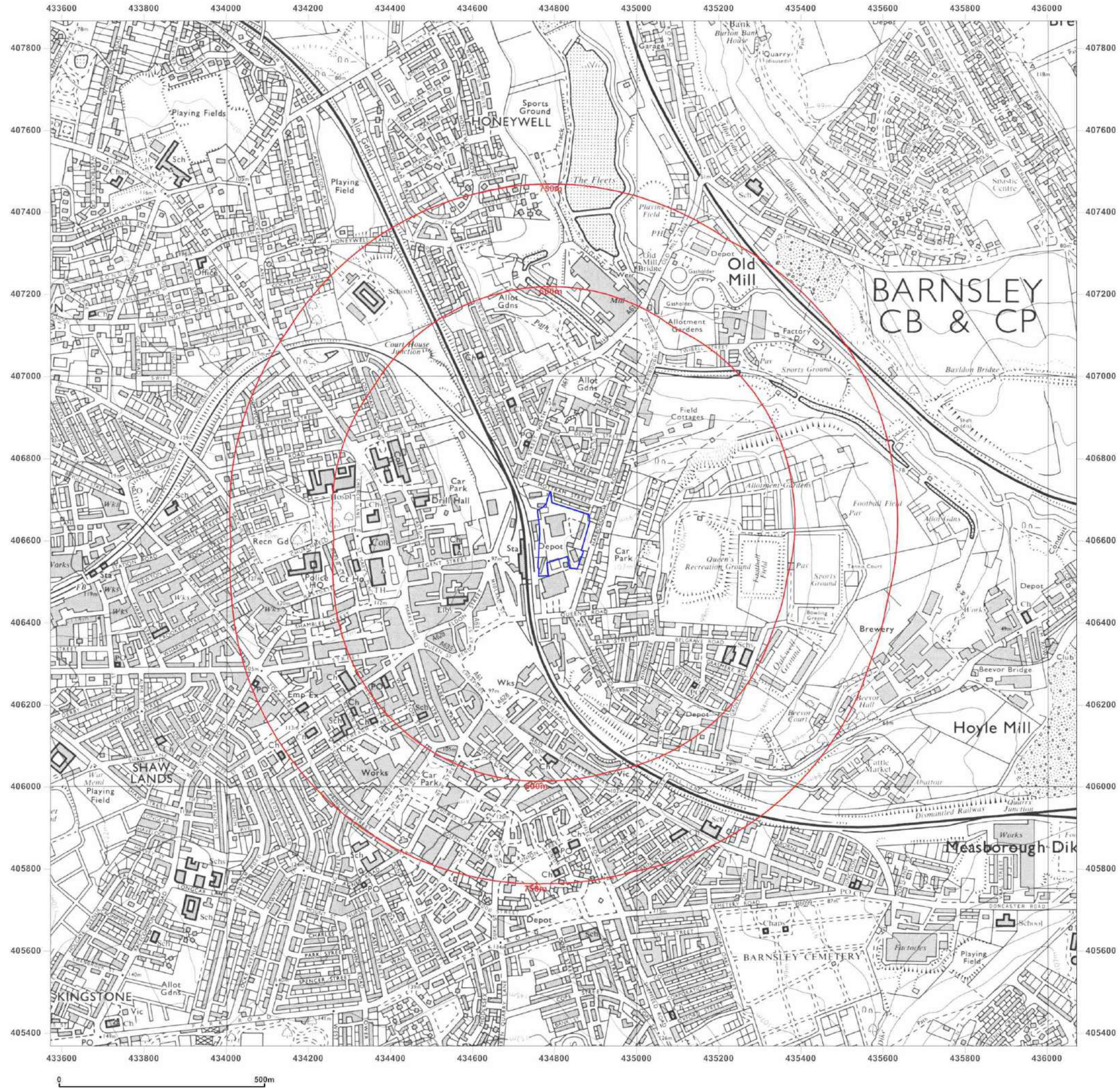
Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Site Details:

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** National Grid

**Map date:** **1973-1974**

**Scale:** 1:10,000

**Printed at:** 1:10,000

N
W E
S

Surveyed 1973
Revised 1973
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1974
Revised 1974
Edition N/A
Copyright 1975
Levelled 1978

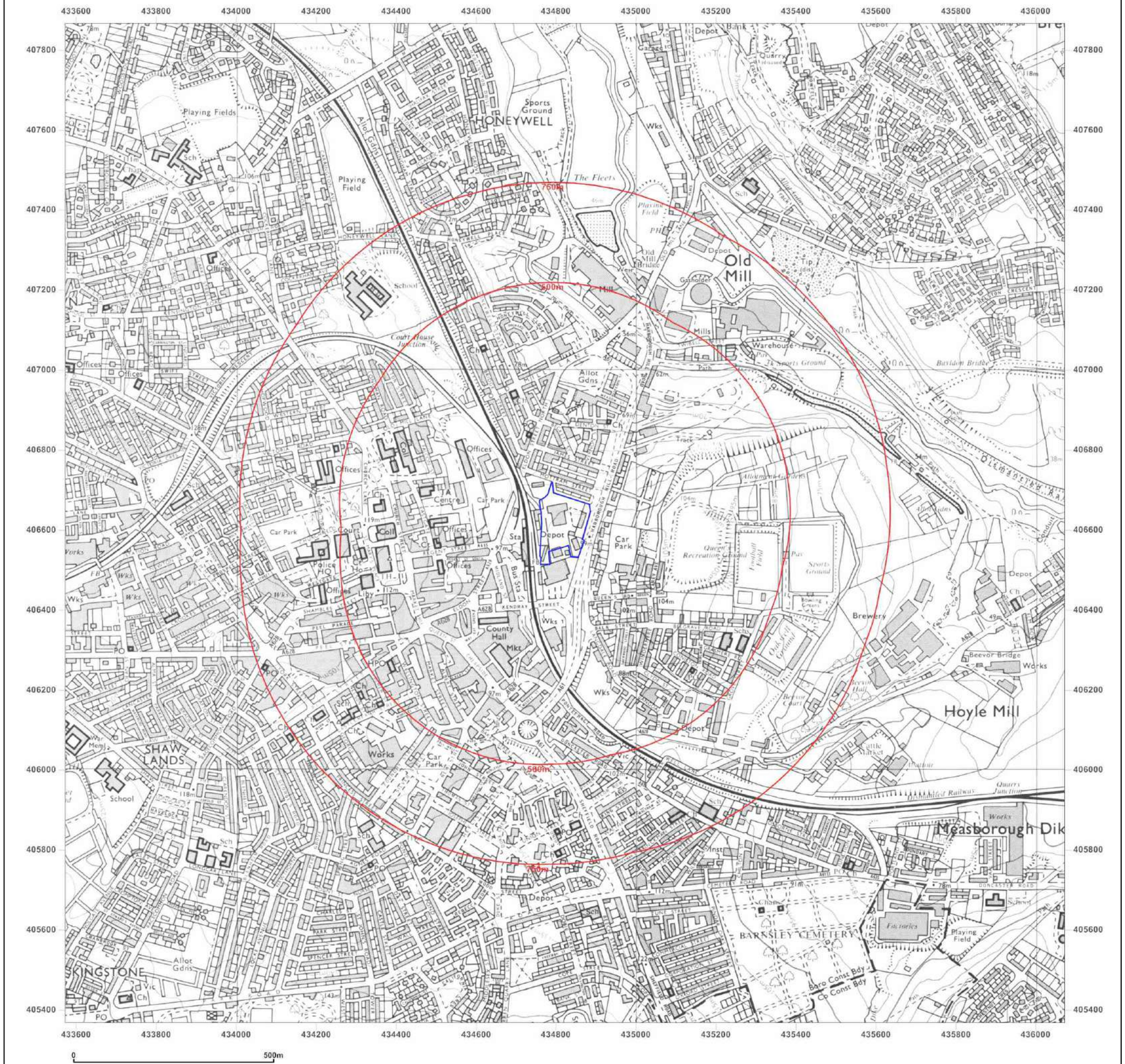
Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** National Grid

**Map date:** **1982**

**Scale:** 1:10,000

**Printed at:** 1:10,000

N
W E
S

Surveyed 1982
Revised 1982
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1981
Revised 1982
Edition N/A
Copyright 1983
Levelled 1978

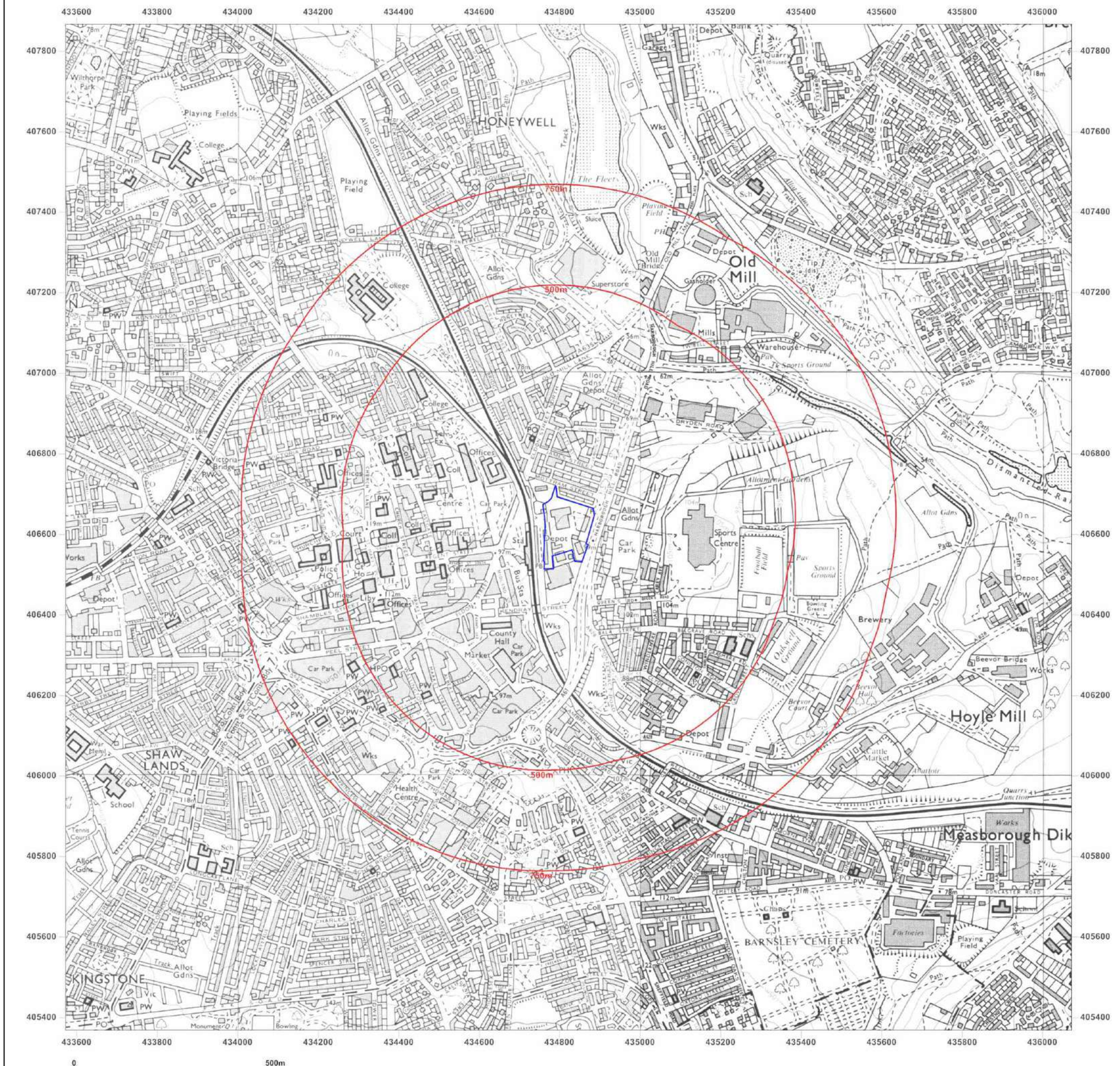
Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** National Grid

**Map date:** **1992-1993**

**Scale:** 1:10,000

**Printed at:** 1:10,000

N
W E
S

Surveyed 1992
Revised 1993
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1981
Revised 1992
Edition N/A
Copyright 1993
Levelled 1978

Powered by

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




# Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** 1:10,000 Raster
**Map date:** **2002**
**Scale:** 1:10,000
**Printed at:** 1:10,000

N
W E
S

2002

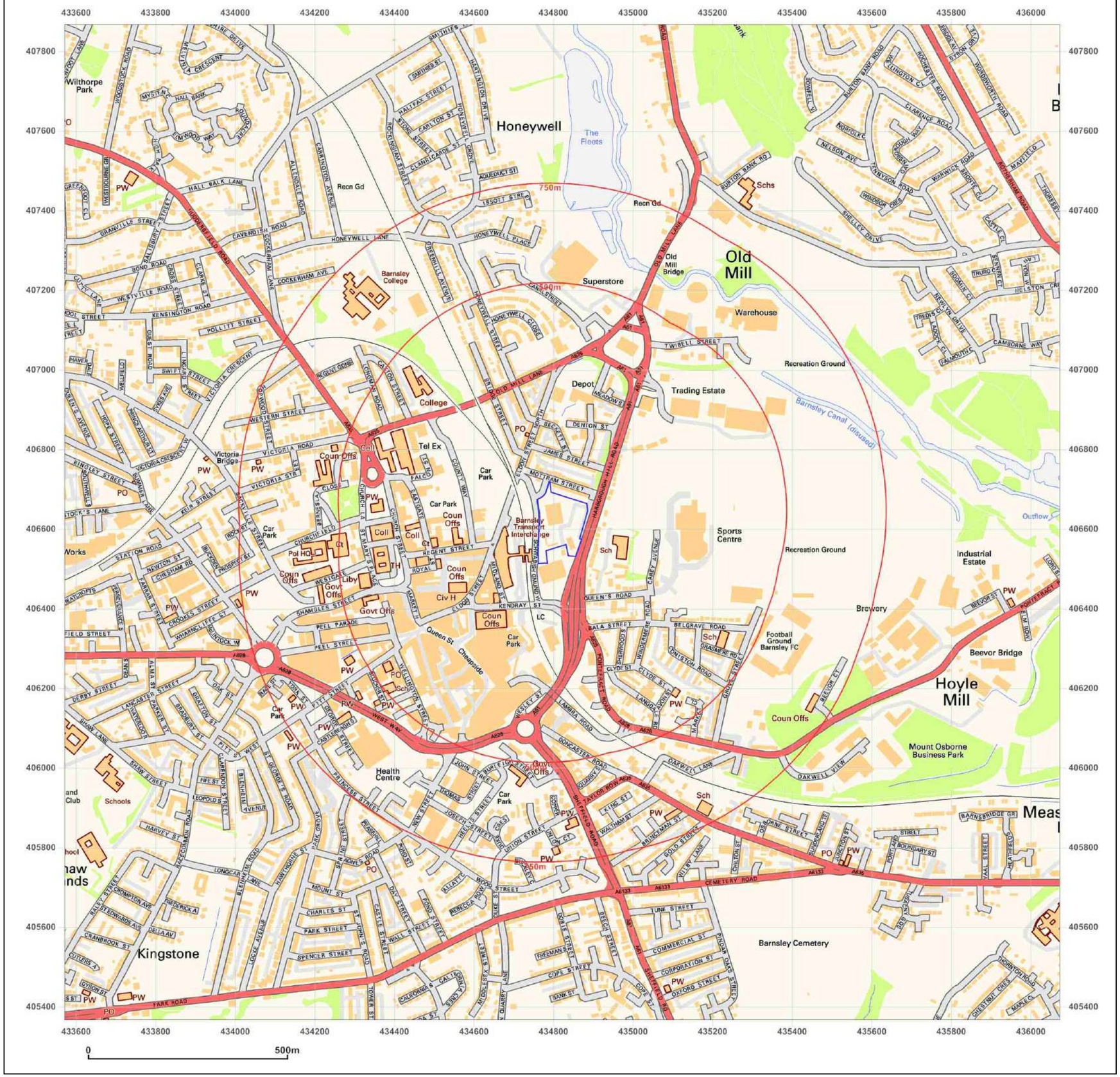
Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** National Grid
**Map date:** **2010**
**Scale:** 1:10,000
**Printed at:** 1:10,000

N W E S

2010

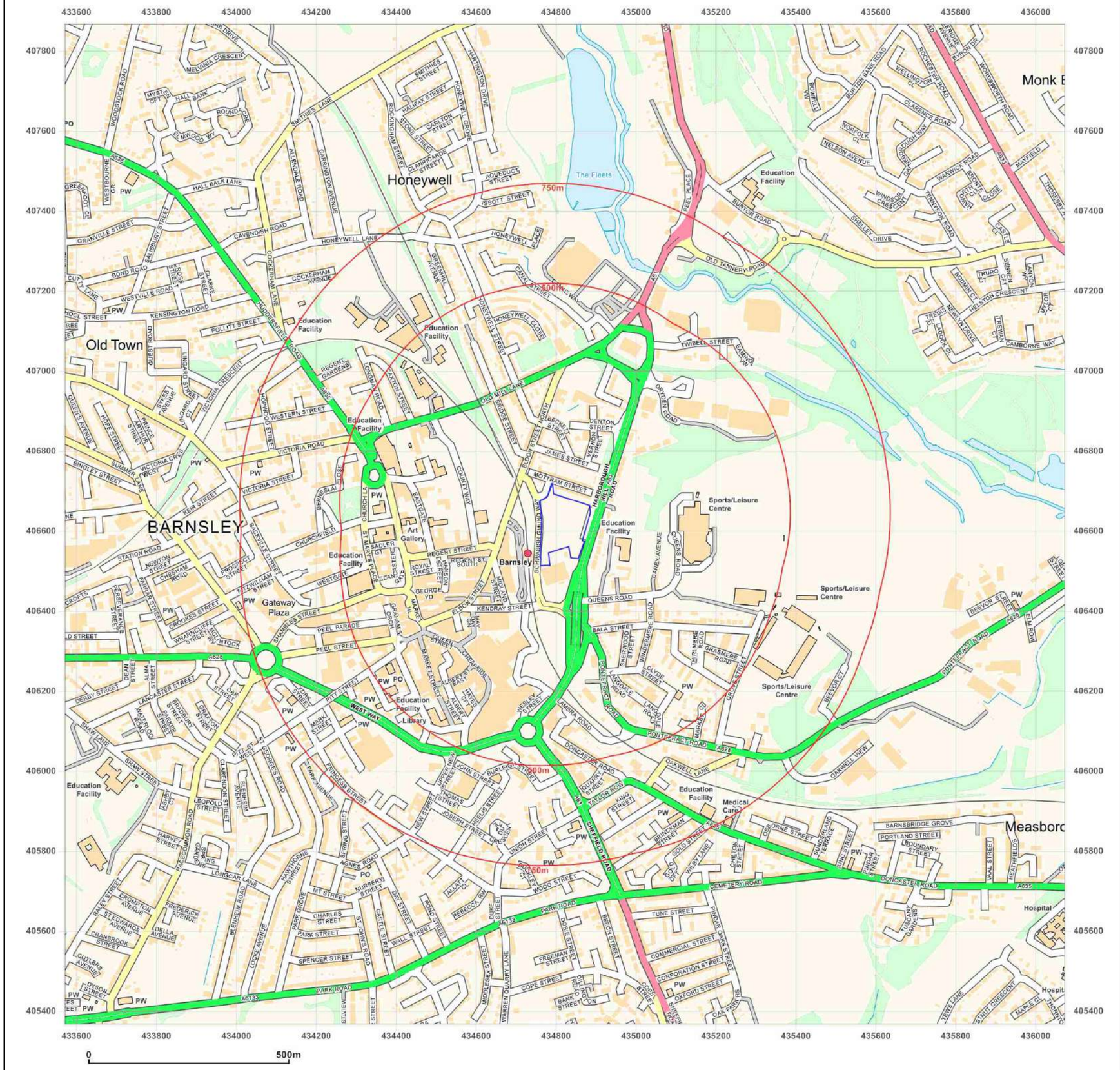
Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf




Groundsure INSIGHTS

**Site Details:**

Schwabisch Gmund Way, S71 1BP

**Client Ref:** Schwabisch_Gmund_Way_PO23003026
**Report Ref:** GS-5235677
**Grid Ref:** 434821, 406617

**Map Name:** National Grid

**Map date:** **2014**

**Scale:** 1:10,000

**Printed at:** 1:10,000

N
W E
S

2014

Powered by OS

Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

© Crown copyright and database rights 2018 Ordnance Survey 100035207

Production date: 13 July 2018

Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf

# Appendix G

# SYMAS Mineral Report

PLACE DIRECTORATE
**South Yorkshire Mining Advisory Service**

BARNSLEY
Metropolitan Borough Council

| | | | | | |
|---|---|---|---|---|---|
| **To:** | Housing & Energy | | **FAO:** | Alison Dalton | |
| **My Ref:** | M4089/6 | | **Your Ref:** | (YEB). | |
| **Date:** | 13th February 2018 | **Enquiries to:** | Mr. M. Lyons | **Ext:** | 2690 |
| **Subject:** | FORMER YEB DEPOT OFF SCHWABISCH GMUND WAY, BARNSLEY. | | | | |

Further to your consultation request of the 6th February 2018, I can confirm the following.

SITUATION

A mining report has been requested for land off Schwabisch Gmund Way, which is being considered for residential development. This report provides a review of the mining and geological history of the site and an assessment for the potential for mining legacy risks. The report makes recommendations regarding the need for any investigative and/or remediation requirements.

GEOLOGICAL INFORMATION

Geological records indicate that the land is underlain by shales and mudstones of the Middle Coal Measures, as indicated on the attached plan no. M4089/6A. The strata in this vicinity (according to deep mining abandonment plans) is known to dip to the east at a rate of around 1 in 12 (5°).

The 'Two Foot' coal seam is conjectured to outcrop on the eastern boundary of the site as shown on the above plan. As such, part of this coal may be encountered beneath surface soils/made ground in that vicinity. The thickness of this coal is expected to be in the region of 950mm.

The 'Abdy' (sometimes known as 'Winter') coal seam is shown to outcrop through the site as indicated. This coal may be encountered beneath the surface soils/made ground centrally within the site and at shallow depth eastwards as it dips beneath the land. The thickness of this coal is expected to be in the region of 1000mm.

The 'Top Beamshaw' coal seam is conjectured to outcrop some 70m away to the west/north-west. The coal will dip beneath the land at depths estimated of around 7m in the west to around 20m in the east. The thickness of this coal is expected to be in the region of 1200mm.

The 'Meltonfield' coal seam is conjectured to outcrop some 110m away to the east which will dip away clear of the site.

No geological faults are conjectured or known in the vicinity of the site.

MINING

Opencast

None recorded nearby.

Shallow Mining

No underground mine workings are recorded in any of the shallow coal seams detailed above. However, such workings are known nearby (beneath lands to the east of Harborough Hill Road) in both the Two Foot and Abdy coal seams. Consequently the likelihood of further more historic mine workings of which there is no record should not be entirely ruled out. It is likely to be the case that the coal is too shallow to pose any risk for shallow voided workings causing a stability concerns to future development, and considering that the site was previously developed means that any associated issues may have already been resolved – however as there is no knowledge of this it should not be precluded.

No underground workings are known in the area of the Top Beamshaw seam, possibly due to being of a relatively poor quality in these parts.

Deep Mining

Deep mining operations have taken place beneath this area in the Barnsley coal seam at over 100m deep in the mid 1900's. All subsidence movement from these operations will be long complete and as no coalfields now remain the site will be stable from the deep coal mining aspect for the foreseeable future.

Mine Entries

There are no known mine entries within the site or to within 20m of the sites boundary; the closest being two disused mine adits around 100m away to the east (as shown on plan no. M4089/6A) which accessed workings in the Meltonfield coal seam and possibly the Two Foot seam.

Considering the likely presence of shallow workable coal, the potential for discovering other historic mine entries of which there is no record should not be ruled out.

LANDFILL

According to the Borough Landfill Register the site does not lie within 250m of a past landfill operation.

FORMER LAND USES

According to historical details no indications of any past mining or quarrying operations are shown in the vicinity of the site. A structure thought to be an air-raid shelter is noted on 1932 Edition County Series plan – as illustrated on attached plan no. M4089/6B.

CONCLUSIONS

1. Deep coal mining beneath this land is now long complete, and as no coalfields now remain the site will be stable from the deep coal mining subsidence aspect for the foreseeable future.

2. The risk of shallow coal workings causing stability issues to future development is considered as Low to Moderate for this site. A limited site investigation would be prudent for future development in order to check the depth and nature of the Abdy (Winter) coal seam and possibly the Two Foot seam in the east. Prior consultations with the Coal Authority would be required to facilitate such an investigation of their interests.

3. Any coal exposed in future foundational work will require removal and blinding off to help prevent any spontaneous combustion risks.

4. Some risk will exist for historic mine entries being present of which there is no record. The Coal Authority (as owners) should be consulted where any such feature is suspected.

5. Considering the likely presence of shallow coal all usual safety precautions regarding fugitive gases should be employed in any future deep excavations or confined spaces. Mitigation measures may also be required within foundation design such as methane membranes.

6. No historical evidence is known of any other mining or quarrying in the vicinity of the site and there are no landfill operations shown within 250m. A small historic feature that may be an air-raid shelter may require investigation to ensure sound foundations within its vicinity.

THIS REPORT IS BASED ON AND LIMITED TO THE RECORDS IN THE POSSESSION OF SYMAS AT THE TIME THE ENQUIRY IS ANSWERED.
Copyright in this mineral stability report belongs to SYMAS. All rights are reserved and unauthorised use is prohibited. Copyright is not transferred to external parties by possession of this report; however, those for whom the report is compiled have the right to use it.

Report prepared by M. Lyons 13th February, 2018.

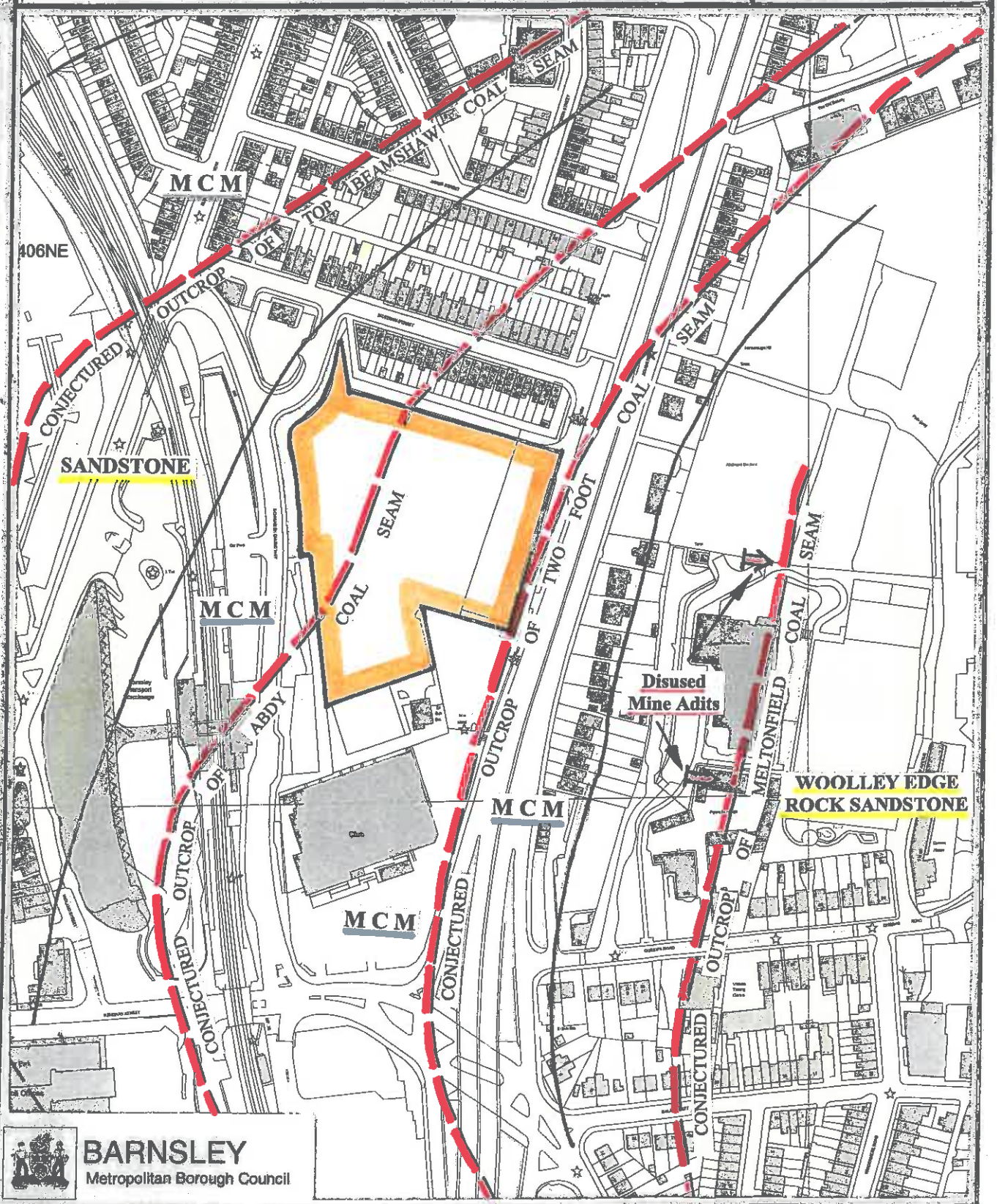
P. James,
Principal Mining Engineer.

DRAWING TITLE

# FORMER YEB DEPOT
# OFF SCHWABISCH GMUND WAY
# BARNSLEY
# GEOLOGICAL INFORMATION

DRAWING NO.

**M4089/6A**




BARNSLEY
Metropolitan Borough Council

| SCALE | DATE | | O.S REFERENCE |
|---|---|---|---|
| 1:2500 | 7.2.18 | SOUTH YORKSHIRE MINING ADVISORY SERVICE | SE 3406 |
| DRAWN BY: AS | CHECKED BY: | | P. JAMES BSc (Hons) PRINCIPAL MINING ENGINEER |


SMBC Licence Number 100022264 2018

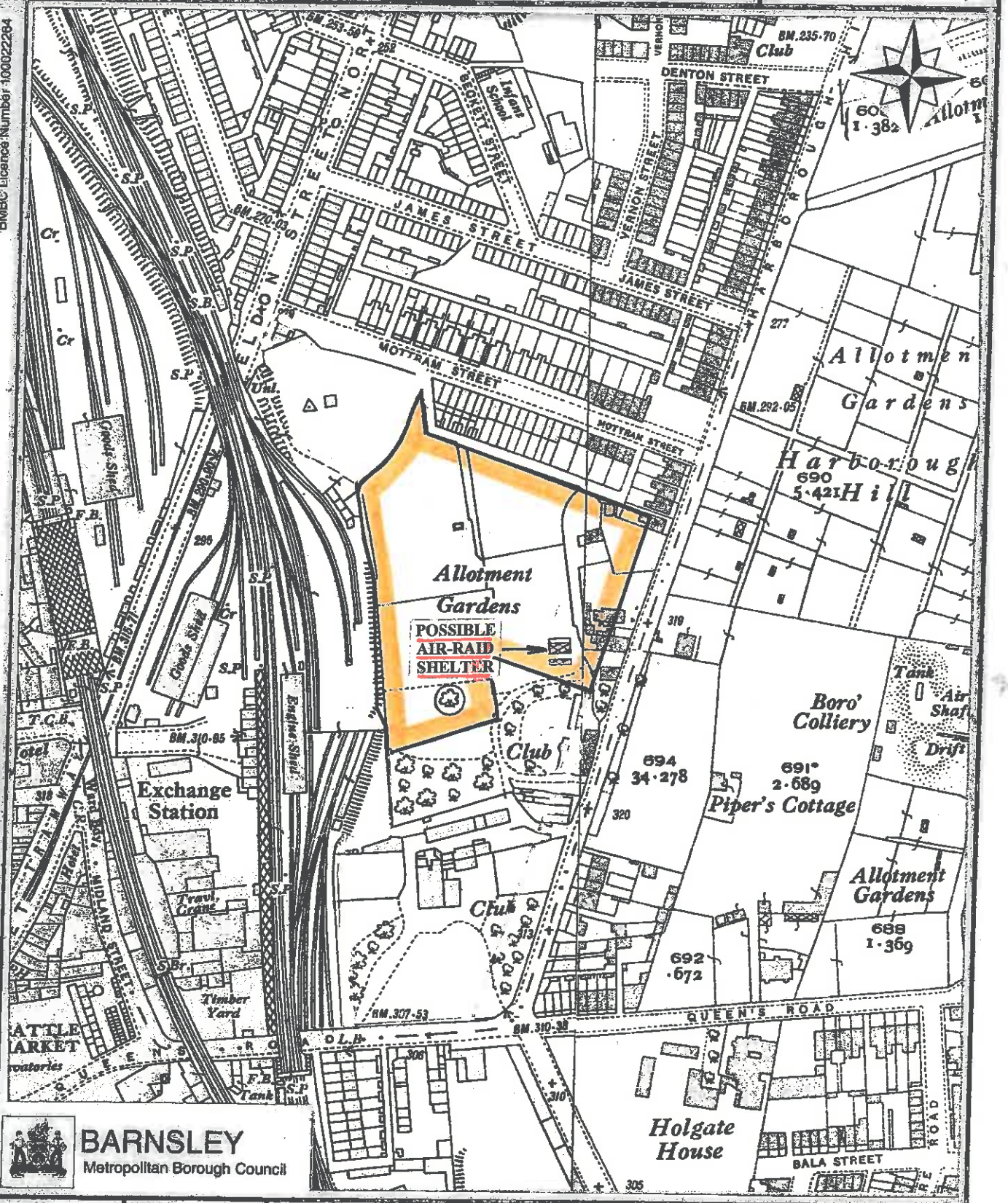
Reproduced from the Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office © Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.

DRAWING TITLE

# FORMER YEB DEPOT
# OFF SCHWABISCH GMUND WAY
# BARNSLEY
# HISTORICAL INFORMATION

DRAWING NO.

**M4089/6B**




BARNSLEY
Metropolitan Borough Council

| SCALE | DATE | | O.S REFERENCE |
|---|---|---|---|
| 1:2500 | 7.2.18 | **SOUTH YORKSHIRE MINING ADVISORY SERVICE** | 274/7 & 274/8-1932 Edition |
| DRAWN BY: AS | CHECKED BY: MAL | | P. JAMES BSc (Hons) PRINCIPAL MINING ENGINEER |


BMBC Licence Number 100022264 2018

Reproduced from the Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office © Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.