LITHOS



Land at Dewsbury Riverside Gateway

For Kirklees Council & Barton Willmore

Report no: 3901/2A

Date: July 2021

SUMMARY OF GEOENVIRONMENTAL ISSUES

Job No.	3901	**Site area/ha**	30 hectares
Client:	Kirklees Council & Barton Willmore	**NGR:**	SE 228 195
Site:	Dewsbury Riverside Gateway	**Nearest postcode:**	WF12 9EE

The site is located off Ravensthorpe Road, approximately 2.5km southwest of Dewsbury town centre and predominantly comprises arable farmland. The west is occupied by areas of woodland (former colliery) and the north-east is occupied by Ravenshall School, a nursery car park and allotments.

The area considered in this report is called the Dewsbury Riverside Central Gateway Development and falls within a much larger area (c. 156 ha) called the Dewsbury Riverside Development which has been allocated for the construction of about 4,000 residential dwellings as well as three schools.

Whilst the total site area is 30.3 ha, this includes 9.1ha of land (Ravenshall School, Lady Wood & Lady Wood Extension) where no development is proposed. Of the remaining 21.2ha, the vast majority (20ha) is currently greenfield (arable farmland), with a small area of allotments (1.1ha) and a nursery car park (0.15ha) in the northeast. This Report gives some consideration to land within Lady Wood & Lady Wood Extension but focuses on the main area of proposed development.

Lithos were commissioned by KC to provide a geoenvironmental appraisal of the site. Lithos' investigation included a review of the site's history and environmental setting, and a ground investigation comprising 57 trial pits, 15 window sample boreholes and 56 'deep' rotary probeholes.

A summary of salient geoenvironmental issues is provided in the table below:

Issue	Remarks
Made ground	Within the area of proposed development, a thin veneer of made ground is present in the northeast beneath the allotments and nursery car park. Further made ground is anticipated within a small, former sandstone quarry in the centre of the site, but to date this has not been located.
Natural ground	An area of about 13.5ha in the northeast is underlain by medium to high strength Cohesive Glacial Deposits to depths in excess of c. 3.5m. Elsewhere medium to high strength Cohesive Residual Soils, overly Coal Measures Bedrock (sandstones and mudstones).
Contamination	Topsoil should be chemically suitable for re-use. With respect to the proposed development area, some (relatively minor) contamination has been identified in the northeast (vicinity of the allotments and nursery car park). The new Spine Road is expected to pass through this area, but no built development is anticipated.
Mining & quarrying	A small (c. 350m^2) sandstone quarry is located in the centre; to date this has not been located. There is an area of former opencast coal extraction within Lady Wood Extension; beyond the proposed development. Evidence of underground workings has been encountered in the Middleton Main and Wheatley Lime coal seams; workings encountered to date are essentially restricted to the centre north. No mineworkings have been encountered in the 3rd Brown Metal, Middleton Little or un-named coal seams. Drilling to date suggests that these coal seams are locally absent at the expected depth. This is possibly due to these coals locally thinning or 'washing' out, but might be due to 'packed' workings which can be difficult to detect when drilling is undertaken using rotary open-hole techniques.
Hazardous gas	The site is at risk from hazardous ground gasses from underground workings, areas of landfill and backfilled quarries and opencast coal sites. Wells have been installed in 25 boreholes. KC requested an initial round of 6 monitoring visits be undertaken over a 3-month period. An initial tentative assessment has been provided. Based on the site conceptual model and need to protect new dwelling from changing ground gas conditions, it is likely that parts of the site will fall within an Amber 1 or Amber 2 classification. However, further ground gas monitoring will be required before final recommendations can be made.
Preparatory works	General site clearance and topsoil strip. Earthworks regrade is anticipated to create development terraces. Based on the findings of Lithos' investigation to date, the general north of the site will require consolidation (drill & grout) of underground mineworkings in the Middleton Main Coal Seam.
Foundations	It is envisaged that plots will be built on 'traditional' strip footings founded in natural soils or on bedrock. Footings will require reinforcement where underlain by consolidated shallow mineworkings. Earthworks regrade may necessitate alternative foundation solutions if the depth of fill exceeds about 2.5m.

This brief summary should not be assumed to represent a complete account of all the potential geo-environmental issues that may exist at the site. As such it is strongly recommended that the report be read in its entirety.

SUMMARY OF GEOENVIRONMENTAL ISSUES

Job No.	3901	**Site area/ha**	30 hectares
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Site:	Dewsbury Riverside Gateway	**Nearest postcode:**	WF12 9EE

Issue	Remarks
Groundwater & excavations	Excavations should remain stable in the short term, but some overbreak may occur where boulders are encountered in the Glacial Deposits. Excavations in the north are likely to encounter some groundwater ingress if left open for extended periods of time.
Flooding & drainage	The site lies in Flood Zone 1 where the risk of flooding is low. Soakaway testing across low lying parts of the site (the north) gave very poor results. However, soakaways across the centre and south might give more favourable results; further testing would remove ambiguity.
Highways	Natural soils should yield CBR values of at least 3%

Significant developer abnormals relating to geoenvironmental issues at the site are:

- Topography will result in the need for earthworks regrade.
- Shallow underground workings will require consolidation.

Some further work is required, most notably:

- Post-vacation in the northeast (allotments and nursery car-park), to confirm ground conditions (most notably risks associated with shallow mineworkings) beneath the proposed highway.
- Across the proposed development area to 'tighten the grid' of exploratory holes and reduce uncertainties, most notably risks associated with shallow mineworkings. At this stage such investigation would be expected to comprise:
  - Additional rotary probeholes
  - Rotary cored boreholes to determine whether any packed workings are present and to assess bedrock in any proposed areas of significant earthworks cut
  - Further trial pits to locate the former small sandstone quarry
  - Bioaccessibility testing for arsenic in topsoil from the main development area
- Consideration could be given to a geophysical survey to check for the presence of unrecorded mine entries.
- If a detention basin is proposed, water table levels should be taken from borehole monitoring wells over 4 consecutive seasons, for at least 3 points in the basin area.
- Further ground gas monitoring will be required before final recommendations can be made with respect to appropriate protection measures.

This brief summary should not be assumed to represent a complete account of all the potential geo-environmental issues that may exist at the site. As such it is strongly recommended that the report be read in its entirety.

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Appendix A - General notes

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02	Ground investigation fieldwork
03	Geotechnical testing
04	Contamination laboratory analysis & interpretation
05	Hazardous gas
06	Soakaways

Appendix B - Drawings

Drawing	Revision	Title
3901/1	-	Site location plan
3901/2	-	Proposed site layout
3901/3	-	Site features
3901/4	-	Site photographs
3901/5	-	Preliminary conceptual site model
3901/6	-	Exploratory hole locations
3901/7	-	Revised conceptual site model
3901/8	-	Geology & mining features
3901/9a	-	Coal Authority mining abandonment plan (Lady Wood Colliery)
3901/9b	-	Coal Authority mining abandonment plan (Middleton Main Coal Seam)
3901/10	-	Environmental sources & receptors
3901/11	-	Ground Conditions
3901/12	-	Depth to competent bedrock
3901/13	-	Bedrock composition
3901/14	-	Geological cross-sections
3901/15	-	Extent of Middleton Main requiring consolidation (drill & grout)

Appendix C - Commission

Appendix D - Historical OS plans

Appendix E - Search responses

From	Date	Content
Landmark	26/11/2020	Environmental search data
Coal Authority	26/11/2020	Mining report
NCB	20/06/1973	Geological Plan (NCB Drawing 05/9517) – showing location of investigation boreholes & findings
Environment Agency	16/04/2021	Environmental Information Request - Thornhill Power Stn landfill

Appendix F to H - Exploratory records

Appendix F	TPs 301 to 322 & 501 to 534
Appendix G	WS501 to 515
Appendix H	PHs 201, 202, 207 to 219 & 501 to 532

Appendix I - Chemical test results

Appendix J - Geotechnical test results

Appendix K – Soakaway test results

Appendix L – Gas Monitoring Results

Appendix M – Yorkshire Water Contaminated Land Assessment Form

FOREWORD (geoenvironmental appraisal report)

This report has been prepared for the sole internal use and reliance of the Client named on page 1. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Lithos Consulting Limited (Lithos); such authorisation not to be unreasonably withheld. If any unauthorised third party comes into possession of this report, they rely on it at their peril and the authors owe them no duty of care and skill.

This report has been reviewed by a Competent Person, as defined in the National Planning Policy Framework. We ensure that all projects are managed by individuals with necessary experience, relevant qualifications, and current membership of a relevant professional organisation. Records of engineers, project managers and reviewers involved in this project are maintained by us. Lithos QA/QC procedures for all our work forms an integral part of our ISO9001 accreditation and as such is regularly audited.

The report presents observations and factual data obtained during our site investigation and provides an assessment of geoenvironmental issues with respect to information provided by the Client regarding the proposed development. Further advice should be sought from Lithos prior to significant revision of the development proposals.

The report should be read in its entirety, including all associated drawings and appendices. Lithos cannot be held responsible for any misinterpretations arising from the use of extracts that are taken out of context. However, it should be noted that in order to keep the number of sheets of paper in the hard copy to a minimum, some information (e.g. full copy of the Landmark/Groundsure Report) is not included in the pdf, by request, it can be provided on a CD.

The findings and opinions conveyed in this report (including review of any third-party reports) are based on information obtained from a variety of sources as detailed within this report, and which Lithos believes are reliable. Reasonable care and skill has been applied in examining the information obtained. Nevertheless, Lithos cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

The report represents the findings and opinions of experienced geoenvironmental consultants. Lithos does not provide legal advice and the advice of lawyers may also be required.

Intrusive investigation can only investigate shallow ground beneath a small proportion of the total site area. It is possible therefore that the intrusive investigation undertaken by Lithos, whilst fully appropriate, may not have encountered all significant subsurface conditions. Consequently, no liability can be accepted for conditions not revealed by the exploratory holes. Any opinion expressed as to the possible configuration of strata between or below exploratory holes is for guidance only and no responsibility is accepted as to its accuracy

It should be borne in mind that the timescale over which the investigation was undertaken may not allow the establishment of equilibrium groundwater levels. Particularly relevant in this context is that groundwater levels are susceptible to seasonal and other variations and may be higher during wetter periods than those encountered during this commission.

Where the report refers to the potential presence of invasive weeds such as Japanese Knotweed, or the presence of asbestos containing materials, it should be noted that the observations are for information only and should be verified by a suitably qualified expert.

This report assumes that ground levels will not change significantly from those existing at present and that houses will be of two storey construction. If this is not to be the case, then some modification to this report may be required.

Lithos cannot be responsible for the consequences of changing practices, revisions to waste management legislation etc that may affect the viability of proposed remediation options.

Lithos reserve the right to amend their conclusions and recommendations in the light of further information that may become available.

GEOENVIRONMENTAL APPRAISAL
of land at
DEWSBURY RIVERSIDE GATEWAY

1 INTRODUCTION

1.1 The commission and brief

1.1.1 Lithos Consulting Limited were commissioned by Kirklees Council (KC) via Barton Willmore to carry out a geoenvironmental appraisal of land to the south and east of Ravensthorpe Road.

1.1.2 The area considered in this report is called the Dewsbury Riverside Central Gateway Development (c. 30 ha). The Central Gateway falls within a much larger area (c. 156 ha) called the Dewsbury Riverside Development which has been allocated for the construction of about 4,000 residential dwellings as well as three schools.

1.1.3 Lithos have issued a total of 7 reports relating to the larger Dewsbury Riverside Development. Of these reports, two cover the current area of interest:

- 'Preliminary Geoenvironmental Appraisal – Land at Dewsbury Riverside', Ref. 2336/1A, issued to Miller Homes in April 2016; and,
- 'Geoenvironmental Appraisal - Land at Dewsbury Riverside Phase 2', Ref. 2336/3, issued to Miller Homes in January 2018.

1.1.4 Ground investigation data, including exploratory hole logs and laboratory test results, contained in Report 2336/3 have been included in the relevant sections of this document. The information contained in this document can be read independently with no reliance required on Reports 2336/1A and 2336/3.

1.1.5 Lithos have also previously issued a Preliminary Investigation Report (Ref 3901/1, dated December 2020) to KC. The information contained in Report 3901/1 has been incorporated within this Report, which now supersedes Report 3901/1.

1.1.6 This document is a revision of the Geoenvironmental Appraisal (Report 3901/2) issued by Lithos in February 2021; Report 3901/2 is now superseded. The only significant revisions to 3901/2 having been made in Sections 3.7, 5.10, 6.1.16, 11.3, 11.4, 13.3.9 & 14.

1.1.7 Correspondence regarding Lithos' appointment, including the brief for this investigation, is included in Appendix C. The agreed scope of works included:

- A site walkover and inspection
- An assessment of the land use history
- Determination of the site's environmental setting
- A mining risk assessment in accordance with Coal Authority guidance.
- An intrusive ground investigation comprising 35 trial pits, 17 dynamic sample boreholes and 32 rotary open probeholes.
- Assessment of the geotechnical properties of the near surface deposits to enable provision of foundation and highway recommendations
- A qualitative assessment of contamination risks
- Recommendations for the necessary site preparatory and remediation works

1.1.8 Primary aims of this investigation were to identify salient geoenvironmental issues affecting the site to support the submission of a planning application, and also to enable KC and/or Developers to obtain budget costs for: foundations; gas protection measures; and site preparatory and remediation works.

1.2 The proposed development

1.2.1 It is understood that consideration is being given to redevelopment of the site with 'traditional' two and/or three storey domestic dwellings, associated gardens, POS and adoptable roads and sewers.

1.2.2 Barton Willmore have been commissioned by KC to prepare an indicative site layout and submit a Hybrid Planning Application.

1.2.3 The planning application will include elements associated with a proposed access roundabout and spine road from Forge Lane.

1.2.4 The total site area is 30.3 ha, but this includes 9.1ha of land (Ravenshall School, Lady Wood & Lady Wood Extension) where no development is proposed. Of the remaining 21.2ha, the vast majority (20ha) is currently greenfield (arable farmland), with a small area of allotments (1.1ha) and a nursery car park (0.15ha) in the northeast. The new Spine Road is expected to pass through the area of allotments and nursery car park, and consequently no new build development is anticipated in the northeast.

1.2.5 This Report gives some consideration to land within Lady Wood & Lady Wood Extension but focuses on the main area of proposed development.

1.3 Report format and limitations

1.3.1 Standard definitions, procedures and guidance are contained within Appendix A, which includes background, generic information on assessment of the site's environmental setting.

1.3.2 General notes and limitations relevant to all Lithos preliminary investigations are described in the Foreword and should be read in conjunction with this report. The text of the report draws specific attention to any modification to these procedures and to any other special techniques employed.

2 SITE DESCRIPTION

2.1 General

2.1.1 The site's location is shown on Drawing 3901/1 presented in Appendix B to this report. Site details are summarised in the table below:

Detail	Remarks
Location	2.5km southwest of Dewsbury town centre.
NGR	SE 228 195.
Approximate area	30 hectares (74 acres).
Known services	Overhead electricity. Underground (mains) gas, water, drainage culvert & (redundant) colliery gas pipeline.

2.2 Site features

2.2.1 Lithos completed a walkover survey of the site on the 24th November 2020. A selection of site photographs are included on Drawing 3901/4.

2.2.2 There are at least 6 sub-areas (see Drawing 3901/2) of significance for various reasons:

- An area previously investigated by Lithos for Miller Homes (c. 7.2 ha). Lithos issued a comprehensive SI Report to Miller Homes (Ref. 2336/3, dated January 2018) and Millers have granted permission to KC allowing Lithos to "re-use" the data obtained.
- Mosque children's nursery and car park (0.15 ha). A new spine road is expected to be routed through here.
- Existing allotments (c. 1.1 ha). Allotments are to be relocated (likely immediately west of the school) and a new spine road is expected to be routed through here.
- Ravenshall primary school (c. 2.0 ha). To be retained; no development and no intrusive ground investigation is proposed within this sub-area.
- Lady Wood (c. 3.1 ha). To be retained; no development and no intrusive ground investigation is proposed within this sub-area.
- Lady Wood Extension (c. 4.0 ha), adjacent to, and east of, Lady Wood. No development is proposed in this sub-area, but it may be underlain by landfill and some ground investigation (mini-boreholes, with well installations) is anticipated.

2.2.3 The site's borders are defined by:

- North: (east) semi-detached residential dwellings with attached gardens, Ravensthorpe Road runs east to west immediately beyond.
- South: a bridleway that runs east to west along the southern boundary between Ouzlewell Lane (east) and Sands Lane (west).
- East: an un-named track with Ouzlewell Lane beyond.
- West: low dry stone walls which open out onto farmland.

2.2.4 Access can be gained:

- From Ouzlewell Lane which runs along the southern boundary via gaps in walls and hedgerows;
- via a track which runs through the east of the site and opens onto Ravensthorpe Road; or
- via one of two gaps in the terraced housing along the northern boundary which open out onto Ravensthorpe Road.

2.2.5 Topography across the site, and the wider area, generally slopes down to the north and northeast. The steepest slopes reach gradients of about 1v:6h in the centre-north, although the 'typical' gradient is c. 1v:12h.

2.2.6 The north, south and centre comprise three **fields** which were covered by rough grasses and stubble at the time of walkover. The fields are separated by low dry-stone walls and hedgerows.

2.2.7 An area of c. 32,000m² in the southeast is a relatively level field which was planted with an immature winter crop at the time of walkover. The field was noted to be very wet underfoot.

2.2.8 Ravenshall **School**, buildings with associated playing fields and macadam/block paved outdoor play areas, is located in the northeast. The school is secured from the wider site by steel palisade fencing and is accessed by a gated entrance which opens onto Ravensthorpe Road.

2.2.9 An area of 11,000m² in the north-easternmost corner is occupied by **allotment** gardens; most allotments have an associated wooden shed and/or glass greenhouse and allotments are accessed by grassed paths.

2.2.10 An unsurfaced access track runs north to south across the west from Ravensthorpe Road (to the north) between Ravenshall School and the allotments to Ouzlewell Lane (to the south). The track is secured by a metal gate.

2.2.11 An area of about 30,000m² in the far-west is occupied by mature woodland which is bounded by low dry-stone walls and post & wire fencing. This mature woodland is named **Lady Wood** on OS maps. Several unsurfaced public footpaths pass through the woodland; these are accessed off a track on the northern boundary and via a footbridge to the northwest of the site. A small watercourse issues in the west of the woodland and flows north for about 30m before draining away into the ground.

2.2.12 Topography in Lady Wood is variable with some steep slopes. Several hummocky areas are present and these likely represent former mine entries, mining features and/or settlement of deep made ground (spoil heaps).

2.2.13 A roughly C shaped area (c. 42,000m²) known as '**Lady Wood Extension**' is located immediately east of Lady Wood. This woodland comprises immature trees which have been planted in straight rows. This woodland is bounded by low dry-stone walls and post & wire fencing. Erosion of footpaths and animal burrows suggest that shallow soils comprise ashy gravel of mudstone, burnt shale and clinker.

2.2.14 Three **electricity** utilities run north to south across the site; one in the east (on wooden poles along the western edge of Ravenshall School and over the cropped field); and, two in the west (steel pylons, over the immature woodland).

2.2.15 A regional **high pressure gas** pipeline runs north to south across the centre of the site. The line of the gas main is shown by marker posts in field boundaries.

2.2.16 There is a **culverted** stormwater drain (not shown on YW plans) running east-west along the northern boundary.

2.2.17 Lithos lifted the manhole cover for the storm sewer during a previous investigation in 2017 (see Section 6), close to its junction with the drainage ditch and could see a 0.5m diameter pipe at 2.3m depth running east-west.

2.2.18 Drainage **ditches** cross the centre-north and run along the eastern boundary. The drainage ditch in the centre-north terminates in the storm sewer.

2.2.19 At the time of an earlier walkover in 2017, 3 shallow excavations in the eastern field had been left open by the farmer. It is understood that these pits were excavated in order to locate, and unblock, a **land drain**. A terracotta land drain could still be seen in the base of one of the excavations, running across from the south east to the drainage ditch in the centre of the site, the water within the land drain was ochreous.

2.2.20 During a site visit in December 2017, the farmer described a 6" land drain that ran from the south-east, and had been exposed (and unblocked) in the centre-north. The farmer believes this land drain ultimately discharges into the storm sewer than runs along and parallel with the northern boundary.

2.2.21 The farmer also mentioned the presence of a **redundant 12" gas pipeline** which runs roughly north-west to south-east across the centre of the site. This pipeline is shown on a British Coal drawing and runs from a former coke works at Ingham's Pit to Ravensthorpe power station; see Drawing 3901/3. Lithos were able to locate the pipeline using a CAT.

2.2.22 Existing salient features, at the time of the walkover are presented on Drawing 3901/3 in Appendix B to this report and summarised in the table below:

Feature	Remarks
Current Access	Off Ravensthorpe Rad (north) & Ouzlewell Lane (South).
Topography	Slopes down to the north & northeast; ave. gradient c. 1:12, max gradient c. 1:6.
Approximate areas	3,000m^2 buildings (school). 3,500m^2 Macadam/block paving/track. 11,000m^2 allotment gardens. 20,000m^2 cut & maintained grass. 32,000m^2 cropped field. 159,500m^2 rough grasses & stubble. 71,000m^2 woodland.
Surrounding land uses	North – commercial/industrial buildings, railway lines & River Calder beyond. South – farmyard & farmland. East – residential dwellings. West – farmland & farmyard.

3 SITE HISTORY

3.1 Site centred extracts from Ordnance Survey (OS) plans dating back to 1855 have been examined. Some of these plans are presented in Appendix D to this report.

3.2 The table below provides a summary of the salient points relating to the history of the site. It is not the intention of this report to describe in detail all the changes that have occurred on or adjacent to the site. Significant former uses/operations are highlighted in **bold** text for ease of reference.

Date	Site	Surrounding land
1855	c. 30,000m² in the west occupied by Lady Wood – woodland. Small sandstone **quarry** in centre-east. Majority of site occupied by fields separated by walls, hedgerows & trees. Road runs north to south through eastern edge & along southern boundary. **Buildings** in north-easternmost corner.	**Railway** line immediately beyond northwestern boundary. Old **coal pits** from 280m south. Surrounding land predominantly comprises fields & areas of woodland. Thornhill Leeds village immediately to the northeast. Colliery/mineral railway runs north to south immediately beyond eastern boundary. Glassworks from 50m northeast.
1893	Small **buildings** & old **shaft** in westernmost corner, in Lady Wood. Quarry no longer shown. Layout of buildings in northeastern corner changed; several buildings no longer shown & new buildings constructed. Several footpaths cross the site.	Further buildings & **old shafts** immediately beyond western boundaries. Development of **ironworks** & residential dwellings to the northeast & east. Ravensthorpe Road runs east to west along northern boundary. Several mounds from 50m to the west; likely spoil heaps associated with mine entries.
1907	Second old **shaft** shown in Lady Wood in the west. Well shown in Lady Wood in the west (possible shaft associated with coal mining). Buildings in the northeast include glasshouses.	Residential dwellings constructed immediately beyond northeastern boundary. **Gravel pit** shown adjacent to glassworks from 200m east. Mineral railway expanded with sidings & some **earthworks** (regrade or spoil heaps) from 50m north. Majority of shafts to the west no longer shown. **Calder New Pit** (colliery) with associated earthworks from 50m northwest.
1922	No significant changes.	Residential dwellings built immediately beyond northwestern boundary. Spoil heaps/earthworks associated with rail sidings significantly expanded to the north.
1930	Buildings in northwest no longer shown. Area now shown as **allotment gardens**. Electricity **pylons** cross the centre-east. Area of **earthworks/spoil/tipping** shown in west.	Ouzlewell Lane runs north to south immediately beyond western boundary. Gravel pit & glassworks no longer shown. Area of **earthworks** with crane from 30m north.
1938	No significant changes.	Residential dwellings constructed immediately beyond northern boundary.
1948	Spring shown in centre.	No significant changes.
1955	Allotment gardens include several small glasshouses. Electrical **sub-station** in northeast. Electricity pylons cross the west. Possible earthworks (raised levels) in the centre. Rectangular feature (possible **building**) in centre-west. Extensive **earthworks** around building & to the west. Earthworks do not extend into Lady Wood, but underlie all of the Lady Wood Extension.	Further residential dwellings & concrete works developed to the north.

Date	Site	Surrounding land
1972	Annotation in west shows earthworks as comprising **slag heaps & refuse tip**. Outline of refuse tip corresponds to area of Lady Wood Extension. Rectangular area in west shown as 'scrub'. Buildings in Lady Wood no longer shown.	Earthworks to the north annotated as refuse tips & spoil heaps. Mineral railway disused where adjacent to eastern boundary.
1983	**School** (single building with associated areas of hardstand) shown in northeast. Footprint of immature woodland shown as refuse tip/slag heap.	Area of **refuse tip/slag heap** from 130m southeast. Residential dwellings developed to the east.
1993	Buildings in Lady Wood to the west no longer shown. School developed with further areas of hardstanding.	
2000	School building expanded.	Area of refuse tip/slag heap from 20m north. Earthworks & mineral railway to the north no longer shown.
2003	No significant changes.	No significant changes.
2009	School building expanded further.	
2020	School expanded further with ancillary buildings & areas of external hardstand.	

3.3 The approximate footprint (c. 350m^2) of the sandstone quarry (mid-1800s) is shown on Drawing 3901/8.

3.4 The area of immature woodland in the west of the site, but east of Lady Wood, is understood to be known as 'Lady Wood Extension' and was planted post 2000 to improve the amenity of the wider area following restoration of former refuse tips/spoil heaps.

3.5 The Northern Mines Research Society records two collieries named Ladywood, operated by Mr Charles Wheatley, both located in Thornhill, Dewsbury. The sites operated from 1877 to 1881 and 1921 to 1928.

3.6 Coal Authority abandonment plans (see Section 5.5) suggest Ladywood Colliery was in operation during the 1920s with 3 primary adits and 4 pits (shafts) located immediately west of Lady Wood.

3.7 The electrical sub-station, shown in northeast of the area now occupied by Ravenshall primary school (vicinity of current bin store) in the 1950s, appears to have been decommissioned and removed by the 1970s.

4 ENVIRONMENTAL SETTING

4.1 General

4.1.1 Notes describing how the site's environmental setting has been assessed are included in Appendix A to this report. Reference has been made to publicly available Government held digital data via QGIS (an Open Source Geographic Information System). Extracts from the response received from Landmark, and responses from the Coal Authority are presented in Appendix E. These responses are summarised below, together with the findings of our own "desk study" investigation.

Issue	Data reviewed	Summary
Geology	1:10,000 BGS map (Sheet SE21NW) BGS Technical Report WA/98/6	Drift soils – Glaciofluvial Deposits (northeastern corner). None mapped across majority of site. Solid (bedrock) – Lower Coal Measures (interbedded mudstone, siltstone & sandstone), Lepton Edge Sandstone unit outcrops across the centre-south, Birstall Rock sandstone unit outcrops across the south. Strata dip – gentle to the north. Faults – A fault runs north to south across the west & downthrows to the to the east. Second fault runs north to south immediately beyond western boundary.
Mining	Coal Authority	About 70% of the site is located within a Coal Mining Development High Risk Area. The remaining 30% is located in a Low Risk Area. Further details in Section 5 below.
Quarrying	Historical OS plans	Small sandstone quarry (c. 350m^2) located in centre-east. No further known areas of quarrying in, or within 250m of, site's boundary.
Radon	Envirocheck Landmark Report Public Health England Environment Agency electronic open data via QGIS	The site lies in an area where between 1% & 3% of homes are estimated to be above the action level. See Section 14.5.
Hydrogeology		Groundwater Source Protection Zone? None beneath site or surrounding area. Aquifer Secondary A (Drift in northeast only); Secondary A (Solid). Groundwater abstractions? None of significance. Soil leaching potential: Medium. Pollution incidents: none of significance. Discharge consents: Crowthroyd Farm, 10m south. Discharge of treated effluent to land/soakaway. Start December 1989, ongoing.
Hydrology		Nearest watercourses: unnamed tertiary river emerges from spring in west (Lady Wood) & flows north through site into R. Calder 170m northwest. Un-named tertiary river flows northeast along southeastern boundary into R. Calder 670m north. Catchment of R. Calder; R. Colne to R. Chad. Water quality moderate (ecological moderate, chemical fail). There is a culverted stormwater drain (not shown on YW plans). Pollution incidents: none of significance. Abstractions? Fortcrete Ltd. Abstraction of surface waters from R. Calder 150m northwest for general use preparing mineral products & dust suppression. 2008 – ongoing. Licence no. 2/27/13/229. Discharge Consents: Yorkshire Water Services Ltd, Foxroyd Service Reservoir, 650m south, discharge of processed effluent to surface water (tributary of R. Calder) which flows through site. Start April 1988, end March 2004
Flood risk		The site lies in Flood Zone 1, where the risk of flooding from rivers or the sea is classified as low. In accordance with Chapter 10 of the National Planning Policy Framework, a site-specific flood risk assessment is required for proposals of 1 hectare or greater in Flood Zone 1.

4.1.2 The approximate area underlain by the Glaciofluvial Deposits and the line of the geological fault (based on BGS mapping) are shown on Drawing 3901/8.

4.1.3 There are 3 recorded pollution incidents on site. Two of these incidents involved household waste and are classified as Category 3 (minor) towards water and land, Category 4 (no impact) towards air. One further incident involved asbestos pollutants and was assessed as Category 3 (minor) towards land, Category 4 (no impact) towards air and water.

4.1.4 The EA have provided 3 years of water quality results for the River Calder at the closest monitored upstream/downstream locations to the site. The immediate upstream point at Mitchell Cotts only carries more basic analyses. In order to offer more upstream/downstream comparison they have also included data (a more extensive suite) from the site further upstream at Battyeford. This EA data (Microsoft excel format) can be provided on request.

4.1.5 The EA have no concerns regarding surface/groundwater passing through the site.

4.2 Landfills

4.2.1 Known or suspected areas of landfill in the vicinity of the proposed development site are summarised below:

Location	NGR (proximity to site)	Remarks	Source of data
Off Ravensthorpe Road.	SE 226 196 Beneath west of site.	Thornhill Power Station. Provider ref. EAHLD31749. First input December 1923. Included inert & industrial waste. See also EA search response in Appendix E.	QGIS*/ Environment Agency data/ BGS Mapping
North of Ravensthorpe Road.	SE 229198 20m north of site.	C R Longley Ltd. Provider ref. EAHLD35738. First input December 1900. Included inert, industrial & special waste.	
		C. R. Lomgley Ltd. First input April 1992, ongoing, waste limited to materials produced on-site: breeze blocks, sand, gravel, ceramic, slate, concrete & cement, earth brick & stone.	
Thornhill Quarry site, off Calder Road.	SE 232 201 210m north of site.	Thornhill Landfill. Demex Ltd. Waste excluding inert waste >10T/D. Start date 2016.	
Thornhill Steel Works, off Forge Lane.	SE 238 196 200m east of site.	James Austin & Sons Ltd. Provider ref. EAHLD04230. First input December 1947, last input June 1989 included inert, commercia (construction demolition, non-hazardous & non-toxic) & industrial (non-hazardous, inert & non-flammable) waste.	

* QGIS is an Open Source Geographic Information System.

4.2.2 Areas of known landfill are shown on Drawing 3901/10.

4.2.3 The Envirocheck report and QGIS data shows that footprint of the Thornhill Power Station landfill to underlie Lady Wood Extension and land immediately east of the woodland (but off site). The 1973 OS maps includes the annotation "refuse tip" here, but it seems more likely material deposited was associated with combustion (ash, clinker & slag; see comments in Section 2.2.13). Such material is less prone to generate hazardous gas than household waste.

4.2.4 Lithos have undertaken some ground investigation on land east of Lady Wood Extension (but beyond the area of current interest). An overview of this investigation is included in Section 6, but, in summary, no evidence of landfilling/tipping was found.

4.2.5 Consequently, the area of tipping associated with Thornhill Power Station Landfill is unlikely to be as extensive as suggested in the Envirocheck Report.

5 COAL & MINING

5.1 General

5.1.1 In July 2011 the Coal Authority (CA) formalised their requirements in relation to planning applications and introduced some new terminology relating to coal mining development areas. This Section provides the necessary preliminary mining risk assessment required by the proposed planning application.

5.1.2 About 70% of the site is located in a Coal Mining Development **High Risk Area**; an area with specific mining legacy risks to the surface, including mine entries, shallow underground workings etc. The remaining c. 30% lies in a Development **Low Risk Area**; within the Coalfield, but no defined risks have been identified to date; there might still be unrecorded issues.

5.1.3 Information examined later in this Section (BGS maps, a Coal Authority mining report, abandonment plans and an NCB opencast investigation report) has yielded some inconsistencies in terms of seam names and lines of outcrop. However, in essence 9 coal seams underlie the site at shallow depth, and these are:

Seam name(s)	Approximate thickness (m)	Approximate depth below 2nd Brown Metal coal (m)	Remarks
2nd Brown Metal aka Old Hards	0.3 – 0.7	-	Known workings associated with Ladywood Colliery in 1920s.
3rd Brown Metal aka Stone	0.2 – 0.6	10 - 20	Outcrops close to southern boundary in centre-south.
Middleton Little aka Green lane	0.3 - 0.7	30 - 40	Outcrops across centre of site. Known workings associated with Ladywood Colliery in 1920s.
Un-named	0 – 0.4	52	Outcrops across centre-north of site.
Middleton Main aka New Hards	0.2 – 0.4	75	Outcrops along western boundary. Known workings associated with Ladywood Colliery in 1920s and from Thornhill colliery until 1972.
Un-named	-	90	Outcrops in west, within Lady Wood (central).
Wheatley Lime	0.7 – 1.2	100	Outcrops in west, within Lady Wood (north).
Middleton Eleven Yard Coal	0 - 0.8	107	Does not outcrop within current area of interest.
Blocking Coal	0.4 – 0.6	134	

5.1.4 Approximate outcrops are shown on Drawing 3901/8.

5.1.5 The BGS Technical Report notes that all of the named seams have been worked in the area, with the 2nd Brown Metal, New Hards (Middleton Main) and Wheatley Lime described as extensively worked.

5.1.6 The 3rd Brown Metal seam is described as having been worked by opencast methods only.

5.1.7 Given dip (c. 2° to 3° to the east & south-east) and topography, the entire site is expected to be underlain by shallow coal in several seams.

5.2 BGS information

5.2.1 BGS mapping shows that solid geology beneath the site is divided into two fault blocks; an area of c. 4 ha in the west and an area of c. 26 ha in the centre and east. The conjectured line of the **fault** is shown on Drawing 3901/8. The area of the western fault block broadly corresponds with the footprint of Lady Wood.

5.2.2 BGS mapped coal seams outcropping/at shallow depth beneath the **western fault block** are:

- A thin un-named coal seam outcropping in the centre.
- The Wheatley Lime Coal; outcropping along the northwestern boundary.
- The Middleton Eleven Yard Coal.
- The Blocking Coal.

5.2.3 BGS mapped coal seams outcropping/at shallow depth beneath the **central/eastern fault block** are:

- 3rd Brown Metal/Stone Coal outcropping in the centre south.
- Green Lane/Middleton Little Coal; outcropping across the centre.
- An un-named Coal; outcropping across the north.
- The New Hard/Middleton Main Coal outcropping along the northwestern boundary and to the north.
- A thin un-named coal seam.
- The Wheatley Lime Coal.

5.2.4 Approximate outcrops based on BGS information are shown on Drawing 3901/8. It should be noted that outcrops shown on BGS maps have been known to be inaccurate by distances in excess of 100m.

5.2.5 The BGS technical report notes that:

- The Wheatley Lime Coal is a single seam which has been extensively worked underground and at surface in the wider area.
- The New Hards/Middleton Main Coal varies between 0.2m and 1.8m in thickness (this contradicts the map sheet) but is generally c. 0.7m thick and has been extensively worked deep underground and at surface in the wider area.
- The Green Lane/Middleton Little Coal is only known to have been worked underground at the former Calder Colliery (c. 400m northwest of the site) and has been extensively worked by opencast in the area.
- The 3rd Brown Metal/Stone Coal is only known to have been worked in opencast.

5.3 Anecdotal information

5.3.1 Discussions with the current tenant farmer of the site yielded the following information:

- A 'walk-in' mine was located roughly in the centre of the site which included rail tracks. The mine entry was formerly marked by a valley. However, years of ploughing has levelled the area off. The metal rail tracks are anecdotally suggested to still remain buried within nearby hedgerows/
- A mine entry in the northeast has settled and subsequently been infilled and capped; around 25 years ago.
- Water which passes through land drainage is believed to partly come from underground workings.

5.3.2 The walk-in mine likely refers to an adit which would be expected to serve mineworkings in the centre-south. Rail tracks likely ran from the workings to the adit mouth, or to Ravensthorpe Road (north) to enable efficient removal of coal and/or spoil.

5.3.3 The mine entry which settled in the northeast is believed to be CA Ref. 423419-004 (see Section 5.7.7 below) which is located in the grounds of Ravenshall School. However, the CA do not hold any records of treatment for this mine entry.

5.4 Unrecorded mineworkings

5.4.1 Coal has been mined in Yorkshire for centuries, and there are likely to be unrecorded mineworkings which pre-date the requirement for abandonment plans (Coal Mines Regulation Act of 1872). Early mining methods included drifts or adits from outcrop. Where mining extended further from the crop, bell pits were often sunk, and as the coal got deeper still, shafts were used to access gallery workings (pillar & stall).

5.4.2 The shafts associated with bell pits are typically only about 1.2m in diameter, and the bell pit itself was typically 5m to 10m in diameter (bell pit size would have been constrained by roof stability). Consequently, bell pits are often closely spaced; the most intensive concentration of shafts recorded to date (66 per acre) was at the Middleton Broom Opencast site.

5.4.3 As coal was removed during bell pitting, the unsupported strata above assumed an inverted slope of stability, generating a bee-hive shape around the base of the shaft which forms the characteristic vertical section. The depth limit of bell pit mining is almost certainly 15m, and this is considered a deep bell pit; the vast majority were probably less than half this depth.

5.4.4 At greater depths, pillar and stall workings appear to have been the preferred method, and such workings were often accessed via a single shaft. Consequently, shafts associated with such workings are more widely spaced; but rarely exceeded one quarter of a mile (400m) shaft to shaft, due to problems with ventilation and underground haulage. It was customary to view the life expectancy of an individual pit as about three to five years and at any one time several new pits would be sinking to replace those currently operating.

5.4.5 Up until the last decades of the eighteenth century, coal mining almost always represented a short-term interruption to ongoing use of land for agricultural. The right to sink shafts and extract coal was usually conditional upon restoration of the surface after coal extraction was complete. This not only involved filling the shaft, but also required that any subsequent settlement of shaft fill material did not result in depressions in the field surface. Consequently, it was usual to fill the shaft and heap excess arisings into a dome over the shaft eye. Over subsequent years, the dome supplied material to compensate for settlement of the shaft fill. In the normal course of events, at the conclusion of the recovery period, any remaining spoil accumulations above ground level would have been planed-off to leave a relatively stable, level surface where the shaft had been.

5.4.6 Bell pits may be present across the whole of the site near coal outcrops (see Drawing 3901/8). Given the absence of loose superficial deposits across the majority of the site, it is considered unlikely that any shallow mine entries at Dewsbury Riverside would have been lined.

5.4.7 A fault is present in the west. Faults are usually bordered by a shatter zone where the coal is degraded. The nature and extent of a shatter zone varies according to the intensity of the faulting. Early and modern mining practice was to leave the coal in the shatter zone untouched as it was of little economic value. Thus there is usually a margin between the workings and the fault, which based on observations elsewhere might be about 60m wide (30m either side of the fault). This is shown on abandonment plans for the Lady Wool Colliery.

5.5 Recorded mineworkings

Coal Authority information – Mining Report

5.5.1 A Consultants Mining report has been obtained from the Coal Authority which states that:

- Known workings have taken place in 5 seams beneath the site. These are the:
  - Middleton Main; at 4.0m to 31m depth with a maximum extraction thickness of 1.14m from 1833 to 1927.
  - Top Beeston; at 97m to 108m depth with a maximum extraction thickness of 1.08m from between 1903 and 1909.
  - Whinmoor; at 123m depth with an extraction thickness of 0.41m in 1915.
  - Black Bed; at 54m depth with an extraction thickness of 76cm in 1915.
  - Better Bed; at 237m depth with an extraction thickness of 0.60m in 1909.

  In fact, abandonment plans suggest there are also known workings in the Green Lane and 2nd Brown Metal coals.
- The site is underlain by probable shallow workings (*i.e. the CA is aware of shallow economic coal which is likely to have been worked historically, but no records exist*).
- There are no known spine roadways at shallow depth.
- A total of 40 mine entries are present in, or within 25m of, the site's boundary.
- A total of 4 coal seams outcrop within the site boundary.
- A fault is recorded (*this refers to the fault in the west*).
- Several areas of opencast coal extraction are present in the west and from c. 50m to the south.
- There are no CA managed tips within 500m.
- There is one claim within 50m of the site for subsidence damage claims. This comprises a single residential dwelling located 10m east off Ouzlewell Lane.
- There are no mines gas emissions recorded within 500m.
- The site is in an area where a notice to withdraw support was given in 1947; the property is not in an area where notice has been given... cancelling the right to withdraw support.

5.5.2 The Coal Authority suggest that the following seams outcrop within the current area of interest:

- Low Fenton (2nd Brown Metal).
- Middleton Little.
- Middleton Main.
- Wheatley Lime.

5.5.3 The above names do not tally with seam names on an NCB drawing (see Section 5.5) or the BGS map.

5.5.4 A total of 40 mine entries are located in, or within 25m of, the site's boundary. The locations of the mine entries are shown on Drawing 3901/8. A summary of mine entries is outlined below:

Type	Total no.	Location	CA Reference's
Adit	18	West, vicinity of Lady Wood & Lady Wood Extension	422419-012, 422419-013, 422419-014, 422419-016, 422419-017, 422419-018, 422419-019, 422419-020, 422419-021, 422419-022, 422419-023, 422419-024, 422419-028, 422419-029, 422419-030, 422419-031, 422419-032 & 422419-037.
Shaft	8		422419-003, 422419-005, 422419-006, 422419-007, 422419-009, 422419-010, 422419-011 & 422419-026.
Shaft	1	Centre	422419-027.
Shaft	3	East (adj. to School)	423419-006, 423419-005 & 423419-004.
Adit	1	Off-site; southwest	422419-025.
Shaft	3	Off-site; west	422419-004, 422419-015 & 422419-043.
Shaft	2	Off-site; north	423419-008 & 422419-002.
Shaft	4	Off-site; east	423419-011, 423419-002, 423419-001 & 423419-003.

5.5.5 Of the above 40 mine entries the CA only have treatment records for one; Shaft ref. 422419-002 which is positioned off-site to the north in the former Calder Colliery and which was located, found and subsequently capped with an 8.5m x 8.5m x 0.75m thick reinforced concrete cap at rockhead by IMC Ltd on behalf of the Coal Authority in 2003.

5.5.6 Given the absence of further records it is likely that the remaining mine entries, especially those located within the site's boundary, have not been formally treated.

5.5.7 The majority of these mine entries are located in the vicinity of Lady Wood, beyond areas of proposed development. Within the area proposed for development, there are only 3 known mine entries, CA Refs. 422419-027, 423419-004 & 423419-005.

5.5.8 It should be noted that there may be further mine entries located in the site's boundary which the Coal Authority have no record of.

Coal Authority information – Abandonment Plans

5.5.9 Abandonment plans have been obtained from the Coal Authority and are reproduced in Drawings 3901/9A & 3901/9B in Appendix B to this report. These plans show workings within the Middleton Main, Middleton little and 2nd Brown Metal coal seams. It should be noted that further abandonment plans have been examined for the wider Dewsbury Riverside area which show that coal has been extensively worked in the surrounding vicinity.

5.5.10 The abandonment plans also show areas of 'Old Workings' beyond the recorded mines which indicates that large portions of the site are also underlain by older, unrecorded mineworkings.

5.5.11 In addition, some opencast extraction of the Middleton Little and 2nd Brown Coals has taken place; shown on both on the abandonment plan and the Consultants Mining Report map. These areas are also shown on Drawing 3901/8 in Appendix B and lie in the west, within the Lady Wood Extension, beyond areas of proposed development.

5.5.12 Unfortunately, none of the abandonment plans include levels (mAoD) for the workings. However, they do often include sections which indicate thicknesses of coal and fireclay. These suggestions suggest:

- The New Hards / Middleton Main seam comprises 3'6" (1.0m) of coal, with a 3" dirt parting. It is underlain by Fireclay (thickness not stated, so likely not worked).
- The Green Lane / Middleton Little seam comprises 2'" (0.6m) of coal, underlain by 9" (0.2m) of Fireclay.
- The Old Hards / 2nd Brown Metal seam comprises 1'7" (0.5m) of coal.

5.5.13 The fault shown on BGS maps which runs through Lady Wood is shown on abandonment plans to have a downthrow to the east of 30 yards (27m).

5.5.14 Relevant abandonment plans are reproduced in Drawings 3901/9a and 3901/9b and summarised in the table below:

Abdn Plan Ref. (Lithos Drwng)	Coal Seam	Workings section?	General remarks	Mine entries
Ladywood Colliery 9482 (3901/9a)	Middleton Main.	Yes; coal in two leaves (0.69m & 0.38m) with dirt parting (8cm). Total thickness 1.14m). Fireclay at base (thickness not given).	Extensive underground workings beneath Lady Wood, Lady Wood Extension & the centre-west. Absence of workings where fault cuts across site.	Regularly spaced adits along coal outcrop in south of Lady Wood. Three pits (shafts) in centre & east of Lady Wood between 3.4m & ft &19.4m deep. Two adits in the north of Lady Wood Extension.
	Middleton Little.	Yes; single leaf of coal. Total thickness 60cm. Fireclay at base 0l22m thickness).	Worked from surface (opencast) in the southeast of Lady Wood & worked underground beneath the centre & south of Lady Wood Extension. Further opencast working of outcrop in northernmost tip of Lady Wood.	5 adits in the southwest of Lady Wood extension.
	2nd Brown Metal.	Yes; single leaf of coal. Total thickness 0.48m.	Worked from surface (opencast) in the south of Lady Wood Extension. Minimal underground workings in the south of Lady Wood Extension.	Single adit in centre-south of Lady Wood Extension.
Thornhill Colliery NE774 (3901/9b)	Middleton Main.	No.	Worked underground across the centre-east, southeast & south of the site. Old workings suggested across the centre.	Three shafts in the centre-northeast. Fault shown running east to west across the south downthrowing 8.2m to the north.

5.6 NCB information

5.6.1 In July 1973, the NCB Opencast Executive issued a Report summarising the findings of an intensive borehole investigation within 4 sub-areas (A to D) of the wider site. The Report was issued to parties interested in tendering for anticipated opencast contract(s) and a copy was included in Appendix E of Lithos' earlier Desk Study (Ref. 3901/1, dated December 2020).

5.6.2 It is apparent from review of the 1:10,000 BGS map that coal was subsequently opencast (likely in the early 1980s) from land in the vicinity of the former Ingham's Pit, about 500m east of the current area of interest; broadly equating to the NCB sub-areas C & D.

5.6.3 **Areas A & B** lie within the centre-south of the current area of interest, but coal is not believed to have been extracted.

5.6.4 The NCB Report includes the findings of a large number of boreholes drilled within the current area of interest; see NCB Drawing 05/9517 copied in Appendix E. Within the area of current interest to KC, boreholes were drilled in both Areas A & B and across surrounding land.

5.6.5 The key to Drawing 05/9517 indicates that the majority of boreholes were 'openholed', but some were partly cored (likely through the target coal seams), and a few were fully cored. Within the area of current interest to KC (excluding the Ladywood extension), a total of about 70 boreholes were drilled, of which about a quarter were partly cored and one was fully cored.

5.6.6 Drawing 05/9517 also shows:

- The 4 sub-areas (A to D).
- Boreholes which encountered:
  - neither coal nor old workings
  - Solid coal only
  - Old workings
- The position of known or suspected shafts & adits.
- Seam outcrops.
- Direction & rate of seam dip.

5.6.7 The seams expected to be extracted were the 3rd Brown Metal (Area A) and the 2nd Brown Metal (Area B). Coal outcrops shown on the NCB Drawing do not tally with those shown on the British Geological Survey map (Sheet SE21NW).

5.6.8 The NCB Report refers to "parting variation", which is the thickness of undifferentiated Coal Measures bedrock between each of the main coal seams. This suggests:

- the 3rd Brown Metal lies between 9.9m and 18.7m below the 2nd Brown Metal; and
- the Middleton Little lies 20.0m below the 3rd Brown Metal.

5.6.9 These partings tally reasonably well with those on the stratigraphic section on BGS mapping.

5.6.10 The NCB Report suggests:

- The predominant lithology is mudstone & made ground was not encountered.
- Geological structure was interpreted by contouring the 2nd Brown Metal and the 3rd Brown Metal Coal Seams. The seams dip at about 1 in 60 to the east and up to 1 in 30 to the west. Some deformation of the coal seam seems apparent in the west, close to the line of the geological fault.
- No washouts were identified by the investigation. (A washout occurs where a river changes course and cuts into the swamp material that will form coal; the coal seam is then locally absent)
- No faulting was identified (boreholes were not drilled in the western fault block).
- No groundwater was encountered during drilling.
- The only underground workings were encountered in "small patches" in the west of Area A in the **3rd Brown Metal** Coal. Workings have been **packed** with 'waste'; colliery arisings likely comprising mudstone, clay etc.
- No underground workings were encountered in Area B

5.7 Mining risks

5.7.1 Risks associated with shallow mineworkings include:

- Mines gas
- Combustion
- Collapse, with consequent subsidence affecting surface stability
- Recorded, and unrecorded, mine entries

Mining risks – gas

5.7.2 Gas monitoring and a hazardous gas risk assessment will be required and is proposed (see Sections 4.2 & 14).

Mining risks – combustion

5.7.3 Where coal is exposed during any site preparatory earthworks, or within excavations, care should be taken to avoid the potential for spontaneous coal combustion.

5.7.4 If any foundation excavation comes into contact with coal, the foundation should be taken through the coal seam, into underlying natural in-situ strata of adequate bearing. The full thickness of coal should then be sealed with mass concrete fill placed as soon as possible after exposing the seam to prevent the ingress of air.

5.7.5 By virtue of the provisions of the Coal Industry Act 1994 interests in unworked coal and coal mines previously vested in the British Coal Corporation are now vested in the Coal Authority. The Developer will need to contact the Coal Authority to dig or carry away such coal as they encounter in connection with redevelopment of the site (this is often referred to as incidental coal).

5.7.6 Any ground investigation and \or drilling for grouting purposes should be carried out to HSE and Coal Authority guidelines to minimise the risk of coal combustion and potential for migration of mine gases into neighbouring properties.

Mining risks – mine entries

5.7.7 The Coal Authority hold records of 40 known mine entries on, or adjacent to, the site, all but one (off-site shaft) of which are believed to remain uncapped.

5.7.8 The majority of these mine entries are located in the vicinity of Lady Wood, beyond areas of proposed development. There are only 3 known shafts within the proposed development. However, it is possible that in addition to these known entries several unrecorded mine entries, possibly including bell pits exist.

5.7.9 The Coal Authority discourage development over or adjacent to shafts. However, such features are typically of less concern where they only extend to relatively shallow seams. The recommended no build zone around deep shafts is usually defined by a line drawn up at 45^{o} from the top of the shaft, where it intercepts rock head.

5.7.10 Once located, each shaft should be accurately located by grid co-ordinates, proved to its base, pressure grouted and then be capped off at rockhead level. A shaft cap is generally required to be twice the shaft diameter and designed to support the depth of fill above plus any surcharge loads. Detailed cap design is beyond the scope of this report but should also include gas venting measures.

Mining risks – surface stability

5.7.11 Mineworkings which could affect surface stability are probably present beneath the majority of the site. Coal is likely to have been extracted by pillar & stall methods.

5.7.12 In addition, there may also have been earlier, unrecorded mineworkings via bell pits and/or pillar and stall methods, indeed several CA abandonment plans record the presence of 'old workings', and if present these could result in unpredictable subsidence. Individual pillars may collapse at any time, leading to settlement in the overlying strata. As the mine roof degrades and collapse the void migrates upwards, sometimes causing a surface collapse or crown hole.

5.7.13 The vertical distance through which a void can migrate is difficult to assess. Made ground and superficial deposits are considered to have no inherent strength and the assumption is generally made that if a void reaches the base of these formations, it will reach the surface.

5.7.14 CIRIA C758D[1] notes that given the limited evidence of structural damage caused by pillar failure, compared with that resulting from roof collapses, engineering assessment of the potential for surface instability has focused on the latter. Failure of roof strata results in the progressive transmission of the void upwards through overlying rock. The extent of 'void migration' can be influenced by factors such as: strata dip; bulking characteristics of the collapsed rock or soil; capability for arching of the collapsed zone; groundwater flow and the presence of strong and intact rock layers with the ability to span that may attenuate the upward movement.

5.7.15 The limit height on the void migration, where no appreciable surface subsidence results, is often termed 'acceptable cover', with its determination based upon a criterion reflecting the worked thickness of the seam and the rock cover. The acceptable cover criterion is generally represented as 'ht', where 'h' is the thickness of rock above the workings expressed as a multiple of t, the worked thickness. This has been a popular approach because the two elements can be reasonably well determined via conventional ground investigation.

5.7.16 Most evaluations of required bedrock cover come from the examination of Coal Measures mines. In these, it has been observed that the height of migration in bedrock might, exceptionally, extend to 10 times the height of the original extraction. Consequently, the 10t criterion has, for over 30 years, been adopted by the industry as providing reasonable assurance against surface subsidence resultant from roof collapse in old, room and pillar mines. However, collapses might attenuate within a lesser cover and there will be circumstances where using the 10t criterion could be considered overly conservative.

5.7.17 That said, a Coal Authority Technical Guidance Note[2] which describes a subsidence event that affected a number of properties on a housing estate in north-east England in 2016, concluded that the 10 times rock cover guidance is only a 'rule of thumb' for crown hole collapses. Other subsidence mechanisms can occur, such as pillar failure, for which the 10 times rock cover rule of thumb is not an appropriate guide.

5.7.18 Mitigation of the risks posed by the shallow mineworkings will be required, and this could be achieved in one of two ways:

- Extraction of the remaining coal
- Consolidation, via drilling & grouting

[1] *CIRIA C758D:2019. Abandoned mine workings manual*
[2] *Coal Authority, TGN01/2019. Findings from a large subsidence event on a residential estate.*

5.8 Mine water emissions

5.8.1 Springs and areas of very waterlogged ground are present across localised parts of the site. It is likely that at least some springs are a result of waters draining from mineworkings via adits, most notably across Lady Wood (the far-west) where the CA record a very high concentration of mine entries.

5.8.2 Mine waters can commonly include very high concentrations of contaminants, most notably dissolved metals (including iron), which have leached out from the underground seams.

5.8.3 At this stage it cannot be discounted that some spring waters at this site might yield significant contaminant concentrations that pose a risk to human or environmental receptors.

5.8.4 A request for information was sent to the Coal Authority and is included in Appendix E.

5.8.5 The Coal Authority have no records of mine water monitoring locations, treatment sites or specific discharges in the area, although this does not mean that no issues are present.

5.8.6 It is likely that the water discharging here has interacted with mine workings and could therefore be described as mine water. This water is likely to contain elevated concentrations of minerals associated with the Coal Measures including iron which is often seen as ochreous (orange) deposits around discharges. However, these constituents would also be likely to occur in natural groundwater occurring in this area.

5.8.7 The CA note that "acid mine drainage" is rare in the UK and is related to specific conditions unlikely to be present at this site.

5.9 Mineral safeguarded areas

5.9.1 The site is underlain by at least 5 seams of coal, although some areas have previously been subject to opencast extraction and might therefore be considered by the Local Authority to lie within a Mineral Safeguarding Area (MSA).

5.9.2 MSAs are areas of known mineral resources that are of sufficient economic or conservation value to warrant protection for generations to come. The purpose of MSAs is not to preclude automatically other forms of development, but to make sure that mineral resources are adequately and effectively considered in land-use planning decisions.

5.9.3 Specialist guidance on Mineral Safeguarding "A Guide to Mineral Safeguarding in England" has been produced by The Coal Authority and the British Geological Survey.

5.9.4 Paragraph 204 of the National Planning Policy Framework (NPPF) requires Local Authorities, when preparing Local Plans to:

- Define Minerals Safeguarding Areas and adopt appropriate policies in order that known locations of specific minerals resources of local and national importance are not needlessly sterilised by non-mineral development, whilst not creating a presumption that resources defined will be worked; and define Minerals Consultation Areas based on these Minerals Safeguarding Areas.
- Set out policies to encourage the prior extraction of minerals, where practicable and environmentally feasible, if it is necessary for non-mineral development to take place.

5.9.5 NPPF Paragraph 144 notes that when determining planning applications, local planning authorities should give weight to the benefits of the mineral extraction.

5.9.6 As a consequence of the NPPF, and the presence of coal beneath the site, the Local Authority may require the Developer to consider the opportunity to recover (extract) the coal. Applicants submitting planning applications may need to demonstrate to the Local Authority that they will extract the coal, unless:

- It can be shown it is not economically viable to do so, or
- It is not environmentally acceptable to do so, or
- The need for the development outweighs the need to extract the coal, or
- The coal will not be sterilised by the development

5.10 Coal extraction

KC Policy

5.10.1 The Kirklees **Local Plan** was adopted on 27th February 2019. The Local Plan is now the statutory development plan for Kirklees and has superseded the Kirklees Unitary Development Plan. The Local Plan comprises the strategy and policies document, allocations and designations document and associated policies map showing the allocations and designations.

5.10.2 The Local Plan will indicate specific areas for potential future mineral working through allocations based principally on information provided by the local quarrying industry relating to its requirement for minerals over the plan period. Safeguarding areas will be based on the British Geological Survey mineral resources information. The release of allocated sites will be linked to a demonstrated need for the mineral and, in general, permission will only be granted when an operator's remaining permitted reserves are approaching exhaustion.

5.10.3 Section 15 (Minerals) of the Local Plan notes that the two principal minerals currently extracted in the district are sandstone (which is primarily used in the construction of buildings and for paving), and clay / shale (used for pipe manufacture).

5.10.4 With respect to coal, it is noted that there are extensive economically viable coal reserves underlying the eastern side of Kirklees extending as far as the eastern outskirts of Huddersfield. It is likely however that any future interest in the extraction of this coal will be in the form of proposals for surface extraction and will be located near to the boundaries with Wakefield and Leeds Districts.

5.10.5 National planning guidance does not support the opening of new opencast coal sites unless they meet strict criteria regarding environmental impact or provide overwhelming community benefits.

Site-specifics

5.10.6 Prior extraction of coal is encouraged by both the Coal Authority and Planning Authorities, largely because a potential mineral resource will not be sterilised by the development. However, it is worth noting that the UK market for coal is changing (driven by government carbon emission targets) – most notably very few power stations are still burning coal. Consequently, prior extraction of coal has become less attractive in recent times.

5.10.7 The Extraction Contractor would pay the landowner a disturbance allowance for the coal (likely to be between £2 and £4 per tonne). Consequently, there could be a significant financial benefit to this approach, since in essence any proposed earthworks (i.e. regrading) would be undertaken and there would be a considerable saving because grouting would not be required.

5.10.8 In order to pursue this option, it would be necessary to obtain a statutory licence from the Coal Authority.

5.10.9 In addition to commercial and planning considerations, advantages of coal extraction over grouting include the removal of development constraints associated with known mine entries.

5.10.10 Traffic movements (associated with coal export) are expected to be no greater than those associated with grouting (import of PFA and cement).

5.10.11 However, coal extraction is not without drawbacks; these include:

- The creation of 'high-walls' around the margins of the extraction area (essentially the whole of the site's perimeter).
- The time required to ensure significant settlement of the replaced overburden (anticipated residual settlement must be less than 25mm) is typically at least 12 months. However, the actual delay to build programme might be longer, since it is impossible to predict the actual time required for ongoing creep settlements to fall to tolerable levels. Prediction is hampered by uncertainties associated with groundwater rebound and the nature of the excavated material with respect to suitability for compaction.
- Extraction usually increases developer abnormal foundation costs.
- Local environmental issues associated with noise and dust.
- Public perception issues.
- Concerns that once an initial excavation has been opened, the coal extraction contractor might decide there is insufficient coal remaining and abort further work, or even run into financial difficulties, leaving KC or the Developer with increased foundation abnormals and no royalties.

5.10.12 Assuming the above factors do not preclude further consideration at the 'first hurdle', the viability of extraction is influenced by physical factors, most notably:

- the presence (or not) of old mineworkings;
- seam thickness (greater the better); and
- seam depth (shallower the better).

5.10.13 It is understood from preliminary enquiries, that extraction is viable where the overburden above a seam is less than 10 times the seam's thickness; in the north of this site (the "Miller's area) the overburden thickness is less than 10 times seam thickness for the Middleton Little and 3rd Brown Metal coal but greater than 10 times seam thickness for the Middleton Main.

5.10.14 Consequently, in theory prior extraction of the Middleton Little and 3rd Brown Metal coals might be economically viable.

5.10.15 However, extraction of the Middleton Little coal is unlikely to be viable because:

- The degree of previous extraction (historic mineworkings) appears to be in the order of 75%.
- If the Middleton Little were extracted, there might insufficient competent bedrock cover above deeper workings in the Middleton Main seam (which might therefore require grouting).
- The proximity of existing housing along Ravensthorpe Road.

5.11 Drilling & grouting

5.11.1 If shallow coal seams are not entirely removed by prior extraction, then it may be necessary to consolidate the mineworkings by drilling and grouting.

5.11.2 The necessary consolidation should be achieved by drilling holes on an appropriate grid (likely 3m to 5m spacings). A viscous grout composed of appropriate proportions of OPC, PFA, sand or pea gravel would then be injected into the workings via these holes.

5.11.3 Drilling and grouting operations should be carried out with engineering supervision, and be undertaken in accordance with a suitable, approved Specification tailored to the site-specifics associated with this site.

5.11.4 Proposals to treat the mineworkings and shafts will need to be discussed with both Kirklees Council (most notably Highways), and the Coal Authority well in advance of starting works on site.

6 PREVIOUS INVESTIGATION FINDINGS

6.1 Lithos – "Miller's" area

6.1.1 Lithos have previously undertaken ground investigation on c. 7.2 hectares of land in the centre-north of this site ("Miller's" area).

6.1.2 Findings were provided in Report 2336/3, issued to Miller Homes in January 2018. Millers have granted permission to KC allowing Lithos to "re-use" the data obtained.

6.1.3 From Section 9 onwards of this Report, 2018 ground investigation data has been assimilated with data collected from across the remainder of the current area of interest in January 2021. However, a brief summary of 2018 findings is also included below.

6.1.4 The 2018 investigation comprised:

- 22 trial pits, TPs 301 to 322 (1.9m to 4.1m depth)
- 20 rotary open probeholes, PHs 207 to 219, 209a, 210a, 211a, 212a, 216a, 217a & 217b (10.0m to 36.0m depth), with spot cores to recover samples of coal for subsequent quality analysis
- 13 samples of Topsoil were analysed for a suite of chemical testing to check suitability for re-use
- 20 samples of residual soils and bedrock were submitted for geotechnical testing
- 7 samples of coal were recovered and submitted for coal quality analysis.

6.1.5 Shallow ground typically comprised the following:

- Topsoil to c. 0.3m.
- Subsoil (slightly gravelly clay) to between 0.3m & 0.7m.
- Cohesive Residual Soil (medium strength gravelly sandy clay).
- Granular Residual Soil (sandy gravel of sandstone).
- Coal Measures (bedrock; sandstone or mudstone) encountered from between 0.9m and 3.1m depth (ave. 2.1m).

6.1.6 No made ground, nor any visual or olfactory evidence of significant contamination was encountered.

6.1.7 The rotary probeholes encountered 5 coal seams in the following succession:

- 3rd Brown Metal (0.3m to 0.5m thick)
- An un-named seam (0.3m to 0.5m thick)
- Middleton Little (0.5m to 1.6m thick)
- Middleton Main (1.2m thick)
- An un-named seam (0.2m thick)

6.1.8 Evidence of workings was encountered in the Middleton Little and Middleton Main coal seams comprising voids, and areas of soft push/broken ground.

6.1.9 No evidence of workings was encountered in the 3rd Brown Metal Coal (although this only underlies a small part in the far south of the "Miller's" area) or the two un-named seams. It should be noted that the 3rd Brown Metal as identified above may actually be the 2nd Brown Metal Coal.

6.1.10 Report 2336/3 concluded that underground workings should be anticipated in the Middleton Main and Middleton Little Coal Seams. Mitigation of the risks posed by these workings will be necessary and could be achieved either by prior extraction or consolidation (drill & grout). However, if the Middleton Little Coal were extracted (i.e. opencast, with subsequent backfill of excavations) then there might be a need for grouting of the underlying, deeper Middleton Main Coal.

6.1.11 Mine entries were not located during Lithos' investigation as this lay beyond the scope of works.

6.1.12 Topsoil was found to be slightly 'contaminated' with arsenic but was considered suitable for re-use on site, although there might be implications if export off-site were proposed (further testing and assessment would be required). No further contamination was encountered.

6.1.13 Natural soils are of medium to high strength and cohesive soils are of medium shrinkability. Sub-surface concrete should be Design Sulphate Class DS-1 with an ACEC Classification of AC-1.

6.1.14 Foundations for 'traditional' two/three storey builds could comprise 'traditional' strip footings to a minimum depth of 600mm (granular founding stratum) or 900mm (cohesive founding stratum). Reinforcement of footings would be required where consolidated (i.e. grouted) seams remain at shallow depth.

6.1.15 The redundant 12" gas pipeline (see Section 2.2.21) was located with a CAT during Lithos' investigation.

6.1.16 Given the likelihood of significant earthworks regrade to create development plateaux, and probably some coal extraction, no monitoring wells were installed during this 2018 investigation. However, installation of monitoring wells and a subsequent gas risk assessment will ultimately be required.

6.2 Lithos – Lyttle land

6.2.1 An area of 7.2 ha in the north-west, beyond the area of current interest (the Lyttle land) was investigated in April 2017. This investigation had originally been intended to include the "Miller's" area, but access to that land was not granted until 2018, other than for the drilling of 2 probeholes. The aims of this investigation were to:

- Determine the extent of the Thornhill Power Station landfill (as outlined in the Envirocheck information (see Section 4.2)
- Confirm the depth of a gas main
- Determine the depth and thickness of an un-named coal seam

6.2.2 The 2017 investigation comprised:

- 14 trial pits, TPs 201 to 214 (1.9m to 4.1m depth)
- 7 rotary open probeholes, PHs 201 to 206 & 206A (10.0m to 36.0m depth)

6.2.3 Ground conditions encountered are summarised in the Tables on page 25.

6.2.4 Interestingly, no made ground was encountered within the licensed boundary of the former Thornhill Power Station landfill. This conflicts with data provided in the Envirocheck Report but is consistent with review of historical OS mapping. It was concluded that tipping, if indeed any took place at all, was restricted to the area of new planting (Lady Wood Extension) further to the south and west.

6.2.5 Ground encountered in the trial pits comprised: Topsoil (typically 300mm in thickness), over cohesive residual soils, which grade down into granular residual soils and eventually into bedrock.

6.2.6 Bedrock was encountered in all the pits, and typically comprised sandstone. Rockhead was encountered between 1.1m and 2.7m; average 2.0m. In addition, coal was encountered in TPs 205 & 213.

6.2.7 Five different coal seams (all intact) were encountered. Whilst there is some uncertainty regarding which specific seams were encountered, the table on page 25 includes tentative names.

6.2.8 An inspection pit was dug by hand, under NGN supervision, which demonstrated that the high-pressure gas main lies at a depth of greater than 1.5m in the vicinity of a proposed new road. A CAT scan at 1.5m indicated that the main was possibly a further 1.7m deep.

Summary of Ground Conditions (Trial pits) - Lyttle land

Hole	Final depth (m)	Natural Soils				Bedrock	Coal
		Topsoil	Subsoil	Cohesive Residual Soil	Granular Residual Soil		
TP201	2.7	0.3	0.5	2.4	2.7	>2.7	
TP202	2.7	0.3	0.5	2.1	2.5	>2.7	
TP203	3.0	0.3		2.0	2.7	>3.0	
TP204	2.5	0.4		1.2	2.2	>2.5	
TP205	3.7	0.3		2.0		>2.0	2.6 - 3.0
TP206	3.2	0.3		1.1		>1.4	
TP207	1.7	0.3		1.1		>1.1	
TP208	2.4	0.3		1.4		>1.4	
TP209	2.2	0.3		1.6		>2.2	
TP210	2.2	0.3		1.7		>1.7	
TP211	2.9	0.3		2.6		>2.6	
TP212	3.6	0.4		2.2		>2.2	
TP213	4.0	0.3		1.8		>1.8	3.0 - 3.7
TP214	2.7	0.3		1.5	2.5	>2.7	

Summary of Ground Conditions (Probeholes) - Lyttle land

Hole	Final depth (m)	Overburden thickness (m)	Coal seam depth (m)					Remarks
			Middleton Main	Unnamed Coal	Wheatley Lime	Unnamed Coal	Middleton Eleven Yard	
PH201	33.0	1.3			10.2 - 11.3		27.3 - 28.5	
PH202	27.0	2.9						No coal encountered
PH203	27.0	1.5		1.5 - 2.0	*15.8 - 16.3			*Only present as coal traces
PH204	27.0	1.7			10.6 - 11.2	15.4 - 15.6		
PH205	33.0	1.8			8.6 - 9.7	*22.3 - 23.0	28.0 - 28.6	*Only present as coal traces
PH206	42.0	1.3	9.5 - 10.2	15.0 - 15.7	28.4 - 29.7			
PH206A	18.0	1.3	9.5 - 10.2					Spot cored from 9.5m to 12.5m & 15.0m to 18.0m

7 GROUND INVESTIGATION DESIGN

7.1 Anticipated ground conditions & potential issues

7.1.1 Based on the data reviewed in Sections 4 to 6, anticipated ground conditions are expected to comprise:

Anticipated condition	Remarks
Made ground	Anticipated across Lady Wood & Lady Wood Extension; notably area of landfill/tip/slag/spoil heap. Deep Made Ground in footprints of former opencast areas & a small sandstone quarry.
Natural soils	Veneer of Topsoil over Residual Soils (gravelly clay & sandy gravel). Glaciofluvial deposits in northeastern corner.
Bedrock	Coal Measures Sandstone & Mudstone from between c. 1.0m & 3.0m depth.
Mineworkings	Anticipated from shallow depth in 2nd Brown Metal, Middleton Main, Middleton Little & Wheatley Lime Coal Seams from shallow to c. 50.0m depth. In addition, several mine entries present, most notably in Lady Wood (west).
Groundwater	Anticipated in bedrock; likely flow direction to the north. Waters likely to flow through underground mineworkings & localised springs may be the result of minewaters draining from former adits.

7.1.2 Based on the data above and that in Sections 2 (Site Description) and 3 (History), potential ground-related issues associated with this site are likely to include:

Type of issue	Specific issue	Remarks
Potential on-site contamination sources	1. Made Ground. 2. Farming related activities. 3. Minewaters.	1. Area of slag/refuse tip (Lady Wood Extension). Areas of former opencast coal extraction. Around buildings in Lady Wood. 2. See Section 7.2 below. 3. Potential emission of minewaters contaminated with metals.
Potential off-site contamination sources	1. Landfill.	1. Areas of landfill to the north; potential for generation & migration of hazardous ground gasses.
Potential geotechnical hazards	1. Shallow underground workings 2. Buried highwalls 3. Mine entries 4. Sloping topography 5. Cohesive soils 6. Deep made ground	1. In several seams of coal beneath site. 2. Around periphery of areas of former opencast. 3. Most notably across Lady Wood. 4. Some site regrade into developable levels is anticipated. 5. Potential for shrink/swell of soils influenced by trees. 6. Within areas of former opencast & landfill.
Other potential constraints	1. Underground & overhead utilities cross the site.	1. May be a requirement for diversion or easement.

7.2 Preliminary conceptual site model

7.2.1 A preliminary conceptual site model, presented as Drawing No 3901/5 in Appendix B, has been prepared after consideration of all the data presented in Sections 2 to 7.1 inclusive of this report.

7.2.2 Historical plans show that the site has been occupied by arable farmland which is not considered likely to have caused significant ground contamination. Nonetheless, activities such as slurry spreading, the discharge of chemicals to ground, and unregulated burial have all occurred on farmland. Potential contaminants associated with farming activity might include any of the following:

Agricultural activity	Potential contaminant
Sewage farming, slurry spreading	Methane, metals, nitrates, oxygen depletion
Orchards	Metals, pesticides
Carcase burial	Anthrax & other biohazards
Plant & animal protection	Pesticides & herbicides
Soil conditioners	Metals, sulphates, PAH
Equipment maintenance	Hydrocarbons, metals
Waste burial, land levelling, backfilling ponds/quarries	Methane, metals, PAH etc
Naturally occurring contaminants	Arsenic, metals

7.2.3 Whilst it is likely that pesticides have been applied during arable use of the land, these are not likely to include the persistent organochloride pesticides such as Dieldrin, Aldrin, DDT etc. Pesticides routinely used on arable crops the UK (Phenoxy Acetic acid herbicide or PAAH) rapidly degrade in soils or leach via rainwater infiltration to groundwater. It is highly unlikely these would be detected by soil sampling and therefore these have not been included within the proposed sampling suite.

7.3 Ground investigation design & strategy

7.3.1 KC's requirements were outlined in tender documents and required probeholes and trial pits on a 50m grid across the site (alternate probeholes/trial pits), with installation of gas and water monitoring wells in 50% of the probeholes. It was acknowledged that further rotary drilling may be required to assess mining risk, which, if required, will be determined and costed at a later stage.

7.3.2 Whilst KC's requirements have been used as the basis for the proposed ground investigation, account has also been taken of the preliminary conceptual site model, the proposed development area and constraints associated with the allotments and areas of woodland. The proposed ground investigation scope is summarised below:

Exploratory holes	Purpose
About 40 trial pits	To determine the general nature of soils underlying the site, including the: • nature, distribution & thickness of shallow soils, including any made ground. • suitability of the ground for founding structures & highways.
Trial trenches	To determine the location & nature of buried highwalls around small sandstone quarry.
Shallow excavations	To locate the known mine entry (CA Ref. 4224419-027).
About 20 mini-BHs	To determine ground conditions in allotments & woodland (Lady Wood Extension) where access is constrained.
About 35 rotary probeholes	To check for the presence of voids or broken ground associated with possible unrecorded shallow mine workings
Including 17 probeholes	To install hazardous gas monitoring wells.

7.3.3 Proposed exploratory hole locations should provide a representative view of the strata beneath the site and to target potential areas of interest identified in Section 7.1.2 above. A nominal 50m grid spacing has been proposed by KC. Additional exploratory locations may be scheduled as necessary in light of the ground conditions actually encountered.

7.3.4 Representative soil samples of natural and any man-made ground should be taken during the works. The number of soil samples taken should be reflective of the geological complexity actually encountered, but in general about 3 samples should be taken from most exploratory holes.

8 FIELDWORK

8.1 Objectives

8.1.1 The original investigation strategy is outlined in Section 7 above.

8.1.2 The findings of Lithos' previous investigation (Lithos' Report 2336/3, January 2018) in the Millers area has been incorporated into this section and subsequent sections of the report.

8.1.3 It should be noted that some amendments have been made to Lithos' previous exploratory holes due to further investigation improving our understanding of ground conditions at this site (e.g. geology types and coal seam names).

8.2 Exploratory hole location constraints

8.2.1 No access was available along the lines of overhead electrical and underground gas and water utilities.

8.2.2 No access was available in the footprint of Ravenshall School (northeast).

8.2.3 Limited access was available in the allotments and the nursery carpark (northeast) due to ongoing site usage and in Lady Wood and Lady Wood Extension (west) due to badger setts and dense growth of trees and shrubs.

8.2.4 Window sampling was the only practical means of investigation in the allotment, nursery and woodland areas. It should be noted that window sampling allows only a limited inspection of the ground (especially made ground with a significant proportion of coarse material). Furthermore, assessment of the strength of cohesive soils, via hand vane tests, is difficult due to disturbance caused by drilling.

8.3 Scope of works

8.3.1 Fieldwork was supervised by Lithos between the 4th and the 21st January 2021 and comprised the exploratory holes listed below:

Technique	Exploratory holes	Final depth(s)	Remarks
Trial pitting (machine dug)	TPs 501 to 535	1.4m to 3.9m	Vane tests in cohesive soils
Soakaway tests	Within TPs 531 to 534	2.3m to 3.7m	-
Window sample boreholes	WSs 501 to 515	1.0m to 3.65m	Monitoring wells installed in 8 BHs.
Rotary open-hole probeholes	PHs 501 to 532	25.0m to 54.0m	Monitoring wells installed in 17 PHs.

8.3.2 The exploratory holes listed below were advanced across the Millers Parcel by Lithos in April, November & December 2017:

Technique	Exploratory holes	Final depth(s)	Remarks
Trial pitting (machine dug)	TPs 301 to 322	2.4m to 4.5m	Vane tests in cohesive soils
Rotary open-hole probeholes	PHs 201 to 204 & 207 to 219	10.0m to 36.0m	Spot coring undertaken to retrieve coal samples

8.3.3 Notes describing ground investigation techniques, in-situ testing and sampling are included in Appendix A to this report.

8.3.4 Exploratory hole logs are presented in Appendices F to H to this Report. These logs include details of the:

- Samples taken
- Descriptions of the solid strata, and any groundwater encountered.
- Results of the in-situ testing
- The monitoring wells installed

8.3.5 Exploratory hole locations are shown on Drawing 3901/6 presented in Appendix B. Exploratory holes were picked-up by a surveyor and co-ordinates/ground levels are included on the logs.

9 GROUND CONDITIONS

9.1 General

9.1.1 A complete record of strata encountered beneath the site is given on the various exploratory hole records, presented in Appendices F to H.

9.1.2 Typical ground conditions encountered at the site are described below in Sections 9.2 (made ground) and 9.4 (natural ground), with a summary provided in the table on pages 32 to 34. The findings of the rotary probeholes are discussed in Section 9.9.

9.2 Made ground

9.2.1 The made ground on site is a heterogeneous mixture of materials and it is unlikely, even with a huge amount of sampling, that it could be accurately characterised. Nonetheless, the bulk of the made ground can be categorised as one of 6 broad types in two areas (the Lady Wood Extension and Nursery/Allotments):

Lady Wood Extension (c. 4 ha in far west)

- **Made Ground Topsoil:** Encountered in WSs 501, 502 & 513 to 515. Comprising sandy clay occasionally with gravel of mixed lithologies, and rare coal, brick and pottery.
- **Ash & Clinker:** Encountered in WS513 to 1.0m depth, comprising ash sand and gravel of sandstone, clinker and slag.
- **Cohesive Made Ground:** Encountered in WSs 501, 502, 514 & 515, up to 1.5m depth (WS514), comprising clay with gravel of sandstone and occasional coal, clinker and brick, a medium cobble content and rare sandstone boulders.
- **Granular Made Ground:** Encountered in WS 515 to 2.4m, comprising sand and gravel of brick, sandstone, clinker and occasional coal.

Note: no development, or disturbance of the ground is anticipated within Lady Wood Extension.

Nursery/Allotments (c. 1.3 ha in north-east)

- **Made Ground Topsoil:** Encountered in WSs 503 to 505 to around 0.4m depth. Comprising sandy clay occasionally with gravel of mixed lithologies, and rare coal, brick and pottery.
- **Burnt Shale:** Encountered in WS511 in the nursery car park to 0.5m depth, comprising gravel of burnt shale.
- **Sub-Base:** Encountered in WSs 510 to 512 in the nursery car park from the base of hardstand to 0.3m depth, comprising slightly clayey slightly sandy gravel of limestone.
- **Cohesive Made Ground:** Encountered in WSs 506 to 508 and 509A to 512 within the allotments and the nursery car park, to between 0.4m (WS506) & 0.9m (WS511) depth comprising clay with gravel of sandstone and occasional coal, clinker and brick, a medium cobble content and rare sandstone boulders.
- **Granular Made Ground:** Encountered in WSs 509 & 515 to 0.1m & 2.4m respectively, comprising sand and gravel of brick, sandstone, clinker and occasional coal.

Note: the new Spine Road is expected to pass through this area, but no built development is anticipated.

9.2.2 Made Ground across Lady Wood Extension is associated with historical tipping. Tipped materials appear to comprise Burnt Shale, Ash & Clinker and reworked natural soils with anthropogenic inclusions. To date made ground has been encountered to up to 2.4m depth in this area, although it is expected that greater depths are present (given that CA information shows areas of opencast in the vicinity).

9.2.3 Made Ground beneath the allotments and the nursery car park is most likely associated with former buildings, allotment activities (i.e. turnover of shallow soils, construction of sheds etc) and construction of the existing car park. To date made ground in these areas has only been encountered to 0.9m depth (typically c. 0.6m depth).

9.2.4 Made Ground Topsoil and Cohesive Made Ground were also encountered in an isolated area in the centre-south (**TP525**). This is likely associated with construction of the underground gas utility which runs nearby; ground disturbed during excavation and backfill of the utility trench.

9.2.5 No evidence of a former small quarry shown on old OS maps was encountered in TP535; see Section 9.8.

9.3 Obstructions

9.3.1 The vast majority of the site is essentially greenfield and no significant underground obstructions are anticipated.

9.3.2 Some former buildings have been present in the northeast (allotments & nursery car park) and the far-west (Lady Wood). To date no obstructions have been encountered in these areas but the presence of some relict foundations, floor slabs etc cannot be entirely discounted.

9.3.3 Some foundations, floor slabs etc are present within the Ravenshall School Grounds (beneath existing school buildings). However, no development is anticipated in this area.

9.3.4 The presence of oversize materials and/or oversize obstructions placed during tipping across Lady Wood Extension cannot be discounted, although again no development is proposed across this area.

9.3.5 Glacial Deposits in the northeast (see Section 9.4 below) include occasional cobbles and boulders which were difficult to excavate through.

9.4 Natural ground

9.4.1 Natural ground was encountered in the majority of the exploratory holes, and typically comprised the following succession:

- **Topsoil:** Encountered in 60 of 61 trial pits, but no dynamic sample boreholes, to a typical depth of 0.3m. Comprising sandy, occasionally silty, clay with occasional gravel of mixed lithologies and rare pottery and coal.
- **Cohesive Glacial Deposits:** Encountered in the centre-north & northwest to between 0.8m (TP307) and >3.0m (TP517) depth (average 2.2m). Comprising firm and stiff, gravelly clay often with a low to medium cobble content and rare sandstone boulders. Boulders are generally <1.0m in diameter, but a large boulder was encountered during excavation of TP531.
- **Cohesive Residual Soil:** Encountered in the majority of exploratory holes from the base of Topsoil/made ground/Glacial Deposits to rockhead. Comprising firm to stiff clay with gravel of mudstone, siltstone and/or sandstone.
- **Lower Coal Measures bedrock:** Encountered in 42 of 74 trial pits and dynamic sample boreholes from between 0.7m (TP521) and 3.1m (TP317) depth. Comprising one of three types:
  - Sandstone; weak to medium strong and fine grained, recovered as sandy gravel.
  - Siltstone; weak, recovered as slightly clayey gravel.
  - Mudstone; very weak to weak, recovered as clayey gravel.

9.4.2 In addition to the above, **Granular Glacial Deposits** comprising gravel of sandstone, siltstone and occasional coal were encountered to up to 2.7m depth in TPs 308, 501 and 535 and WSs 503 and 512.

9.4.3 The approximate area underlain by Glacial Deposits is shown on Drawing 3901/11; this is larger than the area shown on BGS mapping.

9.4.4 **Granular Residual Soil** was encountered in TPs 512, 513, 518 and 529 to between 1.2m and 2.2m depth, comprising gravel of sandstone which was occasionally slightly sandy, or which included a low to medium sandstone cobble content. Where Granular Residual Soils were encountered the underlying bedrock was sandstone.

9.4.5 Approximate depths to bedrock are shown on Drawing 3901/12 and the approximate distribution of bedrock types is shown on Drawing 3901/13.

Summary of Ground Conditions (Trial pits)

Hole	Final Depth (mbgl)	Depth to Base (m bgl)											
		Total Made Ground	Made Ground Topsoil	Cohesive Made Ground	Topsoil	Cohesive Glacial Deposits	Granular Glacial Deposits	Cohesive Residual Soil	Granular Residual Soil	Rock-head (mbgl)	Pent'n (m)	Coal (top & base mbgl)	Seat Earth (base mbgl)
TP301	2.9	-	-	-	0.4	2.0	-	2.5	-	2.5	0.4	-	-
TP302	2.9	-	-	-	0.4	2.9	-	-	-	-	-	-	-
TP303	2.6	-	-	-	0.3	1.4	-	-	-	1.4	1.2	-	-
TP304	2.6	-	-	-	0.3	2.4	-	-	-	2.4	0.3	-	-
TP305	2.6	-	-	-	0.4	1.4	-	2.1	-	2.1	0.5	-	-
TP306	4.1	-	-	-	0.3	2.0	-	-	-	2.0	1.7	3.7 to 4.1	-
TP307	2.6	-	-	-	0.3	0.8	-	-	-	0.8	1.8	0.8 to 0.9	-
TP308	2.7	-	-	-	0.25	1.6	2.7	-	-	-	-	-	-
TP309	2.7	-	-	-	0.3	2.5	-	-	-	2.5	0.2	-	-
TP310	4.5	-	-	-	0.3	2.7	-	-	-	2.7	1.8	-	-
TP311	4.2	-	-	-	0.4	2.5	-	-	-	2.5	1.7	3.4 to 4.1	-
TP312	4.2	-	-	-	0.3	1.4	-	1.8	-	1.8	2.0	2.7 to 3.4	-
TP313	2.9	-	-	-	0.2	-	-	2.9	-	-	-	-	-
TP314	3.0	-	-	-	0.3	-	-	2.5	-	2.5	0.5	-	-
TP315	3.0	-	-	-	0.4	1.3	-	2.7	-	2.7	0.3	-	-
TP316	1.9	-	-	-	0.5	1.4	-	1.7	-	1.7	0.2	-	-
TP317	3.6	-	-	-	0.3	3.1	-	-	-	3.1	0.5	-	-
TP318	2.9	-	-	-	0.4	1.7	-	2.6	-	2.6	0.3	-	-
TP319	4.3	-	-	-	0.4	-	-	1.7	-	1.7	2.6	-	-
TP320	2.4	-	-	-	0.4	-	-	1.2	-	1.2	1.2	-	-
TP321	2.5	-	-	-	0.3	1.1	-	1.7	-	1.7	0.8	-	-
TP322	2.5	-	-	-	0.3	0.9	-	1.5	-	1.5	1.3	2.2 to 2.6	-
TP501	2.7	-	-	-	0.3	1.5	2.7	-	-	-	-	-	-
TP502	3.4	-	-	-	0.35	2.5	-	-	-	2.5	0.9	-	-
TP503	2.9	-	-	-	0.25	1.8	-	2.3	-	2.3	0.6	-	-
TP504	3.4	-	-	-	0.3	2.5	-	-	-	2.5	0.9	-	-
TP505	3.6	-	-	-	0.3	3.6	-	-	-	-	-	-	-
TP506	4.0	-	-	-	0.15	4.0	-	-	-	-	-	-	-

Hole	Final Depth (mbgl)	Depth to Base (m bgl)											
		Total Made Ground	Made Ground Topsoil	Cohesive Made Ground	Topsoil	Cohesive Glacial Deposits	Granular Glacial Deposits	Cohesive Residual Soil	Granular Residual Soil	Rock-head (mbgl)	Pent'n (m)	Coal (top & base mbgl)	Seat Earth (base mbgl)
TP507	3.2	-	-	-	0.25	1.6	-	-	-	1.6	1.6	-	-
TP508	3.9	-	-	-	0.2	3.9	-	-	-	-	-	-	-
TP509	3.4	-	-	-	0.2	3.4	-	-	-	-	-	-	-
TP510	3.0	-	-	-	0.25	0.9	-	3.0	-	-	-	-	-
TP511	1.7	-	-	-	0.3	-	-	1.3	-	1.3	0.4	0.6 - 0.9	1.1
TP512	2.7	-	-	-	0.3	-	-	-	1.3	1.3	1.4	-	-
TP513	2.7	-	-	-	0.3	-	-	-	1.2	1.2	1.5	-	-
TP514	2.4	-	-	-	0.25	-	-	2.2	-	2.2	0.2	-	-
TP515	3.5	-	-	-	0.3	-	-	0.9	-	0.9	2.6	1.4 - 2.2	2.7
TP516	3.0	-	-	-	0.2	-	-	2.3	-	2.3	0.7	-	-
TP517	3.0	-	-	-	0.35	-	-	3.0	-	-	-	-	-
TP518	2.6	-	-	-	0.3	-	-	1.0	2.2	1.0	1.6	-	-
TP519	3.1	-	-	-	0.25	-	-	1.8	-	1.8	1.3	-	-
TP520	2.4	-	-	-	0.35	-	-	1.8	-	1.8	0.6	-	-
TP521	2.4	-	-	-	0.3	-	-	0.7	-	0.7	1.7	0.7 - 1.9	2.1
TP522	3.0	-	-	-	0.2	-	-	1.4	-	1.4	1.6	0.6 - 0.8 & 1.4 - 2.3	-
TP523	3.3	-	-	-	0.25	-	-	2.2	-	-	-	2.2 - 2.9	3.3
TP524	1.4	-	-	-	0.25	-	-	1.1	-	-	-	-	-
TP525	2.0	1.2	0.3	1.2	-	-	-	1.6	-	-	-	-	-
TP526	3.3	-	-	-	0.25	-	-	1.9	-	1.9	1.4	2.4 - 2.9	-
TP527	2.9	-	-	-	0.3	-	-	2.6	-	2.6	0.3	-	-
TP528	2.5	-	-	-	0.3	-	-	2.0	-	2.0	0.5	-	-
TP529	2.6	-	-	-	0.3	-	-	0.6	1.3	1.3	0.3	-	-
TP530	3.5	-	-	-	0.25	-	-	0.9	-	0.9	2.6	0.9 - 1.3 & 1.7 - 2.2	3.0
TP531	3.2	-	-	-	0.3	3.3	-	-	-	-	-	-	-
TP532	3.7	-	-	-	0.23	3.7	-	-	-	-	-	-	-
TP533	2.7	-	-	-	0.3	2.2	-	-	-	2.2	0.5	-	-
TP534	2.3	-	-	-	0.3	2.0	-	-	-	2.0	0.3	-	-
TP535	1.4	-	-	-	0.9	-	0.9	-	-	0.9	0.5	-	-

Summary of Ground Conditions (Dynamic sampled boreholes)

Area	Hole	Final Depth (mbgl)	Depth to Base (m bgl)										Coal (top & base mbgl)
			Total Made Ground	Made Ground Topsoil	Ash & Clinker	Burnt Shale	Sub-Base	Cohesive Made Ground	Granular Made Ground	Cohesive Glacial Deposits	Granular Glacial Deposits	Cohesive Residual Soil	
Ladywood Extension	WS501	3.65	1.4	0.2	-	-	-	1.4	-	-	-	3.65	2.9 - 3.1
	WS502	1.9	0.8	0.5	-	-	-	0.8	-	-	-	1.9	-
Allotments	WS503	3.0	0.4	0.4	-	-	-	-	-	3.0	1.0	-	-
	WS504	3.0	0.3	0.3	-	-	-	-	-	3.0	-	-	-
	WS505	2.0	0.4	0.4	-	-	-	-	-	2.0	-	-	-
	WS506	2.0	0.4	-	-	-	-	0.4	-	2.0	-	-	-
	WS506A	2.0	0.4	-	-	-	-	0.4	-	2.0	-	-	-
	WS507	2.0	0.5	-	-	-	-	0.5	-	2.0	-	-	-
Nursey car park	WS508	3.0	0.8	-	-	-	-	0.8	-	3.0	-	-	-
	WS509	1.0	0.1	-	-	-	-	-	0.1	0.4	-	-	-
	WS509A	2.0	0.5	-	-	-	-	0.5	-	2.0	-	-	-
	WS510	3.0	0.8	-	-	-	0.3	0.8	-	3.0	-	-	-
	WS511	3.0	0.9	-	-	0.5	0.3	0.9	-	3.0	-	-	-
	WS512	3.0	0.6	-	-	-	0.3	0.6	-	3.0	1.3	-	-
Ladywood Extension	WS513	2.5	1.0	0.4	1.0	-	-	-	-	-	-	2.5	-
	WS514	2.0	1.5	0.35	-	-	-	1.5	-	-	-	2.0	-
	WS515	3.0	1.1	0.1	-	-	-	1.1	2.4	-	-	3.0	-

9.5 Visual & olfactory evidence of organic contamination

9.5.1 No visual or olfactory evidence of contamination was noted during Lithos' investigation.

9.5.2 However, some made ground, notably Ash & Clinker and Burnt Shale, includes materials which are commonly associated with a number of inorganic and organic contaminants (metals and PAHs).

9.5.3 Selected samples of topsoil and made ground have been forwarded to a laboratory for chemical testing to determine the presence of any contamination and the materials suitability for re-use; see Section 11.

9.6 Groundwater

9.6.1 Groundwater inflows were noted in the following exploratory holes:

Hole	Depth (mbgl)	Geology	Nature of ingress
TP306	3.4m	Lower Coal Measures – Mudstone.	Seepage in base of trial pit.
TP313	2.9m	Cohesive Residual Soil.	Seepage in base of trial pit on completion of excavation.
TP313	3.0m	Lower Coal Measures – Sandstone.	Seepage in base of trial pit on completion of excavation.
TP319	2.9m.	Lower Coal Measures – Sandstone.	Seepage from trial pit base.
TP320	2.4	Lower Coal Measures – Sandstone.	Seepage in base of trial pit on completion of excavation.
TP502	2.6m	Lower Coal Measures – Sandstone.	Seepage from trial pit walls.
TP504	2.9m	Lower Coal measures – Sandstone.	Seepage from trial pit walls.
TP515	2.5m	Lower Coal Measures – Seat Earth.	Seepage from trial pit walls.
TP516	1.0m	Lower Coal Measures – Sandstone.	Seepage from eastern trial pit wall.
TP519	2.6m	Lower Coal Measures – Mudstone/Siltstone.	Seepage from trial pit walls.
TP524	1.3m	Lower Coal Measures – Sandstone.	Seepage from trial pit walls.
TP525	1.8m	Lower Coal Measures – Sandstone.	Seepage from trial pit walls.
TP529	2.4m	Lower Coal Measures – Sandstone.	Seepage from northern trial pit wall.
TP534	2.3m	Lower Coal Measures – Sandstone.	Seepage in base of trial pit on completion of excavation.

9.6.2 It is apparent that the majority of groundwater seepages were encountered during excavation in sandstone bedrock.

9.6.3 In addition, during drilling of the rotary probeholes significant groundwater ingress was noted when drilling through beds of sandstone at depth.

9.6.4 Monitoring wells were installed in 17 "shallow" rotary probeholes and 8 dynamic sampled boreholes. Groundwater levels recorded to date are summarised in the table below:

Hole	Response zone (depth range & strata)	Groundwater body	Typical standing water level	
			m bgl	m AoD#
WS501	1.2m – 1.4m; Cohesive Made Ground, 1.4m – 2.2; Cohesive Residual Soils	Drift (Secondary A Aquifer)	1.16	65.89
WS502	0.9m – 1.9m; Cohesive Residual Soil	Bedrock (Secondary A Aquifer)	1.40	83.10
WS503	1.0m – 3.0m; Cohesive Glacial Deposits		0.72	47.13
WS504	1.0m – 3.0m; Cohesive Glacial Deposits		1.45	46.75
WS508	1.0m – 3.0m; Cohesive Glacial Deposits		1.28	44.52
WS513	0.5m – 1.0m; Ash & Clinker	Perched	N.D.	-
WS514	0.5m – 1.5m; Cohesive Made Ground		0.92	79.73
WS515	1.0m – 2.4m; Granular Made Ground		N.D.	-
PH502A	2.0m – 5.0m; Coal Measures (Sandstone [1.0m - 3.0m], Mudstone [3.0m -4.0m], Coal [4.0m – 4.5m], Mudstone [4.5m – 5.0m])	Bedrock (Secondary A Aquifer)	2.33	82.37
PH504A	1.0m – 3.0m; Coal Measures (Sandstone)		2.20	74.60
PH506A	2.0m – 4.0m; Coal Measures (Sandstone)		1.19	67.71
PH507A	2.0m – 5.0m; Coal Measures (Mudstone [2.0m – 2.7m], Coal [2.7m – 3.0m], Mudstone [3.0m – 5.0m])		3.32	75.88
PH509A	1.5m – 4.5m; Coal Measures (Sandstone)		1.70	80.35
PH511A	1.5m – 4.5m; Coal Measures (Sandstone)		0.98	81.92
PH513A	3.0m – 5.0m; Coal Measures (Coal [3.0m – 3.1m], Sandstone [3.1m – 5.0m])		N.D.	-
PH514A	1.5m – 4.5m; Coal Measures (Sandstone)		2.49	69.96
PH516A	0.5m – 3.5m; Coal Measures (Sandstone)		1.42	74.78
PH517A	1.0m – 4.0m; Coal Measures (Sandstone [1.0m – 2.9m], Coal [2.9m -3.4m], Mudstone [3.4m – 4.0m])		2.79	73.31
PH518A	1.5m – 5.0m; Coal Measures (Sandstone)		3.45	67.10
PH522A	1.5m – 4.5m; Coal Measures (Mudstone)		1.61	62.34
PH524A	1.5m – 4.5m; Coal Measures (Sandstone [1.5m – 4.2m], Mudstone [4.2m – 4.5m])		1.41	59.04
PH526A	1.0m – 4.0m; Coal Measures (Sandstone)		1.30	54.50
PH528A	1.0m – 4.0m; Coal Measures (Sandstone)		3.11	51.09
PH530A	1.5m – 3.0m; Coal Measures (Sandstone)		1.19	50.51
PH531A	1.5m – 4.5m; Coal Measures (Sandstone)		4.04	46.31

 # levelled-in by survey to enable groundwater assessment

9.6.5 Groundwater broadly lies at greater depths below existing ground levels across the centre and south where topography is higher and lies closer to surface in the north in lower lying areas.

9.7 Stability

9.7.1 Stability within excavations through natural ground was generally good. However, excavations into the Glacial Deposits encountered oversize materials (cobbles and boulders) which occasionally resulted in overbreak of the trial pit walls.

9.7.2 To date no excavations have been undertaken through made ground in the northeast and it would be prudent to assume that where made ground is encountered some spalling and overbreak may occur (although made ground is typically <1m thick).

9.8 Quarrying investigation

9.8.1 A small former **sandstone quarry** (c. 350m^2) is shown on old OS maps (see Section 3). A surveyor set-out the centre of the old quarry (based on OS mapping) and a trial trench (TP535) was excavated across its footprint. The trench was excavated in a north – south orientation to a length of about 10m. The trench was also extended in an east – west orientation to a length of about 8.0m.

9.8.2 No evidence of the former quarry was encountered. It is likely that the positioning shown on OS mapping is incorrect and the quarry is located elsewhere in the centre of the site.

9.8.3 Constraints on site (tree & shrub growth) prevented an investigation to determine the extents of historical **opencast** coal extraction beneath Lady Wood Extension in the far-west.

9.9 Mining investigation

Shallow workings (rotary probeholes)

9.9.1 It is clear from the desk study that the site is likely to be underlain by several shallow (<50m deep) coal seams, possibly with associated mineworkings. These seams are the 2nd & 3rd Brown Metal coals, the Middleton Little Coal, the Middleton Main Coal, the Wheatley Lime Coal and two un-named (thin) coal seams.

9.9.2 Consequently, a mining investigation has been undertaken. The investigation has been completed in two phases; the first phase was carried out in 2017 across the 'Miller Homes' parcel (centre & north) and the second phase was carried out in January 2021 across the centre and south of the site.

9.9.3 In total the investigation comprised 56 'deep' rotary open probeholes; 24 in 2017 – the '200 series' and 32 in 2021 – the '500 series'.

9.9.4 Due to site constraints (see Section 8.2) no rotary probeholes have been advanced within the nursery car park, allotments of the areas of woodland.

9.9.5 It should be noted that all probeholes were advanced to the east of a fault (which crosses Lady Wood Extension); see Drawing 3901/8. The geological succession discussed below only refers to ground conditions to the east of the fault. All proposed development within the area of current interest lies east of the fault.

9.9.6 It is apparent from Section 5 that there are some ambiguities associated with coal seam names and outcrops; there are several sources of information – British Geological Survey, the Coal Authority and the National Coal Board.

9.9.7 Lithos have drawn geological cross sections which have been compared with the BGS stratigraphical column, CA abandonment plans, NCB investigation and our own knowledge of the wider area to interpret coal seam names.

9.9.8 Based on this interpretation a total of 7 shallow (i.e. <50m bgl) coal seams have been identified beneath the site; these are the:

- 2nd Brown Metal (beneath Lady Wood Extension only)
- 3rd Brown Metal (beneath Lady Wood Extension & the far-west)
- Middleton Little Coal
- An un-named 'thin' seam
- Middleton Main Coal
- An un-named 'thin' seam
- Wheatley Lime Coal

9.9.9 It should be noted that some amendments have been made to Lithos' previous exploratory hole logs due to further investigation improving our understanding of the geological succession. Coal seam names have been changed:-

Seam name used in 2017 (Report 2336/3)	Seam name used in this Report
3rd Brown Metal (aka Stone)	Middleton Little
Middleton Little (aka Green Lane)	Middleton Main
Middleton Main (aka New Hards or Silkstone)	Wheatley Lime

9.9.10 The findings of the mining investigation are presented in the table on Page 40.

9.9.11 On examination of the data obtained from the mining investigation the following assessments have been made relating to each coal seam:

Coal Seam	Typical thickness	Typical depth(s)	Worked ?	Remarks
2nd Brown Metal	n/a	n/a	n/a	Absent beneath proposed development area; outcrops beneath Lady Wood Extension.
3rd Brown Metal	0.5m & 0.2m (max 1.0m)	0.3m to 6.0m	No	Present in the west & beneath Lady Wood Extension. Often as two leaves separated by c. 0.3m of mudstone. No 'firm' evidence of workings encountered to date, although packed workings may be present.
Middleton Little	0.2m to 1.2m (typically 0.8m)	2.4m to 20.0m	No	Present across the centre & west & beneath Lady Wood Extension. No 'firm' evidence of workings encountered to date, although packed workings may be present.
Un-named seam	0.2m to 1.3m (typically c. 0.5m)	2.5m to 25.2m	No	Present across the centre & west & beneath Lady Wood Extension. No evidence of mineworkings encountered to date. Generally, too thin to have been worked.
Middleton Main	0.3m to 2.5m (typically c. 1.5m)	9.5m to > c. 50m	**Yes**	Present beneath the entire site. Evidence of workings encountered beneath the north & east.
Un-named seam	0.2m to 1.2m (typically 0.3m)	16.0m to > c. 50m	No	Present beneath the entire site. No evidence of mineworkings encountered to date. Generally, too thin to have been worked.
Wheatley Lime	0.9m to 2.0m (typically c. 1.5m)	25.0m to > c. 50m	**Yes**	Present beneath the entire site. Evidence of workings beneath the north.

9.9.12 All seams typically occur at greater depth in the west; a function seam dip and of topography.

9.9.13 The two **un-named coals** are generally too thin for underground extraction to have been economic (although they appear to thicken significantly in the far east), and no mineworkings have been encountered in these seams.

9.9.14 Abandonment plans (see Drawing 3901/9a) show that the **Second Brown Metal** outcrops beneath Lady Wood Extension, beyond the area of Lithos' mining investigation.

9.9.15 The **Third Brown Metal** underlies land in the west at very shallow depth as two leaves which are separated by about 0.5m of weak mudstone.

9.9.16 To date, evidence of underground workings has only been recorded in the **Middleton Main** and the **Wheatley Lime** coal seams. The workings encountered are essentially restricted to the centre north (the "Miller" area).

9.9.17 It should be noted that probeholes drilled to date have been at relatively wide centres (c. 100m), in accordance with the scope issued by KC. It was acknowledged by KC in the tender documents "*that further rotary drilling may be required to assess mining risk, which, if required, will be assessed and costed at a later stage*". Therefore, there may be unrecorded mineworkings within coal seams other than the Middleton Main and Wheatley Lime which have not yet been discovered.

9.9.18 Any workings in the Third Brown Metal, Middleton Little and the 'shallower' un-named coal seam would lie close enough to surface to pose a risk to the stability of the proposed development.

Uncertainty

9.9.19 Based on the findings of Lithos' investigation to date there do not appear to be extensive workings in the 3rd Brown Metal and Middleton Little seams, but this might not necessarily be the case. For example, examination of the rotary probehole logs, and geological cross-sections (see Drawing 3901/14) suggests that the Middleton Little seam is locally absent at the expected depth. This is possibly due to the coal locally thinning or 'washing' out.

9.9.20 However, it might be that the absence of coal indicates mineworkings. Usually where coal extraction has occurred a combination of loss of flush, zone of soft push, broken ground and/or voids would be noted during drilling but this may not be the case if underground workings have been 'packed' (backfilled with surplus spoil during mining). Compression of the packed materials, and the fact that they comprise re-worked Coal Measures rock, make such former mineworkings very difficult to identify in rotary open probeholes (and possibly even in a cored boreholes).

9.9.21 NCB boreholes (see Section 5.6) only encountered underground workings in "small patches" in the west of Area A in the 3rd Brown Metal Coal; the NCB Report suggests these workings were 'packed' (backfilled).

9.9.22 The likelihood of workings in the 3rd Brown Metal and Middleton Little seams is supported by anecdotal presence of the 'walk-in mine' (adit) in the centre (see Section 5.3) which would broadly 'line up' with the Middleton Little coal seam.

9.9.23 Consequently, some uncertainty remains, and further investigation will be required.

Summary table of mining investigation

Hole ID	All depths shown in mbgl																								Remarks
	Final Depth	Depth to rockhead	3rd Brown Metal				Middleton Little				Un-named				Middleton Main				Un-named				Wheatley Lime				
			Top	Thickness	Worked?	10h?	Top	Thickness	Worked?	10h?	Top	Thickness	Worked?	10h?	Top	Thickness	Worked?	10h?	Top	Thickness	Worked?	10h?	Top	Thickness	workings	10h?	
PH207	25.0	1.3	-	-	-	-	**3.7**	**0.3**	**No**	**No**	**11.5**	**0.3**	**No**	**No**	**22.5**	**>2.5**	**Yes**	**No**	-	-	-	-	-	-	-	-	
PH208	15.0	1.6	-	-	-	-	-	-	-	-	2.5	0.3	No	Yes	**13.5**	**1.3**	**Yes**	**No**	-	-	-	-	-	-	-	-	
PH209	13.0	2.3	-	-	-	-	-	-	-	-	-	-	-	-	**10.0**	**1.0**	**Yes**	**No**	-	-	-	-	-	-	-	-	
PH209a	36.0	2.5	-	-	-	-	-	-	-	-	-	-	-	-	**9.5**	**1.4**	**No**	**No**	-	-	-	-	32.0	1.2	No	Yes	
PH210	11.0	1.2	-	-	-	-	-	-	-	-	-	-	-	-	**10.0**	**>1.0**	**Yes**	**No**	-	-	-	-	-	-	-	-	
PH210a	11.0	1.3	-	-	-	-	-	-	-	-	-	-	-	-	**10.0**	**>1.0**	**Yes**	**No**	-	-	-	-	-	-	-	-	
PH211	18.0	3.0	-	-	-	-	-	-	-	-	-	-	-	-	**9.5**	**1.5**	**Yes**	**No**	-	-	-	-	-	-	-	-	
PH211a	24.0	3.0	-	-	-	-	-	-	-	-	-	-	-	-	**12.0**	**2.5**	**Yes**	**No**	16.0	0.5	No	Yes	-	-	-	-	
PH212	15.0	3.5	-	-	-	-	-	-	-	-	-	-	-	-	**9.5**	**2.0**	**Yes**	**No**	-	-	-	-	-	-	-	-	
PH212a	24.0	3.5	-	-	-	-	-	-	-	-	-	-	-	-	13.0	0.5	Yes	Yes	-	-	-	-	-	-	-	-	
PH213	30.0	3.0	-	-	-	-	-	-	-	-	-	-	-	-	**15.5**	**1.6**	**No**	**No**	-	-	-	-	-	-	-	-	
PH214	15.0	2.5	-	-	-	-	-	-	-	-	**5.0**	**0.25**	**No**	**No**	**13.0**	**1.5**	**Yes**	**No**	-	-	-	-	-	-	-	-	
PH215	25.0	3.0	-	-	-	-	-	-	-	-	**4.0**	**0.5**	**No**	**No**	-	-	-	-	-	-	-	-	-	-	-	-	
PH216	28.0	2.0	-	-	-	-	-	-	-	-	-	-	-	-	**XXX**	**XXX**	**XXX**	**XXX**	18.0	0.2	No	Yes	25.5	1.5	Yes	Yes	
PH216a	28.0	2.0	-	-	-	-	-	-	-	-	-	-	-	-	9.5	0.25	No	Yes	18.0	0.25	No	Yes	25.0	2.0	Yes	Yes	
PH217	10.0	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PH217a	15.0	2.5	-	-	-	-	-	-	-	-	-	-	-	-	**12.5**	**1.5**	**Yes**	**No**	-	-	-	-	-	-	-	-	
PH217b	31.0	2.5	-	-	-	-	-	-	-	-	-	-	-	-	13.0	1.0	Yes	Yes	21.5	0.25	No	Yes	28.0	1.5	Yes	Yes	
PH218	23.0	3.5	-	-	-	-	-	-	-	-	8.5	0.2	No	Yes	**19.5**	**2.5**	**Yes**	**No**	-	-	-	-	-	-	-	-	
PH219	24.0	2.0	-	-	-	-	5.0	0.5	No	No	14.7	0.3	No	Yes	21.5	1.5	Yes	Yes	-	-	-	-	-	-	-	-	
PH501	45.0	1.5	**3.5**	**0.5 & 0.2**	**No**	**No**	**XXX**	**XXX**	**XXX**	**XXX**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PH502	25.0	1.0	**4.0**	**0.5**	**No**	**No**	20.0	0.3	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PH503	25.0	0.5	**2.5**	**0.5**	**No**	**No**	17.5	0.3	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PH504	25.0	1.0	**XXX**	**XXX**	**XXX**	**XXX**	12.0	0.25	No	Yes	19.5	0.3	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	
PH505	45.0	0.5	**XXX**	**XXX**	**XXX**	**XXX**	**5.0**	**1.0**	**No**	**No**	12.5	0.5	No	Yes	**25.8**	**0.4**	**No**	**No**	30.5	0.2	No	Yes	-	-	-	-	
PH506	34.0	1.0	**XXX**	**XXX**	**XXX**	**XXX**	**6.0**	**1.0**	**No**	**No**	13.7	0.3	No	Yes	**XXX**	**XXX**	**XXX**	**XXX**	-	-	-	-	-	-	-	-	
PH507	27.0	0.5	**1.0**	**1.0 & 0.3**	**No**	**No**	16.0	1.0	No	Yes	23.0	0.2	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	
PH508	25.0	1.5	**4.2**	**0.7**	**No**	**No**	20.0	0.2	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PH509	25.0	1.0	**4.5**	**0.5**	**No**	**No**	19.5	0.5	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PH510	39.0	1.0	**6.0**	**0.5**	**No**	**No**	**XXX**	**XXX**	**XXX**	**XXX**	-	-	-	-	34.5	???	???	?Yes?	-	-	-	-	-	-	-	-	
PH511	25.0	1.0	**5.0**	**0.5**	**No**	**No**	19.7	0.3	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PH512	27.0	0.5	**4.0**	**0.5 & 0.2**	**No**	**No**	19.0	0.5	No	Yes	25.2	0.2	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	
PH513	27.0	0.5	**1.0**	**0.5 & 0.1**	**No**	**No**	6.5	0.2	No	Yes	23.0	0.2	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	
PH514	45.0	1.0	-	-	-	-	10.7	0.7	No	Yes	18.0	0.2	No	Yes	31.3	0.2	No	Yes	32.1	0.2	No	Yes	41.4	0.1	No	Yes	
PH515	27.0	0.6	**4.2**	**0.4 & 0.2**	**No**	**No**	19.2	0.6	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PH516	26.0	0.4	**3.5**	**0.5 & 0.4**	**No**	**No**	18.8	0.6	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PH517	54.0	0.8	**2.9**	**0.5 & 0.2**	**No**	**No**	17.2	0.2	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PH518	25.0	1.5	-	-	-	-	12.1	0.7	No	Yes	19.0	0.5	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	
PH519	30.0	0.8	**1.2**	**0.5 & 0.2**	**No**	**No**	16.6	0.6	No	Yes	22.8	0.3	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	
PH520	36.0	1.2	**XXX**	**XXX**	**XXX**	**XXX**	12.0	0.5	No	Yes	18.3	0.2	No	Yes	**XXX**	**XXX**	**XXX**	**XXX**	-	-	-	-	-	-	-	-	
PH521	30.0	0.3	**0.3**	**0.5**	**No**	**No**	13.6	0.6	No	Yes	19.9	0.3	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	
PH522	51.0	0.3	-	-	-	-	**7.0**	**0.9**	**No**	**No**	14.0	0.4	No	Yes	-	-	-	-	-	-	-	-	44.2	1.2	No	Yes	
PH523	25.0	1.0	-	-	-	-	**2.4**	**0.8**	**No**	**No**	10.6	0.3	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	
PH524	25.0	1.5	-	-	-	-	-	-	-	-	-	-	-	-	18.1	1.2	No	Yes	-	-	-	-	-	-	-	-	
PH525	45.0	1.5	-	-	-	-	**-**	**-**	**-**	**-**	**11.0**	**1.2**	**No**	**No**	21.0	0.2	No	Yes	29.0	1.0	No	Yes	37.2	1.0	No	Yes	
PH526	30.0	1.0	-	-	-	-	-	-	-	-	14.5	0.8	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	
PH527	25.0	0.7	-	-	-	-	-	-	-	-	15.5	0.5	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	
PH528	33.0	0.6	-	-	-	-	-	-	-	-	4.0	0.2	No	Yes	19.6	1.1	No	Yes	-	-	-	-	-	-	-	-	
PH529	25.0	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PH530	49.0	1.0	-	-	-	-	**3.0**	**0.4**	**No**	**No**	-	-	-	-	27.0	0.3	No	Yes	34.3	1.2	No	Yes	40.5	0.9	No	Yes	
PH531	50.0	0.8	-	-	-	-	-	-	-	-	17.0	0.9	No	Yes	26.0	0.7	No	Yes	34.2	0.7	No	Yes	40.7	1.0	No	Yes	
PH532	25.0	1.0	-	-	-	-	-	-	-	-	17.0	1.3	No	Yes	-	-	-	-	-	-	-	-	-	-	-	-	

Note: values in red indicate evidence of mineworkings were encountered in the relevant PH & coal seam. Values in **bold** indicate that sufficient competent to mitigate ground instability from mineworkings is not present. Values in **bold red** indicate that evidence of mineworkings were encountered and sufficient cover is not present.

Where **XXX** is shown see comments in Section 9.9.19

Mine entry search

9.9.24 As discussed in Section 5.7.7 there are 40 known mine entries within, or close to, the site's boundary. However, the majority of mine entries are located in Lady Wood and Lady Wood Extension, and only 3 are located beneath areas where development is anticipated.

9.9.25 Prior to Lithos' appointment, KC had already instructed another company to locate mine entries 423419-005 & -006 (centre-north, within the "Miller" area). In accordance with KC's brief, Lithos were commissioned to search for the third mine entry (Ref. 422419-027). A surveyor set-out the position of -027, based on co-ordinates supplied by the CA in their Consultant's mining report.

9.9.26 As discussed in Section 8.2 an underground gas utility crosses the site; the line of the gas main was confirmed by use of a CAT RD8000 and GENNY. The line of the utility runs about 2.5m east of the pegged location of mine entry -027. Prior to undertaking fieldwork Lithos liaised with Northern Gas Networks (the utility operator) and agreed that excavations could be undertaken to within 3.0m of the gas utility, but no closer. Consequently a 6.0m 'no-dig corridor' had to be adhered to during the shaft search.

9.9.27 Topsoil and subsoil were stripped from about an area of c. 1,400m^2 centred around the pegged shaft location, but beyond the "no-dig" corridor. Where localised made ground, unusual ground (e.g. staining of the subsoil) etc were encountered the excavation was taken deeper into 'clean natural' soils.

9.9.28 The shaft was not found during the shaft search. At this stage it seems likely that the shaft is located within of the 6m "no-dig" corridor. Discussions with the tenant farmer suggests that the gas utility was installed by means of digging a trench to c. 3.0m depth which was subsequently backfilled. Excavation of the trench may have destroyed any shallow evidence of the mine entry.

9.10 Revised conceptual ground model (ground conditions)

9.10.1 The Preliminary Conceptual Site Model has been revised in light of data obtained during the ground investigation, most notably with respect to:

- The nature and distribution of made ground, including the presence of significant buried obstructions
- The strength, nature and depth of underlying natural strata
- The presence of coal/shallow workings
- The nature and distribution of contamination (based on visual/olfactory evidence only)

9.10.2 The most notable changes to the conceptual site model are:

- the extent and nature of the Glacial Deposits,
- coal seam names and seam outcrops,
- the presence of known workings (Middleton Main & Wheatley Lime) and
- the potential for packed workings in the 3rd Brown Metal & Middleton Little seams.

9.10.3 Further refinement of the Conceptual Site Model is presented in Sections 12.3, where the results of laboratory testing for contaminants have been considered.

10 SOAKAWAY TEST RESULTS

10.1 UK Guidance

10.1.1 General notes about soakaways, including their location, design, and Lithos' test methodology are presented in Appendix A.

10.2 Field tests

10.2.1 A total of 4 soakaway tests were carried out in general accordance with BRE Digest 365[3] "Soakaway Design". The locations of the soakaways are shown on Drawing 3901/6 presented in Appendix B to this report. Soakaway locations were determined by Buro Happold Engineering on behalf of KC.

10.2.2 Infiltration rates are calculated (where possible), in accordance with BRE Digest 365, by taking account of the time for the water level to fall from 75% to 25% of its effective depth. The effective depth is the difference between the starting water level and the soakaway pit base depth.

10.2.3 None of the 4 tests drained to 75% full, or indeed drained noticeably at all after a period of several hours and the tests are considered unsuccessful. Copies of the test results are included in Appendix K and are summarised in the table below:

Soakaway	Stratum	Infiltration rate	Remarks
TP531 – test 1	Cohesive Glacial Deposits; gravelly CLAY.	N/A	Did not drain after 4.5 hours.
TP532 – test 1			Water level fell by 3cm after 5 hours.
TP533 – test 1	Cohesive Glacial Deposits & Lower Coal Measures; Sandstone.		Water level fell by 4cm after 3.5 hours.
TP534 – test 1			Water level fell by 5cm after 3.8 hours.

10.3 Discussion & conclusions

10.3.1 Consequently, soakaways are unlikely to provide a suitable drainage solution for the discharge of surface water run-off across the north and therefore there may be a need for surface water balancing.

10.3.2 Based on the findings of the trial pitting, soakaway testing might give better results across the centre and south where shallow bedrock predominantly comprises sandstone. Further testing across the wider site could be undertaken to remove ambiguity. However, consideration would need to be given to groundwater depths and topography.

10.3.3 Drainage solutions are discussed further in Section 16.8.

[3] BRE Digest 365. Soakaway Design (1991).

11 CONTAMINATION (ANALYSIS)

11.1 General

11.1.1 The majority of the site has been used as farmland which has been subject to historical coal mining.

11.1.2 In the far west, beyond the area of proposed development, Lady Wood has been occupied by a colliery, and Lady Wood Extension has been subject to opencast coal extraction and subsequent tipping associated with a power station. There are several buildings in the northeast (associated with allotments and nursery car park).

11.1.3 Former usage within the area of proposed development is considered unlikely to have led to significant ground contamination.

11.1.4 In the context of risks to human health associated with residential development, the Tier 1 Soil Screening Values referenced in this report have been derived via the CLEA default conceptual site model (CSM) used for generating SGVs, but amended, where appropriate, to be more specific to redevelopment within the planning process.

11.1.5 Where available, Category 4 Screening Levels (C4SL) have also been referenced.

11.1.6 Generic Note 04 in Appendix A provides further details with respect to current guidance and the interpretation of analytical data.

11.2 Testing scheduled

11.2.1 Based on the above assessment, Lithos submitted a test schedule (summarised in the table below) to a UKAS accredited laboratory.

Type of sample	No. of samples	Determinands
Topsoil	25	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) & Asbestos ID. Total organic carbon (TOC) & poly aromatic hydrocarbons (PAHs).
	14	Clay/sand/silt content and visible contaminants, sharps (glass etc) to check compliance with BS3882:2015
Made Ground Topsoil	2	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) & Asbestos ID. Total organic carbon (TOC) & poly aromatic hydrocarbons (PAHs).
Made Ground	17	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) & Asbestos ID. TOC & PAH.
	17	Water soluble sulphate, chloride, nitrate & magnesium. Total petroleum hydrocarbons (TPH).
	2	Calorific value (CV)

11.2.2 Account was taken of previous uses in specific areas, most notably areas where made ground has been encountered.

11.3 Soil contamination results

11.3.1 The soil contamination test results are summarised in the tables on pages 44 to 47.

11.3.2 Laboratory test certificates as received from the laboratory are presented in Appendix I to this report.

Summary of degree of soils contamination (inorganics- topsoil)

Area	Expl Hole	Depth (m)	Material	Concentrations in mg/kg unless otherwise stated. Results are quoted to 1 decimal place if <10, and whole numbers if >10. Trigger Level Concentrations are shown in BLUE and assume a **residential with gardens** end-use.											Asbestos
				pH	As ∞	B~	Cd ∞	Cr x	Cu♣$	Pb ∞	Hg*	Ni	Se	Zn$	CV	
					37	5	26	3000	200	200	169	127	350	200	2	
"Millers" (Main dev'mnt)	TP301	0.2	Topsoil	7.2	**57**	0.9	1.0	29	77	91	0.3	26	0.5	100	-	N.D.
	TP303	0.2	Topsoil	7.5	**47**	0.6	1.0	26	68	78	0.1	27	0.5	100	-	N.D.
	TP306	0.2	Topsoil	7.2	25	0.7	0.7	20	39	48	0.1	20	0.5	70	-	N.D.
	TP308	0.1	Topsoil	6.8	19	0.8	0.7	18	27	41	0.1	15	0.5	68	-	N.D.
	TP311	0.1	Topsoil	7.2	23	0.5	0.7	19	31	41	0.1	19	0.5	71	-	N.D.
	TP313	0.1	Topsoil	7.2	**45**	0.9	0.8	21	54	67	0.2	24	0.5	89	-	N.D.
	TP317	0.1	Topsoil	7.3	25	0.6	0.7	19	36	54	0.1	17	0.5	66	-	N.D.
	TP319	0.1	Topsoil	7.4	29	0.7	0.7	23	41	48	0.1	22	0.5	83	-	N.D.
	TP320	0.1	Topsoil	7.5	**47**	0.6	1.0	26	68	78	0.2	27	0.5	100	-	N.D.
Main dev'mnt	TP501	0.1	Topsoil	6.7	**47**	1.0	0.3	22	60	86	0.2	19	1.2	92	-	N.D.
	TP504	0.1	Topsoil	6.7	**40**	0.7	0.5	22	61	72	0.2	38	3.1	110	-	N.D.
	TP505	0.1	Topsoil	7.8	**43**	0.7	0.4	21	63	81	0.3	21	0.7	88	-	N.D.
	TP507	0.1	Topsoil	7.0	28	0.6	0.3	23	46	55	0.1	25	1.1	100	-	N.D.
	TP510	0.1	Topsoil	7.3	34	0.7	0.4	22	49	64	0.2	20	1.3	110	-	N.D.
	TP513	0.1	Topsoil	6.7	**43**	0.7	0.4	22	68	73	0.6	26	0.5	110	-	N.D.
	TP515	0.1	Topsoil	6.8	**42**	1.0	0.4	19	54	70	0.2	20	1.2	96	-	N.D.
	TP516	0.1	Topsoil	6.8	28	0.5	0.3	17	46	54	0.2	20	0.9	91	-	N.D.
	TP517	0.1	Topsoil	6.8	**45**	0.6	0.3	19	64	76	0.2	20	0.5	88	-	N.D.
	TP519	0.1	Topsoil	6.7	24	0.4	0.3	18	37	39	0.1	22	0.8	83	-	N.D.
	TP520	0.1	Topsoil	6.7	**47**	0.8	0.4	21	62	73	0.2	21	1.0	88	-	N.D.
	TP521	0.1	Topsoil	6.5	**42**	0.6	0.4	22	58	69	0.2	23	1.5	86	-	N.D.
	TP524	0.1	Topsoil	6.7	35	0.6	0.3	22	52	67	0.2	19	1.0	89	-	N.D.
	TP525	0.1	Topsoil	6.6	25	0.5	0.2	22	43	48	0.2	18	0.6	79	-	N.D.
	TP527	0.1	Topsoil	7.4	**41**	0.8	0.3	23	60	73	0.3	19	1.0	90	-	N.D.
	TP530	0.1	Topsoil	6.8	35	0.6	0.3	20	55	56	0.2	24	1.3	89	-	N.D.
Allotments	WS503	0.2	MG Topsoil	6.6	**75**	0.9	0.6	34	130	**440**	0.6	28	1.2	**240**	-	N.D.
	WS505	0.2	MG Topsoil	6.9	**50**	1.0	0.5	31	110	**230**	0.5	27	1.1	**270**	-	N.D.

Summary of degree of soils contamination (inorganics– made ground)

Area	Expl Hole	Depth (m)	Material	Concentrations in mg/kg unless otherwise stated. Results are quoted to 1 decimal place if <10, and whole numbers if >10. Trigger Level Concentrations are shown in BLUE and assume a **residential with gardens** end-use.											
				pH	As ∞	B~	Cd ∞	Cr x	Cu♣$	Pb ∞	Hg*	Ni	Se	Zn$	CV	Asbestos
Allotments	WS507	0.1	Cohesive MG	10.1	2.9	2.4	0.1	240	15	8.4	0.1	6.7	1.4	21	-	N.D.
	WS507	0.4		7.4	**48**	0.9	0.6	31	100	190	0.4	25	1.6	**370**	-	N.D.
Nursery car park	WS508	0.2	Cohesive MG	9.0	34	1.6	0.5	76	**240**	**220**	0.3	21	1.0	190	-	N.D.
	WS508	0.6		7.4	**60**	1.2	0.8	29	150	**320**	0.7	29	1.1	**350**	-	N.D.
	WS509	0.2		7.3	**51**	0.7	0.5	45	120	**330**	0.2	37	0.8	140	-	N.D.
	WS510	0.5		6.9	**120**	0.7	0.1	26	180	130	0.5	35	1.2	59	-	N.D.
	WS511	0.7		7.2	**39**	10	0.4	19	60	100	0.5	97	0.9	110	-	N.D.
	WS512	0.4		6.5	**71**	0.6	0.7	29	98	**210**	0.8	40	1.1	**440**	-	N.D.
Ladywood Extension	WS513	0.5	Ash & Clinker	9.4	17	0.8	0.1	24	41	7.4	0.1	21	0.5	19	1.0	N.D.
	WS513	0.8		8.0	23	0.5	0.1	29	49	11	0.01	27	0.5	22	**13**	N.D.
	WS501	0.4	Cohesive MG	7.4	31	0.9	0.2	27	46	36	0.1	27	1.1	74	-	N.D.
	WS501	0.9		7.6	7.1	1.0.	0.1	22	40	21	0.1	33	0.5	110	-	N.D.
	WS502	0.5		7.0	**37**	0.9	0.6	67	160	83	0.4	24	1.3	160	-	N.D.
	WS514	0.5		7.6	**210**	3.8	0.2	33	89	89	0.2	39	2.7	69	-	**Amosite fibres**
	WS514	1.1		8.0	**94**	**10**	0.3	35	110	92	0.2	42	1.9	110	-	**Amosite & chrysotile fibres**
	WS515	0.3		7.0	34	0.8	0.1	21	33	31	0.1	21	1.5	64	-	N.D.
	WS515	1.3		7.3	32	0.9	0.3	22	48	42	0.1	24	0.6	61	-	N.D.

Key	
36	Parameter tested for and found to be in excess of Tier 1 value.
179	Parameter tested for and found to be > 5 x Tier 1 value.
12	Parameter tested for but not found to be in excess of Tier 1 value.
-	Parameter not tested for.
♣	Tier 1 Value is pH dependent.
x	Assumes Cr is CrIII. If demonstrated Cr is CrVI Tier 1 would be 21mg/kg.
ND	No fibres detected (asbestos screen)
~	Engineering judgement (Lithos). Boron is a phytotoxic, although most phytotoxic compounds can pose a risk to human health if sufficient concentrations are present. However, plants represent the most sensitive receptor, and a Tier 1 value which is protective of flora is therefore also protective of human health.

Source of guidance trigger level	
With the exception of those annotated with one of the symbols below (∞, $, ~), all Soil Screening Values in brackets above have been derived using CLEA v1.06.	
∞	Category 4 Screening Level – SP1010, December 2013 (CL:AIRE/Defra).
$	MAFF. Code of Practice for Agricultural Practice for the Protection of Soil, 1998.
*	Assumes mercury present as an inorganic compound (cf elemental metal or within organic compound). See Science Report SC050021/Mercury SGV.

Summary of degree of soils contamination (organics - topsoil)

Area	Expl Hole	Depth (m)	Material	Concentrations in mg/kg. Results are quoted to 1 decimal place if <10, and whole numbers if >10. Trigger Level Concentrations are shown in BLUE and assume a **residential with gardens (and no cover)** end use					
				% TOC	PAH		TPH - C6 to C40		
					B(a)P ∞	Naphthalene	GRO~ C_6 to C_{10}	DRO◊ C_{10} to C_{21}	LRO C_{21} to C_{40}
					5	8	30	151	1000
"Millers" (Main development)	TP301	0.2	Topsoil	3.1	0.1	0.1	-	-	-
	TP303	0.2	Topsoil	6.1	0.1	0.1	-	-	-
	TP306	0.2	Topsoil	3.7	0.1	0.1	-	-	-
	TP308	0.1	Topsoil	3.0	0.1	0.1	-	-	-
	TP311	0.1	Topsoil	3.5	0.1	0.1	-	-	-
	TP313	0.1	Topsoil	3.5	0.1	0.1	-	-	-
	TP317	0.1	Topsoil	2.8	0.1	0.1	-	-	-
	TP319	0.1	Topsoil	2.3	0.1	0.1	-	-	-
	TP320	0.1	Topsoil	4.6	0.1	0.1	-	-	-
Main development	TP501	0.1	Topsoil	7.5	0.1	0.1	-	-	-
	TP504	0.1	Topsoil	5.8	0.1	0.1	-	-	-
	TP505	0.1	Topsoil	6.0	0.1	0.1	-	-	-
	TP507	0.1	Topsoil	3.9	0.1	0.1	-	-	-
	TP510	0.1	Topsoil	3.9	0.1	0.1	-	-	-
	TP513	0.1	Topsoil	7.4	0.1	0.1	-	-	-
	TP515	0.1	Topsoil	4.9	0.1	0.1	-	-	-
	TP516	0.1	Topsoil	4.5	0.1	0.1	-	-	-
	TP517	0.1	Topsoil	8.9	0.1	0.1	-	-	-
	TP519	0.1	Topsoil	4.1	0.1	0.1	-	-	-
	TP520	0.1	Topsoil	6.0	0.1	0.1	-	-	-
	TP521	0.1	Topsoil	8.3	2.8	0.1	-	-	-
	TP524	0.1	Topsoil	5.5	0.1	0.1	-	-	-
	TP525	0.1	Topsoil	3.5	0.1	0.1	-	-	-
	TP527	0.1	Topsoil	4.6	0.1	0.1	-	-	-
	TP530	0.1	Topsoil	13	0.1	0.1	-	-	-
Allotments	WS503	0.2	MG Topsoil	12	0.2	0.1	-	-	-
	WS505	0.2	MG Topsoil	11	0.2	0.1	-	-	-

Summary of degree of soils contamination (organics - made ground)

Area	Expl Hole	Depth (m)	Material	Concentrations in mg/kg. Results are quoted to 1 decimal place if <10, and whole numbers if >10. Trigger Level Concentrations are shown in BLUE and assume a **residential with gardens (and no cover)** end use					
				% TOC	PAH		TPH - C6 to C40		
					B(a)P ∞	Naphthalene	GRO~ C_6 to C_{10}	DRO◊ C_{10} to C_{21}	LRO C_{21} to C_{40}
					5	8	30	151	1000
Ladywood Extension	WS513	0.5	Ash & Clinker	5.3	0.1	0.1	0.1	30	20
	WS513	0.8	Ash & Clinker	24	0.1	0.1	0.1	30	20
	WS501	0.4	Cohesive Made Ground	6.0	0.1	0.1	0.1	30	20
	WS501	0.9	Cohesive Made Ground	0.5	0.1	0.1	0.1	30	20
	WS502	0.5	Cohesive Made Ground	12	0.1	0.1	0.1	64	140
Allotments	WS507	0.1	Cohesive Made Ground	6.5	**19**	0.6	0.1	**2,130**	**7,000**
	WS507	0.4	Cohesive Made Ground	11	0.9	0.1	0.1	**463**	698
Nursey car park	WS508	0.2	Cohesive Made Ground	13	**8**	0.1	0.1	**710**	**1,400**
	WS508	0.6	Cohesive Made Ground	17	0.4	0.1	0.1	**163**	150
	WS509	0.2	Cohesive Made Ground	20	0.2	0.1	0.1	46	74
	WS510	0.5	Cohesive Made Ground	25	0.1	0.1	0.1	30	20
	WS511	0.7	Cohesive Made Ground	7.9	0.1	0.1	0.1	30	20
	WS512	0.4	Cohesive Made Ground	24	0.1	0.1	0.1	69	70
Ladywood Extension	WS514	0.5	Cohesive Made Ground	6.7	0.1	0.1	0.1	30	20
	WS514	1.1	Cohesive Made Ground	10	0.2	0.1	0.1	54	80
	WS515	0.3	Cohesive Made Ground	5.5	0.1	0.1	0.1	30	20
	WS515	1.3	Cohesive Made Ground	3.7	0.1	0.1	0.1	30	20

Key		Source of guidance trigger level	
60	Parameter tested for and in excess of Tier 1 concentration.	∞	Category 4 Screening Level – SP1010, December 2013 (CL:AIRE/Defra).
0.3	Parameter tested for but not in excess of Tier 1 concentration.	~	Assumes all GRO is aromatic fraction C7 to C8.
-	Contaminant not tested for.	◊	Assumes all DRO is aliphatic fraction C10 to C12.

All Soil Screening Values in brackets above have been derived using CLEA v1.06. Values assume contaminants located in a sandy loam, with 6% soil organic matter (SOM).

Inorganic determinands

11.3.3 Of the 19 samples of made ground (including 2 Made Ground Topsoil) and 25 samples of Topsoil (44 in total) analysed for inorganic parameters, 18 can be classified as uncontaminated and 26 could be classified as contaminated.

11.3.4 These samples have been classified by comparison with Tier 1 Soil Screening Values for an end use including domestic gardens and any area where plants are to be grown (the most sensitive of proposed end-uses).

11.3.5 The most common contaminants are arsenic, lead and zinc.

11.3.6 Whilst a total of 15 samples of 'Cohesive Made Ground' have been tested, 6 of these were recovered from the area of Lady Wood Extension - an area of tipping within former opencast workings.

11.3.7 The remaining 9 samples of 'Cohesive Made Ground' were recovered from the northeast (nursery car park & allotments).

11.3.8 The origin of the made ground in these two separate areas is clearly different and therefore it would not be appropriate to carry out statistical analysis on all 15 samples of Cohesive Made Ground together. Furthermore, the ground beneath Lady Wood Extension has been tipped and it is likely that higher concentrations do not represent discrete 'hot-spots' but are more typical of a very large range of contaminant concentrations.

11.3.9 Since the made ground in the northeast and Lady Wood extension is clearly heterogenous and is not likely to fall within a normal distribution, no statistical assessment has been undertaken and individual concentrations have been considered against Lithos Tier 1 screening values.

11.3.10 Given the limited amount of Ash & Clinker and Made Ground Topsoil (recovered from the Allotments) encountered, it was not possible to collect a sufficient number of soil samples to enable meaningful statistical analysis of results for this material type (typically a minimum of 6 samples are required).

11.3.11 A total of 25 samples of topsoil have been analysed from the main development area (9 from the previous investigation in 2018, the remainder during the current ground investigation). The physical description of the topsoil was consistent across the main area and elevated concentrations of arsenic were detected. Consequently, topsoil has been considered as one sample population and statistical assessment undertaken.

11.3.12 Statistical analysis has been carried out in general accordance with the methods outlined in "Guidance on Comparing Soil Contamination Data with a Critical Concentration", CIEH/CL:AIRE (2020) (see comments in Appendix A, Contamination Testing).

11.3.13 Results are summarised below:

Stratum	No. of samples	Mean range (mg/kg)		
		Lower confidence value	Mean	Upper confidence value
Topsoil	25	33	37	41

11.3.14 Naturally occurring arsenic is commonly associated with Coal Measures geology in high concentrations and its presence in topsoil could be a result of surrounding coal mining activities. However, metals can also be associated with land spreading and the continuous use of pesticides. All are viable sources in the main development area.

11.3.15 The statistical assessment indicates that the true mean for arsenic in topsoil is likely to fall between 33 and 41mg/kg. Review of spatial distribution of samples with elevated concentrations (above 37mg/kg) confirmed these were not clustered and were found across the main area. A dot and plot and spatial distribution graph for arsenic in topsoil is included in Appendix I.

11.3.16 Lithos have undertaken previous sampling of topsoil across the wider development area on behalf of Miller in 2017 (Lithos report 2336/1A) and 2018 (Lithos report 2336/3). Elevated concentrations of arsenic (above 37mg/kg) were recorded in all topsoil which supports the spatial distribution and absence of a localised spillage. Bioaccessibility testing was also undertaken on some topsoil samples within Phase 1A of the wider site (c. 800m east of Ravenshall School), and the results indicated low maximum gastro-intestinal bioaccessibility, with a refined Tier 1 value of 116mg/kg being derived.

11.3.17 Based on the available lines of evidence the arsenic concentrations in Topsoil are not considered to prevent retention and reuse on site. However, some bioaccessibility testing should be undertaken to further support this conclusion.

Calorific value

11.3.18 The calorific value of two samples of Ash & Clinker recovered from Lady Wood Extension, have yielded an average CV of 7MJ/kg (max 13MJ/kg). Materials whose CVs exceed 10MJ/kg are almost certainly combustible, while those with values below 2MJ/kg are unlikely to burn.

Asbestos

11.3.19 Asbestos fibres were identified in two samples of Cohesive Made Ground which were recovered from the area of former tipping beneath Lady Wood Extension.

11.3.20 Further quantification was instructed, and the results are presented below:

Hole ID & depth	Material type	Total mass % asbestos	Description of asbestos
WS514 – 0.5m	Cohesive Made Ground	0.003%	Bundles of amphibole fibres.
WS515 – 1.1m	Cohesive Made Ground	0.002%	Bundles of amphibole & chrysotile fibres.

Organic determinands

11.3.21 The majority of this site is essentially greenfield and the only significant inorganic contamination found to date is in samples of Cohesive Made Ground recovered from Lady Wood Extension and the northeast; these areas lie beyond the proposed development and beneath a proposed road respectively rather than beneath potential plots and/or gardens.

11.3.22 For organic compounds the Tier 1 values used in this report have been derived with reference to a CSM that assumes a residential with gardens end use, with no clean cover being placed in gardens/landscaped areas (Lithos Scenario A).

11.3.23 Lithos have used the CLEA model to derive risk-based screening values for hydrocarbons, in accordance with the methodology detailed by the TPHCWG, and reviewed by a UK workshop of experts with respect to UK adoption of the method.

11.3.24 However, these screening values assume a Soil Organic Matter (SOM) of 6% (equivalent to a TOC of 3.5%). Many organic contaminants are more mobile when the SOM is lower, and consequently comparison of soil results with lower screening values may be required.

11.3.25 In order to check the validity of Lithos' Tier 1 Soil Screening Values, the average TOC for each common fill type (beyond any areas of obvious hydrocarbon impact) have been determined.

Fill type	Typical TOC (%)	Comparison of soil results with revised screening value necessary?
Ash & Clinker	6%	No.
Cohesive Made Ground	10%	
Made Ground Topsoil	10%	
Topsoil	5%	

Hydrocarbons (TPH & PAH)

11.3.26 Given the absence of visual/olfactory evidence of any hydrocarbon contamination, only a simple banded TPH (cf full speciation) was scheduled on 17 samples of Made Ground.

11.3.27 Of the 17 samples tested 4 could be considered as being contaminated. These samples all comprise Cohesive Made Ground recovered from WSs 507 & 508 which are located in the allotments.

11.3.28 TPH can be associated with a variety of sources and elevated TPH concentrations do not automatically infer a petroleum product is present; indeed the absence of petroleum products on this site is reflected in the preliminary conceptual model. TPH analysis will detect most hydrocarbons and is not restricted to those detailed within the TPHCWG reports.

11.3.29 Examination of the exploratory hole logs shows that all samples which returned significant organic 'contaminants' included a portion of clinker and coal within their composition.

11.3.30 Whilst not necessarily associated with a petroleum product, the significance of these hydrocarbons, with respect to health, should still be assessed. Providing no other sources are present on site (solvents, degreasers etc), it can be assumed that the most problematic compounds detected within the banded TPH screen are polycyclic aromatic hydrocarbons (PAHs).

11.3.31 The significance of PAHs can be determined by considering indicator compounds. In most cases, benzo(a)pyrene (BaP) is adopted as an indicator (due to the wealth of toxicological data available) and has been used by various authoritative bodies to assess the carcinogenic risk of PAHs in food.

11.3.32 A C4SL toxicity assessment using the surrogate marker approach can be used to estimate the significance of a mixture of PAHs in soil, using toxicity data for indicator compounds within that mixture. Exposure to the indicator (or surrogate marker) is assumed to represent exposure to all PAHs in that matrix.

11.3.33 The sample profiles here are sufficiently similar to the toxicity study adopted for the C4SL assessment, but BaP concentrations exceed Lithos' Tier 1 Value in two samples:

- WS507 in the Allotments; and
- WS508 in the Nursery car park

11.3.34 Consequently, remediation may be required.

11.3.35 Whilst classed as a PAH, naphthalene is more volatile and mobile in the environment than other PAHs. As such the significance of naphthalene has been considered individually against Lithos' Tier 1 Value.

11.3.36 No samples tested returned concentrations of naphthalene above the Tier 1 Value.

11.4 Topsoil

11.4.1 Topsoil, typically 300mm thick underlies the greenfield area of the site. Testing suggests this material should be chemically suitable for re-use on this site. However, scheduling some bioaccessibility testing would be prudent.

Topsoil grading

11.4.2 The clay/sand/silt content and visible contaminants, sharps (glass etc) of 12 topsoil samples have been determined to check compliance with **BS3882**:2015[4] requirements. BS3882 considers visual contaminants to comprise 'undesirable potentially injurious foreign object(s) visible to the naked eye'.

11.4.3 It should be noted that this is a reduced suite of analysis, and no N-P-K etc. testing has been undertaken.

11.4.4 The results are summarised below:

Hole ID & depth	Retained on sieve size						Visible contaminants
	2mm	20mm	50mm	Clay content	Silt content	Sand content	
TP301 – 0.3m	-	-	-	20	34	46	< 0.1
TP305 – 0.1m	-	-	-	26	44	30	< 0.1
TP315 – 0.1m	-	-	-	16	38	46	< 0.1
TP320 – 0.1m	-	-	-	22	40	38	< 0.1
TP321 – 0.1m	-	-	-	20	39	41	< 0.1
TP501 – 0.2m	< 1.0	< 1.0	< 1.0	33	40	27	< 0.1
TP506 – 0.1m	< 1.0	< 1.0	< 1.0	**42**	45	13	< 0.1
TP509 – 0.1m	< 1.0	< 1.0	< 1.0	26	32	42	< 0.1
TP517 – 0.2m	< 1.0	< 1.0	< 1.0	32	27	41	< 0.1
TP520 – 0.2m	< 1.0	< 1.0	< 1.0	21	28	51	< 0.1
TP523 – 0.1m	< 1.0	< 1.0	< 1.0	20	28	52	< 0.1
TP526 – 0.1m	< 1.0	< 1.0	< 1.0	26	35	39	< 0.1

Notes
Values in bold type fail the required specification for multipurpose topsoil

11.4.5 The above results suggest that the topsoil at this site generally complies to the standards set out in BS3882. In terms of textural classification the Topsoil generally falls into the loam/clay loam class.

[4] *BS3882:2015. Specification for topsoil. Published by BSI Standards Limited.*

12 CONTAMINATION

12.1 General

12.1.1 Given constraints, discussed in Section 8.2, in the northeast (Allotments & Nursery car park) some further ground investigation will ultimately be required.

12.1.2 Approval of the recommendations given below should be sought from the appropriate regulatory authorities prior to commencement of site redevelopment.

12.2 Summary of significant contamination

12.2.1 A veneer of made ground underlies Lady Wood Extension (in the west) and the allotments and nursery car park (northeast).

12.2.2 Made Ground beneath Lady Wood Extension comprises Cohesive Made Ground and Ash & Clinker which have been placed during tipping of former opencast workings. Made Ground in this area includes a number of inorganic determinands as well as asbestos and are potentially combustible (Ash & Clinker only). Indeed, given the source of this material more significant contamination than that encountered to date is likely to be present.

12.2.3 Cohesive Made Ground is present beneath the allotment gardens which has been found to include a number of inorganic (arsenic and boron) and organic (TPHs & PAHs) determinands.

12.2.4 Topsoil recovered from the Allotment gardens is slightly contaminated with arsenic and is not considered suitable for re-use.

12.3 Revised conceptual ground model (contamination)

12.3.1 The Preliminary Conceptual Site Model has been amended in light of data obtained during the ground investigation, most notably with respect to the distribution of made ground and contaminants.

12.3.2 A revised Conceptual Site Model is presented as Drawing 3901/7 in Appendix B. The Model includes the contaminants described in Section 12.1 above, and potential pollutant linkages (summarised below in Section 12.5) to receptors.

12.4 Environmental setting & end use

12.4.1 With respect to the proposed development area, it is apparent from Section 12.1 above, that some (relatively minor) contamination has been identified in the northeast (vicinity of the allotments and nursery car park). The new Spine Road is expected to pass through this area, but no built development is anticipated. However, some further post vacation/clearance investigation will be required.

12.4.2 In order to assess the significance of the contamination encountered to date, consideration must be given to the site's environmental setting and the proposed end use.

12.4.3 The underlying Glacial Deposits and Coal Measures are both classified as Secondary A Aquifers. The nearest surface watercourse is an un-named tertiary river which emerges in the far-west (beneath Lady Wood) and flows north to the River Calder about 670m north. Therefore, the site's environmental setting is considered to be **moderate sensitivity**.

12.4.4 With respect to human health, the proposed end use (residential) is considered sensitive.

12.4.5 Transient risks to construction workers can be addressed by the adoption of appropriate health and safety measures, see Section 17.5.

12.5 Pollutant linkages

12.5.1 In terms of a proposed redevelopment of this site, plausible pollutant linkages can be summarised as follows.

Contaminants

12.5.2 Contaminants have been summarised in Section 12.1 above.

Pathways

12.5.3 Potential contaminant pathways include:

- Ingestion
- Dermal contact
- Inhalation of contaminated particulates

Receptors

12.5.4 Potential contaminant receptors include:

- The environment – groundwater aquifer and/or surface watercourses
- End users of the site (residents)

12.5.5 It can be concluded that there are plausible pathways between the soil contaminants summarised in Section 12.1 above and potential receptors. Consequently, some remediation will be required; either treatment/removal of the contaminant, or "breakage" of the pathway.

13 CONTAMINATION (DISCUSSION)

13.1 Contamination (Main development area - greenfield)

13.1.1 The majority of the site, including the area to be given to residential development, is essentially greenfield, occupied by arable farmland.

13.1.2 Topsoil, typically 300mm thick underlies the greenfield area of the site. Testing suggests this material should be chemically suitable for re-use on this site. However, scheduling some bioaccessibility testing would be prudent.

13.2 Contamination (Nursery car park & Allotments)

13.2.1 Made Ground beneath the area of the allotments and the nursery car park comprises a veneer of Made Ground Topsoil or hardstand over Cohesive Made Ground.

13.2.2 **Made Ground Topsoil** within the **allotments** has been found to be slightly 'contaminated' with inorganic contaminants (namely lead & arsenic). This material is not suitable for re-use and should either be exported from site or isolated beneath clean cover.

13.2.3 Given the compressible nature and gas-generating potential of this material if buried at depth, it is recommended that it is placed in garden areas and/or POS, immediately beneath the proposed 600mm cover, and that it is overlain by no more than 1m of soil.

13.2.4 **Cohesive Made Ground** (**allotments & nursey car park**) has yielded slightly elevated concentrations of TPHs & benzo(a)pyrene. Whilst BaP exceeds the Lithos' Tier 1 value for a residential end use with no soil cover, it is below the Tier 1 value for a residential end use with 600mm soil cover; see Generic Note 04 in Appendix A for further details.

13.2.5 The slightly elevated concentrations of TPHs & BaP are most likely either be associated with fragments of coal, clinker, tarmac, or possibly a localised spill/leak of fuel/oil from machinery (e.g. lawnmower / strimmer used in the allotments). If the latter, this is usually of limited concern given anticipated very small volume of soil impacted impacted (cf leakage from a tank).

13.2.6 The Cohesive Made Ground could remain beneath the proposed highway where it will be satisfactorily isolated from end users.

13.2.7 If this material were to underlie proposed gardens or landscaped areas, it would need to be isolated beneath at least 600mm of clean cover comprising 450mm of 'clean' subsoil and at least 150mm of Topsoil.

13.2.8 Topsoil and Residual Soils recovered from these areas should be suitable for use as clean cover.

13.3 Contamination (Lady Wood Extension)

13.3.1 It should be noted that due to the constraints discussed in Section 8.2 a fairly limited scope of investigation has been carried out in Lady Wood Extension to date. No development is proposed in this area.

13.3.2 Data obtained from Landmark and QGIS indicates the presence of an area of landfill, associated with Thornhill Power Station, beneath Lady Wood Extension and the Lyttle land to the northeast; see Drawing 3901/10. Previous ground investigation suggests the area of landfill is not as extensive as indicated; indeed landfill appears to be restricted to an area of former opencast coal mining in an area now referred to as Lady Wood Extension.

13.3.3 Cohesive Made Ground and Ash & Clinker have been encountered beneath Lady Wood Extension. The Made Ground beneath this area has been found to be: potentially combustible (Ash & Clinker only); include (sporadic & low level) asbestos fibres; and include a number of inorganic determinands which exceed Lithos' Tier 1 screening values (most notably arsenic).

13.3.4 Given the source of this material more significant contamination than that encountered to date is likely to be present.

13.3.5 Lady Wood Extension is occupied by semi-mature trees and can be accessed by the public via unsurfaced footpaths. It will remain woodland and be allowed to mature to improve the local amenity and wildlife diversity. Nevertheless, some contamination exists in near-surface soils, and this merits further consideration.

13.3.6 As no development is proposed in this area the 'traditional' pathways between the source (made ground) and the most sensitive receptors (end users) are far less significant than if this made ground were present beneath plots, gardens and landscaped areas.

13.3.7 Root growth will act to stabilise shallow soils and 'bind' inorganic contaminants within the soil mass reducing the potential for wind-blown dust etc. Furthermore, digging is not envisaged, although animal burrows may fetch contaminated soils to the surface.

13.3.8 In summary, risks to health associated with transient activities in this area are likely to be negligible and no "remediation" is anticipated at this stage.

13.3.9 Given proximity of the River Calder (c. 120m north), the Environment Agency were asked whether they have any regulatory concerns regarding this former landfill and whether it has been identified as causing a problem to the River Calder under the Water Framework Directive. The EA search response is included in Appendix E and notes that according to their records there is nothing to suggest that the landfill is having an impact under WFD on the River Calder (from River Colne to River Chald).

13.4 Summary of potential pollutant linkages & mitigation

13.4.1 In terms of the proposed redevelopment plausible pollutant linkages, and feasible remediation options, can be summarised as follows:

Receptors	Pathways	Contaminants	Plausible pollutant linkage? (and remediation options where required)
Greenfield Areas			
No significant contamination encountered to date.			
Nursery car park & allotments			
Human health (Future residents) ◊	Consumption of contaminated vegetables	Metals, hydrocarbons in the made ground	**No;** area lies on the line of a proposed highway. Hardstand will sufficiently isolate end users from contaminants.
	Ingestion		
	Dermal contact		
	Inhalation (dust and/or vapours)		
	Infiltration of water supply pipes	Hydrocarbons in the made ground	Water company may insist of "protectaline" pipework
Buildings	Migration & accumulation of explosive gas	Methane	To be assessed on completion of monitoring and gas risk assessment
Surface watercourse & groundwater	Surface water run-off & infiltration through made ground.	Hydrocarbons & inorganics in made ground.	**No;** contamination relatively minor and construction of impermeable highway & highways drainage will significantly reduce contact between waters and contaminants in made ground.
Lady Wood Extension			
Human health (Future residents) ◊	Consumption of contaminated vegetables	Metals, asbestos & combustibility.	**No;** development not anticipated across this area.
	Ingestion		
	Dermal contact		
	Inhalation (dust and/or vapours)		
Buildings	Migration & accumulation of explosive gas	Methane & carbon monoxide.	**No;** development not anticipated across this area.
	Combustion & generation of hazardous gas	Combustibility of Ash & Clinker.	**No;** development not anticipated across this area & woodland growth precludes bonfires etc.
Surface watercourse & groundwater	Surface water run-off & infiltration through made ground	Metals, hydrocarbons in the made ground	**No;** ongoing growth of vegetation will reduce over/through ground flow & stabilise shallow soils.

◊ transient risks to construction workers will be addressed by the adoption of appropriate health and safety measures in accordance with the Health and Safety at Work Act 1974 and regulations made under the Act including for example the COSHH Regulations.

13.5 Waste classification

13.5.1 Some excess arisings (topsoil & subsoil) may be generated by excavations for foundations, sewers etc. If these are intended for retention and reuse on the site, they would be classed as clean naturally occurring soils and would not be considered waste, under the Waste Framework Directive.

13.5.2 Off-site disposal of surplus clean naturally occurring soils to landfill is not recommended. In accordance with the CL:AIRE Code of Practice[5] any excess natural soil arisings should be suitable for Direct Transfer to another development site, for use either as clean cover material, or bulk fill for use, without the need for waste legislation to be applied.

13.5.3 Off-site disposal of made ground recovered from Lady Wood Extension would likely be more onerous and further testing is required to consider cost implications if this is proposed.

13.5.4 A thin veneer of macadam is present across the nursery car park.

13.5.5 This **macadam** could be recycled and crushed to yield a 6F3 selected granular material, provided the recovered bitumen content is less than 10% (determined in accordance with BS598-1[6]). Crushed tarmac could also be blended with crushed concrete etc to generate 6F2 graded material. 6F2 can contain up to 50% recycled tarmac/asphalt (provided it does not pose a contamination risk to controlled waters and, if the proportion of asphalt is greater than 20%, the recovered bitumen content is less than 2%).

13.5.6 However, if off-site disposal is anticipated, tarmac assessment is based on the amount of coal tar present, this will vary depending on the age of the tarmac. The assessment is based on the amount of benzo(a)pyrene and has a concentration limit of 50mg/kg.

13.5.7 Speciated PAH analysis has been undertaken on two samples of tarmac and BaP concentrations were < 50mg/kg. Consequently, tarmac is likely to fall within waste code 17 03 02:

- 17 - Construction and Demolition wastes,
- 03 – bituminous mixtures, coal tar and tarred products
- 02 – bituminous mixtures other than those mentioned in 17 03 01

13.5.8 17 03 02 is a mirror non-hazardous entry (17 03 01 is the corresponding mirror hazardous entry). This code along with this supporting report, in particular the laboratory results, should be used to complete a paper trail documenting disposal routes for tarmac.

13.5.9 Contractors exporting waste from the site should review the site investigation data and make their own assessment. Alternatively, Lithos could undertake this assessment once exported waste streams have been identified.

[5] The Definition of Waste: Development Industry Code of Practice. CL:AIRE, 2011.
[6] *BS598 (2003) Sampling and examination of bituminous mixtures for roads and other paved areas.*

14 HAZARDOUS GAS

14.1 General

14.1.1 Consideration of the conceptual site model and potential linkages has enabled a preliminary qualitative assessment of risks associated with gas:-

Source	Receptors	Hazard	Pathway	Initial risk
On-site made ground	Human health	Asphyxiation & explosion	Vertical migration, ingress & accumulation	**Low**: made ground essentially inert, with little degradable matter
	Buildings	Explosion		
Off-site landfill (multiple north & east)	Human health	Asphyxiation & explosion	Lateral migration, ingress & accumulation	**Low**: natural strata to at least 5m depth are generally of low permeability
	Buildings	Explosion		
Shallow mineworkings	Human health	Asphyxiation & explosion	Vertical migration, ingress & accumulation	**Moderate**: no significant thickness of low permeability drift or bedrock above workings
	Buildings	Explosion		

14.1.2 Given the above gas monitoring wells have been installed in 25 boreholes across the site. Details of the installations are given on the borehole logs presented in Appendices G & H.

14.1.3 The generation potential of these sources is considered to be Low to Moderate.

14.1.4 In accordance with KC's scope of works 6 visits have been scheduled over a three month period. It should be noted that based on the findings of the gas monitoring and in accordance with CIRIA Report C665[7], given a proposed residential end use, there might be a requirement for further gas monitoring in the future.

14.2 Scope of works

14.2.1 The generation potential of the gas source was initially considered to be Moderate, and this has been confirmed by the monitoring results obtained.

14.2.2 Under the ground investigation scope of works, KC requested an initial round of 6 monitoring visits be undertaken over a 3-month period. The findings of this monitoring period are summarised below with an initial tentative assessment. However further ground gas monitoring will be required before final recommendations can be made.

14.2.3 The wells have been monitored on 6 occasions for groundwater levels and soils-gases, and the results are presented in Appendix L.

14.2.4 A standard procedure was followed, in accordance with CIRIA guidance:

- Atmospheric temperature & pressure
- Methane, oxygen and carbon dioxide concentrations and flow rates using a Gas Data GFM436 infra-red gas analyser
- Standing water level using a dipmeter

[7] CIRIA C665: Assessing risks posed by hazardous ground gases to buildings (2007).

14.3 Monitoring results

14.3.1 The results of the monitoring completed to date are summarised below.

Hole ID	Response zone	Methane concentration (% v/v)	Carbon dioxide concentration (% v/v)	Steady flow rate (ltr/hour)
WS501	1.2m – 1.4m; Cohesive Made Ground, 1.4m – 2.2; Cohesive Residual Soils	N.D.	0.6 – 1.7	N.D – 0.1
WS502	0.9m – 1.9m; Cohesive Residual Soil	N.D.	0.9 – 2.4	N.D.
WS503	1.0m – 3.0m; Cohesive Glacial Deposits	N.D.	0.7 – 2.2	N.D.
WS504	1.0m – 3.0m; Cohesive Glacial Deposits	N.D.	2.3 – 4.3	N.D. – 0.1
WS508	1.0m – 3.0m; Cohesive Glacial Deposits	N.D.	0.7 - 1.7	N.D.
WS513	0.5m – 1.0m; Ash & Clinker	N.D.	0.7 – 1.2	N.D.
WS514	0.5m – 1.5m; Cohesive Made Ground	N.D.	2.0 – 5.0	N.D.
WS515	1.0m – 2.4m; Granular Made Ground	N.D.	0.6 – 4.4	N.D.
PH502A	2.0m – 5.0m; Coal Measures (Sandstone [1.0m - 3.0m], Mudstone [3.0m -4.0m], Coal [4.0m – 4.5m], Mudstone [4.5m – 5.0m])	N.D.	0.5 – 3.4	N.D. - 0.1
PH504A	1.0m – 3.0m; Coal Measures (Sandstone)	N.D.	N.D. – 0.3	N.D.
PH506A	2.0m – 4.0m; Coal Measures (Sandstone)	N.D.	0.4 – 0.9	0.1 – **4.0**
PH507A	2.0m – 5.0m; Coal Measures (Mudstone [2.0m – 2.7m], Coal [2.7m – 3.0m], Mudstone [3.0m – 5.0m])	N.D.	2.7 – 4.6	N.D. – 0.1
PH509A	1.5m – 4.5m; Coal Measures (Sandstone)	N.D.	0.3 – 2.4	N.D.
PH511A	1.5m – 4.5m; Coal Measures (Sandstone)	N.D.	0.6 – 2.6	N.D. – 0.1
PH513A	3.0m – 5.0m; Coal Measures (Coal [3.0m – 3.1m], Sandstone [3.1m – 5.0m])	N.D.	0.4 – 2.3	N.D.
PH514A	1.5m – 4.5m; Coal Measures (Sandstone)	N.D.	0.7 - 2.1	N.D.
PH516A	0.5m – 3.5m; Coal Measures (Sandstone)	N.D.	0.5 – 1.3	N.D. – 0.1
PH517A	1.0m – 4.0m; Coal Measures (Sandstone [1.0m – 2.9m], Coal [2.9m -3.4m], Mudstone [3.4m – 4.0m])	N.D.	0.8 – 4.4	N.D.
PH518A	1.5m – 5.0m; Coal Measures (Sandstone)	N.D.	0.7 – 1.3	N.D.
PH522A	1.5m – 4.5m; Coal Measures (Mudstone)	N.D.	0.8 – 3.6	N.D.
PH524A	1.5m – 4.5m; Coal Measures (Sandstone [1.5m – 4.2m], Mudstone [4.2m – 4.5m])	N.D.	2.4 – 4.5	0.1
PH526A	1.0m – 4.0m; Coal Measures (Sandstone)	N.D.	0.2 – 2.6	N.D. – 0.1
PH528A	1.0m – 4.0m; Coal Measures (Sandstone)	N.D.	0.1 – 1.8	0.1
PH530A	1.5m – 3.0m; Coal Measures (Sandstone)	N.D.	0.4 – 0.8	0.1
PH531A	1.5m – 4.5m; Coal Measures (Sandstone)	N.D.	0.6 – 1.3	N.D.

Note: Atmospheric pressures varied between 993mb and 1019mb.

14.3.2 During 3 of the 6 monitoring visits, atmospheric pressure was falling, including one where the pressure was below 1,000mb (Visit 4). Plots of atmospheric pressure versus time are included in Appendix L.

14.4 Current guidance.

14.4.1 Generic Note 05 in Appendix A outlines how monitoring results are interpreted.

14.5 Current gas regime.

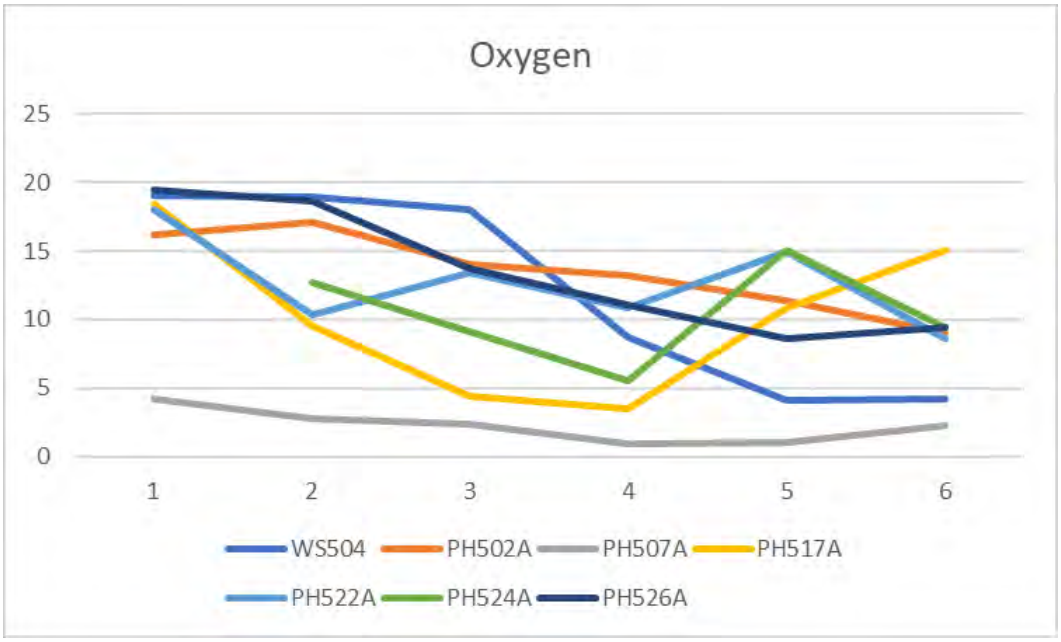
14.5.1 The proposed residential development comprises low rise residential housing. Consequently, the gas regime has been characterised in accordance with the Situation B (traffic light) methodology outlined in CIRIA Report C665.

14.5.2 In line with BS8485, before a site-wide gas screening value is calculated, further consideration of each individual monitoring event should be undertaken, considering the carbon dioxide concentration and flow rate. A decision must be made, when calculating the hazardous flow (Q_{hg}) for each borehole – is it reasonable to calculate this for each monitoring event, or per monitoring location across all monitoring events?

14.5.3 Q_{hg} is calculated by the equation: Q_{hg} = flow x (gas concentration / 100).

14.5.4 Monitoring data here does indicate one isolated gas flow in PH506A, but no elevated carbon dioxide was recorded in this location. The hazardous gas flow for each borehole, suggests a Green classification (Q_{hg} is below 0.78l/hr in all boreholes).

14.5.5 Further consideration of monitoring data indicated very low oxygen. The graph below shows oxygen levels in monitoring wells where concentrations fell below 10%v/v.



14.5.6 Very low oxygen concentrations are aften associated with mine gases, often termed Blackdamp.

14.5.7 Blackdamp is an asphyxiant gas created in old mine workings and is characterised by very low oxygen and concentrations of carbon dioxide of up to 20%v/v.

14.5.8 In general, as atmospheric pressure rises, air tends to be drawn into the ground and through mineworkings producing air-rich mine gas mixtures. During periods of falling atmospheric pressure the flow direction reverses bringing increasingly oxygen-deficient gas mixtures towards the surface[8].

[8] *Abandoned mine workings manual, CIRIA 2019*

14.5.9 Whilst elevated carbon dioxide concentrations and flow were not recorded, the low oxygen concentrations indicate a potential risk from mine gas.

14.5.10 The monitoring wells where reduced oxygen was recorded (WS504, PH502A, 507A, 517A, 522A, 524A & 562A), lie in an approximate line through the centre of the site running east to west, this corresponds with workings identified in the ground investigation.

14.5.11 Groundwater dip data indicates that groundwater rest levels were between 44 and 83m AOD (approx. 0.7 to 4mbgl). Where very shallow groundwater was encountered this was identified above the top of some monitoring response zones.

14.6 Further gas monitoring

14.6.1 It is recommended that further monitoring should be undertaken, as a minimum, bi-monthly for a further 3 months.

14.6.2 Consideration should also be given to:

- the installation of shallow 1m piezometers to ensure shallow groundwater does not impair ground gas movement, and
- the possible presence of dissolved carbon dioxide in groundwater; it is recommended that some groundwater samples be collected and analysed for dissolved gases.

14.7 Scope of protection measures.

14.7.1 A full gas risk assessment cannot be undertaken with the limited data available. However initial review of the available data supports the following observations.

14.7.2 Current data indicates a gas screening value for the site that could fall within NHBC classification of Green. However, low oxygen concentrations, shallow fluctuating groundwater, and the presence of shallow mineworkings suggest a more precautionary approach is necessary.

14.7.3 Based on the site conceptual model and need to protect new dwelling from changing ground gas conditions, it is more likely that parts of the site will fall within **Amber 1** or **Amber 2** classification.

14.7.4 Both Amber classifications require a ventilated subfloor void and gas resistant membrane, and both classifications require independent verification. A higher score is required for Amber 2 sites and this is usually achieved through independent installation and verification of gas measures.

14.7.5 At present it would be prudent to assume an Amber classification for all plots. However, some areas in the south are not underlain by mine workings an are in a CA low risk area. If further monitoring can provide confidence that gas is not migrating from mineworkings in the centre/north, into southern areas and no other source of ground gas is impacting the southern part of the site (i.e. historic landfill in the west), some zoning of gas protection measures should be possible.

14.7.6 Any zoning should also consider future consolidation of shallow workings and whether this could change the pre- consolidation gas regime.

14.7.7 The requirements for each classification, Green, Amber 1 & 2 are shown in the table below.

Traffic light classificn and "score" req'd by BS8485#	Floor slab (BS8485 "score")	Protective measures	
		Sub-floor ventilation (BS8485 "score")	Membrane Type (BS8485 "score")
Green & **CS2** (Wilson & Card) **2.5***	*Select one from:* i. Block & Beam – **(0)**. ii. Reinforced ground bearing slab – **(0.5)**. iii. Reinforced, cast in-situ suspended slab (with minimal and suitably sealed service penetrations & joints) – **(1.5)**. iv. Reinforced ground bearing raft (with limited service penetrations cast into slab). Note: the venting area through any downstand beam should be 3 times greater than that provided by the side ventilation (air bricks) – **(1.5)**.	*Select one from:* Passive sub-floor ventilation; venting layer could be: i. A min. 150mm clear void **(2.5)**, or ii. A proprietary void former providing an equivalent clear void depth of 60mm; see Section B7 in BS8485 **(2.5)**, or iii. Min. 300mm thick blanket of min. 20mm single size gravel **(1.0)**. Min. ventilation = 1,500 mm^2/m run of external wall (via air bricks on each of 2 opposite sides), with 100mm pipes at 1.75m centres or honeycombing of any sub-floor sleeper walls.	Waterproof DPM (2000 gauge polyethylene). Lapped & sealed in accordance with BR 414. **(0)**
Amber 1 **3.5***	*Select one from:* i. Block & Beam – **(0)**. ii. Reinforced ground bearing slab – **(0.5)**. iii. Reinforced, cast in-situ suspended slab (with minimal and suitably sealed service penetrations & joints) – **(1.5)**. iv. Reinforced ground bearing raft (with limited service penetrations cast into slab). Note: the venting area through any downstand beam should be 3 times greater than that provided by the side ventilation (air bricks) – **(1.5)**.	*Select one from:* Passive sub-floor ventilation; venting layer could be: i. A min. 150mm clear void **(2.5)**, or ii. A proprietary void former providing an equivalent clear void depth of 60mm; see Section B7 in BS8485 **(2.5)**, or iii. Min. 300mm thick blanket of min. 20mm single size gravel **(1.0)**. Min. ventilation = 1,500 mm^2/m run of external wall (via air bricks on each of 2 opposite sides), with 100mm pipes at 1.75m centres or honeycombing of any sub-floor sleeper walls.	Gas resistant membrane meeting all of the following criteria: • sufficiently impervious to gases with a methane gas transmission rate <40.0 ml/day/m^2/atm (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method); • sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions; • sufficiently strong to withstand in-service stresses; • sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, dropping tools, etc); • capable, after installation, of providing a complete barrier to the entry of the relevant gas; and • a minimum 0.4 mm thickness (1600g polyethylene) reinforced membrane (virgin polymer • verified in accordance with CIRIA C735∞ **(2.0)**
Amber 2 **4.5***	*Select one from:* i. Block & Beam – **(0)**. ii. Reinforced ground bearing slab – **(0.5)**. iii. Reinforced, cast in-situ suspended slab (with minimal and suitably sealed service penetrations & joints) – **(1.5)**. iv. Reinforced ground bearing raft (with limited service penetrations cast into slab). Note: the venting area through any downstand beam should be 3 times greater than that provided by the side ventilation (air bricks) – **(1.5)**.	*Select one from:* Passive sub-floor ventilation; venting layer could be: i. A min. 150mm clear void **(2.5)**, or ii. A proprietary void former providing an equivalent clear void depth of 60mm; see Section B7 in BS8485 **(2.5)**. Min. ventilation = 2,000 mm^2/m run of external wall (via air bricks on each of 2 opposite sides), with 100mm pipes at 1.3m centres or honeycombing of any sub-floor sleeper walls.	Gas resistant membrane meeting all of the following criteria: • sufficiently impervious to the gases with a methane gas transmission rate <40.0 ml/day/m^2/atm (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method); • sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions; • sufficiently strong to withstand in-service stresses (e.g. settlement if placed below a floor slab); • sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc); • capable, after installation, of providing a complete barrier to the entry of the relevant gas; • a minimum 0.4 mm thickness (1600g polyethylene) reinforced membrane (virgin polymer)and • verified in accordance with CIRIA C735∞ **(2.0)**

Scores are broadly based on those outlined in BS8485:2015+A1:2019 (for Characteristic Situations 2 & 3, and Building Type A).

* Modified from BS8485:2015+A1:2019 by Lithos. Monitoring data has also been reviewed using Wilson & Card methodology and found to be Characteristic Situation 2; consequently a lapped/sealed membrane & ventilation are recommended.

∞ In accordance with CIRIA C735, a Verification Plan should be prepared which outlines the activities (inspection and testing), the relevant personnel, and the type of records to be collected. Gas membranes need to be visually inspected to establish possible damage. For Amber 2 sites inspection & verification should be carried out by an independent third party. However, whilst conflicts of interest in verification should be avoided, the Developer's staff on site could undertake inspection & verification on Amber 1 sites. In all circumstances, the verifier should be competent, experienced and suitably trained.

Note NHBC guidance only requires membranes to be fitted by a specialist contractor, and be fully certified, on Amber 2 sites. However, BS8485 is considered to 'outrank' NHBC guidance, and it would be prudent to comply with this Standard and CIRIA C735. Furthermore, (YALPAG) local authorities have issued guidance requiring a detailed verification method statement in advance of the construction phase. This should address how gas measures will be installed and what verification information will be provided to demonstrate that installation has been carried out in accordance with the appropriate guidance.

1. A combination of two or more of the three types of protection measures (slab, ventilation & membrane) should be used to achieve the BS8485 score.
2. The membrane should always be lapped and sealed in accordance with BRE\Environment Agency Report BR 414 (2001) – "*Protective Measures for housing on gas-contaminated land*". The membrane should be **continuous** across internal walls & the cavity, and there should be a **cavity tray** in external walls.
3. In all cases there should be minimum penetration of floor slab by **services**; any penetrations should be suitably sealed.
4. Integral **garages** with occupied rooms above, or direct access through a doorway from the garage to the house, should be provided with the same protective measures as the rest of the dwelling. Buildings with basement car parks (with ventilation in accordance with Building Regulations) may not require gas resistant membranes.

14.7.8 **Verification** is required for all Amber (1 & 2) sites. In accordance with recent YALPAG guidance[9], a detailed verification method statement should be issued to Kirklees Council in advance of the construction phase. This should address how the gas protection measures will be installed and what verification information will be provided to demonstrate the installation has been carried out in accordance with the appropriate guidance. As a minimum the report should include (but not be limited to):

- A summary of the gas risk assessment.
- The gas protection measures proposed and confirmation they will meet the gas protection requirements for the lifetime of the development.
- Technical drawings showing how the gas protection measures will be incorporated.
- Formal qualifications/experience/training of the person carrying out the installation.
- Formal qualifications/experience/training of the person carrying out the verification.
- Clear demonstration of the independence of the person carrying out the verification.
- The manufacturer's specification of the gas protection membrane to be used.
- Full details of what the verification process will comprise and at what stage verification will be carried out.
- Details of how any non-conformance will be dealt with.
- Details of the number of plots to be validated.
- Timeline of when during the build, each of the gas protection measures will be installed.
- Details of management measures proposed to ensure how damage to the membrane will be prevented prior to the floor being installed, post installation.
- Details of how all site personnel (including follow-on trades) will be made aware of the presence of the membrane and that damage to the membrane must be prevented.
- Details of the extent of overlap and method of sealing.

14.7.9 BRE\Environment Agency Report BR 414 (2001) – "*Protective Measures for housing on gas-contaminated land*" provides a practical guide to good practice for the detailing and construction of passive soil gas protection measures for new residential development. Of particular relevance are a list of 'Watchpoints', which offer practical information for installation and buildability.

[9] *Verification Requirements for Gas Protection Systems - Technical Guidance for Developers, Landowners and Consultants. Yorkshire and Lincolnshire Pollution Advisory Group, December 2016.*

14.8 Radon

14.8.1 Requirements with respect radon measures are set out in Building Regulations Approved Document C. Probability bandings (based on the proportion of properties in a given area that exceed the Action Level; currently 200 $Bq.m^{-3}$) are used to determine whether a property requires no, basic or full measures.

14.8.2 At present Approved Document C advocates basic measures for the probability banding 3% to 10% (full measures if >10%). However, Public Health England would like to see all new build include basic measures.

14.8.3 The Public Health England UK radon map and the Landmark report indicate that the site is in an area where **between 1% and 3%** of homes are estimated to be above the action level.

14.8.4 Consequently, basic radon protection measures are not required. However, in light of Public Health England advice, the Developer might consider providing all new dwellings with basic radon protection measures.

15 GEOTECHNICAL TESTING

15.1 General

15.1.1 A total of 34 samples of natural soil were delivered to a suitably accredited laboratory with a schedule of geotechnical testing drawn up by Lithos.

15.1.2 The geotechnical laboratory test results are presented in Appendix J to this report.

15.2 Atterberg limits

15.2.1 The plasticity indices of 34 samples of cohesive soil have been determined; results are summarised below.

Soil type	No. samples tested	Moisture content range (average)	Range of Plasticity Indices* (average)	Shrinkability
Cohesive Glacial Deposits	19	16 – 26 (22)	14 – 29 (22)	Medium
Cohesive Residual Soil	23	9 – 33 (19)	11 – 39 (20)	Medium
Seat Earth	4	9 – 32 (22)	9 – 37 (24)	Medium
Lower Coal Measures	3	10 – 28 (21)	23 – 33 (28)	Medium

* Modified where appropriate in accordance with Chapter 4.2 of the NHBC Standards.

Note. The term Shrinkability is equivalent to the term Volume Change Potential used in Chapter 4.2.

15.2.2 For the purposes of foundation design, it is recommended that all cohesive soils be regarded as being of **medium** shrinkability.

15.3 Soluble sulphate and pH

15.3.1 In accordance with BRE Special Digest 1:2005, this site (the area being given to development) has been classified as greenfield with a mobile groundwater regime.

15.3.2 It is envisaged foundations will extend to depths of about 1m into natural strata and samples taken from this depth range have been submitted for pH and water-soluble sulphate (2:1 soil/water extract).

15.3.3 The concentrations of sulphate in the aqueous natural soil extracts of 48 samples were determined. In addition, 17 samples of made ground were tested as part of the contamination suite. The pH value of each sample has also been determined.

15.3.4 The highest water-soluble sulphate concentration and the lowest pH value for each soil type analysed are shown in the table below.

Soil type	No. samples tested	Lowest pH values	Highest soluble sulphate concentration (mg/l)
Ash & Clinker	2	8.0	100
Cohesive Made Ground	15	6.5	1,600 (typically <200)
Glacial Deposits	16	6.5	58
Residual Soils	17	5.3 (typically >5.5)	26
Coal Measures Bedrock	8	5.4 (typically >5.5)	78
Coal	4	5.6	43
Seat Earth	3	4.9	33

15.3.5 A single sample of Residual Soil and a single sample of Coal Measures bedrock returned pH values of slightly less than 5.5. However, no other samples from these soil types returned values of less than 5.5 and these values are not considered representative of the soil mass.

15.3.6 A single sample recovered from Cohesive Made Ground beneath the nursery car park returned a sulphate value of 1,600mg/l. None of the other samples tested returned a sulphate value of greater than 500. Therefore, this value is not considered representative for Cohesive Made Ground.

15.3.7 A single sample of seat earth returned a pH value of less than 5.5, and the average pH value of pH for the Seat Earth is 5.5. Consequently, supplementary analysis to determine the concentrations of magnesium, chloride and nitrate was scheduled. The three supplementary samples yielded some magnesium, chloride and nitrate results of greater than 10 and consequently the low pH values must be considered.

15.3.8 In accordance with Tables C1 and C2 of SD1, sub surface concrete which is in contact with **Cohesive Made Ground** should be Design Class **DS2**, with an ACEC Classification of **AC-1**.

15.3.9 Sub surface concrete across the **greenfield areas** of the site (the area to be developed) should be Design Class **DS-1** with an ACEC classification of **AC-1**, however where sub surface concrete comes into contact with **Seat Earths** (below the base of the coal seams), the classification should be increased to **DS-1** and **AC-2z**.

15.3.10 It would be prudent to assume that all plots within 50m of the coal seam outcrops may encounter seat earth and require an increased concrete classification.

15.4 Compaction tests

15.4.1 Laboratory compaction tests are useful wherever ground improvement is anticipated, for example to provide a satisfactory CBR beneath proposed highways.

15.4.2 In accordance with BS5930:2015 engineered fill is defined as material which is selected, placed and compacted to an appropriate specification so that it will exhibit the required engineering behaviour.

15.4.3 Grading and moisture content control the degree to which materials can be effectively compacted. If the grading or moisture content of an in-situ material is not suitable to facilitate its compaction then screening, wetting, or lime addition may be required.

15.4.4 Laboratory compaction testing was scheduled on 10 samples of weathered Coal Measures and Cohesive Residual Soils (using a 4.5kg rammer) to determine their suitability for re-engineering.

15.4.5 Laboratory compaction tests are only appropriate if:

- At least 90% of the material passes the 37.5mm sieve; and/or
- At least 70% of the material passes the 20mm sieve

15.4.6 It is apparent from the gradings tabulated below, that the samples scheduled for compaction tests are suitable (i.e. at least 70% of the material is finer than 20mm).

15.4.7 Material particle density (Gs) is required in order to plot the 0, 5 and 10% air voids lines on the compaction graph for each material type. Results are summarised in the tables below:

Sample location & depth	Material description	% passing 37.5mm sieve	% passing 20mm sieve
TP304 1.5m	Cohesive Glacial Deposits	100	100
TP309 1.8m		100	98
TP310 1.2m		100	98
TP313 1.4m		100	98
TP314 2.4m		100	95
TP316 1.1m		100	96
TP301 2.5m	Weathered Coal Measures	97	95
TP303 1.5m		100	96
TP319 2.6m		100	95
TP320 2.2m		92	82

Sample location & depth	Material description	Gs (Mg/m³)	MDD (Mg/m³)	OMC (%)	Allowable mc range for 95% MDD & <5% air voids	Typical in-situ moisture content (%)
TP304 1.4m	Cohesive Glacial Deposits	2.6	1.89	12	11.75 to 16.25	21 (17 to 33)
TP309 1.8m		2.6	1.83	14	13.5 to 19.0	
TP310 1.2m		2.6	1.81	15	14.0 to 19.25	
TP313 1.4m		2.6	1.99	10	9.4 to 14.25	
TP314 2.4m		2.6	1.91	10	11.1 to 15.25	
TP316 1.1m		2.6	1.91	15	11.5 to 16	
TP301 2.5m	Weathered Coal Measures	2.65	2.04	9	9.0 to 13.25	18 (10 to 28)
TP303 1.5m		2.6	1.94	11	10.6 to 15.25	
TP319 2.6m		2.6	2.02	9	8.6 to 13	
TP320 2.2m		2.6	2.06	9	7.8 to 12.25	

15.4.8 The in-situ moisture content of both soil types is typically slightly too wet to achieve 95% MDD. Therefore, the Cohesive Glacial Deposits are likely to require some drying out before they can be utilised for engineered fill.

15.4.9 Drying out of these soils will require careful management on site. They should be placed in sealed stockpiles during periods of wet weather, or while the site is unattended. During periods of favourable weather (ideally warm & windy) the soils should be spread in thin layers over as wide an area as possible and aerated by turning with an excavator. Alternatively, consideration could be given to lime stabilisation

15.4.10 Acceptability of both the weathered Coal Measures and Glacial Deposits for use in the proposed controlled earthworks will need detailed appraisal by the Earthworks Designer in light of the required performance characteristics.

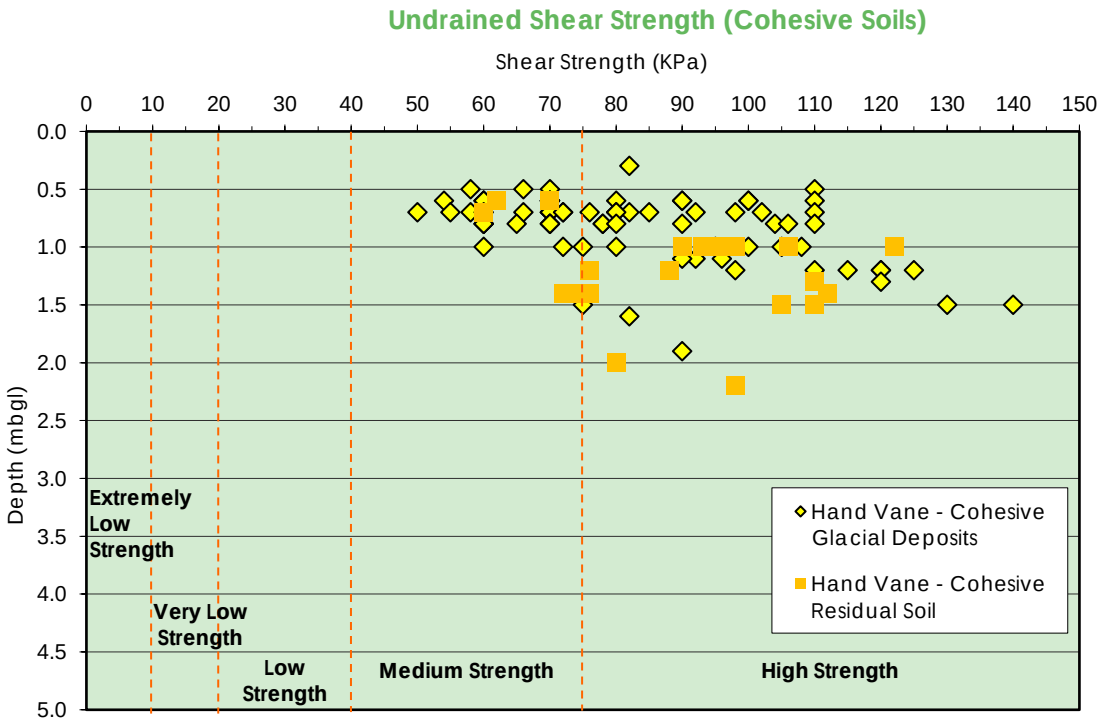
15.5 Undrained shear strength testing

Hand shear vane testing

15.5.1 Hand shear vane testing was undertaken within trial pits in-situ to around 1.2m depth and from larger blocks of excavated clay below that depth.

15.5.2 The results are summarised within the plot below and illustrate a broad linear increase in undrained shear strength (Su) with depth within both the Cohesive Glacial Deposits and Residual Soils. The typical shear strength encountered at a.0m depth is around 75kPa and the minimum shear strength encountered at 1.0m is 60kPa.

15.5.3 The plot below provides a summary of undrained shear strengths.



16 GEOTECHNICAL ISSUES

16.1 Conceptual site model

16.1.1 This Section focusses on the main area of proposed development; no consideration of ground conditions beneath Lady Wood and Lady Wood Extension (in the west) is required. The vast majority of the proposed development area (c. 20 ha, 94%) is greenfield. The far northeast (the allotments and the nursery car park; c. 1.25ha, 6%) is to be given to construction to a new adoptable road which will provide access to the proposed development off Ravensthorpe Road (which runs east to west beyond the northern boundary).

16.1.2 A thin veneer of made ground is present beneath the allotments and nursery car park in the northeast. Further made ground is anticipated within a small, former sandstone quarry in the centre of the site, but to date this has not been located.

16.1.3 Natural ground across the area of proposed development predominantly comprises medium to high strength Cohesive Residual Soils, over Coal Measures Bedrock (sandstones and mudstones).

16.1.4 An area of about 13.5ha in the northeast is underlain by medium to high strength Cohesive Glacial Deposits to depths in excess of c. 3.5m; see Drawing 3901/11.

16.1.5 Approximate depths to bedrock are shown on Drawing 3901/12 and the approximate distribution of bedrock types is shown on Drawing 3901/13.

16.1.6 The 3rd Brown Metal and Middleton Little coal seams outcrop across the centre of the site. A further three coal seams outcrop beneath Lady Wood in the west (separated from the wider site by a north-south trending fault).

16.2 Mining & quarrying

16.2.1 A small sandstone quarry is shown in the centre of the site on old OS maps (see Section 3) but to date this quarry has not been located.

16.2.2 Much of the site is located in a CA Development High Risk Area; known mineworkings and several coal seams are present at shallow depth beneath the entire site.

16.2.3 In summary 9 coal seams underlie the site at shallow depth, and these are:

Seam name(s)	Approximate thickness (m)	Approximate depth below 2nd Brown Metal coal (m)
2nd Brown Metal, aka Old Hards	0.3 – 0.7	-
3rd Brown Metal, aka Stone	0.2 – 0.6	10 - 20
Middleton Little, aka Green lane	0.3 - 0.7	30 - 40
Un-named	0 – 0.4	52
Middleton Main, aka New Hards	0.2 – 0.4	75
Un-named		90
Wheatley Lime	0.7 – 1.2	100
Middleton Eleven Yard Coal	0 - 0.8	107
Blocking Coal	0.4 – 0.6	134

16.2.4 Approximate outcrops are shown on Drawing 3901/11.

16.2.5 The site is split into two fault blocks by a north-south trending fault which runs beneath Lady Wood Extension. Development is only proposed within the eastern fault block.

16.2.6 Lithos' mining investigation comprised drilling of 56 'deep' rotary open probeholes across the eastern fault block.

16.2.7 All seams typically occur at greater depth in the west; a function of seam dip and topography.

16.2.8 Evidence of underground workings have been encountered in the Middleton Main and Wheatley Lime coal seams in the north and east. Workings encountered to date are essentially restricted to the centre north (the "Miller" area).

16.2.9 No mineworkings have been encountered in the 3rd Brown Metal, Middleton Little or un-named coal seams. Drilling to date suggests that these coal seams are locally absent at the expected depth; see Drawing 3901/14. This is possibly due to these coals locally thinning or 'washing' out, but might be due to 'packed' workings which can be difficult to detect when drilling is undertaken using rotary open-hole techniques.

16.2.10 Further underground workings and areas of opencast coal extraction are expected beneath Lady Wood Extension and Lady Wood, but these lie beyond the area of proposed development and investigation is proposed.

Shallow mineworkings

16.2.11 CIRIA SP32:1984 (Construction over abandoned mine workings) suggests voids resulting from mineral extraction are unlikely to migrate more than 10 times the seam thickness through competent bedrock. CIRIA C758D, 2019 (Abandoned mine workings manual) notes that the use of this 10 times 'rule-of-thumb', as the design basis for treatment depth, has been observed to be successful over many years for a wide range of mineworkings and overlying rock/soil strata scenarios. However, consideration must always be given to site specifics such as nature of roof strata, strata dip, groundwater, extraction ratio etc.

16.2.12 Based on the findings of Lithos' investigation to date, the general north of the site will require consolidation (drill & grout) of underground mineworkings in the **Middleton Main** Coal Seam, but not the underlying Wheatley Lime Coal. The approximate area requiring consolidation is shown on Drawing 3901/15.

16.2.13 Consolidation of underground workings will most likely require drilling holes on a 3m grid. A viscous grout composed of appropriate proportions of OPC, PFA, sand or pea gravel would then be injected into the workings via these holes.

16.2.14 Further holes would need to be drilled in areas of high grout take (to confirm filling of void space), and in areas where several adjacent holes encountered solid coal (to confirm that the local area is underlain by no workings, rather than pillars).

16.2.15 Drilling and grouting operations should be carried out with engineering supervision and be undertaken in accordance with a revision of Lithos' "General Specification for the Treatment of Shallow Mineworkings" tailored to the site-specifics.

16.2.16 The south of the site will require consolidation of underground mineworkings in the 3rd Brown Metal Coal (where present) and the Middleton Little Coal **if** underground workings are present in these seams.

16.2.17 Risks to surface stability still exist above packed workings, albeit somewhat reduced, due to localised areas (e.g. associated with tramways, water ways etc) where packing has not occurred.

16.2.18 Therefore, plots underlain by packed workings, if proven, should be proof-drilled. Grout takes in the majority of proof-drilled holes would be expected to be low.

16.2.19 Alternatively, consideration could be given to coal extraction (see Section 17.6).

Mine entries

16.2.20 As discussed in Section 5.7.7 there are 40 known mine entries within, or close to, the site's boundary. However, the majority of mine entries are located in Lady Wood and Lady Wood Extension, and only three are located beneath areas which are anticipated to be given to development; see Drawing 3901/8.

16.2.21 Prior to Lithos' appointment, KC had already instructed another company to locate mine entries 423419-005 & -006 (centre-north, within the "Miller" area). In accordance with KC's brief, Lithos were commissioned to search for the third mine entry (Ref. 422419-027). To date mine entry -027 has not been located; it likely lies within the easement for an underground gas main.

16.2.22 A fourth mine entry ref. 423419-004 is located within the grounds of Ravenshall School but no development is anticipated here.

16.2.23 Consideration should also be given to a search for the 'walk-in' mine entry located in the centre of the site; see Section 5.3. Although evidence for this feature is only anecdotal if present the adit will require treatment, capping and likely a no-build zone around its location.

16.2.24 The CA expect the Developer's layout to assume a no-build "zones of influence" around each shaft based on the following calculation:

Zone of influence = 0.5 x assumed shaft diameter + departure + drift/made ground depth

16.2.25 In essence, departure relates to the degree of certainty with respect to the entry's location; approximate co-ordinates are provided on the CA's mine entry data sheets; see Appendix E). In turn, departure is dictated by the "source" of the entry's location as provided by the CA's mine entry data sheets.

16.2.26 Consequently, at this stage (prior to location) the zones of influence associated with each shaft must be assumed to be:

Shaft Ref.	Source	Departure	Diameter /m	Depth to bedrock/m	Zone of influence (circle of radius)/m	Approx. location
422419-027	-	10m	?2.5	2.0m	3.25m	Centre-west.
423419-005	Abandonment plan	8m	?2.5	2.4m	3.65m	Centre-northeast.
423419-006		8m	?2.5	2.4m	3.65m	Centre-northeast.

16.2.27 Following location, the zones of influence can be reduced by the departure.

16.2.28 At this stage it is expected that shafts -005 & -006 will lie within a "new" area of allotments. Given the presence of the gas main, shaft -027 will likely lie well beyond the footprint of any proposed dwellings.

16.2.29 At all 3 locations, bedrock should lie within 3m of ground level. Consequently, these shafts should be capped at or below rockhead. The cap should be a least twice the internal diameter of the shaft and be designed by a competent structural engineer.

16.2.30 It is possible that further, unrecorded "shallow" shafts (possibly bell pits) are present, and consideration could be given to a geophysical survey. The success of geophysics would be dependent on the "contrast" between shaft backfill and the surrounding ground (i.e. the survey is likely to be more successful if shaft backfill is significantly different material or less dense than the surrounding ground). Follow-up intrusive investigation (pitting) would be recommended to determine the cause of any anomalies identified by the geophysics.

16.2.31 A topsoil strip will be required prior to construction and the exposed surface should be carefully inspected for evidence of unrecorded mine entries.

16.2.32 Whilst the Coal Authority (and NHBC) discourage development over or adjacent to all mine entries, Lithos consider such features to pose a low risk to surface stability where they only extend to relatively shallow workings that require treatment (grouting). Consequently, we would not expect any (previously unrecorded) shallow shafts, encountered during site preparatory works and/or the subsequent construction phase, to result in the need for "no-build" zones and/or revision of the planning-approved layout although the Developer may choose to do this.

16.2.33 However, where build over a shaft(s) is proposed, the Developer will need to discuss proposed treatment (which is likely to include both grouting of the shaft backfill, and a cap at rockhead) and bespoke foundation design, by a suitably qualified structural engineer, with the Coal Authority. A Permit to Enter or Disturb Coal Authority Mining Interests will be required prior to construction of any shaft cap.

16.2.34 Proposals to treat the mineworkings and shafts will need to be discussed with both the Local Authority (most notably Highways), the Coal Authority and NHBC well in advance of starting works on site.

16.2.35 Any shafts encountered during the development of this site should be made safe by treatment in accordance with an appropriate Specification (Lithos can prepare this) and a Coal Authority Permit to Enter or Disturb Coal Authority Mining Interests.

16.3 Site regrade and/or ground improvement

16.3.1 Given existing topography (much of the site is sloping, with gradients of up to 1 in 6 in the centre-north, some earthworks regrade is anticipated, with the need for underbuild and retaining walls.

16.3.2 Careful consideration will need to be given to earthworks design, and implications for slope stability, retaining walls, foundations, highway gradients and drainage.

16.3.3 Furthermore, regrade to create development terraces could result in a reduction of the depth of competent cover above mineworkings and consideration should be given to this during any earthworks modelling.

16.3.4 Any areas of deeper cut (say>3m) are likely to encounter bedrock. Approximate depths to bedrock are shown on Drawing 3901/12 and the approximate distribution of bedrock types is shown on Drawing 3901/13. It is understood that some sections of the proposed new spine road might require cuttings in excess of 6m depth; further ground investing (rotary cored boreholes) would be prudent in such areas.

16.3.5 Natural ground underlying this site is often clayey, therefore consideration should be given to the implication of undertaking earthworks in poor/wet weather when the ground surface is likely to become difficult to cross with heavy machinery.

16.3.6 Wherever possible, Lithos recommend that excavated soils are retained on site. However, if this is not possible the comments in Section 13.5 should apply.

16.4 Foundation recommendations

General

16.4.1 Foundation recommendations assume that development will be of 'traditional' two or three storey construction and that line loads will not exceed 90kN/m run. If this is not the case significant alteration to these recommendations will be required.

16.4.2 Within the area of proposed development, and surrounding area, land falls to the north with a typical slope of 1v:12h; maximum about 1v:6h. It is envisaged that some cut and fill earthworks to create development terraces will be undertaken prior to/as part of the construction process.

16.4.3 Any digital terrain modelling undertaken, or commissioned, by the Developer should consider implications for the foundation recommendations outlined below.

16.4.4 Foundation depths (and types) will depend on thicknesses of fill following the anticipated earthworks regrade.

16.4.5 Following the anticipated earthworks, placed fill materials should not contain obstructions and be relatively stable with little overbreak. At this stage, it is assumed that fill will be placed with nominal compaction only; reinforced footings on engineered fill are not currently anticipated.

16.4.6 Made ground is not considered a suitable foundation material and foundations should therefore be taken through these materials into underlying natural strata of adequate bearing capacity.

16.4.7 In accordance with Tables C1 and C2 of SD1, sub surface concrete which is in contact with Cohesive Made Ground should be Design Class **DS2**, with an ACEC Classification of **AC-1**.

16.4.8 Sub surface concrete across the greenfield areas of the site (the area to be developed) should be Design Class **DS-1** with an ACEC classification of **AC-1**, however where sub surface concrete comes into contact with seat earth (below the base of the coal seams), the classification should be increased to **DS-1** and **AC-2z**.

16.4.9 It would be prudent to assume that all plots within 50m of the coal seam outcrops may encounter seat earth and require an increased concrete classification.

Strip/trench fill footings

16.4.10 It is considered that shallow strip or deepened trench fill footings will be the most suitable foundation solution for two or three storey houses constructed at the site. Footings will be founded in the Glacial Deposits, Residual Soils or competent rock. This solution will not be viable if site regrade results in greater than c. 2.5m of fill being placed; in this event alternative foundations (likely piles/rafts on engineered fill) will be required.

16.4.11 Shallow spread foundations could be utilised for plots above and treated shallow mineworkings. Where underlying mineworkings are to be consolidated, foundations should be "beefed-up" to accommodate any potential time dependant differential settlement.

16.4.12 Further advice regarding reinforcement should be sought from the appointed Structural Engineer, but in the meantime, reference should be made to the table below.

Rock cover above grouted seam	Preferred Foundation
<5 x seam thickness	Raft - designed to span 3m over potential soft spots and cantilever 1.5m at corners. Either stiffened, flat-bottomed rafts a minimum of 300mm thick, on 450mm of compacted Type 1 material, with reinforcement top and bottom. Or, rafts could be of 300mm concrete with a 150mm upstand to allow for wall construction provided that the base of compacted type 1 material lies at a depth of at least 600mm
>5 x seam thickness – 10m	Strip footing OK, but thickened (300mm), and reinforced top and bottom
>10m	Strip footing OK, but needs to be 300mm thick reinforced with one layer of mesh

16.4.13 Beyond areas of treated mineworkings, reinforcement, as a precaution against differential settlement, is recommended only where foundation excavations encounter significant lateral and vertical variations in strata. One layer of B385 mesh placed 75mm above the base of the footing is likely to provide suitable reinforcement, but further advice should be sought from the Structural Engineer.

16.4.14 Foundations will be required to be placed below a line drawn up at 45^{o} from the base of any service or similar excavation.

16.4.15 Deepened foundations should be stepped in accordance with NHBC Standards, Chapter 4.4.

16.4.16 In order to minimise softening and swelling of cohesive soils or loosening of granular soils, it is recommended that footings are cast as soon as formation level is reached (or alternatively formation could be blinded using concrete with as low a water:cement ratio as possible).

16.4.17 In addition to the above, the Developer should review proposed plot designs and layouts, since deeper excavations for trench fill are likely to be unstable where the centre-lines of parallel trenches are closer than about 2m (assuming 600mm widths). the Developer should supervise their groundworker to ensure footings are excavated in a controlled and safe manner.

16.4.18 The Developer or their groundworker should seek further advice from Lithos if unexpected ground conditions are encountered in foundation or sewer excavations, including any conflict between soft ground associated with a backfilled trial pit excavation and the line of a proposed footing.

16.4.19 In accordance with NHBC Standards, founding depths in cohesive soils should be taken from original or finished ground level, whichever is the lower, to the underside of the footing.

16.4.20 Where placed in cohesive soils foundations should be deepened near trees in accordance with NHBC Standards Chapter 4.2. It is estimated that up to 15% of the site may be affected by trees.

16.4.21 Trench fill foundations should be designed in accordance with NHBC Standards, Chapter 4.2. Heave precautions (a suitable approved compressible void former) should be used on the internal face of all external walls where the foundation is within the zone of influence of trees and greater than 1.5m deep.

16.4.22 Any trench fill foundation deeper than 2.5m will need to be designed by a Chartered Engineer, whose status is accepted by NHBC (NHBC Standards, Technical Requirement R5).

16.4.23 It would therefore be prudent to prepare a detailed foundation schedule and seek approval from NHBC in order to determine likely foundation abnormals.

16.4.24 Further investigation should be commissioned if any apartment blocks, or public service buildings such as larger schools, shops etc, with higher line loads (say >120kN/m run) are proposed. Such investigation would include cable percussion boreholes and geotechnical analysis (triaxial and oedometer testing) of recovered, undisturbed samples.

16.4.25 Clay classification tests suggest that all natural cohesive soils at this site should be regarded as being of **medium** shrinkability. A minimum founding depth of 900mm is therefore recommended for all soils on the site where strip footings on Cohesive Glacial Deposits or Cohesive Residual Soils are proposed.

Cohesive Glacial Deposits

16.4.26 A safe bearing capacity of around 170kPa, allowing a maximum foundation line load of 100kN/m run, can be assumed if the following are true

- A foundation length of 10m
- A foundation breadth of 0.6m
- A foundation thickness of 225mm
- A foundation depth of 0.9m depth
- An undrained shear strength of 60kPa for the firm clay (typical minimum recorded on site)

16.4.27 Assuming the foundation geometry detailed above, minimal settlements would be anticipated. This is considered likely to be acceptable, however, further advice should be sought from the Structural Engineer responsible for foundation design.

Cohesive Residual Soils

16.4.28 A safe bearing capacity of around 185kPa, allowing a maximum foundation line load of 110kN/m run, can be assumed if the following are true

- A foundation length of 10m
- A foundation breadth of 0.6m
- A foundation thickness of 225mm
- A foundation depth of 0.9m depth
- An undrained shear strength of 65kPa for the firm clay (typical minimum recorded on site)

16.4.29 Assuming the foundation geometry detailed above, minimal settlements would be anticipated. This is considered likely to be acceptable, however, further advice should be sought from the Structural Engineer responsible for foundation design.

Granular Residual Soils

16.4.30 The weathered in-situ sandstone (sand, gravel and cobbles) is assumed to have a relative density of at least medium dense (in accordance with BS5930:2015).

16.4.31 A safe bearing capacity of around 150kPa, allowing a maximum foundation line load of 90kN/m run, can be assumed if the following are true:

- A foundation length of 10m
- A foundation breadth of 0.6m
- A foundation thickness of 225mm
- A foundation depth of 0.6m depth
- An angle of shearing resistance of ϕ=32° for the granular deposits

16.4.32 Assuming the foundation geometry detailed above, minimal settlements would be anticipated. This is considered likely to be acceptable, however, further advice should be sought from the Structural Engineer responsible for foundation design.

16.4.33 In accordance with NHBC Standards, a minimum founding depth of 450mm (due to potential frost susceptibility) is required in granular soils. However, in order to improve bearing capacity and reduce the potential for settlement a minimum founding depth of 600mm is recommended for granular soils at this site.

16.4.34 This depth should be taken from finished ground level to the underside of the footing. If finished ground level is to be above existing ground level then the foundation excavation simply needs to ensure that there is sufficient depth of excavation to allow casting of the footing entirely within natural ground (not made ground or topsoil).

16.4.35 However, if the excavation is dug from original ground level in cold conditions when freezing is expected, then foundation depth should be taken from the existing, not finished, ground level.

16.4.36 Where ground level is being raised, it would be prudent to proof roll the exposed granular soils after stripping topsoil (to mitigate any near-surface disturbance), and ideally fill should be placed prior to construction (otherwise the Developer will need to consider the potential for movement associated with placement of the fill).

16.4.37 It should also be noted that the footing may require deepening or stepping in order to allow plot drainage to exit the plot footprint (either over or under the footing).

Bedrock

16.4.38 Coal Measures bedrock (mudstones, siltstones and sandstones) should provide a safe bearing capacity of at least 200kPa and minimal settlements would be anticipated.

16.4.39 Where rock is encountered at shallow depth foundations should be placed entirely on rock and not partially on rock and partially on soil. This may, depending on surface gradient, necessitate significant deepening of foundations.

16.4.40 Bedrock at the site comprises mudstone which can be easily excavated using a backhoe excavator and will be recovered as a tabular gravel. Where in-situ mudstone is encountered at founding depth (minimum of 450mm), it will provide a suitable founding stratum for two or three storey dwellings and need only be penetrated by the proposed foundation thickness. Note: any overlying residual soil (typically clay with gravel-sized lithorelicts of mudstone) is likely to be a shrinkable soil; Mudstone is not.

Coal

16.4.41 Some excavations for foundations in the centre-south of the site may come into contact with coal. Care should be taken not to unnecessarily overdeepen foundations, in order to minimise the chance of encountering coal.

16.4.42 Where foundation excavations do come into contact with coal, the foundation should be taken through the coal seam, into underlying natural in-situ strata of adequate bearing. The full thickness of coal should then be sealed with concrete to create a trench fill foundation. To prevent the ingress of air, the mass concrete fill should be placed as soon as possible after exposing the seam.

16.4.43 By virtue of the provisions of the Coal Industry Act 1994 interests in unworked coal and coal mines previously vested in the British Coal Corporation are now vested in the Coal Authority. The Developer will need to contact the Coal Authority to dig or carry away such coal as they encounter in connection with redevelopment of the site (this is often referred to as incidental coal).

Geological fault

16.4.44 Drawing 3901/8 shows the approximate line of the fault; the fault crosses the northwestern corner passing through Lady Wood and Lady Wood Extension. No development is expected over, or within 50m of, the line of the fault.

16.4.45 Further advice should be sought if significant weak zones are encountered (e.g. ground comprising loose, broken or soft 'gouge' material) during the excavation of footings. If associated with a fault, the weak zone is likely to form a fairly continuous "linear belt", rather than a localised "pocket", and be anything from a few centimetres to a few metres in width.

16.5 Floor slabs

16.5.1 Suspended floor slabs should be utilised where the depth of made ground or engineered stone exceeds 600mm in accordance with NHBC Standards Chapter 5.1 (to negate potential settlement problems).

16.5.2 At present it is estimated that the thickness of made ground will not exceed 600mm beneath the majority of plots (>95%). However following site regrade this is unlikely to remain the case.

16.5.3 Where shallow foundations are within the influence of existing or proposed trees (and are underlain by shrinkable soils), NHBC require a suspended floor slab, with sub-floor void. The floor slab is most commonly a precast block and beam construction, but alternatively could comprise a suspended timber floor, or a slab cast on a suitable compressible void former. Ground-bearing and cast in-situ suspended slabs (other than those cast on a void former) are not acceptable where foundations are within the influence of trees.

16.5.4 In accordance with NHBC Standards Chapter 4.2, a minimum void height of 250mm should be adopted for a precast block and beam (or suspended timber) floor; this includes a 150mm ventilation allowance. If a suspended, cast in-situ slab (on a void former) is proposed, a minimum clear void height of 100mm should be adopted; of course, the actual thickness of the void former will be significantly greater.

16.5.5 Beyond the influence of existing or proposed trees, it is considered that the natural ground is generally suitable for the use of ground bearing floors. However, ground bearing slabs should not be cast on topsoil. Where plots are elevated for design reasons, the depth of engineered stone below a ground bearing slab should not exceed 600mm, in accordance with NHBC guidance.

16.5.6 The natural ground beneath this site includes cohesive soils and is therefore subject to seasonal variation in moisture content. If ground slabs were constructed on desiccated soil, heave of the slab would occur on re-hydration of the ground. If any significantly desiccated soil is present, a suspended floor slab, with sub-floor void will be required.

16.5.7 It should be noted that NHBC have suffered a significant number of claims resulting from the use of ground bearing floor slabs. Consequently, if ground bearing slabs are proposed, care should be taken to ensure correct and careful construction. For example, if fill to the internal face of the foundation excavation is not properly compacted, subsequent settlement can result in cracking of the slab.

16.5.8 In the unlikely event that coal is exposed beneath the floor void, it would be prudent to prevent air ingress and the potential for spontaneous combustion by blinding with concrete or removing the coal.

16.5.9 Floor slab design should be finalised/take account of the results of the gas monitoring and protection measures required, which will be detailed in Lithos' gas risk assessment, to be issued on completion of monitoring in April 2021.

16.6 Designated concrete mixes

16.6.1 Designated mixes are considered in BRE Special Digest SD1 and BS 8500 -1:2015+A1:2016. However, in addition to soil chemistry (sulphate class), there are a number of other considerations relating to structural design that need to be taken into account when determining an appropriate concrete mix.

16.6.2 Consequently, the Developer should seek advice from their appointed Structural Engineer.

16.7 Excavations

16.7.1 Based on the results of the investigation it is considered unlikely that major groundwater flows will be encountered in shallow excavations, but any excavations which remain open for longer periods of time, most notably across low ling land in the north, are likely to fill with groundwaters.

16.7.2 Groundwater should be controlled in accordance with CIRIA report 113 "Control of Groundwater for Temporary Works".

16.7.3 Excavations should remain stable in the short term but if left open for any significant period of time may require shoring most notably in granular soils and made ground.

16.7.4 Bedrock was encountered in several exploratory holes, especially in the centre. Based on the exploratory hole logs, excavation greater than 3.0m is likely to prove difficult across about 60% of the site. It would therefore be prudent to allow for excavation of hard rock in any deep excavations such as those that may be required for drainage etc.

16.7.5 Approximate depths to bedrock are shown on Drawing 3901/12 and the approximate distribution of bedrock types is shown on Drawing 3901/13. It is understood that some sections of the proposed new spine road might require cuttings in excess of 6m depth; further ground investing (rotary cored boreholes) would be prudent in such areas.

16.8 Drainage

16.8.1 Soakaway testing has been carried out in the north of the site at locations which were determined by Buro-Happold. The tests were undertaken into Cohesive Glacial Deposits and mudstone bedrock.

16.8.2 Test results indicate that soakaways will not provide a suitable drainage solution for surface water run-off across low lying areas in the north of the site. Furthermore, shallow groundwater would preclude soakaway design and construction in low lying areas.

16.8.3 Based on the findings of the trial pitting, soakaway testing might give better results across the centre and south where shallow bedrock predominantly comprises sandstone. Further testing across the wider site could be undertaken to remove ambiguity. However, consideration would need to be given to groundwater depths, topography and the presence of mineworkings.

16.8.4 Soakaway construction in the centre and south could prove problematic for the following reasons:

- Bedding dip of bedrock and the site topography (both down to the north). Soakaway waters might result in springs forming down slope.
- Soakaway waters which infiltrate mineworkings might result in minewaters 'blowing out' of buried adits or lines of geological weakness down slope.

16.8.5 Alternative SUDS options (see CIRIA C753:2015 for further details) include:

- Swales – linear grassed features in which surface water can be stored or conveyed. Where suitable, swales can be designed to allow infiltration.
- Infiltration basins – vegetated depressions designed to store runoff and infiltrate it gradually into the ground.
- Pervious Pavements – provide a surface suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate into subsurface storage, with subsequent infiltration or controlled discharge. Pavement could be porous (water able to infiltrate across entire surface material; e.g. reinforced grass), or permeable (water infiltrates via joints between concrete blocks).
- Ponds – designed to have permanent pool of water, but with capacity to provide temporary storage-controlled discharge.

16.8.6 Yorkshire Water have published a guide[10] for developers and designers outlining their design requirements for surface water attenuation assets.

16.8.7 With respect to detention basins, which should normally be dry, water table levels should be taken from borehole monitoring wells over 4 consecutive seasons, for at least 3 points in the basin area. The detention basin should be designed to ensure that there is a minimum of 1m of unsaturated soil between the maximum groundwater level and the lowest part of the structure.

16.8.8 Ground conditions must be suitable to allow free drainage from the detention basin all year round by having regard to groundwater levels, and impermeable liners are not to be used.

16.8.9 It is Lithos' understanding that ground does not have to be free-draining (i.e. sands/gravels), but where clay is present the basin needs to be designed to prevent waterlogging - because this renders maintenance (grass cutting) difficult. It would be prudent to seek confirmation of this from Yorkshire Water and/or the appointed drainage designer.

16.8.10 Appropriate design usually comprises a fall across the short axis (to centre of basin), and then along the long axis (possibly inclusive of a pipe in gravel trench) to the outfall.

16.8.11 The guide also discusses required access to flow control chambers, large diameter (i.e. >900mm) surface water storage pipes, and surface water storage tanks.

16.8.12 It is recommended that the Developer contact Yorkshire Water Services with respect to capacity in existing foul and surface water sewers in the vicinity of the development area.

[10] *Design Requirements for Surface Water Attenuation Assets, February 2017.*

16.9 Highways

16.9.1 The natural soils present at shallow depth (anticipated formation) are predominantly cohesive. Based on visual inspection of the natural materials and the recorded plasticity indices at the site, published tables[11] indicate that the Cohesive Glacial Deposits and Cohesive Residual Soils would be expected to provide a CBR value of at least 3%. These values should be verified prior to or during construction.

16.9.2 Whilst the CBRs estimated above should be achievable, significant deterioration during/after periods of significant rainfall and/or site trafficking is likely. Consequently, it would be prudent to consider flexibility in the groundworks programme to enable highway construction during prolonged dry/warm weather (typically between May and September) when formation will be least vulnerable to deterioration. Alternatively, a minimum 200mm thickness of suitable granular fill (i.e. a "blanket" of 6F2) could be placed along the line of proposed highways to protect formation during the construction phase.

16.10 External works

16.10.1 Any digital terrain modelling undertaken, or commissioned, by KC or a Developer should be made available to their Engineering Designer prior to issue of an External Works Drawing.

17 REDEVELOPMENT ISSUES

17.1 General

17.1.1 This report has presented options with respect to foundation solutions, treatment of contamination re-use of topsoil etc that are considered technically feasible and in line with current good practice. Consequently, we would expect to obtain regulatory approval for whichever option is adopted, although this cannot be guaranteed. Copies of this report should be forwarded to the relevant regulatory authorities (Warranty Provider & Local Authority) for their comment/approval.

17.1.2 Even after an appropriate preliminary investigation and ground investigation, with exploratory holes on a closely spaced grid (say trial pits at 30m centres), a geoenvironmental appraisal is typically based on inspection of the ground underlying less than 0.5% of the total site area (and much less at depths in excess of about 3.5m). Consequently, there is always a possibility that unanticipated ground conditions will be encountered during the construction phase.

17.1.3 If unanticipated ground is encountered during the construction phase, the Contractor should immediately seek further advice from the Engineer.

17.2 Remediation strategy

17.2.1 KC have requested preparation of a Remediation Strategy which will be issued as a separate Lithos Report. Anticipated preparatory works required will include:

- Relocation of the allotment gardens
- General site clearance of surface materials and vegetation
- Consolidation of underground mineworkings by drill & grout or prior extraction
- Cap & treatment of mine entries
- Grubbing up of hardstand (nursery car park)

[11] *Interim Advice Note 73/06 Revision 1 (2009), Chapter 5. Characterisation of Materials Design Guidance for Road Pavement Foundations - Draft HD25*

17.2.2 It should be ensured that the groundworker understands the need for good materials management. Most notably the importance of not mixing different materials within a given stockpile; i.e. there should be separate stockpiles of: topsoil; grubbed-up hardstand; tarmac; Ash & Clinker; excess clean, natural soil arisings; general construction waste etc.

17.2.3 No areas of gross contamination were encountered during the site investigation. However, if any buried drums, "oily", odorous, brightly coloured etc. materials are encountered, further advice should be sought from Lithos. Further advice should also be sought if deep foundations etc associated with the former buildings beneath the allotments and nursery car park are encountered during the preparatory works; such obstructions might necessitate revised foundation design.

17.3 Good practice guidance

17.3.1 The construction phase groundworker should follow good environmental practice to minimise the risks of spillage, leakage etc with reference, but not limited, to the following documents:

- CIRIA C502 'Environmental Good Practice on Site'
- EA Pollution Prevention Guidelines[12]:
  - PPG6 - Working at construction and demolition sites
  - PPG2 - Above ground oil storage tank
  - PPG7 – The safe operation of refuelling facilities.
  - PPG21 – Incident Response Planning

17.3.2 Site preparatory works associated with this project are likely to involve the re-use of both natural and made ground soils on site and the import of natural soils from another development site. Therefore, the Contractor should prepare a Materials Management Plan (MMP) in accordance with the CL:AIRE Code of Practice (v2, March 2011).

17.3.3 The MMP will document how all of the materials to be excavated during the proposed site preparatory and remediation earthworks are to be dealt with.

17.4 New utilities

17.4.1 It is strongly recommended that all statutory service bodies are consulted at an early stage with respect to the ground conditions within which they will lay services in order to enable them to assess at an early stage any potential abnormal costs.

17.4.2 Drainage and other utilities should not be placed within any coal seam; the seam should either be removed to below the base of the lowest service, or services should be placed in oversize trenches cut into the seam & backfilled with inert material.

17.4.3 Any utilities which are placed in ground within Lady Wood Extension, the allotments or the nursery car park should be laid in trenches that are cut over size in order to isolate pipe materials from potential contaminants and to enable maintenance to be conducted in "clean" material.

17.4.4 At this stage it is considered likely that the use of 'standard' polyethylene water supply pipes should be acceptable, although the Developer should consult Yorkshire Water at the earliest opportunity to confirm this.

17.4.5 This site investigation has enabled completion of Yorkshire Water's Contaminated Land Assessment Form, a copy of which is included in Appendix M.

[12] *Whilst this has formally been withdrawn it can still be accessed via the EA archives and provides useful information on managing risks.*

17.5 Health & safety issues - construction workers

17.5.1 Access into excavations etc. must be controlled and undertaken in accordance with the CDM Regulations 2015, most notably Regulation 22, to mitigate risk of collapse or asphyxiation.

17.5.2 Before site operations are started, the necessary COSHH statements and Health & Safety Plan should be drafted in accordance with the CDM regulations.

17.5.3 The bulk of the made ground (restricted to a relatively small area in the northeast) will be retained on site. This made ground contains contaminants at concentrations above the guidance threshold values for an end use that includes domestic gardens. Workers involved in excavations for foundations, drainage, utilities etc are likely to come into direct contact with the made ground.

17.5.4 Although workers will only be exposed to the contaminated soil for a relatively short time, the contaminants represent a risk, and simple precautionary measures are required, i.e. good personal hygiene and basic personnel protective equipment.

17.5.5 Consequently, during the remediation and construction phases of the site development it will be necessary to protect the health and safety of site personnel. General guidance on these matters is given in the Health and Safety Executive (HSE) document "Protection of Workers and the General Public during the Redevelopment of Contaminated Land".

17.6 Coal extraction

17.6.1 Several coal seams underlie the site at shallow depths, most notably the 3rd Brown Metal and Middleton Little Coals which outcrop across the centre and underlie the south at between c. 1.0m and 10.0m depth.

17.6.2 Prior extraction of coal is encouraged by both the Coal Authority and Planning Authorities, largely because a potential mineral resource will not be sterilised by the development. However, it is worth noting that the UK market for coal is changing (driven by government carbon emission targets) – most notably very few power stations are still burning coal. Consequently, prior extraction of coal has become less attractive in recent times.

17.6.3 There can be financial benefits to extraction, since the extraction contractor would pay the landowner a disturbance allowance for the coal (likely to be between £2 and £4 per tonne), and there would be a saving because grouting would not be required.

17.6.4 Furthermore, any unrecorded mine entries would also be found and removed. Traffic movements (associated with coal export) are expected to be similar to those associated with grouting (import of PFA and cement). However, coal extraction is not without drawbacks; these include:

- The creation of 'high-walls' around the margins of the extraction area (essentially the whole of the site's perimeter).
- The time required to ensure significant settlement of the replaced overburden is typically at least 12 months. However, the actual delay to build programme might be longer, since it is impossible to predict the actual time required for ongoing creep settlements to fall to tolerable levels.
- Local environmental issues associated with noise and dust.
- Public perception issues.
- Concerns that once an initial excavation has been opened, the coal extraction contractor might decide there is insufficient coal remaining and abort further work, or even run into financial difficulties, leaving the Developer with increased foundation abnormals and no royalties.

17.6.5 It is worth noting that the UK market for coal is changing (driven by government carbon emission targets) – most notably very few power stations are still burning coal. Consequently, prior extraction of coal has become less attractive in recent times.

17.6.6 Assuming the above factors do not preclude further consideration at the 'first hurdle', the viability of extraction is influenced by physical factors, most notably:

- the presence (or not) of old mineworkings;
- seam thickness (greater the better); and
- seam depth (shallower the better).

17.6.7 Extraction is generally considered possible where the overburden above a seam is less than 12 times the seam's thickness. This indicates that the coal extraction could be considered further.

17.7 Shallow coal in garden areas

17.7.1 Whilst there is no explicit guidance in NHBC Standards, liaison with NHBC suggests their stance is essentially the same as that they would apply to potentially combustible fills (such as Ash & Clinker). So where significant coal is present at very shallow depth in garden areas (uppermost 1m), it should either be removed, or covered with inert subsoil/topsoil so that it lies at greater than 1m depth.

17.7.2 In theory this could be an issue for about 20% of the total site area.

17.7.3 The most pragmatic way of dealing with shallow coal in gardens will be to inspect foundation excavations, and where coal is recorded within the uppermost 1m or so then excavate an inspection pit in the rear garden. Further advice should be sought from Lithos during the construction phase.

17.7.4 As with foundation arisings, the Developer will need to contact the Coal Authority to dig or carry away excavated (incidental) coal.

17.8 Potential development constraints

17.8.1 Topography will require significant regrade earthworks to create development 'terraces'. This is likely to have a significant impact on foundation design as well as the impact of shallow underground coal seams and workings.

17.8.2 Significant deterioration of the surface is likely to be caused by trafficking, especially after topsoil has been stripped and during/after periods of significant rainfall. Consequently, it would be prudent to consider placement of a minimum 200mm thickness of suitable granular fill (i.e. a "blanket" of 6F2) along the line of proposed highways and any temporary haul roads to protect formation during the construction phase.

17.8.3 Sterile 'no build' zones will be required around the three known mine shafts, as well as any further undiscovered mine entries and the 'walk-in' mine (if present). The no-build zone should be derived by assuming a 45^{o} line from the outer edge of the shaft cap at rockhead, running up to the finished ground level.

17.8.4 The abandoned gas liquor pipeline should be located de-gassed/purged of residual liquids and removed.

17.8.5 The underground gas utility and overhead electrical utilities present a potential development constraint unless they can be relocated. Additional enquiries are required to ascertain the feasibility of such diversionary works and the particular easement required by each service undertaker if they remain in-situ.

17.8.6 It is almost certain that Northern Gas Networks will have restrictions with respect to development in the vicinity of the gas utility and Northern Powergrid will have restrictions with respect to the overhead electrical utilities; easements will probably be required.

17.8.7 There is a culverted stormwater drain (not shown on YW plans but see Section 2.2.16); this will need removal or incorporating into the sites new drainage system.

18 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

18.1 General

18.1.1 The scope of Lithos' investigation was set out by KC; the intention of this Report is to support the sale of the site to prospective developers.

18.1.2 The site is located off Ravensthorpe Road about 2.5km southwest of Dewsbury town centre. Land falls to the north and northeast with slopes of up to 1v:6h (typically c. 1v:12h).

18.1.3 The area considered in this report is called the Dewsbury Riverside Central Gateway Development (c. 30 ha). The Central Gateway falls within a much larger area (c. 156 ha) called the Dewsbury Riverside Development which has been allocated for the construction of about 4,000 residential dwellings as well as three schools.

18.1.4 Whilst the total site area is 30.3 ha, this includes 9.1ha of land (Ravenshall School, Lady Wood & Lady Wood Extension) where no development is proposed. Of the remaining 21.2ha, the vast majority (20ha) is currently greenfield (arable farmland), with a small area of allotments (1.1ha) and a nursery car park (0.15ha) in the northeast. The new Spine Road is expected to pass through the area of allotments and nursery car park, and consequently no new build development is anticipated in the northeast.

18.1.5 This Report gives some consideration to land within Lady Wood & Lady Wood Extension but focuses on the main area of proposed development.

18.1.6 A thin veneer of made ground is present beneath the allotments and nursery car park in the northeast. Further made ground is anticipated within a small, former sandstone quarry in the centre of the site, but to date this has not been located.

18.1.7 Natural ground across the area of proposed development predominantly comprises medium to high strength Cohesive Residual Soils, over Coal Measures Bedrock (sandstones and mudstones).

18.1.8 An area of about 13.5ha in the northeast is underlain by medium to high strength Cohesive Glacial Deposits to depths in excess of c. 3.5m; see Drawing 3901/11.

18.1.9 Approximate depths to bedrock are shown on Drawing 3901/12 and the approximate distribution of bedrock types is shown on Drawing 3901/13.

18.1.10 The 3rd Brown Metal and Middleton Little coal seams outcrop across the centre of the site. A further three coal seams outcrop beneath Lady Wood in the west (separated from the wider site by a north-south trending fault).

18.2 Mining

18.2.1 This site is located in a Coal Authority High Risk Area, with bands of low risk, due to the presence of 9 coal seams at shallow depth; approximate outcrops are shown on Drawing 3901/11. All seams typically occur at greater depth in the west; a function of dip and topography.

18.2.2 Lithos' mining investigation comprised drilling of 56 'deep' rotary open probeholes. Evidence of underground workings have been encountered in the Middleton Main and Wheatley Lime coal seams in the north and east. Workings encountered to date are essentially restricted to the centre north (the "Miller" area).

18.2.3 No mineworkings have been encountered in the 3rd Brown Metal, Middleton Little or un-named coal seams. Drilling to date suggests that these coal seams are locally absent at the expected depth. This is possibly due to these coals locally thinning or 'washing' out, but might be due to 'packed' workings which can be difficult to detect when drilling is undertaken using rotary open-hole techniques.

18.2.4 Further underground workings and areas of opencast coal extraction are expected beneath Lady Wood Extension and Lady Wood, but these lie beyond the area of proposed development and investigation is proposed.

18.2.5 Based on the findings of Lithos' investigation to date, the general north of the site will require consolidation (drill & grout) of underground mineworkings in the Middleton Main Coal Seam, but not the underlying Wheatley Lime Coal. The approximate area requiring consolidation is shown on Drawing 3901/15.

18.2.6 The south of the site will require consolidation of underground mineworkings in the 3rd Brown Metal Coal (where present) and the Middleton Little Coal **if** underground workings are present in these seams.

18.2.7 Alternatively, consideration could be given to coal extraction (see Section 17.6).

18.2.8 There are known mine entries within the area of proposed development; see Drawing 3901/8.

18.2.9 At this stage it is expected that shafts -005 & -006 will lie within a "new" area of allotments. Given the presence of the gas main, shaft -027 will likely lie well beyond the footprint of any proposed dwellings.

18.2.10 At all 3 locations, bedrock should lie within 3m of ground level. Consequently, these shafts should be capped at or below rockhead.

18.2.11 It is possible that further, unrecorded "shallow" shafts (possibly bell pits) are present, and consideration could be given to a geophysical survey.

18.2.12 A topsoil strip will be required prior to construction and the exposed surface should be carefully inspected for evidence of unrecorded mine entries.

18.3 Hazardous gas

18.3.1 The site is in an area where less than 1% of homes are estimated to be above the radon action level. Radon protection is not required, but the Developer might consider providing new dwellings with basic measures in light of Public Health England advice.

18.3.2 There are areas of known landfill, backfilled quarries, opencast and underground workings beneath the site and in the surrounding area. Monitoring wells have been installed in 25 boreholes and hazardous gas monitoring is ongoing.

18.4 Contamination & remediation

18.4.1 The area of proposed development is essentially greenfield and no significant contamination has been encountered. Topsoil should be chemically suitable for re-use. However, some bioaccessibility testing should be scheduled to support this conclusion given the range of arsenic concentrations recorded.

18.4.2 With respect to the proposed development area, some (relatively minor) contamination has been identified in the northeast (vicinity of the allotments and nursery car park). The new Spine Road is expected to pass through this area, but no built development is anticipated. However, some further post vacation/clearance investigation will be required.

18.5 Foundations

18.5.1 New properties could be constructed on 'traditional' strip footings founding at 600mm in granular soils and at least 900mm in cohesive soils. Some footings will require deepening where influenced by trees and hedgerows.

18.5.2 Where underlain by shallow treated workings, foundations will require reinforcement in accordance with NHBC guidance.

18.5.3 However, some plots might require alternative foundations (likely piles/rafts on engineered fill) following earthworks regrade if/where this results in fill depths greater than c. 2.5m.

18.6 Flooding

18.6.1 The site lies in Flood Zone 1, where the risk of flooding from rivers or the sea is classified as low.

18.7 Drainage

18.7.1 Soakaway testing across the north of the site gave very poor infiltration rates; all 4 tests carried out by Lithos failed to drain appreciably.

18.8 Drainage

18.8.1 Test results indicate that soakaways will not provide a suitable drainage solution for surface water run-off across low lying areas in the north of the site. Furthermore, shallow groundwater would preclude soakaway design and construction in low lying areas.

18.8.2 Consequently, it may be necessary to consider alternative sustainable drainage systems (SUDS), and there may be a need for surface water balancing.

18.9 Highways

18.9.1 Based on visual inspection of the shallow natural materials and published guidance, natural soils should provide a CBR value of at least 3%. This value should be verified prior to or during construction.

18.9.2 Where made ground is present it should be excavated and either replaced with suitable aggregate, or screened, to allow selection of suitable material, before being replaced in engineered layers. Where the made ground is re-engineered it is considered that a CBR value of at least 3% should be achievable. However, this should be verified by field trials.

18.10 Further works

18.10.1 To date Lithos' investigation has been undertaken in general accordance with the scope of works commissioned by KC.

18.10.2 Given constraints in the northeast (allotments and the nursery car-park), supplementary, post-vacation investigation will be required in to confirm ground conditions (most notably risks associated with shallow mineworkings) beneath the proposed highway.

18.10.3 Some supplementary investigation will also be required across the proposed development area to 'tighten the grid' of exploratory holes and reduce uncertainties, most notably risks associated with shallow mineworkings. At this stage such investigation would be expected to comprise:

- Additional rotary probeholes
- Rotary cored boreholes to determine whether any packed workings are present and to assess bedrock in any proposed areas of significant earthworks cut
- Further trial pits to locate the former sandstone quarry in the centre
- Bioaccessibility testing for arsenic in topsoil from the main development area

18.10.4 Consideration could be given to further topsoil stripping in order to locate Shaft -027, but this would require liaison with Northern Gas Networks. In any case, given the presence of the gas main (and the area already searched), this shaft likely lies well beyond the footprint of any proposed dwellings.

18.10.5 Consideration could also be given to a geophysical survey to check for the presence of unrecorded mine entries. Follow-up intrusive investigation (pitting) would be recommended to determine the cause of any anomalies identified by the geophysics.

18.10.6 If a detention basin is proposed, water table levels should be taken from borehole monitoring wells over 4 consecutive seasons, for at least 3 points in the basin area.

Appendix A

General Notes

01 - Environmental setting
Generic notes – geoenvironmental Investigations

General

Third party information obtained from the British Geological Survey (BGS), the Coal Authority, the Local Authority etc is presented in the "Search Responses" Appendix of this Geoenvironmental Report.

Geology, mining & quarrying

In order to establish the geological setting of a site, Lithos refer to BGS maps for the area, and the relevant geological memoir. Further information is sourced by reference to current and historical OS plans.

In July 2011, the Coal Authority (CA) formalised their requirements in relation to planning applications and introduced some new terminology. The CA, using its extensive records has prepared plans for all coalfield Local Planning Authorities, which effectively refines the defined coalfield areas into High Risk and Low Risk areas. **High Risk** areas are likely to be affected by a range of legacy issues that pose a risk to surface stability, including: mine entries; shallow coal workings; workable coal seam outcrops; mines gas; and previous surface mining sites. **Low Risk** areas comprise the remainder of the defined coalfield, and are areas where no known defined risks have been recorded; although there may still be unrecorded issues. Where a site lies within either a High or Low Risk area, a mining report is obtained from the CA.

Landfills

Reference is made to publicly available Government held digital data via **QGIS** (an Open Source Geographic Information System), data from Landmark or Groundsure, and sometimes the Environment Agency and the Local Authority with respect to known areas of landfilling within 250m of the proposed development site.

Historical OS plans are also inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

Radon

Radon is a colourless, odourless gas, which is radioactive. It is formed in strata that contain uranium and radium (most notably granite), and can move though fissures eventually discharging to atmosphere, or the spaces under and within buildings. Where radon occurs in high concentrations, it can pose a risk to health.

In order to assess potential risks associated with radon gas, Lithos refer to BRE Report BR211[1], and the Public Health England website. Advice on the limitation of exposure of the population to radon in buildings was originally published in 1990 by the National Radiological Protection Board (NRPB), which joined the Health Protection Agency (HPA) in 2005; the HPA updated NRPB advice in July 2010[2]. The HPA became part of Public Health England in 2013.

The HPA recommended that the NRPB radon Action Level for homes be retained, and a new Target Level for radon in homes be introduced. The values of the Action Level and Target Level, expressed as the annual average radon concentration in the home, are 200 Bqm^{-3} and 100 Bqm^{-3} respectively. The Target Level was to provide an objective for remedial action in existing homes and preventive action in new homes.

The term 'radon Affected Area' is defined as those parts of the country with >1% of homes estimated to be above the Action Levels. The NRPB first indicated which parts of the country should be regarded as radon Affected Areas in 1990. A more detailed mapping method was developed by the HPA in conjunction with the British Geological Survey in 2007[3]. The level of protection needed is site-specific and can be determined by reference to this mapping on the Public Health England website, which indicates the highest radon potential within each 1km grid square. Each 1km grid square is classified on the basis of the percentage of existing homes within that grid square estimated to have radon concentrations above the Action Level. There are 6 'bands': <1%; 1 to 3%; 3 to 5%; 5 to 10%; 10 to 30%; and >30%.

The NRPB advised that action should be taken to reduce radon concentrations in existing homes if the radon concentration exceeded the Action Level of 200 Bqm^{-3} in room air averaged over a year; ten times the average UK domestic radon concentration. NRPB advice informed changes in the requirements for radon protection in new buildings.

- **Basic** preventive measures are required in new buildings, extensions, conversions and refurbishments if the probability of exceeding the Action Level is **>3%** in England and Wales, and >1% in Scotland and Northern Ireland.
- Provision for further preventive (**Full**) measures is required in new buildings if the probability of exceeding the Action Level is **>10%**.

At present Building Regulations Approved Document C advocates basic measures for the probability banding 3% to 10%, and full measures if >10%. However, Public Health England would like to see all new build include basic measures.

Action & Target Levels should also be applied to non-domestic buildings with public occupancy exceeding 2,000 hrs/yr and to all schools.

Hydrogeology

Reference is made to publicly available Government held digital data via QGIS, and Landmark or Groundsure with respect to:

- Groundwater quality
- Recorded pollution incidents
- Licensed groundwater abstractions

From April 2010 the EA's Groundwater Protection Policy uses aquifer designations that are consistent with the Water Framework Directive. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply), but also their role in supporting surface water flows and wetland ecosystems. The aquifer designation data is based on geological mapping provided by the British Geological Survey. The maps are split into two different types of aquifer designation:

- Superficial (Drift) - permeable unconsolidated (loose) deposits. For example, sands and gravels
- Bedrock - solid permeable formations e.g. sandstone, chalk and limestone

The maps display the following aquifer designations:

Principal aquifers: These are layers of rock or superficial deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

Secondary aquifers: These include a wide range of rock layers or superficial deposits with an equally wide range of water permeability and storage. Secondary aquifers are subdivided into three types:

- **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
- **Secondary B** - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers
- Secondary undifferentiated - In most cases, this is because the rock type in question has previously been designated as both a minor and non-aquifer in different locations due to the variable characteristics.

[1] BRE Report BR211, 2015: "Radon: guidance on protective measures for new buildings.

[2] Limitation of Human Exposure to Radon, Documents of the Health Protection Agency - Radiation, Chemical and Environmental Hazards, RCE-15. July 2010.

[3] Miles JCH, Appleton JD, Rees DM, Green BMR, Adlam KAM and Myers AH (2007). Indicative Atlas of Radon in England and Wales. Chilton, HPA-RPD-033.

Unproductive strata: These are rock layers or superficial deposits with low permeability that have negligible significance for water supply or river base flow.

The EA maps only display the principal and secondary aquifers as coloured areas. All uncoloured areas on the map will be unproductive strata. However, for uncoloured areas on the superficial (drift) designation map it is not possible to distinguish between areas of unproductive strata and areas where no superficial deposits are present; to do this, it is necessary to consult the published geological survey maps.

For the purposes of the EA's Groundwater Protection Policy the following default position applies, unless there is site specific information to the contrary:

- If no superficial (drift) aquifers are shown, the bedrock designation is adopted
- In areas where the bedrock designation shows unproductive strata (the uncoloured areas) the superficial designation is adopted
- In all other areas, the more sensitive of the two designations is used (e.g. If secondary superficial overlies principal bedrock, an overall designation of principal is assumed)

The EA have also designated groundwater Source Protection Zones, which are based on proximity to a groundwater source (springs, wells and abstraction boreholes). The size of a Source Protection Zone is a function of the aquifer, volume of groundwater abstracted and the effective rainfall, and may vary from tens to several thousand hectares.

Hydrology

Reference is made to publicly available Government held digital data via QGIS, and Landmark or Groundsure with respect to:

- Surface water quality
- Recorded pollution incidents
- Licensed abstractions (groundwater & surface waters)
- Licensed discharge consents
- Site susceptibility to flooding

The EA have set **water quality** targets for all rivers. These targets are known as River Quality Objectives (RQOs). The water quality classification scheme used to set RQO planning targets is known as the River Ecosystem scheme. The scheme comprises five classes (RE1 to RE5) which reflect the chemical quality requirements of communities of plants and animals occurring in our rivers.

General Quality Assessment (GQA) grades reflect actual water quality. They are based on the most recent analytical testing undertaken by the EA. There are 6 GQA grades (denoted A to F) defined by the concentrations of biochemical oxygen demand, total ammonia and dissolved oxygen.

The susceptibility of a site to **flooding** is assessed by reference to a Flood Map on the Environment Agency's website. These maps show natural floodplains - areas potentially at risk of flooding if a river rises above its banks, or high tides and stormy seas cause flooding in coastal areas. There are two different kinds of area shown on the Flood Map:

1. Dark blue areas (Flood Zone 3) could be flooded by the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year, or by a river by a flood that has a 1% (1 in 100) or greater chance of happening each year
2. Light blue areas (Flood Zone 2) show the additional extent of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1% (1 in 1000) chance of occurring each year

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. Where there is no blue shading (Flood Zone 1), there is less than a 0.1% (1 in 1000) chance of flooding occurring each year.

The maps also show all flood defences built in the last five years to protect against river floods with a 1% (1 in 100) chance of happening each year, or floods from the sea with a 0.5% (1 in 200) chance of happening each year, together with some, but not all, older defences and defences which protect against smaller floods.

The Agency's assessment of the likelihood of flooding from rivers and the sea at any location is based on the presence and effect of all flood defences, predicted flood levels, and ground levels.

It should also be noted that as the floodplain shown is the 1 in 100 year, areas outside this may be flooded by more extreme floods (e.g. the 1 in 1000 year flood). Also, parts of the areas shown at risk of flooding will be flooded by lesser floods (e.g. the 1 in 5 year flood). In some places due to the shape of the river valley, the smaller floods will flood a very similar extent to larger floods but to a lesser depth.

If a site falls within a floodplain, it is recommended that a flood survey be undertaken by a specialist who can advise on appropriate mitigating measures; i.e. raising slab levels, provision of storage etc. In accordance with Chapter 10 of the National Planning Policy Framework, a site-specific flood risk assessment is required for: proposals of 1 hectare or greater in Flood Zone 1, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency); and any new development in Flood Zones 2 and 3.

COMAH & explosive sites

Lithos obtain information from Landmark or Groundsure with respect to Control of Major Accident Hazards (COMAH) or explosive sites within 1km of the proposed development site. Lithos' report refers to any that are present, and recommends that the Client seeks further advice from the HSE.

Areas around COMAH sites (chemical plants etc) are zoned with respect to the implementation of emergency plans. The HSE are a statutory consultee to the local planning authority for all COMAH sites. The COMAH site may have to revise its emergency action plan if development occurs. This might be quite straightforward or could entail significant expenditure. Consequently, the COMAH site may object to a proposed development (although it is the Local Authority who have final say, and they are likely to place more weight on advice from the HSE).

Preliminary conceptual site model

The site's environmental setting (and proposed end use) is used by Lithos to assess the significance of any contamination encountered during the subsequent ground investigation.

Assessment of contaminated land is based on an evaluation of pollutant linkages (source-pathway-receptor). Contaminants within the near surface strata represent a potential source of pollution. The environment (most notably groundwater), site workers and end users are potential receptors.

Potential pollutant linkages are shown on a preliminary conceptual site model (pCSM). A CSM is essentially a cross-section through a site that reflects both the surface topography and underlying geology, and shows surface features of interest. The most significant sources of contamination are then superimposed onto this cross-section together with potential receptors (human health & controlled waters), and plausible pathways between the two. In addition to environmental issues, the CSM should also highlight geotechnical issues.

A pCSM is prepared after consideration of all available "desk study" data, and before design of the ground investigation. Data reviewed should include historical plans (with superimposition on a current-day plan), previous SI reports, geological maps etc. The pCSM, in conjunction with knowledge of site constraints (buildings, services, slopes etc) is used to design the ground investigation.

The revised CSM takes account of data obtained during the ground investigation, including the distribution of made ground, the nature and distribution of contamination etc.

02 - Ground investigation fieldwork
Generic notes – geoenvironmental investigations

General

Lithos Ground Investigations are undertaken in accordance with current UK guidance including:

- BS5930:2015 "Code of practice for site investigation"
- Eurocode 7: BS EN 1997-1:2004. Geotechnical design - Part 1: General rules
- Eurocode 7: BS EN 1997-2:2007. Geotechnical design - Part 2: Ground investigation and testing
- BS10175:2013 "Code of practice for the identification of potentially contaminated sites"
- "Technical Aspects of Site Investigation" – EA R&D Technical Report P5-065/TR (2000)
- "Development of appropriate soil sampling strategies for land contamination" – EA R&D Technical Report P5-066/TR (2001)
- Contaminated Land Reports 1 to 6, most notably CLR Report No. 4 "Sampling strategies for contaminated land"
- "Guidance on the protection of housing on contaminated land" – NHBC & EA R&D Publication 66 (2000)
- AGS: 1996 "Guide to the selection of Geotechnical Soil Laboratory Testing"

Exploratory hole locations

Exploratory hole locations are selected by Lithos, prior to commencement of fieldwork, to provide a representative view of the strata beneath the site and to target potential contaminant sources identified during the preliminary investigation (desk study). Additional exploratory locations are often determined by the site engineer in light of the ground conditions actually encountered; this enables better delineation of the depth and lateral extent of organic contamination, poor ground, relict structures etc.

Investigation techniques

Ground conditions can be investigated by a number of techniques; the procedures used are in general accordance with BS5930: 2015 and BS1377: 1990. Techniques most commonly used by Lithos include:

- Machine excavated trial pits, usually equipped with a backactor and a 0.6m wide bucket.
- Cable percussive (Shell & Auger) boreholes, typically using 150mm diameter tools and casing.
- Window or windowless sampling boreholes (dynamic sampling). Constraints associated with existing buildings, operations and underground service runs can render some sites partly or wholly inaccessible to a mechanical excavator. In such circumstances, window sampling is often the most appropriate technique. A window sampling drilling rig can be manoeuvred in areas of restricted access and results in minimal disturbance of the ground (a 150mm diameter tarmac/concrete core can be lifted and put to one side). However, it should be noted that window sampling allows only a limited inspection of the ground (especially made ground with a significant proportion of coarse material).
- Rotary percussive open-hole probeholes are typically drilled using a tri-cone rock roller or polycrystalline diamond compact (PDC) bit with air as the flushing medium. Probeholes are generally lined through made ground with temporary steel casing to prevent hole collapse.

Where installed, gas\groundwater monitoring wells typically comprise a lower slotted section, surrounded by a filter pack of 10 mm non-calcareous gravel and an upper plain section surrounded in part by a bentonite seal and in part by gravel or arisings. The top of the plain pipe is cut off below ground level and the monitoring well protected by a square, stopcock type manhole cover set in concrete, or the plain pipe is cut off just above ground level and the well protected by 100mm diameter steel borehole helmet set in concrete. Monitoring well details, including the location of the response zone and bentonite seal are presented on the relevant exploratory hole logs.

In-situ testing

Relative densities of granular materials given on the trial pit logs are based on visual inspection only, they do not relate to any specific bearing capacities.

The relative densities of granular materials encountered in cable percussive boreholes are based on Standard Penetration Test (SPT) results. SPTs are carried out boreholes, in accordance with BS 1377 1990, Part 9 Section 3.3. Where full penetration (600mm) is not possible, N values are calculated by linear extrapolation and are shown on the logs as N* = x. The strength of cohesive deposits is determined using a hand shear vane.

Shear strength test results (hand vane readings) reported on trial pit logs are considered to be more reliable than those reported on window sample logs. Significant sample disturbance occurs during window sampling and consequently shear strength results on disturbed window samples are generally lower than results obtained during trial pitting, in-situ or in large excavated blocks.

Sampling

Typically Lithos collect at least three soil samples from each exploratory hole, although in practice a greater number are often taken. The collection of a sufficient number of samples provides a sound basis upon which to schedule laboratory analysis, ensuring:

- A sufficient number of samples from each (common) site material are tested
- Horizontal and vertical coverage of the site is adequate, thereby providing a robust data set for use in the conceptual ground model
- Any localised, significant, but non-pervasive conditions are considered

Made ground and natural soils encountered in the field during a ground investigation often contain a significant proportion of coarse grained material (e.g. brick etc). Soil samples obtained during most investigations are often only truly representative of the in-situ soil mass where there is an absence of particles coarser than medium gravel; i.e the entire soil mass would pass a 20mm sieve.

Representative bulk samples of the **soil mass** are retrieved from coarse soils for specific geotechnical tests (most notably grading and compaction); this typically requires the collection of at least 10kg of soil, and occasionally >50kg. However, in the context of assessing land contamination, it is generally accepted that samples should be representative of the **soil matrix** of the stratum from which they are taken. Consequently, truly representative samples of coarse soils for subsequent contaminant analysis are not obtained - only the finer fraction is placed in sample containers. Coarse constituents not sampled would typically comprise any 'particles' with an average diameter greater than about 20mm (i.e. coarse gravel, cobble and boulder).

At present, neither ISO/IEC 17025 nor MCERTS specify sample pre-treatment with respect to stone removal. Unsurprisingly therefore UKAS accredited testing laboratories do not adopt the same approach to stones[1] – some crush and test the "as received" soil, whilst others sieve out stones and analyse only the residual soil (the sieve size used varies depending on the laboratory).

[1] *Mark Perrin. Stoned – Sample Preparation for Soils Analysis. Ground Engineering, April 2007.*

In essence, samples taken from coarser soils for contaminant analysis are "screened" by the geoenvironmental engineer in the field, and often sieved again by the laboratory during sample preparation. Geoenvironmental engineers do not typically re-calculate soil mass contaminant concentrations by taking account of the unsampled coarse fraction. Likewise, laboratories that remove stones typically report contaminant concentrations based on the dry weight of soil passing the sieve. In the context of land contamination and human health risk assessment, this is considered reasonable, because it is the soil matrix which is of greatest concern. Stones are unlikely to:

- Provide a significant source for plant uptake (consumption of vegetables)
- Remain on vegetables after washing (consumption of vegetables)
- Be eaten (accidentally by an adult, or deliberately by a child)
- Be whipped-up by the wind for dust generation (inhalation)
- Stick to the skin for any length of time (dermal contact)
- Yield toxic vapour (inhalation)

Consequently, Lithos instruct labs to remove all stones >10mm, and to report the results as dry-weight based on the mass of matrix tested. However, the laboratory are given site-specific instruction where coarse stones are coated in say oil, or impregnated with mobile contaminants such as diesel. Where the stones are predominantly natural, or inert (e.g. brick, concrete etc), removal will clearly result in higher reported concentrations, than if the stones were crushed and added to the matrix.

Where the stones include a significant proportion of contaminant-rich material (e.g. slag, fragments of galvanised metal etc) an argument could be made for crushing and analysing. However, provided the stones are stable (i.e. unlikely to disintegrate or degrade) they should not pose a significant risk to human health for the reasons stated above.

Sometimes it is necessary to obtain samples that are not representative of the wider soil matrix, for example when investigating localised, significant, but non-pervasive conditions. Any such unrepresentative samples are annotated with the suffix '*' (eg 2D*, or 4G*). Lithos' site engineer describes both the unrepresentative sample, and the soil mass from which it was been taken.

Sample Containers (for contaminant analysis). Samples of soil for contaminant testing are placed into appropriate containers (see below). Soil samples for organic analysis are stored in cool boxes, at a temperature of approximately 4°C, until delivery to the selected laboratory.

Anticipated testing	Container(s)
Asbestos identification	500ml plastic tub
pH & metals, and non-volatile organics	500ml glass jar
Speciated TPH	500ml & 50ml glass jars
VOCs (incl. naphthalene and\or GRO)	50ml glass jar

Sample Containers (for geotechnical analysis). The majority of samples are only scheduled for PI and sulphate testing, for which 500g of sample is required (a full 0.5-litre plastic tub). However, bulk bags are taken where scheduling of compaction or grading tests is proposed.

Groundwater

Where encountered during fieldwork, groundwater is recorded on exploratory hole logs. If monitoring wells are installed, groundwater levels are also recorded on one or more occasions after completion of the fieldwork. Long-term monitoring of standpipes or piezometers is always recommended if water levels are likely to have a significant effect on earthworks or foundation design.

It should be borne in mind that the rapid excavation rates used during a ground investigation may not allow the establishment of equilibrium water levels. Water levels are likely to fluctuate with season/rainfall and could be substantially higher at wetter times of the year than those found during this investigation.

Description of strata

Soils encountered during a Lithos investigation are described (logged) in general accordance with BS 5930:2015. The descriptions and depth of strata encountered are presented on the exploratory hole logs and summarised in the Ground Conditions section within the main body of text. The materials encountered in the trial pits are logged, samples taken, and tests performed on the in-situ materials in the excavation faces, to depths of up to 1.2m; below this depth these operations are conducted at the surface on disturbed samples recovered from the excavation.

Key to exploratory hole logs

Keys to logs are presented in the Appendix containing the logs. There are two Keys – Symbols & Legends and Terms & Definitions.

03 – Geotechnical laboratory testing
Generic notes – geoenvironmental investigations

General

Soil samples are delivered to the laboratory for testing along with a schedule of testing drawn up by Lithos. All tests are carried out in accordance with BS 1377:1990. The following laboratory testing is routinely carried out on a selection of samples:

- Atterberg limits & moisture contents
- Soluble sulphate & pH

Where soft, cohesive soils are encountered, one-dimensional consolidation tests are scheduled in order to assess settlement characteristics, and unconsolidated undrained triaxial compression tests to assess shear strength.

The additional tests are typically only scheduled where significant earthworks regrade is anticipated:

- Grading
- Compaction tests
- Particle density

Test results are presented as received in an Appendix to the Geoenvironmental Report.

Atterberg limits & moisture content

The Liquid and Plastic Limits of samples of natural in-situ clay are determined using the cone penetrometer method and the rolling thread test. These tests enable determination of an average Plasticity Index (PI) for each "type" of clay, although judgement is applied where variable results are reported.

PI can be related to shrinkability (low, medium or high) and then to minimum founding depth. Lithos typically only consider a soil to be shrinkable if the proportion finer than 63µm is >35%. PI results are compared against guidance given in the NHBC Standards, Chapter 4.2 (revised April 2003), which advocates the use of modified Plasticity Index (I'p), defined as:

I'p = Ip * (%< 425µm/100)

i.e. if PI is 30%, but the soil contains 80% < 425µm, then: I'p = 30 * 80/100 = 24%.

It should be noted that in accordance with the requirements of BS 1377, the % passing the 425µm sieve is routinely reported by testing labs. Lithos apply engineering judgment where PI results are spread over a range of classifications. Consideration is given to:

- The average values for each particular soil type (ie differentiate between residual soil and alluvium)
- The number of results in each class and
- The actual values

Unless the judgment strongly indicates otherwise, Lithos typically adopts a conservative approach and recommends assumption of the higher classification.

Soluble sulphate and pH

Sulphates in soil and groundwater are the chemical agents most likely to attack sub-surface concrete, resulting in expansion and softening of the concrete to a mush. Another common cause of concrete deterioration is groundwater acidity.

The rate of chemical attack depends on the concentration of aggressive ions and their replenishment at the reaction surface. The rate of replenishment is related to the presence and mobility of groundwater.

Lithos refer to BRE Special Digest 1 (SD1) "Concrete in aggressive ground. Part 1: Assessing the aggressive chemical environment" (2005). SD 1 provides definitions of:

- The nature of the site (greenfield, brownfield or pyritic)
- The groundwater regime (static, mobile or highly mobile)
- The design sulphate class (DS class) and
- The aggressive chemical environment for concrete (ACEC class)

Lithos reports clearly state each of the above for the site being considered.

The concentrations of sulphate in aqueous soil/fill extracts are determined in the laboratory using the gravimetric method. The results are expressed in terms of SO_4 for direct comparison with BS 5328:1997. The pH value of each sample was determined by the electrometric method.

SD1 also discusses determination of "representative" sulphate concentration from a number of tests. Essentially if <10 samples of a given soil-type have been tested, the highest measured sulphate concentration should be taken. If >10 samples have been tested, the mean of the highest 20% of the sulphate test results can be taken. With respect to groundwater, the highest sulphate concentration should always be taken.

With respect to pH (soil & groundwater) the value used is the lowest value if <10 samples have been tested and the mean of the lowest 20% if >10 samples have been tested.

Oedometer (Consolidation) tests

Oedometer tests measure a soil's consolidation properties, and are performed by applying different loads to a soil sample and measuring the deformation response. Typically the sample is subject to 5 incremental pressures (4 loading & 1 unloading), and the convention is for each subsequent pressure to be double the previous pressure. BS1377 suggests the **initial** pressure should be:

a) For stiff soils the effective overburden pressure*
b) For firm soils "somewhat less" than the effective overburden pressure
c) For soft soils "appreciably less" than the effective overburden pressure, usually 25 kPa or less
d) For very soft soils very low, typically 5 kPa or 10 kPa

* Effective **overburden pressure** (kNm^{-2}) = depth (m) x soil bulk unit weight (kNm^{-3})

Results from these tests are used to predict how a soil in the field will deform in response to a change in effective stress.

Triaxial tests

This test measures the mechanical properties of a soil by placing the sample between two parallel platens which apply stress in one (usually vertical) direction, with fluid used to apply a confining pressure in the perpendicular directions. During the test, the surrounding fluid is pressurized, and then stress on the platens is increased until the material in the cylinder fails.

From triaxial test data, it is possible to extract fundamental material parameters, including its angle of shearing resistance, apparent cohesion, and dilatancy angle. These parameters are then used in computer models to predict how the material will behave in a larger-scale engineering application.

Quick (single stage, Unconsolidated, Undrained tests) are most appropriate for foundation design. This is because load is applied relatively quickly, and shear strength of the clay will be lowest initially; after the applied load causes some consolidation of the ground (after drainage results in dissipation of short-term excess pore water pressure), the in-situ clays will become progressively stronger and hence the factor of safety will increase. Confining pressure is specified as equivalent to overburden pressure (kNm^{-2}).

Foundations on granular soils would use effective shear strength parameters (c' and phi') to assess safe bearing capacity, as the soil would fully drain quickly. These effective shear strength parameters could be determined from Consolidated Undrained (or sometimes the more expensive Consolidated Drained) triaxial tests, but often correlations to the SPT are used.

Unconsolidated Undrained triaxial tests are most appropriate for assessment of the stability of fill slopes on clays. Similar to foundations, the application of load gradually increases the strength of the clays and hence the critical case is the short term undrained condition.

Consolidated Undrained (or sometimes **Consolidated Drained**) triaxial tests are most appropriate for assessment of the stability of cut slopes in clays. This is because unloading of the ground leads to short term reduction in pore pressures that approximately balance the unloading, hence the soil strength is largely unchanged. Over time the reduced pore pressures suck water in, which leads in to the progressive increase in pore pressure and loss of strength. The fully drained state is critical, which must be modelled using effective strength parameters and a reasonable estimate of the long term water table conditions.

Slopes formed in granular soils would use effective shear strength parameters (c' and phi') to assess safe bearing capacity, as the soil would fully drain quickly. These effective shear strength parameters could be determined from Consolidated Undrained (or sometimes the more expensive Consolidated Drained) triaxial tests, but often correlations to the SPT are used.

Determination of analytical suite

An assessment of potential contaminants associated with the former usages of the site is undertaken with reference to CLR 8 "Potential contaminants for the assessment of land" and the relevant DETR Industry Profile(s).

Common contaminants

Common **Inorganic** Contaminants include:

- Metals, most notably cadmium, copper, chromium, mercury, lead, nickel, and zinc
- Semi-metals, most notably arsenic, selenium, and (water soluble) boron
- Non-metals, most notably sulphur
- Inorganic anions, most notably cyanides (free & complex), sulphates, sulphides, and nitrates

With respect to the terminology used by most analytical laboratories:

Total cyanide = Free cyanide + Complex cyanide

Total cyanide (CN) is determined by acid extraction; whereas free cyanide is the water soluble fraction. Complex cyanide is "bound" in compounds and is hard to breakdown. Laboratory determination of complex CN involves subjecting the sample to UV digestion for determination of both free and total CN.

Thiocyanate (SCN) is a different species combined with sulphur.

Elemental sulphur (S) and free sulphur are the same. Total sulphur is all forms, including that present in sulphates (SO_4), sulphides etc.

There are 2 forms of chromium (Cr), chromium VI and chromium III. Chromium VI is the more toxic of these. In soils, total chromium is determined by a strong aqua regia acid digestion. Chromium VI is an empirical method based on a water extract test.

Common **Organic** Contaminants include hydrocarbons, phenols, and polychlorinated biphenyls.

Petroleum is a mixture of hydrocarbons produced from the distillation of crude oil, and includes aliphatics (alkanes, alkenes and cycloalkanes), aromatics (benzene and derivatives) and hydrocarbon-like compounds containing minor amounts of oxygen, sulphur or nitrogen. Petroleum hydrocarbons can be grouped based on the carbon number range:

- GRO – Gasoline Range Organics (typically C_6 to C_{10}). Also referred to as PRO – Petroleum Range Organics
- DRO – Diesel Range Organics (typically C_{10} to C_{28})
- LRO - Lubricating Oil Range Organics (typically C_{28} to C_{40})
- MRO – Mineral Oil Range Organics (typically C_{18} to C_{44})

However, it should be borne in mind that the terms "GRO" and "DRO" analysis are purely descriptive terms, the exact definition of which varies. Total Petroleum Hydrocarbons (TPH) is also a poorly defined term; some testing laboratories regard TPH as hydrocarbons ranging from C_5-C_{40}, whereas others define TPH as C_{10}-C_{30}.

The composition of a TPH plume migrating through the ground can vary significantly; this is primarily dictated by the nature of the source (e.g. petrol, diesel, engine oil etc). Furthermore, different hydrocarbons are affected differently by weathering processes, and this can result in further variation in the chemical composition of the TPH.

Gasoline contains light aliphatic hydrocarbons (especially within the C_4 to C_5 range) that are volatile. The aromatic hydrocarbons in gasoline are primarily benzene, toluene, ethylbenzene and xylenes, referred to as BTEX. Small amounts of polycyclic aromatic hydrocarbons (PAHs) such as benzo(a)pyrene may also be present. Diesel and light fuel oils have higher molecular weights than gasoline. Consequently, they are less volatile and less water soluble. About 25 to 35% is composed of aromatic hydrocarbons. BTEX concentrations are generally low.

Heavy Fuel Oils are typically dark in colour and considerably more viscous than water. They contain 15 to 40% aromatic hydrocarbons. Polar nitrogen, sulphur and oxygen-containing compounds (NSO) compounds are also present. Lubricating Oils are relatively viscous and insoluble in groundwater. They may contain 10 to 30% aromatics, including the heavier PAHs. NSO compounds are also common.

Polycyclic Aromatic Hydrocarbons (PAHs) have more than two fused benzene rings as a structural characteristic. PAH compounds are present in both petrol and diesel, although in significantly lower concentrations than in coal tars. Certain PAH compounds are carcinogenic (benzo(a)pyrene) and\or mobile in the environment (naphthalene).

Volatile Organic Compounds (VOCs) are organic chemicals, and most are liquids that readily evaporate on exposure to air. Examples include benzene, toluene, xylene, chloroform etc. Semi-Volatile Organic Compounds (sVOCs) include phenol and benzo(a)pyrene, and have relatively low boiling points. Both groups of chemicals are readily absorbed through skin and some, such as benzene, are believed to be linked to tumour growth.

Phenols are compounds that have a hydroxyl group (-OH) attached to an aromatic ring (ie include a benzene ring and an –OH group). Most are colourless solids. A solution of phenol in water is known as carbolic acid, and is a powerful antiseptic. However, phenol vapour is toxic, and skin contact can result in burns.

Polychlorinated Biphenyls (PCBs) were used in pre-1974 transformers as dielectric fluids. PCB's are of increasing toxicity relative to the degree of chlorination. Acute symptoms of PCB poisoning are irritation of the respiratory tract leading to coughing and shortness of breath. Nausea, vomiting and abdominal pain are caused by ingestion of PCB's.

Dioxins and furans (polychlorinated dibenzodioxins and polychlorinated dibenzofurans) are some of the most toxic chemicals known; in the environment, they tend to bio-accumulate in the food chain. Dioxin is a general term that describes a group of hundreds of chemicals that are highly persistent in the environment. The most toxic compound is 2,3,7,8-tetrachlorodibenzo-p-dioxin or TCDD.

Dioxin is formed by burning chlorine-based chemical compounds with hydrocarbons. The major source of dioxin in the environment comes from waste-burning incinerators and also from backyard burn-barrels. Dioxin pollution is also affiliated with paper mills which use chlorine bleaching in their process and with the production of Polyvinyl Chloride (PVC) plastics and with the production of certain chlorinated chemicals (like many pesticides).

Methods of analysis (organic compounds)

TPH by GC-FID is an analytical technique which only detects hydrocarbons (aliphatic and aromatic) in the range C_{10} to C_{40} (volatiles, heavy tars, humic material and sulphur are not detected). The laboratory can provide a broad, 'banded' breakdown of the TPH results into gasoline range organics (GRO), diesel range organics (DRO) and heavier lubricating oil range organics (LRO), or fully speciated results with the reporting of hydrocarbon concentrations in 14 specific carbon bandings based upon behavioural characteristics, e.g. aliphatic C_6 to C_8, aromatic C_{10} to C_{12} etc.

Speciated VOC (by GC-MS) analysis quantifies the concentrations of 30 USA-EPA priority compounds. These include chlorinated alkanes and alkenes (in the molecular weight range chloroethane to tetrachloroethane); trimethylbenzenes; dichlorobenzenes; and the 4 BTEX compounds (benzene, ethyl-benzene, toluene & xylene).

Speciated sVOC by (GC-MS) analysis quantifies the concentrations of a variety of organic compounds, including the 16 USA-EPA priority PAHs, phenols, 7 USA EPA priority PCB congeners, herbicides & pesticides.

Note: PAHs are hydrocarbons and consequently (where present) will be picked-up when scheduling TPH by GC-FID.

Note: Risk assessment models require physiochemical properties (solubilities, toxicities etc) of compounds in order to model their behaviour in the environment. These physiochemical properties cannot be derived from a single "TPH", "GRO" or "DRO" value. However, the carbon banded fractions can be used in risk assessment models.

Current UK guidance

The UK approach to contaminated land is set out in Contaminated Land Report No. 11 (2004) "Model Procedures for the Management of Land Contamination". The approach is based upon risk assessment, where risk is defined as the combination of the probability of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.

In the context of land contamination, there are three essential elements to any risk: (1) a contaminant source; (2) a receptor (eg controlled water or people); and (3) a pathway linking (1) and (2). Risk can only exist where all three elements combine to create a pollutant linkage. Risk assessment requires the formulation of a conceptual model which supports the identification and assessment of pollutant linkages.

Lithos adopt a tiered approach to risk assessment, consistent with UK guidance and best practice. The initial step of such a risk assessment (or Tier 1) is the comparison of site data with appropriate UK guidance levels, Lithos risk-derived screening values, or remedial targets. It should be noted that exceedance of Tier 1 does not necessarily mean that remedial action will be required.

Soil screening values used by Lithos

In March 2002 DEFRA and the Environment Agency published a series of technical papers (R&D Publications CLR 7, 8, 9 and 10) outlining the UK approach to the assessment of risk to human health from land contamination. In 2008 CLR 7, 9 and 10 and all corresponding SGV and Tox reports were withdrawn and superseded by new guidance including:

- Guidance on Comparing Soil Contamination Data with a Critical Concentration - CL:AIRE and CIEH, May 2008
- Evaluation of models for predicting plant uptake of chemicals from soil - Science Report – SC050021/SR
- Human health toxicological assessment of contaminants in soil - Science Report: SC050021/SR2
- Updated technical background to the CLEA model - Science Report: SC050021/SR3
- CLEA Software Handbook (Version 1.071), Science report: SC050021/SR4
- Compilation of data for priority organic pollutants for derivation of Soil Guideline Values - Science Report: SC050021/SR7

The approach set out in these documents represents current scientific knowledge and thinking; and includes the Contaminated Land Exposure Model (CLEAv1.06). The Environment Agency are in the process of using this updated approach to regenerate a selection of Soil Guideline Values (SGVs).

CLEA SGVs were derived for standard land use scenarios predominantly in the context of Part IIA, using a conceptual site model (CSM) defined in SR3. Lithos have incorporated amendments to the CSM used to derive SGVs, that more accurately reflect redevelopment within the planning regime; consequently, Lithos have not adopted any published SGV as a screening value.

The CLEA conceptual site model assumes a source located in a sandy loam, with 6% soil organic matter (SOM) - equivalent to 3.5% total organic carbon (TOC). However, where the average TOC value for a particular soil type is significantly lower than the 3.5%, evaluation of Lithos Screening Values should be undertaken and a site specific risk assessment will usually be required. Other CLEA default characteristics adopted by Lithos are:

Sandy Loam characteristics (source)	Default values adopted
Total porosity (fraction)	0.53
Water filled porosity (fraction)	0.33
Air filled porosity (fraction)	0.2

Lithos have derived Screening Values for four different CSMs (scenarios); these are:

A - Residential with gardens, but no cover (or only up to 300mm)

B - Residential with gardens and 600mm 'clean' cover

C - Residential apartments with landscaping (i.e. no home grown produce)

D - Commercial/industrial with landscaping

E – Importation of soil cover

The **exposure** pathways considered for each scenario are detailed in the table below.

Scenario	Land use	Pathways	Justification
A	Residential with garden, but no cover (or only up to 300mm)	• Direct ingestion of soil • Dermal contact • Consumption of vegetables & soil attached to vegetables • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust	Minimal cover – insufficient to break any pathways therefore all exposure pathways are relevant.
B	Residential with garden minimum 600mm cover	• Inhalation of indoor vapours • Inhalation of outdoor vapours	The 600mm cover removes the risk from all pathways other than inhalation.
C	Residential apartments with landscaped areas and minimum 300mm cover	• Direct ingestion of soil • Dermal contact • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust	All pathways applicable due to possible exposure from landscaped areas. However consumption of home grown produce not included as unlikely to be grown in landscaped areas. Where vegetables are to be grown site specific QRA may be required.
D	Commercial/ industrial with landscaped areas no cover	• Direct ingestion of soil • Dermal contact • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust	All pathways applicable due to possible exposure from landscaped areas. Assumed the commercial development consists of offices to provide a conservative assessment.
E	Importation of soil for cover in garden and landscaped areas	• Direct ingestion of soil • Dermal contact • Consumption of vegetables & soil attached to vegetables • Inhalation of outdoor vapours and dust	Material used as cover to break existing pathways therefore all direct and indirect pathways relevant; however cover is **not** placed below plots therefore indoor inhalation is not relevant.

Lithos have assumed the source of contamination is directly below the building foundations; i.e. a depth to source of 0.15m as opposed to the CLEA default of 0.65m. This assumption provides for a more conservative approach than the UK default. This adjustment has been included to account for sites where made ground is re-engineered to enable new buildings to be established on raft foundations. In such situations contamination may lie directly beneath the foundation.

The Soil Screening Values referred to in this document are **not** intended to be used when considering potential risks associated with:

- Existing land uses in the context of Part IIA of the Environment Protection Act 1990;
- End uses such as allotments, sports fields, children's playgrounds, care homes, hospitals etc; and
- Controlled waters.

In December 2013 Defra published the results of research project SP1010 – Development of Category 4 Screening Levels (C4SLs) for Assessment of Land Affected by Contamination. The objective of this project was provide technical guidance in support of Defra's revised Statutory Guidance for Part 2A of the Environmental Protection Act 1990 (Part 2A). The revised Statutory Guidance, published in April 2012, introduced a new four-category system for classifying land under Part 2A where Category 1 includes land where the level of risk is clearly unacceptable, and Category 4 includes land where the level of risk posed is acceptably low. Project SP1010 aimed to deliver:

- A methodology for deriving C4SLs for four generic land-uses comprising residential, commercial, allotments and public open space; and
- Demonstration of the methodology, via derivation of C4SLs for 6 substances – arsenic, cadmium, chromium IV, lead, benzene & benzo(a)pyrene.

The methodology for deriving both the previous Soil Guideline Values and the new Category 4 Screening Levels is based on the Environment Agency's Contaminated Land Exposure Assessment (CLEA) methodology. Development of C4SLs has been achieved by modifying the toxicological and\or exposure parameters used within CLEA (while maintaining current exposure parameters).

The Part 2A Statutory Guidance was developed on the basis that C4SLs could be used under the planning regime. However, policy responsibility for the National Planning Policy Framework falls to the Department for Communities and Local Government. Defra anticipate that, where they exist, C4SLs will be used as generic screening criteria, and Lithos consider C4SLs to be suitable for use as Tier 1 Screening Values. Lithos have discussed this matter with both NHBC and YALPAG (collection of Yorkshire & Lincolnshire local authorities) and received confirmation that they are satisfied with this approach.

With respect to **inorganic** determinands, Lithos derived Tier 1 values for the five Scenarios A to E are presented below:

Inorganic contaminant	Tier 1 assessment criteria (mg/kg) for Scenarios A to E							Comments/notes
	SGV*	C4SL*	A	B	C	D	E	
As	32	37	37	Use (A) in SI Report for initial "screen". If >5 x A, then consider increase of cover to 1,000mm	40	640	37	C4SL adopted
Cd	10	26	26		149	410	26	C4SL adopted
Cr			3,000		3,000	30,000	3,000	Assumes Cr is CrIII
Pb	450	200	200		310	2,330	200	C4SL adopted
Ni	130		127		127	1,700	127	Assessment of health risk only
Se	350		350		595	13,000	434	
Hg	170		169		238	3,640	199	Assumes in an inorganic compound
B			5		5	5	5	Based on phytotoxic risks as plants are the more sensitive receptor (Cu is pH dependant)
Cu			80-200		80-200	80-200	80-200	
Zn			200		200	200	200	

With respect to **organic** determinands, Lithos derived Tier 1 values for the five Scenarios A to E are presented below:

Organic contaminant (all sourced via CLEA)	Tier 1 assessment criteria (mg/kg) for Scenarios A to E							Comments/notes
	SGV*	C4SL*	A	B	C	D	E	
Benzene	0.33	0.87	0.9	0.9	3.3	98	N/A	C4SL adopted
Toluene	610		600	3,000	2,700	5,000	N/A	Calculated value over 10,000
Ethyl Benzene	350		350	932	843	5,000	N/A	
Xylenes	240		246	327	321	5,000	N/A	
Phenol	420		412	2,400	519	5,000	N/A	
PCBs			2	8	2	38	N/A	Based on toxicity of EC7
Benzo(a)pyrene		5	5	25	5.3	76	5	C4SL adopted. Where source is not a coal tar
Naphthalene			8	9	9	1,000	12	
Gasoline Range Organics			30	34	34	5,000	45	See 3-step assessment of TPH below
Diesel Range Organics			151	156	154	5,000	219	
Lubricating Range Org			1,000	5,000	2,000	5,000	1,000	

* *For a residential end use*

The significance of PAHs can be determined by considering indicator compounds. In most cases benzo(a)pyrene (BaP) is adopted as an indicator due to the amount of toxicological data available and has been used by various authoritative bodies to assess the carcinogenic risk of PAHs in food. A surrogate marker approach can be used to estimate the toxicity of a mixture of PAHs in soil using toxicity data for individual indicator compounds within that mixture. Exposure to the surrogate marker is assumed to represent exposure to all PAHs in that matrix. The surrogate marker approach relies on a number of assumptions:

- Surrogate marker (bap) must be present in all soil samples
- Profile of the different pah relative to bap should be similar in all samples
- PAH profile in the soil samples should be similar to that used in the pivotal toxicity study[1]

[1] SP1010 Appendix E, Provisional C4SIs for benzo(a)pyrene as a surrogate marker for PAHs, CL:AIRE 2013

To assess the PAH profile in a soil sample, the ratio of the seven genotoxic PAHs (benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, chrysene, dibenz[a,h]anthracene and indeno[1,2,3-c,d]pyrene), relative to BaP, should be calculated. The ratio relative to BaP should lie within an order of magnitude above and below the mean ratio to BaP.

Naphthalene should also be considered separately against its generic screen. Whilst classed as a PAH, naphthalene is more volatile and mobile in the environment than most other PAHs. As such the significance of naphthalene cannot be considered within the surrogate marker approach.

Similarly, **TPH** cannot be assessed as a single "total" value, and reference has been made to the Environment Agency's document P5-080/TR3, "The UK approach for evaluating human health risks from petroleum hydrocarbons in soils". This document supports the assumptions and recommendations made by the US Total Petroleum Hydrocarbons Criteria Working Group (TPHCWG). The TPHCWG have broken down "TPH" into representative constituent fractions or "EC Bandings". The TPHCWG have derived a series of physiochemical and toxicological parameters for each of the bandings.

The significance of speciated TPH results can be assessed by following the 3 steps outlined in the tables below.

Step	Result	Action
1. Consider indicator compounds: Are BTEX, naphthalene, benzo(a)pyrene above their respective Tier 1 values?	Yes	Remediation or dQRA required
	No	Proceed to Step 2
2. Consider individual TPH fractions: are they above respective screening values?	Yes	Remediation or dQRA required
	No	Proceed to Step 3
3. Assess Cumulative effects: Is the calculated Hazard Index for each source >1	Yes	Remediation or dQRA required
	No	TPH compounds pose no significant risk

Step 1 - Assessing indicator compounds

TPH fraction Indicator compound	End use specific screening value (mg/kg)			
	A: Residential no cover	B: Residential with 600mm cover	C: Residential no gardens	D: Commercial\ industrial
Benzene	0.9	0.9	3.3	98
Toluene	600	3,000	2,700	5,000
Ethyl Benzene	350	932	843	5,000
Xylenes	246	327	321	5,000
Naphthalene	8	9	9	1,000
Benzo(a)pyrene	5	25	5.3	76

Step 2 - Assessing individual TPH fractions

TPH fraction		End use specific screening value (mg/kg)			
		A: Residential no cover	B: Residential with 600mm cover	C: Residential with no gardens	D: Commercial/ industrial
Aliphatic 5-6	GRO	41	41	42	5,000^ per fraction
Aliphatic 6-8	GRO	125	125	125	
Aliphatic 8-10	GRO	31	31	32	
Aliphatic 10-12	DRO	151	156	154	
Aliphatic 12-16	DRO	500^	500^	500^	
Aliphatic 16-21	DRO	1,000^	5,000#	1,000^	
Aliphatic 21-35	LRO	1,000^	5,000#	1,000^	
Aromatic 5-7	GRO	100	123	122	
Aromatic 7-8	GRO	30	34	34	
Aromatic 8-10	GRO	47	50	50	
Aromatic 10-12	DRO	215	287	266	
Aromatic 12-16	DRO	689	1,000*	1,000*	
Aromatic 16-21	DRO	1,000^	5,000#	1,000^	
Aromatic 21-35	LRO	1,000^	5,000#	1,000^	

* Calculated Screening Value exceeded soil saturation limit and could indicate free product, therefore calculated soil saturation limit adopted as a target

^ Calculated Screening Value close to soil saturation limit, screening value selected by Lithos considering visual and olfactory impacts.

Five times the screening value for Scenario A.

Step 3 - Assessing Cumulative Effects

$$HI = \sum_{F_i=1}^{16} HQ\ F_i = \frac{Measured\ concentration\ F_i\ (mg\,kg^{-1})}{SGV\ F_i\ (mg\,kg^{-1})}$$

where HI = Hazard Index
HQ = Hazard Quotient
F_i = Fraction $_i$
SGV = Soil Guideline Value

Other screening values used by Lithos

Tier 1 risk assessment of **hazardous gas** is undertaken through reference to the following documents (and further information is presented in Generic Note No. 5 – Hazardous Gas):

- Approved Document C, Building Regulations 2000
- Boyle & Witherington (2007) – Guidance on evaluation on development proposals on sites where methane and carbon dioxide are present, incorporating "traffic lights". Report Ref. 10627-R01-(02), for NHBC
- CIRIA C665 (2007) – Assessing risks posed by hazardous ground gases to buildings
- BS 8485:2015 – Code of Practice for the characterisation & remediation from ground gas in affected developments

With respect to the assessment of potential **phytotoxic effects** of contaminants, Lithos refer to "The Soil Code" (MAFF, 1998) for copper and zinc. The CLEA SGV is adopted for nickel due to its human health effects.

The potential risk to **building materials** is considered through reference to relevant BRE Digests, with particular emphasis on BRE Special Digest 1, 'Concrete in aggressive ground', 2005.

With respect to the interpretation of the **calorific values**, at present there are no accepted methods to assess whether a sample is combustible and under what circumstances it might smoulder. Some guidance is given in ICRCL Note 61/84 "Notes on the fire hazards of contaminated land" which states that: "*In general … it seems likely that materials whose CV's exceed 10MJ/kg are almost certainly combustible, while those with values below 2MJ/kg are unlikely to burn*".

Tier 1 **groundwater** risk assessments are undertaken by comparing leachate or groundwater concentrations with the appropriate water quality standard. Tier 1 Screening Values have been discussed with the Environment Agency, and typically those in **bold** below are adopted.

Analyte	Source of Tier 1 Screening Value (µg/l)			
	Surface water (Abstraction for drinking) 1996	Water Supply Regulations 2000	Water Framework Directive	EA Advice
Arsenic	50	10	**50**	
Selenium	10	**10**		
Cadmium	5	5	**1.5**	
Chromium	50	50	**32**	
Copper	50	2,000	**28**	
Lead	50	10	**7.2**	
Nickel		20	**20**	
Zinc	3,000		**125**	
Boron		**1,000**		
Mercury	1	1	**0.07**	
Petroleum Hydrocarbons				**10**
1,1,1-Trichloroethane			**100**	
1,1 Dichloroethane				**100**
1,2-Dichloroethane		3	**10**	
1,1-Dichloroethene				**100**
Benzene		1	**10**	
Ethylbenzene				**10**
Tetrachloroethene		10	**10**	
Toluene			**50**	
Trichloroethene		10	**10**	
Vinyl Chloride		**0.5**		
Trichloromethane			**2.5**	
Xylenes			**30**	
Chloroethane				**100**

Waste classification & WAC

In the context of waste soils generated by remediation and\or groundworks activities on brownfield sites, the following definitions (from the Landfill Regulations 2002) apply:

- Inert (e.g. uncontaminated 'natural' soil, bricks, concrete, tiles & ceramics)
- Non-Hazardous (e.g. soil excavated from a contaminated site which contains dangerous substances, but at concentrations below prescribed thresholds)
- Hazardous (e.g. soil excavated from a contaminated site which contains dangerous substances at concentrations above prescribed thresholds)

Dangerous substances include compounds containing a variety of determinants commonly found in contaminated soils on brownfield sites, for example arsenic, lead, chromium, benzene etc.

Landfill operators require Waste Acceptance Criteria (WAC) laboratory data, if soil waste is classified as **hazardous**, and such waste must have been subjected to pre-treatment. However, subject to WAC testing it may be possible to classify it as stable, non-reactive hazardous waste, which can be placed within a dedicated cell within the non-hazardous landfill.

Lithos typically only include WAC analysis in site investigation proposals and reports, if significant off-site disposal (of soil classified as hazardous waste) is anticipated, for example where redevelopment proposals include basement construction etc. If off-site disposal of soils classified as hazardous waste during redevelopment is anticipated, then WAC analysis should be scheduled at an early stage in the remediation programme. However, organic compounds (BTEX, TPH, PAH etc) are the most common contaminants that result in soils being classed as hazardous, and these contaminants can often be dealt with by alternative technologies (e.g. by bioremediation or stabilisation) and consequently retention on site is often possible.

It should be noted that **non-hazardous** soil waste can go to a non-hazardous landfill facility; no further testing (e.g. WAC) is required.

Possible action in event of Tier 1 exceedance

Should any of the Tier 1 criteria detailed above be exceeded, then three potential courses of action are available. (The first is only applicable in terms of human health, but the second and third could also be applied to groundwater or landfill gas).

1. Undertake further statistical analysis following the approach set out in "*Guidance on Comparing Soil Contamination Data* with *a Critical Concentration - CL:AIRE and CIEH, May 2008*" in order to determine whether contaminant concentrations of inorganic contaminants within soil\fill actually present a risk (only applicable to assessing the risk to human health).
2. Carry out a more detailed quantitative risk assessment in order to determine whether contamination risks actually exist.
3. Based on a qualitative risk assessment, advocate an appropriate level of remediation to "break" the pollutant linkage - for example the removal of the contaminated materials or the provision of a clean cover.

Prior to undertaking any statistical analysis the issue of the **averaging area** requires further consideration. The CL:AIRE\CIEH document still refers to CLR 7, which suggests averaging area should reflect receptor behaviour and therefore might be a single garden, or an open area used by the local community as a play area. This approach to averaging areas is considered applicable within the context of Part IIA of the Environmental Protection Act (EPA) 1990, in terms of an existing residential development.

However, Lithos consider the concept of a single garden as an averaging area to be inappropriate with respect to brownfield redevelopment, which is regulated by the planning regime. In this context, contamination across the entire site needs to be characterised by reference to the Conceptual Site Model. Consequently, Lithos gather and analyse sample results by fill type, and\or by former use in a given sub-area of the site, before undertaking statistical analysis; ie the averaging area is associated with the extent of a particular fill type, or an area affected by spillage\leakage.

In terms of brownfield redevelopment, this is considered a more appropriate methodology which provides a more representative sample population for statistical analysis. As such the entire site is considered in terms of the proposed end use, be this residential with, or without gardens.

Analysis by soil\fill type is appropriate for essentially immobile contaminants associated with a particular fill type, for example arsenic in colliery spoil, metals in ash & clinker, sulphate in plaster-rich demolition rubble etc.

Analysis by former use is appropriate where more mobile contaminants have entered the ground, for example diesel associated with leakage from a former fuel tank, downward migration of leachable metals through granular materials, various soluble contaminants present in a wastewater leaking into the ground via a fractured sewer etc. In these circumstances, it may be appropriate to undertake statistical analysis of sample results from a variety of different soil\fill types. However, consideration would have to be given to factors such as porosity which might influence impregnation of a mobile contaminant into the soil mass, ie contamination would normally be more pervasive and significant in granular soils than cohesive soils

05 – Hazardous gas
Generic notes – geoenvironmental investigations

General

Hazardous gas is considered to be any mixture of potentially explosive, toxic or asphyxiating gases, most notably methane, carbon dioxide and oxygen (deficiency). In addition, radon, a naturally occurring radioactive gas is also considered. Further information about radon is included in Notes 01 – Environmental Setting.

Assessment of potential risks associated with hazardous gas are based on a review of data obtained from the Landmark Information Group, the Environment Agency and the Local Authority and the British Geological Survey. Reference is also made to historical OS plans, which are inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

Where landfilling has occurred within 250m of the site boundary, the Local Planning Authority may request a landfill gas investigation in accordance with the Town and Country Planning General Development Order, 1988.

Sources

Potential sources of hazardous gas include:

- Landfill sites
- Made ground, especially where significant depths are present
- Shallow mineworkings associated with coal extraction
- Geological strata, including peat, organic silts, coal and limestone (reaction with acidic waters), granite (radon)
- Groundwater can sometimes act as a "carrier" for hazardous gas
- Leakages from pipelines or storage tanks
- Sewers, septic tanks and cess pits

Generation

Wherever biodegradable material is deposited, landfill gas (principally a mixture of methane and carbon dioxide) is likely to be generated by microbial activity. Carbon dioxide is an asphyxiant and toxic; methane is flammable and a mixture containing between 5% and 15% methane by volume in air is explosive. Landfill gas in the ground is unlikely in itself to pose a significant risk, though it may damage vegetation. However, infiltration of landfill gas into confined spaces (e.g. cellars, services, etc) may give rise to considerable risk.

There is no typical figure for the length of time that landfill gas will be evolved, but at many sites significant gas generation continues for at least 15 years after the last deposit of waste.

Migration

Gas migration from a landfill site may occur in several ways. It may migrate through adjacent strata; the distance of migration being dependent on the pressure gradients, volume of gas and permeability of the strata. Where there are faults, cavities and fissures within the strata, gas may move considerable distances. Other migration pathways for gas include man-made features such as mine shafts, roadways and underground services.

Gas migration is influenced by a number of climatic factors, such as atmospheric pressure variations, water table level variations and the influence of a covering of snow or ice over the surface of the site and surrounding area.

Gas monitoring procedure

Lithos adopt a standard gas monitoring procedure, in accordance with CIRIA guidance. This procedure involves the measurement, in the following order of:

- Atmospheric temperature, pressure and ambient oxygen concentration
- Gas emission rate
- Methane, oxygen and carbon dioxide concentrations using an infra-red gas analyser
- Standing water level using a dipmeter.

In addition, ground conditions at each sampling location are recorded together with prevailing weather conditions and any other observations such as any vandalism. Where samples of gas are required for laboratory analysis, Gresham Tubes or multi-layer Tedlar / ALTEF sampling bags are used. Gas concentrations in the well are typically recorded immediately before and after retrieval of a sample.

Current guidance

CIRIA Report 151 (1995)[i] identified that there was inadequate guidance on trigger concentrations for ground gases. CIRIA concluded that the most important aspect of a gas regime below or adjacent to a site was the surface emission rate, i.e. how quickly the gas is coming out of the ground. The lower the surface emission rate the lower the risk. CIRIA Report C665 (2007)[ii] advocates two methodologies for characterising sites:

A – All developments except low rise housing. The advocated methodology is that proposed by Wilson & Card, 1999[iii]

B – Low rise housing. An alternative (traffic light) methodology, derived by Boyle and Witherington, 2006[iv] for NHBC

Both methodologies refer to Gas Screening Values (GSV); previously referred to as limiting borehole gas volume flow.

A – All developments except low rise housing

(Wilson & Card, 1999)[v] revised Table 28 of CIRIA 149[v] in terms of borehole gas volume flow rate (now GSV) in order to achieve a more consistent design of protection measures. This was done to reflect the importance of recognising the gas surface emission rate. Wilson & Card then developed a method for classifying gassing sites (Table 1 below), which took into account the combined gas concentration and GSV.

Characteristic Situation	Gas Screening Value, CH_4 or CO_2 (l/hr)	Additional limiting factors	Typical source of generation
1	<0.07	Methane not to exceed 1% v/v and carbon dioxide not to exceed 5% v/v	Natural soils with low organic content
2	<0.7	Borehole air flow rate not to exceed 70 litre/hr otherwise increase to Characteristic Situation 3	Natural soil, high peat/organic content
3	<3.5		Old landfill, inert waste, mineworkings flooded.
4	<15	Quantitative Risk Assessment required to evaluate scope of protection measures.	Mineworkings – susceptible to flooding, completed landfill, inert waste
5	<70		Mineworkings unflooded, inactive
6	>70		Recent landfill site

Notes: *Borehole flow rate = volume of gas (regardless of composition) which is escaping from well (l/hr). Gas Screening Value (litre/hour) = gas concentration (%) / 100 x borehole flow rate (l/hr). To facilitate design implementation, the limiting values for both methane and carbon dioxide are identical.*

B – Low rise housing.

NHBC have developed a characterisation system similar to that of Wilson & Card above, but specific to low-rise housing development (Boyle and Witherington) (Table 8.7). This approach compares measured gas emission rates with generic "Traffic Lights". The Traffic Lights include "Typical Maximum Concentrations" for initial screening, and risk-based Gas Screening Values (GSVs) for consideration of situations where the Typical Maximum Concentrations are exceeded. Calculations are carried out for both methane and carbon dioxide and the worst case adopted in order to establish the appropriate protection measures.

Table 8.7 NHBC Traffic light system for 150 mm void

Traffic Light Classification	Methane [1]		Carbon Dioxide [1]	
	Typical Maximum Concentration [5] (%v/v)	Gas Screening Value [2,4,6] (l/hr)	Typical Maximum Concentration [5] (%v/v)	Gas Screening Value [2,3,4,6] (l/hr)
Green	1	0.16	5	0.78
Amber 1	5	0.63	10	1.56
Amber 2	20	1.56	30	3.13
Red				

Notes:

1. The worst gas-regime identified at the site, either methane or carbon dioxide, recorded from monitoring in the worst temporal conditions, will be the decider for which Traffic Light and GSV is allocated.
2. Generic GSVs are based on guidance contained within "The Building Regulations: Approved Document C" (2004) and assume a sub-floor void of 150 mm thickness.
3. A leak of gas from the sub-floor void into a small room (e.g. downstairs toilet with soil pipe potentially passing into sub-floor void) of dimensions 1.50m × 1.50m × 2.50m, with a total room volume of 5.63m^3 has been considered.
4. The GSV, in litres per hour, is as defined in Wilson and Card (1999) as the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered.
5. The Typical Maximum Concentrations can be exceeded in certain circumstances should the conceptual site model indicate it is safe to do so. This is where professional judgment will be required, based on a thorough understanding of the gas regime identified at the site where monitoring in the worst temporal conditions has occurred.
6. The GSV thresholds should not generally be exceeded without completion of a detailed gas risk assessment taking into account site-specific conditions.

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i *Harries CR, Witherington PJ and McEntee JM (1995). Interpreting measurements of gas in the ground. CIRIA Report 151*

ii *CIRIA (2007) – Assessing risks posed by hazardous ground gases to buildings.*

iii *Wilson SA and Card GB (February 1999). Reliability and Risk in Gas Protection Design. Ground Engineering.*

iv *Boyle & Witherington (2006) – Guidance on evaluation on development proposals on sites where methane and carbon dioxide are present, incorporating "traffic lights". Report Ref. 10627-R01-(02), for NHBC*

v *Wilson SA and Card GB (February 1999). Reliability and Risk in Gas Protection Design. Ground Engineering.*

06 - Soakaways
Generic notes – geoenvironmental investigations

Background

Soakaways have been the traditional way to dispose of stormwater from buildings and paved areas remote from a public sewer or watercourse. In recent years, soakaways have been used within urban, fully-sewered areas to limit the impact on discharge of new upstream building works, and to avoid costs of sewer up-grading outside a development.

Soakaways are increasingly seen as a more widely applicable option alongside other means of stormwater control and disposal. Soakaways must store the immediate stormwater run-off and allow for its efficient infiltration into the adjacent soil. They must discharge their stored water sufficiently quickly to provide the necessary capacity to receive run-off from a subsequent storm. The time taken for discharge depends upon the soakaway shape and size, and the surrounding soil's infiltration characteristics. Soakaways can be constructed in many different forms and from a range of materials.

BRE Digest 365, DG365: 1991 describes design and construction procedures, explains how to calculate rainfall design values and soil infiltration rates, and gives design examples. Further advice is provided in **NHBC** Standards Chapter 5.3 (Section 9 & Appendix F), **Building Regulations** Section 3 of Approved Document H (Drainage & Waste Disposal), and Chapter 13 of **CIRIA's** SUDS Manual (C753:2015).

Soakaways should generally be built on land lower than or sloping away from buildings and be sited **at least 5m** from the foundations of a building.

BRE365 states that '**Groundwater should not rise to the level of the base of the soakaway** during annual variations in the water table' this is further reinforced in Chapter 13 of CIRIA C753:2015 which states that: "*A minimum distance of 1m between the base of the infiltration system and the maximum likely groundwater level should always be adopted. This is to minimise the risk of groundwater rising into the infiltration component and reducing the available storage volume, to protect the functionality of the infiltration process by ensuring a sufficient depth of unsaturated material and to protect the groundwater from any contamination in the run-off*". There may be a requirement to install groundwater monitoring wells at a site in order to monitor seasonal variations in groundwater level at least over a wet winter period.

Soakaways should **not be sited on sloping sites**, an assessment should also be made to ensure that infiltrating water will not cause a rise in groundwater levels, waterlogging of downhill areas or springs, and that slopes are not made unstable.

Made ground (and ground within 5m of deep fill) is not generally regarded as suitable for soakaways, due to the potential for inundation settlement and the leaching of contaminants.

Chalk: CIRIA C574:2002 notes that concentrated ingress of water into the chalk can initiate dissolution, particularly in low-density chalk. For this reason, soakaways should be sited well away from foundations for structures, roads or railways:-

- in areas where dissolution features are known to be prevalent, soakaways should be avoided but, if unavoidable, should be sited at least 20m away from foundations etc
- where the chalk is of low density (weak), or where density is not known, soakaways should be sited at least 10m away from foundations
- where the chalk is of medium density, or higher (moderately weak), soakaways should be sited at least 5m away from foundations

Test methodology

Lithos undertake soakaway tests in general accordance with BRE Digest 365 "Soakaway Design". The BRE Digest recommends that each soakaway pit is filled and allowed to drain three times to near empty; the three fillings to be on the same or consecutive days. However, each test can take over 2 hours to complete. Consequently, at site investigation / feasibility stage, testing is usually undertaken in a 'broad sweep', relatively widely spaced; often only 1 or 2 fills. The drainage designer reviews SI data and if soakaways look feasible, commences design with the incorporation of soakaways. Prior to finalising design, the Drainage Engineer will usually recommend further soakaway testing: (a) within 25m of proposed chamber locations; and (b) to include 3 fills.

Whilst in theory 3 fills is fine, in practice it is often not straightforward. Where drainage rates are quick (draining < 1 hour), allowing 3 fills per pit within a day, even larger water bowsers (say 2,300 gallon/10,000 litre) will run out of water after testing in two pits. Re-filling can take 2 to 3 hours depending on available water supplies etc. So, it is typically only possible to do fully compliant BRE 365 testing in 4 pits a day.

Where infiltration is moderate (a fill drains in say 2 to 4 hours), soakaways may be considered feasible, but it will not usually be possible to complete 3 fills in a day. Therefore, it becomes necessary to leave pits open overnight (usually with a consequent need for herras fencing, site security etc, or the use of stone backfill).

Infiltration rates

Infiltration rates for each soakaway test are calculated (where possible) in accordance with BRE Digest 365. This design takes into account the time of emptying the soakaway pit between 25% and 75% of its effective depth. The effective depth is calculated from the starting water level to the soakaway pit base. Where the water level did not fall to 25% effective depth, the data was interpolated in order to obtain a representative infiltration rate.

Soakaway design

Soakaway design should be carried out by a suitably qualified and experienced Drainage Engineer, in accordance with BRE Digest 365 using the infiltration rates calculated from soakaway testing during a ground investigation.

It is generally assumed that soakaways become impracticable on residential developments when:

- A chamber type design requires a square pit with side length in excess of 1.8m, or an effective depth greater than 1.5m.
- A trench type design requires a length greater than about 10m, or an effective depth greater than 1.5m.

Increasing the soakaway effective depth might offer a solution, but consideration should be given to:

- Standing groundwater level
- Depth to base of permeable strata
- Cost of excavation

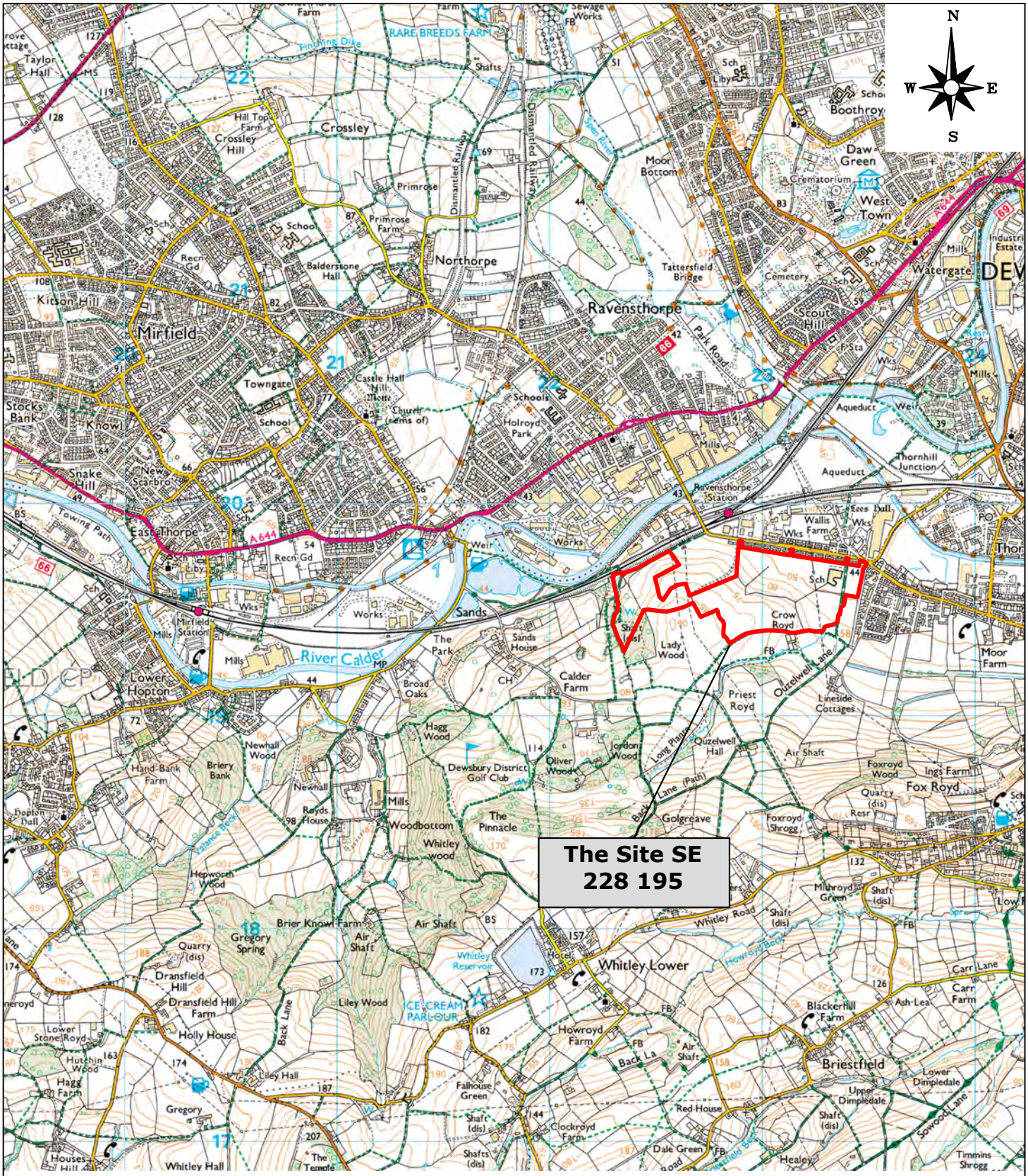
Soakaway percolation in some rock types is predominately via the vertical joints within the rock mass. The relatively small-scale soakaway test pits may not intercept such joints and this can result in variable test results. However, it is likely that the larger surface area of a completed soakaway within the development will intercept such joints.

The drainage designer submits designs for approval to:

- The Lead Local Flood Authority (LLFA), usually part of the Local Authority (e.g. NYCC). The LLFA are a consultee to the planning authority. They review the full technical design to ensure that proposals (both plots & highways) are satisfactory. The LLFA may also set standards for soakaway design (NYCC have, and these now require 3 fills and soakaway testing within 25m of proposed chamber locations).
- Local Authority Highways Dept. The Highways Authority adopt highways drainage, so review drainage design (via approval of a Section 38 submission). They also visit site to inspect construction.
- Building warranty provider (e.g. NHBC, Premier etc), if soakaways are proposed for roof & driveway waters.

Appendix B

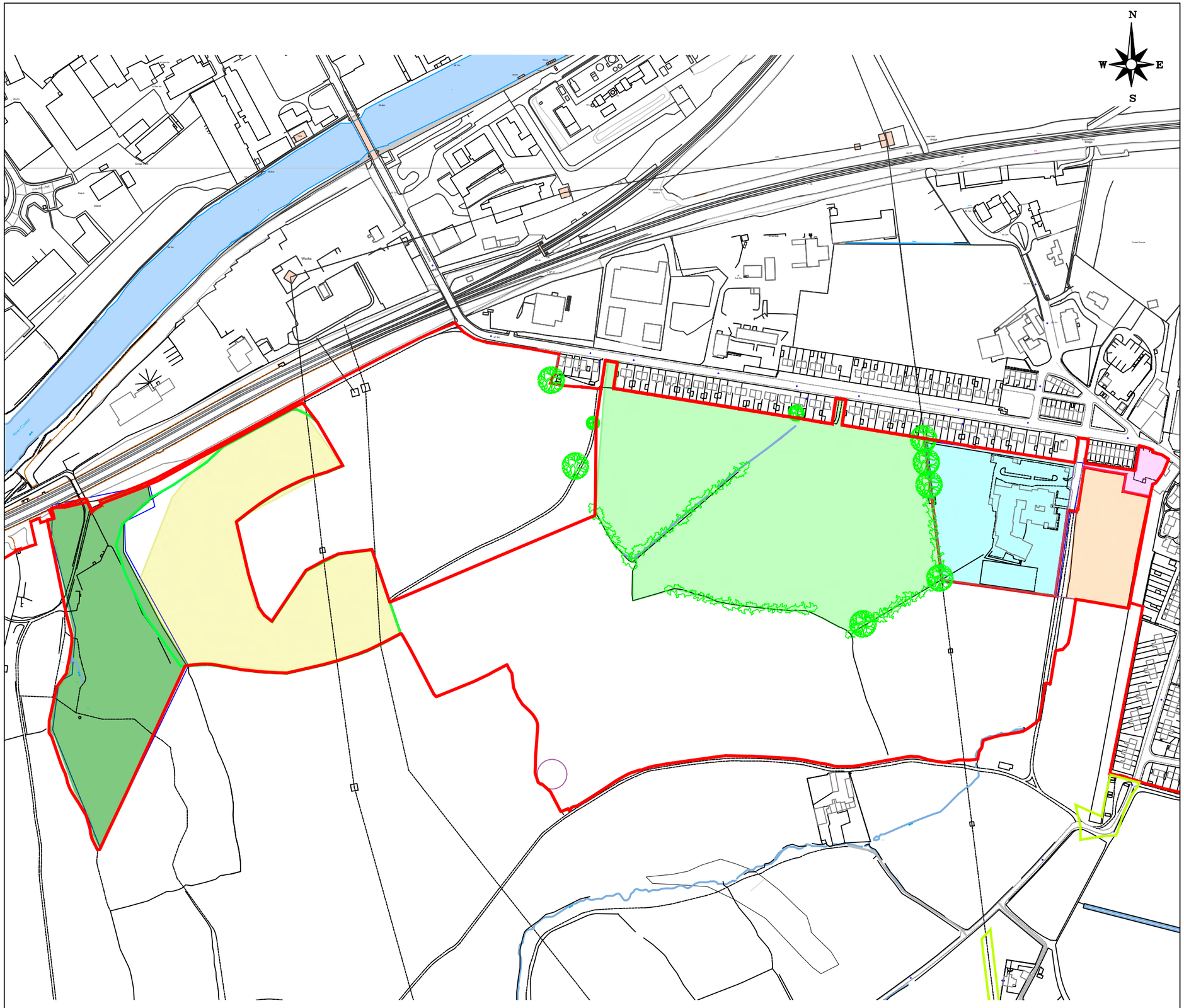
Drawings



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www.lithos.co.uk
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CLIENT	KIRKLEES COUNCIL
JOB TITLE	DEWSBURY RIVERSIDE CENTRAL GATEWAY
DRAWING TITLE	SITE LOCATION PLAN
DRAWN	GLM
DATE	25/11/2020
CHECKED	REG
DATE	25/11/2020
STATUS	FOR COMMENT ☐ DRAFT ☐ FOR APPROVAL ☐ FINAL ☑
SCALE	1:25,000
SHEET	A4
DRAWING NO.	3901/1
REVISION	



NOTES

- ALLOTMENT GARDENS
- MOSQUE PLAY SCHOOL/CAR PARK
- RAVENSTHORPE SCHOOL
- 'MILLERS' AREA
- LADY WOOD EXTENSION
- LADY WOOD
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

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JOB TITLE

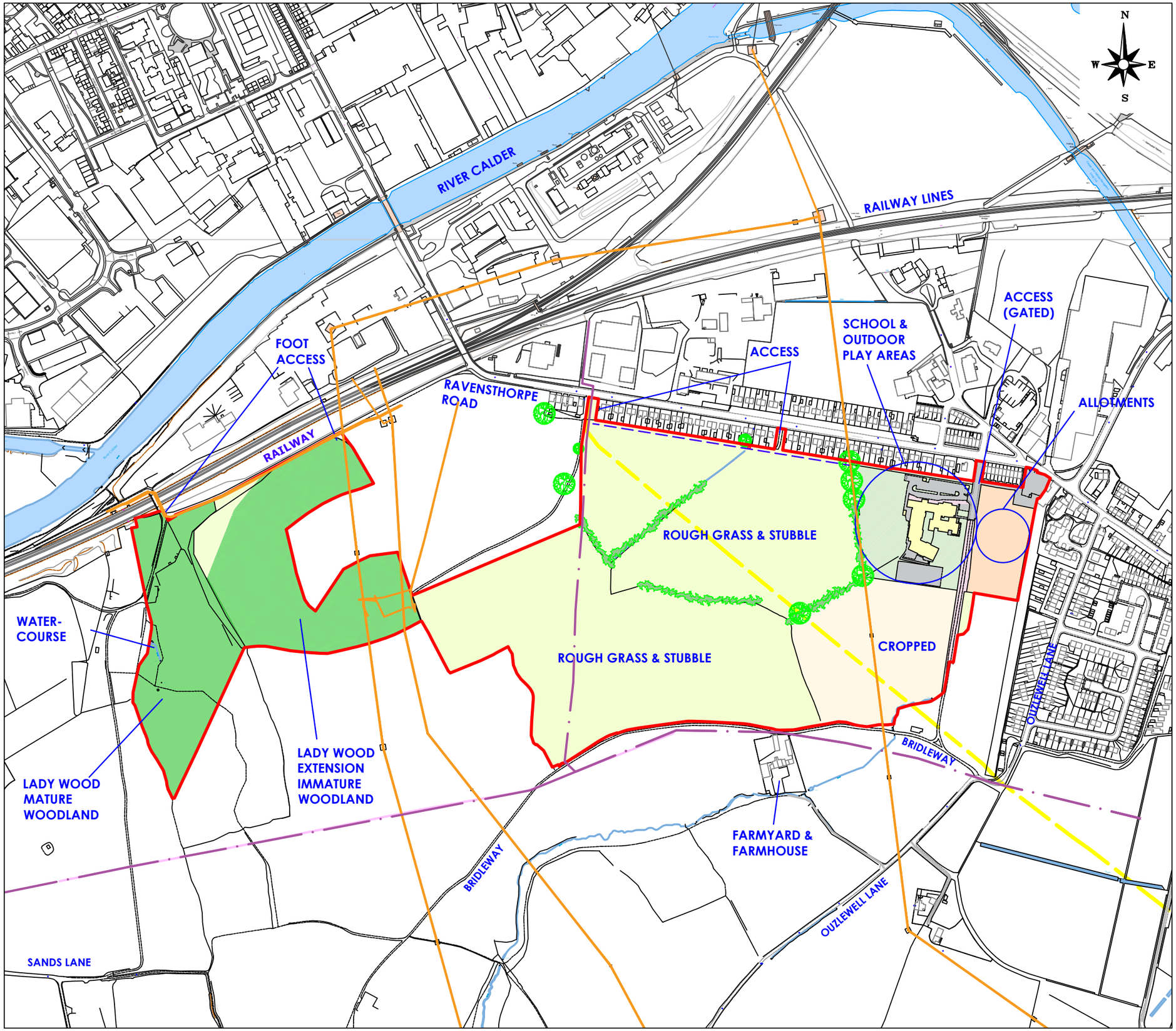
DEWSBURY RIVERSIDE CENTRAL GATEWAY

DRAWING TITLE

SITE SUB-AREAS PLAN

DRAWN	DATE	STATUS
GLM	25/11/2020	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	25/11/2020	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1:5,000	A3	3901/2	



NOTES

- GRASS/ROUGH STUBBLE
- CROPPED LAND
- MACADAM HARDSTAND
- BUILDING
- ALLOTMENT GARDENS
- HARDCORE/TRACK
- WOODLAND
- WATERCOURSE/SURFACE WATER
- OVERHEAD ELECTRICAL UTILITY
- HIGH PRESSURE GAS UTILITY
- REDUNDANT COLLIERY GAS UTILITY
- STORM DRAINAGE UTILITY
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

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JOB TITLE

DEWSBURY RIVERSIDE CENTRAL GATEWAY

DRAWING TITLE

SITE FEATURES

DRAWN	DATE	STATUS
GLM	07/12/2020	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	07/12/2020	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1:5,000	A3	3901/3	

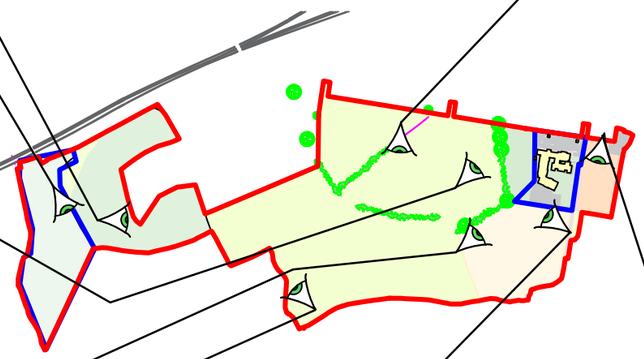


















NOTES

- GRASS/ROUGH STUBBLE
- CROPPED LAND
- MACADAM HARDSTAND
- BUILDING
- ALLOTMENT GARDENS
- HARDCORE/TRACK
- WOODLAND
- APPROXIMATE SITE BOUNDARY
- LOCATION & ORIENTATION OF PHOTOGRAPH

REV.	DESCRIPTION	DATE

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JOB TITLE

DEWSBURY RIVERSIDE CENTRAL GATEWAY

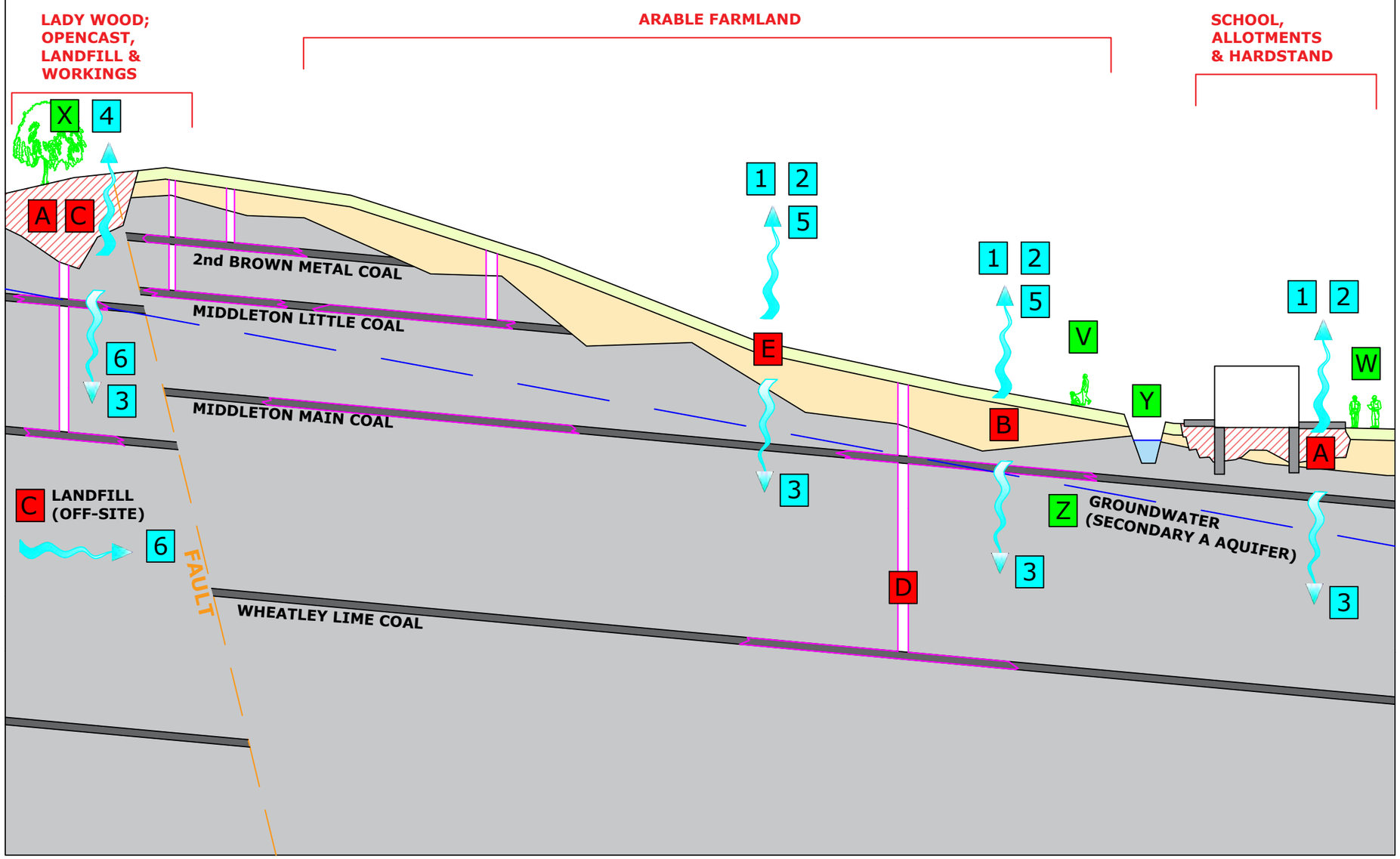
DRAWING TITLE

SITE PHOTOGRAPHS

DRAWN	DATE	STATUS
GLM	22/12/2020	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	22/12/2020	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
NOT TO SCALE	A3	3901/4	

SITE EXTENTS



KEY
MADE GROUND
TOPSOIL
RESIDUAL SOIL
LOWER COAL MEASURES
COAL

SOURCES
A MADE GROUND (INORGANICS)
B LEAKAGE/SPILLAGE (ORGANICS)
C LANDFILL
D MINEWORKINGS
E FARMING ACTIVITIES

PATHWAYS
1 DERMAL CONTACT
2 INGESTION/INHALATION
3 LEACHING OF CONTAMINANTS
4 UPTAKE BY PLANTS
5 VOLATILISATION
6 MIGRATION OF GAS

RECEPTORS
V END USERS (RESIDENTS)
W SITE WORKERS
X VEGETATION
Y SURFACE WATERS
Z GROUNDWATER

NOTES

REV.	DESCRIPTION	DATE

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JOB TITLE

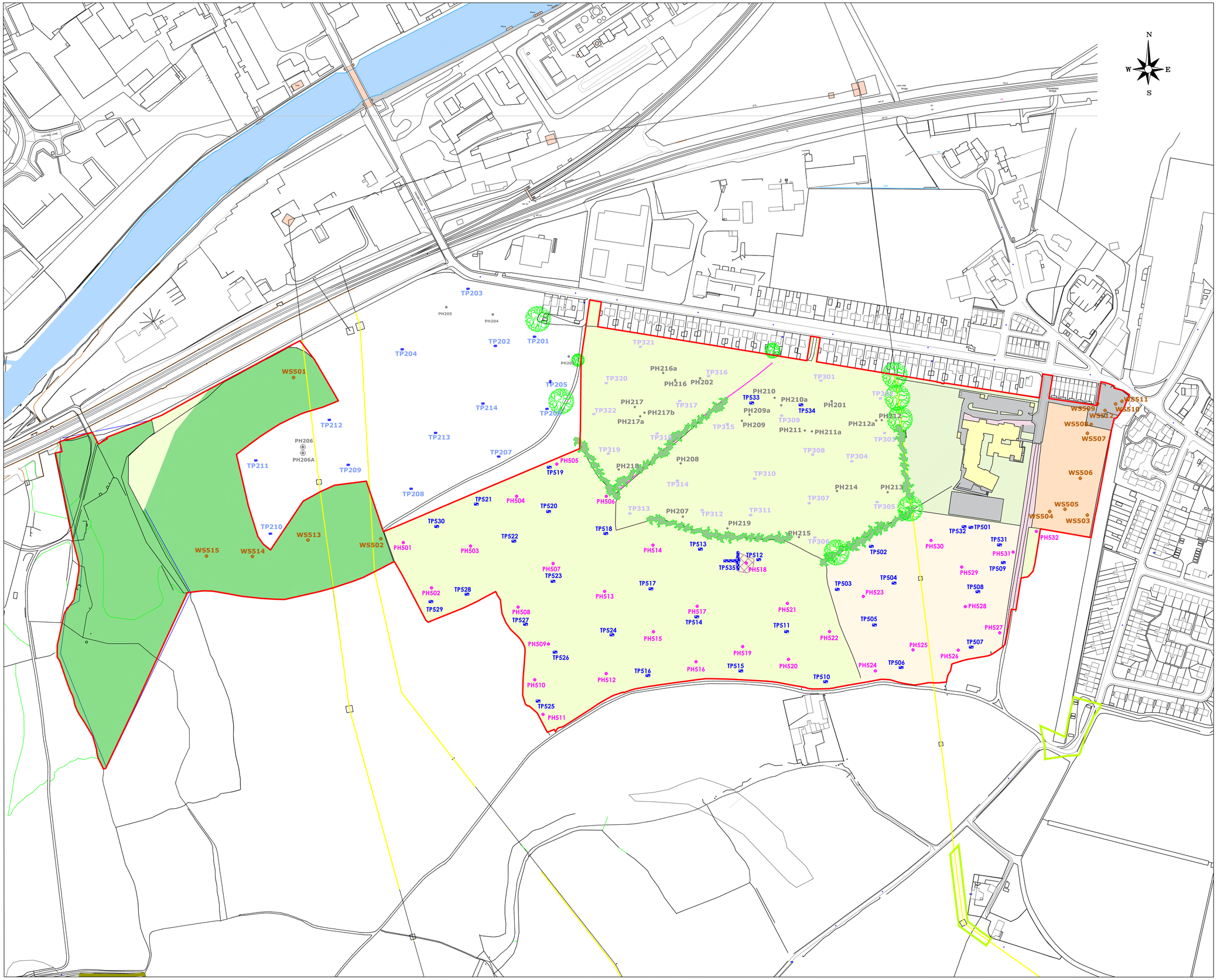
DEWSBURY RIVERSIDE CENTRAL GATEWAY

DRAWING TITLE

PRELIMINARY CONCEPTUAL SITE MODEL

DRAWN	DATE	STATUS
GLM	09/12/2020	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	09/12/2020	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
Not to scale	A3	3901/5	



NOTES

- TRIAL PIT LOCATION (JAN 2021)
- PROBEHOLE LOCATION (JAN 2021)
- WINDOW SAMPLE LOCATION (JAN 2021)
- TRIAL PIT LOCATION (PREVIOUS INVESTIGATION)
- PROBEHOLE LOCATION (PREVIOUS INVESTIGATION)
- FORMER SANDSTONE QUARRY
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

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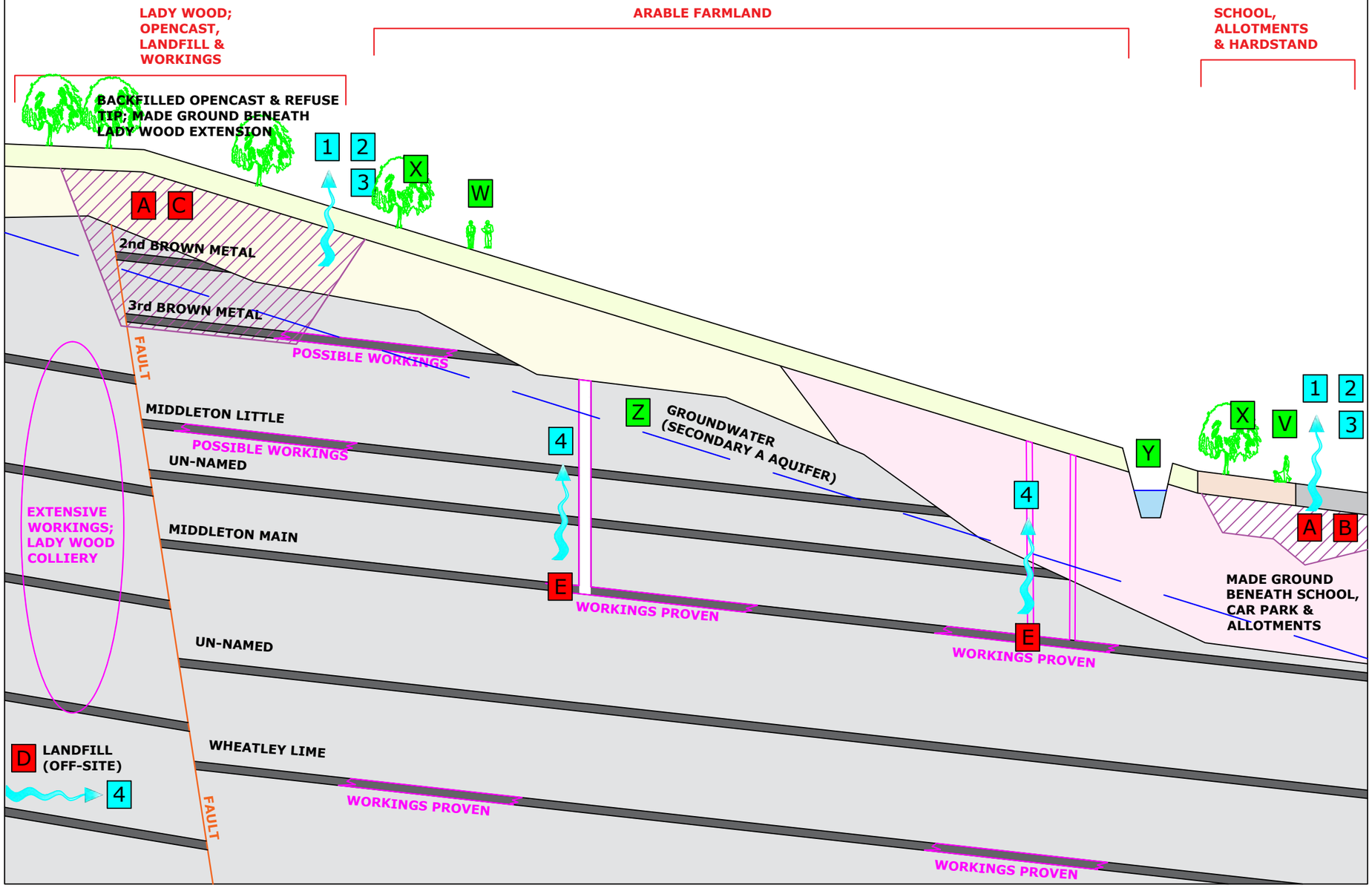
CLIENT
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JOB TITLE
DEWSBURY RIVERSIDE CENTRAL GATEWAY

DRAWING TITLE
EXPLORATORY HOLE LOCATION PLAN

DRAWN	DATE	STATUS
GLM	15/02/2021	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	15/02/2021	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1: 2,000	A1	3901/6	



KEY
MADE GROUND
TOPSOIL
GLACIAL DEPOSITS
RESIDUAL SOIL
LOWER COAL MEASURES
COAL

SOURCES
A MADE GROUND (INORGANICS)
B MADE GROUND (ORGANICS)
C MADE GROUND (ASBESTOS)
D LANDFILL
E MINEWORKINGS

PATHWAYS
1 DERMAL CONTACT
2 INGESTION/INHALATION
3 UPTAKE BY PLANTS
4 MIGRATION OF GAS

RECEPTORS
V END USERS (RESIDENTS)
W SITE WORKERS
X VEGETATION
Y SURFACE WATERS
Z GROUNDWATER

NOTES

REV.	DESCRIPTION	DATE

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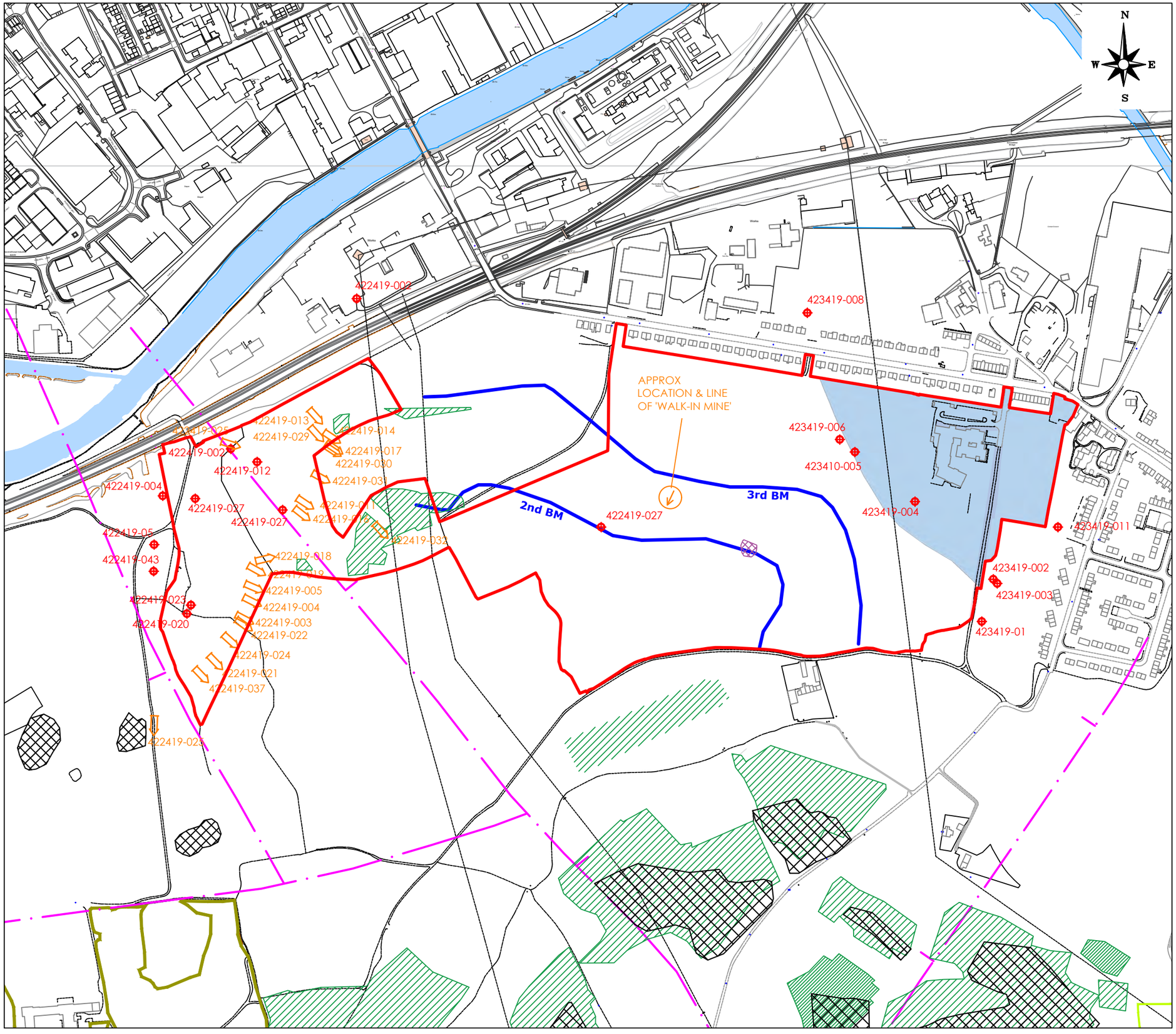
CLIENT: KIRKLEES COUNCIL

JOB TITLE: DEWSBURY RIVERSIDE CENTRAL GATEWAY

DRAWING TITLE: REVISED CONCEPTUAL SITE MODEL

DRAWN	DATE	STATUS
GLM	16/02/2021	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	16/02/2021	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
Not to scale	A3	3901/7	



NOTES

- GLACIOFLUVIAL DEPOSITS (BASED ON BGS MAPPING)
- FORMER SANDSTONE QUARRY (BASED ON HISTORICAL OS MAPPING)
- AREA OF OPENCAST EXTRACTION (BASED ON CA REPORT)
- AREA OF OPENCAST EXTRACTION/SPOIL HEAP (BASED ON BGS MAPPING)
- COAL SEAM OUTCROP & NAME (BASED ON NCB DRAWING)
- KNOWN SHAFT LOCATION
- KNOWN ADIT LOCATION
- APPROXIMATE LINE OF GEOLOGICAL FAULT
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

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JOB TITLE

DEWSBURY RIVERSIDE CENTRAL GATEWAY

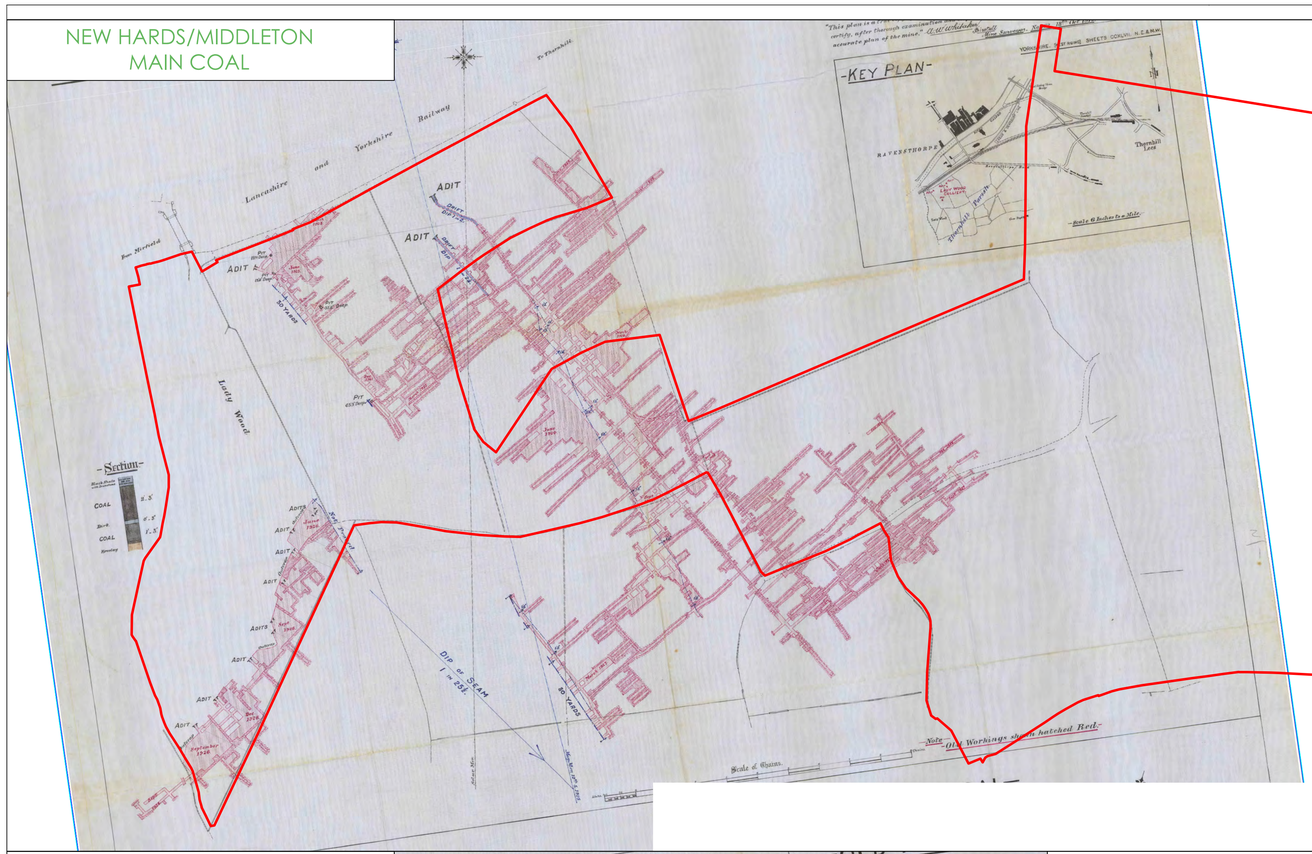
DRAWING TITLE

COAL MINING & GEOLOGICAL FEATURES

DRAWN	DATE	STATUS
GLM	09/12/2020	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	09/12/2020	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1:1000	A3	3901/8	

NEW HARDS/MIDDLETON
MAIN COAL



GREEN LANE/MIDDLETON
LITTLE COAL

OLD HARDS/2ND BROWN
METAL COAL

Catalogue No.: 9482 Sheet Info:
Date: 18/02/2016
Database Right and Copyright, The Coal Authority 2003. Unauthorised Use Prohibited.
Andrea Holmes - The Coal Authority 200 Lichfield Lane,Mansfield,Notts,NG18 4RG,England
Scale: 1 CHAIN TO 1 INCH (1 TO 792)
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Date: 18/02/2016
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NOTES

APPROXIMATE SITE BOUNDARY

REPRODUCED FROM COAL AUTHORITY ABANDONMENT PLAN FOR LADY WOOD COLLIERY REF. 9482.
PLAN PREPARED FOR LADY WOOD COLLIERY, THORNTON LEES, DEWSBURY; WORKINGS BY MR FOSTER-TAYLOR; DATE OF ABANDONMENT 16th MAY 1928

REV.	DESCRIPTION	DATE

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JOB TITLE
DEWSBURY RIVERSIDE CENTRAL GATEWAY

DRAWING TITLE
COAL AUTHORITY ABANDONMENT PLAN - LADY WOOD COLLIERY (MIDDLETON MAIN, MIDDLETON LITTLE & 2ND BROWN METAL COALS)

DRAWN	DATE	STATUS
GLM	04/12/2020	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	04/12/2020	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1:2,000	A1	3901/9a	

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3986 Cert. No.

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Nov 1972

Date 12.7.73

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knowledge and
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986 Cert. No

N
W E
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OLD WORKINGS

Not Known

Not Known

27/-

18

THESE WORKINGS COPIED FROM
ABANDONMENT PLAN No. 2363

ABANDONED 1888

54/-

OLD WORKINGS

NOTES

APPROXIMATE SITE BOUNDARY

REPRODUCED FROM COAL AUTHORITY
ABANDONMENT PLAN REF. NE774. COLLIERY
NOT STATED. FIRST EXTRACTION JULY 1957,
ABANDONED 18th APRIL 1973

REV.	DESCRIPTION	DATE

LITHOS CONSULTING
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www.lithos.co.uk
Tel 01937 545330

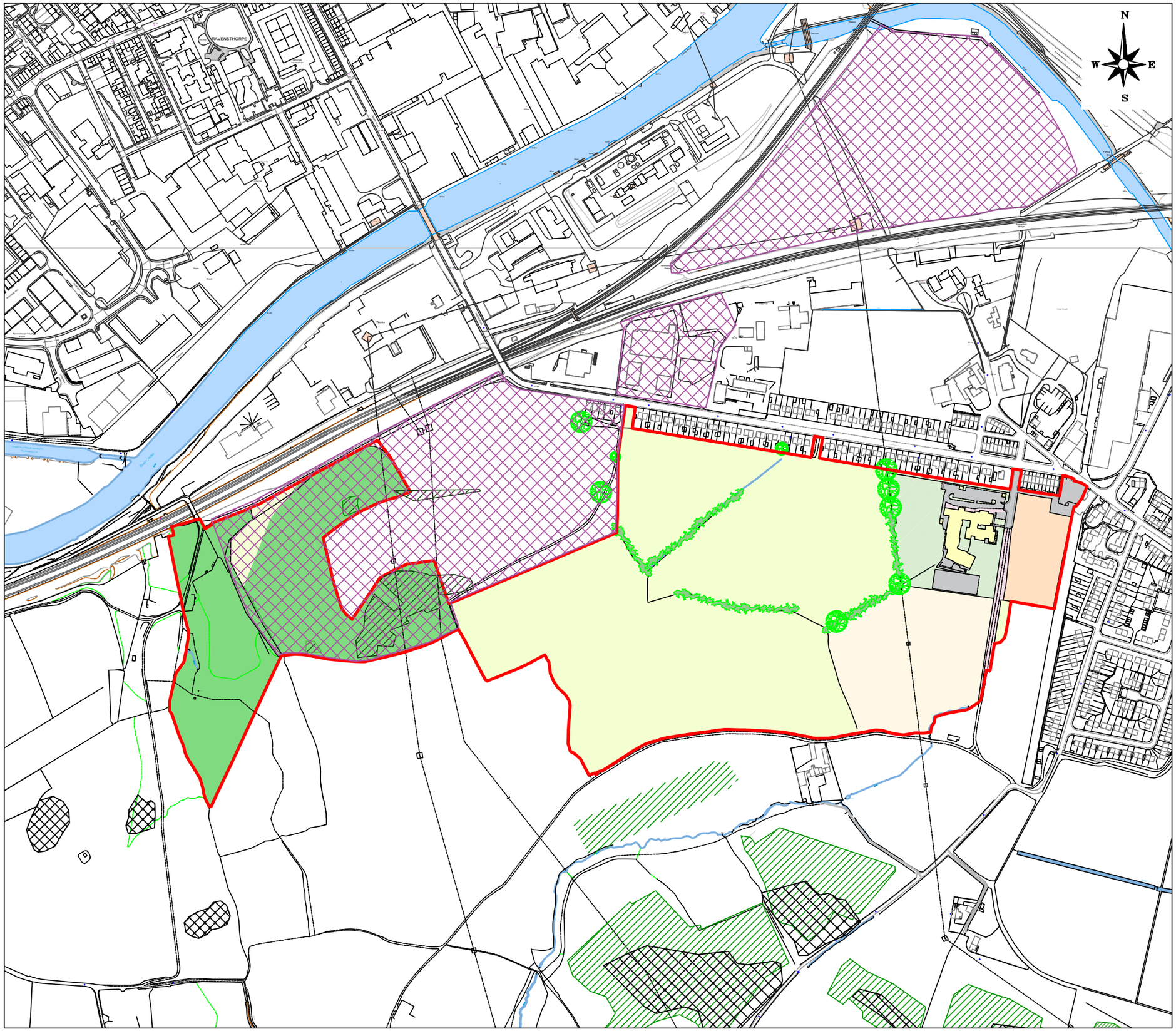
CLIENT
KIRKLEES COUNCIL

JOB TITLE
DEWSBURY RIVERSIDE CENTRAL GATEWAY

DRAWING TITLE
COAL AUTHORITY ABANDONMENT PLAN (MIDDLETON MAIN COAL)

DRAWN	DATE	STATUS
GLM	04/12/2020	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	04/12/2020	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1: 2,000	A1	3901/9b	



NOTES

- GRASS/ROUGH STUBBLE
- CROPPED LAND
- MACADAM HARDSTAND
- BUILDING
- ALLOTMENT GARDENS
- HARDCORE/TRACK
- WOODLAND
- AREA OF LANDFILL (BASED ON LANDMARK/EA RECORDS)
- SURFACE WATER/WATERCOURSE
- AREA OF OPENCAST EXTRACTION (BASED ON CA REPORT)
- AREA OF OPENCAST EXTRACTION/SPOIL HEAP (BASED ON BGS MAPPING)
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

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CLIENT

KIRKLEES COUNCIL

JOB TITLE

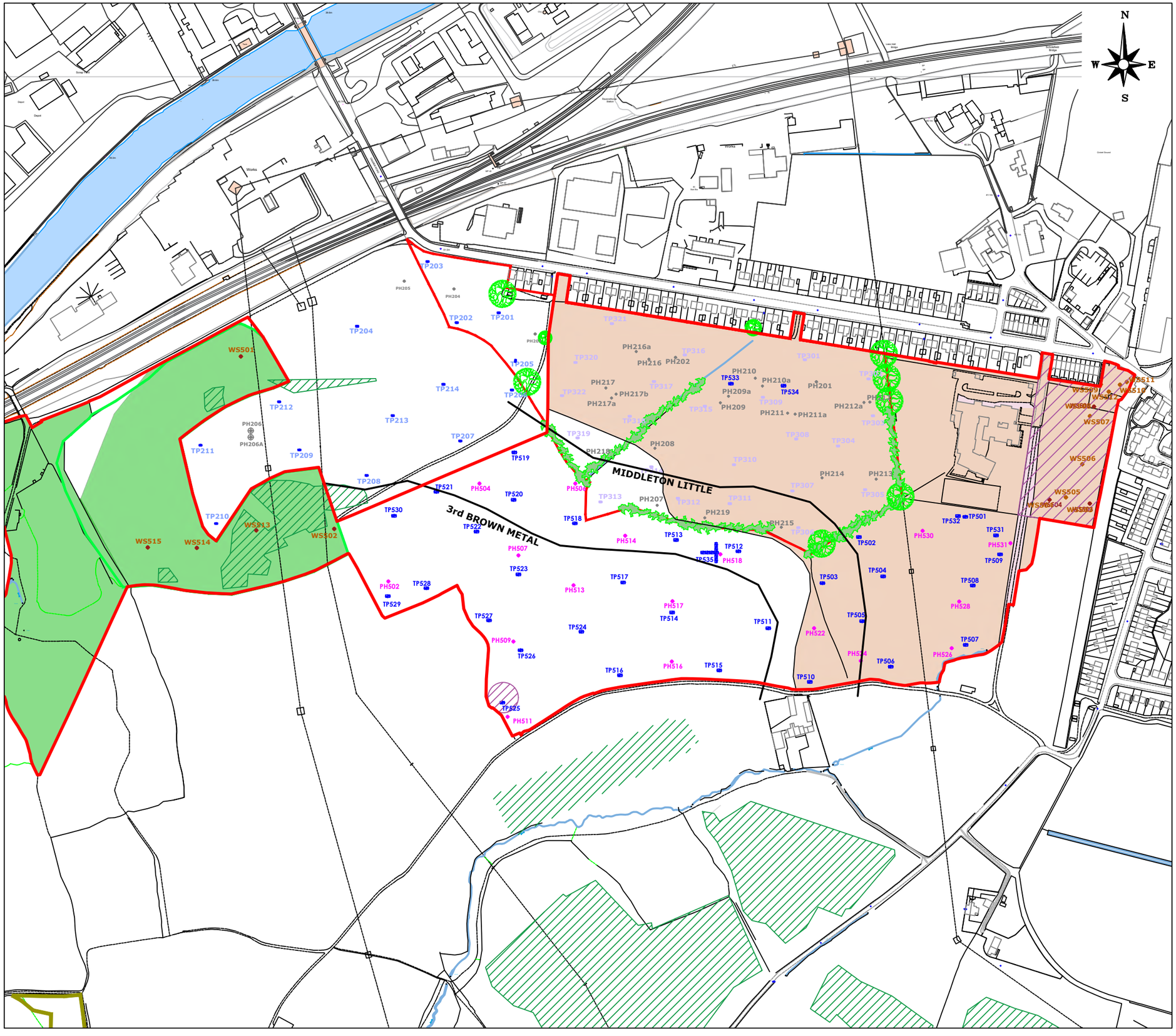
DEWSBURY RIVERSIDE CENTRAL GATEWAY

DRAWING TITLE

ENVIRONMENTAL FEATURES

DRAWN	DATE	STATUS
GLM	09/12/2020	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	09/12/2020	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1:1000	A3	3901/10	



NOTES

- WOODLAND
- APPROX AREA OF MADE GROUND
- AREA OF GLACIAL DEPOSITS
- AREA OF OPENCAST EXTRACTION (BASED ON CA REPORT)
- COAL SEAM OUTCROP & NAME (BASED ON LITHOS PHs)
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

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CLIENT

KIRKLEES COUNCIL

JOB TITLE

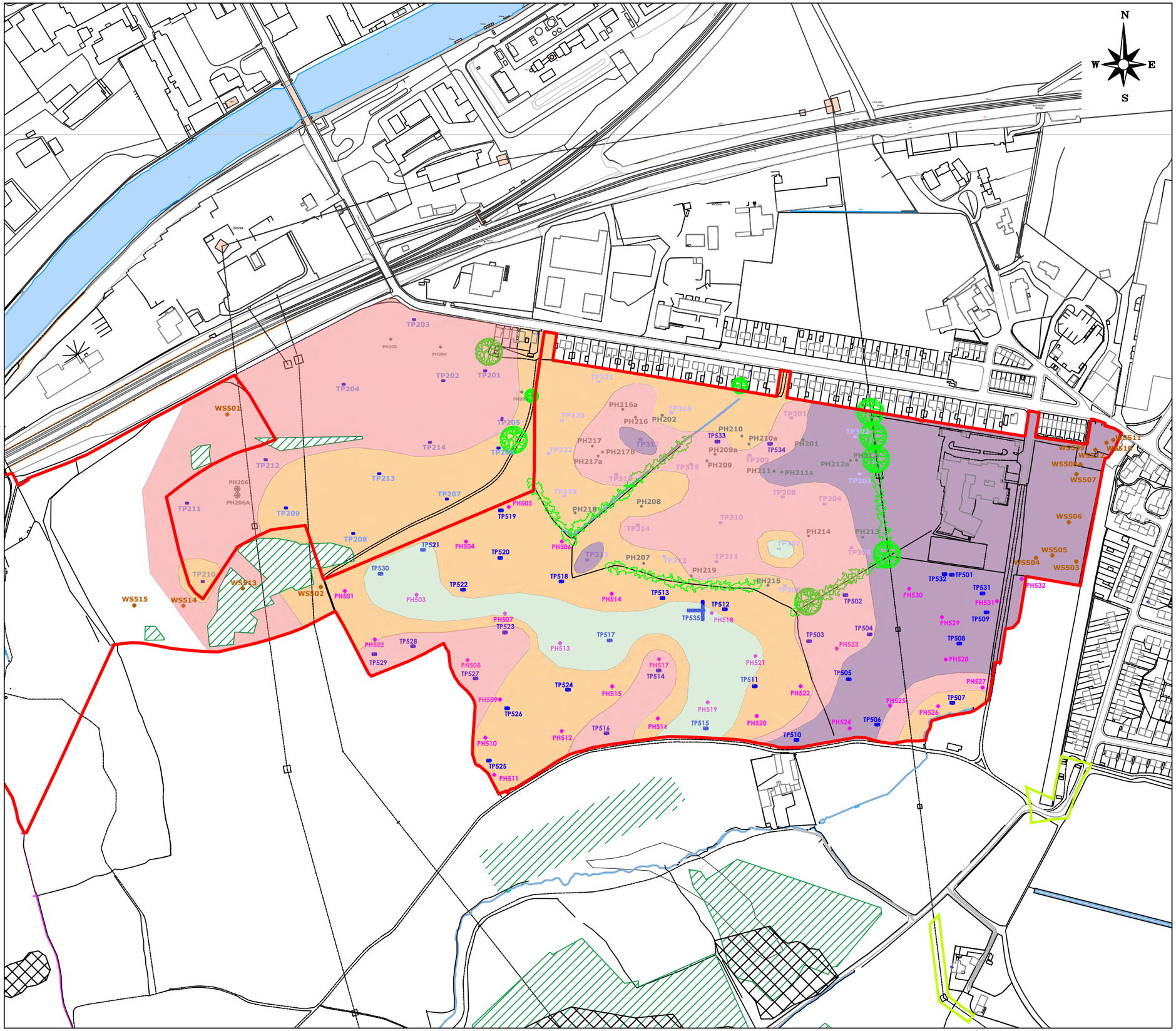
DEWSBURY RIVERSIDE CENTRAL GATEWAY

DRAWING TITLE

GROUND CONDITIONS

DRAWN	DATE	STATUS
GLM	24/02/2021	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	24/02/2021	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1:4,000	A3	3901/11	



NOTES

- ROCKHEAD AT < 1.0m
- ROCKHEAD AT BETWEEN 1.0m & 2.0m
- ROCKHEAD AT BETWEEN 2.0m & 3.0m
- ROCKHEAD AT GREATER THAN 3.0m
- CA AREA OF OPENCAST; LIKELY DEEP MADE GROUND
- APPROXIMATE SITE BOUNDARY

DEPTHS TO ROCKHEAD PRESENTED IN METERS BELOW EXISTING GROUND LEVELS & BASED ON THE FINDINGS OF LITHOS' TRIAL PITS

REV.	DESCRIPTION	DATE

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www.lithos.co.uk

Tel 01937 545330

CLIENT

KIRKLEES COUNCIL

JOB TITLE

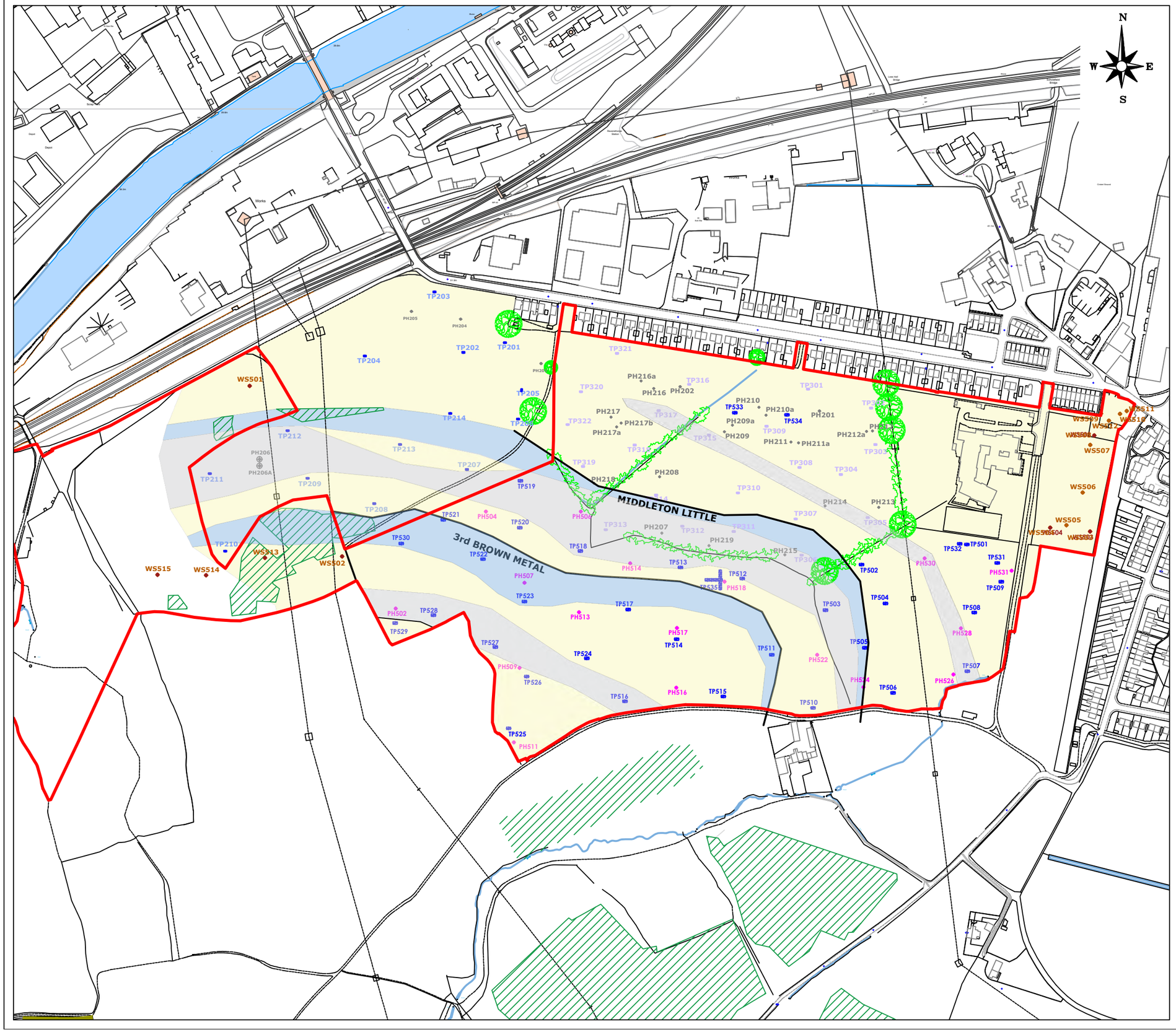
DEWSBURY RIVERSIDE CENTRAL GATEWAY

DRAWING TITLE

DEPTH TO COMPETENT ROCKHEAD

DRAWN	DATE	STATUS
GLM	15/02/2021	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	15/02/2021	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1:4,00	A3	3901/12	



NOTES

- CA AREA OF OPENCAST; LIKELY DEEP MADE GROUND
- SANDSTONE
- MUDSTONE/SILTSTONE
- COAL EXPECTED IN EXCAVATIONS
- COAL SEAM OUTCROP & NAME (BASED ON LITHOS PHs)
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

LITHOS CONSULTING

info@lithos.co.uk
www.lithos.co.uk

Tel 01937 545330

CLIENT

KIRKLEES COUNCIL

JOB TITLE

DEWSBURY RIVERSIDE CENTRAL GATEWAY

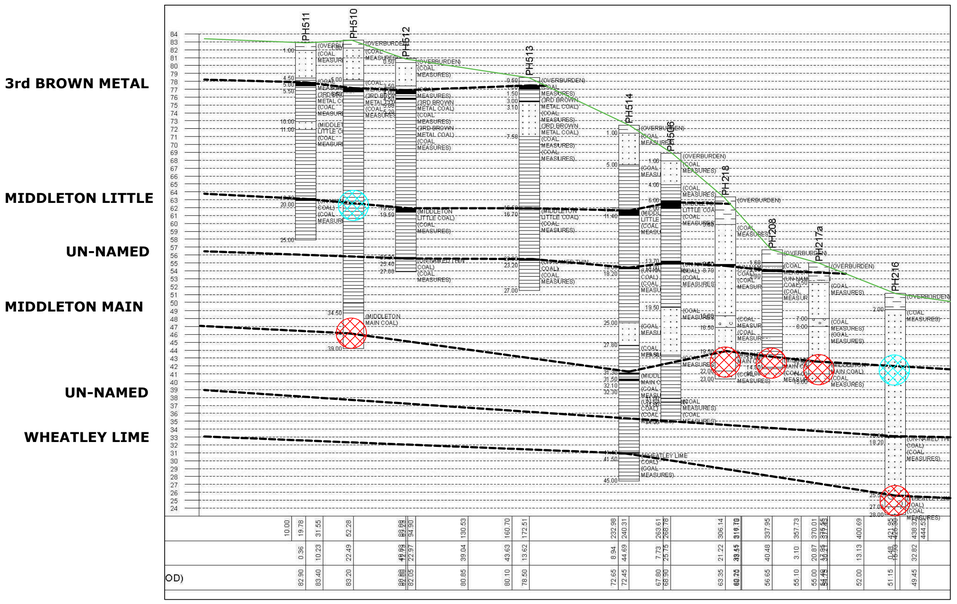
DRAWING TITLE

BEDROCK COMPOSITION

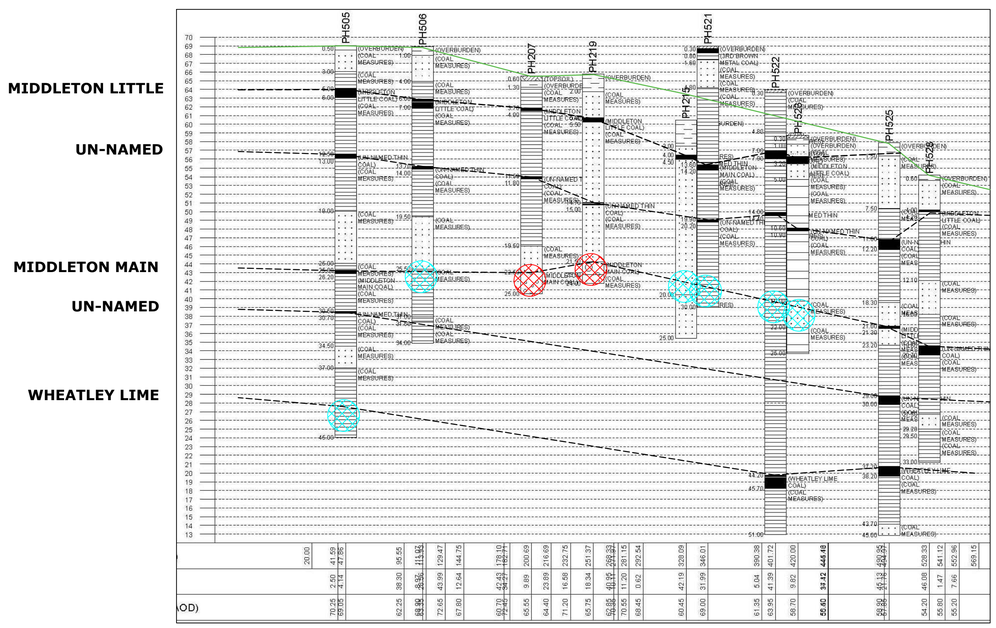
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CHECKED	DATE	FOR APPROVAL ☐
REG	24/02/2021	DRAFT ☐
		FINAL ☑

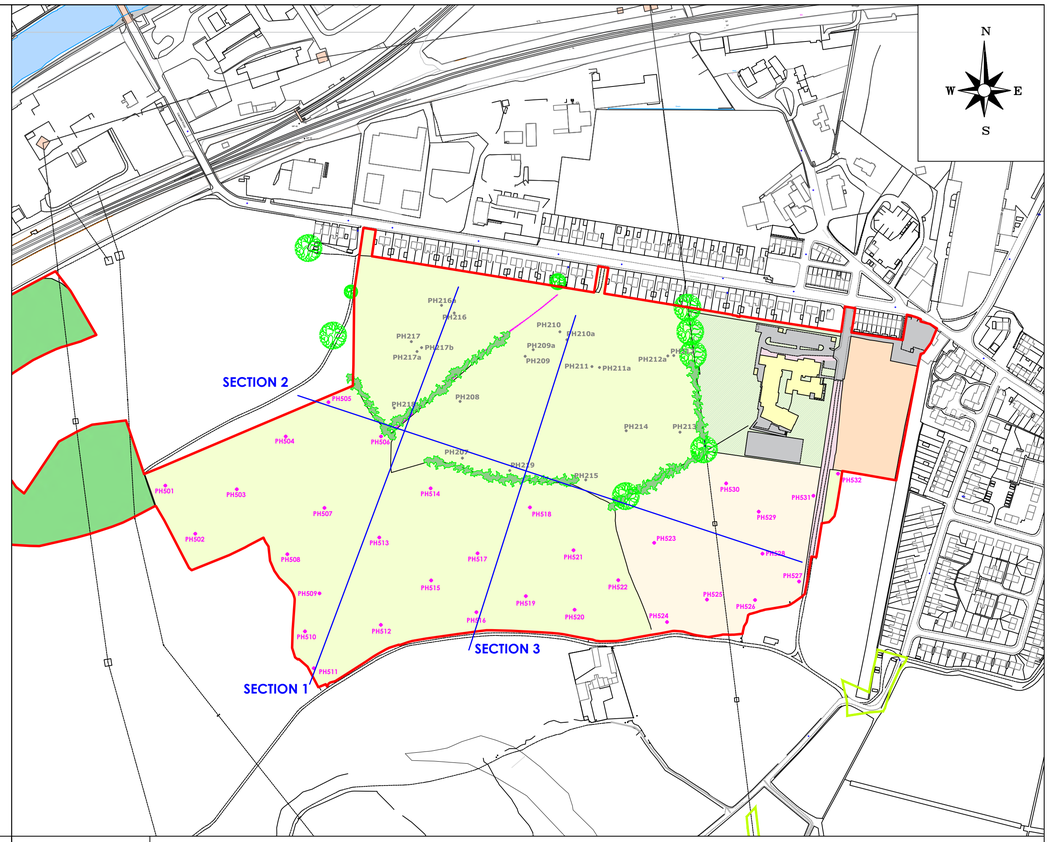
SCALE	SHEET	DRAWING NO.	REVISION
1:4,000	A3	3901/13	

SECTION 1

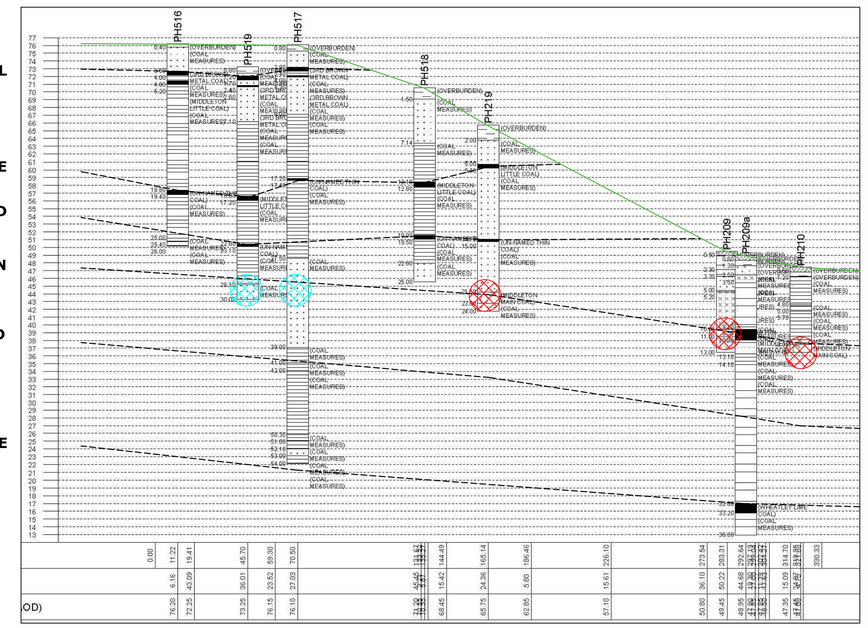


SECTION 2





SECTION 3



NOTES

GEOLOGY INTERPRETED FROM LITHOS' PROBEHOLE LOGS & CONSIDERATION OF CA ABANDONMENT PLANS, BGS MAPPING & THE NCB OPENCAST REPORT

- COAL SEAM & NAME
- EVIDENCE OF WORKINGS
- COAL SEAM ABSENT; POSSIBLE PACKED WORKINGS
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

LITHOS CONSULTING

info@lithos.co.uk
www.lithos.co.uk

Tel 01937 545330

CLIENT

KIRKLEES COUNCIL

JOB TITLE

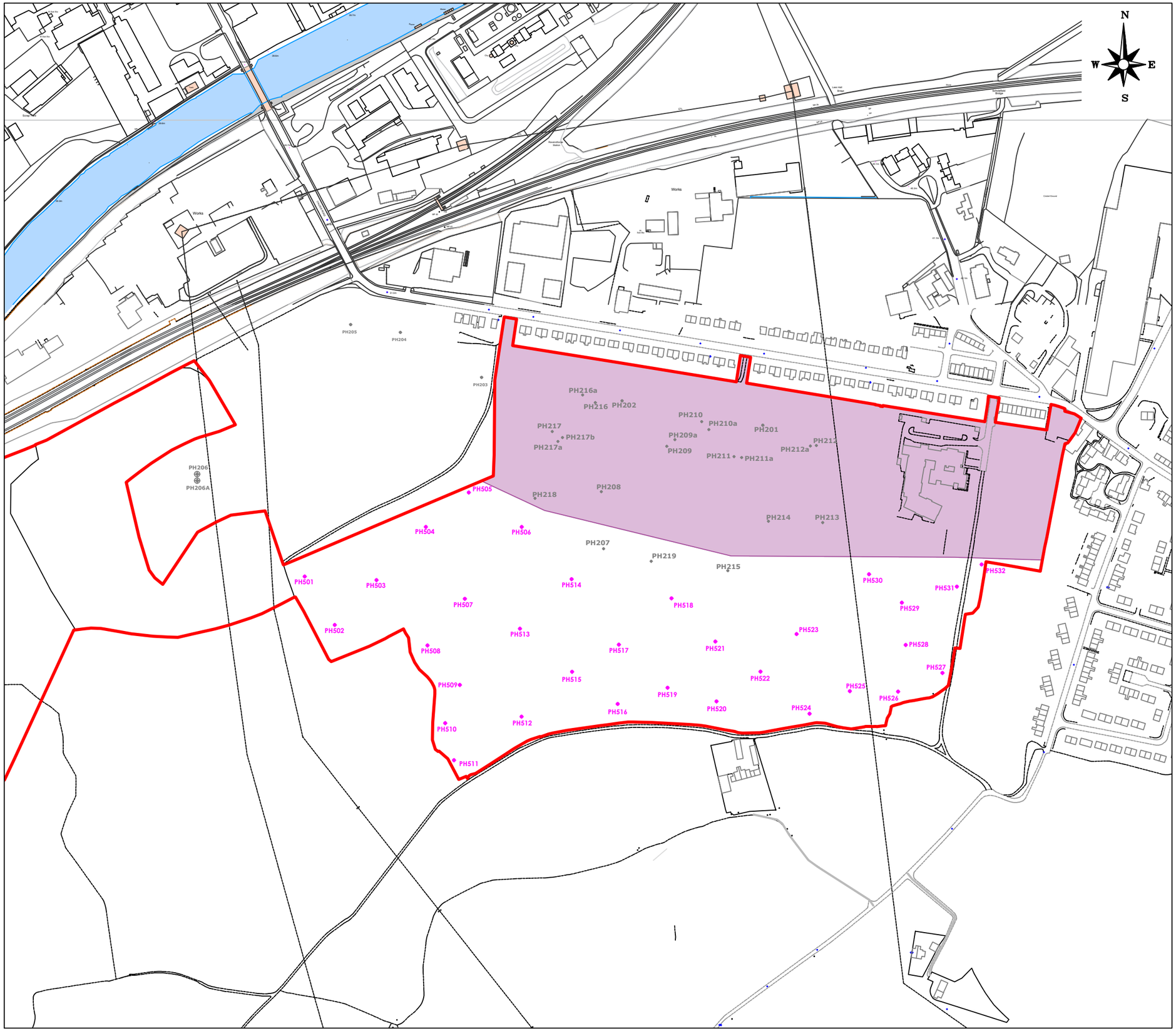
DEWSBURY RIVERSIDE CENTRAL GATEWAY

DRAWING TITLE

GEOLOGICAL CROSS SECTIONS

DRAWN	DATE	STATUS
GLM	04/03/2021	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	04/03/2021	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1: 2,000	A1	3901/14	



NOTES

- APPROXIMATE AREA OF MIDDLETON MAIN COAL SEAM REQUIRING CONSOLIDATION
- PROBEHOLE LOCATION (JAN 2021)
- PROBEHOLE LOCATION (PREVIOUS INVESTIGATION)
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

LITHOS CONSULTING

info@lithos.co.uk
www.lithos.co.uk

Tel 01937 545330

CLIENT

KIRKLEES COUNCIL

JOB TITLE

DEWSBURY RIVERSIDE CENTRAL GATEWAY

DRAWING TITLE

EXTENT OF MIDDLETON MAIN COAL REQUIRING CONSOLIDATION

DRAWN	DATE	STATUS
GLM	04/03/2021	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
REG	04/03/2021	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1:4,000	A3	3901/15	

Appendix C

Commission

023/3901/REG

1st December 2020

Registered in England 07068066

Parkhill
Wetherby
West Yorkshire
LS22 5DZ

T 01937 545 330
www.lithos.co.uk

Mr S Tucker
Barton Willmore
Tower 12
Bridge Street
Spinningfields
Manchester
M3 3BZ

Dear Stephen

Dewsbury Riverside Central Gateway

Further to our recent meetings with Kirklees Council (KC), please find attached our updated (additions in blue text) for costed proposal for undertaking the Stage 1, Technical Due Diligence for this site.

This proposal now also allows for some dynamic sampling (mini-boreholes) in the Allotments and Woodland.

We understand that Barton Willmore have now been appointed as the Consultant for all three elements (Stages 1, 2 & 3), and that Lithos will be appointed to undertake Stage 1 by Barton Willmore rather than the KC direct. However, to simplify matters relating to reliance on our work, Lithos reports will be issued in joint names (Barton Willmore & Kirklees Council).

Review of the information supplied at tender stage suggests that the site consists of a single parcel of land of approximately 30 hectares south of Ravensthorpe Road. However, there are at least 5 sub-areas of significance for various reasons:-

- Area previously investigated by Lithos for **Miller** Homes (c. 7.2 ha). Lithos issued a comprehensive SI Report to Miller Homes (Ref. 2336/3, dated January 2018) and Millers have recently granted permission to KC allowing Lithos to "re-use" the data obtained. Consequently, no significant further ground investigation is anticipated within this sub-area and the data obtained in 2008 will be included within our new Report(s).
- Primary **school** (c. 2.0 ha). At tender stage, it was agreed that no intrusive ground investigation would be possible within this sub-area.
- Existing **allotments** (c. 1.1 ha). Some ground investigation might be possible here, but the scope will need to be agreed with KC. Only 2 (of 24) plots are currently vacant. If we are able to gain access, we will advance a couple of trial pits and a couple of probeholes here. We should be able to advance about 8 mini-boreholes in this area.
- **Lady Wood** (c. 3.1 ha). At tender stage, it was agreed that no ground investigation was required within this sub-area, as the woodland is to be retained "as is".
- **Woodland** (c. 4.0 ha), adjacent to, and east of, Lady Wood. No development is proposed in this sub-area, and ground investigation will be limited to about 12 mini-boreholes to check for the presence of landfill.

APPROACHABLE REGISTERED ac UKAS MANAGEMENT SYSTEMS 8320
CHAS Accredited Contractor CHAS.co.uk
CQMS Safety Scheme
Constructionline A UK GOVERNMENT CERTIFICATION SERVICE
AGS Association of Geotechnical & Geoenvironmental Specialists

Previous work by Lithos suggests the wider site:

- Appears to have mostly remained undeveloped throughout its history, with the exception of the existing school and allotments (north-east) and coal mining activities.
- The Woodland sub-area (and adjacent Lyttle land) is shown by the EA to be underlain by a known landfill site; Thornhill Power Station landfill, but previous investigation within the Lyttle land found no evidence of this.
- Is not within a groundwater source protection zone.
- Is in an area where the risk of encountering UXO is considered low.
- Is directly underlain by Coal Measures bedrock; mostly interbedded mudstone, siltstone & sandstone, but with a more significant bed of sandstone in the south (Lepton Edge Rock). Strata dip gently to the north. In the far north-east bedrock might be overlain by Glaciofluvial Deposits.
- Is located mostly within a Coal Mining Development High Risk Area due to the presence of several shallow coal seams and numerous mine entries (especially in the vicinity of Lady Wood).
- Is crossed by an underground high-pressure gas main, and overhead electricity lines.

The scope of works outlined in this letter should enable us to assess abnormal development issues, associated with ground. However, the nature of site investigation is such that it is not always possible to foresee all the potential issues. Consequently, it is sometimes necessary to recommend additional work, but where this occurs we will inform you immediately, provide costs, and seek your further instruction. We have visited site and reviewed available internet data and our geological maps in order to minimise the likelihood of further work.

Our site investigation will be undertaken in accordance with UK good practice (as outlined in BS5930, BS10175, LCRM etc). Our Report may not be fully compliant with Eurocode 7 (EC7) and will not purport to be a Ground Investigation Report, nor a Geotechnical Design Report as defined by EC7. Our ground appraisal is intended to assist others as they proceed with design of the proposed development.

This proposal allows for the following works:

Desk study: Environmental search data and historical maps (obtained from Landmark or Groundsure), will be reviewed in order to determine whether past land uses have had any effect on the proposed development. In addition, published geological plans of the area will be examined.

Given the site's location within a Coal Mining High Risk Area, a Consultant's mining report will be obtained, and abandonment plans for known shallow mineworkings will be reviewed.

We will also visit site to review current operations and undertake a walkover survey.

On completion of the desk study, we will issue a "Phase 1 Desktop" Report, with a coal mining risk assessment prepared in accordance with Coal Authority guidance (either included within the Desk Study, or as a separate document; KC to confirm preference).

Fieldwork: In accordance with tender requirements, this proposal allows for probeholes/trial pits to be undertaken on a 50m grid across the site (alternate probeholes/trial pits). However, as discussed above, no significant intrusive investigation is currently anticipated in the following sub-areas: Millers; primary school; Lady Wood; or the Woodland.

We have allowed for the excavation about 40 no. trial pits and the drilling of about 35 no. probeholes, with all pits and probeholes to be supervised and logged by an experienced geoenvironmental engineer.

Given nature of the land and the time of year, we have allowed for pits to be dug using a tracked 360° excavator.

Trial pitting / trenching will enable us to determine the:

- Nature of any made ground, including:
  - visual/olfactory evidence of potential contamination and the proportion of undesirable elements e.g. biodegradable matter, relict foundations etc
  - the proportion of "oversize", boulder-sized material
- Nature, distribution and thickness of shallow soils
- Suitability of the ground for founding structures and highways

Representative soil samples of natural and man-made ground, including any contaminated samples, will be taken during the works. In-situ shear strengths of any cohesive soils encountered will be determined by the use of a hand-held shear vane.

We will make every effort to compact arisings and 'sweep' them over each trial pit. However, you should be aware that on completion of the investigation, "graves" of spoil (each about 3m long by 1m wide) unsuitable for trafficking, will be left up to 400mm proud at each trial pit location. At this stage, no allowance has been made for any further reinstatement such as removal of excess arisings, replacement of turf.

If the pitting encounters significant thicknesses of made ground or very soft/loose deposits (neither considered likely), boreholes may be required to obtain geotechnical data from greater depth. We will advise you of any need for boreholes within 2 days of completion of the pitting.

Based on anticipated ground and topography, **soakaways** are considered unlikely to provide a satisfactory solution for surface water drainage, and no allowance has been made for soakaway testing at this stage. If required, or considered feasible based on the ground actually encountered, soakaway tests could be undertaken for an additional fee of about £ per day.

The site is underlain by several shallow coal seam, including the Middleton Little, the 2nd & 3rd Brown Metal, and therefore we have allowed for the drilling of 35 **rotary probeholes** to check for the presence of mineworkings. This drilling should be sufficient to determine whether old mineworkings are present and pose a significant risk to surface stability of the site. However, if a potential risk is perceived to exist, further probeholes may be required to delineate the extent of workings in order to obtain fixed price quotations for the necessary consolidation works. It was acknowledged by KC during the tender period that further rotary drilling may be required to assess mining risk, and if so this was to be assessed and costed at a later stage.

It will be necessary to submit an application (with the associated fee) to the Coal Authority (CA) for 'Permission to enter CA mining interests'; and we have allowed for this. Given the site's size and location, we should be able to avoid the need to drill holes within 50m of surrounding residential properties and therefore, in accordance with CA requirements, we should be able to use air as the flushing medium. However, some probeholes may need to be advanced using water as the flushing medium (as reinforced by recent CA guidance on managing the risk of hazardous gas). Our drilling sub-contractor will need to locate the wash outs close to the site, and procure a standpipe and licence from Yorkshire Water.

With reference to the control, management and disposal of surplus water and flush arising from the works, (and in order to avoid additional costs associated with the provision of a telehandler to transfer a weir tank between boreholes, and the provision of a pump to transfer surplus water from the weir tank to an approved disposal point), we have made provision for a sand bag bund at the foot of the drilling mast, at each borehole to contain the majority of the drill cuttings. However, we have assumed that potentially discoloured surplus water will be allowed to flow and settle into the field.

Mini-boreholes are proposed here in order to:

- Allow investigation within areas of restricted access (Allotments & Woodland).
- Allow the installation of gas monitoring wells.
- Assess of the density of granular soils either via discrete SPTs or dynamic probing
- Minimise disturbance of the surface (Allotments).

However, dynamic sampling can typically only reach depths of 3m to 4m due partly rig capacity and partly to hole instability (unlike drilling using a cable percussion rig, steel casings are not used as a temporary liner to prevent borehole collapse).

We have allowed for all exploratory holes to be picked-up by a **surveyor** (co-ordinates/ground levels will be included on the logs).

This site is predominantly greenfield but is underlain by shallow mine workings and there may be landfill in the southwest. Consequently, we have allowed for the installation of wells in 17 probeholes and monitoring for hazardous **gas** (and any shallow groundwater).

The generation potential of these gas sources is considered likely to be Low to Moderate, but as required for the purposes of tendering, we have initially allowed for 6 visits over a 3-month period. A hazardous gas risk assessment will be issued on completion of monitoring.

Testing: This will comprise routine **geotechnical** soils analysis, including 30 moisture content & Atterberg limits, and 30 pH & water-soluble sulphate.

The site is understood is predominantly Greenfield, at this stage, we have no reason to expect wide areas of the site to be underlain by significant thicknesses of made ground. Consequently, we have only allowed for **contaminant** testing of up to 18 made ground samples, plus a further 18 samples of topsoil to confirm its suitability for re-use. The test suite will include heavy metals, speciated PAH, and banded TPH (with supplementary speciation as/where appropriate). Visible contaminants, sharps and the clay/sand/silt content of 9 topsoil samples will be determined to check compliance with BS3882 requirements.

If more significant made ground is encountered, we will inform you immediately and provide costs for the recommended chemical testing.

Within in our proposal we have allowed for the screening (ID) of 36 samples for asbestos. In the event that positive IDs are reported, it is likely that we will need to schedule further analysis (asbestos quantification), in order to determine the significance of the results. Asbestos quantification is currently a relatively expensive test and consequently we have not allowed for it at this stage. We will inform you immediately after receipt of results if we consider asbestos quantification is required.

Reporting & timescales: On completion of the desk study, fieldwork and laboratory testing a comprehensive, factual and interpretative report will be issued. This will contain exploratory hole logs, laboratory test results, copies of all relevant correspondence and drawings of the site. The report will include qualitative risk assessment with respect to both controlled waters and human health. The report will also include consideration of foundation types.

At the time of writing, fieldwork could be commenced within 3 weeks of receipt of your written instruction to proceed. Our comprehensive geoenvironmental appraisal report will be issued within 5 weeks of fieldwork completion. This report will comment on issues associated with hazardous gas, but the gas risk assessment will not be issued until monitoring is completed.

A completed copy of the **YW** Contaminated Land Assessment Form will be included in an Appendix to our Report.

Our proposal allows for the preparation of a separate Remediation Strategy report as required by the tender.

Invoicing: The attached proposal provides a breakdown of the costs associated with this project. This breakdown is for information only and the proposal can be regarded as a lump sum price of **£** plus VAT. Variation will only occur in the event that a given item is not undertaken or that substantial additional works are recommended, in which case we will inform you immediately, provide costs for the required works, and seek your prior consent.

We will submit invoices for this project at the milestones defined below:

- 1st milestone invoice (Item A) on issue of the Desk Study & Mining Risk Assessment
- 2nd milestone invoice (Items B to F) within 5 days of fieldwork completion, with exploratory hole logs and an interim letter report outlining our initial findings
- 3rd milestone invoice (Items G to J) on issue of the final SI report
- 4th milestone invoice (Item K) on issue of the Remediation Strategy
- 5th and final invoice (Item L) after completion of the gas monitoring/issue of the supplementary letter report

Health, safety & welfare: The works outlined above will be carried out in accordance with Lithos' task- and site- specific Risk Assessments and Method Statements.

Details of welfare will be included within the Method Statements. However, this investigation is expected to last for at least 7 working days and therefore this proposal includes for provision of a Welfare Unit, with the benefit of full canteen facilities, hot water with full size sink, toilet and drying room.

Utility plans are required in order to protect operatives from the hazards associated with striking buried services and avoid potentially substantial disruption\repair costs. We will make every effort not to damage any services (including review of utility plans and use of a CAT detector). However, Lithos cannot accept liability for damage to any underground services that are not accurately marked on plans made available to us prior to commencement of our field investigation, or have not been accurately marked on the ground by a responsible third party (e.g. utility company, site owner).

It would be appreciated if you could forward copies of the necessary utility plans (including electricity, gas, water, drainage & telecom), prior to the proposed fieldworks.

Under the **CDM** Regulations 2015, Lithos must be provided with pre-construction information already in your possession, or information that can reasonably be obtained through sensible enquiry. This information must be relevant to the project, have an appropriate level of detail, and be proportionate to the nature of the risks.

If no other designers or contractors have been appointed, Lithos could perform the role of Principal Contractor but only for the duration of the site investigation outlined in this proposal. If you require us to perform the role of Principal Contractor, please make this clear in your instruction. It should be noted that we are not suitably qualified to perform either role where other designers or contractors are also appointed.

It is anticipated that the site investigation outlined in this proposal will be undertaken several months before any construction is commenced on site. Consequently, our works can be considered in isolation and, given the anticipated number of person days on site, this site investigation is not notifiable to the HSE.

Terms & conditions: This work will be undertaken in accordance with a sub-consultancy Agreement to be agreed between Barton Willmore and Lithos. However, if the Appointment term expires or remains unsigned, works will be undertaken in accordance with our Standard Terms and Conditions, a copy of which are enclosed.

It is hoped the above is sufficient for your present needs. However, should you require any further information, please contact the undersigned.

Yours sincerely



Mark Perrin
Director
for and on behalf of
LITHOS CONSULTING LIMITED

Terms and Conditions for the Appointment of Lithos Consulting Limited

V006.18

1 DEFINITIONS AND INTERPRETATION

1.1 In this Agreement, unless the context otherwise requires, the following words and expressions have the following meanings:

"Agreement" shall mean these Terms (entitled "Terms and Conditions for the Appointment of Lithos Consulting"), the Proposal, any document recording the Client's unequivocal acceptance of the Proposal and any other documents or parts of other documents expressly referred to in any of the foregoing:

"Client" shall mean the party for whom the Services are being provided by Lithos;

"Documents" shall mean all documents of any kind and includes plans, drawings, reports, programmes, specifications, Bills of Quantities, calculations, letters, e-mails, faxes, memoranda, films and photographs (including negatives), or any other form of record prepared or provided or received by, or on behalf of Lithos, and whether in paper form or stored electronically or on disk, or otherwise;

"Lithos" shall mean Lithos Consulting Limited whose registered office is at Parkhill, Walton Road, Wetherby, West Yorkshire, LS22 5DZ.

"Intellectual Property" includes all rights to, and any interests in, any patents, designs, trade marks, copyright, know-how, trade secrets and any other proprietary rights or forms of intellectual property (protectable by registration or not) in respect of any technology, concept, idea, data, programme or other software (including source and object codes), specification, plan, drawing, schedule, minutes, correspondence, scheme, programme, design, system, process logo, mark, style, or other matter or thing, existing or conceived, used, developed or produced by any person;

"Parties" shall mean the Client and Lithos

"Project" shall mean the project described in the Proposal and any enquiry from the Client on which Lithos has based its Proposal;

"Proposal" means the offer document prepared by Lithos in response to an enquiry or otherwise, in connection with the proposed provision of the Services;

"Services" means the work and services relating to the Project to be provided by Lithos pursuant to the Agreement and as set out in the Proposal and shall include any additions or amendments thereto made in accordance with these Terms;

"Terms" means these terms entitled "Lithos Consulting Terms of Appointment".

1.2 Words importing the singular only shall also include the plural and vice versa, where the context requires.

1.3 Words importing persons or parties shall include firms, corporations and any organisation having legal capacity and vice versa, where the context requires; and words importing a particular gender include all genders.

1.4 The sub-headings to the clauses of these Terms are for convenience only and shall not affect the construction of the Agreement.

1.5 A reference to legislation includes that legislation as from time to time amended, re-enacted or substituted and any Orders in Council, orders, rules, regulations, schemes, warrants, by-laws, directives or codes of practice issued under any such legislation.

1.6 In the event of conflict between the documents forming part of the Agreement, the Proposal shall prevail, followed by the Terms.

2 APPOINTMENT

2.1 The Client agrees to engage Lithos and Lithos agrees to provide the Services in accordance with the provisions of the Agreement.

3 OBLIGATIONS OF LITHOS

3.1 Lithos shall perform the Services using the reasonable standard of skill and care normally exercised by similar professional Environmental firms in performing similar services under similar conditions.

3.2 Lithos shall use all reasonable endeavours to perform the Services in accordance with all relevant environmental and safety legislation.

4 OBLIGATIONS OF THE CLIENT

4.1 Throughout the period of this Agreement the Client shall afford to Lithos or procure the affording to Lithos of access to any site where access is required for the performance of the Services.

4.2 The Client accepts responsibility for ensuring that Lithos is notified in writing of all special site and/or plant conditions, including without prejudice to the generality of the foregoing, the existence and precise location of all underground services, cables, pipes, drains or underground buildings, constructions or any hazards known or suspected by the Client, which the Client shall clearly mark on the ground or identify on accurate location plans supplied to Lithos prior to the commencement of the Services. The Client shall also inform Lithos in writing of any relevant operating procedures including any site safe operating procedures and any other regulations relevant to the carrying out of the Services. The Client shall indemnify Lithos against all costs, claims, demands and expenses arising as a result of any non-disclosure in this respect, including but not limited to indemnification against any action brought by the owner of the land or otherwise.

4.3 If the Client discovers any conflict, defect or other fault in the information or designs provided by Lithos pursuant to the Agreement, he will advise Lithos in writing of such defect, conflict or other fault and Lithos shall have the right to rectify the same or where necessary, to design the solution for rectification of any works carried out by others pursuant the conflicting, defective or in any other way faulty information or designs.

5 INTELLECTUAL PROPERTY

5.1 The copyright in all Intellectual Property prepared by or on behalf of Lithos in connection with the Project for delivery to the Client shall remain vested in Lithos.

5.2 The Client shall have a non-exclusive licence to copy and use such Intellectual Property for purposes directly related to the Project. Such licence shall enable the Client to copy and use the Intellectual Property but solely for its own purposes in connection with the Project and such use shall not include any licence to reproduce any conceptual designs or professional opinions contained therein nor shall it include any license to amend any drawing, design or other Intellectual Property produced by Lithos.

5.3 Should the Client wish to use such Intellectual Property in connection with any other works or for any other purpose not directly related to the Project or wish to pass any Intellectual Property to any third party, it must obtain the prior written consent of Lithos. The giving of such consent shall be at the discretion of Lithos and shall be upon such terms as may be required by Lithos. Lithos shall not be liable for the use by any person of such Intellectual Property for any purpose other than that for which the same were prepared by or on behalf of Lithos.

5.4 Ownership of any proposals submitted to the Client that are not subsequently confirmed as part of the Services to be provided for the Client remain with Lithos and such proposals must not be used as the basis for any future work undertaken by the Client or a third party and no liability can be accepted howsoever arising from such proposals.

5.5 In the event of the Client being in default of payment of any fees or other amounts due, Lithos may suspend further use of the licence on giving 2 days' notice of the intention to do so. Use of the licence may be resumed on receipt of the outstanding amounts.

6 TITLE

6.1 Lithos shall transfer only such title or rights in respect of the Documents as it has, and if any part is purchased from a third party Lithos shall transfer only such title or rights as that party had and has transferred to Lithos.

6.2 Title in the Documents shall remain with and shall not pass to the Client until the amount due under the invoice(s) (including interest and costs) has been paid in full.

6.3 Until title passes, the Client shall hold the Documents as bailee for Lithos and shall store or mark them so that they can at all times be identified as the property of Lithos.

6.4 At any time before title passes (save and except where payment is not due), but only after prior consultation with the Client, Lithos may without any liability to the Client repossess and use or sell all or any of part of the Documents and by doing so terminate the right of the Client to use, sell or otherwise deal in the Documents.

6.5 Lithos may maintain an action for the price of the Documents notwithstanding that title in them has not passed to the Client.

7 CONFIDENTIALITY AND DATA PROTECTION

7.1 Lithos undertakes not to divulge or disclose to any third party without the written consent of the Client information which is designated confidential by the Client or which can reasonably be considered to be confidential and arises during the performance of the Services unless required to do so by law or necessary in the proper performance of its duties in relation to the Project, or in order to make full frank and proper disclosure to its insurers or intended insurers, or to obtain legal or accounting advice.

7.2 Subject to the above and Lithos' Privacy Policy which can be found on www.lithos.co.uk, Lithos shall be permitted to use information related to the Services it provides in connection with the Project for the purposes of marketing its services and in proposals for work of a similar type.

8 THIRD PARTIES

8.1 The Agreement or any part thereof or any benefit or interest thereunder may not be assigned by the Client without the prior written consent of Lithos. The giving of such consent shall be at the discretion of Lithos and Lithos will only agree to an assignment on its terms and in return for payment of a fee by the Client to Lithos to cover Lithos' legal and other costs associated with any assignment.

8.2 The Agreement shall not confer and shall not purport to confer on any third party any benefit or any right to enforce any term of this Agreement for the purposes of the Contracts (Rights of Third Parties) Act 1999 or otherwise.

8.3 Lithos will consider and may consent to any request from the Client for Lithos to enter a collateral warranty with a third party with regard to the Services provided under the Agreement. The giving of such consent shall be at the discretion of Lithos and Lithos will only enter a collateral warranty on its terms and in return for payment of a fee by the Client to Lithos to cover Lithos' legal and other costs associated with any collateral warranty.

9 INSURANCE

9.1 Lithos warrants to the Client that there is in force a policy of Professional Indemnity insurance covering its liabilities for negligence under this Agreement, with a limit of indemnity of £5,000,000 (FIVE MILLION POUNDS) any one claim, save for pollution and contamination claims and asbestos claims both of which carry £2,000,000 (TWO MILLION) in the aggregate cover. This policy is annually renewable and whilst renewal is not automatic, Lithos agrees to use reasonable endeavours to maintain such insurance at all times until six years from the date of the completion (or termination) of the Services under the Agreement, provided such insurance is available at commercially reasonable rates having regard, inter alia, to premiums required and policy terms obtainable.

9.2 If for any period such insurance is not available at commercially reasonable rates, Lithos shall forthwith inform the Client and shall obtain in respect of such period such reduced level of Professional Indemnity insurance as is available and as would be fair and reasonable in the circumstances for Lithos to obtain.

10 LIMITATIONS ON LIABILITY

10.1 Unless otherwise agreed in writing, Lithos' liability under or in connection with the Agreement whether in contract, tort, negligence, breach of statutory duty or otherwise (other than in respect of personal injury or death) shall be limited to and shall not exceed the lesser of either five million pounds in the aggregate (unless it is a pollution, contamination or asbestos claim in which case it is two million pounds in the aggregate) or 10 times the total value of invoices issued to the Client for consultancy work instructed under the Agreement.

10.2 No action or proceedings under or in respect of the Agreement whether in contract, tort, negligence, under statute or otherwise shall be commenced against Lithos after the expiry of a period of six years from the date of the completion (or termination) of the Services under the Agreement.

10.3 Whilst Lithos will scan all potential exploratory locations with a Cable Avoidance Tool, Lithos shall not be liable for any damage to underground services, cables, pipes, drains or underground buildings, constructions and the like which were either not marked on site or for which accurate plans were not provided.

10.4 Lithos shall not be liable for the cost of rectifying any defect, conflict or other fault in the information or designs provided by Lithos or for the cost of designing a solution for and rectifying any subsequent works carried out by others pursuant to the conflicting, defective or in any other way faulty information or designs, unless Lithos has been advised in writing of the same by the Client and has been given the opportunity to rectify the same or where necessary, to design the solution for rectification of any subsequent works carried out by others pursuant to the same.

11 PAYMENT

11.1 Invoices for services rendered will be submitted for payment in accordance with the Proposal.

11.2 The due date for payment is the date of the invoice and the final date for payment is 28 days from the date of the invoice.

11.3 If the Client disputes the amount included for payment in an invoice a written notice must be served on Lithos by the Client not later than 14 days before the final date for payment. If no notice is given the amount due shall be the amount stated in the invoice.

11.4 In the event of failure on the part of the Client to pay any monies in accordance with the foregoing payment provisions, Lithos will be entitled to charge interest on any monies owed to it by the Client, such interest to be at a rate of 8% above the base rate of a clearing bank from time to time calculated from the final date for payment to the date of actual payment on a compound basis.

12 DELAY

12.1 Lithos will comply with any timescale agreed for completion of the Services unless delayed or prevented by circumstances beyond its reasonable control and in the event of any such circumstances arising Lithos undertakes to complete the Services within a reasonable period, but will not be liable to the Client for any delay as a result.

13 TERMINATION

13.1 The Agreement may be terminated by either party in the event of the other making a composition or arrangement with its creditors, becoming bankrupt, or being a company, making a proposal for a voluntary arrangement for a composition of debts, or has a provisional liquidator appointed, or has a winding-up order made, or passes a resolution for voluntary winding-up (except for the purposes of a bona fide scheme of amalgamation or reconstruction), or has an administrator or an administrative receiver appointed to the whole or any part of its assets. Notice of termination must be given to the party which is insolvent by the other party.

13.2 If for any reason the performance of the Services by Lithos is suspended for a period in excess of three calendar months then Lithos shall be entitled to terminate its appointment in respect of the Services by seven days written notice to the Client.

13.3 If the Client shall fail to pay in full any sum due under the terms of the Agreement by the final date for payment for that sum and no effective notice of intention to withhold payment has been issued, Lithos may serve written notice on the Client demanding payment within 14 days of such notice. If the Client shall fail to comply with such notice, Lithos shall be entitled to terminate its employment under the Agreement forthwith.

13.4 Any termination of the appointment of Lithos howsoever caused shall be without prejudice to the right of Lithos to require payment for all services performed up to the date of such termination including but not limited to payment of a fair and reasonable proportion of any figure identified in the Proposal or otherwise for fees in respect of a particular service which Lithos has started, but not completed.

14 NOTICES

14.1 Any notice provided for in the Agreement shall be in writing and shall be deemed to be properly given if delivered by hand or sent by first class post to the address of the relevant party as may have been notified by each party to the other or, in the absence of notification, to the address of Lithos set out above or to the registered address of the Client.

14.2 Such notice shall be deemed to have been received on the day of delivery if delivered by hand or on the second working day after the day of posting if sent by first class post.

15 ENTIRE AGREEMENT

15.1 The Agreement constitutes the complete and entire agreement between the Client and Lithos with respect to the Services and supersedes any prior oral and/or written warranties, terms, conditions, communications and representations, whether express or implied and any claim against Lithos in respect of the Services can only be made in contract under the provisions of the Agreement and not otherwise under the law or tort or otherwise.

15.2 No amendments, modifications or variation of the Agreement shall be valid unless made in writing and agreed to by both the Client and Lithos; such agreement must be recorded in writing by at least one of the Parties.

15.3 Lithos will not be bound by any standard or printed terms or conditions furnished by the Client in any of its documents unless Lithos specifically states in writing separately from such documents that it intends such terms and conditions to apply.

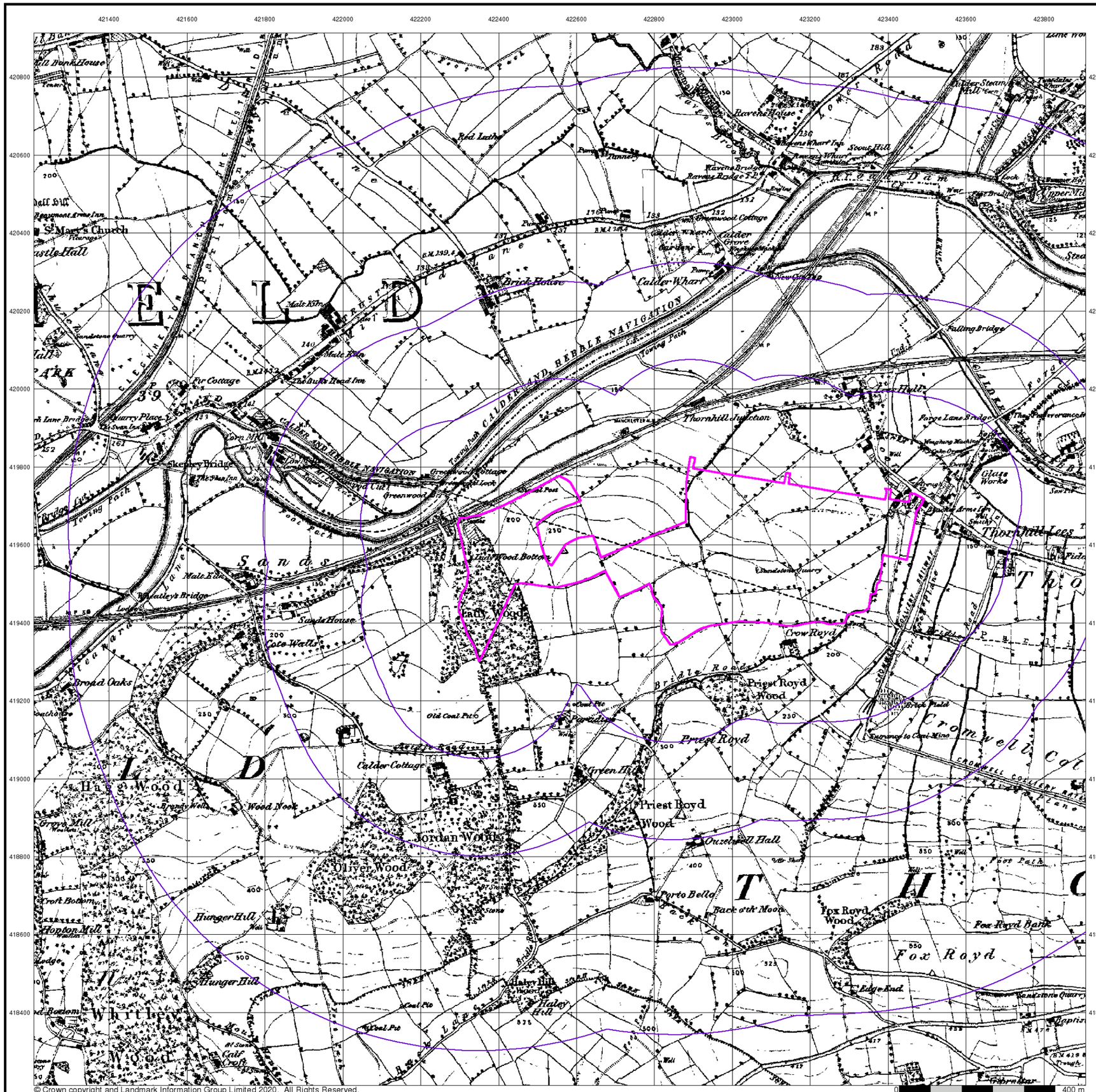
16 DISPUTES AND GOVERNING LAW

16.1 The Agreement shall be governed by and construed in accordance with English law and the Parties irrevocably and unconditionally submit to the jurisdiction of the English Courts.

16.2 Where the Housing Grants, Construction and Regeneration Act 1996 applies, any dispute between the Parties may be referred to adjudication in accordance with The Scheme for Construction Contracts Regulations 1998 or any amendment or modification thereof being in force at the time of the dispute, as applicable to England, Wales, Scotland and Northern Ireland.

Appendix D

Historical OS Plans



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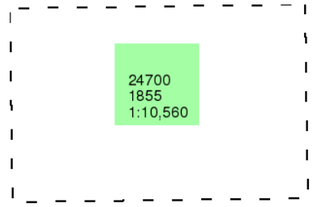
Yorkshire

Published 1855

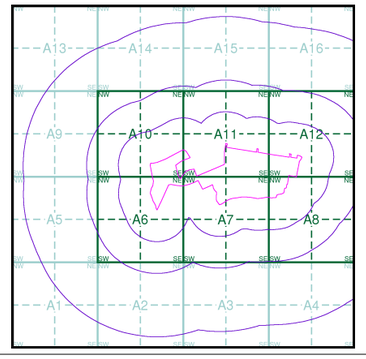
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



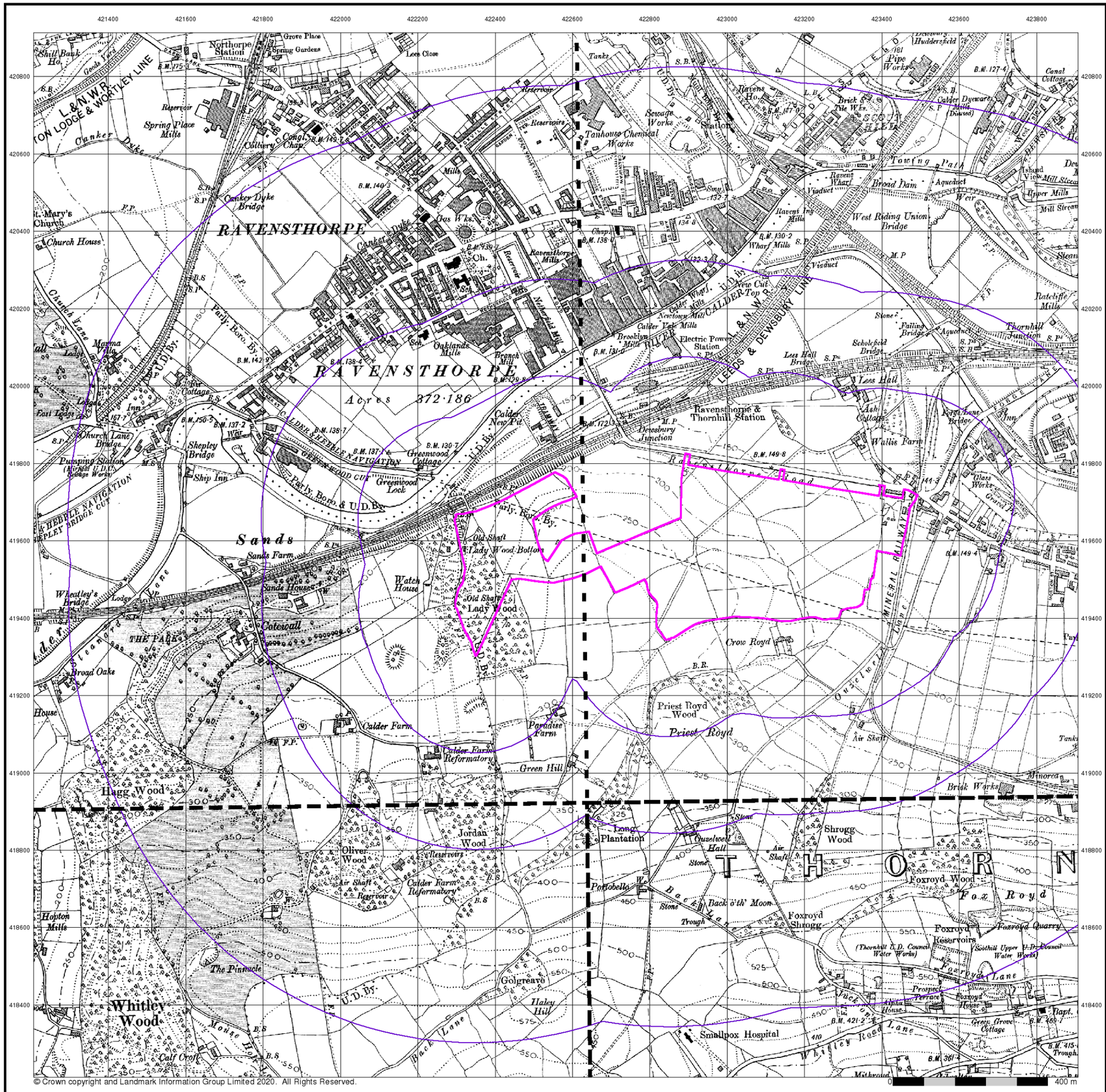
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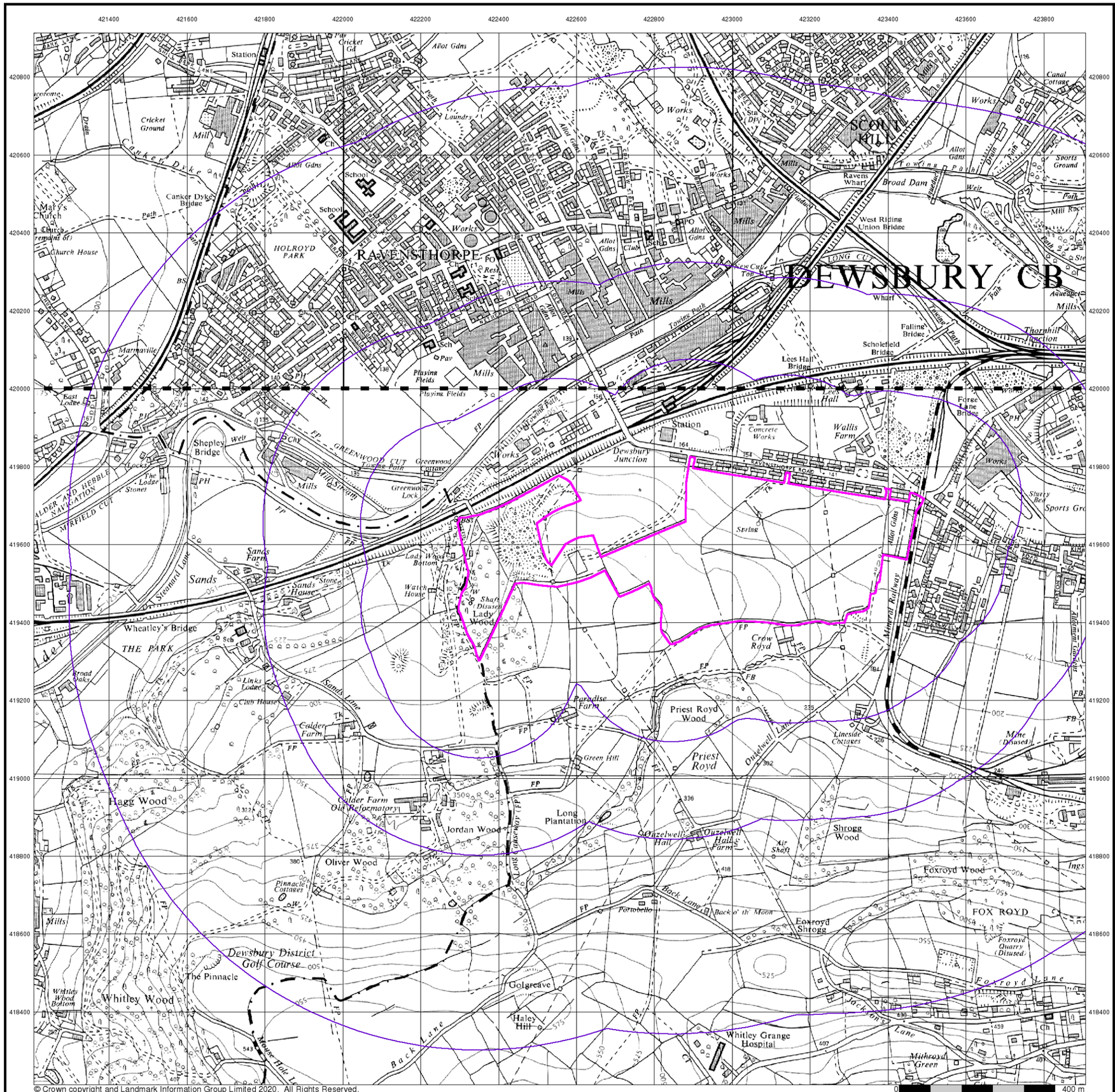
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Customer Ref:	3901
National Grid Reference:	422680, 419550
Slice:	A
Site Area (Ha):	30.39
Search Buffer (m):	1000

Site Details

Dewsbury Riverside Gateway, DEWSBURY, WF12 9EE

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Fax: 0844 844 9951
Web: www.envirocheck.co.uk


RAVENSTHORPE
RAVENSTHORPE
Acres 372·186
Sands
THE PALE
Whitley Wood
Hagg Wood
Jordan Wood
Oliver Wood
Hopton Mills
Broad Oaks
Whitley Road
Back Lane
Ravensthorpe & Thornhill Station
Calder New Pit
Calder Farm
Calder Farm Reformatory
Paradise Farm
Green Hill
Priest Royd Wood
Priest Royd
Crow Royd
Long Plantation
Golgreave
Haley Hill
The Pinnacle
Foxroyd Wood
Foxroyd
Foxroyd Shrogg
Foxroyd Reservoirs
Foxroyd Quarry
Shrogg Wood
Quelsicoat Hall
Smallpox Hospital
Lees Hall
Lees Hall Bridge
Scholefield Bridge
Wallis Farm
Ash Cottage
Ravens Ho.
Ravens Wharf
Ravens Ing Mills
Broad Dam
West Riding Union Bridge
Towing Path
Aqueduct
Viaduct
Thornhill Junction
Ratcliffe Mills
Failing Bridge
Wharf Mills
Calder Wharf
Calder Vale Mills
Brooklyn Mills
Electric Power Station
Oaklands Mills
Branch Mill
Mahogfield Mill
Ravensthorpe Mills
Spring Place Mills
Colliery Chap.
Gas Wks.
Sewage Works
Tanhouse Chemical Works
Pipe Works
Brick & Tile Wks.
Glass Works
Canal Cottage
Island View
Upper Mills
Mill Stream
Northorpe Station
Grove Place
Spring Gardens
Lees Close
Canker Dyke
Canker Dyke Bridge
Church House
St. Mary's Church
Church Lane Bridge
Pumping Station (Morley U.D.C. Sewage Works)
Shipley Bridge
Ship Inn
Greenwood Cottage
Greenwood Lock
Greenwood Cut
Calder & Hebble Navigation
Wheatley's Bridge
Sands Farm
Sands House
Watch House
Old Shaft
Lady Wood Bottom
Catcowall
Calder Farm Reformatory
Air Shaft
Reservoir
Portobello
Back o'th' Moon
Trough
Stone
Mithroyd
Green Grove Cottage
Foxroyd House
Prospect Terrace
Alpha House
Tunnel
Quelsicoat Line
Mineral Railway
L. & N.W.R. Leeds & Dewsbury Line
L. & N.W.R. Ton Lodge & Wortley Line
Barly. Boro. & U.D.By.
U.D.By.
Barly. Boro. By.
Calder & Hebble Navigation
Greenwood Cut
Calder New Top
Aqueduct Tunnel
Tunnel
Goods Yard
Station
Reservoir
Tanks
Stone
Trough
Air Shaft
Brick Works
Mineral Railway
Foxroyd Lane
Whitley Road
Back Lane
Church Lane
Mouse Hole Lane
Steanard Lane
Ravensthorpe Road
Dewsbury Junction
Mithroyd
Huddersfield
Dewsbury
Leeds
Wakefield
Barnsley
Manchester
Halifax
Bradford
Ossett
Normanton
Castleford
Pontefract
Goole
Selby
York
Harrogate
Ripon
Skipton
Keighley
Leeds
Wakefield
Barnsley
Doncaster
Scunthorpe
Hull
Beverley
Bridlington
Scarborough
Whitby
Middlesbrough
Darlington
Richmond
Northallerton
Thirsk
Malton
Pickering
Filey
Ripon
Skipton
Keighley
Bradford
Halifax
Huddersfield
Dewsbury
Ossett
Normanton
Castleford
Pontefract
Goole
Selby
York
Harrogate



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Ordnance Survey Plan

Published 1966 - 1967

Source map scale - 1:10,000

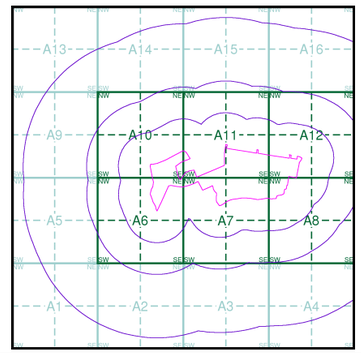
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Map Name(s) and Date(s)

SE22SW
1967
1:10,560

SE21NW
1966
1:10,560

Historical Map - Slice A



Order Details

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Customer Ref:	3901
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Slice:	A
Site Area (Ha):	30.39
Search Buffer (m):	1000

Site Details

Dewsbury Riverside Gateway, DEWSBURY, WF12 9EE

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Appendix E

Search Responses & other Correspondence

Envirocheck® Report:

Datasheet

Order Details:

Order Number:
269449509_1_1

Customer Reference:
3901

National Grid Reference:
422680, 419550

Slice:
A

Site Area (Ha):
30.39

Search Buffer (m):
1000

Site Details:

Dewsbury Riverside Gateway
DEWSBURY
WF12 9EE

Client Details:

Mr G Morton
Lithos Consulting Ltd
Parkhill
Walton Road
Wetherby
LS22 5DZ

Contents

Report Section	Page Number
Summary	-
Agency & Hydrological	1
Waste	79
Hazardous Substances	94
Geological	95
Industrial Land Use	110
Sensitive Land Use	147
Data Currency	148
Data Suppliers	153
Useful Contacts	154

Introduction

The Environment Act 1995 has made site sensitivity a key issue, as the legislation pays as much attention to the pathways by which contamination could spread, and to the vulnerable targets of contamination, as it does the potential sources of contamination.
For this reason, Landmark's Sita Sensitivity mapa and Datasheet(s) place great emphasis on statutory data provided by the Environment Agency/Natural Resources Wales and the Scottish Environment Protection Agency; it also incorporates data from Natural England (and the Scottish and Welsh equivalents) and Local Authorities; and highlights hydrogeological features required by environmental and geotechnical consultants. It does not include any information concerning past uses of land. The datasheet is producad by querying the Landmark database to a distance defined by the client from a sita boundary provided by the client.
In this datasheet the National Grid References (NGRs) are rounded to the nearest 10m in accordance with Landmark's agreements with a number of Data Suppliers.

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Report Version v53.0

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Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Agency & Hydrological					
BGS Groundwater Flooding Susceptibility	pg 1	Yes	Yes	Yes	n/a
Contaminated Land Register Entries and Notices	pg 5				3
Discharge Consents	pg 6	2	5	10	32
Prosecutions Relating to Controlled Waters			n/a	n/a	n/a
Enforcement and Prohibition Notices					
Integrated Pollution Controls	pg 18		5		16
Integrated Pollution Prevention And Control	pg 21			19	17
Local Authority Integrated Pollution Prevention And Control					
Local Authority Pollution Prevention and Controls	pg 31		6	8	5
Local Authority Pollution Prevention and Control Enforcements					
Nearest Surface Water Feature	pg 33	Yes			
Pollution Incidents to Controlled Waters	pg 33		3	4	42
Prosecutions Relating to Authorised Processes	pg 42			1	1
Registered Radioactive Substances					
River Quality	pg 42		4	1	4
River Quality Biology Sampling Points					
River Quality Chemistry Sampling Points	pg 44				8
Substantiated Pollution Incident Register	pg 51			3	1
Water Abstractions	pg 52		2	12	17 (*16)
Water Industry Act Referrels	pg 64			2	
Groundwater Vulnerability Map	pg 64	Yes	n/a	n/a	n/a
Groundwater Vulnerability - Soluble Rock Risk			n/a	n/a	n/a
Groundwater Vulnerability - Local Information			n/a	n/a	n/a
Bedrock Aquifer Designations	pg 65	Yes	n/a	n/a	n/a
Superficial Aquifer Designations	pg 65	Yes	n/a	n/a	n/a
Source Protection Zones					
Extreme Flooding from Rivers or Sea without Defences	pg 65		Yes	n/a	n/a
Flooding from Rivers or Sea without Defences	pg 67		Yes	n/a	n/a
Areas Benefiting from Flood Defences				n/a	n/a
Flood Water Storage Areas	pg 67		Yes	n/a	n/a
Flood Defences				n/a	n/a
OS Water Network Lines	pg 68	6	26	11	49

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Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Waste					
BGS Recorded Landfill Sites	pg 79	1			
Historical Landfill Sites	pg 79	1	3		3
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)	pg 80		2		
Licensed Waste Management Facilities (Locations)	pg 81		2	9	3
Local Authority Landfill Coverage	pg 84	1	n/a	n/a	n/a
Local Authority Recorded Landfill Sites					
Potentially Infilled Land (Non-Water)	pg 84	4	7	3	8
Potentially Infilled Land (Water)	pg 85		1	2	3
Registered Landfill Sites	pg 86		2	2	2
Registered Waste Transfer Sites	pg 88			3	5
Registered Waste Treatment or Disposal Sites	pg 91			2	3
Hazardous Substances					
Control of Major Accident Hazards Sites (COMAH)	pg 94				1
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)					
Planning Hazardous Substance Consents	pg 94				1
Planning Hazardous Substance Enforcements					

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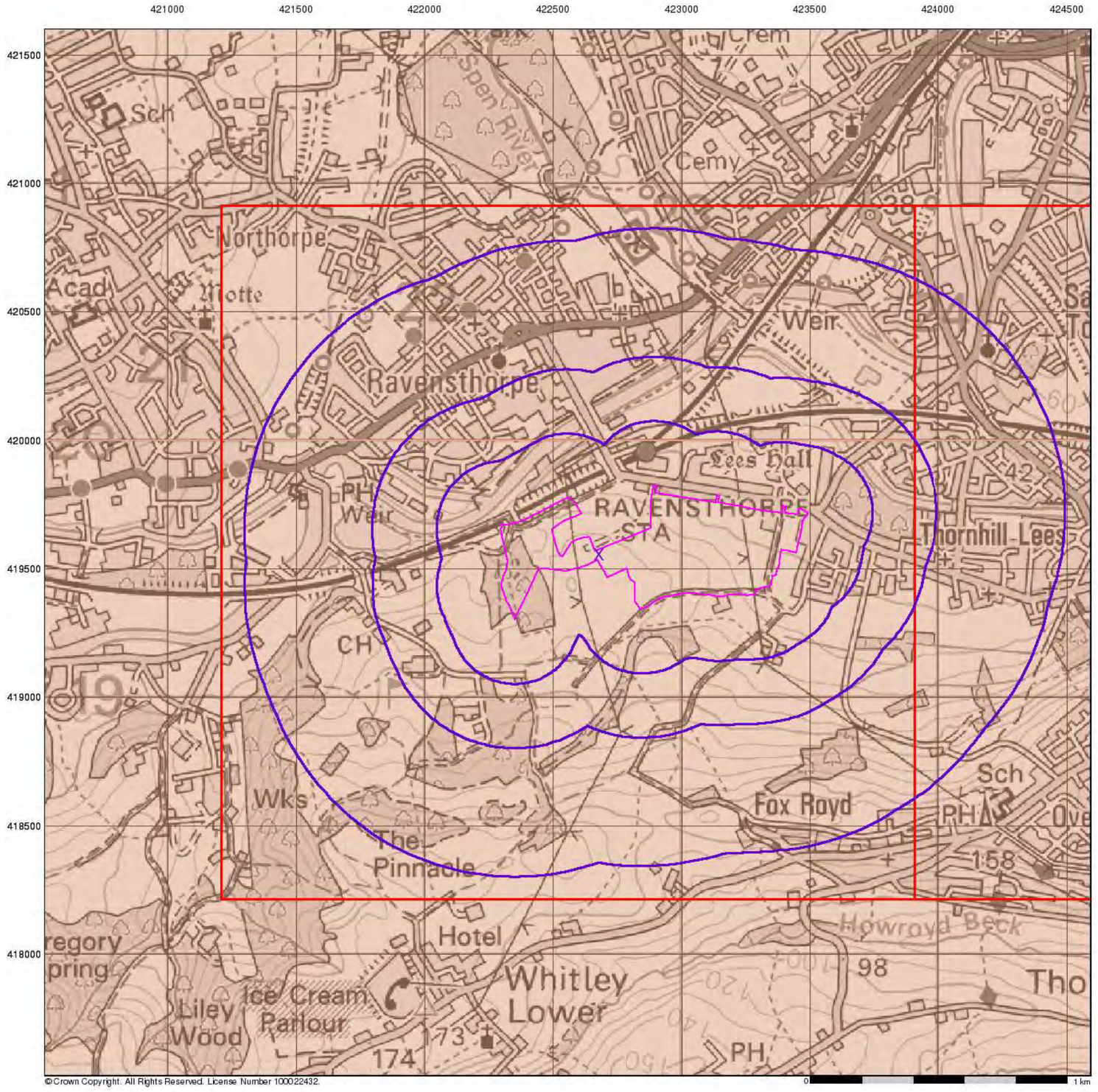
Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Geological					
BGS 1:625,000 Solid Geology	pg 95	Yes	n/a	n/a	n/a
BGS Estimated Soil Chemistry	pg 95	Yes	Yes	Yes	Yes
BGS Recorded Mineral Sites	pg 103	1	1	3	8
BGS Urban Soil Chemistry					
BGS Urban Soil Chemistry Averages					
CBSCB Compensation District			n/a	n/a	n/a
Coal Mining Affected Areas	pg 106	Yes	n/a	n/a	n/a
Mining Instability	pg 106	Yes	n/a	n/a	n/a
Man-Made Mining Cavities					
Natural Cavities					
Non Coal Mining Areas of Great Britain				n/a	n/a
Potential for Collapsible Ground Stability Hazards	pg 106	Yes	Yes	n/a	n/a
Potential for Compressible Ground Stability Hazards	pg 106		Yes	n/a	n/a
Potential for Ground Dissolution Stability Hazards				n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 107	Yes	Yes	n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 108	Yes	Yes	n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 108	Yes	Yes	n/a	n/a
Radon Potential - Radon Affected Areas	pg 109	Yes	n/a	n/a	n/a
Radon Potential - Radon Protection Measures			n/a	n/a	n/a
Industrial Land Use					
Contemporary Trade Directory Entries	pg 110		21	96	100
Fuel Station Entries	pg 129				3
Points of Interest - Commercial Services	pg 129		5	28	35
Points of Interest - Education and Health					
Points of Interest - Manufacturing and Production	pg 135		21	27	32
Points of Interest - Public Infrastructure	pg 142		6	12	27
Points of Interest - Recreational and Environmental	pg 145		1		7
Gas Pipelines					
Underground Electrical Cables					

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Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Sensitive Land Use					
Ancient Woodland	pg 147			1	1
Areas of Adopted Green Belt	pg 147	1			1
Areas of Unadopted Green Belt	pg 147	1			1
Areas of Outstanding Natural Beauty					
Environmentally Sensitive Areas					
Forest Parks					
Local Nature Reserves	pg 147				2
Marine Nature Reserves					
National Nature Reserves					
National Parks					
Nitrate Sensitive Areas					
Nitrate Vulnerable Zones	pg 147				1
Ramsar Sites					
Sites of Special Scientific Interest					
Special Areas of Conservation					
Special Protection Areas					
World Heritage Sites					



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Bedrock Aquifer Designation

General

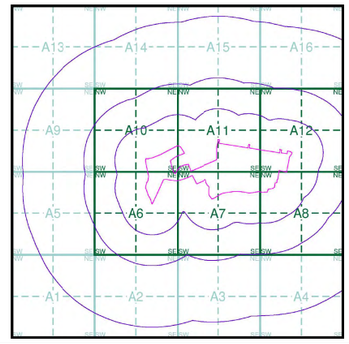
Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice A

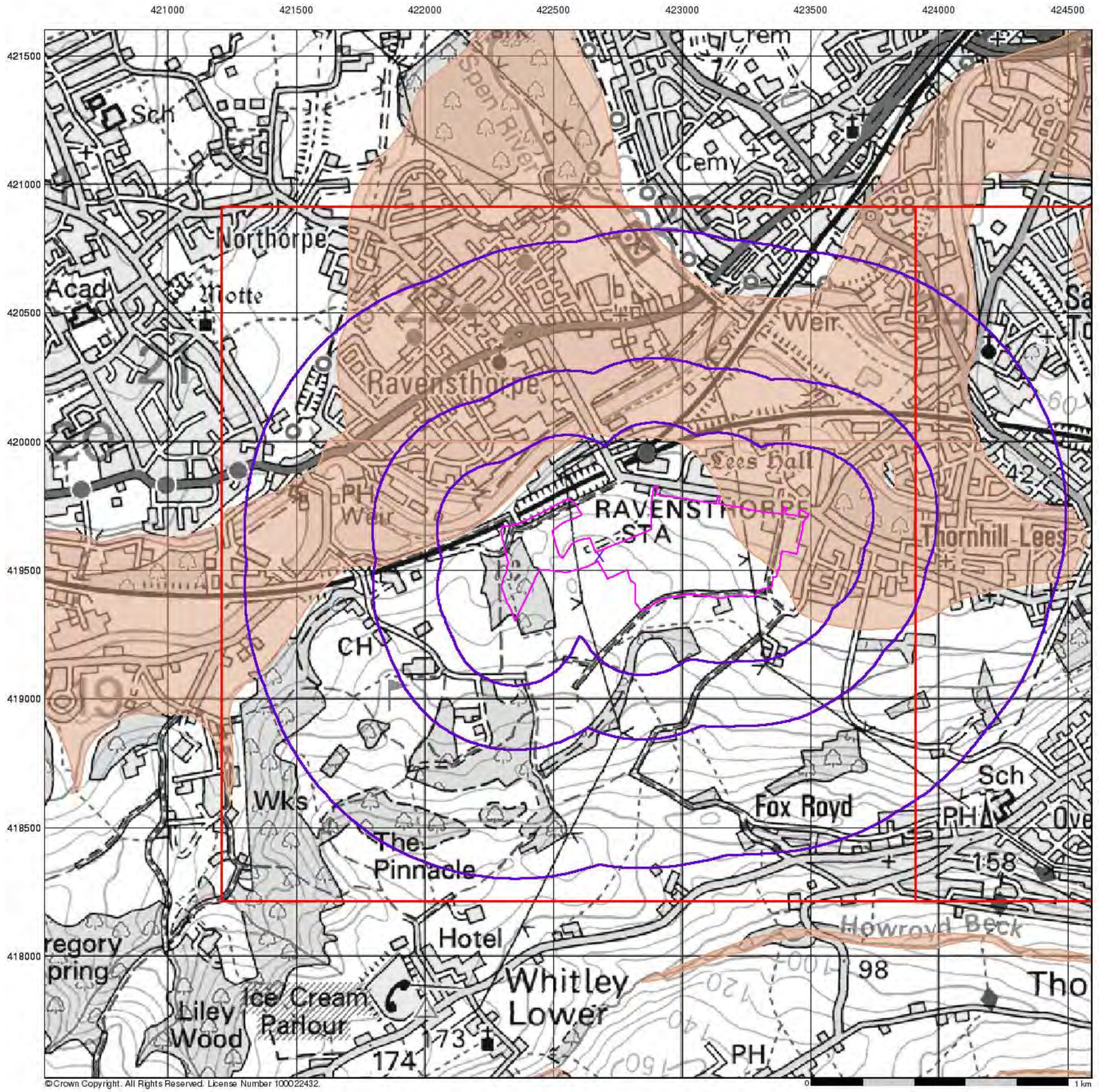


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Search Buffer (m):	1000

Site Details

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Superficial Aquifer Designation

General

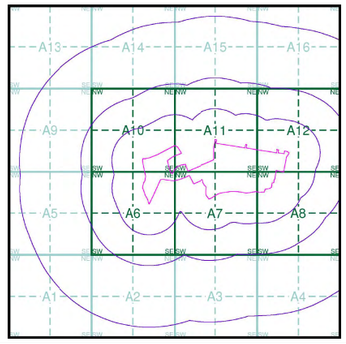
Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

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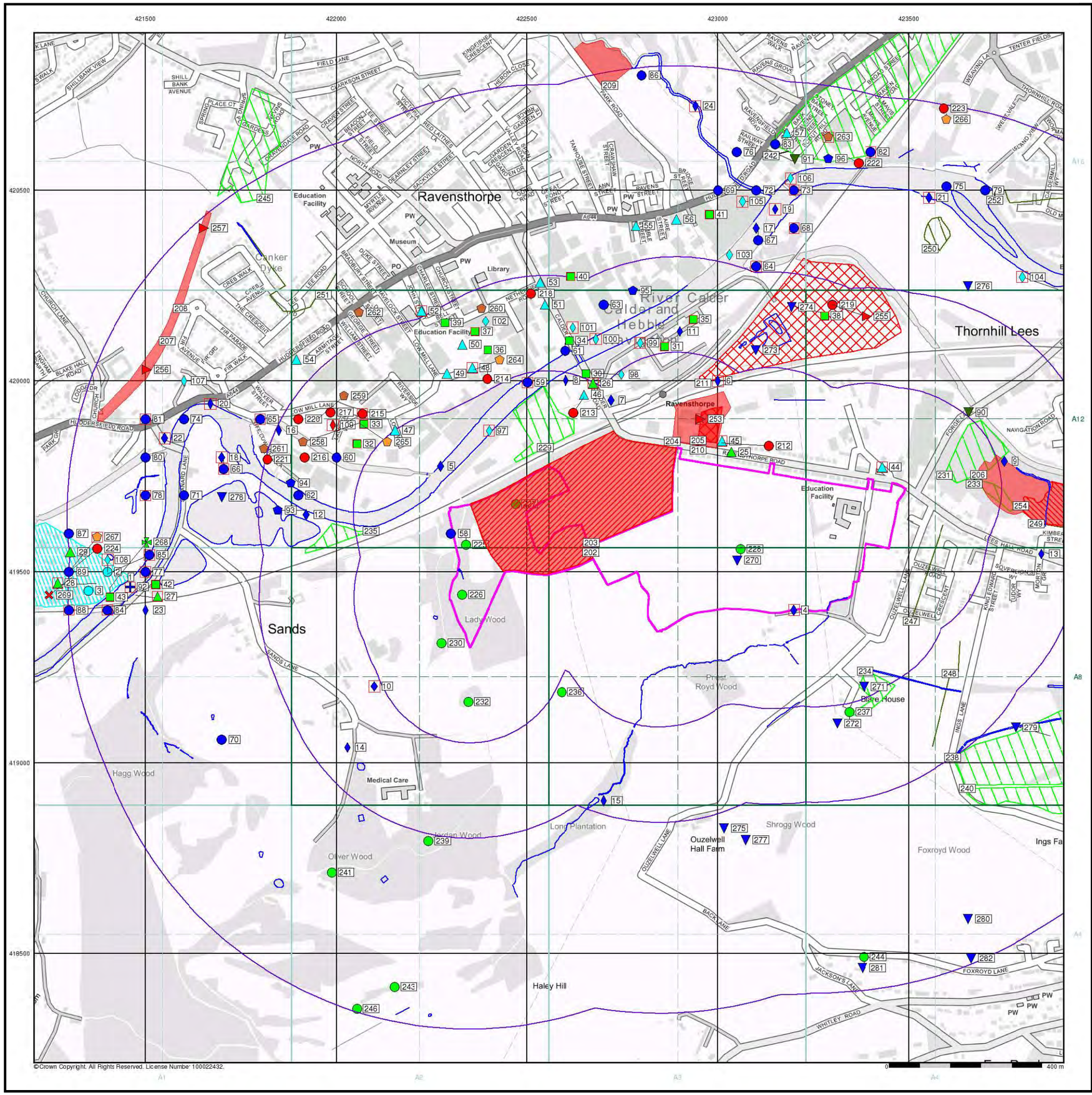
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Site Details

Dewsbury Riverside Gateway, DEWSBURY, WF12 9EE

Landmark INFORMATION GROUP
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



LITHOS CONSULTING

General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Map ID

Several of Type at Location

Agency and Hydrological

- Contaminated Land Register Entry or Notice (Location)
- Contaminated Land Register Entry or Notice
- Discharge Consent
- Enforcement or Prohibition Notice
- Integrated Pollution Control
- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Waters
- Prosecution Relating to Authorised Processes
- Prosecution Relating to Controlled Waters
- Registered Radioactive Substance
- River Network or Water Feature
- River Quality Sampling Point
- Substantiated Pollution Incident Register
- Water Abstraction
- Water Industry Act Referral

Hazardous Substances

COMAH Site | Explosive Site | NIHHS Site

- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

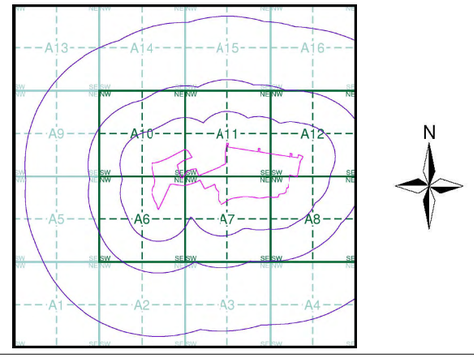
Geological

- BGS Recorded Mineral Site

Waste

- BGS Recorded Landfill Site (Location)
- BGS Recorded Landfill Site
- EA Historic Landfill (Buffered Point)
- EA Historic Landfill (Polygon)
- Integrated Pollution Control Registered Waste Site
- Licensed Waste Management Facility (Landfill Boundary)
- Licensed Waste Management Facility (Location)
- Local Authority Recorded Landfill Site (Location)
- Local Authority Recorded Landfill Site
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Water)
- Potentially Infilled Land (Water)
- Potentially Infilled Land (Water)
- Registered Landfill Site
- Registered Landfill Site (Location)
- Registered Landfill Site (Point Buffered to 100m)
- Registered Landfill Site (Point Buffered to 250m)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site (Location)
- Registered Waste Treatment or Disposal Site

Site Sensitivity Map - Slice A



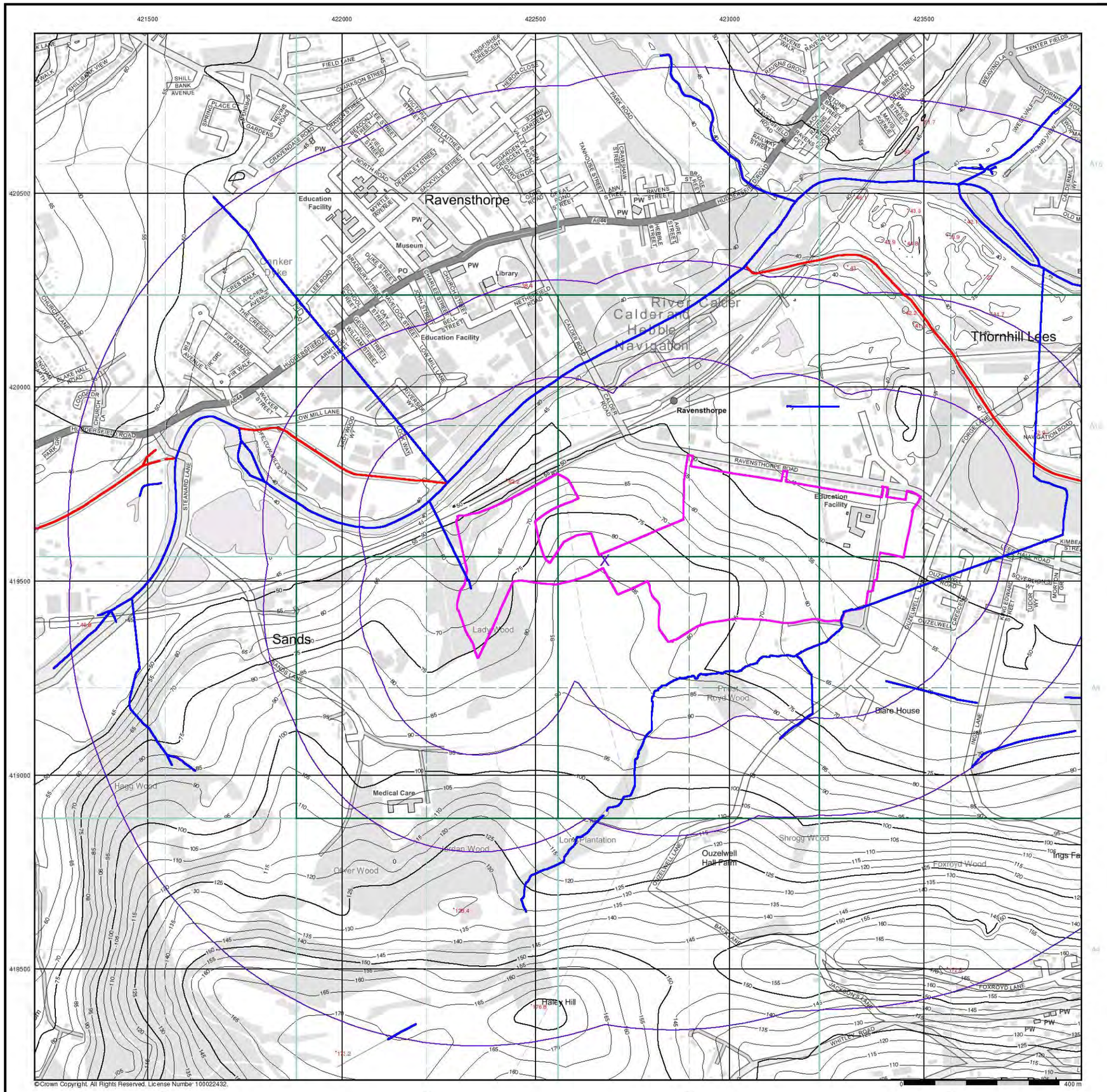
Order Details

Order Number:	269449509_1_1
Customer Ref:	3901
National Grid Reference:	422680, 419550
Slice:	A
Site Area (Ha):	30.39
Search Buffer (m):	1000

Site Details

Dewsbury Riverside Gateway, DEWSBURY, WF12 9EE

Landmark INFORMATION GROUP
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



LITHOS CONSULTING

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

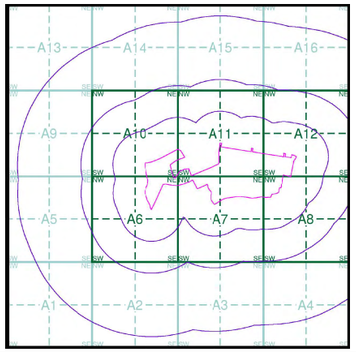
OS Water Network Data

- Canal
- Reservoir
- Foreshore
- Marsh
- Tidal River
- Inland River
- Drain
- Other
- Lake
- Transfer
- Lock Or Flight Of Locks
- Sea

Contours (height in meters)

- Standard Contour
- Master Contour
- Spot Height
- MLW Mean Low Water
- MHW Mean High Water

OS Water Network Map - Slice A



Order Details

Order Number:	269449509_1_1
Customer Ref:	3901
National Grid Reference:	422680, 419550
Slice:	A
Site Area (Ha):	30.39
Search Buffer (m):	1000

Site Details

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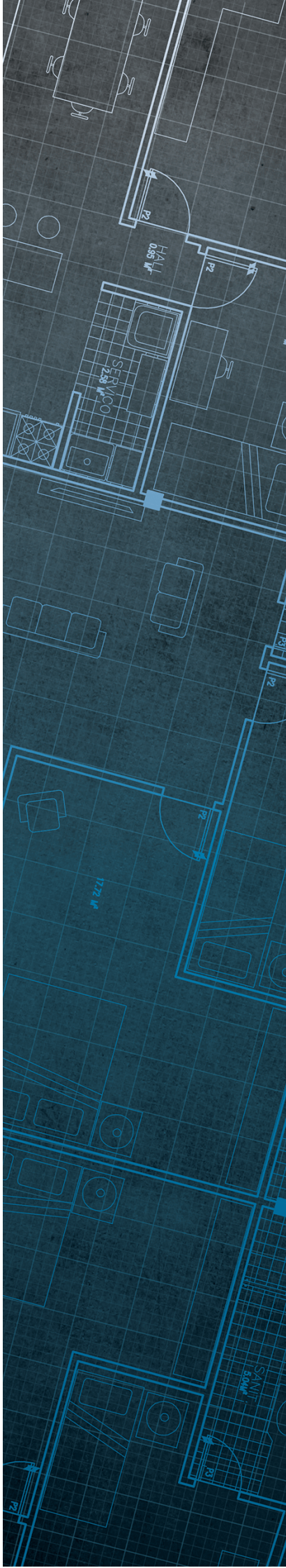
The Coal Authority

Consultants

Coal Mining Report

Dewsbury Riverside Gateway
WF12 9EE

Date of enquiry:	**26 November 2020**
Date enquiry received:	**26 November 2020**
Issue date:	**26 November 2020**
Our reference:	**51002322476001**
Your reference:	**PO16816/glm/3901**



Consultants

Coal Mining Report

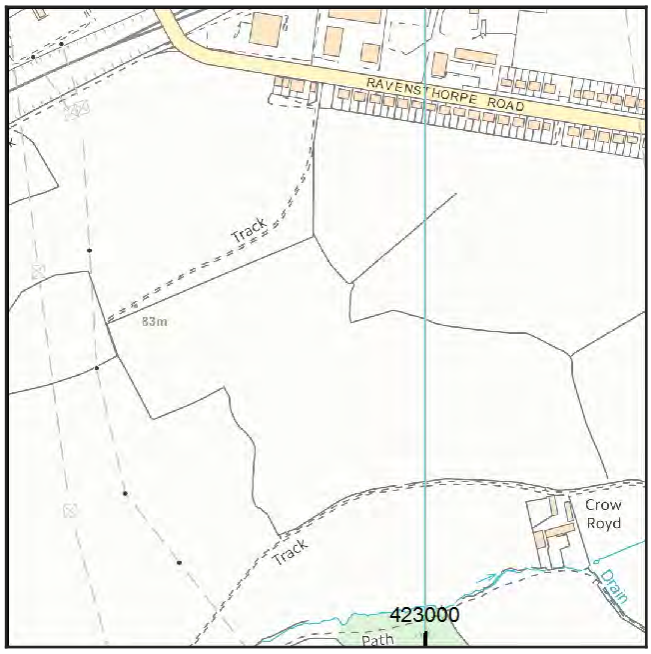
This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

LITHOS CONSULTING

Enquiry address

Dewsbury Riverside Gateway
WF12 9EE



Approximate position of property

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How to contact us

0345 762 6848 (UK)
+44 (0)1623 637 000 (International)

200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

www.groundstability.com

@coalauthority
/company/the-coal-authority
/thecoalauthority
/thecoalauthority

Section 1 – Mining activity and geology

Past underground mining

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	MIDDLETON MAIN	Coal	6NF8	4	Beneath Property	3.0	South-East	114	1833
unnamed	MIDDLETON LITTLE	Coal	6NI7	5	Beneath Property	2.4	East	84	1926
unnamed	MIDDLETON MAIN	Coal	6NC8	8	Beneath Property	3.2	South-East	114	1926
unnamed	MIDDLETON LITTLE	Coal	6NH7	9	Beneath Property	2.5	East	84	1926
unnamed	MIDDLETON MAIN	Coal	6ND8	14	Beneath Property	3.2	South-East	114	1926
unnamed	MIDDLETON MAIN	Coal	6NE8	31	Beneath Property	3.1	South-East	114	1927
unnamed	TOP BEESTON	Coal	6NCA	97	Beneath Property	3.5	South	137	1909
unnamed	TOP BEESTON	Coal	6NDA	108	South-East	2.9	East	97	1903
unnamed	WHINMOOR	Coal	6NFA	123	North-West	2.0	South-East	41	1909
unnamed	BLACK BED	Coal	6NGA	154	Beneath Property	2.5	North-East	76	1915
unnamed	BETTER BED	Coal	6NIA	237	Beneath Property	3.1	East	60	1909

Probable unrecorded shallow workings

Yes.

Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	422419-002	422554 419858	was found filled and subsequently capped with an 8.5m x 8.5m x 0.75m thick reinforced concrete cap at rockhead in 2003 by IMC Ltd on behalf of the Coal Authority	Coal	
Shaft	422419-003	422333 419446		Coal	
Shaft	422419-004	422302 419599		Coal	
Shaft	422419-005	422344 419596		Coal	
Shaft	422419-006	422290 419536		Coal	
Shaft	422419-007	422290 419501		Coal	
Shaft	422419-009	422388 419674		Coal	
Shaft	422419-010	422425 419643		Coal	
Shaft	422419-011	422458 419581		Coal	
Adit	422419-012	422376 419669		Coal	
Adit	422419-013	422490 419714		Coal	
Adit	422419-014	422493 419688		Coal	
Adit	422419-015	422421 419514		Coal	
Adit	422419-016	422422 419509		Coal	
Adit	422419-017	422488 419628		Coal	
Adit	422419-018	422406 419499		Coal	
Adit	422419-019	422407 419487		Coal	
Adit	422419-020	422404 419467		Coal	
Adit	422419-021	422395 419442		Coal	
Adit	422419-022	422396 419437		Coal	
Adit	422419-023	422380 419417		Coal	
Adit	422419-024	422360 419391		Coal	
Adit	422419-025	422343 419374		Coal	
Shaft	422419-026	422390 419660		Coal	

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	422419-027	422873 419558		Coal	
Adit	422419-028	422509 419680		Coal	
Adit	422419-029	422502 419674		Coal	
Adit	422419-030	422473 419598		Coal	
Adit	422419-031	422473 419583		Coal	
Adit	422419-032	422576 419564		Coal	
Adit	422419-037	422291 419312		Coal	
Shaft	422419-043	422339 419457		Coal	
Shaft	423419-001	423369 419436		Coal	
Shaft	423419-002	423389 419486		Coal	
Shaft	423419-003	423383 419491		Coal	
Shaft	423419-004	423282 419592		Coal	
Shaft	423419-005	423203 419656		Coal	
Shaft	423419-006	423184 419672		Coal	
Shaft	423419-008	423141 419838		Coal	
Shaft	423419-011	423468 419558		Coal	

Abandoned mine plan catalogue numbers

The following abandoned mine plan catalogue numbers intersect with some, or all, of the enquiry boundary:

FGB823	11057	FGB822
FGB551	2363	GCR56
FGB217	14457	10527

Our records show we have more plans than those shown above which could affect the enquiry boundary.

Please contact us on 0345 762 6848 to determine the exact abandoned mine plans you require based on your needs.

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Outcrops

Seam name	Mineral	Seam workable	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
LOW FENTON	Coal	Yes	Within	N/A	13
LOW FENTON	Coal	Yes	Within	N/A	134
MIDDLETON LITTLE	Coal	Yes	Within	N/A	58
MIDDLETON LITTLE	Coal	Yes	Within	N/A	88
MIDDLETON MAIN	Coal	Yes	Within	N/A	42
MIDDLETON MAIN	Coal	Yes	Within	N/A	210
MIDDLETON MAIN	Coal	Yes	Within	N/A	211
WHEATLEY LIME	Coal	Yes	Within	N/A	220

Geological faults, fissures and breaklines

Please refer to the 'Summary of findings' map (on separate sheet) for details of any geological faults, fissures or breaklines either within or intersecting the enquiry boundary.

Fault under or close to the property recorded.

Opencast mines

Please refer to the “Summary of findings” map (on separate sheet) for details of any opencast areas within 500 metres of the enquiry boundary.

Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

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Section 2 – Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

Site investigations

None recorded within 50 metres of the enquiry boundary.

Remediated sites

Distance to site remediation (m)	Direction
30.9	East
17.0	East
Within	N/A

See Section 4 for further information.

Coal mining subsidence

There are 1 claim(s) within 50 metres of the property boundary that do not match the property address. These are shown on the enquiry boundary plot.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

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

If further subsidence damage claims information is required, please visit www.groundstability.com.

See Section 4 for further information.

Mine gas

None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

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Section 3 – Licensing and future mining activity

Future underground mining
None recorded.

Coal mining licensing
None recorded within 200 metres of the enquiry boundary.

Court orders
None recorded.

Section 46 notices
No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

Withdrawal of support notices
The property is in an area where a notice to withdraw support was given in 1947.

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

Payments to owners of former copyhold land
The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

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Section 4 – Further information

The following potential risks have been identified and as part of your risk assessment should be investigated further.

Development advice

The site is within an area of historical coal mining activity. Should you require advice and/or support on understanding the mining legacy, its risks to your development or what next steps you need to take, please contact us.

Remediated sites

The site is within an area of previous interest. It is close to where the Coal Authority has investigated and where necessary remediated mine entries and/or shallow coal mine workings following specific reported hazards.

The site requires further investigation and may influence your risk assessment. We recommend that you order the Coal Authority **Surface Hazards Incident Report**, which will include more information about the hazard.

Coal mining subsidence

The site is within an area of previous interest. It is close to where the Coal Authority or licensed mine operator has investigated and where necessary remediated issues relating to coal mining subsidence.

The site requires further investigation and may influence your risk assessment. We recommend that you order the appropriate **Coal Authority Subsidence Claims Report**, which will include more information about the hazard.

For further information on specific site or ground investigations in relation to any issues raised in Section 4, please call us on 0345 762 6848 or email us at groundstability@coal.gov.uk.

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Section 5 – Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **call us on 0345 762 6848** or **email us at groundstability@coal.gov.uk.**

Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

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Opencast mines
Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

Coal Authority managed tips
Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

Site investigations
Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

Remediated sites
Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

Coal mining subsidence
Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

Mine gas
Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission.

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Mine water treatment schemes
Locations where the Coal Authority has constructed or operates assets that remove pollutants from mine water prior to the treated mine water being discharged into the receiving water body.

These schemes are part of the UK's strategy to meet the requirements of the Water Framework Directive. Schemes fall into 2 basic categories: Remedial – mitigating the impact of existing pollution or Preventative – preventing a future pollution incident.

Mine water treatment schemes generally consist of one or more primary settlement lagoons and one or more reed beds for secondary treatment. A small number are more specialised process treatment plants.

Future underground mining
Details of all planned underground mining relative to the enquiry boundary. Only those future workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination will be included.

Coal mining licensing
Details of all licenses issued by the Coal Authority either within or within 200 metres of the enquiry boundary in relation to the under taking of surface coal mining, underground coal mining or underground coal gasification.

Court orders
Orders in respect of the working of coal under the Mines (Working Facilities and Support) Acts of 1923 and 1966 or any statutory modification or amendment thereof.

Section 46 notices
Notice of proposals relating to underground coal mining operations that have been given under section 46 of the Coal Mining Subsidence Act 1991.

Withdrawal of support notices
Published notices of entitlement to withdraw support and the date of the notice. Details of any revocation notice withdrawing the entitlement to withdraw support given under Section 41 of the Coal Industry Act 1994.

Payment to owners of former copyhold land
Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.

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The Coal Authority

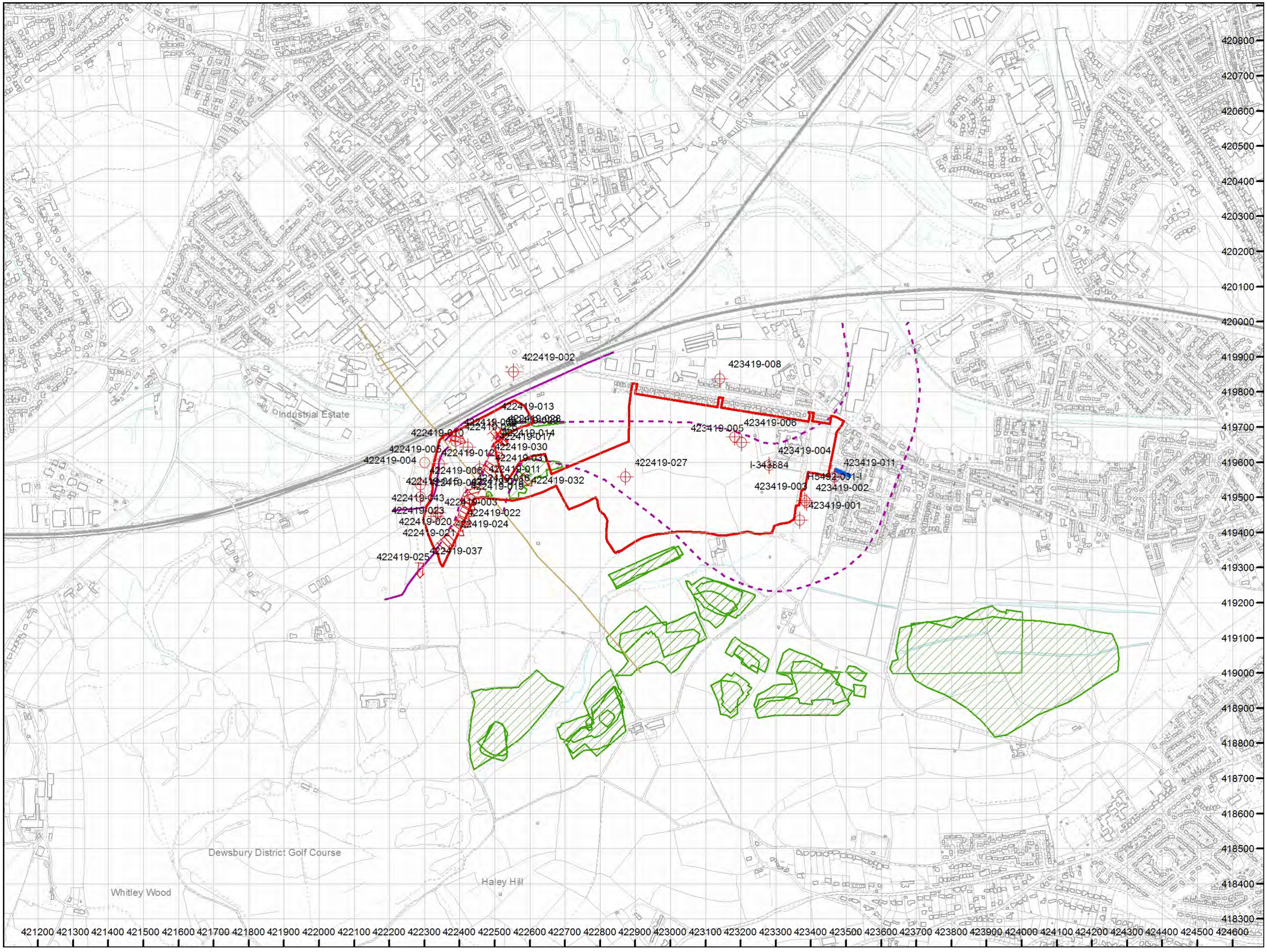
Summary of findings

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The map highlights any specific surface or subsurface features within or near to the boundary of the site.

Key

- Approximate position of the enquiry boundary shown
- Disused mine shaft
- Disused adit
- Outcrop (Proven)
- Outcrop (Conjectured)
- Geological faults
- Unlicensed opencast site
- Remediated sites
- Coal claim



How to contact us
0345 762 6848 (UK)
+44 (0)1623 637 000 (International)
www.groundstability.com

George Morton

From: George Morton
Sent: 18 December 2020 13:26
To: George Morton
Subject: FW: [External] mine waters query

From: John Leyland <JohnLeyland@coal.gov.uk>
Sent: 15 December 2020 17:45
To: George Morton <George.Morton@lithos.co.uk>
Cc: EnvironmentMail <EnvironmentMail@coal.gov.uk>; Rhiannon Marchi-Smith <RhiannonMarchi-Smith@coal.gov.uk>
Subject: RE: [External] mine waters query

George,

Many thanks for your enquiry. I have reviewed your Consultants mining report and the internal data sources on which it was based and can confirm that there are no Coal Authority mine water monitoring locations near to the site and that we are not aware of any specific mine water discharges in the area.

This does not mean that there are no mine water discharges in the area, just that they have not been reported which may indicate that they are not high flow, that they have not caused a nuisance to date or there is a general acceptance that there are mine water discharges in the area.

You have identified springs or water arising to the west of your site around the densely grouped mine entries in this area and I see that there are features marked on the OS mapping alluding to springs. It is likely that the water discharging here has interacted with mine workings and could therefore be described as mine water. This water is likely to contain elevated concentrations of minerals associated with the Coal Measures including iron which often presents as ochreous(orange) deposits around discharges. These constituents would be detected by standard metals analysis but they would also likely to occur in natural groundwater occurring in this area. It should be noted that “acid mine drainage” is rare in the UK and is related to specific conditions unlikely to be present at this site.

Please feel free to contact me directly to discuss this if required.

Regards

John

The Coal Authority

John Leyland BSc (Hons) MSc FGS
Hydrogeologist

DD: 01623 637 376
M : 07765 222 038
W : gov.uk/coalauthority

From: George Morton <George.Morton@lithos.co.uk>
Sent: 14 December 2020 15:48

To: thecoalauthority <thecoalauthority@coal.gov.uk>
Subject: [External] minewaters query

WARNING: This email originated outside of the Coal Authority. DO NOT CLICK any links or open any file attachments unless you recognise the sender and know the content is safe. Check the spelling of any email addresses carefully for anything unusual. If you are unsure please contact the ICT Service Desk for guidance.

Good afternoon.

We are currently undertaking a ground investigation at land off Ravensthorpe Road, Dewsbury. For reference please find attached a CA Consultants Mining Report which refers to our site boundary.

We are aware of several 'springs' where groundwaters issue from the ground which has been very heavily mined beneath this site. Most notably in places where there are very closely spaced mine entries (to the west). Therefore we are considering whether there could be the risk or 'contaminated' minewaters at this site.

Is the CA aware of any minewater contamination issues, reports, treatments etc in the immediate area, notably draining in to the River Calder which is located just to the north? If so are you able to advise on what information is available & the best way to make a search request/order?

Finally in the CA's experience are there any specific water quality tests which you would expect to see when dealing with mine water emissions from localised mine entries such as these?

Many thanks in advance for any advice.

Yours

George

George Morton
Senior Engineer
Lithos Consulting Ltd

Parkhill
Walton Road
Wetherby, LS22 5DZ

M 07887367346
DD 01937 545 338

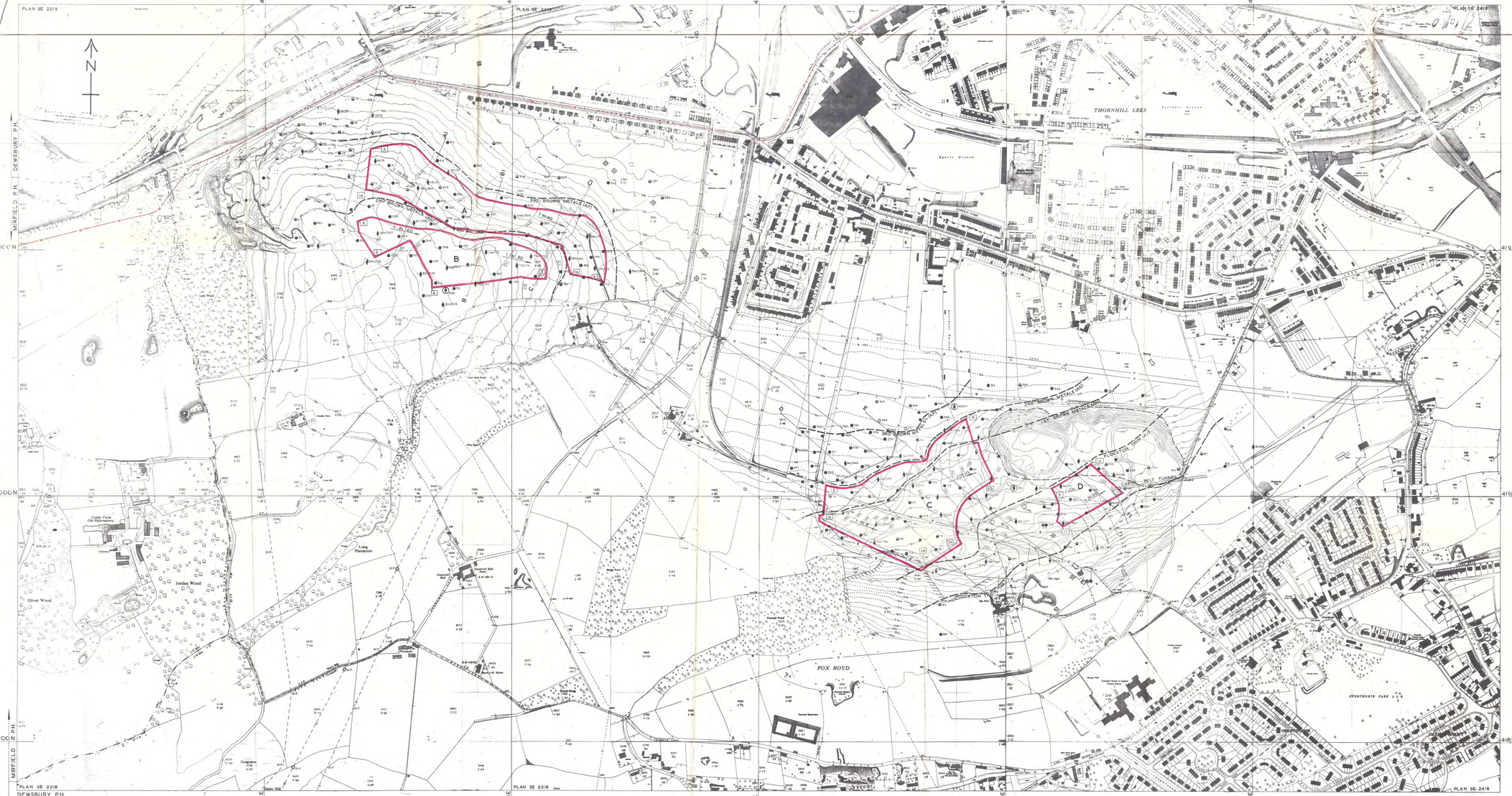
george@lithos.co.uk

www.lithos.co.uk





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030240 RAVENSTHORPE (DEWSBURY C.B.)
LOCATION:– 2 MILES S.W. OF DEWSBURY.
PLAN SE :– 2219, 2319, 2418 (1967) 2218, 2318, (1961) 2419 (1955).
SCALE :– 1/2500

LEGEND

COLOUR	SYMBOL (OPEN / PARTLY STRATA TIMED / CORE)	DESCRIPTION
BLACK	○	BOREHOLE SHOWING NEITHER COAL NOR OLD WORKINGS
BLACK	● ◐ ◐	BOREHOLE SHOWING SOLID COAL ONLY
BLACK	◒ ◒	BOREHOLE SHOWING OLD WORKINGS OR GOB SLACK WITH OR WITHOUT SOLID COAL
BLACK	190	SURFACE CONTOUR ABOVE ORDNANCE DATUM (METRES)
YELLOW	⊕	SHAFTS
YELLOW	⇨	POSITION OF KNOWN OR SUSPECTED OLD ADITS
BLACK	A — A1	LINE OF GEOLOGICAL SECTION
BLACK		EDGE OF UPSTANDING TYP
BLACK		OUTCROP OF FLOOR OF COAL SEAM
BLACK	190	CONTOURS AT BASE OF COAL SEAM ABOVE DATUM (METRES)
BLACK	1 in 5th	DIRECTION AND RATE OF DIP
VARIOUS	A	PROPOSED WORKING, PERIMETER OF SEAM WITH SPOT DEPTHS IN METRES
		DEEP MINES OLD WORKINGS IN 1ST OR 2ND BROWN METALS
BLACK		SITE BOUNDARY (INSIDE EDGE OF SYMBOL TO BE TAKEN AS BOUNDARY)
BLACK		AUTHORISED LIMIT OF EXCAVATION
BLACK		OLD WORKING IN OLD HANDS

SEAM DETAILS

COLOUR	SEAM NAME	SEAM CODE	SEAM CONTOUR
RED	FLOCKTON THIN	AJ	(50)
GREEN	FIRST BROWN METALS	AH	
BROWN	SECOND BROWN METALS	AG	(100)
BLUE	THIRD BROWN METALS	AF	(150)

SERVICES

Y.E.B.	O/H LINE	E — E
Y.E.B.	U/G CABLE	UE — UE
P.O	O/H LINE	T — T
P.O.	U/G CABLE	UT — UT
N.E.G.B.	GAS MAIN	G — G
C.E.G.B.	O/H LINE	CE — CE
MID CALDER W.B.	WATER MAIN	W — W
WAKEFIELD AND DISTRICT W.B.	WATER MAIN	WW — WW
DEWSBURY C.B.	SEWER	S — S
N.C.B.	WATER MAIN	NW — NW
N.C.B.	GAS MAIN	NG — NG
N.C.B.	O/H LINE	NE — NE
N.C.B.	U/G CABLE	NUE — NUE
PROPOSED WATER MAIN		W — W

NB. A DATUM 100m B.O.D. HAS BEEN USED ON THIS PLAN

GEOLOGICAL PLAN

030240 RAVENSTHORPE

DRAWING No. 05/9517

	REVISIONS	DATE		REVISIONS	DATE
A	PLAN DRAWN	PS 31-11-72			
B	SERVICES ADDED	" 23-3-76			
C	GEOLOGICAL INFORMATION ADDED	ES 2-4-78			
D	SERVICES AMENDED	20-6-78			

NATIONAL COAL BOARD—OPENCAST EXECUTIVE
No. 5 (CENTRAL) REGION. NOTTINGHAM.

BASED UPON THE ORDNANCE SURVEY MAP WITH THE SANCTION OF THE CONTROLLER OF H.M. STATIONERY OFFICE.
CROWN COPYRIGHT RESERVED.
ORDNANCE DATUM REFERRED TO:– NEWLYN.

Reg

From: France, Debbie <Debbie.France@environment-agency.gov.uk>
Sent: 16 April 2021 13:13
To: Reg
Subject: Your Enquiry: RFI/2021/208248

Our Ref: RFI/2021/208248

Dear Reg

RE: Environmental Information Request – 3901, Dewsbury Riverside Gateway
Request for information under the Freedom of Information Act 2000 (FOIA) / Environmental Information Regulations 2004 (EIR)

Thank you for your enquiry which was received on 4 March 2021. Apologies for the delay in responding

In response to your queries:

*A) Do the EA have **any regulatory concerns** associated with this former landfill?*

Other than the location of and basic information, the Environment Agency holds no detailed information on the landfills related to Thornhill Power Station as these are classed as *historic* landfills. We do not regulate these sites as they have no environmental permits associated with them. Kirklees Metropolitan Council have the remit for historic landfills and may hold more information as information on historic landfills was passed to the Local Authorities over 20 years ago.

The landfill known as Thornhill Quarry, operated by Demex Limited and located north of the proposed development does hold an environmental permit which we regulate. The site is now closed to waste acceptance. We have no regulatory concerns with this site.

*B) Has the landfill been identified as causing a problem to the River Calder under the **Water Framework Directive**?*

Having checked our records we can't find anything to suggest that the landfill is having an impact under WFD on the waterbody it is located within (waterbody GB104027062631, Calder from River Colne to River Chald).

I hope that we have correctly interpreted your request. Please see the Open Government Licence (here) for details of permitted use.

We respond to requests for recorded information that we hold under the Freedom of Information Act 2000 (FOIA) and the associated Environmental Information Regulations 2004 (EIR).

If you are not satisfied with our response to your request for information you can contact us within 2 calendar months to ask for our decision to be reviewed.

If you require any further help, please do not hesitate to contact me.

Yours sincerely

Debbie France
Customers and Engagement Team
Environment Agency | Lateral, 8 City Walk, Leeds, LS11 9AT

debbie.france@environment-agency.gov.uk
External: 0203 0254731 | Internal :54731

Enquiries Team Tel: 020 847 48174
Email: neyorkshire@environment-agency.gov.uk

Working days: Monday to Friday







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Appendix F

Trial Pit Logs

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP301
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423149.23 - 419735.08 Level: 45.80	Date 29/11/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.90	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20 0.20	B J&T					Dark brown slightly gravelly sandy CLAY with rare ceramic fragment. (TOPSOIL)
				0.40	45.40		Firm light brown and light grey very sandy CLAY. (COHESIVE GLACIAL DEPOSITS)
	0.80	D					*At 0.8m, terracotta land drain, dry.*
			HVP=96	1.00	44.80		Stiff bluish grey gravelly CLAY. Gravel is fine to coarse angular to sub angular of sandstone and coal. (COHESIVE GLACIAL DEPOSITS)
	1.20	D					
				2.00	43.80		Stiff medium brown cobbley gravelly CLAY. Cobbles and gravel are fine to coarse angular to sub angular and tabular sandstone lithorelicts. (COHESIVE RESIDUAL SOIL)
	2.30	D					
	2.50	B		2.50	43.30		Light yellowish brown SANDSTONE. Recovered as sandy cobbley angular fine to coarse gravel. (COAL MEASURES)
				2.90	42.90		End of pit at 2.90 m

1
2
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4
5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP302
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423215.65 - 419715.14 Level: 45.20	Date 29/11/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.90	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	J&T		0.40	44.80		Dark brown slightly gravelly clayey SAND. Gravel is fine to coarse angular to sub angular of mixed lithologies. (TOPSOIL)
	0.90	D	HVP=70 HVP=80 HVP=85	1.00	44.20		Firm light brown and light grey mottled gravelly sandy CLAY. Gravel is fine to coarse angular to sub angular and tabular of mixed lithologies. (COHESIVE GLACIAL DEPOSITS)
	1.80	D		1.90	43.30		Stiff bluish light grey gravelly very sandy CLAY. Gravel is fine to coarse angular to sub angular of sandstone. (COHESIVE GLACIAL DEPOSITS)
				2.90	42.30		Stiff bluish grey very gravelly CLAY with rare angular 60cm long cobble of fine to medium grained yellowish brown sandstone. Gravel is fine to coarse angular to sub angular of predominantly sandstone. (COHESIVE GLACIAL DEPOSITS) End of pit at 2.90 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP303
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423220.23 - 419676.70 Level: 46.75	Date 29/11/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.60	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	J&T		0.30	46.45		Dark brown gravelly cobbley sandy CLAY. Cobbles and gravel are angular to sub angular fine to coarse of mixed lithologies. (TOPSOIL)
	0.70	D	HVP=50 HVP=55 HVP=60	1.10	45.65		Firm light brown and light grey mottled sandy CLAY with occasional gravel of angular fine to medium grained yellowish brown sandstone. (COHESIVE GLACIAL DEPOSITS)
	1.20	D	HVP=110 HVP=115 HVP=120	1.40	45.35		Stiff bluish grey and light brown gravelly CLAY. Gravel is fine to coarse angular to sub angular of mixed lithologies. (COHESIVE GLACIAL DEPOSITS)
	1.50	B		2.60	44.15		Dark brown and bluish grey SANDSTONE. Recovered as clayey fine to coarse angular to sub angular gravel and cobbles. (COAL MEASURES) End of pit at 2.60 m

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4
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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP304
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423183.89 - 419645.17 Level: 49.35	Date 30/11/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.70	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T					Dark brown sandy CLAY with occasional gravel of angular black coal. (TOPSOIL)
				0.30	49.05		Stiff orange brown and mottled light grey slightly gravelly CLAY. Gravel is fine to coarse angular to sub angular of sandstone and coal. (COHESIVE GLACIAL DEPOSITS)
	0.80	D					
			HVP=105 HVP=75 HVP=80 HVP=95				
				1.40	47.95		Stiff bluish grey gravelly CLAY. Gravel is fine to coarse angular to sub angular of sandstone and coal. (COHESIVE GLACIAL DEPOSITS)
	1.50 1.50	B D					
			HVP=90				
				2.40	46.95		Medium brown SANDSTONE. Recovered as sandy angular fine grained gravel occasional coal traces. (COAL MEASURES)
				2.70	46.65		End of pit at 2.70 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit were unstable between 2.4m and 2.7m depth during excavation with some overbreak in the granular strata.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP305
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423212.05 - 419599.75 Level: 50.45	Date 29/11/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.60	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10 0.10	B J&T					Dark brown sandy CLAY with occasional rootlets and rare glass fragment. (TOPSOIL)
				0.40	50.05		
	0.60	D					Firm orangish brown and light grey slightly gravelly CLAY. Gravel is fine to coarse angular to sub angular fine to coarse of mixed lithologies. (COHESIVE GLACIAL DEPOSITS)
			HVP=60 HVP=65 HVP=70				*At 0.8m, land drain with water seepage.*
				1.40	49.05		Stiff brown and grey very gravelly CLAY. Gravel is angular to sub angular and tabular of laminated mudstone lithorelicts. (COHESIVE RESIDUAL SOIL)
	1.80	D					
				2.10	48.35		Bluish dark grey MUDSTONE. Recovered as clayey angular fine grained gravel and cobbles. (COAL MEASURES)
	2.50	D					
				2.60	47.85		End of pit at 2.60 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit were unstable between 2.1m and 2.6m depth during excavation with some overbreak in the granular strata.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP306
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423142.55 - 419560.21 Level: 59.55	Date 29/11/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 4.10	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T					Dark brown sandy CLAY with occasional gravel of mixed lithologies. (TOPSOIL)
				0.30	59.25		
	0.60	D	HVP=102 HVP=110 HVP=98				Stiff light brown and light grey mottled gravelly very sandy CLAY. Gravel is fine to coarse angular to sub angular and tabular of mixed lithologies. (COHESIVE GLACIAL DEPOSITS)
				1.20	58.35		
	1.30	D	HVP=130 HVP=140				Stiff bluish grey and orange brown very gravelly CLAY. Gravel is fine to coarse angular to sub angular and tabular of mixed lithologies. (COHESIVE GLACIAL DEPOSITS)
				2.00	57.55		Bluish dark grey MUDSTONE. Recovered as angular and tabular fine grained cobbles and gravel. (COAL MEASURES)
▼							*At 3.4m, water seeping in from base pit.*
				3.70	55.85		Black COAL recovered as angular gravel.
	4.00	B					
				4.10	55.45		End of pit at 4.10 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was apparent as significant inflow at 3.4m during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit were unstable between 3.4m and 4.1m depth during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP307
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423136.30 - 419598.41 Level: 56.60	Date 30/11/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.60	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	J&T		0.30	56.30		Dark brown very clayey SAND. (TOPSOIL)
	0.60	D	HVP=82				Stiff light grey and orange brown very sandy CLAY. (COHESIVE GLACIAL DEPOSITS)
	0.80	D		0.80	55.80		Black clayey GRAVEL of COAL.
				0.90	55.70		Yellowish brown and bluish grey SANDSTONE. Recovered as clayey angular and tabular fine grained gravel. (COAL MEASURES)
	1.70	D					*From 1.9m, becoming cobbley.*
				2.60	54.00		End of pit at 2.60 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit were unstable between 1.9m and 2.6m depth during excavation with some overbreak in the granular strata.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP308
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423140.23 - 419652.59 Level: 50.80	Date 30/11/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.70	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T		0.25	50.55		Dark brown sandy CLAY. (TOPSOIL)
	0.60	D	HVP=104 HVP=106 HVP=110	1.60	49.20		Stiff light grey and orange brown sandy CLAY with occasional gravel of angular sandstone lithorelicts and coal. (COHESIVE GLACIAL DEPOSITS)
	2.60	D		2.70	48.10		Dark to medium brown sandy clayey fine to coarse angular to sub angular GRAVEL of sandstone and coal. (GRANULAR GLACIAL DEPOSITS) End of pit at 2.70 m

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4
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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP309
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423105.53 - 419696.01 Level: 47.85	Date 30/11/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.70	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T		0.30	47.55		Dark brown clayey SAND. (TOPSOIL)
	0.60	D	HVP=70 HVP=78 HVP=80 HVP=90	1.10	46.75		Stiff medium brown and light grey slightly gravelly sandy CLAY. Gravel is angular to sub angular fine grained sandstone. (COHESIVE GLACIAL DEPOSITS)
	1.20	D	HVP=112				Stiff bluish grey and medium brown slightly gravelly CLAY. Gravel is fine to coarse angular to sub angular fine grained sandstone and coal. (COHESIVE GLACIAL DEPOSITS)
	1.80	B		2.50	45.35		Light grey and bluish grey SANDSTONE. Recovered as angular and tabular cobbles and gravel. (COAL MEASURES)
				2.70	45.15		End of pit at 2.70 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP310
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423075.39 - 419625.77 Level: 57.10	Date 30/11/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 4.50	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	J&T		0.30	56.80		Dark brown very sandy gravelly CLAY with rootlets. (TOPSOIL)
				0.40	56.70		Light greyish brown slightly sandy CLAY. (SUBSOIL)
			HVP=70 HVP=92				Stiff orange brown medium brown and light grey slightly sandy CLAY. (COHESIVE GLACIAL DEPOSITS)
	0.90	D					*From 1.0m, becoming gravelly.*
			HVP=90				
	1.20	B					*At 1.4m, 40cm by 40cm boulder of fine grained yellowish brown sandstone.*
							From 1.6m to 1.7m, weathered coal fragments abundant within clay.
				2.20	54.90		Stiff bluish grey and light brown sandy gravelly CLAY. Gravel is angular to sub angular fine to coarse sandstone and coal. (COHESIVE GLACIAL DEPOSITS)
				2.70	54.40		Orange and dark medium brown SANDSTONE. Recovered as clayey angular and tabular gravel and cobbles. (COAL MEASURES)
				3.50	53.60		Dark bluish grey MUDSTONE. Recovered as angular and tabular laminated gravel. (COAL MEASURES)
				4.50	52.60		End of pit at 4.50 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP311
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423071.00 - 419585.17 Level: 62.85	Date 30/11/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 4.20	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T					Dark brown slightly gravelly CLAY. Gravel is fine to coarse angular to sub angular of mixed lithologies. (TOPSOIL)
				0.40	62.45		Stiff orange brown and light grey slightly gravelly sandy CLAY. Gravel is fine to coarse angular to sub angular of yellowish brown sandstone. (COHESIVE GLACIAL DEPOSITS)
	0.70	D	HVP=70 HVP=72 HVP=80				
	1.10	D	HVP=120 HVP=125	1.20	61.65		Stiff medium brown and light grey gravelly CLAY. Gravel is angular to sub angular fine grained sandstone and coal. (COHESIVE GLACIAL DEPOSITS)
				2.50	60.35		Dark and light grey MUDSTONE. Recovered as angular and tabular gravel. (COAL MEASURES)
				3.40	59.45		Black COAL recovered as angular gravel.
	3.60	B					
				4.10	58.75		Dark bluish grey MUDSTONE. Recovered as angular and tabular laminated gravel. (COAL MEASURES)
				4.20	58.65		End of pit at 4.20 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No **TP312**

Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423016.91 - 419590.80 Level: 64.40	Date 30/11/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.80	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T					Dark brown sandy gravelly CLAY. Gravel is fine to coarse angular to sub angular of mixed lithologies. (TOPSOIL)
				0.30	64.10		
	0.50	D	HVP=100 HVP=60 HVP=70 HVP=80 HVP=90				Stiff orangish brown and light grey slightly cobbley gravelly sandy CLAY. Cobbles and gravel are fine to coarse angular to sub angular and tabular yellowish brown sandstone. (COHESIVE GLACIAL DEPOSITS)
				1.40	63.00		Stiff bluish grey and dark brown sandy CLAY. (COHESIVE RESIDUAL SOIL)
			HVP=82				
				1.80	62.60		Dark and light grey MUDSTONE. Recovered as angular and tabular gravel and cobbles. (COAL MEASURES)
				2.70	61.70		Black COAL recovered as angular gravel.
	3.10	B					
				3.40	61.00		Yellowish brown SANDSTONE. Recovered as angular and tabular fine grained gravel and cobbles. (COAL MEASURES)
				3.80	60.60		End of pit at 3.80 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP313
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422936.32 - 419586.99 Level: 67.80	Date 30/11/2017
Location:	Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.90	Scale 1:25
Client:	Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T		0.20	67.60		Dark brown cobbley gravelly sandy CLAY. Cobbles and gravel are angular and tabular of mixed lithologies. (TOPSOIL)
				0.30	67.50		Light greyish brown cobbley gravelly very sandy CLAY. Cobbles and gravel are angular to sub angular and tabular fine to medium sandstone. (SUBSOIL)
							Stiff orange brown cobbley very sandy CLAY. Cobbles are fine to coarse angular and tabular sandstone. (COHESIVE RESIDUAL SOIL)
	1.40	B		1.60	66.20		Stiff bluish grey gravelly CLAY. Gravel is fine to coarse angular to sub angular of sandstone. (COHESIVE RESIDUAL SOIL)
							From 2.4m, spalling in pit sides.
▼				2.90	64.90		End of pit at 2.90 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was at 2.9m apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit were unstable between 2.4m and 2.9m depth during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP314
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422989.32 - 419623.53 Level: 60.70	Date 30/11/2017
Location:	Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.00	Scale 1:25
Client:	Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30	60.40		Dark brown sandy CLAY. (TOPSOIL)
				0.50	60.20		Light brown very sandy slightly cobbley slightly gravelly CLAY. Cobbles and gravel are angular to sub angular and tabular fine to medium sandstone. (SUBSOIL)
							Stiff light brown and light grey mottled gravelly CLAY. Gravel is fine to coarse angular to sub angular and tabular of sandstone. (COHESIVE RESIDUAL SOIL)
				1.60	59.10		Stiff bluish grey and light brown very gravelly CLAY. Gravel is angular and tabular fine to medium sandstone. (COHESIVE RESIDUAL SOIL)
	2.40	B					
				2.50	58.20		Yellow brownish SANDSTONE. Recovered as angular and tabular fine grained gravel and cobbles. (COAL MEASURES)
▼				3.00	57.70		End of pit at 3.00 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was apparent at 3.0m during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP315
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423045.00 - 419686.74 Level: 50.40	Date 01/12/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.00	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10 0.10	B J&T					Dark brown sandy CLAY with much fine gravel of coal. (TOPSOIL)
				0.40	50.00		
				0.50	49.90		Light greyish brown slightly gravelly sandy CLAY. (SUBSOIL)
			HVP=60 HVP=60 HVP=70				Firm orange brown and mottled grey slightly gravelly very sandy CLAY. Gravel is fine to coarse angular to sub angular sandstone. (COHESIVE GLACIAL DEPOSITS)
				1.30	49.10		Stiff light grey and light brown gravelly CLAY. Gravel is fine to coarse angular and tabular. (COHESIVE RESIDUAL SOIL)
			HVP=72 HVP=75 HVP=76				
	1.60	B					
			HVP=80				
				2.70	47.70		Dark grey and brown MUDSTONE. Recovered as clayey angular to sub angular fine grained gravel. (COAL MEASURES)
	2.90	D					
				3.00	47.40		End of pit at 3.00 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP316
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423024.11 - 419740.11 Level: 49.45	Date 01/12/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 1.90	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	J&T		0.50	48.95		Dark brown very sandy CLAY with occasional angular to sub angular fine to coarse gravel and rare glass. (TOPSOIL)
	0.60	D	HVP=60 HVP=70 HVP=70				Stiff orange brown and light grey very sandy gravelly CLAY. Gravel is angular to sub angular tabular fine to medium yellowish brown sandstone. (COHESIVE GLACIAL DEPOSITS)
	1.10	B		1.40	48.05		Stiff light grey gravelly CLAY. Gravel is angular to sub angular and tabular sandstone. (COHESIVE RESIDUAL SOIL)
	1.60	D	HVP=105 HVP=110	1.70	47.75		Yellowish brown SANDSTONE. Recovered as angular and tabular fine grained gravel and cobbles. (COAL MEASURES)
				1.90	47.55		End of pit at 1.90 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP317
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422991.93 - 419712.40 Level: 52.00	Date 01/12/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.60	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T					Dark brown slightly gravelly sandy CLAY. Gravel is fine to coarse angular to sub angular of mixed lithologies. (TOPSOIL)
				0.30	51.70		Stiff orangish brown and light grey gravelly very sandy CLAY. Gravel is fine to coarse angular to sub angular and tabular sandstone and coal. (COHESIVE GLACIAL DEPOSITS) *At 0.5m, large fine to medium grained yellowish brown sandstone boulder. (40cm x 30xm)*
			HVP=100 HVP=110 HVP=90				
	0.70	D					
				1.40	50.60		Stiff light grey very gravel CLAY. Gravel is angular to sub angular fine to coarse sandstone. (COHESIVE GLACIAL DEPOSITS) *At 1.5m, rare angular cobbles of sandstone.*
	2.10	B					
				3.10	48.90		Dark grey MUDSTONE. Recovered as clayey angular to sub angular fine grained gravel. (COAL MEASURES)
				3.60	48.40		End of pit at 3.60 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit were unstable between 0.5m and 0.8m depth and also between 1.5m and 1.7m during excavation with some overbreak in the granular strata.

AGS

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Trial Pit Log

Trialpit No
TP318
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422966.75 - 419676.17 Level: 55.10	Date 01/12/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.90	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.40	54.70		Dark brown very sandy CLAY with occasional gravel of sandstone and coal. (TOPSOIL)
				0.60	54.50		Light brown sandy gravelly CLAY. Gravel is angular to sub angular fine to coarse sandstone and coal. (SUBSOIL)
	1.50	B	HVP=75	1.70	53.40		Stiff orangish brown and light grey gravelly sandy CLAY. Gravel is fine to coarse angular to sub angular and tabular sandstone. (COHESIVE GLACIAL DEPOSITS)
			HVP=98	2.60	52.50		Stiff medium brown and light grey gravelly CLAY. Gravel is fine to coarse angular to sub angular and tabular sandstone. (COHESIVE RESIDUAL SOIL)
	2.80	D		2.90	52.20		Buff and light grey SANDSTONE. Recovered as angular to sub angular and tabular fine grained gravel and cobbles. (COAL MEASURES)
							End of pit at 2.90 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP319
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422912.34 - 419653.63 Level: 62.25	Date 01/12/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 4.30	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T					Dark brown sandy slightly gravelly CLAY. Gravel is fine to coarse angular fine grained sandstone. (TOPSOIL)
				0.40	61.85		
	0.60	D					Light and medium brown very gravelly clayey SAND. Gravel is fine to medium grained sandstone. (SUBSOIL)
				0.70	61.55		
							Stiff orange brown and light grey gravelly sandy CLAY with occasional sandstone cobbles. Gravel and cobbles are angular to sub angular. (COHESIVE RESIDUAL SOIL)
				1.70	60.55		
							Buff and light grey SANDSTONE. Recovered as angular to sub angular and tabular fine grained gravel and cobbles. (COAL MEASURES)
	2.60	B					*From 2.6m, Becoming very cobbly.*
▼							*At 2.9m, water seeping in from base of pit.*
				4.30	57.95		End of pit at 4.30 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was apparent at 2.9m during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit were unstable between 2.6m and 2.9m depth during excavation.

AGS

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Trial Pit Log

Trialpit No
TP320
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422910.19 - 419732.28 Level: 55.75	Date 01/12/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.40	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10 0.10	B J&T					Dark brown sandy slightly gravelly CLAY with rare glass. Gravel is fine to coarse of mixed lithologies. (TOPSOIL)
				0.40	55.35		
				0.50	55.25		Light orangish brown clayey SAND. (SUBSOIL)
	1.00	D	HVP=90				Stiff light grey and orange brown mottled gravelly CLAY. Gravel is angular to sub angular sandstone. (COHESIVE RESIDUAL SOIL)
				1.20	54.55		Buff and light grey SANDSTONE. Recovered as angular to sub angular and tabular fine grained gravel. (COAL MEASURES)
							From 1.9m, becoming cobbly.
	2.20	B					
▼				2.40	53.35		End of pit at 2.40 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was apparent at 2.4m during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit were unstable between 1.9m and 2.4m depth during excavation.

AGS

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Trial Pit Log

Trialpit No
TP321
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422940.50 - 419772.71 Level: 51.15	Date 01/12/2017
Location:	Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.50	Scale 1:25
Client:	Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	B		0.30	50.85		Dark brown slightly gravelly clayey SAND. Gravel is angular and sub angular fine to coarse of mixed lithologies. (TOPSOIL)
				0.40	50.75		Light orangish brown gravelly clayey SAND. Gravel is angular to sub angular fine sandstone. (SUBSOIL)
							Stiff light grey and mottled orange brown very sandy slightly gravelly CLAY. Gravel is angular to sub angular fine to medium sandstone. (COHESIVE GLACIAL DEPOSITS)
			HVP=110	1.10	50.05		Stiff light grey very gravelly CLAY. Gravel is angular to sub angular and tabular fine to medium sandstone. (COHESIVE RESIDUAL SOIL)
				1.70	49.45		Buff and light grey SANDSTONE. Recovered as angular to sub angular and tabular fine grained gravel. (COAL MEASURES)
				2.50	48.65		End of pit at 2.50 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP322
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422896.18 - 419697.73 Level: 59.45	Date 01/12/2017
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.80	Scale 1:25
Client: Kirklees Council			Logged FQ

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30	59.15		Dark brown sandy CLAY. (TOPSOIL)
				0.90	58.55		Stiff orange brown and light grey slightly gravelly sandy CLAY. Gravel is fine to coarse angular to sub angular of yellowish brown sandstone. (COHESIVE GLACIAL DEPOSITS)
				1.50	57.95		Stiff light grey very gravelly CLAY. Gravel is angular to sub angular and tabular fine to medium sandstone. (COHESIVE RESIDUAL SOIL)
	2.30	B		2.20	57.25		Yellowish brown and light grey SANDSTONE. Recovered as angular to sub angular and tabular fine grained gravel. (COAL MEASURES)
				2.60	56.85		Black COAL recovered as angular gravel.
				2.80	56.65		Buff and light grey SANDSTONE. Recovered as angular to sub angular and tabular fine grained gravel. (COAL MEASURES)
							End of pit at 2.80 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP501
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423316.53 - 419571.48 Level: 50.45	Date 05/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.70	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T					Dark greyish brown sandy silty CLAY. Some rootlets and plant debris. (TOPSOIL)
	0.20	B		0.30	50.15		Firm light yellowish brown slightly sandy slightly gravelly CLAY. Gravel is subangular fine to medium of sandstone. (COHESIVE GLACIAL DEPOSITS)
	0.60	D		0.90	49.55		Firm brown mottled grey sandy gravelly CLAY. Gravel is subangular fine to medium of sandstone and siltstone. (COHESIVE GLACIAL DEPOSITS)
	1.20	D		1.50	48.95		Grey clayey angular fine to coarse GRAVEL of sandstone and siltstone. (GRANULAR GLACIAL DEPOSITS)
				2.70	47.75		End of pit at 2.70 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP502
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423205.57 - 419550.34 Level: 54.35	Date 05/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.40	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T					Dark greyish brown silty slightly sandy CLAY with some rootlets. Two sandstone boulders of up to 1.0m diameter at base. (TOPSOIL)
				0.35	54.00		Firm brown sandy CLAY. (COHESIVE GLACIAL DEPOSITS)
				0.50	53.85		Stiff yellowish brown mottled grey gravelly CLAY. Gravel is subangular fine to coarse of siltstone. (COHESIVE GLACIAL DEPOSITS)
			HVP=66				
	0.80	D					
				1.10	53.25		Stiff brown mottled grey gravelly CLAY. Gravel is very angular to angular fine to medium of mudstone. (COHESIVE GLACIAL DEPOSITS)
			HVP=98				
							From 2.0m, with very closely spaced fissures.
▼				2.50	51.85		Medium strong grey thickly laminated to thinly bedded SILTSTONE. Recovered as angular, tabular fine to coarse gravel. (LOWER COAL MEASURES)
							At 2.6m, groundwater seepage from pit walls.
	3.00	D					
				3.40	50.95		End of pit at 3.40 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was apparent at 2.6m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP503
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423167.59 - 419502.36 Level: 61.35	Date 06/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.90	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.25	61.10		Greyish brown silty CLAY. Rare angular fine to medium gravel of mudstone and coal. Occasional rootlets and plant fragments. (TOPSOIL)
	0.60	D	HVP=72 HVP=60 HVP=120				Firm light brown mottled grey gravelly CLAY. Gravel is angular to subangular fine to coarse of sandstone. (COHESIVE GLACIAL DEPOSITS) *From 1.1m, clay is stiff.*
	2.00	D		1.80	59.55		Brownish grey clayey angular tabular fine to coarse GRAVEL of siltstone. (COHESIVE RESIDUAL SOIL)
				2.30	59.05		Weak greyish brown thinly laminated SILTSTONE. Recovered a slightly clayey angular, tabular fine to medium gravel. (LOWER COAL MEASURES) *From 2.7m, orangish brown with gravel and cobble sized ironstone nodules.*
				2.90	58.45		End of pit at 2.90 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP504
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423230.84 - 419509.41 Level: 55.50	Date 06/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.40	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T					Dark greyish brown sandy silty CLAY. Some rootlets and occasional plant debris. (TOPSOIL)
	0.20	B		0.30	55.20		
▼							Firm light brown sandy slightly gravelly CLAY. Gravel is angular fine to medium of sandstone. (COHESIVE GLACIAL DEPOSITS)
							At 0.4m, groundwater seepage in southeastern trial pit wall.
	0.80	D					
				1.00	54.50		Dark brown mottled grey very gravelly CLAY. Gravel is angular, tabular fine to coarse of sandstone. (COHESIVE GLACIAL DEPOSITS)
							At 2.2m, 20cm bed of dark grey CLAY with much very angular tabular fine gravel of mudstone.
				2.50	53.00		Moderately weak light brown thinly bedded fine grained SANDSTONE. Recovered as angular, tabular fine to coarse gravel with a low angular, tabular cobble content. (LOWER COAL MEASURES)
▼							*At 2.9m, groundwater seepage from pit walls.*
	3.00	D					
				3.40	52.10		End of pit at 3.40 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was apparent at 0.4m and 2.9m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP505
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423209.05 - 419462.70 Level: 58.40	Date 06/01/2021
Location:	Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.60	Scale 1:25
Client:	Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T					Dark greyish brown sandy silty CLAY. Rare angular fine gravel of mudstone, sandstone and pottery. Occasional rootlets and plant fragments. (TOPSOIL)
				0.30	58.10		Stiff light brown mottled grey slightly gravelly CLAY. Gravel is angular to subangular, tabular fine to coarse of sandstone. (COHESIVE GLACIAL DEPOSITS)
	0.50	D	HVP=70				
			HVP=78				
				1.00	57.40		Brown mottled grey very gravelly CLAY. Gravel is angular, tabular fine to coarse of siltstone and sandstone. (COHESIVE GLACIAL DEPOSITS)
				2.10	56.30		Very stiff grey friable CLAY. (COHESIVE GLACIAL DEPOSITS)
	2.30	D					
				3.60	54.80		End of pit at 3.60 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP506
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423238.73 - 419415.35 Level: 58.90	Date 06/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 4.00	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	B		0.15	58.75		Dark greyish brown silty slightly sandy CLAY with rare angular fine gravel of mudstone and sandstone. Some rootlets and plant fragments. (TOPSOIL)
	0.30	D	HVP=66	0.60	58.30		Firm light brown mottled grey slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of sandstone. (COHESIVE GLACIAL DEPOSITS)
	0.90	D		1.60	57.30		Brown mottled grey gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse of sandstone and siltstone. (COHESIVE GLACIAL DEPOSITS)
	2.00	D		4.00	54.90		Grey mottled brown very gravelly CLAY with a low angular, tabular cobble content. Gravel is angular, tabular fine to coarse of sandstone. (COHESIVE GLACIAL DEPOSITS) End of pit at 4.00 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

Trial Pit Log

Trialpit No **TP507**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423316.93 - 419438.06 Level: 55.20
Date	06/01/2021		
Location:	Dewsbury Riverside Central Gateway	Dimensions (m): Depth 3.20	Scale 1:25
Client:	Kirklees Council		Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T	HVP=82	0.25	54.95		Dark brownish grey silty slightly gravelly CLAY. Gravel is angular fine to medium of coal, mudstone and sandstone. Occasional rootlets. (TOPSOIL)
	0.50	D					Firm light brown slightly gravelly CLAY. Gravel is angular, tabular fine to medium of sandstone. (COHESIVE GLACIAL DEPOSITS) *At 0.5m, terracotta land drain.*
	1.00	D		0.80	54.40		Brown mottled grey very gravelly CLAY. Gravel is very angular to angular, tabular fine to medium of siltstone and sandstone. (COHESIVE GLACIAL DEPOSITS)
				1.60	53.60		Stiff brown mottled grey friable gravelly CLAY. Gravel is angular fine to coarse of sandstone and siltstone. (COHESIVE GLACIAL DEPOSITS)
				3.00	52.20		Weak greyish brown SILTSTONE. Recovered as angular fine to coarse gravel. (LOWER COAL MEASURES)
				3.20	52.00		End of pit at 3.20 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

Trial Pit Log

LITHOS CONSULTING

Trialpit No **TP508** Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423324.31 - 419499.87 Level: 53.05	Date 06/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.90	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T		0.20	52.85		Dark greyish brown slightly sandy silty CLAY. Occasional rootlets and plant fragments. (TOPSOIL)
	0.70	D	HVP=76	0.90	52.15		Firm light brown gravelly CLAY. Gravel is angular, tabular medium to coarse of sandstone. (COHESIVE GLACIAL DEPOSITS)
			HVP=92				Stiff brown mottled grey gravelly CLAY. Gravel is very angular to angular, tabular fine to medium of siltstone and sandstone. (COHESIVE GLACIAL DEPOSITS)
	1.50	D					*From 1.5m, medium angular, tabular sandstone cobbles.*
							From 2.1m, rare angular, tabular 1.0m sandstone boulders.
							From 3.0m, with high boulder and cobble content. Becoming difficult to excavate further.
				3.90	49.15		End of pit at 3.90 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP509
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423352.73 - 419532.31 Level: 50.95	Date 06/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.40	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	B		0.20	50.75		Dark greyish brown silty CLAY. Some rootlets and occasional plant debris. (TOPSOIL)
	0.60	D	HVP=54	0.70	50.25		Firm light brown sandy CLAY. (COHESIVE GLACIAL DEPOSITS)
			HVP=100				Stiff brown mottled grey gravelly CLAY. Gravel is angular to subangular, tabular fine to coarse of sandstone and occasional siltstone and mudstone. Low angular tabular sandstone cobble content. (COHESIVE GLACIAL DEPOSITS)
	1.30	D					*From 1.9m, medium subangular cobble and subangular boulder content.*
				3.40	47.55		End of pit at 3.40 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP510
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423154.52 - 419399.50 Level: 64.10	Date 07/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.00	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T		0.25	63.85		Dark greyish brown slightly silty gravelly CLAY. Gravel is angular to subangular fine to medium of sandstone and rare pottery and coal. (TOPSOIL)
	0.60	D	HVP=58	0.90	63.20		Firm light brown sandy slightly gravelly CLAY. Gravel is angular fine to coarse of sandstone. (COHESIVE GLACIAL DEPOSITS)
			HVP=76				Stiff brown mottled grey very gravelly slightly sandy CLAY. Gravel is angular fine to medium of siltstone, mudstone, sandstone and rare coal. (COHESIVE RESIDUAL SOIL)
	2.00	D					*From 1.8m, medium subangular sandstone cobble and low subangular sandstone boulder content.*
				3.00	61.10		End of pit at 3.00 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP511
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423111.10 - 419455.36 Level: 69.45	Date 07/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 1.70	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T					Dark greyish brown silty CLAY with occasional rootlets. (TOPSOIL)
				0.30	69.15		Firm light brown CLAY. (COHESIVE RESIDUAL SOIL)
	0.70	D		0.60	68.85		Black clayey SAND and fine subangular GRAVEL of coal. (COAL)
	1.00	D		0.90	68.55		Stiff friable grey CLAY. (SEAT EARTH)
				1.10	68.35		Firm light brown gravelly CLAY. Gravel is angular, tabular fine to medium of sandstone. (COHESIVE RESIDUAL SOIL)
	1.50	D		1.30	68.15		Moderately weak thickly laminated finely grained SANDSTONE. Recovered as angular, tabular fine to coarse gravel. (LOWER COAL MEASURES)
				1.70	67.75		End of pit at 1.70 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP512
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423076.54 - 419538.46 Level: 68.45	Date 07/01/2021
Location:	Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.70	Scale 1:25
Client:	Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30	68.15		Dark greyish brown silty CLAY. Occasional rootlets and plant fragments. (TOPSOIL)
	0.50	D					Buff slightly clayey slightly sandy angular to subangular, tabular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)
				1.30	67.15		Weak light brown thinly bedded finely grained SANDSTONE. Recovered as sandy angular to subangular fine to coarse gravel. (LOWER COAL MEASURES)
	1.60	D					
				2.70	65.75		End of pit at 2.70 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP513
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423014.96 - 419547.30 Level: 71.20	Date 07/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.70	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T		0.30	70.90		Dark greyish brown clayey slightly sandy SILT. Sand includes fragments of coal. Some rootlets and plant fragments. (TOPSOIL)
	0.50	D		1.20	70.00		Light brown clayey slightly sandy angular, tabular fine to coarse GRAVEL of sandstone. Low angular, tabular sandstone cobble content. (GRANULAR RESIDUAL SOIL)
	1.50	D		2.70	68.50		Very weak grey mottled orangish brown thinly bedded fine grained SANDSTONE. Recovered as clayey angular, tabular fine to medium gravel. (LOWER COAL MEASURES)
							End of pit at 2.70 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP514
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423010.74 - 419471.80 Level: 76.15	Date 07/01/2021
Location:	Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.40	Scale 1:25
Client:	Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T		0.25	75.90		Dark greyish brown silty slightly sandy CLAY. Occasional rootlets. (TOPSOIL)
			HVP=58				Firm light brown mottled grey slightly gravelly CLAY. Gravel is subangular fine to coarse of sandstone. Rare subangular, tabular sandstone cobbles. (COHESIVE RESIDUAL SOIL)
	0.90	D	HVP=72				
				2.20	73.95		Weak light brown thinly bedded finely grained SANDSTONE. Recovered as sandy angular to subangular fine to coarse gravel. (LOWER COAL MEASURES)
				2.40	73.75		End of pit at 2.40 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP515
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423059.62 - 419411.48 Level: 72.25	Date 07/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.50	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T					Dark greyish brown sandy slightly gravelly SILT. Gravel is subangular fine to medium of sandstone and rare coal, mudstone and pottery. (TOPSOIL)
				0.30	71.95		Firm light brown mottled grey gravelly CLAY. Gravel is angular, tabular fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)
	0.50	D					
				0.90	71.35		Moderately weak grey mottled orangish brown thinly bedded fine grained SANDSTONE. Recovered as clayey angular, tabular medium to coarse gravel with much angular, tabular cobbles. (LOWER COAL MEASURES)
				1.40	70.85		Extremely weak black COAL. Recovered as sand and angular, tabular fine gravel. (COAL)
	1.70	D					
				2.20	70.05		Stiff grey friable gravelly CLAY. Gravel is angular, tabular fine of mudstone. (SEAT EARTH)
▼	2.50	D					*At 2.5m, groundwater seepage from trial pit walls.*
				2.70	69.55		Extremely weak brownish grey thinly laminated MUDSTONE. Recovered as angular fine gravel. (LOWER COAL MEASURES)
				3.50	68.75		End of pit at 3.50 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was apparent at 2.5m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP516
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422956.49 - 419406.45 Level: 78.75	Date 07/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.00	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T		0.20	78.55		Dark greyish brown silty slightly gravelly CLAY. Gravel is angular to subangular fine to medium of sandstone. Occasional rootlets. (TOPSOIL)
	0.50	D		0.70	78.05		Firm light brown mottled grey very gravelly slightly sandy CLAY. Gravel is angular, tabular fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)
▼				1.30	77.45		Medium strong light grey thinly bedded fine grained SANDSTONE. Recovered as slightly clayey angular, tabular medium to coarse gravel with medium angular tabular cobble content. (LOWER COAL MEASURES) *At 1.0m, groundwater seepage from eastern trial pit walls.*
				2.30	76.45		Stiff grey friable gravelly CLAY. Gravel is angular, tabular fine of mudstone lithorelicts. (COHESIVE RESIDUAL SOIL)
				3.00	75.75		Very weak grey thickly laminated MUDSTONE. Recovered as slightly clayey angular, tabular fine to medium gravel. (LOWER COAL MEASURES) End of pit at 3.00 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was apparent at 1.0m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP517
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422959.83 - 419503.05 Level: 78.10	Date 07/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.00	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10 0.20	J&T B					Dark greyish brown silty slightly sandy CLAY. Rare angular fine to medium gravel of pottery, sandstone and mudstone. Occasional rootlets and plant debris. (TOPSOIL)
				0.35	77.75		Firm light orangish brown mottled grey slightly gravelly CLAY. Gravel is subangular medium to coarse of sandstone with a low subangular sandstone cobble and medium subangular sandstone boulder content. (COHESIVE RESIDUAL SOIL)
	0.90	D					
				1.30	76.80		Stiff grey mottled brown gravelly CLAY with closely spaced fissures. Gravel is angular, tabular fine of mudstone. (COHESIVE RESIDUAL SOIL)
				3.00	75.10		End of pit at 3.00 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP518
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422909.52 - 419564.67 Level: 72.65	Date 07/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.60	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T					Dark greyish brown silty sandy CLAY with occasional rootlets. (TOPSOIL)
				0.30	72.35		
	0.60	D	HVP=70				Firm light orangish brown mottled grey slightly gravelly CLAY. Gravel is angular to subangular, tabular fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)
				1.00	71.65		
							Light greyish brown clayey slightly sandy angular, tabular fine to coarse GRAVEL of siltstone. Low angular, tabular siltstone cobble content. (GRANULAR RESIDUAL SOIL)
				2.20	70.45		
	2.40	D					Moderately weak brownish grey thinly bedded SILTSTONE. Recovered as slightly clayey angular, tabular medium gravel. (LOWER COAL MEASURES)
				2.60	70.05		End of pit at 2.60 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP519
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422846.39 - 419638.55 Level: 70.25	Date 07/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.10	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T		0.25	70.00		Dark greyish brown silty slightly sandy CLAY. Occasional rootlets and plant debris. (TOPSOIL)
	0.60	D	HVP=60				Firm orangish brown mottled grey gravelly CLAY. Gravel is angular, tabular fine to medium of sandstone. (COHESIVE RESIDUAL SOIL)
	2.00	D		1.80	68.45		Very weak grey mottled orangish brown thickly interlaminated MUDSTONE and SILTSTONE. Recovered as slightly clayey angular, tabular fine to medium gravel. (LOWER COAL MEASURES)
▼							*At 2.6m, groundwater seepage from trial pit walls.*
				2.80	67.45		Moderately weak brownish grey SILTSTONE. Recovered as angular, tabular fine to coarse gravel. (LOWER COAL MEASURES)
				3.10	67.15		End of pit at 3.10 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was apparent at 2.6m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP520
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422845.68 - 419589.16 Level: 74.85	Date 07/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.40	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T					Dark greyish brown silty slightly gravelly CLAY. Gravel is subangular to rounded fine to medium of sandstone and occasional mixed lithologies. (TOPSOIL)
	0.20	B					
				0.35	74.50		Firm orangish brown mottled grey gravelly CLAY. Low angular tabular sandstone cobble content. Gravel is angular, tabular medium to coarse of sandstone and siltstone. (COHESIVE RESIDUAL SOIL)
	0.50	D					
				1.80	73.05		Moderately weak greyish brown thickly laminated fine grained SANDSTONE. Recovered as angular, tabular fine to coarse gravel. (LOWER COAL MEASURES)
				2.40	72.45		End of pit at 2.40 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP521
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422769.04 - 419595.50 Level: 79.25	Date 07/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.40	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T					Dark greyish brown silty slightly gravelly CLAY. Gravel is angular to subangular fine to medium of siltstone with occasional coal and sandstone. Occasional rootlets. (TOPSOIL)
				0.30	78.95		Firm orangish brown mottled grey CLAY. (COHESIVE RESIDUAL SOIL)
	0.50	D					*At 0.6m, terracotta land drain excavated with some water ingress.*
				0.70	78.55		Very weak black ashy COAL. Recovered as clayey angular, tabular fine gravel. (COAL)
	1.00	D					*From 1.0m to 1.2m, with closely spaced partings of grey friable clay.*
							From 1.5m to 1.8m, medium beds of yellow sulphurous staining.
				1.90	77.35		Stiff friable brownish grey gravelly CLAY. Gravel is angular tabular fine of siltstone. (SEAT EARTH)
				2.10	77.15		Moderately weak brown fine grained SANDSTONE. Recovered as angular fine to coarse gravel with medium angular cobble content. (LOWER COAL MEASURES)
				2.40	76.85		End of pit at 2.40 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP522
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422807.05 - 419556.17 Level: 79.70	Date 08/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.00	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T		0.20	79.50		Dark greyish brown slightly sandy slightly gravelly CLAY. Gravel is angular, tabular fine of siltstone, sandstone and occasional coal and pottery. (TOPSOIL)
	0.50	D	HVP=110	0.60	79.10		Stiff brown slightly sandy slightly gravelly CLAY. Gravel is angular fine to medium of sandstone. (COHESIVE RESIDUAL SOIL) *At 0.5m, terracotta land drain excavated.*
				0.80	78.90		Black clayey SAND and angular fine GRAVEL of coal. (COAL) *At 0.7m, groundwater seepage from coal seam in trial pit walls.*
	1.00	D	HVP=122	1.40	78.30		Stiff brownish grey gravelly CLAY. Gravel is angular, tabular medium of mudstone lithorelicts. (COHESIVE RESIDUAL SOIL)
	1.50	D		1.60	78.10		Black sandy angular, tabular fine GRAVEL of coal. (COAL)
				2.30	77.40		Very weak black COAL. Recovered as slightly clayey slightly sandy angular, tabular fine to medium gravel. (COAL)
				3.00	76.70		Weak dark grey thinly laminated MUDSTONE. Recovered as very angular fine to coarse gravel. (LOWER COAL MEASURES) End of pit at 3.00 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP523
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422850.61 - 419510.30 Level: 80.10	Date 08/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.30	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	B		0.25	79.85		Dark greyish brown sandy slightly gravelly CLAY. Gravel is subangular fine of mudstone and sandstone with occasional coal and pottery. Occasional rootlets. (TOPSOIL)
			HVP=70				Stiff brown mottled grey gravelly CLAY. Gravel is subangular medium to coarse of sandstone and siltstone. (COHESIVE RESIDUAL SOIL)
	0.80	D					
			HVP=106				
				2.20	77.90		Very weak black COAL. Recovered as sandy angular, tabular fine to medium gravel. (COAL)
	3.00	D		2.90	77.20		Stiff grey friable very gravelly CLAY. Gravel is tabular fine of mudstone lithorelicts. (SEAT EARTH)
				3.30	76.80		End of pit at 3.30 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP524
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422916.31 - 419451.75 Level: 80.85	Date 08/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 1.40	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T		0.25	80.60		Dark brownish grey sandy silty CLAY. Occasional rootlets. (TOPSOIL)
	0.70	D		1.10	79.75		Firm light brown mottled grey sandy gravelly CLAY. Gravel is angular, tabular medium to coarse of sandstone. (COHESIVE RESIDUAL SOIL)
▼	1.20	D		1.40	79.45		Medium strong light brown gravelly medium bedded fine grained SANDSTONE. Recovered as angular, tabular coarse gravel with a medium angular, tabular cobble content. (LOWER COAL MEASURES) *At 1.3m, groundwater seepage from pit walls.* End of pit at 1.40 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was apparent at 1.3m during excavation. 3. Backfilled with materials arising upon completion. 4. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP525
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422833.98 - 419377.94 Level: 83.40	Date 08/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.00	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T					Dark greyish brown sandy slightly gravelly CLAY. Gravel is subangular fine to medium of sandstone, mudstone and occasional coal and pottery. (TOPSOIL)
				0.30	83.10		MADE GROUND: Brown gravelly CLAY. Gravel is angular to subrounded fine to coarse of sandstone. Medium subangular sandstone cobble and a medium subangular sandstone boulder content. (COHESIVE MADE GROUND)
	0.50	J&T					*0.3m to 1.0m overbreak of trial pit walls during excavation.*
				1.20	82.20		Stiff light brown mottled grey CLAY. (COHESIVE RESIDUAL SOIL)
	1.40	D					
▼				1.60	81.80		Brown fine SANDSTONE. Recovered angular, tabular fine to coarse gravel. (LOWER COAL MEASURES)
							At 1.8m, groundwater seepage from pit walls.
				2.00	81.40		End of pit at 2.00 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was apparent at 1.8m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP526
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422852.95 - 419432.47 Level: 82.00	Date 08/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.30	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	B		0.25	81.75		Dark brownish grey sandy silty CLAY. Occasional rootlets. (TOPSOIL)
	0.50	D	HVP=62				Firm light brown mottled grey slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)
			HVP=88	1.00	81.00		Stiff brown mottled grey gravelly CLAY. Gravel is angular medium of sandstone. (COHESIVE RESIDUAL SOIL)
	1.50	D					
	2.00	D		1.90	80.10		Medium strong grey thinly bedded fine grained SANDSTONE. Recovered as angular, tabular fine to medium gravel. (LOWER COAL MEASURES)
				2.40	79.60		Weak black COAL. Recovered as slightly sandy angular, tabular fine to medium gravel. (COAL)
				2.90	79.10		Medium strong brown fine grained SANDSTONE. Recovered as angular tabular gravel. (LOWER COAL MEASURES)
				3.30	78.70		End of pit at 3.30 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP527
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422819.98 - 419463.56 Level: 82.25	Date 08/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.90	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T					Dark greyish brown silty sandy CLAY. Occasional rootlets and plant fragments. (TOPSOIL)
				0.30	81.95		Firm light brown mottled grey CLAY. Low subangular sandstone cobble content. (COHESIVE RESIDUAL SOIL)
	0.70	D	HVP=60	0.80	81.45		Stiff brown mottled grey gravelly CLAY. Gravel is subangular fine to coarse of sandstone with a low subangular sandstone cobble content. (COHESIVE RESIDUAL SOIL)
	1.00	D	HVP=98				
				1.80	80.45		Stiff friable brownish grey very gravelly CLAY. Gravel is angular, tabular fine to medium of mudstone lithorelicts. (COHESIVE RESIDUAL SOIL)
				2.60	79.65		Weak grey MUDSTONE. Recovered as clayey angular, tabular fine gravel. (LOWER COAL MEASURES)
				2.90	79.35		End of pit at 2.90 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP528
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422754.75 - 419497.10 Level: 84.05	Date 08/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.50	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T		0.30	83.75		Dark greyish brown sandy CLAY. Recovered as angular fine to medium gravel of sandstone and rare brick and coal. Occasional rootlets and plant debris. (TOPSOIL)
	1.00	D		1.30	82.75		Firm light brown mottled grey slightly gravelly CLAY. Gravel is subangular fine to coarse of sandstone and siltstone with a low subangular sandstone cobble content. (COHESIVE RESIDUAL SOIL)
	1.60	D		2.00	82.05		Stiff friable brownish grey very gravelly CLAY. Gravel is angular, tabular fine of mudstone lithorelicts. (COHESIVE RESIDUAL SOIL)
				2.50	81.55		Very weak grey MUDSTONE. Recovered as angular fine to medium gravel. (LOWER COAL MEASURES)
							End of pit at 2.50 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP529
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422714.52 - 419488.79 Level: 85.65	Date 08/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.60	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	B					Dark greyish brown sandy silty CLAY with occasional rootlets. (TOPSOIL)
	0.40	D		0.30	85.35		Firm brown sandy CLAY. (COHESIVE RESIDUAL SOIL)
	0.80	D		0.60	85.05		Light greyish brown clayey angular, tabular medium to coarse GRAVEL of sandstone with a medium angular, tabular sandstone cobble content. (GRANULAR RESIDUAL SOIL)
▼				1.30	84.35		Medium strong greyish brown thinly bedded finely grained SANDSTONE. Recovered as slightly clayey slightly sandy angular, tabular medium to coarse gravel. (LOWER COAL MEASURES)
							At 2.4m, groundwater inflow from northern trial pit wall.
				2.60	83.05		End of pit at 2.60 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater inflow was apparent at 2.4m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

LITHOS CONSULTING

Trial Pit Log

Trialpit No
TP530
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422720.98 - 419572.50 Level: 82.45	Date 08/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.50	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	J&T		0.25	82.20		Dark greyish brown sandy CLAY with occasional rootlets. (TOPSOIL)
	0.70	D		0.90	81.55		Firm brown slightly sandy slightly gravelly CLAY. Gravel is angular, tabular medium of siltstone. (COHESIVE RESIDUAL SOIL)
	1.10	D		1.30	81.15		Very weak black COAL. Recovered as sandy angular, tabular fine gravel. (COAL) *At 1.0m, groundwater seepage from trial pit walls.*
	1.40	D		1.70	80.75		Stiff friable grey CLAY. (LOWER COAL MEASURES)
	2.50	D		2.20	80.25		Weak black COAL. Recovered as angular, tabular fine to medium GRAVEL. (COAL)
				3.00	79.45		Stiff yellowish grey gravelly CLAY. Gravel is angular, tabular fine of mudstone lithorelicts. (SEAT EARTH)
				3.50	78.95		Weak grey mottled brown MUDSTONE. Recovered as angular fine to coarse gravel. (LOWER COAL MEASURES)
							End of pit at 3.50 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

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Trial Pit Log

Trialpit No
TP531
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423348.46 - 419552.03 Level: 50.30	Date 12/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.20	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30	50.00		Dark brownish grey silty slightly sandy CLAY. Occasional rootlets and plant fragments. (TOPSOIL)
				0.90	49.40		Light brown sandy gravelly CLAY. Gravel is angular to subangular fine to coarse of sandstone. (COHESIVE GLACIAL DEPOSITS)
							Stiff brown mottled grey gravelly CLAY. Gravel is subangular fine to coarse of sandstone and siltstone. Medium subangular sandstone cobble content. (COHESIVE GLACIAL DEPOSITS)
							1.5m Large sandstone boulder encountered; excavation difficult.
				3.20	47.10		End of pit at 3.20 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

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Trial Pit Log

Trialpit No
TP532
Sheet 1 of 1

Project Name: Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423308.95 - 419572.22 Level: 50.50	Date 12/01/2021
Location: Dewsbury Riverside Central Gateway		Dimensions (m): Depth 3.70	Scale 1:25
Client: Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.23	50.27		Dark brown gravelly silty slightly sandy CLAY with occasional rootlets and plant fragments. (TOPSOIL)
				0.60	49.90		Brown very sandy gravelly CLAY. Gravel is angular fine to coarse of sandstone and occasional siltstone. (COHESIVE GLACIAL DEPOSITS)
							Brown mottled grey gravelly slightly sandy CLAY. Gravel is subangular fine to coarse of sandstone with a low subangular sandstone cobble content. (COHESIVE GLACIAL DEPOSITS) *0.6m Terracotta land drain excavated with some ingress of groundwater.*
				3.70	46.80		End of pit at 3.70 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

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Trial Pit Log

Trialpit No
TP533
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423072.13 - 419710.18 Level: 48.50	Date 12/01/2021
Location:	Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.70	Scale 1:25
Client:	Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30	48.20		Dark greyish brown sandy slightly gravelly CLAY. Gravel is subangular fine to medium of sandstone with occasional coal, mudstone and siltstone. Occasional rootlets. (TOPSOIL)
				0.70	47.80		Firm light brown mottled grey gravelly slightly sandy CLAY. Gravel is angular fine to coarse of sandstone. (COHESIVE GLACIAL DEPOSITS)
				2.20	46.30		Stiff brown mottled grey gravelly CLAY. Gravel is angular to subangular of sandstone and siltstone with a low subangular sandstone cobble content. (COHESIVE GLACIAL DEPOSITS)
				2.70	45.80		Medium strong light brownish grey thinly bedded fine grained SANDSTONE. Recovered as angular, tabular medium to coarse gravel. (LOWER COAL MEASURES) End of pit at 2.70 m

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Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

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Trial Pit Log

Trialpit No
TP534
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423127.09 - 419708.00 Level: 47.00	Date 12/01/2021
Location:	Dewsbury Riverside Central Gateway		Dimensions (m): Depth 2.30	Scale 1:25
Client:	Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30	46.70		Dark greyish brown sandy silty CLAY with occasional rootlets. Rare angular fine gravel of pottery. (TOPSOIL)
				2.00	45.00		Firm light brown sandy slightly gravelly CLAY. Gravel is angular fine of sandstone and mudstone. (COHESIVE GLACIAL DEPOSITS)
				2.30	44.70		Medium strong light brownish grey thinly bedded fine grained SANDSTONE. Recovered as angular, tabular medium to coarse gravel. (LOWER COAL MEASURES) *2.3m Seepage of groundwater from base of excavation on completion.* End of pit at 2.30 m

1 2 3 4 5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

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Trial Pit Log

Trialpit No
TP535
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423053.38 - 419537.11 Level: 70.35	Date 08/01/2021
Location:	Dewsbury Riverside Central Gateway		Dimensions (m): Depth 1.40	Scale 1:25
Client:	Kirklees Council			Logged GLM

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30	70.05		Dark greyish brown sandy CLAY with occasional rootlets. (TOPSOIL)
				0.90	69.45		Light greyish brown clayey angular, tabular medium to coarse GRAVEL of sandstone with a medium angular, tabular sandstone cobble content. (GRANULAR RESIDUAL SOIL) *trial pit expanded into trenches orientated north to south & east to west. No evidence of historical quarry encountered.*
				1.40	68.95		Medium strong greyish brown thinly bedded finely grained SANDSTONE. Recovered as slightly clayey slightly sandy angular, tabular medium to coarse gravel. (LOWER COAL MEASURES) End of pit at 1.40 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates supplied by surveyor.

Stability: 1. The sides of the trial pit remained stable during excavation.

AGS

Appendix G

Dynamic Sample Borehole Logs

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Borehole Log

Borehole No. **WS501**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422561.23 - 419738.45	Hole Type WS
Location:	Dewsbury Riverside Central Gateway		Level:	67.05	Scale 1:25
Client:	Kirklees Council		Dates:	06/01/2021 - 06/01/2021	Logged By CR

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20	66.85		MADE GROUND: Brown clayey slightly gravelly SAND with rare rootlets. Gravel is fine to medium subangular of clinker. (MADE GROUND TOPSOIL)
		0.40	J&T		0.80	66.25		MADE GROUND: Firm dark brown and brown gravelly CLAY with rare lenses of ashy sand (up to 0.05m). Gravel is fine to medium angular to subangular of mixed lithologies including brick, coal and clinker. (COHESIVE MADE GROUND)
		0.90	J&T					
		1.00		N=22 (2,3/3,4,7,8) HVP=93	1.40	65.65		MADE GROUND: Firm light brown with orange and light grey mottling gravelly CLAY with rare brick gravel. Gravel is angular to subangular fine to medium of mudstone and siltstone. (COHESIVE MADE GROUND)
		1.90	D					Stiff friable light brownish-grey slightly gravelly silty CLAY. Gravel is fine to medium angular to subangular of mudstone and siltstone. (COHESIVE RESIDUAL SOIL)
		2.00		N=27 (8,8/6,7,6,8)	2.10	64.95		Stiff friable dark brown and dark grey slightly gravelly CLAY. Gravel is fine to medium angular of mudstone. (COHESIVE RESIDUAL SOIL)
					2.90	64.15		Black COAL.
					3.10	63.95		Very stiff grey with orange mottling very gravelly CLAY. Gravel is very angular to angular fine to coarse of mudstone. (COHESIVE RESIDUAL SOIL)
	▼							*At 3.4m, weight on rig starts bouncing.*
					3.65	63.40		*At 3.65m, sampler refusal.* End of borehole at 3.65 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 3.55m.

AGS

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Borehole Log

Borehole No. **WS502**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422658.67 - 419558.85	Hole Type WS
Location:	Dewsbury Riverside Central Gateway		Level:	84.50	Scale 1:25
Client:	Kirklees Council		Dates:	06/01/2021 - 06/01/2021	Logged By CR

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.50	J&T		0.50	84.00		MADE GROUND: Dark brown clayey slightly gravelly SAND with rare rootlets. Gravel is subangular to subrounded fine to medium of clinker and brick. (MADE GROUND TOPSOIL) *From 0.3m, becomes very clayey.*
					0.80	83.70		MADE GROUND: Firm greyish-brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone, coal, brick and clinker. (COHESIVE MADE GROUND)
				HVP=96				Firm to stiff brownish-grey with orangish-brown and grey mottling slightly gravelly CLAY. Gravel is subangular fine to medium of mudstone. (COHESIVE RESIDUAL SOIL)
		1.40	D					
					1.90	82.60		*At 1.9m, sampler refusal.* End of borehole at 1.90 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **WS503**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423446.29 - 419585.18	Hole Type WS
Location:	Dewsbury Riverside Central Gateway		Level:	47.85	Scale 1:25
Client:	Kirklees Council		Dates:	07/01/2021 - 07/01/2021	Logged By CR

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	J&T					MADE GROUND: Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is angular to subrounded fine to medium of sandstone, glass, ceramics, clinker and brick. (MADE GROUND TOPSOIL)
					0.40	47.45		Firm orangish-brown and grey mottled slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone and siltstone. (COHESIVE GLACIAL DEPOSITS)
		0.80	D		0.60	47.25		Dark brown clayey very gravelly SAND. Gravel is angular to subangular fine to coarse of mudstone and siltstone. (GRANULAR GLACIAL DEPOSITS)
					1.00	46.85		Firm becoming very stiff greyish-brown gravelly CLAY. Gravel is angular to subrounded fine to coarse of mudstone, siltstone and sandstone. (COHESIVE GLACIAL DEPOSITS)
		2.00		N=40 (5,7/8,12,9,11)				
					3.00	44.85		*At 3.0m, terminated on very stiff Clay.* End of borehole at 3.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
WS504
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423404.30 - 419589.12	Hole Type WS
Location:	Dewsbury Riverside Central Gateway		Level:	48.20	Scale 1:25
Client:	Kirklees Council		Dates:	07/01/2021 - 07/01/2021	Logged By CR

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.50	D		0.30	47.90		MADE GROUND: Dark brown sandy CLAY with rare rootlets and rare subangular fine to medium gravel of clinker. (MADE GROUND TOPSOIL)
								At 0.2m, becomes brown.
					0.60	47.60		Firm orangish-brown with light grey mottling slightly sandy CLAY with rare angular fine to coarse sandstone gravel. (COHESIVE GLACIAL DEPOSITS)
					1.00	47.20		Stiff brown sandy gravelly CLAY. Gravel is angular to subangular fine to medium of sandstone, mudstone and coal. (COHESIVE GLACIAL DEPOSITS)
								Stiff to very stiff greyish-brown slightly sandy slightly gravelly CLAY. Gravel is angular fine to coarse of mudstone, siltstone and sandstone. (COHESIVE GLACIAL DEPOSITS)
								At 2.8m, 100mm lens of soft very sandy Clay.
								At 3.0m, terminated on very stiff Clay.
					3.00	45.20		End of borehole at 3.00 m

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Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

LITHOS CONSULTING

Borehole Log

Borehole No.
WS505
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423421.45 - 419591.68	Hole Type WS
Location:	Dewsbury Riverside Central Gateway		Level:	48.00	Scale 1:25
Client:	Kirklees Council		Dates:	07/01/2021 - 07/01/2021	Logged By CR

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	J&T					MADE GROUND: Dark greyish-brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is angular to subrounded fine to medium of mixed lithologies including coal and brick.
					0.40	47.60		(MADE GROUND TOPSOIL)
								Firm to stiff orangish-brown and light grey mottled slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of sandstone. (COHESIVE GLACIAL DEPOSITS)
					1.10	46.90		Firm brown sandy gravelly CLAY. Gravel is angular to subangular fine to medium of mudstone, siltstone and sandstone. (COHESIVE GLACIAL DEPOSITS)
					1.40	46.60		Stiff becoming very stiff greyish-brown with light grey mottling slightly sandy gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone, siltstone and sandstone. (COHESIVE GLACIAL DEPOSITS)
								At 2.0m, terminated on very stiff Clay (weight bouncing).
					2.00	46.00		End of borehole at 2.00 m

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Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **WS506**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423438.45 - 419626.22	Hole Type WS
Location:	Dewsbury Riverside Central Gateway		Level:	46.95	Scale 1:25
Client:	Kirklees Council		Dates:	07/01/2021 - 07/01/2021	Logged By CR

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								MADE GROUND: Dark brown slightly sandy slightly gravelly CLAY with rare rootlets. Gravel is angular to subangular fine to medium of mixed lithologies including coal and clinker. (COHESIVE MADE GROUND)
					0.40	46.55		Firm brown slightly sandy CLAY. (COHESIVE GLACIAL DEPOSITS)
								Between 0.5-1.0m, no recovery. Possible cobble blocking sampler.
								Between 1.0-2.0m, no recovery except for some gravel of sandstone possibly broken off cobble blocking sampler.
								At 2.0m, terminated due to no recovery, hole moved 2m south.
					2.00	44.95		End of borehole at 2.00 m

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Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **WS506A**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type WS
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:25
Client:	Kirklees Council		Dates: 07/01/2021 - 07/01/2021	Logged By CR

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.70	D		0.40			MADE GROUND: Dark brown slightly sandy slightly gravelly CLAY with rare rootlets and rare ceramics. Gravel is angular to subangular fine to medium of mixed lithologies including coal and clinker. (COHESIVE MADE GROUND)
					1.00			Firm orangish-brown and light grey mottled slightly sandy slightly gravelly CLAY. Gravel is angular fine to medium of mudstone and sandstone. (COHESIVE GLACIAL DEPOSITS)
					2.00			Stiff to very stiff greyish-brown with light grey mottling slightly sandy gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone, siltstone and sandstone. (COHESIVE GLACIAL DEPOSITS)
								At 2.0m, terminated on very stiff Clay.
								End of borehole at 2.00 m

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Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
WS507
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423446.41 - 419676.34	Hole Type WS
Location:	Dewsbury Riverside Central Gateway		Level:	45.85	Scale 1:25
Client:	Kirklees Council		Dates:	07/01/2021 - 07/01/2021	Logged By CR

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	J&T					MADE GROUND: Dark grey sandy angular fine to coarse GRAVEL of coal, clinker, brick, sandstone and mudstone. (COHESIVE MADE GROUND)
		0.40	J&T		0.25	45.60		MADE GROUND: Dark greyish-brown slightly sandy gravelly CLAY. Gravel is angular to subangular fine to coarse of mixed lithologies including clinker, brick and coal. (COHESIVE MADE GROUND)
					0.50	45.35		Firm becoming stiff orangish-brown and light grey mottled slightly sandy slightly gravelly CLAY. Gravel is angular fine to coarse of sandstone. (COHESIVE GLACIAL DEPOSITS)
					1.10	44.75		Stiff to very stiff greyish-brown slightly sandy gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone and sandstone. (COHESIVE GLACIAL DEPOSITS)
					2.00	43.85		*At 2.0m, terminated on very stiff Clay.* End of borehole at 2.00 m

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Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

			Borehole No.	**WS508**
				Sheet 1 of 1
Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423450.66 - 419686.26	Hole Type WS
Location:	Dewsbury Riverside Central Gateway		Level: 45.80	Scale 1:25
Client:	Kirklees Council		Dates: 07/01/2021 - 07/01/2021	Logged By CR

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	J&T					MADE GROUND: Dark greyish-brown slightly sandy gravelly CLAY with rare rootlets and rare glass fragments. Gravel is angular to subangular fine to coarse of mixed lithologies including clinker, coal and shale. (COHESIVE MADE GROUND)
					0.40	45.40		
		0.60	J&T					MADE GROUND: Dark brown very sandy slightly gravelly CLAY. Gravel is angular to subangular fine to medium of mixed lithologies including clinker and brick. (COHESIVE MADE GROUND)
					0.80	45.00		*At 0.4m, plastic/terram layer.*
					1.00	44.80		Firm dark brownish-grey slightly sandy very gravelly CLAY. Gravel is angular fine to medium of coal. (COHESIVE GLACIAL DEPOSITS)
		1.20	D					Firm to stiff brown with light grey mottling slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of sandstone. (COHESIVE GLACIAL DEPOSITS)
					1.90	43.90		Very stiff greyish-brown with light grey mottling slightly sandy gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone, siltstone and sandstone. (COHESIVE GLACIAL DEPOSITS)
								At 3.0m, terminated on very stiff Clay.
					3.00	42.80		End of borehole at 3.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **WS509**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423457.86 - 419709.31	Hole Type WS
Location:	Dewsbury Riverside Central Gateway		Level:	44.55	Scale 1:25
Client:	Kirklees Council		Dates:	07/01/2021 - 07/01/2021	Logged By CR

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10	44.45		MADE GROUND: Dark grey clayey slightly gravelly SAND. Gravel is angular fine to medium of sandstone and brick. (GRANULAR MADE GROUND)
					0.30	44.25		
					0.40	44.15		MADE GROUND: Dark greyish-brown slightly sandy gravelly CLAY. Gravel is very angular to angular fine to medium of brick, clinker and coal. (COHESIVE GLACIAL DEPOSITS)
								MADE GROUND: Brownish-grey with white specks slightly sandy gravelly CLAY. Gravel is very angular to angular fine to medium of brick, clinker and coal. (COHESIVE GLACIAL DEPOSITS)
					1.00	43.55		No recovery - likely cobble blocking sampler.
								At 1.0m, terminated due to no recovery, hole moved 1m east.
								End of borehole at 1.00 m

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Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
WS509A
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type WS
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:25
Client:	Kirklees Council		Dates: 07/01/2021 - 07/01/2021	Logged By CR

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	J&T					MADE GROUND: Dark greyish-brown slightly sandy slightly gravelly CLAY. Gravel is angular fine to medium of clinker, brick and coal. (COHESIVE MADE GROUND)
					0.50			Soft brown sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE GLACIAL DEPOSITS)
					0.80			Firm to stiff orangish-brown and light grey mottled slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of sandstone and mudstone. (COHESIVE GLACIAL DEPOSITS)
		1.10	D		1.00			Stiff to very stiff greyish-brown slightly sandy gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone, sandstone and siltstone. (COHESIVE GLACIAL DEPOSITS)
								At 2.0m, terminated on very stiff Clay.
					2.00			End of borehole at 2.00 m

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
WS510
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423484.89 - 419711.96	Hole Type WS
Location:	Dewsbury Riverside Central Gateway		Level:	44.50	Scale 1:25
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By CR

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.01	T		0.05	44.45		MADE GROUND: Black MACADAM. 90% aggregate of very angular to angular fine to medium gravel. 5% matrix. 5% voids of up to 5mm.
					0.30	44.20		MADE GROUND: Light grey slightly clayey slightly sandy angular fine to coarse GRAVEL of limestone. (SUB-BASE)
		0.50	J&T					
					0.80	43.70		MADE GROUND: Dark grey becoming greyish-brown slightly sandy gravelly CLAY. Gravel is very angular to angular fine to coarse of mixed lithologies including brick, coal, limestone and rare clinker. (COHESIVE MADE GROUND)
		0.90	D		1.00	43.50		*From 0.4m, becomes sandy.* Firm grey slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone. (COHESIVE GLACIAL DEPOSITS)
					1.50	43.00		Stiff orangish-brown and light grey mottled slightly sandy slightly gravelly CLAY. Gravel is angular fine to coarse of sandstone. (COHESIVE GLACIAL DEPOSITS)
								Stiff to very stiff greyish-brown with orange and light grey mottling slightly sandy gravelly CLAY. Gravel is angular fine to coarse of mudstone, siltstone and sandstone. (COHESIVE GLACIAL DEPOSITS)
					3.00	41.50		*At 3.0m, terminated on very stiff Clay.* End of borehole at 3.00 m

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Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

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Borehole Log

Borehole No.
WS511
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423477.81 - 419709.02	Hole Type WS
Location:	Dewsbury Riverside Central Gateway		Level:	44.60	Scale 1:25
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By CR

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.01	T		0.05	44.55		MADE GROUND: Black MACADAM.
					0.30	44.30		MADE GROUND: Light grey slightly clayey slightly sandy very angular to angular fine to coarse GRAVEL of limestone. (SUB-BASE)
					0.50	44.10		MADE GROUND: Red slightly clayey slightly sandy very angular to angular fine to coarse GRAVEL of burnt shale. (BURNT SHALE)
		0.70	J&T					MADE GROUND: Dark greyish-brown becoming dark grey slightly sandy gravelly CLAY. Gravel is angular fine to coarse of brick, clinker, ceramics and sandstone.
				HVP=108	0.90	43.70		(COHESIVE MADE GROUND)
					1.30	43.30		Stiff brown and light grey mottled slightly sandy slightly gravelly CLAY. Gravel is angular fine to coarse of mudstone. (COHESIVE GLACIAL DEPOSITS)
		1.40	D					Stiff greyish-brown slightly sandy very gravelly CLAY. Gravel is angular fine to coarse of mudstone and sandstone. (COHESIVE GLACIAL DEPOSITS)
								From 2.2m, becomes very stiff.
								At 3.0m, terminated on very stiff Clay.
					3.00	41.60		End of borehole at 3.00 m

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

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Borehole Log

Borehole No.
WS512
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423466.17 - 419701.74	Hole Type WS
Location:	Dewsbury Riverside Central Gateway		Level:	44.85	Scale 1:25
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By CR

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.05	44.80		MADE GROUND: Dark grey slightly sandy angular fine to medium GRAVEL of macadam.
					0.30	44.55		MADE GROUND: Light brown slightly sandy angular to subangular fine to coarse GRAVEL of sandstone. (SUB-BASE)
		0.40	J&T					
					0.60	44.25		MADE GROUND: Dark grey slightly sandy slightly gravelly CLAY. Gravel is angular fine to medium of brick, coal, clinker and sandstone. (COHESIVE MADE GROUND)
								Firm brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of sandstone. (COHESIVE GLACIAL DEPOSITS)
					1.00	43.85		*Between 0.8m and 1.0m, no recovery. Sandstone cobble stuck in sampler shoe.*
					1.30	43.55		Orangish-brown and greyish-brown with light grey mottling clayey sandy angular fine to coarse GRAVEL of sandstone. (GRANULAR GLACIAL DEPOSITS)
		1.50	D					Stiff to very stiff greyish-brown with light grey mottling clayey slightly sandy gravelly CLAY. Gravel is angular fine to coarse of sandstone, mudstone and siltstone (COHESIVE GLACIAL DEPOSITS)
								At 3.0m, terminated on very stiff Clay.
					3.00	41.85		End of borehole at 3.00 m

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Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

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Borehole Log

Borehole No.
WS513
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422577.45 - 419557.32	Hole Type WS
Location:	Dewsbury Riverside Central Gateway		Level:	84.45	Scale 1:25
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By CR

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.50	J&T		0.40	84.05		MADE GROUND: Brown clayey slightly gravelly SAND with frequent rootlets. Gravel is angular to subangular fine to medium of brick and sandstone. (MADE GROUND TOPSOIL)
		0.80	J&T		0.70	83.75		MADE GROUND: Dark grey sandy angular to subangular fine to coarse GRAVEL of sandstone, clinker and slag with high ash content. (ASH & CLINKER)
		1.20	D		1.00	83.45		MADE GROUND: Dark grey slightly gravelly SAND with high ash content. Gravel is subangular fine to medium of clinker and slag. (ASH & CLINKER)
								Stiff to very stiff slightly sandy slightly gravelly CLAY. Gravel is very angular to angular fine to coarse of mudstone. (COHESIVE RESIDUAL SOIL)
								From 2.4m, becomes friable.
					2.50	81.95		End of borehole at 2.50 m

1 2 3 4 5

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

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Borehole Log

Borehole No. **WS514**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422515.48 - 419539.11	Hole Type WS
Location:	Dewsbury Riverside Central Gateway		Level:	80.65	Scale 1:25
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By CR

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.50	J&T		0.35	80.30		MADE GROUND: Brown very clayey gravelly SAND with occasional rootlets. Gravel is angular fine to medium of brick, clinker and sandstone. (MADE GROUND TOPSOIL)
								MADE GROUND: Dark brown sandy gravelly CLAY. Gravel is very angular to angular fine to coarse of brick, clinker, ceramics and sandstone. (COHESIVE MADE GROUND)
		1.20	J&T					*At 1.0m, slight eggy odour, occasional glass fragments noted.*
					1.50	79.15		Very stiff slightly sandy very gravelly CLAY. Gravel is angular fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)
					2.00	78.65		*At 2.0m, terminated on very stiff Clay.* End of borehole at 2.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **WS515**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422464.33 - 419539.56	Hole Type WS
Location:	Dewsbury Riverside Central Gateway		Level:	75.95	Scale 1:25
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By CR

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	J&T		0.10	75.85		MADE GROUND: Light brown slightly sandy CLAY with occasional rootlets. (MADE GROUND TOPSOIL)
								MADE GROUND: Orangish-brown and light grey mottled and greyish-brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of brick, clinker, coal and sandstone. (GRANULAR MADE GROUND)
		1.30	J&T		1.10	74.85		MADE GROUND: Brown and red clayey sandy very angular to angular fine to coarse GRAVEL of brick, clinker and concrete. (GRANULAR MADE GROUND)
								At 1.9m, cobble of red 'conglomerate' of brick and clinker.
					2.40	73.55		Firm becoming stiff greyish-brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and siltstone. (COHESIVE RESIDUAL SOIL)
								At 3.0m, terminated on very stiff Clay.
					3.00	72.95		End of borehole at 3.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Appendix H

Rotary Open Probehole Logs

Borehole Log

Borehole No. **PH207**

Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422996.58 - 419584.59	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	65.55	Scale 1:50
Client:	Kirklees Council		Dates:	30/11/2017 - 30/11/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								TOPSOIL. (TOPSOIL)
					0.60	64.95		CLAY. (OVERBURDEN)
					1.30	64.25		Grey MUDSTONE. (COAL MEASURES)
					3.70	61.85		Black vitreous COAL. (MIDDLETON LITTLE COAL)
					4.00	61.55		Grey MUDSTONE. (COAL MEASURES)
								From 4.0m to 5.5m spot coring undertaken for coal sample, no coal recovered.
								From 9.0m to 12.0m spot coring undertaken for coal sample, coal present between 11.0 and 11.3m.
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
PH207
Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422996.58 - 419584.59	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	65.55	Scale 1:50
Client:	Kirklees Council		Dates:	30/11/2017 - 30/11/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					11.50	54.05		Black vitreous COAL. (UN-NAMED THIN COAL)
					11.80	53.75		Grey MUDSTONE. (COAL MEASURES)
					19.50	46.05		Grey SANDSTONE. (COAL MEASURES)

Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH207**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422996.58 - 419584.59	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	65.55	Scale 1:50
Client:	Kirklees Council		Dates:	30/11/2017 - 30/11/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					22.50	43.05		Soft ground. (MIDDLETON MAIN COAL) *Below 22.50m very soft and borehole collapsing.*
					25.00	40.55		End of borehole at 25.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH208**

Sheet 1 of 2

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422994.19 - 419644.00	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	56.65	Scale 1:50
Client:	Kirklees Council		Dates:	30/11/2017 - 01/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.60	55.05		Grey MUDSTONE. (COAL MEASURES)
					2.50	54.15		Black vitreous COAL. (UN-NAMED THIN COAL)
					2.80	53.85		Grey MUDSTONE. (COAL MEASURES)
								From 8.0m to 11.0m spot coring was undertaken for coal samples, no coal recovered.
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH208**

Sheet 2 of 2

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422994.19 - 419644.00	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	56.65	Scale 1:50
Client:	Kirklees Council		Dates:	30/11/2017 - 01/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					13.50	43.15		VOID. (MIDDLETON MAIN COAL)
					14.80	41.85		Grey MUDSTONE. (COAL MEASURES)
					15.00	41.65		End of borehole at 15.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
PH209
Sheet 1 of 2

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423062.50 - 419691.38	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	49.45	Scale 1:50
Client:	Kirklees Council		Dates:	29/11/2017 - 29/11/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								TOPSOIL. (OVERBURDEN)
					0.50	48.95		Grey CLAY. (OVERBURDEN)
					2.30	47.15		Grey MUDSTONE. (COAL MEASURES)
					3.20	46.25		Brown SANDSTONE. (COAL MEASURES)
					5.00	44.45		Brown SILTSTONE. (COAL MEASURES)
					5.20	44.25		Solid ground. Brown SILTSTONE? (COAL MEASURES)
								From 5.2m flush returns were lost.
					10.00	39.45		Continued on next sheet

1 2 3 4 5 6 7 8 9 10

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 5.2m.

AGS

Borehole Log

Borehole No. **PH209** Sheet 2 of 2

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423062.50 - 419691.38	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	49.45	Scale 1:50
Client:	Kirklees Council		Dates:	29/11/2017 - 29/11/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								VOID. (MIDDLETON MAIN COAL)
					11.00	38.45		Solid ground. Brown SILTSTONE? (COAL MEASURES)
					13.00	36.45		End of borehole at 13.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 5.2m.

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Borehole Log

Borehole No.
PH209a
Sheet 1 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423070.91 - 419698.24	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	48.95	Scale 1:50
Client:	Kirklees Council		Dates:	29/11/2017 - 29/11/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								TOPSOIL. (OVERBURDEN)
					0.60	48.35		CLAY. (OVERBURDEN)
					1.30	47.65		Mudstone GRAVEL. (OVERBURDEN)
					2.50	46.45		SILTSTONE. (COAL MEASURES)
					3.50	45.45		Grey MUDSTONE. (COAL MEASURES)
					9.20	39.75		Black MUDSTONE. (COAL MEASURES)
					9.50	39.45		Black vitreous COAL. (MIDDLETON MAIN COAL)
								Continued on next sheet

1 2 3 4 5 6 7 8 9 10

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

LITHOS CONSULTING

Borehole Log

Borehole No.
PH209a
Sheet 2 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423070.91 - 419698.24	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	48.95	Scale 1:50
Client:	Kirklees Council		Dates:	29/11/2017 - 29/11/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					10.90	38.05		Grey MUDSTONE. (COAL MEASURES)
					13.10	35.85		Black MUDSTONE. (COAL MEASURES)
					14.10	34.85		Grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

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Borehole Log

Borehole No.
PH209a
Sheet 3 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423070.91 - 419698.24	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	48.95	Scale 1:50
Client:	Kirklees Council		Dates:	29/11/2017 - 29/11/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				

21
22
23
24
25
26
27
28
29
30

Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH209a** Sheet 4 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423070.91 - 419698.24	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	48.95	Scale 1:50
Client:	Kirklees Council		Dates:	29/11/2017 - 29/11/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					32.00	16.95		Black vitreous COAL. (WHEATLEY LIME COAL)
					33.20	15.75		Grey MUDSTONE. (COAL MEASURES)
					36.00	12.95		End of borehole at 36.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
PH210
Sheet 1 of 2

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423098.88 - 419717.10	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	47.45	Scale 1:50
Client:	Kirklees Council		Dates:	29/11/2017 - 29/11/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								TOPSOIL. (OVERBURDEN)
					0.60	46.85		Yellow CLAY. (OVERBURDEN)
					1.20	46.25		Grey MUDSTONE. (COAL MEASURES)
					4.80	42.65		Black SILTSTONE. (COAL MEASURES)
					5.00	42.45		Brown MUDSTONE. (COAL MEASURES)
					5.70	41.75		Grey MUDSTONE. (COAL MEASURES)
					10.00	37.45		Continued on next sheet

1 2 3 4 5 6 7 8 9 10

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 10.0m.

AGS

Borehole Log

Borehole No. **PH210** Sheet 2 of 2

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423098.88 - 419717.10	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	47.45	Scale 1:50
Client:	Kirklees Council		Dates:	29/11/2017 - 29/11/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								COAL. Old workings. (MIDDLETON MAIN COAL)
								From 10.0m flush returns were lost.
								From 10.0m borehole collapsing.
					11.00	36.45		End of borehole at 11.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 10.0m.

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Borehole Log

Borehole No.
PH210a
Sheet 1 of 2

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423106.27 - 419708.81	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	47.35	Scale 1:50
Client:	Kirklees Council		Dates:	29/11/2017 - 29/11/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								TOPSOIL. (OVERBURDEN)
					0.50	46.85		Yellow CLAY. (OVERBURDEN)
					1.30	46.05		Grey MUDSTONE. (COAL MEASURES)
					7.00	40.35		Grey MUDSTONE. (COAL MEASURES)
					8.20	39.15		Grey MUDSTONE. (COAL MEASURES)
					10.00	37.35		

Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

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Borehole Log

Borehole No.
PH210a
Sheet 2 of 2

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423106.27 - 419708.81	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	47.35	Scale 1:50
Client:	Kirklees Council		Dates:	29/11/2017 - 29/11/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								COAL. Old workings. (MIDDLETON MAIN COAL) *From 10.0m borehole collapsing.*
					11.00	36.35		End of borehole at 11.00 m

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH211**

Sheet 1 of 2

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423132.57 - 419680.57	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	47.80	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Overburden. (OVERBURDEN)
					3.00	44.80		SANDSTONE. (COAL MEASURES)
					9.50	38.30		VOID. (MIDDLETON MAIN COAL)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 13.5m.

Borehole Log

Borehole No. **PH211**

Sheet 2 of 2

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423132.57 - 419680.57	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	47.80	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					11.00	36.80		Broken ground. (MIDDLETON MAIN COAL)
					13.50	34.30		Solid ground. SANDSTONE? (COAL MEASURES) *From 13.5m flush returns were lost.*
					18.00	29.80		End of borehole at 18.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 13.5m.

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Borehole Log

Borehole No.
PH211a
Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423140.43 - 419679.67	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	47.85	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Overburden. (OVERBURDEN)
					3.00	44.85		SANDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 18.0m.

AGS

Borehole Log

Borehole No. **PH211a**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423140.43 - 419679.67	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	47.85	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.00	35.85		Black vitreous COAL. (MIDDLETON MAIN COAL)
					12.20	35.65		Broken ground. (MIDDLETON MAIN COAL)
					14.50	33.35		SANDSTONE. (COAL MEASURES)
					16.00	31.85		Black vitreous COAL. (UN-NAMED THIN COAL)
					16.50	31.35		SANDSTONE. (COAL MEASURES)
					18.00	29.85		Solid ground. SANDSTONE? (COAL MEASURES) *From 18.0m flush returns were lost.*

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 18.0m.

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Borehole Log

Borehole No. **PH211a** Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423140.43 - 419679.67	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	47.85	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					24.00	23.85		End of borehole at 24.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 18.0m.

AGS

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Borehole Log

Borehole No.
PH212
Sheet 1 of 2

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423218.32 - 419692.18	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	46.05	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Overburden. (OVERBURDEN)
					3.50	42.55		SANDSTONE. (COAL MEASURES)
					9.50	36.55		Broken ground. (MIDDLETON MAIN COAL)
								Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 12.5m.

AGS

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Borehole Log

Borehole No.
PH212
Sheet 2 of 2

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423218.32 - 419692.18	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	46.05	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.50	33.55		Solid ground. SANDSTONE? (COAL MEASURES) *From 12.5m flush returns were lost.*
					15.00	31.05		End of borehole at 15.00 m

11 12 13 14 15 16 17 18 19 20

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 12.5m.

AGS

Borehole Log

Borehole No. **PH212a**

Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423212.15 - 419691.72	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	46.25	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Overbuden. (OVERBURDEN)
					3.50	42.75		SANDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 20.0m.

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Borehole Log

Borehole No.
PH212a
Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423212.15 - 419691.72	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	46.25	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					13.00	33.25		Broken ground. (MIDDLETON MAIN COAL)
					13.50	32.75		SANDSTONE. (COAL MEASURES)
					20.00	26.25		Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 20.0m.

AGS

Borehole Log

Borehole No. **PH212a**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423212.15 - 419691.72	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	46.25	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Solid ground. SANDSTONE? (COAL MEASURES) *From 20.0m flush returns were lost.*
					24.00	22.25		End of borehole at 24.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 20.0m.

Borehole Log

Borehole No. **PH213**

Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423224.92 - 419611.81	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	49.40	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Overburden. (OVERBURDEN)
					3.00	46.40		SANDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH213**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423224.92 - 419611.81	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	49.40	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					15.50	33.90		Black vitreous COAL. (MIDDLETON MAIN COAL)
					16.00	33.40		SANDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
PH213
Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423224.92 - 419611.81	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	49.40	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					30.00	19.40		End of borehole at 30.00 m

21 22 23 24 25 26 27 28 29 30

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

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Borehole Log

Borehole No.
PH214
Sheet 1 of 2

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423168.40 - 419613.22	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	53.00	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Overburden. (OVERBURDEN)
					2.50	50.50		SANDSTONE. (COAL MEASURES)
					5.00	48.00		Black vitreous COAL. (UN-NAMED THIN COAL)
					5.25	47.75		SANDSTONE. (COAL MEASURES)
								Continued on next sheet

1 2 3 4 5 6 7 8 9 10

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 13.0m.

AGS

Borehole Log

Borehole No. **PH214**

Sheet 2 of 2

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423168.40 - 419613.22	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	53.00	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					13.00	40.00		Broken ground. (MIDDLETON MAIN COAL) *From 13.0m flush returns were lost.*
					14.50	38.50		Solid ground. SANDSTONE? (COAL MEASURES)
					15.00	38.00		End of borehole at 15.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 13.0m.

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Borehole Log

Borehole No.
PH215
Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423126.02 - 419561.79	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	60.45	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Overburden. (OVERBURDEN)
					3.00	57.45		SANDSTONE. (COAL MEASURES)
					4.00	56.45		Black vitreous COAL. (UN-NAMED THIN COAL)
					4.50	55.95		SANDSTONE. (COAL MEASURES)
								Continued on next sheet

1 2 3 4 5 6 7 8 9 10

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 20.0m.

AGS

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Borehole Log

Borehole No.
PH215
Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423126.02 - 419561.79	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	60.45	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					20.00	40.45		Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 20.0m.

AGS

Borehole Log

Borehole No. **PH215**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423126.02 - 419561.79	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	60.45	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Solid ground. SANDSTONE? (COAL MEASURES)
								From 20.0m flush returns were lost.
								At 25.0m drilling stopped due to clogging of drill bit.
					25.00	35.45		End of borehole at 25.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 20.0m.

Borehole Log

Borehole No. **PH216**

Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422988.01 - 419736.83	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	51.15	Scale 1:50
Client:	Kirklees Council		Dates:	06/12/2017 - 06/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Overburden. (OVERBURDEN)
					2.00	49.15		SANDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 25.5m.

Borehole Log

Borehole No. **PH216**

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422988.01 - 419736.83	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	51.15	Scale 1:50
Client:	Kirklees Council		Dates:	06/12/2017 - 06/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					18.00	33.15		Black vitreous COAL. (UN-NAMED THIN COAL)
					18.20	32.95		SANDSTONE. (COAL MEASURES)
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 25.5m.

Borehole Log

Borehole No. **PH216**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422988.01 - 419736.83	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	51.15	Scale 1:50
Client:	Kirklees Council		Dates:	06/12/2017 - 06/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					25.50	25.65		Broken ground. (WHEATLEY LIME COAL) *From 25.5m flush returns were lost.*
					27.00	24.15		Solid ground. SANDSTONE? (COAL MEASURES)
					28.00	23.15		End of borehole at 28.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 25.5m.

Borehole Log

Borehole No. **PH216a**

Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422974.00 - 419746.00	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 06/12/2017 - 06/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Overbuden. (OVERBURDEN)
					2.00			SANDSTONE. (COAL MEASURES)
					9.50			Black vitreous COAL. (MIDDLETON MAIN COAL)
					9.75			SANDSTONE.
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 25.0m.

Borehole Log

Borehole No. **PH216a**

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422974.00 - 419746.00	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 06/12/2017 - 06/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								(COAL MEASURES)
					18.00			Black vitreous COAL. (UN-NAMED THIN COAL)
					18.25			SANDSTONE. (COAL MEASURES)
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 25.0m.

Borehole Log

Borehole No. **PH216a**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 422974.00 - 419746.00	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 06/12/2017 - 06/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					20.50			Soft ground. (COAL MEASURES)
					21.00			SANDSTONE. (COAL MEASURES)
					25.00			Broken ground. (WHEATLEY LIME COAL) *From 25.0m flush returns were lost.*
					27.00			Solid ground. SANDSTONE. (COAL MEASURES)
					28.00			End of borehole at 28.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 25.0m.

Borehole Log

Borehole No. **PH217**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422943.06 - 419706.78	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	54.75	Scale 1:50
Client:	Kirklees Council		Dates:	01/12/2017 - 01/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellow CLAY. (OVERBURDEN)
					1.50	53.25		Grey MUDSTONE. (COAL MEASURES)
					7.00	47.75		Grey MUDSTONE. (COAL MEASURES) *From 7.0m to 10.0m spot coring was undertaken for coal samples, no coal recovered.*
					10.00	44.75		End of borehole at 10.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
PH217a
Sheet 1 of 2

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422949.00 - 419696.43	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	55.00	Scale 1:50
Client:	Kirklees Council		Dates:	06/12/2017 - 06/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Overburden. (OVERBURDEN)
					2.50	52.50		SANDSTONE. (COAL MEASURES)
					7.00	48.00		Soft ground. (COAL MEASURES)
					8.00	47.00		SANDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 12.5m.

AGS

Borehole Log

Borehole No. **PH217a**
Sheet 2 of 2

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422949.00 - 419696.43	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	55.00	Scale 1:50
Client:	Kirklees Council		Dates:	06/12/2017 - 06/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.50	42.50		VOID. (MIDDLETON MAIN COAL) *From 12.5m flush returns were lost.*
					14.00	41.00		Solid ground. SANDSTONE? (COAL MEASURES)
					15.00	40.00		End of borehole at 15.00 m

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 12.5m.

Borehole Log

Borehole No. **PH217b**

Sheet 1 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422953.76 - 419700.50	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	54.40	Scale 1:50
Client:	Kirklees Council		Dates:	06/12/2017 - 06/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Overburden. (OVERBURDEN)
					2.50	51.90		SANDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 28.0m.

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Borehole Log

Borehole No.
PH217b
Sheet 2 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422953.76 - 419700.50	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	54.40	Scale 1:50
Client:	Kirklees Council		Dates:	06/12/2017 - 06/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					13.00	41.40		Soft ground. (MIDDLETON MAIN COAL)
					14.00	40.40		SANDSTONE. (COAL MEASURES)
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 28.0m.

AGS

Borehole Log

Borehole No. **PH217b**

Sheet 3 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422953.76 - 419700.50	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	54.40	Scale 1:50
Client:	Kirklees Council		Dates:	06/12/2017 - 06/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					21.50	32.90		Black vitreous COAL. (UN-NAMED THIN COAL)
					21.75	32.65		SANDSTONE. (COAL MEASURES)
					23.00	31.40		Soft ground. (COAL MEASURES)
					23.50	30.90		SANDSTONE. (COAL MEASURES)
					28.00	26.40		Broken ground. (WHEATLEY LIME COAL) *From 28.0m flush returns were lost.*
					29.50	24.90		Solid ground. SANDSTONE? (COAL MEASURES)

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 28.0m.

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Borehole Log

Borehole No.
PH217b
Sheet 4 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422953.76 - 419700.50	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	54.40	Scale 1:50
Client:	Kirklees Council		Dates:	06/12/2017 - 06/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					31.00	23.40		End of borehole at 31.00 m

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 28.0m.

AGS

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Borehole Log

Borehole No.
PH218
Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422925.11 - 419637.20	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	63.35	Scale 1:50
Client:	Kirklees Council		Dates:	06/12/2017 - 06/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Overburden. (OVERBURDEN)
					3.50	59.85		SANDSTONE. (COAL MEASURES)
					8.50	54.85		Black vitreous COAL. (UN-NAMED THIN COAL)
					8.70	54.65		SANDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 19.5m.

AGS

Borehole Log

Borehole No. **PH218**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422925.11 - 419637.20	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	63.35	Scale 1:50
Client:	Kirklees Council		Dates:	06/12/2017 - 06/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					15.00	48.35		Soft ground. (COAL MEASURES)
					16.50	46.85		SANDSTONE. (COAL MEASURES)
					19.50	43.85		VOID. (MIDDLETON MAIN COAL) *From 19.5m flush returns were lost.*
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 19.5m.

Borehole Log

Borehole No. **PH218**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422925.11 - 419637.20	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	63.35	Scale 1:50
Client:	Kirklees Council		Dates:	06/12/2017 - 06/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					22.00	41.35		Solid ground. SANDSTONE? (COAL MEASURES)
					23.00	40.35		End of borehole at 23.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 19.5m.

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Borehole Log

Borehole No.
PH219
Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423046.26 - 419571.51	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	65.75	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Overburden. (OVERBURDEN)
					2.00	63.75		SANDSTONE. (COAL MEASURES)
					5.00	60.75		Black vitreous COAL. (MIDDLETON LITTLE COAL)
					5.50	60.25		SANDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 21.5m.

AGS

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Borehole Log

Borehole No.
PH219
Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423046.26 - 419571.51	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	65.75	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					14.70	51.05		Black vitreous COAL. (UN-NAMED THIN COAL)
					15.00	50.75		SANDSTONE. (COAL MEASURES)
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 21.5m.

AGS

Borehole Log

Borehole No. **PH219**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423046.26 - 419571.51	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	65.75	Scale 1:50
Client:	Kirklees Council		Dates:	05/12/2017 - 05/12/2017	Logged By JEJ

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					21.50	44.25		Broken ground. (MIDDLETON MAIN COAL) *From 21.5m flush returns were lost.*
					23.00	42.75		Solid ground. SANDSTONE. (COAL MEASURES)
					24.00	41.75		End of borehole at 24.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 21.5m.

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Borehole Log

Borehole No.
PH501
Sheet 1 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422683.76 - 419554.51	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	83.65	Scale 1:50
Client:	Kirklees Council		Dates:	07/01/2021 - 07/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Brown sandy CLAY. (OVERBURDEN)
					1.50	82.15		Light yellowish brown SANDSTONE. (COAL MEASURES)
					2.00	81.65		Light grey MUDSTONE. (COAL MEASURES)
					3.50	80.15		Black COAL. (3RD BROWN METAL COAL)
					4.00	79.65		Light grey MUDSTONE. (COAL MEASURES)
					5.00	78.65		Black COAL. (3RD BROWN METAL COAL)
					5.20	78.45		Light grey MUDSTONE. (COAL MEASURES)
					9.00	74.65		Yellowish brown SANDSTONE. (COAL MEASURES)
					10.00	73.65		Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

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Borehole Log

Borehole No.
PH501
Sheet 2 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422683.76 - 419554.51	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	83.65	Scale 1:50
Client:	Kirklees Council		Dates:	07/01/2021 - 07/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

LITHOS CONSULTING

Borehole Log

Borehole No.
PH501
Sheet 3 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422683.76 - 419554.51	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	83.65	Scale 1:50
Client:	Kirklees Council		Dates:	07/01/2021 - 07/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				

21
22
23
24
25
26
27
28
29
30

Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH501**

Sheet 4 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422683.76 - 419554.51	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	83.65	Scale 1:50
Client:	Kirklees Council		Dates:	07/01/2021 - 07/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					38.00	45.65		Black SHALE. (COAL MEASURES)
					38.50	45.15		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

31 32 33 34 35 36 37 38 39 40

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No.
PH501
Sheet 5 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422683.76 - 419554.51	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	83.65	Scale 1:50
Client:	Kirklees Council		Dates:	07/01/2021 - 07/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					45.00	38.65		End of borehole at 45.00 m

41
42
43
44
45
46
47
48
49
50

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
PH502
Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422715.17 - 419504.06	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	84.70	Scale 1:50
Client:	Kirklees Council		Dates:	07/01/2021 - 07/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Brown CLAY. (OVERBURDEN)
					1.00	83.70		Yellowish brown SANDSTONE. (COAL MEASURES)
					3.00	81.70		Light grey MUDSTONE. (COAL MEASURES)
					4.00	80.70		Black COAL. (3RD BROWN METAL COAL)
					4.50	80.20		Light grey MUDSTONE. (COAL MEASURES)
					9.00	75.70		Yellowish brown SANDSTONE. (COAL MEASURES)

Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH502**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422715.17 - 419504.06	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	84.70	Scale 1:50
Client:	Kirklees Council		Dates:	07/01/2021 - 07/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.00	72.70		Light grey MUDSTONE. (COAL MEASURES)
					20.00	64.70		Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH502**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422715.17 - 419504.06	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	84.70	Scale 1:50
Client:	Kirklees Council		Dates:	07/01/2021 - 07/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					20.30	64.40		Black COAL. (MIDDLETON LITTLE COAL)
								Light grey MUDSTONE. (COAL MEASURES)
					25.00	59.70		End of borehole at 25.00 m

21 22 23 24 25 26 27 28 29 30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No.
PH502A
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 07/01/2021 - 07/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Brown CLAY. (OVERBURDEN)
					1.00			Yellowish brown SANDSTONE. (COAL MEASURES)
					3.00			Light grey MUDSTONE. (COAL MEASURES)
					4.00			Black COAL. (3RD BROWN METAL COAL)
					4.50			Light grey MUDSTONE. (COAL MEASURES)
					5.00			End of borehole at 5.00 m

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
PH503
Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422758.67 - 419550.72	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	81.90	Scale 1:50
Client:	Kirklees Council		Dates:	07/01/2021 - 07/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					0.50	81.40		Yellowish brown SANDSTONE. (COAL MEASURES)
					2.50	79.40		Black COAL. (3RD BROWN METAL COAL)
					3.00	78.90		Light grey MUDSTONE. (COAL MEASURES)
								From 4.5m to 5.0m, Dark mudstone.
								Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH503**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422758.67 - 419550.72	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	81.90	Scale 1:50
Client:	Kirklees Council		Dates:	07/01/2021 - 07/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					17.50	64.40		Black COAL. (MIDDLETON LITTLE COAL)
					17.80	64.10		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

LITHOS CONSULTING

Borehole Log

Borehole No.
PH503
Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422758.67 - 419550.72	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	81.90	Scale 1:50
Client:	Kirklees Council		Dates:	07/01/2021 - 07/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					25.00	56.90		End of borehole at 25.00 m

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH504**

Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422807.58 - 419603.14	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	76.80	Scale 1:50
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.00	75.80		Yellowish brown SANDSTONE. (COAL MEASURES)
					3.00	73.80		Light brown MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH504**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422807.58 - 419603.14	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	76.80	Scale 1:50
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.00	64.80		Black COAL. (MIDDLETON LITTLE COAL)
					12.25	64.55		Light grey MUDSTONE. (COAL MEASURES)
					19.50	57.30		Black COAL. (UN-NAMED THIN COAL)
					19.80	57.00		Light grey MUDSTONE.
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No.
PH504
Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422807.58 - 419603.14	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	76.80	Scale 1:50
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								(COAL MEASURES)
					25.00	51.80		End of borehole at 25.00 m

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH504A**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 08/01/2021 - 08/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.00			Yellowish brown SANDSTONE. (COAL MEASURES)
					3.00			End of borehole at 3.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
PH505
Sheet 1 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422854.84 - 419642.03	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	69.05	Scale 1:50
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.50	68.55		Yellowish brown CLAY. (OVERBURDEN)
								Yellowish brown SANDSTONE. (COAL MEASURES)
					3.00	66.05		Light grey MUDSTONE. (COAL MEASURES)
					5.00	64.05		Black COAL. (MIDDLETON LITTLE COAL)
					6.00	63.05		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

1 2 3 4 5 6 7 8 9 10

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

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Borehole Log

Borehole No.
PH505
Sheet 2 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422854.84 - 419642.03	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	69.05	Scale 1:50
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.50	56.55		Black COAL. (UN-NAMED THIN COAL)
					13.00	56.05		Light grey MUDSTONE. (COAL MEASURES)
					19.00	50.05		Yellowish brown SANDSTONE. (COAL MEASURES)
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

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Borehole Log

Borehole No.
PH505
Sheet 3 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422854.84 - 419642.03	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	69.05	Scale 1:50
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					25.00	44.05		Light grey MUDSTONE. (COAL MEASURES)
					25.80	43.25		Black COAL. (MIDDLETON MAIN COAL)
					26.20	42.85		Dark grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

21 22 23 24 25 26 27 28 29 30

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH505**

Sheet 4 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422854.84 - 419642.03	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	69.05	Scale 1:50
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					30.50	38.55		Black COAL. (UN-NAMED THIN COAL)
					30.70	38.35		Light grey MUDSTONE. (COAL MEASURES)
					34.50	34.55		Yellowish brown SANDSTONE. (COAL MEASURES)
					37.00	32.05		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

31 32 33 34 35 36 37 38 39 40

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH505**

Sheet 5 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422854.84 - 419642.03	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	69.05	Scale 1:50
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					45.00	24.05		End of borehole at 45.00 m

41 42 43 44 45 46 47 48 49 50

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH506**

Sheet 1 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422907.11 - 419604.15	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	68.90	Scale 1:50
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.00	67.90		Yellowish brown SANDSTONE. (COAL MEASURES)
					4.00	64.90		Light grey MUDSTONE. (COAL MEASURES)
					6.00	62.90		Black COAL. (MIDDLETON LITTLE COAL)
					7.00	61.90		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH506**

Sheet 2 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422907.11 - 419604.15	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	68.90	Scale 1:50
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					13.70	55.20		Black COAL. (UN-NAMED THIN COAL)
					14.00	54.90		Light grey MUDSTONE. (COAL MEASURES)
					19.50	49.40		Yellowish brown SANDSTONE. (COAL MEASURES)

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
PH506
Sheet 3 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422907.11 - 419604.15	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	68.90	Scale 1:50
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					25.50	43.40		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

21 22 23 24 25 26 27 28 29 30

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH506**

Sheet 4 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422907.11 - 419604.15	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	68.90	Scale 1:50
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					31.00	37.90		Dark Grey MUDSTONE. (COAL MEASURES)
					31.50	37.40		Light grey MUDSTONE. (COAL MEASURES)
					34.00	34.90		End of borehole at 34.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH506A**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 08/01/2021 - 08/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.00			Yellowish brown SANDSTONE. (COAL MEASURES)
					4.00			End of borehole at 4.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH507**

Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422850.86 - 419530.80	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	79.20	Scale 1:50
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					0.50	78.70		Yellowish brown SANDSTONE. (COAL MEASURES)
					1.00	78.20		Black COAL. (3RD BROWN METAL COAL)
					2.00	77.20		Light grey MUDSTONE. (COAL MEASURES)
					2.70	76.50		Black COAL. (3RD BROWN METAL COAL)
					3.00	76.20		Dark grey MUDSTONE. (COAL MEASURES)
					6.00	73.20		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH507**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422850.86 - 419530.80	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	79.20	Scale 1:50
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					16.00	63.20		Black COAL. (MIDDLETON LITTLE COAL)
					17.00	62.20		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH507**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422850.86 - 419530.80	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	79.20	Scale 1:50
Client:	Kirklees Council		Dates:	08/01/2021 - 08/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					23.00	56.20		Black COAL. (UN-NAMED THIN COAL)
					23.20	56.00		Light grey MUDSTONE. (COAL MEASURES)
					27.00	52.20		End of borehole at 27.00 m

21 22 23 24 25 26 27 28 29 30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH507A**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 11/01/2021 - 11/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					0.50			Yellowish brown SANDSTONE. (COAL MEASURES)
					1.00			Black COAL. (3RD BROWN METAL COAL)
					2.00			Light grey MUDSTONE. (COAL MEASURES)
					2.70			Black COAL. (3RD BROWN METAL COAL)
					3.00			Light grey MUDSTONE. (COAL MEASURES)
					5.00			End of borehole at 5.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH508**

Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422811.71 - 419482.64	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	81.95	Scale 1:50
Client:	Kirklees Council		Dates:	11/01/2021 - 11/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.50	80.45		Yellowish brown SANDSTONE. (COAL MEASURES)
					4.20	77.75		Black COAL. (3RD BROWN METAL COAL)
					4.90	77.05		Yellowish brown SANDSTONE. (COAL MEASURES)
					6.00	75.95		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
PH508
Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422811.71 - 419482.64	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	81.95	Scale 1:50
Client:	Kirklees Council		Dates:	11/01/2021 - 11/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					20.00	61.95		Continued on next sheet

11
12
13
14
15
16
17
18
19
20

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

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Borehole Log

Borehole No.
PH508
Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422811.71 - 419482.64	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	81.95	Scale 1:50
Client:	Kirklees Council		Dates:	11/01/2021 - 11/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					20.20	61.75		Black COAL. (MIDDLETON LITTLE COAL)
								Light grey MUDSTONE. (COAL MEASURES)
					25.00	56.95		End of borehole at 25.00 m

21 22 23 24 25 26 27 28 29 30

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

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Borehole Log

Borehole No.
PH509
Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422845.52 - 419441.52	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	82.05	Scale 1:50
Client:	Kirklees Council		Dates:	11/01/2021 - 11/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.00	81.05		Yellowish brown SANDSTONE. (COAL MEASURES)
					4.50	77.55		Black COAL. (3RD BROWN METAL COAL)
					5.00	77.05		Yellowish brown SANDSTONE. (COAL MEASURES)
					6.00	76.05		Dark grey MUDSTONE. (COAL MEASURES)
					7.00	75.05		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

LITHOS CONSULTING

Borehole Log

Borehole No.
PH509
Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422845.52 - 419441.52	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	82.05	Scale 1:50
Client:	Kirklees Council		Dates:	11/01/2021 - 11/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					19.50	62.55		Black COAL. (MIDDLETON LITTLE COAL)
					20.00	62.05		Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH509**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422845.52 - 419441.52	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	82.05	Scale 1:50
Client:	Kirklees Council		Dates:	11/01/2021 - 11/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Light grey MUDSTONE. (COAL MEASURES)
					25.00	57.05		End of borehole at 25.00 m

21 22 23 24 25 26 27 28 29 30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH509A**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 11/01/2021 - 11/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.00			Yellowish brown SANDSTONE. (COAL MEASURES)
					4.50			End of borehole at 4.50 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

LITHOS CONSULTING

Borehole Log

Borehole No.
PH510
Sheet 1 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422830.24 - 419401.73	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	83.20	Scale 1:50
Client:	Kirklees Council		Dates:	11/01/2021 - 11/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.00	82.20		Yellowish brown SANDSTONE. (COAL MEASURES)
					5.00	78.20		Light grey MUDSTONE. (COAL MEASURES)
					6.00	77.20		Black COAL. (3RD BROWN METAL COAL)
					6.50	76.70		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 34.5m.

AGS

LITHOS CONSULTING

Borehole Log

Borehole No.
PH510
Sheet 2 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422830.24 - 419401.73	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	83.20	Scale 1:50
Client:	Kirklees Council		Dates:	11/01/2021 - 11/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				

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Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 34.5m.

AGS

LITHOS CONSULTING

Borehole Log

Borehole No.
PH510
Sheet 3 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422830.24 - 419401.73	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	83.20	Scale 1:50
Client:	Kirklees Council		Dates:	11/01/2021 - 11/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				

21
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Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 34.5m.

AGS

Borehole Log

Borehole No. **PH510**

Sheet 4 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422830.24 - 419401.73	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	83.20	Scale 1:50
Client:	Kirklees Council		Dates:	11/01/2021 - 11/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					34.50	48.70		No flush returns. Possible workings. (MIDDLETON MAIN COAL) *At 34.5m, flush lost.*
					39.00	44.20		End of borehole at 39.00 m

31 32 33 34 35 36 37 38 39 40

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 34.5m.

LITHOS CONSULTING

Borehole Log

Borehole No.
PH511
Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422839.48 - 419363.09	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	82.90	Scale 1:50
Client:	Kirklees Council		Dates:	11/01/2021 - 11/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.00	81.90		Yellowish brown SANDSTONE. (COAL MEASURES)
					4.50	78.40		Light grey MUDSTONE. (COAL MEASURES)
					5.00	77.90		Black COAL. (3RD BROWN METAL COAL)
					5.50	77.40		Light grey MUDSTONE. (COAL MEASURES)
					10.00	72.90		Continued on next sheet

1 2 3 4 5 6 7 8 9 10

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH511**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422839.48 - 419363.09	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	82.90	Scale 1:50
Client:	Kirklees Council		Dates:	11/01/2021 - 11/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown SANDSTONE. (MIDDLETON LITTLE COAL)
					11.00	71.90		Light grey MUDSTONE. (COAL MEASURES)
					19.70	63.20		Black COAL.
					20.00	62.90		Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

LITHOS CONSULTING

Borehole Log

Borehole No.
PH511
Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422839.48 - 419363.09	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	82.90	Scale 1:50
Client:	Kirklees Council		Dates:	11/01/2021 - 11/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								(UN-NAMED THIN COAL) Light grey MUDSTONE. (COAL MEASURES)
					25.00	57.90		End of borehole at 25.00 m

21 22 23 24 25 26 27 28 29 30

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH511A**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 12/01/2021 - 12/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.00			Yellowish brown SANDSTONE. (COAL MEASURES)
					4.50			End of borehole at 4.50 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH512**

Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422909.89 - 419408.53	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	80.90	Scale 1:50
Client:	Kirklees Council		Dates:	12/01/2021 - 12/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					0.50	80.40		Yellowish brown SANDSTONE. (COAL MEASURES)
					3.50	77.40		Light grey MUDSTONE. (COAL MEASURES)
					4.00	76.90		Black COAL. (3RD BROWN METAL COAL)
					4.50	76.40		Light grey MUDSTONE. (COAL MEASURES)
					5.00	75.90		Black COAL. (3RD BROWN METAL COAL)
					5.20	75.70		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH512**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422909.89 - 419408.53	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	80.90	Scale 1:50
Client:	Kirklees Council		Dates:	12/01/2021 - 12/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					19.00	61.90		Black COAL. (MIDDLETON LITTLE COAL)
					19.50	61.40		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH512**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422909.89 - 419408.53	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	80.90	Scale 1:50
Client:	Kirklees Council		Dates:	12/01/2021 - 12/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					25.20	55.70		Black COAL. (UN-NAMED THIN COAL)
					25.40	55.50		Light grey MUDSTONE. (COAL MEASURES)
								At 27m, Drill rod blocked.
					27.00	53.90		End of borehole at 27.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH513**

Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422908.17 - 419500.15	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	78.50	Scale 1:50
Client:	Kirklees Council		Dates:	12/01/2021 - 12/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					0.50	78.00		Yellowish brown SANDSTONE. (COAL MEASURES)
					1.00	77.50		Black COAL. (3RD BROWN METAL COAL)
					1.50	77.00		Light grey MUDSTONE. (COAL MEASURES)
					3.00	75.50		Black COAL. (3RD BROWN METAL COAL)
					3.10	75.40		Yellowish brown SANDSTONE. (COAL MEASURES)
					7.50	71.00		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

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Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH513**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422908.17 - 419500.15	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	78.50	Scale 1:50
Client:	Kirklees Council		Dates:	12/01/2021 - 12/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					16.50	62.00		Black COAL. (MIDDLETON LITTLE COAL)
					16.70	61.80		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH513**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422908.17 - 419500.15	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	78.50	Scale 1:50
Client:	Kirklees Council		Dates:	12/01/2021 - 12/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					23.00	55.50		Black COAL. (UN-NAMED THIN COAL)
					23.20	55.30		Light grey MUDSTONE. (COAL MEASURES)
					27.00	51.50		End of borehole at 27.00 m

21 22 23 24 25 26 27 28 29 30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

LITHOS CONSULTING

Borehole Log

Borehole No.
PH513A
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 12/01/2021 - 12/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					0.50			Yellowish brown SANDSTONE. (COAL MEASURES)
					1.00			Black COAL. (3RD BROWN METAL COAL)
					1.50			Light grey MUDSTONE. (COAL MEASURES)
					3.00			Black COAL. (3RD BROWN METAL COAL)
					3.10			Yellowish brown SANDSTONE. (COAL MEASURES)
					5.00			End of borehole at 5.00 m

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

LITHOS CONSULTING

Borehole Log

Borehole No.
PH514
Sheet 1 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422962.07 - 419551.69	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	72.45	Scale 1:50
Client:	Kirklees Council		Dates:	12/01/2021 - 12/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.00	71.45		Yellowish brown SANDSTONE. (COAL MEASURES)
					5.00	67.45		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH514**

Sheet 2 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422962.07 - 419551.69	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	72.45	Scale 1:50
Client:	Kirklees Council		Dates:	12/01/2021 - 12/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					10.70	61.75		Black COAL. (MIDDLETON LITTLE COAL)
					11.40	61.05		Light grey MUDSTONE. (COAL MEASURES)
					18.00	54.45		Black COAL. (UN-NAMED THIN COAL)
					18.20	54.25		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH514**

Sheet 3 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422962.07 - 419551.69	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	72.45	Scale 1:50
Client:	Kirklees Council		Dates:	12/01/2021 - 12/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					25.00	47.45		Yellowish brown SANDSTONE. (COAL MEASURES)
					27.80	44.65		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

21 22 23 24 25 26 27 28 29 30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH514**

Sheet 4 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422962.07 - 419551.69	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	72.45	Scale 1:50
Client:	Kirklees Council		Dates:	12/01/2021 - 12/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					31.30	41.15		Black COAL. (MIDDLETON MAIN COAL)
					31.50	40.95		Dark grey MUDSTONE. (COAL MEASURES)
					32.10	40.35		Black COAL. (UN-NAMED THIN COAL)
					32.30	40.15		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

31 32 33 34 35 36 37 38 39 40

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH514**

Sheet 5 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422962.07 - 419551.69	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	72.45	Scale 1:50
Client:	Kirklees Council		Dates:	12/01/2021 - 12/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					41.40 41.50	31.05 30.95		Black COAL. (WHEATLEY LIME COAL) Light grey MUDSTONE. (COAL MEASURES)
					45.00	27.45		End of borehole at 45.00 m

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Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH514A**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 13/01/2021 - 13/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.00			Yellowish brown SANDSTONE. (COAL MEASURES)
					4.50			End of borehole at 4.50 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH515**

Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422962.58 - 419455.17	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	79.20	Scale 1:50
Client:	Kirklees Council		Dates:	13/01/2021 - 13/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					0.60	78.60		Yellowish brown SANDSTONE. (COAL MEASURES)
					4.00	75.20		Light grey MUDSTONE. (COAL MEASURES)
					4.20	75.00		Black COAL. (3RD BROWN METAL COAL)
					4.60	74.60		Light grey MUDSTONE. (COAL MEASURES)
					5.10	74.10		Black COAL. (MIDDLETON LITTLE COAL)
					5.30	73.90		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH515**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422962.58 - 419455.17	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	79.20	Scale 1:50
Client:	Kirklees Council		Dates:	13/01/2021 - 13/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					19.20	60.00		Black COAL. (UN-NAMED THIN COAL)
					19.80	59.40		Light grey MUDSTONE.
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH515**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	422962.58 - 419455.17	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	79.20	Scale 1:50
Client:	Kirklees Council		Dates:	13/01/2021 - 13/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								(COAL MEASURES)
					24.70	54.50		Dark grey MUDSTONE. (COAL MEASURES)
					25.10	54.10		Light grey MUDSTONE. (COAL MEASURES)
					27.00	52.20		End of borehole at 27.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH516**

Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423010.55 - 419420.68	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	76.20	Scale 1:50
Client:	Kirklees Council		Dates:	13/01/2021 - 13/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					0.40	75.80		Yellowish brown SANDSTONE. (COAL MEASURES)
					3.50	72.70		Black COAL. (3RD BROWN METAL COAL)
					4.00	72.20		Light grey MUDSTONE. (COAL MEASURES)
					4.80	71.40		Black COAL. (MIDDLETON LITTLE COAL)
					5.20	71.00		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH516**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423010.55 - 419420.68	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	76.20	Scale 1:50
Client:	Kirklees Council		Dates:	13/01/2021 - 13/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					18.80	57.40		Black COAL. (UN-NAMED THIN COAL)
					19.40	56.80		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH516**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423010.55 - 419420.68	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	76.20	Scale 1:50
Client:	Kirklees Council		Dates:	13/01/2021 - 13/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					25.00	51.20		Dark grey MUDSTONE. (COAL MEASURES)
					25.40	50.80		Light grey MUDSTONE. (COAL MEASURES)
					26.00	50.20		End of borehole at 26.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No.
PH516A
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 13/01/2021 - 13/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.40			Yellowish brown CLAY. (OVERBURDEN)
								Yellowish brown SANDSTONE. (COAL MEASURES)
					3.50			End of borehole at 3.50 m

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH517**

Sheet 1 of 6

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423011.28 - 419483.53	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	76.10	Scale 1:50
Client:	Kirklees Council		Dates:	13/01/2021 - 13/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					0.80	75.30		Yellowish brown SANDSTONE. (COAL MEASURES)
					2.90	73.20		Black COAL. (3RD BROWN METAL COAL)
					3.40	72.70		Light grey MUDSTONE. (COAL MEASURES)
					4.00	72.10		Black COAL. (3RD BROWN METAL COAL)
					4.20	71.90		Yellowish brown SANDSTONE. (COAL MEASURES)
					9.00	67.10		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

1 2 3 4 5 6 7 8 9 10

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH517**

Sheet 2 of 6

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423011.28 - 419483.53	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	76.10	Scale 1:50
Client:	Kirklees Council		Dates:	13/01/2021 - 13/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					17.20	58.90		Black COAL. (MIDDLETON LITTLE COAL)
					17.40	58.70		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

			Borehole No.	**PH517**
				Sheet 3 of 6
Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: 423011.28 - 419483.53	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level: 76.10	Scale 1:50
Client:	Kirklees Council		Dates: 13/01/2021 - 13/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					27.50	48.60		Yellowish brown SANDSTONE. (COAL MEASURES)
								Continued on next sheet

21 22 23 24 25 26 27 28 29 30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
PH517
Sheet 4 of 6

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423011.28 - 419483.53	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	76.10	Scale 1:50
Client:	Kirklees Council		Dates:	13/01/2021 - 13/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					39.00	37.10		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

31 32 33 34 35 36 37 38 39 40

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

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Borehole Log

Borehole No. **PH517**

Sheet 5 of 6

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423011.28 - 419483.53	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	76.10	Scale 1:50
Client:	Kirklees Council		Dates:	13/01/2021 - 13/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					41.00	35.10		Dark grey MUDSTONE with coal traces. (COAL MEASURES)	41
					42.00	34.10		Light grey MUDSTONE. (COAL MEASURES)	42
									43
									44
									45
									46
									47
									48
									49
								Continued on next sheet	50

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH517**

Sheet 6 of 6

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423011.28 - 419483.53	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	76.10	Scale 1:50
Client:	Kirklees Council		Dates:	13/01/2021 - 13/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					50.30	25.80		Dark grey MUDSTONE. (COAL MEASURES)
					51.00	25.10		Light grey MUDSTONE. (COAL MEASURES)
					52.10	24.00		Yellowish brown SANDSTONE. (COAL MEASURES)
					53.00	23.10		Light grey MUDSTONE. (COAL MEASURES)
					54.00	22.10		End of borehole at 54.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
PH517A
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 13/01/2021 - 13/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					0.80			Yellowish brown SANDSTONE. (COAL MEASURES)
					2.90			Black COAL. (3RD BROWN METAL COAL)
					3.40			Light grey MUDSTONE. (COAL MEASURES)
					4.00			End of borehole at 4.00 m

1 2 3 4 5 6 7 8 9 10

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

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Borehole Log

Borehole No.
PH518
Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423061.31 - 419532.35	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	70.55	Scale 1:50
Client:	Kirklees Council		Dates:	15/01/2021 - 15/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.50	69.05		Yellowish brown SANDSTONE. (COAL MEASURES)
					7.14	63.41		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH518**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423061.31 - 419532.35	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	70.55	Scale 1:50
Client:	Kirklees Council		Dates:	15/01/2021 - 15/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.10	58.45		Black COAL. (MIDDLETON LITTLE COAL)
					12.80	57.75		Light grey MUDSTONE. (COAL MEASURES)
					19.00	51.55		Black COAL. (UN-NAMED THIN COAL)
					19.50	51.05		Light grey MUDSTONE. (COAL MEASURES)

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
PH518
Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423061.31 - 419532.35	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	70.55	Scale 1:50
Client:	Kirklees Council		Dates:	15/01/2021 - 15/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					22.60	47.95		Yellowish brown SANDSTONE. (COAL MEASURES)
					25.00	45.55		End of borehole at 25.00 m

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No.
PH518A
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 15/01/2021 - 15/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.50			Yellowish brown SANDSTONE. (COAL MEASURES)
					5.00			End of borehole at 5.00 m

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH519**

Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423061.99 - 419438.61	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	73.25	Scale 1:50
Client:	Kirklees Council		Dates:	15/01/2021 - 15/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					0.80	72.45		Yellowish brown SANDSTONE. (COAL MEASURES)
					1.20	72.05		Black COAL. (3RD BROWN METAL COAL)
					1.70	71.55		Yellowish brown SANDSTONE. (COAL MEASURES)
					2.40	70.85		Black COAL. (3RD BROWN METAL COAL)
					2.60	70.65		Yellowish brown SANDSTONE. (COAL MEASURES)
					7.10	66.15		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH519**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423061.99 - 419438.61	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	73.25	Scale 1:50
Client:	Kirklees Council		Dates:	15/01/2021 - 15/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					16.60	56.65		Black COAL. (MIDDLETON LITTLE COAL)
					17.20	56.05		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH519**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423061.99 - 419438.61	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	73.25	Scale 1:50
Client:	Kirklees Council		Dates:	15/01/2021 - 15/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					22.80	50.45		Black COAL. (UN-NAMED THIN COAL)
					23.10	50.15		Light grey MUDSTONE. (COAL MEASURES)
					28.10	45.15		Yellowish brown SANDSTONE. (COAL MEASURES)
					30.00	43.25		End of borehole at 30.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
PH520
Sheet 1 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423113.12 - 419424.35	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	68.60	Scale 1:50
Client:	Kirklees Council		Dates:	15/01/2021 - 15/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.20	67.40		Yellowish brown SANDSTONE. (COAL MEASURES)
					6.30	62.30		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

1 2 3 4 5 6 7 8 9 10

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH520**

Sheet 2 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423113.12 - 419424.35	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	68.60	Scale 1:50
Client:	Kirklees Council		Dates:	15/01/2021 - 15/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.00	56.60		Black COAL. (MIDDLETON LITTLE COAL)
					12.50	56.10		Light grey MUDSTONE. (COAL MEASURES)
					18.30	50.30		Black COAL. (UN-NAMED THIN COAL)
					18.50	50.10		Light grey MUDSTONE. (COAL MEASURES)

11 12 13 14 15 16 17 18 19 20

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH520**

Sheet 3 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423113.12 - 419424.35	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	68.60	Scale 1:50
Client:	Kirklees Council		Dates:	15/01/2021 - 15/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					25.00	43.60		Yellowish brown SANDSTONE. (COAL MEASURES)
					27.60	41.00		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

21 22 23 24 25 26 27 28 29 30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH520**

Sheet 4 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423113.12 - 419424.35	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	68.60	Scale 1:50
Client:	Kirklees Council		Dates:	15/01/2021 - 15/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					34.70	33.90		Yellowish brown SANDSTONE. (COAL MEASURES) *From 37.4m, Very hard sandstone.*
					36.00	32.60		End of borehole at 36.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH521**

Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423111.93 - 419486.79	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	69.00	Scale 1:50
Client:	Kirklees Council		Dates:	18/01/2021 - 18/01/2021	Logged By GLM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.30	68.70		Topsoil. (OVERBURDEN)
					0.80	68.20		Black COAL. (3RD BROWN METAL COAL)
					1.60	67.40		Grey MUDSTONE. (COAL MEASURES)
					4.80	64.20		Brown SANDSTONE. (COAL MEASURES)
								Grey interbedded MUDSTONE and SILTSTONE. (COAL MEASURES)
								Continued on next sheet

1 2 3 4 5 6 7 8 9 10

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH521**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423111.93 - 419486.79	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	69.00	Scale 1:50
Client:	Kirklees Council		Dates:	18/01/2021 - 18/01/2021	Logged By GLM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					13.60	55.40		Black COAL. (MIDDLETON LITTLE COAL)
					14.20	54.80		Grey MUDSTONE. (COAL MEASURES)
					19.90	49.10		

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH521**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423111.93 - 419486.79	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	69.00	Scale 1:50
Client:	Kirklees Council		Dates:	18/01/2021 - 18/01/2021	Logged By GLM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					20.20	48.80		Black COAL. (UN-NAMED THIN COAL) Grey MUDSTONE. (COAL MEASURES)
					30.00	39.00		End of borehole at 30.00 m

21 22 23 24 25 26 27 28 29 30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

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Borehole Log

Borehole No.
PH522
Sheet 1 of 6

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423158.88 - 419455.36	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	63.95	Scale 1:50
Client:	Kirklees Council		Dates:	18/01/2021 - 18/01/2021	Logged By GLM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.30	63.65		Topsoil. (OVERBURDEN)
								Brown interbedded MUDSTONE and SANDSTONE. (COAL MEASURES)
					4.80	59.15		Grey MUDSTONE. (COAL MEASURES)
					7.00	56.95		Black COAL. (MIDDLETON LITTLE COAL)
					7.90	56.05		Grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH522**

Sheet 2 of 6

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423158.88 - 419455.36	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	63.95	Scale 1:50
Client:	Kirklees Council		Dates:	18/01/2021 - 18/01/2021	Logged By GLM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					14.00	49.95		Black COAL. (UN-NAMED THIN COAL)
					14.40	49.55		Grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

LITHOS CONSULTING

Borehole Log

Borehole No.
PH522
Sheet 3 of 6

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423158.88 - 419455.36	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	63.95	Scale 1:50
Client:	Kirklees Council		Dates:	18/01/2021 - 18/01/2021	Logged By GLM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				

21
22
23
24
25
26
27
28
29
30

Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

LITHOS CONSULTING

Borehole Log

Borehole No.
PH522
Sheet 4 of 6

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423158.88 - 419455.36	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	63.95	Scale 1:50
Client:	Kirklees Council		Dates:	18/01/2021 - 18/01/2021	Logged By GLM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				

31
32
33
34
35
36
37
38
39
40

Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH522**

Sheet 5 of 6

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423158.88 - 419455.36	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	63.95	Scale 1:50
Client:	Kirklees Council		Dates:	18/01/2021 - 18/01/2021	Logged By GLM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					44.20	19.75		Black COAL. (WHEATLEY LIME COAL) *From 44.2m to 45.7m, Broken ground and loss of flush.*
					45.70	18.25		Grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

41 42 43 44 45 46 47 48 49 50

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

LITHOS CONSULTING

Borehole Log

Borehole No.
PH522
Sheet 6 of 6

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423158.88 - 419455.36	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	63.95	Scale 1:50
Client:	Kirklees Council		Dates:	18/01/2021 - 18/01/2021	Logged By GLM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					51.00	12.95		End of borehole at 51.00 m

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

LITHOS CONSULTING

Borehole Log

Borehole No.
PH522A
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 18/01/2021 - 18/01/2021	Logged By GLM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.30			Topsoil. (OVERBURDEN)
								Grey MUDSTONE. (COAL MEASURES)
					4.50			End of borehole at 4.50 m

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

LITHOS CONSULTING

Borehole Log

Borehole No.
PH523
Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423196.56 - 419494.57	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	58.70	Scale 1:50
Client:	Kirklees Council		Dates:	18/01/2021 - 18/01/2021	Logged By GLM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.30	58.40		Topsoil. (OVERBURDEN)
								Brown CLAY. (OVERBURDEN)
					1.00	57.70		Brown SANDSTONE. (COAL MEASURES)
					2.40	56.30		Black COAL. (MIDDLETON LITTLE COAL)
					3.20	55.50		Brown SANDSTONE. (COAL MEASURES)
					5.00	53.70		Grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

1 2 3 4 5 6 7 8 9 10

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH523**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423196.56 - 419494.57	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	58.70	Scale 1:50
Client:	Kirklees Council		Dates:	18/01/2021 - 18/01/2021	Logged By GLM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					10.60	48.10		Black COAL. (UN-NAMED THIN COAL)
					10.90	47.80		Grey MUDSTONE. (COAL MEASURES)
					19.00	39.70		Brown SANDSTONE. (COAL MEASURES)

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

LITHOS CONSULTING

Borehole Log

Borehole No.
PH523
Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423196.56 - 419494.57	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	58.70	Scale 1:50
Client:	Kirklees Council		Dates:	18/01/2021 - 18/01/2021	Logged By GLM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					22.00	36.70		Grey MUDSTONE. (COAL MEASURES)
					25.00	33.70		End of borehole at 25.00 m

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

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Borehole Log

Borehole No.
PH524
Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423207.62 - 419421.32	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	60.45	Scale 1:50
Client:	Kirklees Council		Dates:	18/01/2021 - 18/01/2021	Logged By GLM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.30	60.15		Topsoil. (OVERBURDEN)
								Brown CLAY. (OVERBURDEN)
					1.50	58.95		Brown SANDSTONE. (COAL MEASURES)
					4.20	56.25		Grey MUDSTONE. (COAL MEASURES)
					5.00	55.45		Dark grey MUDSTONE. (COAL MEASURES)
					5.30	55.15		Grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

1 2 3 4 5 6 7 8 9 10

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH524**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423207.62 - 419421.32	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	60.45	Scale 1:50
Client:	Kirklees Council		Dates:	18/01/2021 - 18/01/2021	Logged By GLM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.20	48.25		Brown SANDSTONE. (COAL MEASURES)
					15.30	45.15		Grey MUDSTONE. (COAL MEASURES)
					18.10	42.35		Black COAL. (MIDDLETON MAIN COAL)
					19.30	41.15		Grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH524**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423207.62 - 419421.32	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	60.45	Scale 1:50
Client:	Kirklees Council		Dates:	18/01/2021 - 18/01/2021	Logged By GLM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					22.00	38.45		Dark grey MUDSTONE. (COAL MEASURES)
					22.80	37.65		Grey MUDSTONE. (COAL MEASURES)
					24.60	35.85		Brown SANDSTONE. (COAL MEASURES)
					25.00	35.45		End of borehole at 25.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

LITHOS CONSULTING

Borehole Log

Borehole No.
PH524A
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 18/01/2021 - 18/01/2021	Logged By GLM

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.30			Topsoil. (OVERBURDEN)
					1.50			Brown CLAY. (OVERBURDEN)
					4.20			Brown SANDSTONE. (COAL MEASURES)
					4.50			Grey MUDSTONE. (COAL MEASURES)
								End of borehole at 4.50 m

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH525**

Sheet 1 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423251.98 - 419435.01	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	57.85	Scale 1:50
Client:	Kirklees Council		Dates:	19/01/2021 - 19/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.50	56.35		Yellowish brown SANDSTONE. (COAL MEASURES)
					7.50	50.35		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH525**

Sheet 2 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423251.98 - 419435.01	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	57.85	Scale 1:50
Client:	Kirklees Council		Dates:	19/01/2021 - 19/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					11.00	46.85		Black COAL. (MIDDLETON LITTLE COAL)
					12.20	45.65		Light grey MUDSTONE. (COAL MEASURES)
					18.30	39.55		Yellowish brown SANDSTONE. (COAL MEASURES) *From 18.3m Very hard sandstone.*
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH525**

Sheet 3 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423251.98 - 419435.01	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	57.85	Scale 1:50
Client:	Kirklees Council		Dates:	19/01/2021 - 19/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					21.00	36.85		Black COAL. (MUN-NAMED COAL)
					21.30	36.55		Yellowish brown SANDSTONE. (COAL MEASURES)
					23.20	34.65		Light grey MUDSTONE. (COAL MEASURES)
					29.00	28.85		Black COAL. (MIDDLETON MAIN COAL)
					30.00	27.85		Continued on next sheet

21 22 23 24 25 26 27 28 29 30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH525**

Sheet 4 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423251.98 - 419435.01	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	57.85	Scale 1:50
Client:	Kirklees Council		Dates:	19/01/2021 - 19/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Light grey MUDSTONE. (COAL MEASURES)
					37.20	20.65		Black COAL. (WHEATLEY LIME COAL)
					38.20	19.65		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

31 32 33 34 35 36 37 38 39 40

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH525**

Sheet 5 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423251.98 - 419435.01	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	57.85	Scale 1:50
Client:	Kirklees Council		Dates:	19/01/2021 - 19/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					43.70	14.15		Yellowish brown SANDSTONE. (COAL MEASURES) *From 43.7m, Very hard sandstone.*
					45.00	12.85		End of borehole at 45.00 m

41 42 43 44 45 46 47 48 49 50

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH526**

Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423302.39 - 419434.59	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	55.80	Scale 1:50
Client:	Kirklees Council		Dates:	19/01/2021 - 19/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.00	54.80		Yellowish brown SANDSTONE. (COAL MEASURES)
					4.00	51.80		Light grey MUDSTONE. (COAL MEASURES)
					5.00	50.80		Yellowish brown SANDSTONE. (COAL MEASURES)
					7.20	48.60		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH526**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423302.39 - 419434.59	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	55.80	Scale 1:50
Client:	Kirklees Council		Dates:	19/01/2021 - 19/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					14.50	41.30		Black COAL. (MIDDLETON LITTLE COAL)
					15.30	40.50		Light grey MUDSTONE. (COAL MEASURES)
					18.30	37.50		Yellowish brown SANDSTONE. (COAL MEASURES) *From 18.3m Very hard sandstone.*
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH526**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423302.39 - 419434.59	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	55.80	Scale 1:50
Client:	Kirklees Council		Dates:	19/01/2021 - 19/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					28.00	27.80		Light grey MUDSTONE. (COAL MEASURES)
					30.00	25.80		End of borehole at 30.00 m

21 22 23 24 25 26 27 28 29 30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH526A**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 19/01/2021 - 19/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.00			Yellowish brown SANDSTONE. (COAL MEASURES)
					4.00			End of borehole at 4.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

LITHOS CONSULTING

Borehole Log

Borehole No.
PH527
Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423348.59 - 419453.98	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	53.75	Scale 1:50
Client:	Kirklees Council		Dates:	19/01/2021 - 19/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					0.70	53.05		Yellowish brown SANDSTONE. (COAL MEASURES)
					7.80	45.95		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

1 2 3 4 5 6 7 8 9 10

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH527**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423348.59 - 419453.98	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	53.75	Scale 1:50
Client:	Kirklees Council		Dates:	19/01/2021 - 19/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								From 10.2m to 12.0m, Soft ground - Still keeping flush and getting returns.
					15.30	38.45		Yellowish brown SANDSTONE. (COAL MEASURES)
					15.50	38.25		Black COAL. (UN-NAMED THIN COAL)
					16.00	37.75		Yellowish brown SANDSTONE. (COAL MEASURES)
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH527**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423348.59 - 419453.98	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	53.75	Scale 1:50
Client:	Kirklees Council		Dates:	19/01/2021 - 19/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					22.50	31.25		Light grey MUDSTONE. (COAL MEASURES)
					25.00	28.75		End of borehole at 25.00 m

21 22 23 24 25 26 27 28 29 30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

LITHOS CONSULTING

Borehole Log

Borehole No.
PH528
Sheet 1 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423310.23 - 419483.20	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	54.20	Scale 1:50
Client:	Kirklees Council		Dates:	20/01/2020 - 20/01/2020	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					0.60	53.60		Yellowish brown SANDSTONE. (COAL MEASURES)
					4.00	50.20		Black COAL. (UN-NAMED COAL)
					4.20	50.00		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

1 2 3 4 5 6 7 8 9 10

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH528**

Sheet 2 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423310.23 - 419483.20	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	54.20	Scale 1:50
Client:	Kirklees Council		Dates:	20/01/2020 - 20/01/2020	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.10	42.10		Yellowish brown SANDSTONE. (COAL MEASURES)
					16.00	38.20		Light grey MUDSTONE. (COAL MEASURES)
					19.60	34.60		Black COAL. (MIDDLETON MAIN COAL)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH528**

Sheet 3 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423310.23 - 419483.20	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	54.20	Scale 1:50
Client:	Kirklees Council		Dates:	20/01/2020 - 20/01/2020	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					20.70	33.50		Light grey MUDSTONE. (COAL MEASURES)
					27.50	26.70		Yellowish brown SANDSTONE. (COAL MEASURES) *From 27.5m, Very hard sandstone.*
					29.20	25.00		Dark grey MUDSTONE. (COAL MEASURES)
					29.50	24.70		Light grey MUDSTONE. (COAL MEASURES)

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH528**

Sheet 4 of 4

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423310.23 - 419483.20	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	54.20	Scale 1:50
Client:	Kirklees Council		Dates:	20/01/2020 - 20/01/2020	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					33.00	21.20		End of borehole at 33.00 m

31 32 33 34 35 36 37 38 39 40

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

LITHOS CONSULTING

Borehole Log

Borehole No.
PH528A
Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 20/01/2020 - 20/01/2020	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					0.60			Yellowish brown SANDSTONE. (COAL MEASURES)
					4.00			End of borehole at 4.00 m

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

LITHOS CONSULTING

Borehole Log

Borehole No.
PH529
Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423306.30 - 419527.26	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	52.30	Scale 1:50
Client:	Kirklees Council		Dates:	20/01/2020 - 20/01/2020	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					0.90	51.40		Yellowish brown SANDSTONE. (COAL MEASURES)
					4.50	47.80		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH529**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423306.30 - 419527.26	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	52.30	Scale 1:50
Client:	Kirklees Council		Dates:	20/01/2020 - 20/01/2020	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.00	40.30		Orangish brown SANDSTONE. (COAL MEASURES) *From 12.0m, Very hard sandstone.*
					15.00	37.30		Light grey MUDSTONE. (COAL MEASURES)
								From 18.5m to 19.0m, Soft ground - Still keeping flush and getting returns.
					19.50	32.80		Black SHALE. (COAL MEASURES)
					20.00	32.30		Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH529**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423306.30 - 419527.26	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	52.30	Scale 1:50
Client:	Kirklees Council		Dates:	20/01/2020 - 20/01/2020	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Light grey MUDSTONE. (COAL MEASURES)
					22.50	29.80		Black SHALE. (COAL MEASURES)
					23.00	29.30		Light grey MUDSTONE. (COAL MEASURES)
					25.00	27.30		End of borehole at 25.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

LITHOS CONSULTING

Borehole Log

Borehole No.
PH530
Sheet 1 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423272.09 - 419556.90	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	51.70	Scale 1:50
Client:	Kirklees Council		Dates:	20/01/2020 - 20/01/2020	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.00	50.70		Yellowish brown SANDSTONE. (COAL MEASURES)
					3.00	48.70		Black COAL. (MIDDLETON LITTLE COAL)
					3.40	48.30		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH530**

Sheet 2 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423272.09 - 419556.90	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	51.70	Scale 1:50
Client:	Kirklees Council		Dates:	20/01/2020 - 20/01/2020	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.00	39.70		Yellowish brown SANDSTONE. (COAL MEASURES) *From 12.0m, Very hard sandstone.*
					16.00	35.70		Light grey MUDSTONE. (COAL MEASURES)
					18.50	33.20		Dark grey MUDSTONE. (COAL MEASURES)
					19.50	32.20		Light grey MUDSTONE. (COAL MEASURES)

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH530**

Sheet 3 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423272.09 - 419556.90	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	51.70	Scale 1:50
Client:	Kirklees Council		Dates:	20/01/2020 - 20/01/2020	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					21.30	30.40		Dark grey MUDSTONE. (COAL MEASURES)
					22.40	29.30		Light grey MUDSTONE. (COAL MEASURES)
					24.00	27.70		Yellowish brown SANDSTONE. (COAL MEASURES) *From 24.0m, Very hard sandstone.*
					27.00	24.70		Black COAL. (UN-NAMED COAL)
					27.30	24.40		Yellowish brown SANDSTONE. (COAL MEASURES) *From 27.3m, Very hard sandstone.*
					28.00	23.70		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

21 22 23 24 25 26 27 28 29 30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH530**

Sheet 4 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423272.09 - 419556.90	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	51.70	Scale 1:50
Client:	Kirklees Council		Dates:	20/01/2020 - 20/01/2020	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					32.60	19.10		Yellowish brown SANDSTONE. (COAL MEASURES)
					33.60	18.10		Light grey MUDSTONE. (COAL MEASURES)
					34.30	17.40		Black COAL. (MIDDLETON MAIN COAL)
					35.50	16.20		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

31 32 33 34 35 36 37 38 39 40

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH530**

Sheet 5 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423272.09 - 419556.90	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	51.70	Scale 1:50
Client:	Kirklees Council		Dates:	20/01/2020 - 20/01/2020	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					40.50	11.20		Black COAL. (WHEATLEY LIME COAL)
					41.40	10.30		Light grey MUDSTONE. (COAL MEASURES)
					49.00	2.70		*At 49.0m, Hole stopped due to no progress in 10 minutes.* End of borehole at 49.00 m

41 42 43 44 45 46 47 48 49 50

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH530A**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 20/01/2020 - 20/01/2020	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.00			Yellowish brown SANDSTONE. (COAL MEASURES)
					3.00			End of borehole at 3.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH531**

Sheet 1 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423363.62 - 419543.90	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	50.35	Scale 1:50
Client:	Kirklees Council		Dates:	21/01/2021 - 21/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.80	49.55		Yellowish brown CLAY. (OVERBURDEN)
								Yellowish brown SANDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH531**

Sheet 2 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423363.62 - 419543.90	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	50.35	Scale 1:50
Client:	Kirklees Council		Dates:	21/01/2021 - 21/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.80	37.55		Light grey MUDSTONE. (COAL MEASURES)
					17.00	33.35		Black COAL. (UN-NAMED THIN COAL)
					17.90	32.45		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH531**

Sheet 3 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423363.62 - 419543.90	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	50.35	Scale 1:50
Client:	Kirklees Council		Dates:	21/01/2021 - 21/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					24.70	25.65		Yellowish brown SANDSTONE. (COAL MEASURES)
					26.00	24.35		Black COAL. (MIDDLETON MAIN COAL)
					26.70	23.65		Yellowish brown SANDSTONE. (COAL MEASURES)
					28.20	22.15		Light grey MUDSTONE. (COAL MEASURES)
					29.00	21.35		Yellowish brown SANDSTONE. (COAL MEASURES)
								Continued on next sheet

21 22 23 24 25 26 27 28 29 30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

LITHOS CONSULTING

Borehole Log

Borehole No.
PH531
Sheet 4 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423363.62 - 419543.90	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	50.35	Scale 1:50
Client:	Kirklees Council		Dates:	21/01/2021 - 21/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					34.20	16.15		Black COAL. (UN-NAMED COAL)
					34.90	15.45		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

31 32 33 34 35 36 37 38 39 40

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

AGS

Borehole Log

Borehole No. **PH531**

Sheet 5 of 5

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423363.62 - 419543.90	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	50.35	Scale 1:50
Client:	Kirklees Council		Dates:	21/01/2021 - 21/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					40.70	9.65		Black COAL. (WHEATLEY LIME COAL)
					41.70	8.65		Light grey MUDSTONE. (COAL MEASURES)
					47.00	3.35		Yellowish brown SANDSTONE. (COAL MEASURES)
					48.00	2.35		Light grey MUDSTONE. (COAL MEASURES)
					50.00	0.35		End of borehole at 50.00 m

41 42 43 44 45 46 47 48 49 50

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH531A**

Sheet 1 of 1

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords: -	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	Scale 1:50
Client:	Kirklees Council		Dates: 21/01/2021 - 21/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					0.80			Yellowish brown SANDSTONE. (COAL MEASURES)
					4.50			End of borehole at 4.50 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH532**

Sheet 1 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423389.44 - 419567.06	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	49.20	Scale 1:50
Client:	Kirklees Council		Dates:	21/01/2021 - 21/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Yellowish brown CLAY. (OVERBURDEN)
					1.00	48.20		Yellowish brown SANDSTONE. (COAL MEASURES)
								Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH532**

Sheet 2 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423389.44 - 419567.06	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	49.20	Scale 1:50
Client:	Kirklees Council		Dates:	21/01/2021 - 21/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					13.00	36.20		Light grey MUDSTONE. (COAL MEASURES)
					17.00	32.20		Black COAL. (MIDDLETON MAIN COAL)
					18.30	30.90		Light grey MUDSTONE. (COAL MEASURES)
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Borehole Log

Borehole No. **PH532**

Sheet 3 of 3

Project Name:	Dewsbury Riverside Central Gateway	Project No. 3901	Co-ords:	423389.44 - 419567.06	Hole Type PH
Location:	Dewsbury Riverside Central Gateway		Level:	49.20	Scale 1:50
Client:	Kirklees Council		Dates:	21/01/2021 - 21/01/2021	Logged By AP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					23.00	26.20		Yellowish brown SANDSTONE. (COAL MEASURES)
					25.00	24.20		End of borehole at 25.00 m

21 22 23 24 25 26 27 28 29 30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling.

Appendix I

Chemical Test Results

Certificate of Analysis

Certificate Number 17-17818

18-Dec-17

Client Lithos Consulting Ltd
Parkhill
Walton Rd
Wetherby
LS22 5DZ

Our Reference 17-17818

Client Reference 2336

Order No 12366/2336/FQ

Contract Title Dewsbury Riverside

Description 9 Soil samples.

Date Received 07-Dec-17

Date Started 07-Dec-17

Date Completed 18-Dec-17

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 17-17818
Client Ref 2336
Contract Title Dewsbury Riverside

			Lab No	1270833	1270834	1270835	1270836	1270837	1270838	1270839
			Sample ID	TP301	TP303	TP305	TP306	TP308	TP311	TP313
			Depth	0.20	0.20	0.10	0.20	0.10	0.10	0.10
			Other ID							
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	29/11/17	29/11/17	29/11/17	29/11/17	30/11/17	30/11/17	30/11/17
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**							
Preparation										
Clay content	$*		%	20		26				
Silt content	$*		%	34		44				
Sand content	$*		%	46		30				
Visible contaminants >2 mm of which plastics	*	0.1	% m/m	< 0.1		< 0.1				
Visible contaminants >2 mm man made sharps	*	0.1	% m/m	< 0.1		< 0.1				
Metals										
Arsenic	DETSC 2301#	0.2	mg/kg	57	47		25	19	23	45
Boron, Water Soluble	DETSC 2123#	0.2	mg/kg	0.9	0.6		0.7	0.8	0.5	0.9
Cadmium	DETSC 2301#	0.1	mg/kg	1	1		0.7	0.7	0.7	0.8
Chromium	DETSC 2301#	0.15	mg/kg	29	26		20	18	19	21
Chromium III	DETSC 2301*	0.15	mg/kg	29	26		20	18	19	21
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	77	68		39	27	31	54
Lead	DETSC 2301#	0.3	mg/kg	91	78		48	41	41	67
Mercury	DETSC 2325#	0.05	mg/kg	0.32	0.14		0.09	0.1	0.08	0.2
Nickel	DETSC 2301#	1	mg/kg	26	27		20	15	19	24
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5		< 0.5	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	100	100		70	68	71	89
Inorganics										
pH	DETSC 2008#			7.2	7.5		7.2	6.8	7.2	7.2
Total Organic Carbon	DETSC 2002	0.1	%	3.1	6.1		3.7	3	3.5	3.5
PAHs										
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	0.04		< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03		< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03		< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03		< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.07	0.17		0.13	0.11	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03		< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.12	0.18		0.13	0.15	0.04	0.04
Pyrene	DETSC 3303#	0.03	mg/kg	0.1	0.15		0.11	0.12	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.05	0.05		0.04	0.05	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	0.05	0.08		0.05	0.07	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.05	0.05		0.04	0.05	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.04	< 0.03		< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03		< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03		< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03		< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03		< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.49	0.71		0.5	0.55	< 0.10	< 0.10

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). $ -subcontracted. n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 17-17818
Client Ref 2336
Contract Title Dewsbury Riverside

	Lab No	1270840	1270841	1270842	1270843	1270844
	Sample ID	TP315	TP317	TP319	TP320	TP321
	Depth	0.10	0.10	0.10	0.10	0.1
	Other ID					
	Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampling Date	01/12/17	01/12/17	01/12/17	01/12/17	01/12/17
	Sampling Time	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**			
Preparation						
Clay content	$*		%	16			22	20
Silt content	$*		%	38			40	39
Sand content	$*		%	46			38	41
Visible contaminants >2 mm of which plastics	*	0.1	% m/m	< 0.1			< 0.1	< 0.1
Visible contaminants >2 mm man made sharps	*	0.1	% m/m	< 0.1			< 0.1	< 0.1
Metals								
Arsenic	DETSC 2301#	0.2	mg/kg		25	29	47	
Boron, Water Soluble	DETSC 2123#	0.2	mg/kg		0.6	0.7	0.6	
Cadmium	DETSC 2301#	0.1	mg/kg		0.7	0.7	1	
Chromium	DETSC 2301#	0.15	mg/kg		19	23	26	
Chromium III	DETSC 2301*	0.15	mg/kg		19	23	26	
Chromium, Hexavalent	DETSC 2204*	1	mg/kg		< 1.0	< 1.0	< 1.0	
Copper	DETSC 2301#	0.2	mg/kg		36	41	68	
Lead	DETSC 2301#	0.3	mg/kg		54	48	78	
Mercury	DETSC 2325#	0.05	mg/kg		0.11	0.13	0.24	
Nickel	DETSC 2301#	1	mg/kg		17	22	27	
Selenium	DETSC 2301#	0.5	mg/kg		< 0.5	< 0.5	< 0.5	
Zinc	DETSC 2301#	1	mg/kg		66	83	100	
Inorganics								
pH	DETSC 2008#				7.3	7.4	7.5	
Total Organic Carbon	DETSC 2002	0.1	%		2.8	2.3	4.6	
PAHs								
Naphthalene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	
Acenaphthylene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	
Acenaphthene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	
Fluorene	DETSC 3303	0.03	mg/kg		< 0.03	< 0.03	< 0.03	
Phenanthrene	DETSC 3303#	0.03	mg/kg		0.04	< 0.03	0.07	
Anthracene	DETSC 3303	0.03	mg/kg		< 0.03	< 0.03	< 0.03	
Fluoranthene	DETSC 3303#	0.03	mg/kg		0.07	< 0.03	0.08	
Pyrene	DETSC 3303#	0.03	mg/kg		0.05	< 0.03	0.07	
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	
Chrysene	DETSC 3303	0.03	mg/kg		0.04	< 0.03	0.04	
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg		0.2	< 0.10	0.25	

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). $ -subcontracted. n/s -not supplied.

Summary of Asbestos Analysis
Soil Samples

Our Ref 17-17818
Client Ref 2336
Contract Title Dewsbury Riverside

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1270833	TP301 0.20	SOIL	NAD	none	Chris Samms
1270834	TP303 0.20	SOIL	NAD	none	Chris Samms
1270836	TP306 0.20	SOIL	NAD	none	Chris Samms
1270837	TP308 0.10	SOIL	NAD	none	Chris Samms
1270838	TP311 0.10	SOIL	NAD	none	Chris Samms
1270839	TP313 0.10	SOIL	NAD	none	Chris Samms
1270841	TP317 0.10	SOIL	NAD	none	Chris Samms
1270842	TP319 0.10	SOIL	NAD	none	Chris Samms
1270843	TP320 0.10	SOIL	NAD	none	Chris Samms

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 17-17818
Client Ref 2336
Contract Dewsbury Riverside

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1270833	TP301 0.20 SOIL	29/11/17	PG, PT 1L x2	pH + Conductivity (7 days)	Naphthalene, PAH MS
1270834	TP303 0.20 SOIL	29/11/17	PT 1L x2	pH + Conductivity (7 days)	Naphthalene, PAH MS
1270835	TP305 0.10 SOIL	29/11/17	PG, PT 1L x2		
1270836	TP306 0.20 SOIL	29/11/17	PT 1L x2	pH + Conductivity (7 days)	Naphthalene, PAH MS
1270837	TP308 0.10 SOIL	30/11/17	PT 1L x2		Naphthalene, PAH MS
1270838	TP311 0.10 SOIL	30/11/17	PT 1L x2		Naphthalene, PAH MS
1270839	TP313 0.10 SOIL	30/11/17	PT 1L x2		Naphthalene, PAH MS
1270840	TP315 0.20 SOIL	01/12/17	GJ 250ml, PG, PT 1L x3		
1270841	TP317 0.10 SOIL	01/12/17	GJ 250ml, PT 1L x2		
1270842	TP319 0.10 SOIL	01/12/17	GJ 250ml, PT 1L x2		
1270843	TP320 0.10 SOIL	01/12/17	GJ 250ml, PG, PT 1L x2		
1270844	TP321 0.10 SOIL	01/12/17	PG		

Key: P-Plastic G-Bag T-Tub G-Glass J-Jar

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Certificate of Analysis

Certificate Number	21-00887	*Issued:*	27-Jan-21

Client Lithos Consulting Ltd
Parkhill
Walton Rd
Wetherby
LS22 5DZ

Our Reference	21-00887
Client Reference	3901
Order No	PO16982
Contract Title	Dewsbury Riverside Central Gateway
Description	42 Soil samples.
Date Received	18-Jan-21
Date Started	18-Jan-21
Date Completed	27-Jan-21
Test Procedures	Identified by prefix DETSn (details on request).
Notes	Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 21-00887
Client Ref 3901
Contract Title Dewsbury Riverside Central Gateway

			Lab No	1788095	1788096	1788097	1788098	1788099	1788100
			.Sample ID	TP501	TP506	TP509	TP517	TP520	TP523
			Depth	0.20	0.10	0.10	0.20	0.20	0.10
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	08/01/2021	08/01/2021	08/01/2021	08/01/2021	08/01/2021	08/01/2021
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Preparation									
Clay content	$*		%	33	42	26	32	21	20
Silt content	$*		%	40	45	32	27	28	28
Sand content	$*		%	27	13	42	41	51	52
Stones >2mm	DETSC 1003*	1	% m/m	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Stones >20mm	DETSC 1003*	1	% m/m	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Stones >50mm	DETSC 1003*	1	% m/m	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Visible contaminants >2 mm of which plastics	*	0.1	% m/m	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Visible contaminants >2 mm man made sharps	*	0.1	% m/m	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Stones >10mm	DETSC 1003*	1	% m/m						
Moisture Content	DETSC 1004	0.1	%	26	25	24	21	19	21
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg						
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg						
Cadmium	DETSC 2301#	0.1	mg/kg						
Chromium	DETSC 2301#	0.15	mg/kg						
Chromium III	DETSC 2301*	0.15	mg/kg						
Chromium, Hexavalent	DETSC 2204*	1	mg/kg						
Copper	DETSC 2301#	0.2	mg/kg						
Lead	DETSC 2301#	0.3	mg/kg						
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l						
Mercury	DETSC 2325#	0.05	mg/kg						
Nickel	DETSC 2301#	1	mg/kg						
Selenium	DETSC 2301#	0.5	mg/kg						
Vanadium	DETSC 2301#	0.8	mg/kg						
Zinc	DETSC 2301#	1	mg/kg						
Inorganics									
pH	DETSC 2008#		pH						
Calorific Value	DETSC 5008	1	MJ/kg						
Total Organic Carbon	DETSC 2084#	0.5	%						
Chloride Aqueous Extract	DETSC 2055	1	mg/l						
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l						
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l						
Petroleum Hydrocarbons									
EPH (C6-C10)	DETSC 3321*	0.1	mg/kg						
EPH (C10-C12)	DETSC 3311	10	mg/kg						
EPH (C12-C16)	DETSC 3311	10	mg/kg						
EPH (C16-C21)	DETSC 3311	10	mg/kg						
EPH (C21-C35)	DETSC 3311	10	mg/kg						
EPH (C35-C40)	DETSC 3311	10	mg/kg						
EPH (C10-C40)	DETSC 3311#	10	mg/kg						
PAHs									

Summary of Chemical Analysis
Soil Samples

Our Ref 21-00887
Client Ref 3901
Contract Title Dewsbury Riverside Central Gateway

	Lab No	1788095	1788096	1788097	1788098	1788099	1788100
	.Sample ID	TP501	TP506	TP509	TP517	TP520	TP523
	Depth	0.20	0.10	0.10	0.20	0.20	0.10
	Other ID						
	Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Sampling Date	08/01/2021	08/01/2021	08/01/2021	08/01/2021	08/01/2021	08/01/2021
	Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
Naphthalene	DETSC 3303#	0.03	mg/kg				
Acenaphthylene	DETSC 3303#	0.03	mg/kg				
Acenaphthene	DETSC 3303#	0.03	mg/kg				
Fluorene	DETSC 3303	0.03	mg/kg				
Phenanthrene	DETSC 3303#	0.03	mg/kg				
Anthracene	DETSC 3303	0.03	mg/kg				
Fluoranthene	DETSC 3303#	0.03	mg/kg				
Pyrene	DETSC 3303#	0.03	mg/kg				
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg				
Chrysene	DETSC 3303	0.03	mg/kg				
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg				
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg				
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg				
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg				
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg				
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg				
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg				

Summary of Chemical Analysis
Soil Samples

Our Ref 21-00887
Client Ref 3901
Contract Title Dewsbury Riverside Central Gateway

				Lab No	1788101	1788102	1788103	1788104	1788105	1788106
				.Sample ID	TP526	WS513	WS513	WS501	WS501	WS502
				Depth	0.10	0.50	0.80	0.40	0.90	0.50
				Other ID						
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Sampling Date	08/01/2021	08/01/2021	08/01/2021	06/01/2021	06/01/2021	06/01/2021
				Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**							
Preparation										
Clay content	$*		%	26					
Silt content	$*		%	35					
Sand content	$*		%	39					
Stones >2mm	DETSC 1003*	1	% m/m	< 1.0					
Stones >20mm	DETSC 1003*	1	% m/m	< 1.0					
Stones >50mm	DETSC 1003*	1	% m/m	< 1.0					
Visible contaminants >2 mm of which plastics	*	0.1	% m/m	< 0.1					
Visible contaminants >2 mm man made sharps	*	0.1	% m/m	< 0.1					
Stones >10mm	DETSC 1003*	1	% m/m		16	2.0	< 1.0	1.0	4.0
Moisture Content	DETSC 1004	0.1	%	21	12	19	18	18	25
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg		17	23	31	7.1	37
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg		0.8	0.5	0.9	1.0	0.9
Cadmium	DETSC 2301#	0.1	mg/kg		< 0.1	< 0.1	0.2	< 0.1	0.6
Chromium	DETSC 2301#	0.15	mg/kg		24	29	27	22	67
Chromium III	DETSC 2301*	0.15	mg/kg		24	29	27	22	67
Chromium, Hexavalent	DETSC 2204*	1	mg/kg		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg		41	49	46	40	160
Lead	DETSC 2301#	0.3	mg/kg		7.4	11	36	21	83
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l		< 10	< 10	< 10	< 10	< 10
Mercury	DETSC 2325#	0.05	mg/kg		< 0.05	< 0.05	0.14	< 0.05	0.42
Nickel	DETSC 2301#	1	mg/kg		21	27	27	33	24
Selenium	DETSC 2301#	0.5	mg/kg		< 0.5	< 0.5	1.1	< 0.5	1.3
Vanadium	DETSC 2301#	0.8	mg/kg		67	85	48	34	40
Zinc	DETSC 2301#	1	mg/kg		19	22	74	110	160
Inorganics									
pH	DETSC 2008#		pH		9.4	8.0	7.4	7.6	7.0
Calorific Value	DETSC 5008	1	MJ/kg		< 1.0	13.3			
Total Organic Carbon	DETSC 2084#	0.5	%		5.3	24	6.0	< 0.5	12
Chloride Aqueous Extract	DETSC 2055	1	mg/l		3.1	4.4	4.6	5.2	6.6
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l		6.2	2.3	24	11	16
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l		100	44	32	23	69
Petroleum Hydrocarbons									
EPH (C6-C10)	DETSC 3321*	0.1	mg/kg		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
EPH (C10-C12)	DETSC 3311	10	mg/kg		< 10	< 10	< 10	< 10	< 10
EPH (C12-C16)	DETSC 3311	10	mg/kg		< 10	< 10	< 10	< 10	< 10
EPH (C16-C21)	DETSC 3311	10	mg/kg		< 10	< 10	< 10	< 10	44
EPH (C21-C35)	DETSC 3311	10	mg/kg		< 10	< 10	< 10	< 10	130
EPH (C35-C40)	DETSC 3311	10	mg/kg		< 10	< 10	< 10	< 10	< 10
EPH (C10-C40)	DETSC 3311#	10	mg/kg		< 10	< 10	< 10	< 10	180
PAHs									

Summary of Chemical Analysis
Soil Samples

Our Ref 21-00887
Client Ref 3901
Contract Title Dewsbury Riverside Central Gateway

				Lab No	1788101	1788102	1788103	1788104	1788105	1788106
				.Sample ID	TP526	WS513	WS513	WS501	WS501	WS502
				Depth	0.10	0.50	0.80	0.40	0.90	0.50
				Other ID						
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Sampling Date	08/01/2021	08/01/2021	08/01/2021	06/01/2021	06/01/2021	06/01/2021
				Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**							
Naphthalene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	< 0.03	0.05
Acenaphthylene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	< 0.03	0.05
Fluorene	DETSC 3303	0.03	mg/kg		< 0.03	< 0.03	< 0.03	< 0.03	0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	0.13	< 0.03	0.34
Anthracene	DETSC 3303	0.03	mg/kg		< 0.03	< 0.03	< 0.03	< 0.03	0.05
Fluoranthene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	0.11	< 0.03	0.43
Pyrene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	0.09	< 0.03	0.38
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	0.05	< 0.03	0.11
Chrysene	DETSC 3303	0.03	mg/kg		< 0.03	< 0.03	0.05	< 0.03	0.18
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	0.05	< 0.03	0.14
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	< 0.03	0.04
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	< 0.03	0.07
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	< 0.03	0.04
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg		< 0.03	< 0.03	< 0.03	< 0.03	0.04
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg		< 0.10	< 0.10	0.48	< 0.10	1.9

Summary of Chemical Analysis
Soil Samples

Our Ref 21-00887
Client Ref 3901
Contract Title Dewsbury Riverside Central Gateway

				Lab No	1788107	1788108	1788109	1788110	1788111	1788112
				.Sample ID	WS507	WS507	WS508	WS508	WS509	WS510
				Depth	0.10	0.40	0.20	0.60	0.20	0.50
				Other ID						
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Sampling Date	07/01/2021	07/01/2021	07/01/2021	07/01/2021	07/01/2021	08/01/2021
				Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**							
Preparation										
Clay content	$*		%							
Silt content	$*		%							
Sand content	$*		%							
Stones >2mm	DETSC 1003*	1	% m/m							
Stones >20mm	DETSC 1003*	1	% m/m							
Stones >50mm	DETSC 1003*	1	% m/m							
Visible contaminants >2 mm of which plastics	*	0.1	% m/m							
Visible contaminants >2 mm man made sharps	*	0.1	% m/m							
Stones >10mm	DETSC 1003*	1	% m/m	15	< 1.0	< 1.0	< 1.0	20	1.0	
Moisture Content	DETSC 1004	0.1	%	5.6	24	24	24	20	25	
Metals										
Arsenic	DETSC 2301#	0.2	mg/kg	2.9	48	34	60	51	120	
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	2.4	0.9	1.6	1.2	0.7	0.7	
Cadmium	DETSC 2301#	0.1	mg/kg	< 0.1	0.6	0.5	0.8	0.5	0.1	
Chromium	DETSC 2301#	0.15	mg/kg	240	31	76	29	45	26	
Chromium III	DETSC 2301*	0.15	mg/kg	240	31	76	29	45	26	
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Copper	DETSC 2301#	0.2	mg/kg	15	100	240	150	120	180	
Lead	DETSC 2301#	0.3	mg/kg	8.4	190	220	320	330	130	
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l	< 10	< 10	< 10	< 10	< 10	< 10	
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	0.39	0.32	0.66	0.21	0.45	
Nickel	DETSC 2301#	1	mg/kg	6.7	25	21	29	37	35	
Selenium	DETSC 2301#	0.5	mg/kg	1.4	1.6	1.0	1.1	0.8	1.2	
Vanadium	DETSC 2301#	0.8	mg/kg	83	54	70	64	120	90	
Zinc	DETSC 2301#	1	mg/kg	21	370	190	350	140	59	
Inorganics										
pH	DETSC 2008#		pH	10.1	7.4	9.0	7.4	7.3	6.9	
Calorific Value	DETSC 5008	1	MJ/kg							
Total Organic Carbon	DETSC 2084#	0.5	%	6.5	11	13	17	20	25	
Chloride Aqueous Extract	DETSC 2055	1	mg/l	9.3	10	7.4	7.8	3.4	8.9	
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l	< 1.0	9.6	11	13	4.9	2.7	
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	260	100	110	26	76	76	
Petroleum Hydrocarbons										
EPH (C6-C10)	DETSC 3321*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
EPH (C10-C12)	DETSC 3311	10	mg/kg	< 100.0	15	< 100.0	< 10	< 10	< 10	
EPH (C12-C16)	DETSC 3311	10	mg/kg	230	68	< 100.0	23	< 10	< 10	
EPH (C16-C21)	DETSC 3311	10	mg/kg	1800	370	510	130	26	< 10	
EPH (C21-C35)	DETSC 3311	10	mg/kg	6000	630	1300	140	64	< 10	
EPH (C35-C40)	DETSC 3311	10	mg/kg	1000	68	< 100.0	< 10	< 10	< 10	
EPH (C10-C40)	DETSC 3311#	10	mg/kg	9000	1100	1900	300	100	< 10	
PAHs										

Summary of Chemical Analysis
Soil Samples

Our Ref 21-00887
Client Ref 3901
Contract Title Dewsbury Riverside Central Gateway

			Lab No	1788107	1788108	1788109	1788110	1788111	1788112
			.Sample ID	WS507	WS507	WS508	WS508	WS509	WS510
			Depth	0.10	0.40	0.20	0.60	0.20	0.50
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	07/01/2021	07/01/2021	07/01/2021	07/01/2021	07/01/2021	08/01/2021
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Naphthalene	DETSC 3303#	0.03	mg/kg	0.61	0.08	0.05	0.09	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.30	< 0.03	0.09	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	3.5	0.20	0.37	0.16	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	2.3	0.12	0.23	0.10	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	23	1.2	3.0	1.0	0.21	0.04
Anthracene	DETSC 3303	0.03	mg/kg	5.7	0.25	0.89	0.20	0.04	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	48	2.2	8.8	1.4	0.40	0.06
Pyrene	DETSC 3303#	0.03	mg/kg	45	2.2	8.9	1.3	0.40	0.05
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	17	1.2	5.4	0.52	0.17	0.05
Chrysene	DETSC 3303	0.03	mg/kg	18	0.67	3.2	0.38	0.15	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	23	0.97	7.0	0.44	0.22	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	10	0.40	2.7	0.18	0.08	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	19	0.91	8.0	0.40	0.17	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	7.4	0.17	1.6	0.08	0.05	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	2.0	0.05	0.42	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	9.4	0.18	1.9	0.08	0.05	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	230	11	52	6.2	2.0	0.20

Summary of Chemical Analysis
Soil Samples

Our Ref 21-00887
Client Ref 3901
Contract Title Dewsbury Riverside Central Gateway

				Lab No	1788113	1788114	1788115	1788116	1788117	1788118
				.Sample ID	WS511	WS512	WS514	WS514	WS515	WS515
				Depth	0.70	0.40	0.50	1.10	0.30	1.30
				Other ID						
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Sampling Date	08/01/2021	08/01/2021	08/01/2021	08/01/2021	08/01/2021	08/01/2021
				Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**							
Preparation										
Clay content	$*		%							
Silt content	$*		%							
Sand content	$*		%							
Stones >2mm	DETSC 1003*	1	% m/m							
Stones >20mm	DETSC 1003*	1	% m/m							
Stones >50mm	DETSC 1003*	1	% m/m							
Visible contaminants >2 mm of which plastics	*	0.1	% m/m							
Visible contaminants >2 mm man made sharps	*	0.1	% m/m							
Stones >10mm	DETSC 1003*	1	% m/m	21	1.0	2.0	1.0	2.0	12
Moisture Content	DETSC 1004	0.1	%	18	27	18	17	19	4.5
Metals										
Arsenic	DETSC 2301#	0.2	mg/kg	39	71	210	94	34	32
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	1.0	0.6	3.8	10	0.8	0.9
Cadmium	DETSC 2301#	0.1	mg/kg	0.4	0.7	0.2	0.3	< 0.1	0.3
Chromium	DETSC 2301#	0.15	mg/kg	19	29	33	35	21	22
Chromium III	DETSC 2301*	0.15	mg/kg	19	29	33	35	21	22
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	60	98	89	110	33	48
Lead	DETSC 2301#	0.3	mg/kg	100	210	89	92	31	42
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l	22	< 10	< 10	< 10	< 10	< 10
Mercury	DETSC 2325#	0.05	mg/kg	0.53	0.75	0.21	0.16	0.08	0.14
Nickel	DETSC 2301#	1	mg/kg	97	40	39	42	21	24
Selenium	DETSC 2301#	0.5	mg/kg	0.9	1.1	2.7	1.9	1.5	0.6
Vanadium	DETSC 2301#	0.8	mg/kg	38	86	71	80	33	37
Zinc	DETSC 2301#	1	mg/kg	110	440	69	110	64	61
Inorganics										
pH	DETSC 2008#		pH	7.2	6.5	7.6	8.0	7.0	7.3
Calorific Value	DETSC 5008	1	MJ/kg						
Total Organic Carbon	DETSC 2084#	0.5	%	7.9	24	6.7	10	5.5	3.7
Chloride Aqueous Extract	DETSC 2055	1	mg/l	8.8	7.5	3.7	6.5	71	9.5
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l	< 1.0	8.8	5.9	1.3	9.1	3.7
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	1600	26	49	56	20	34
Petroleum Hydrocarbons										
EPH (C6-C10)	DETSC 3321*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
EPH (C10-C12)	DETSC 3311	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
EPH (C12-C16)	DETSC 3311	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
EPH (C16-C21)	DETSC 3311	10	mg/kg	< 10	49	< 10	34	< 10	< 10
EPH (C21-C35)	DETSC 3311	10	mg/kg	< 10	60	< 10	70	< 10	< 10
EPH (C35-C40)	DETSC 3311	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	120	< 10	120	< 10	< 10
PAHs										

Summary of Chemical Analysis
Soil Samples

Our Ref 21-00887
Client Ref 3901
Contract Title Dewsbury Riverside Central Gateway

			Lab No	1788113	1788114	1788115	1788116	1788117	1788118
			.Sample ID	WS511	WS512	WS514	WS514	WS515	WS515
			Depth	0.70	0.40	0.50	1.10	0.30	1.30
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	08/01/2021	08/01/2021	08/01/2021	08/01/2021	08/01/2021	08/01/2021
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.03	0.08	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	0.03	< 0.03	0.07	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	0.04	< 0.03	0.04	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.03	0.47	0.11	0.40	< 0.03	0.11
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	0.08	< 0.03	0.09	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.04	0.69	0.13	0.76	< 0.03	0.23
Pyrene	DETSC 3303#	0.03	mg/kg	0.04	0.61	0.12	0.69	< 0.03	0.22
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	0.20	0.05	0.24	< 0.03	0.14
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	0.21	0.05	0.23	< 0.03	0.15
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	0.20	0.04	0.24	< 0.03	0.22
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	0.08	< 0.03	0.10	< 0.03	0.08
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.14	0.03	0.19	< 0.03	0.14
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.05	< 0.03	0.06	< 0.03	0.07
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	0.04	< 0.03	0.06	< 0.03	0.08
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	2.8	0.51	3.3	< 0.10	1.5

Summary of Chemical Analysis
Soil Samples

Our Ref 21-00887
Client Ref 3901
Contract Title Dewsbury Riverside Central Gateway

				Lab No	1788119	1788120	1788121	1788122	1788123	1788124
				.Sample ID	WS503	WS505	TP501	TP504	TP505	TP507
				Depth	0.20	0.20	0.10	0.10	0.10	0.10
				Other ID						
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Sampling Date	07/01/2021	07/01/2021	08/01/2021	08/01/2021	08/01/2021	08/01/2021
				Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**		**LOD**	**Units**						
Preparation										
Clay content	$*			%						
Silt content	$*			%						
Sand content	$*			%						
Stones >2mm	DETSC 1003*		1	% m/m						
Stones >20mm	DETSC 1003*		1	% m/m						
Stones >50mm	DETSC 1003*		1	% m/m						
Visible contaminants >2 mm of which plastics	*		0.1	% m/m						
Visible contaminants >2 mm man made sharps	*		0.1	% m/m						
Stones >10mm	DETSC 1003*		1	% m/m	3.0	< 1.0	< 1.0	18	2.0	< 1.0
Moisture Content	DETSC 1004		0.1	%	24	28	20	22	25	24
Metals										
Arsenic	DETSC 2301#		0.2	mg/kg	75	50	47	40	43	28
Boron, Water Soluble	DETSC 2311#		0.2	mg/kg	0.9	1.0	1.0	0.7	0.7	0.6
Cadmium	DETSC 2301#		0.1	mg/kg	0.6	0.5	0.3	0.5	0.4	0.3
Chromium	DETSC 2301#		0.15	mg/kg	34	31	22	22	21	23
Chromium III	DETSC 2301*		0.15	mg/kg	34	31	22	22	21	23
Chromium, Hexavalent	DETSC 2204*		1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#		0.2	mg/kg	130	110	60	61	63	46
Lead	DETSC 2301#		0.3	mg/kg	440	230	86	72	81	55
Magnesium Aqueous Extract	DETSC 2076*		10	mg/l						
Mercury	DETSC 2325#		0.05	mg/kg	0.55	0.45	0.23	0.22	0.25	0.14
Nickel	DETSC 2301#		1	mg/kg	28	27	19	38	21	25
Selenium	DETSC 2301#		0.5	mg/kg	1.2	1.1	1.2	3.1	0.7	1.1
Vanadium	DETSC 2301#		0.8	mg/kg	71	62	48	45	45	48
Zinc	DETSC 2301#		1	mg/kg	240	270	92	110	88	100
Inorganics										
pH	DETSC 2008#			pH	6.6	6.9	6.7	6.7	7.8	7.0
Calorific Value	DETSC 5008		1	MJ/kg						
Total Organic Carbon	DETSC 2084#		0.5	%	12	11	7.5	5.8	6.0	3.9
Chloride Aqueous Extract	DETSC 2055		1	mg/l						
Nitrate Aqueous Extract as NO3	DETSC 2055		1	mg/l						
Sulphate Aqueous Extract as SO4	DETSC 2076#		10	mg/l						
Petroleum Hydrocarbons										
EPH (C6-C10)	DETSC 3321*		0.1	mg/kg						
EPH (C10-C12)	DETSC 3311		10	mg/kg						
EPH (C12-C16)	DETSC 3311		10	mg/kg						
EPH (C16-C21)	DETSC 3311		10	mg/kg						
EPH (C21-C35)	DETSC 3311		10	mg/kg						
EPH (C35-C40)	DETSC 3311		10	mg/kg						
EPH (C10-C40)	DETSC 3311#		10	mg/kg						
PAHs										

Summary of Chemical Analysis
Soil Samples

Our Ref 21-00887
Client Ref 3901
Contract Title Dewsbury Riverside Central Gateway

			Lab No	1788119	1788120	1788121	1788122	1788123	1788124
			.Sample ID	WS503	WS505	TP501	TP504	TP505	TP507
			Depth	0.20	0.20	0.10	0.10	0.10	0.10
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	07/01/2021	07/01/2021	08/01/2021	08/01/2021	08/01/2021	08/01/2021
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Naphthalene	DETSC 3303#	0.03	mg/kg	0.07	0.10	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	0.14	0.16	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	0.08	0.09	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.82	0.90	0.05	< 0.03	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	0.14	0.16	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	1.0	1.2	0.09	0.04	< 0.03	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	0.91	1.0	0.08	< 0.03	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.24	0.28	0.04	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	0.30	0.38	0.05	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.25	0.33	0.05	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.10	0.11	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.16	0.21	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.06	0.08	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.06	0.08	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	4.4	5.1	0.35	< 0.10	< 0.10	< 0.10

Summary of Chemical Analysis
Soil Samples

Our Ref 21-00887
Client Ref 3901
Contract Title Dewsbury Riverside Central Gateway

				Lab No	1788125	1788126	1788127	1788128	1788129	1788130
				.Sample ID	TP510	TP513	TP515	TP516	TP517	TP519
				Depth	0.10	0.10	0.10	0.10	0.10	0.10
				Other ID						
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Sampling Date	08/01/2021	08/01/2021	08/01/2021	08/01/2021	08/01/2021	08/01/2021
				Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**							
Preparation										
Clay content	$*		%							
Silt content	$*		%							
Sand content	$*		%							
Stones >2mm	DETSC 1003*	1	% m/m							
Stones >20mm	DETSC 1003*	1	% m/m							
Stones >50mm	DETSC 1003*	1	% m/m							
Visible contaminants >2 mm of which plastics	*	0.1	% m/m							
Visible contaminants >2 mm man made sharps	*	0.1	% m/m							
Stones >10mm	DETSC 1003*	1	% m/m	< 1.0	6.0	< 1.0	19	12	< 1.0
Moisture Content	DETSC 1004	0.1	%	20	22	19	17	21	20
Metals										
Arsenic	DETSC 2301#	0.2	mg/kg	34	43	42	28	45	24
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.7	0.7	1.0	0.5	0.6	0.4
Cadmium	DETSC 2301#	0.1	mg/kg	0.4	0.4	0.4	0.3	0.3	0.3
Chromium	DETSC 2301#	0.15	mg/kg	22	22	19	17	19	18
Chromium III	DETSC 2301*	0.15	mg/kg	22	22	19	17	19	18
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	49	68	54	46	64	37
Lead	DETSC 2301#	0.3	mg/kg	64	73	70	54	76	39
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l						
Mercury	DETSC 2325#	0.05	mg/kg	0.17	0.63	0.18	0.17	0.20	0.09
Nickel	DETSC 2301#	1	mg/kg	20	26	20	20	20	22
Selenium	DETSC 2301#	0.5	mg/kg	1.3	< 0.5	1.2	0.9	0.5	0.8
Vanadium	DETSC 2301#	0.8	mg/kg	41	49	42	33	42	32
Zinc	DETSC 2301#	1	mg/kg	110	110	96	91	88	83
Inorganics										
pH	DETSC 2008#		pH	7.3	6.7	6.8	6.8	6.8	6.7
Calorific Value	DETSC 5008	1	MJ/kg						
Total Organic Carbon	DETSC 2084#	0.5	%	3.9	7.4	4.9	4.5	8.9	4.1
Chloride Aqueous Extract	DETSC 2055	1	mg/l						
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l						
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l						
Petroleum Hydrocarbons										
EPH (C6-C10)	DETSC 3321*	0.1	mg/kg						
EPH (C10-C12)	DETSC 3311	10	mg/kg						
EPH (C12-C16)	DETSC 3311	10	mg/kg						
EPH (C16-C21)	DETSC 3311	10	mg/kg						
EPH (C21-C35)	DETSC 3311	10	mg/kg						
EPH (C35-C40)	DETSC 3311	10	mg/kg						
EPH (C10-C40)	DETSC 3311#	10	mg/kg						
PAHs										

Summary of Chemical Analysis
Soil Samples

Our Ref 21-00887
Client Ref 3901
Contract Title Dewsbury Riverside Central Gateway

			Lab No	1788125	1788126	1788127	1788128	1788129	1788130
			.Sample ID	TP510	TP513	TP515	TP516	TP517	TP519
			Depth	0.10	0.10	0.10	0.10	0.10	0.10
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	08/01/2021	08/01/2021	08/01/2021	08/01/2021	08/01/2021	08/01/2021
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.05	< 0.03	< 0.03	< 0.03	0.04
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.04	0.08	0.04	0.04	< 0.03	0.06
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.06	< 0.03	< 0.03	< 0.03	0.05
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	0.19	< 0.10	< 0.10	< 0.10	0.15

Summary of Chemical Analysis
Soil Samples

Our Ref 21-00887
Client Ref 3901
Contract Title Dewsbury Riverside Central Gateway

				Lab No	1788131	1788132	1788133	1788134	1788135	1788136
				.Sample ID	TP520	TP521	TP524	TP525	TP527	TP530
				Depth	0.10	0.10	0.10	0.10	0.10	0.10
				Other ID						
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Sampling Date	08/01/2021	08/01/2021	08/01/2021	08/01/2021	08/01/2021	08/01/2021
				Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**							
Preparation										
Clay content	$*		%							
Silt content	$*		%							
Sand content	$*		%							
Stones >2mm	DETSC 1003*	1	% m/m							
Stones >20mm	DETSC 1003*	1	% m/m							
Stones >50mm	DETSC 1003*	1	% m/m							
Visible contaminants >2 mm of which plastics	*	0.1	% m/m							
Visible contaminants >2 mm man made sharps	*	0.1	% m/m							
Stones >10mm	DETSC 1003*	1	% m/m	< 1.0	< 1.0	< 1.0	10	< 1.0	< 1.0
Moisture Content	DETSC 1004	0.1	%	22	23	22	20	19	24
Metals										
Arsenic	DETSC 2301#	0.2	mg/kg	47	42	35	25	41	35
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.8	0.6	0.6	0.5	0.8	0.6
Cadmium	DETSC 2301#	0.1	mg/kg	0.4	0.4	0.3	0.2	0.3	0.3
Chromium	DETSC 2301#	0.15	mg/kg	21	22	22	22	23	20
Chromium III	DETSC 2301*	0.15	mg/kg	21	22	22	22	23	20
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	62	58	52	43	60	55
Lead	DETSC 2301#	0.3	mg/kg	73	69	67	48	73	56
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l						
Mercury	DETSC 2325#	0.05	mg/kg	0.24	0.22	0.23	0.19	0.26	0.26
Nickel	DETSC 2301#	1	mg/kg	21	23	19	18	19	24
Selenium	DETSC 2301#	0.5	mg/kg	1.0	1.5	1.0	0.6	1.0	1.3
Vanadium	DETSC 2301#	0.8	mg/kg	44	45	42	37	45	36
Zinc	DETSC 2301#	1	mg/kg	88	86	89	79	90	89
Inorganics										
pH	DETSC 2008#		pH	6.7	6.5	6.7	6.6	7.4	6.8
Calorific Value	DETSC 5008	1	MJ/kg						
Total Organic Carbon	DETSC 2084#	0.5	%	6.0	8.3	5.5	3.5	4.6	13
Chloride Aqueous Extract	DETSC 2055	1	mg/l						
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l						
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l						
Petroleum Hydrocarbons										
EPH (C6-C10)	DETSC 3321*	0.1	mg/kg						
EPH (C10-C12)	DETSC 3311	10	mg/kg						
EPH (C12-C16)	DETSC 3311	10	mg/kg						
EPH (C16-C21)	DETSC 3311	10	mg/kg						
EPH (C21-C35)	DETSC 3311	10	mg/kg						
EPH (C35-C40)	DETSC 3311	10	mg/kg						
EPH (C10-C40)	DETSC 3311#	10	mg/kg						
PAHs										

Summary of Chemical Analysis
Soil Samples

Our Ref 21-00887
Client Ref 3901
Contract Title Dewsbury Riverside Central Gateway

			Lab No	1788131	1788132	1788133	1788134	1788135	1788136
			.Sample ID	TP520	TP521	TP524	TP525	TP527	TP530
			Depth	0.10	0.10	0.10	0.10	0.10	0.10
			Other ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	08/01/2021	08/01/2021	08/01/2021	08/01/2021	08/01/2021	08/01/2021
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	0.08	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	0.49	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	0.35	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	2.2	< 0.03	0.04	0.04	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	0.53	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	4.4	0.04	0.05	0.05	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	3.7	0.04	0.04	0.04	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	1.9	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	2.1	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	3.3	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	1.3	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	2.8	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.99	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	0.32	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	1.2	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	26	< 0.10	0.13	0.12	< 0.10

Summary of Asbestos Analysis
Soil Samples

Our Ref 21-00887
Client Ref 3901
Contract Title Dewsbury Riverside Central Gateway

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1788102	WS513 0.50	SOIL	NAD	none	Darryl Fletcher
1788103	WS513 0.80	SOIL	NAD	none	Darryl Fletcher
1788104	WS501 0.40	SOIL	NAD	none	Darryl Fletcher
1788105	WS501 0.90	SOIL	NAD	none	Darryl Fletcher
1788106	WS502 0.50	SOIL	NAD	none	Darryl Fletcher
1788107	WS507 0.10	SOIL	NAD	none	Darryl Fletcher
1788108	WS507 0.40	SOIL	NAD	none	Darryl Fletcher
1788109	WS508 0.20	SOIL	NAD	none	Darryl Fletcher
1788110	WS508 0.60	SOIL	NAD	none	Darryl Fletcher
1788111	WS509 0.20	SOIL	NAD	none	Darryl Fletcher
1788112	WS510 0.50	SOIL	NAD	none	Darryl Fletcher
1788113	WS511 0.70	SOIL	NAD	none	Darryl Fletcher
1788114	WS512 0.40	SOIL	NAD	none	Darryl Fletcher
1788115	WS514 0.50	SOIL	Amosite	Bundles of Amosite Fibres	Darryl Fletcher
1788116	WS514 1.10	SOIL	Chrysotile Amosite	Bundle of Amosite Fibres & Bundles of Chrysotile	Darryl Fletcher
1788117	WS515 0.30	SOIL	NAD	none	Darryl Fletcher
1788118	WS515 1.30	SOIL	NAD	none	Darryl Fletcher
1788119	WS503 0.20	SOIL	NAD	none	Darryl Fletcher
1788120	WS505 0.20	SOIL	NAD	none	Darryl Fletcher
1788121	TP501 0.10	SOIL	NAD	none	Darryl Fletcher
1788122	TP504 0.10	SOIL	NAD	none	Darryl Fletcher
1788123	TP505 0.10	SOIL	NAD	none	Darryl Fletcher
1788124	TP507 0.10	SOIL	NAD	none	Darryl Fletcher
1788125	TP510 0.10	SOIL	NAD	none	Darryl Fletcher
1788126	TP513 0.10	SOIL	NAD	none	Darryl Fletcher
1788127	TP515 0.10	SOIL	NAD	none	Darryl Fletcher
1788128	TP516 0.10	SOIL	NAD	none	Darryl Fletcher
1788129	TP517 0.10	SOIL	NAD	none	Darryl Fletcher
1788130	TP519 0.10	SOIL	NAD	none	Darryl Fletcher
1788131	TP520 0.10	SOIL	NAD	none	Darryl Fletcher
1788132	TP521 0.10	SOIL	NAD	none	Darryl Fletcher
1788133	TP524 0.10	SOIL	NAD	none	Darryl Fletcher
1788134	TP525 0.10	SOIL	NAD	none	Darryl Fletcher
1788135	TP527 0.10	SOIL	NAD	none	Darryl Fletcher
1788136	TP530 0.10	SOIL	NAD	none	Darryl Fletcher

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 21-00887
Client Ref 3901
Contract Dewsbury Riverside Central Gateway

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1788095	TP501 0.20 SOIL	08/01/21	PG		
1788096	TP506 0.10 SOIL	08/01/21	PG		
1788097	TP509 0.10 SOIL	08/01/21	PG		
1788098	TP517 0.20 SOIL	08/01/21	PG		
1788099	TP520 0.20 SOIL	08/01/21	PG		
1788100	TP523 0.10 SOIL	08/01/21	PG		
1788101	TP526 0.10 SOIL	08/01/21	PG		
1788102	WS513 0.50 SOIL	08/01/21	GJ 250ml, PT 500ml	pH + Conductivity (7 days)	
1788103	WS513 0.80 SOIL	08/01/21	GJ 250ml, PT 500ml	pH + Conductivity (7 days)	
1788104	WS501 0.40 SOIL	06/01/21	GJ 250ml, PT 500ml	pH + Conductivity (7 days)	
1788105	WS501 0.90 SOIL	06/01/21	GJ 250ml, PT 500ml	pH + Conductivity (7 days)	
1788106	WS502 0.50 SOIL	06/01/21	GJ 250ml, PT 500ml	pH + Conductivity (7 days)	
1788107	WS507 0.10 SOIL	07/01/21	GJ 250ml, PT 500ml	pH + Conductivity (7 days)	
1788108	WS507 0.40 SOIL	07/01/21	GJ 250ml, PT 500ml	pH + Conductivity (7 days)	
1788109	WS508 0.20 SOIL	07/01/21	GJ 250ml, PT 500ml	pH + Conductivity (7 days)	
1788110	WS508 0.60 SOIL	07/01/21	GJ 250ml, PT 500ml	pH + Conductivity (7 days)	
1788111	WS509 0.20 SOIL	07/01/21	GJ 250ml, PT 500ml	pH + Conductivity (7 days)	
1788112	WS510 0.50 SOIL	08/01/21	GJ 250ml, PT 500ml	pH + Conductivity (7 days)	
1788113	WS511 0.70 SOIL	08/01/21	GJ 250ml, PT 500ml	pH + Conductivity (7 days)	
1788114	WS512 0.40 SOIL	08/01/21	GJ 250ml, PT 500ml	pH + Conductivity (7 days)	
1788115	WS514 0.50 SOIL	08/01/21	GJ 250ml, PT 500ml	pH + Conductivity (7 days)	
1788116	WS514 1.10 SOIL	08/01/21	GJ 250ml, PT 500ml	pH + Conductivity (7 days)	
1788117	WS515 0.30 SOIL	08/01/21	GJ 250ml, PT 500ml	pH + Conductivity (7 days)	
1788118	WS515 1.30 SOIL	08/01/21	GJ 250ml, PT 500ml	pH + Conductivity (7 days)	
1788119	WS503 0.20 SOIL	07/01/21	GJ 250ml	pH + Conductivity (7 days)	
1788120	WS505 0.20 SOIL	07/01/21	GJ 250ml, PT 500ml	pH + Conductivity (7 days)	
1788121	TP501 0.10 SOIL	08/01/21	PT 1L	pH + Conductivity (7 days)	Naphthalene, PAH MS
1788122	TP504 0.10 SOIL	08/01/21	PG, PT 1L	pH + Conductivity (7 days)	Naphthalene, PAH MS
1788123	TP505 0.10 SOIL	08/01/21	PT 1L	pH + Conductivity (7 days)	Naphthalene, PAH MS
1788124	TP507 0.10 SOIL	08/01/21	PT 1L	pH + Conductivity (7 days)	Naphthalene, PAH MS
1788125	TP510 0.10 SOIL	08/01/21	PT 1L	pH + Conductivity (7 days)	Naphthalene, PAH MS
1788126	TP513 0.10 SOIL	08/01/21	PT 1L	pH + Conductivity (7 days)	Naphthalene, PAH MS
1788127	TP515 0.10 SOIL	08/01/21	PT 1L	pH + Conductivity (7 days)	Naphthalene, PAH MS
1788128	TP516 0.10 SOIL	08/01/21	PT 1L	pH + Conductivity (7 days)	Naphthalene, PAH MS
1788129	TP517 0.10 SOIL	08/01/21	PT 1L	pH + Conductivity (7 days)	Naphthalene, PAH MS
1788130	TP519 0.10 SOIL	08/01/21	PT 1L	pH + Conductivity (7 days)	Naphthalene, PAH MS
1788131	TP520 0.10 SOIL	08/01/21	PT 1L	pH + Conductivity (7 days)	Naphthalene, PAH MS
1788132	TP521 0.10 SOIL	08/01/21	PT 1L	pH + Conductivity (7 days)	Naphthalene, PAH MS
1788133	TP524 0.10 SOIL	08/01/21	PT 1L	pH + Conductivity (7 days)	Naphthalene, PAH MS
1788134	TP525 0.10 SOIL	08/01/21	PT 1L	pH + Conductivity (7 days)	Naphthalene, PAH MS
1788135	TP527 0.10 SOIL	08/01/21	PT 1L	pH + Conductivity (7 days)	Naphthalene, PAH MS
1788136	TP530 0.10 SOIL	08/01/21	PT 1L	pH + Conductivity (7 days)	Naphthalene, PAH MS

Key: P-Plastic G-Bag G-Glass J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Information in Support of the Analytical Results

Our Ref 21-00887
Client Ref 3901
Contract Dewsbury Riverside Central Gateway

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.
Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.
The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

Certificate of Analysis

Certificate Number	21-01808	*Issued:*	01-Feb-21

Client Lithos Consulting Ltd
Parkhill
Walton Rd
Wetherby
LS22 5DZ

Our Reference	21-01808
Client Reference	3901
Order No	PO16982
Contract Title	Dewsbury Riverside Central Gateway
Description	2 Soil samples.
Date Received	18-Jan-21
Date Started	28-Jan-21
Date Completed	01-Feb-21
Test Procedures	Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager

UKAS TESTING
2139

Summary of Asbestos Analysis

Samples

Our Ref 21-01808
Client Ref 3901
Contract Title Dewsbury Riverside Central Gateway

Lab No	Sample ID	Sample Location	Material Type	Result	Comment*	Analyst

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Summary of Asbestos Quantification Analysis
Soil Samples

Our Ref 21-01808
Client Ref 3901
Contract Title Dewsbury Riverside Central Gateway

		Lab No	1793657	1793658
		.Sample ID	WS514	WS514
		Depth	0.50	1.10
		Other ID		
		Sample Type	SOIL	SOIL
		Sampling Date	08/01/2021	08/01/2021
		Sampling Time		
Test	**Method**	**Units**		
Total Mass% Asbestos (a+b+c)	DETSC 1102	Mass %	**0.003**	**0.002**
Gravimetric Quantification (a)	DETSC 1102	Mass %	na	na
Detailed Gravimetric Quantification (b)	DETSC 1102	Mass %	0.003	0.002
Quantification by PCOM (c)	DETSC 1102	Mass %	na	na
Potentially Respirable Fibres (d)	DETSC 1102	Fibres/g	na	na
Breakdown of Gravimetric Analysis (a)				
Mass of Sample		g	407.60	327.67
ACMs present*		type		
Mass of ACM in sample		g		
% ACM by mass		%		
% asbestos in ACM		%		
% asbestos in sample		%		
Breakdown of Detailed Gravimetric Analysis (b)				
% Amphibole bundles in sample		Mass %	0.003	0.001
% Chrysotile bundles in sample		Mass %	na	<0.001
Breakdown of PCOM Analysis (c)				
% Amphibole fibres in sample		Mass %	na	na
% Chrysotile fibres in sample		Mass %	na	na
Breakdown of Potentially Respirable Fibre Analysis (d)				
Amphibole fibres		Fibres/g	na	na
Chrysotile fibres		Fibres/g	na	na

* Denotes test or material description outside of UKAS accreditation.
% asbestos in Asbestos Containing Materials (ACMs) is determined by
by reference to HSG 264.
Recommended sample size for quantification is approximately 1kg
# denotes deviating sample

Information in Support of the Analytical Results

Our Ref 21-01808
Client Ref 3901
Contract Dewsbury Riverside Central Gateway

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1793657	WS514 0.50 SOIL	08/01/21	PT 1L (1kg)		
1793658	WS514 1.10 SOIL	08/01/21	No containers logged		Cannot evaluate

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

Certificate of Analysis

Certificate Number	21-01738	*Issued:*	01-Feb-21

Client Lithos Consulting Ltd
Parkhill
Walton Rd
Wetherby
LS22 5DZ

Our Reference	21-01738
Client Reference	3901
Order No	16982
Contract Title	Dewsbury Riverside
Description	2 Soil samples.
Date Received	28-Jan-21
Date Started	28-Jan-21
Date Completed	01-Feb-21
Test Procedures	Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 21-01738
Client Ref 3901
Contract Title Dewsbury Riverside

			Lab No	1793254	1793255
			.Sample ID	WS510	WS511
			Depth	0.01	0.01
			Other ID		
			Sample Type	SOIL	SOIL
			Sampling Date	08/01/2021	08/01/2021
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
PAHs					
Naphthalene	DETSC 3303#	0.03	mg/kg	0.07	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	0.04	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	0.05	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.26	0.07
Anthracene	DETSC 3303	0.03	mg/kg	0.10	0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.24	0.07
Pyrene	DETSC 3303#	0.03	mg/kg	0.43	0.15
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.07	0.03
Chrysene	DETSC 3303	0.03	mg/kg	0.14	0.08
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.27	0.06
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.06	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.37	0.05
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.31	0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	0.04	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.54	0.06
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	3.0	0.65

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 21-01738
Client Ref 3901
Contract Dewsbury Riverside

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1793254	WS510 0.01 SOIL	08/01/21	PT 500ml	Naphthalene (14 days), PAH MS (14 days)	Naphthalene, PAH MS
1793255	WS511 0.01 SOIL	08/01/21	PT 500ml	Naphthalene (14 days), PAH MS (14 days)	Naphthalene, PAH MS

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.
Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.
The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

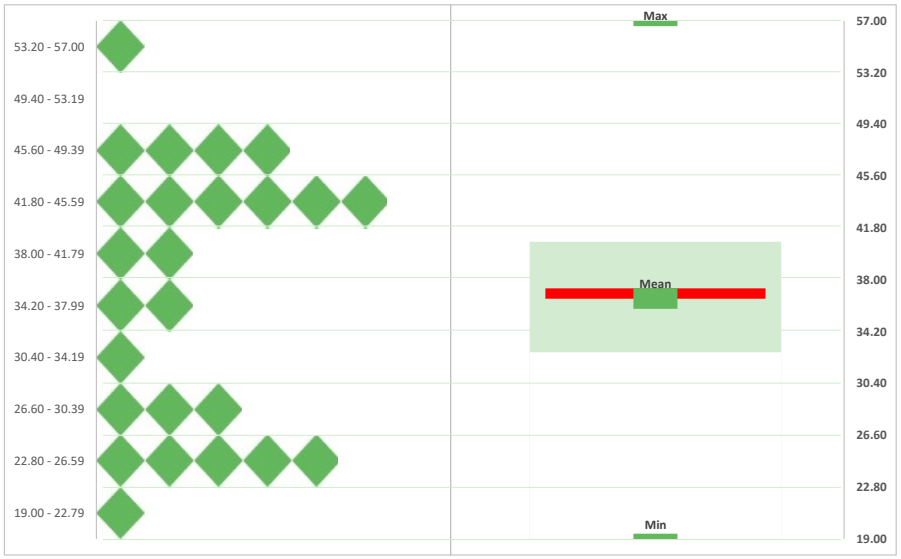
Dewsbury Riverside Gateway

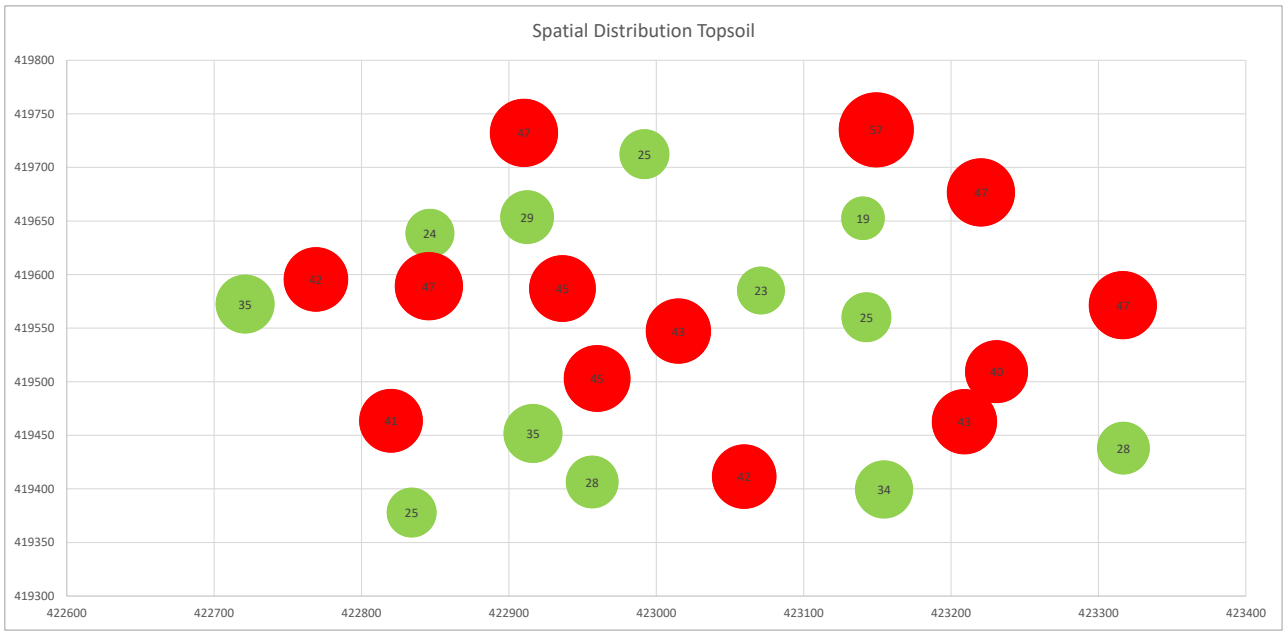
Job No: 3901
Engineer: LH
Date: 05 July 2021

Topsoil: Dataset for As - Dot & Box Plots and Summary Statistics

Determinant	As
Critical concentration	37.00
No. samples	25.00
Max	57.00
Mean	36.64
Min	19.00
Standard Deviation	10.07
Standard Error	2.01
T value	2.06
Upper Confidence Level (95%)	40.80
Upper Confidence Level (80%)	39.30
Lower Confidence Level (5%)	32.69
Transform data	Normal

Upper Confidence Level for chart	95%





Spatial distribution can show sampling clusters based on ground type it **does not** identify areas of contamintion

Appendix J

Geotechnical Test Results

LABORATORY REPORT

REPORT

4043

Contract Number: PSL17/6000

Report Date: 12 January 2018

Client's Reference: 2336

Client Name: Lithos Consulting
Parkhill
Walton Road
Wetherby
North Yorkshire
LS22 5DZ

For the attention of: Matt Thompson

Contract Title: Dewsbury Riverside

Date Received: 8/12/2017
Date Commenced: 8/12/2017
Date Completed: 12/1/2018

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)	A Watkins (Director)	R Berriman (Quality Manager)
L Knight (Senior Technician)	C Marshall (Laboratory Manager)	A Fry (Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP303	4	B	1.50		Brown gravelly slightly sandy CLAY.
TP320	3	B	2.20		Light brown slightly sandy slightly clayey GRAVEL.
TP301	5	B	2.50		Greyish brown gravelly slightly sandy CLAY.
TP305	4	D	2.50		Brown mottled grey CLAY.
TP319	3	B	2.60		Light brown slightly gravelly clayey SILT.
TP318	2	D	2.80		Brown weathered MUDSTONE.
TP315	3	D	2.90		Brown mottled grey highly weathered MUDSTONE.
TP312	2	D	0.50		Brown mottled grey slightly gravelly sandy very silty CLAY.
TP306	2	D	0.60		Brown mottled grey sandy very silty CLAY.
TP307	2	D	0.60		Brown mottled grey sandy CLAY.
TP316	2	D	0.60		Brown mottled grey slightly gravelly sandy CLAY.
TP301	2	D	0.80		Brown mottled grey slightly gravelly sandy very silty CLAY.
TP310	2	D	0.90		Brown slightly gravelly sandy very silty CLAY.
TP320	2	D	1.00		Brown mottled grey slightly sandy CLAY.
TP316	3	B	1.10		Light brown gravelly CLAY.
TP303	3	D	1.20		Brown mottled grey highly weathered MUDSTONE.
TP309	3	D	1.20		Brown mottled grey sandy CLAY.
TP310	3	B	1.20		Brown mottled grey slightly gravelly slightly sandy CLAY.
TP313	2	B	1.40		Brown slightly gravelly sandy CLAY.

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP304	3	B	1.50		Brown slightly gravelly slightly sandy CLAY.
TP309	4	B	1.80		Brownish grey slightly gravelly CLAY.
TP314	1	B	2.40		Brown slightly gravelly slightly sandy CLAY.
TP308	3	D	2.60		Brown mottled grey slightly gravelly sandy very silty CLAY.
TP319	2	D	0.60		Brown slightly gravelly very sandy very silty CLAY.

UKAS TESTING 4043	PSL Professional Soils Laboratory	Dewsbury Riverside	Contract No: PSL17/6000 Client Ref: 2336

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
TP305	4	D	2.50		28			60	27	33	100	High plasticity CH.
TP318	2	D	2.80		10				NP			
TP315	3	D	2.90		14			48	24	24	95	Intermediate plasticity CI.
TP312	2	D	0.50		20			50	25	25	97	High plasticity CH.
TP306	2	D	0.60		23			51	22	29	100	High plasticity CH.
TP307	2	D	0.60		23			51	26	25	100	High plasticity CH.
TP316	2	D	0.60		25			44	23	21	98	Intermediate plasticity CI.
TP301	2	D	0.80		20			38	23	15	93	Intermediate plasticity CI.
TP310	2	D	0.90		23			51	25	26	96	High plasticity CH.
TP320	2	D	1.00		33			67	28	39	100	High plasticity CH.
TP303	3	D	1.20		17			42	24	18	96	Intermediate plasticity CI.
TP309	3	D	1.20		17			46	22	24	100	Intermediate plasticity CI.
TP314	1	B	2.40		17			46	22	24	100	Intermediate plasticity CI.
TP308	3	D	2.60		16			39	24	15	95	Intermediate plasticity CI.
TP319	2	D	0.60		21			37	22	15	94	Intermediate plasticity CI.

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL Professional Soils Laboratory

Dewsbury Riverside

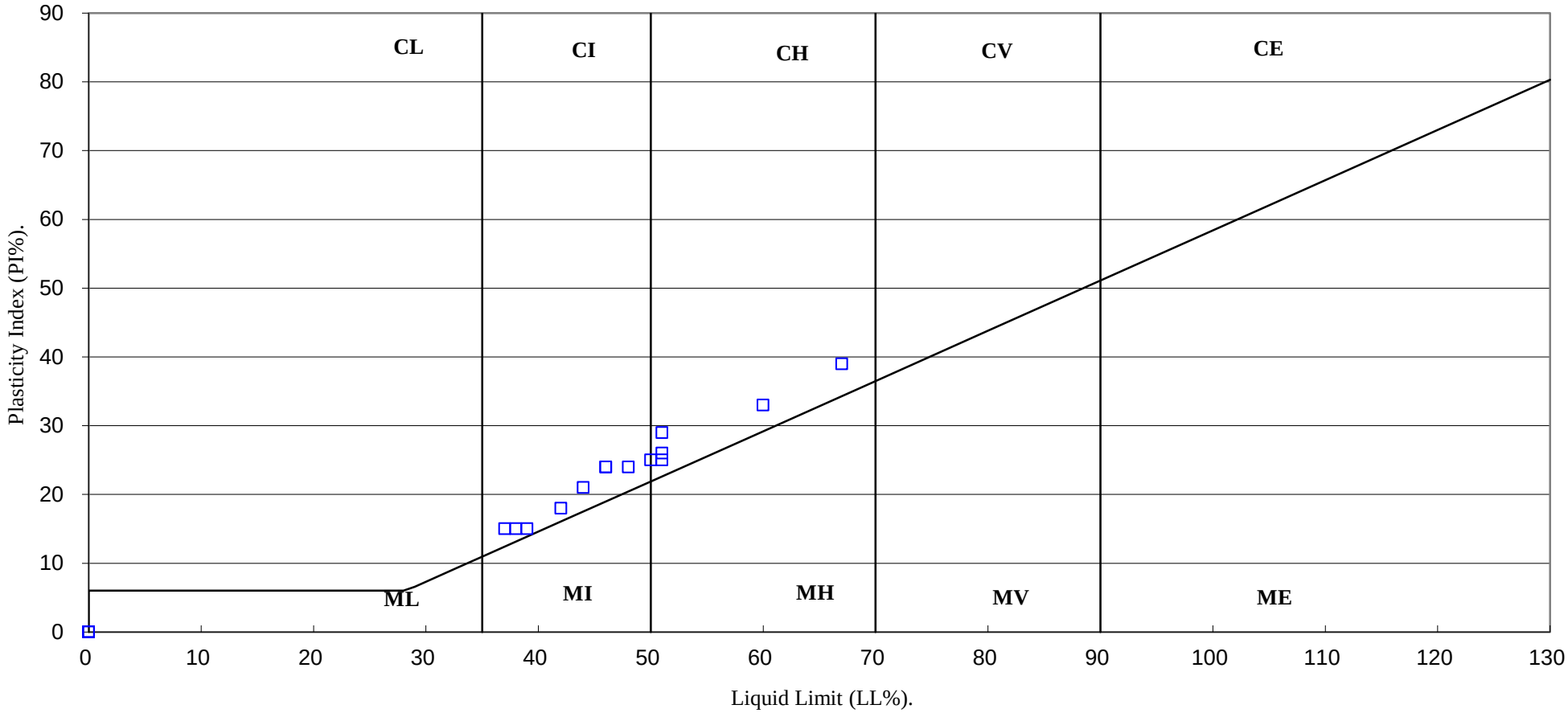
Contract No:

PSL17/6000

Client Ref:

2336

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

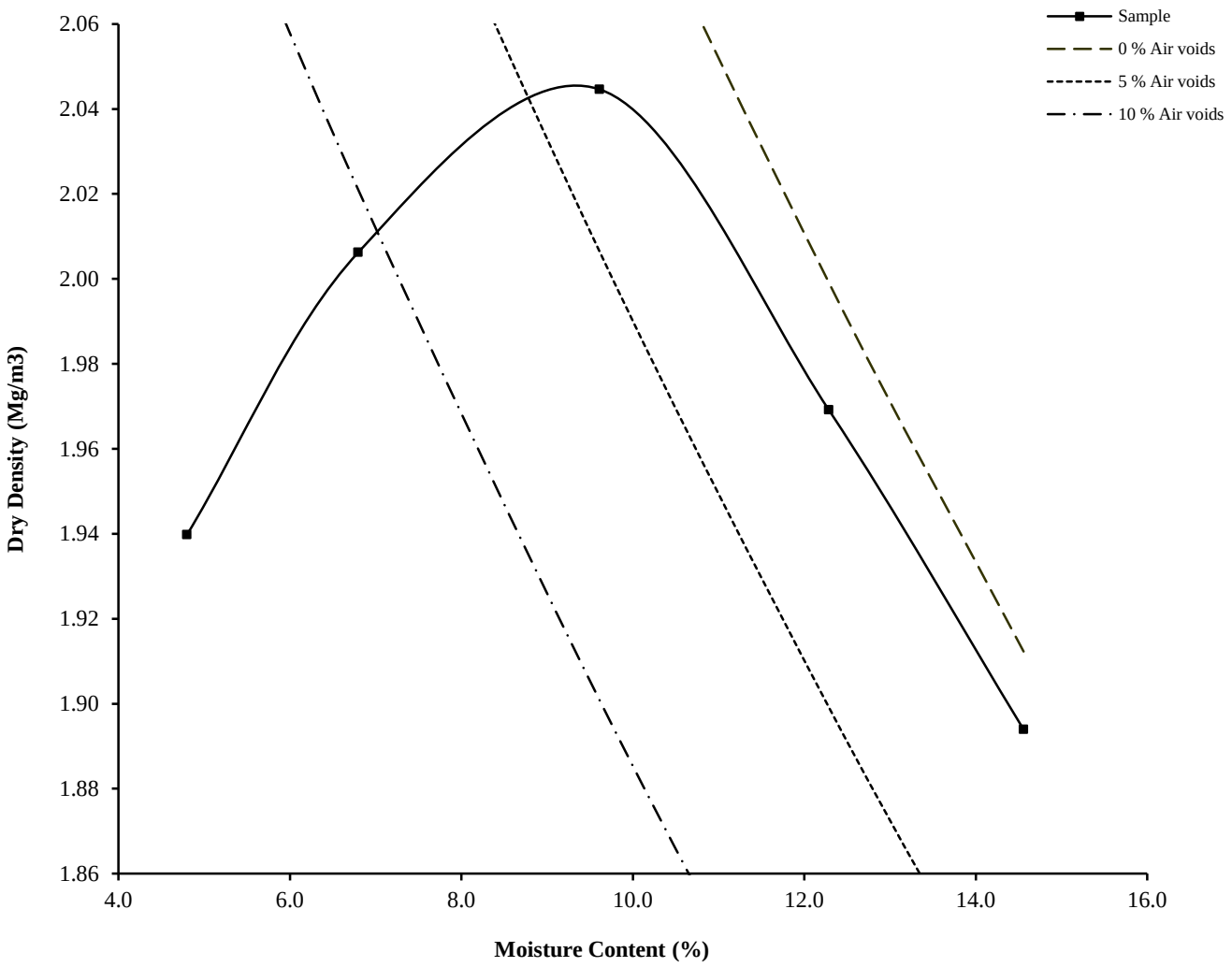


UKAS TESTING 4043	PSL Professional Soils Laboratory	**Dewsbury Riverside**	**Contract No:** PSL17/6000 **Client Ref:** 2336

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

Hole Number:	**TP301**	**Top Depth (m) :**	**2.50**
Sample Number:	**5**	**Base Depth (m) :**	
Sample Type:	**B**		



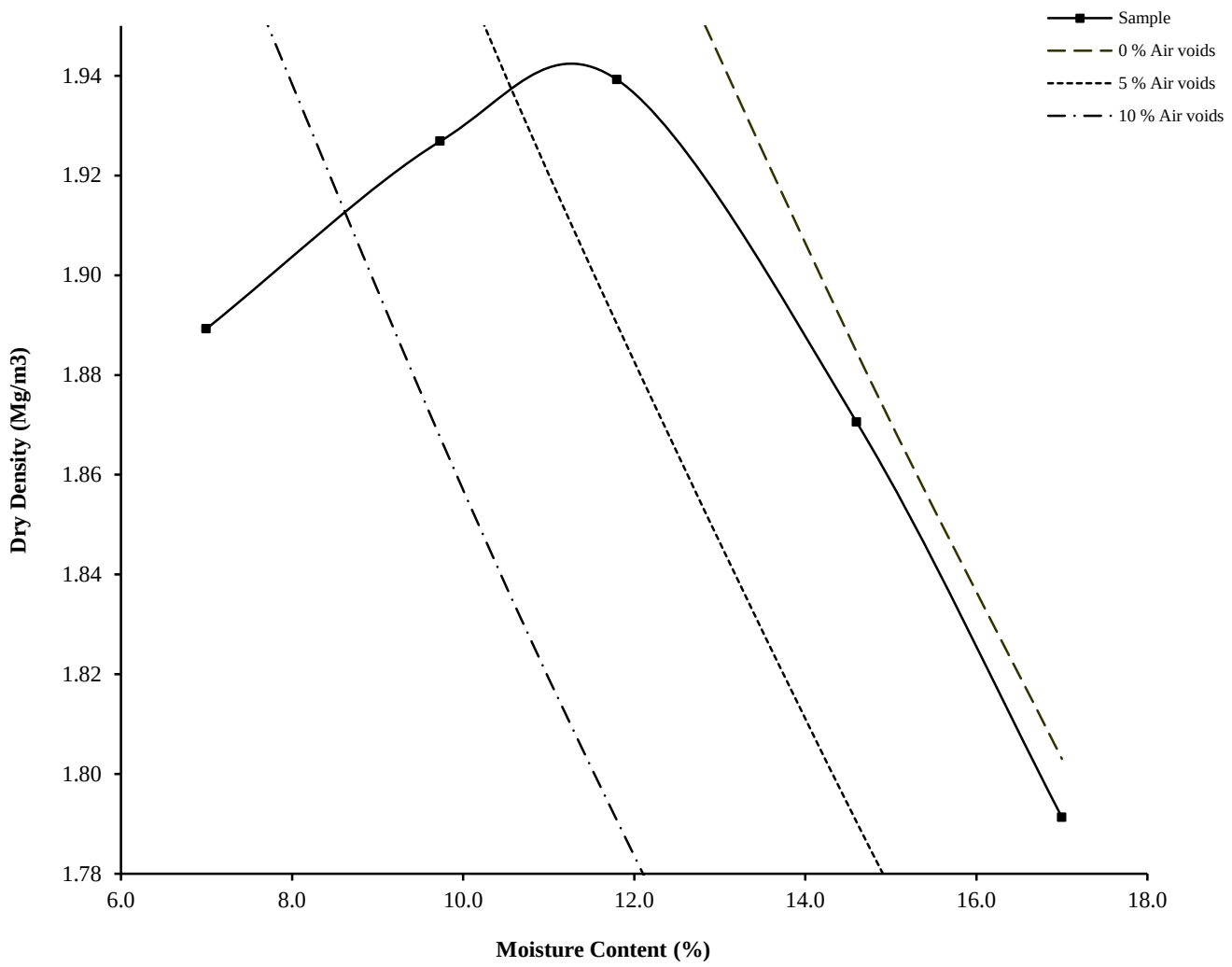
Initial Moisture Content:		13	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m3):	2.65	Assumed	Material Retained on 37.5 mm Test Sieve (%):		3
Maximum Dry Density (Mg/m3):		2.04	Material Retained on 20.0 mm Test Sieve (%):		5
Optimum Moisture Content (%):		9			
Remarks See summary of soil descriptions.					

UKAS TESTING 4043	PSL Professional Soils Laboratory	**Dewsbury Riverside**	**Contract** **PSL17/6000** **Client Ref** **2336**

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

Hole Number:	**TP303**	**Top Depth (m) :**	**1.50**
Sample Number:	**4**	**Base Depth (m) :**	
Sample Type:	**B**		



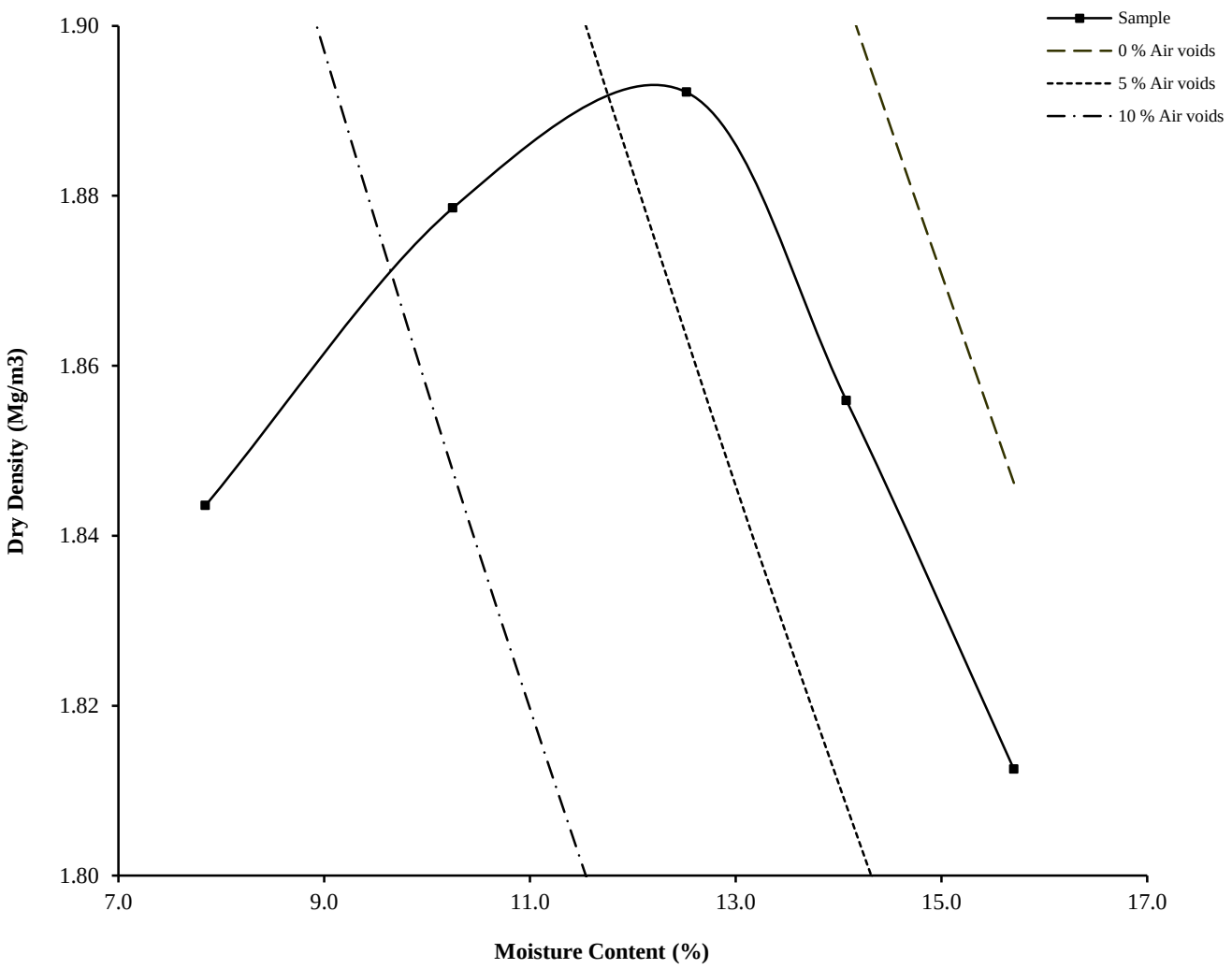
Initial Moisture Content:		17	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m3):	2.60	Assumed	Material Retained on 37.5 mm Test Sieve (%):		0
Maximum Dry Density (Mg/m3):		1.94	Material Retained on 20.0 mm Test Sieve (%):		4
Optimum Moisture Content (%):		11			
Remarks See summary of soil descriptions.					

UKAS TESTING 4043	PSL Professional Soils Laboratory	**Dewsbury Riverside**	**Contract** **PSL17/6000** **Client Ref** **2336**

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

Hole Number:	**TP304**	**Top Depth (m) :**	**1.50**
Sample Number:	**3**	**Base Depth (m) :**	
Sample Type:	**B**		

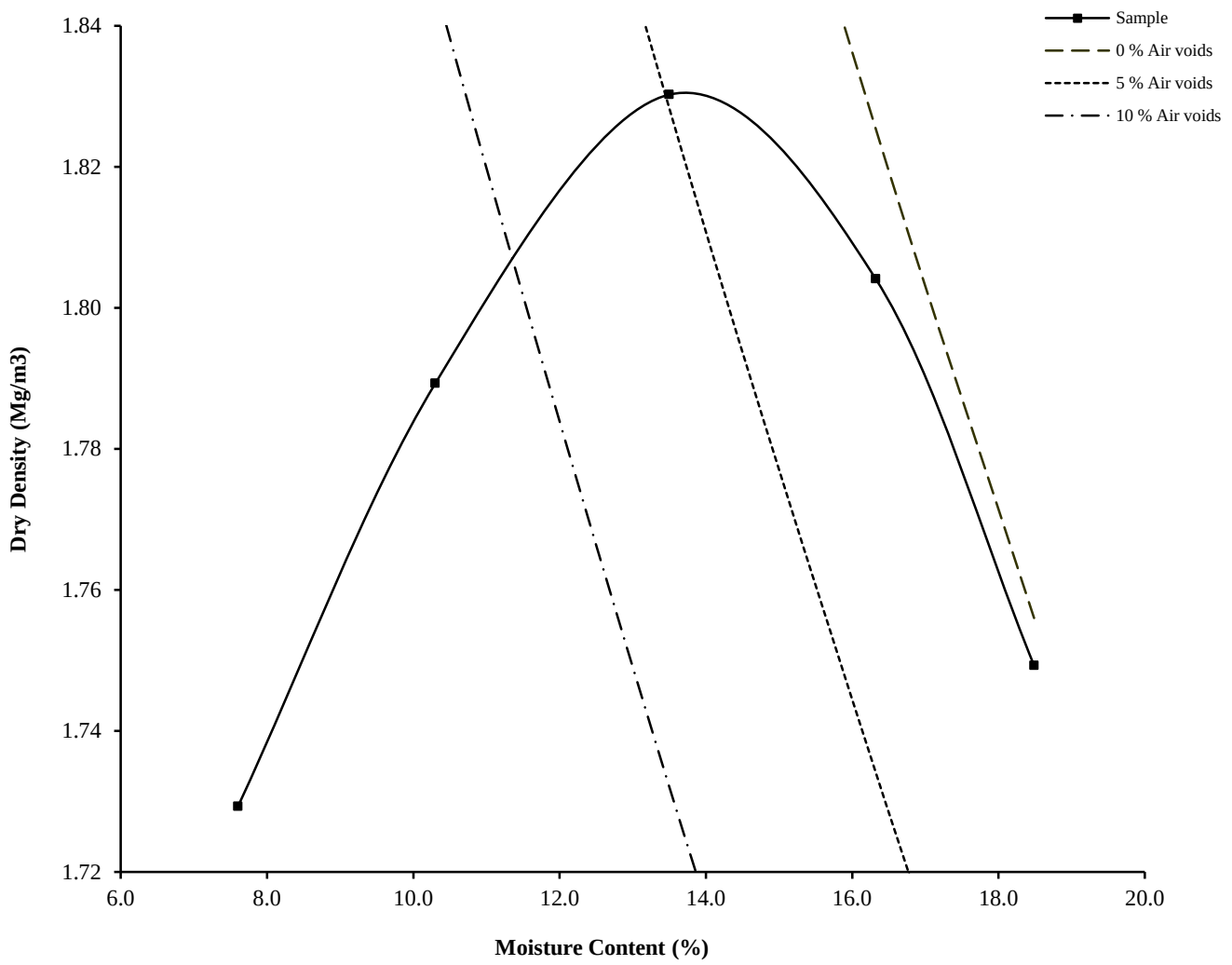


Initial Moisture Content:		17	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m3):	2.6	Assumed	Material Retained on 37.5 mm Test Sieve (%):		0
Maximum Dry Density (Mg/m3):		1.89	Material Retained on 20.0 mm Test Sieve (%):		0
Optimum Moisture Content (%):		12			
Remarks See summary of soil descriptions.					

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

Hole Number:	**TP309**	**Top Depth (m) :**	**1.80**
Sample Number:	**4**	**Base Depth (m) :**	
Sample Type:	**B**		



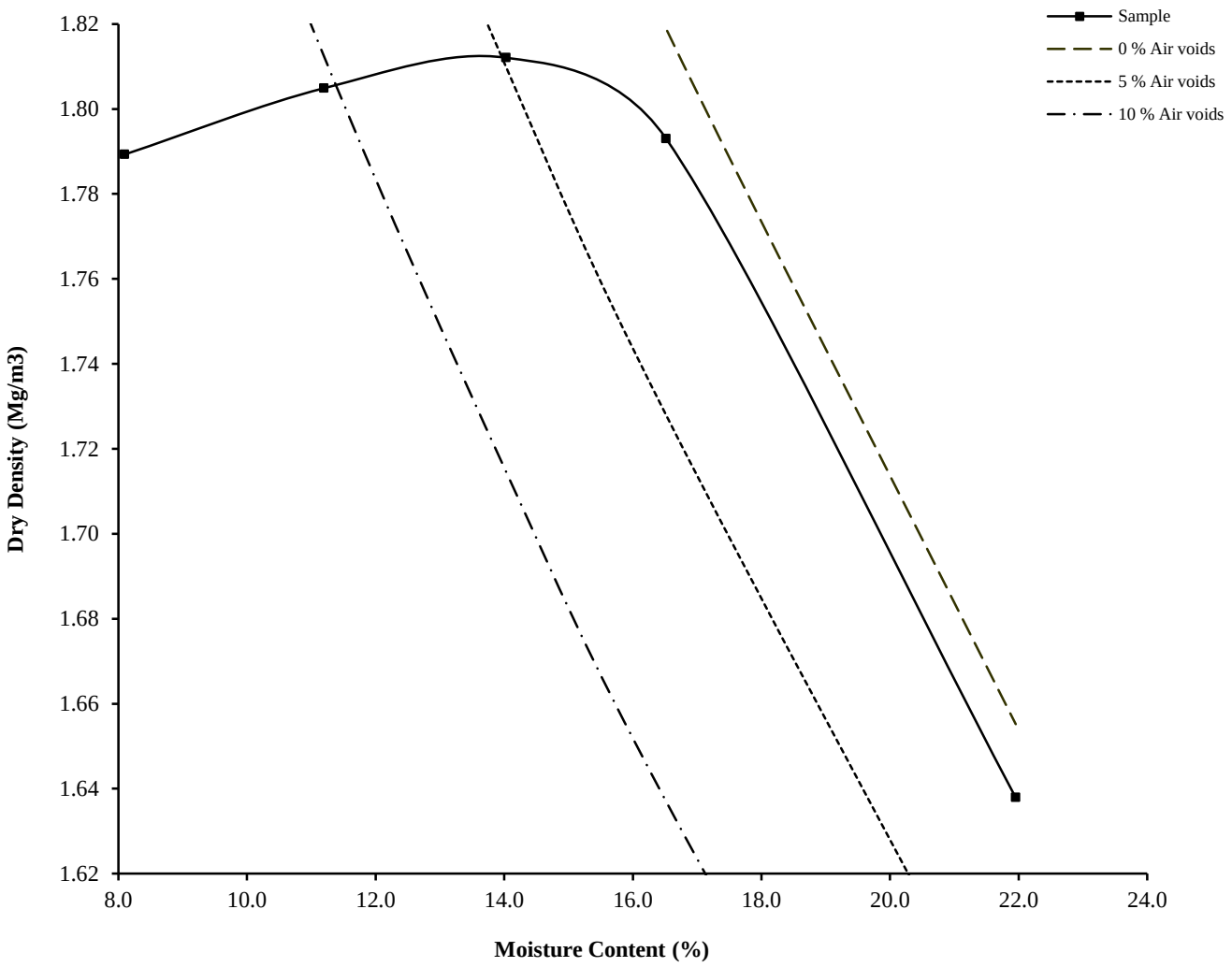
Initial Moisture Content:		20	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m3):	2.60	Assumed	Material Retained on 37.5 mm Test Sieve (%):		0
Maximum Dry Density (Mg/m3):		1.83	Material Retained on 20.0 mm Test Sieve (%):		2
Optimum Moisture Content (%):		14			
Remarks See summary of soil descriptions.					

UKAS TESTING 4043	PSL Professional Soils Laboratory	**Dewsbury Riverside**	**Contract** **PSL17/6000** **Client Ref** **2336**

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

Hole Number:	**TP310**	**Top Depth (m) :**	**1.20**
Sample Number:	**3**	**Base Depth (m) :**	
Sample Type:	**B**		



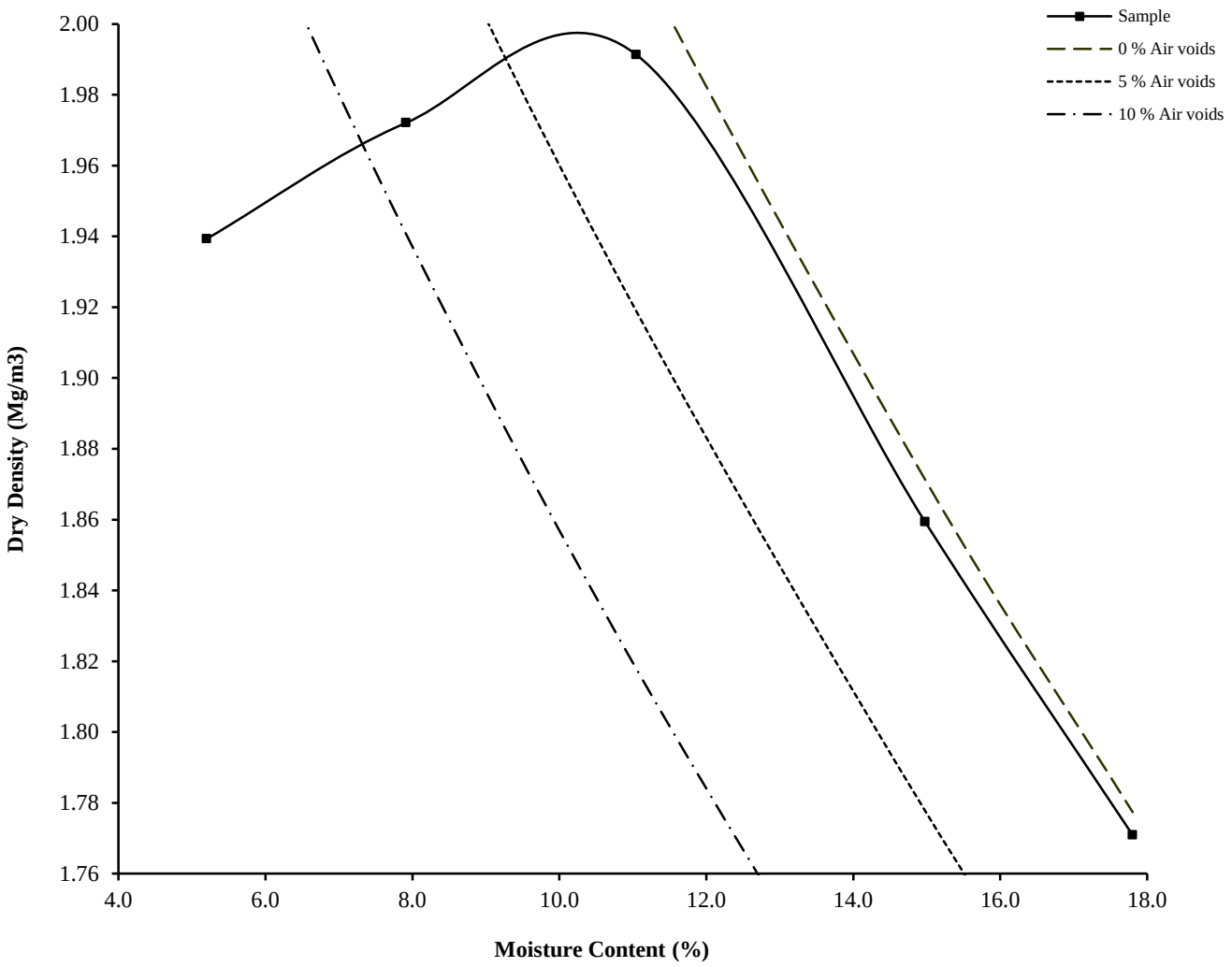
Initial Moisture Content:		22	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m3):	2.60	Assumed	Material Retained on 37.5 mm Test Sieve (%):		0
Maximum Dry Density (Mg/m3):		1.81	Material Retained on 20.0 mm Test Sieve (%):		2
Optimum Moisture Content (%):		15			
Remarks See summary of soil descriptions.					

UKAS TESTING 4043	PSL Professional Soils Laboratory	**Dewsbury Riverside**	**Contract** **PSL17/6000** **Client Ref** **2336**

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

Hole Number:	**TP313**	**Top Depth (m) :**	**1.40**
Sample Number:	**2**	**Base Depth (m) :**	
Sample Type:	**B**		



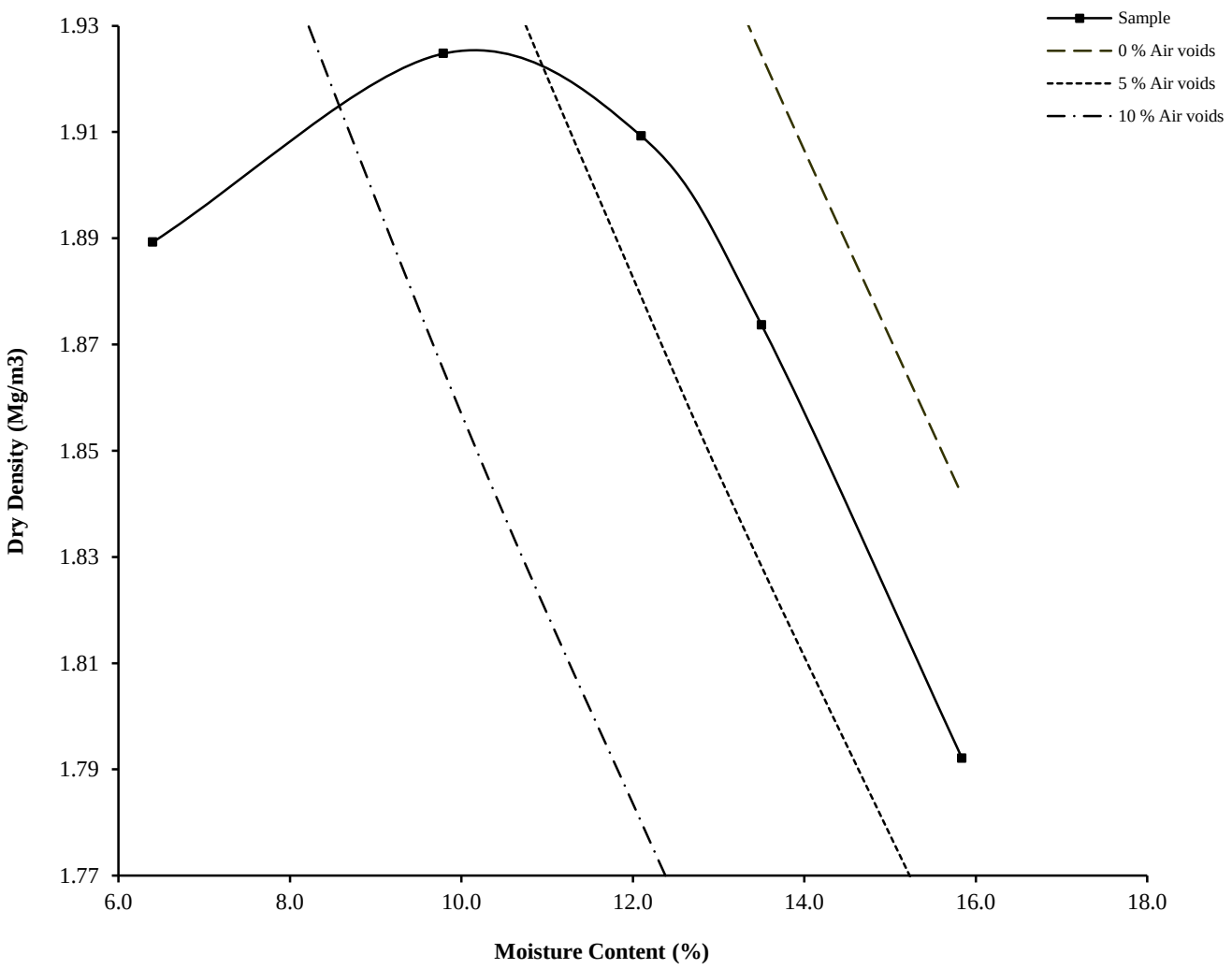
Initial Moisture Content:		15	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m3):	2.60	Assumed	Material Retained on 37.5 mm Test Sieve (%):		0
Maximum Dry Density (Mg/m3):		1.99	Material Retained on 20.0 mm Test Sieve (%):		2
Optimum Moisture Content (%):		10			
Remarks See summary of soil descriptions.					

UKAS TESTING 4043	PSL Professional Soils Laboratory	**Dewsbury Riverside**	**Contract** **PSL17/6000** **Client Ref** **2336**

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

Hole Number:	**TP314**	**Top Depth (m) :**	**2.40**
Sample Number:	**1**	**Base Depth (m) :**	
Sample Type:	**B**		

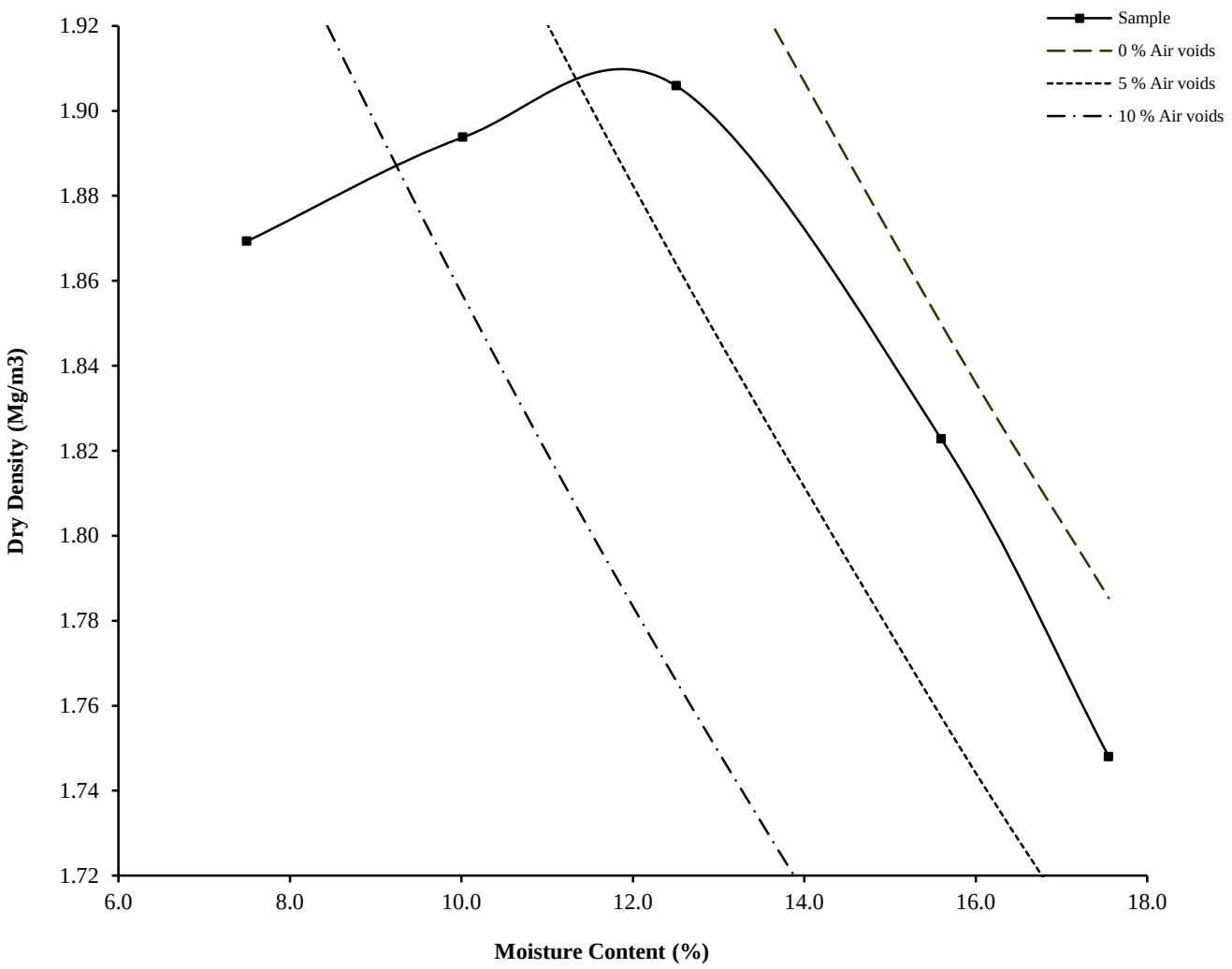


Initial Moisture Content:		17	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m3):	2.60	Assumed	Material Retained on 37.5 mm Test Sieve (%):		0
Maximum Dry Density (Mg/m3):		1.91	Material Retained on 20.0 mm Test Sieve (%):		5
Optimum Moisture Content (%):		10			
Remarks See summary of soil descriptions.					

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

Hole Number:	**TP316**	**Top Depth (m) :**	**1.10**
Sample Number:	**3**	**Base Depth (m) :**	
Sample Type:	**B**		



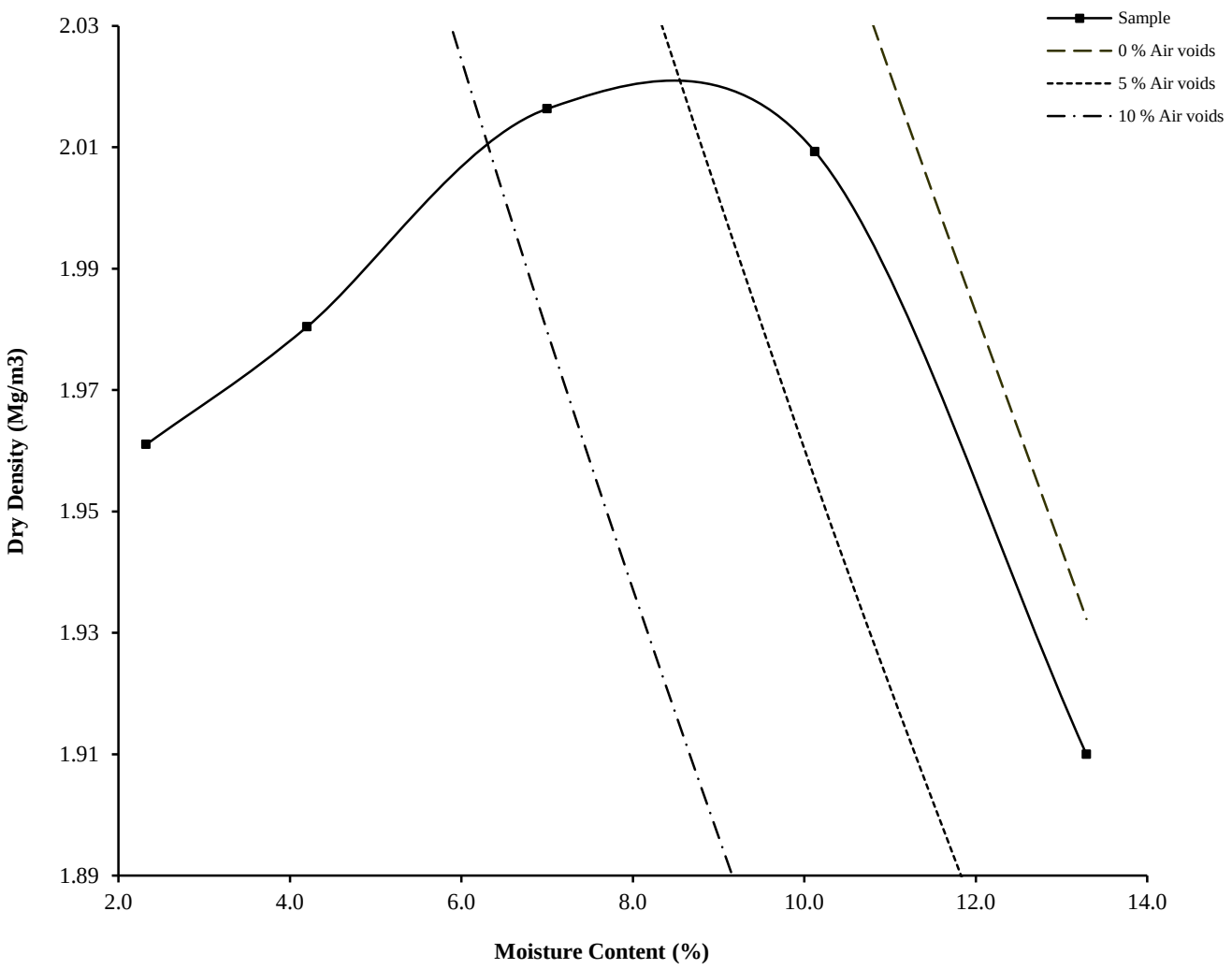
Initial Moisture Content:		18	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m3):	2.60	Assumed	Material Retained on 37.5 mm Test Sieve (%):		0
Maximum Dry Density (Mg/m3):		1.91	Material Retained on 20.0 mm Test Sieve (%):		4
Optimum Moisture Content (%):		15			
Remarks See summary of soil descriptions.					

UKAS TESTING 4043	PSL Professional Soils Laboratory	**Dewsbury Riverside**	**Contract** **PSL17/6000** **Client Ref** **2336**

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

Hole Number:	**TP319**	**Top Depth (m) :**	**2.60**
Sample Number:	**5**	**Base Depth (m) :**	
Sample Type:	**B**		



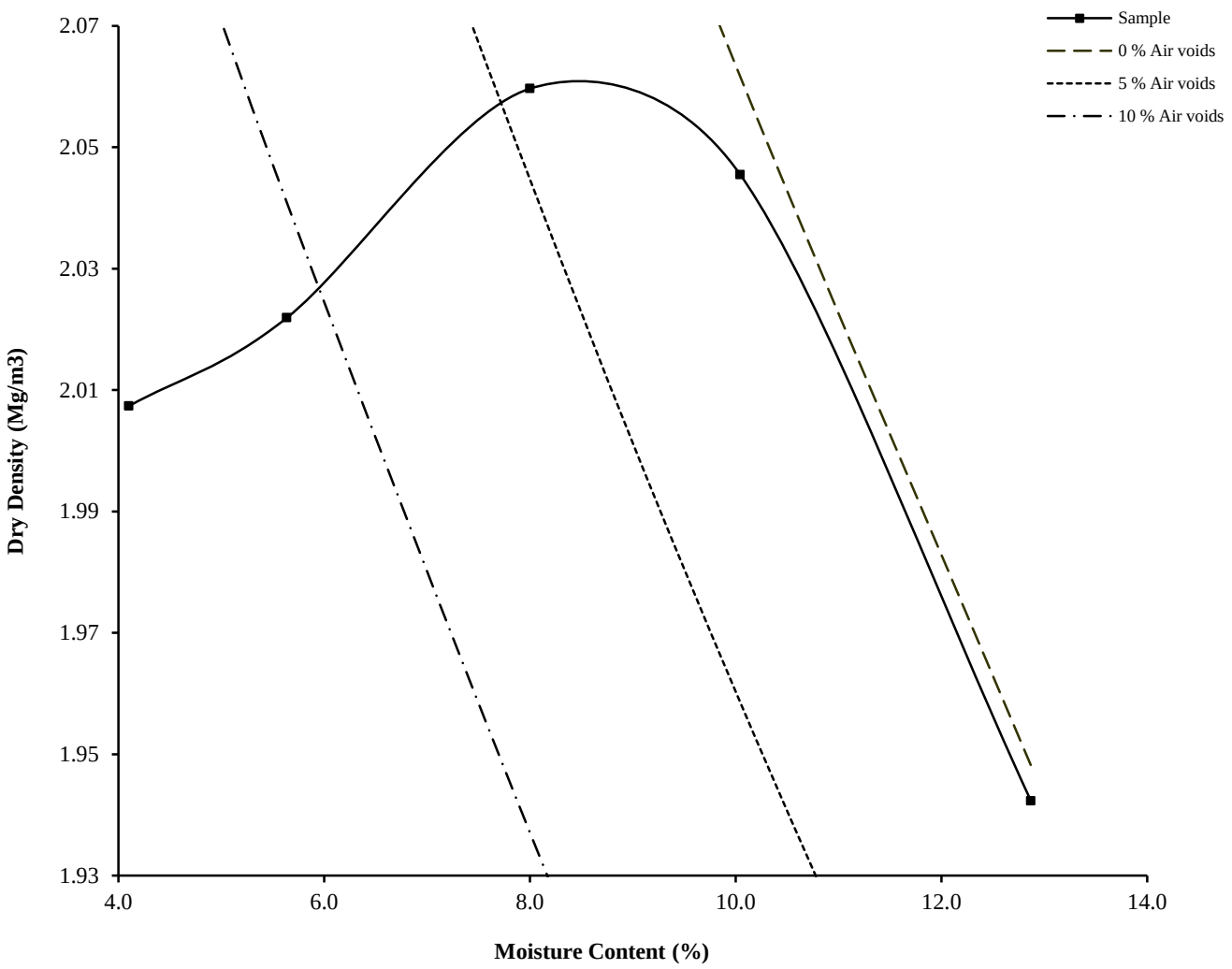
Initial Moisture Content:		13	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m3):	2.60	Assumed	Material Retained on 37.5 mm Test Sieve (%):		0
Maximum Dry Density (Mg/m3):		2.02	Material Retained on 20.0 mm Test Sieve (%):		5
Optimum Moisture Content (%):		9			
Remarks See summary of soil descriptions.					

UKAS TESTING 4043	PSL Professional Soils Laboratory	**Dewsbury Riverside**	**Contract** **PSL17/6000** **Client Ref** **2336**

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

Hole Number:	**TP320**	**Top Depth (m) :**	**2.20**
Sample Number:	**3**	**Base Depth (m) :**	
Sample Type:	**B**		



Initial Moisture Content:		10	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m3):	2.60	Assumed	Material Retained on 37.5 mm Test Sieve (%):		8
Maximum Dry Density (Mg/m3):		2.06	Material Retained on 20.0 mm Test Sieve (%):		18
Optimum Moisture Content (%):		9			
Remarks See summary of soil descriptions.					

Certificate of Analysis

Certificate Number 17-18280

18-Dec-17

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference 17-18280

Client Reference PSL17/6000

Order No (not supplied)

Contract Title Dewsbury Riverside

Description 16 Soil samples.

Date Received 13-Dec-17

Date Started 13-Dec-17

Date Completed 18-Dec-17

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 17-18280
Client Ref PSL17/6000
Contract Title Dewsbury Riverside

				Lab No	1273544	1273545	1273546	1273547	1273548	1273549	1273550	1273551	1273552	1273553	1273554
				Sample ID	TP305	TP318	TP315	TP312	TP306	TP307	TP316	TP301	TP310	TP320	TP303
				Depth	2.50	2.80	2.90	0.50	0.60	0.60	0.60	0.80	0.90	1.00	1.20
				Other ID	4	2	3	2	2	2	2	2	2	2	3
				Sample Type	D	D	D	D	D	D	D	D	D	D	D
				Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
				Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**												
Inorganics															
pH	DETSC 2008#			7.4	7.1	7.3	7.2	7.8	7.7	8.0	8.0	6.7	7.5	7.5
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	51	< 10	13	20	56	17	< 10	< 10	58	< 10	13

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 17-18280
Client Ref PSL17/6000
Contract Title Dewsbury Riverside

				Lab No	1273555	1273556	1273557	1273558	1273559
				Sample ID	TP309	TP314	TP308	TP319	TP307
				Depth	1.20	2.40	2.60	0.60	0.80
				Other ID	3	1	3	2	3
				Sample Type	D	B	D	D	D
				Sampling Date	n/s	n/s	n/s	n/s	n/s
				Sampling Time	n/s	n/s	n/s	n/s	n/s
Test	**Method**		**LOD**	**Units**					
Inorganics									
pH	DETSC 2008#				8.0	6.6	6.5	7.4	7.4
Sulphate Aqueous Extract as SO4	DETSC 2076#		10	mg/l	< 10	17	27	< 10	11

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 17-18280
Client Ref PSL17/6000
Contract Dewsbury Riverside

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1273544	TP305 2.50 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1273545	TP318 2.80 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1273546	TP315 2.90 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1273547	TP312 0.50 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1273548	TP306 0.60 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1273549	TP307 0.60 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1273550	TP316 0.60 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1273551	TP301 0.80 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1273552	TP310 0.90 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1273553	TP320 1.00 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1273554	TP303 1.20 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1273555	TP309 1.20 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1273556	TP314 2.40 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1273557	TP308 2.60 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1273558	TP319 0.60 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1273559	TP307 0.80 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

LABORATORY REPORT

4043

Contract Number: PSL21/0507

Report Date: 29 January 2021

Client's Reference: 3901

Client Name: Lithos Consulting
Parkhill
Walton Road
Wetherby
North Yorkshire
LS22 5DZ

For the attention of: Reg Perrin

Contract Title: Dewsbury Riverside Central Gateway

Date Received: 18/1/2021
Date Commenced: 18/1/2021
Date Completed: 29/1/2021

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins (Director)	R Berriman (Quality Manager)	S Royle (Laboratory Manager)
L Knight (Senior Technician)	S Eyre (Senior Technician)	H Daniels (Senior Technician)

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e-mail: rberriman@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP501	3	D	0.60		Brown mottled grey slightly gravelly sandy CLAY.
TP502	2	D	0.80		Brown mottled grey slightly gravelly sandy CLAY.
TP503	1	D	0.60		Brown mottled grey slightly gravelly sandy CLAY.
TP504	2	D	0.80		Brown mottled grey slightly gravelly sandy CLAY.
TP505	2	D	0.50		Brown mottled grey slightly gravelly slightly sandy CLAY.
TP505	3	D	2.30		Grey sandy silty CLAY.
TP506	3	D	0.90		Brown mottled grey slightly gravelly sandy CLAY.
TP507	2	D	0.50		Brown mottled grey slightly gravelly sandy CLAY.
TP508	2	D	0.70		Brown mottled grey slightly gravelly sandy CLAY.
TP509	2	D	0.60		Brown mottled grey slightly gravelly sandy CLAY.
TP510	2	D	0.60		Brown mottled grey slightly gravelly sandy CLAY.
TP510	3	D	2.00		Brown mottled grey slightly gravelly sandy CLAY.
TP514	2	D	0.90		Brown mottled grey slightly gravelly sandy CLAY.
TP515	2	D	0.50		Brown mottled grey slightly gravelly sandy CLAY.
TP516	2	D	0.50		Brown slightly gravelly sandy CLAY.
TP518	2	D	0.60		Brown mottled grey slightly gravelly sandy CLAY.
TP519	2	D	0.60		Brown mottled grey slightly gravelly sandy CLAY.
TP520	3	D	0.50		Brown mottled grey slightly gravelly sandy CLAY.
TP521	2	D	0.50		Brown mottled grey slightly gravelly slightly sandy sandy CLAY.

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP522	2	D	0.50		Brown mottled grey slightly gravelly sandy CLAY.
TP523	2	D	0.80		Brown mottled grey slightly gravelly very sandy CLAY.
TP524	2	D	0.70		Brown mottled grey slightly gravelly sandy CLAY.
TP525	3	D	1.40		Brown mottled grey slightly gravelly sandy CLAY.
TP526	2	D	0.50		Brown slightly gravelly sandy CLAY.
TP526	3	D	1.50		Brown clayey GRAVEL.
TP527	2	D	0.70		Brown mottled grey slightly gravelly sandy CLAY.
TP528	2	D	1.00		Brown slightly gravelly sandy CLAY.
TP528	3	D	1.60		Brown highly weathered MUDSTONE.
TP530	2	D	0.70		Brown sandy GRAVEL.
TP513	2	D	0.50		Brown gravelly very sandy CLAY.
TP511	3	D	1.00		Brown slightly gravelly slightly sandy silty CLAY.
TP515	4	D	2.50		Brown mottled grey slightly gravelly slightly sandy CLAY.
TP523	3	D	3.00		Brown highly weathered MUDSTONE.
TP530	5	D	2.50		Brown mottled grey sandy CLAY.

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
TP501	3	D	0.60		26			40	20	20	94	Intermediate Plasticity CI
TP502	2	D	0.80		23			46	23	23	97	Intermediate Plasticity CI
TP503	1	D	0.60		23			47	24	23	93	Intermediate Plasticity CI
TP504	2	D	0.80		20			42	22	20	94	Intermediate Plasticity CI
TP505	2	D	0.50		24			53	25	28	96	High Plasticity CH
TP505	3	D	2.30		18			44	22	22	100	Intermediate Plasticity CI
TP506	3	D	0.90		21			37	19	18	96	Intermediate Plasticity CI
TP507	2	D	0.50		23			44	21	23	93	Intermediate Plasticity CI
TP508	2	D	0.70		24			50	24	26	92	High Plasticity CH
TP509	2	D	0.60		24			48	23	25	95	Intermediate Plasticity CI
TP510	2	D	0.60		22			40	20	20	97	Intermediate Plasticity CI
TP510	3	D	2.00		14			35	18	17	100	Intermediate Plasticity CI
TP514	2	D	0.90		20			40	22	18	97	Intermediate Plasticity CI
TP515	2	D	0.50		26			49	24	25	97	Intermediate Plasticity CI
TP516	2	D	0.50		23			41	20	21	95	Intermediate Plasticity CI
TP518	2	D	0.60		16			42	20	22	91	Intermediate Plasticity CI
TP519	2	D	0.60		18			42	22	20	96	Intermediate Plasticity CI
TP520	3	D	0.50		19			42	21	21	92	Intermediate Plasticity CI
TP521	2	D	0.50		27			58	26	32	97	High Plasticity CH

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL Professional Soils Laboratory

Dewsbury Riverside Central Gateway

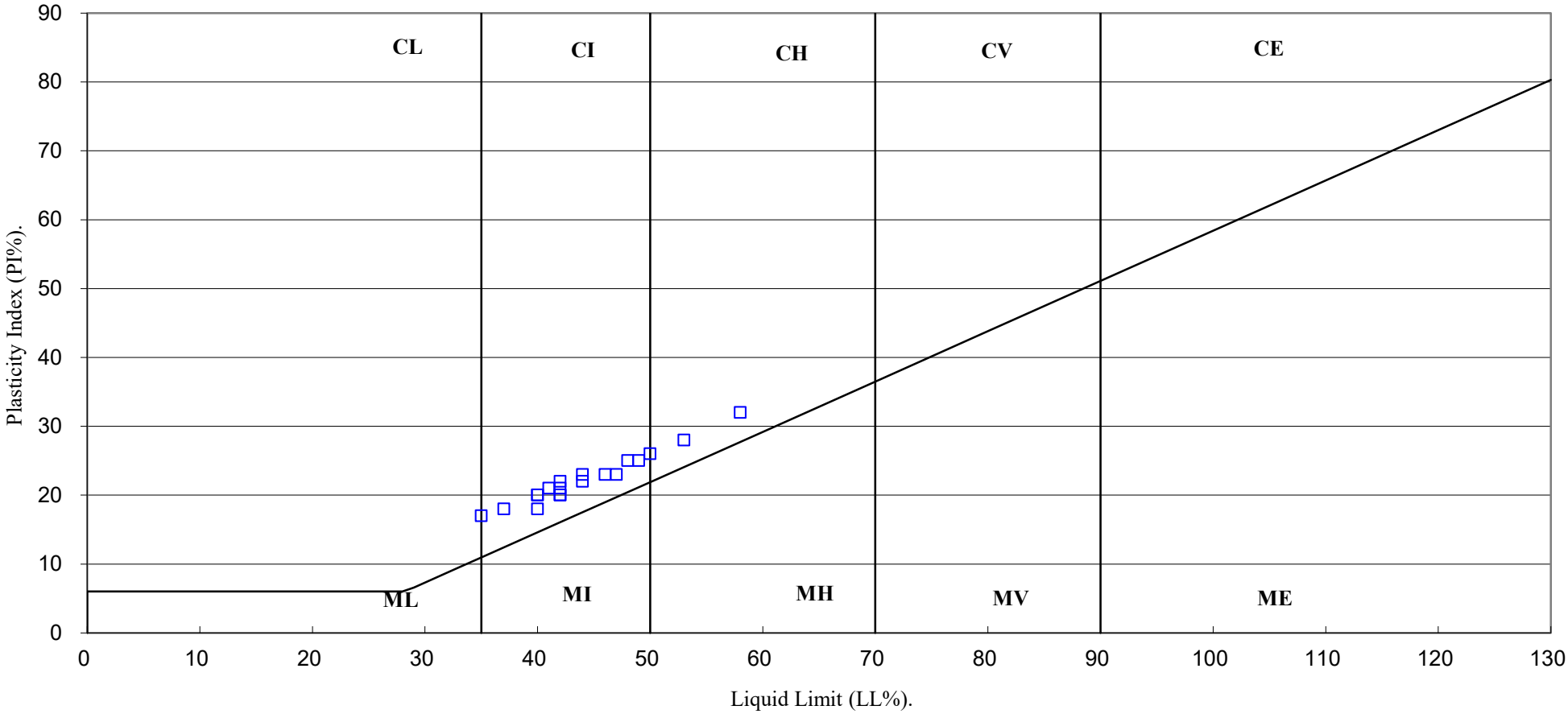
Contract No:

PSL21/0507

Client Ref:

3901

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043	PSL Professional Soils Laboratory	Dewsbury Riverside Central Gateway	Contract No: PSL21/0507 Client Ref: 3901

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
TP522	2	D	0.50		22			50	24	26	96	High Plasticity CH
TP523	2	D	0.80		15			32	17	15	97	Low Plasticity CL
TP524	2	D	0.70		18			38	20	18	94	Intermediate Plasticity CI
TP525	3	D	1.40		21			44	21	23	96	Intermediate Plasticity CI
TP526	2	D	0.50		24			42	21	21	96	Intermediate Plasticity CI
TP526	3	D	1.50		0.9				NP			
TP527	2	D	0.70		23			49	23	26	96	Intermediate Plasticity CI
TP528	2	D	1.00		22			41	22	19	96	Intermediate Plasticity CI
TP528	3	D	1.60		13			28	16	12	92	Low Plasticity CL
TP530	2	D	0.70		8.7				NP			
TP513	2	D	0.50		14			32	18	14	87	Low Plasticity CL
TP511	3	D	1.00		32			68	29	39	94	High Plasticity CH
TP515	4	D	2.50		29			55	26	29	91	High Plasticity CH
TP523	3	D	3.00		9.1			27	16	11	83	Low Plasticity CL
TP530	5	D	2.50		17			46	22	24	100	Intermediate Plasticity CI

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL Professional Soils Laboratory

Dewsbury Riverside Central Gateway

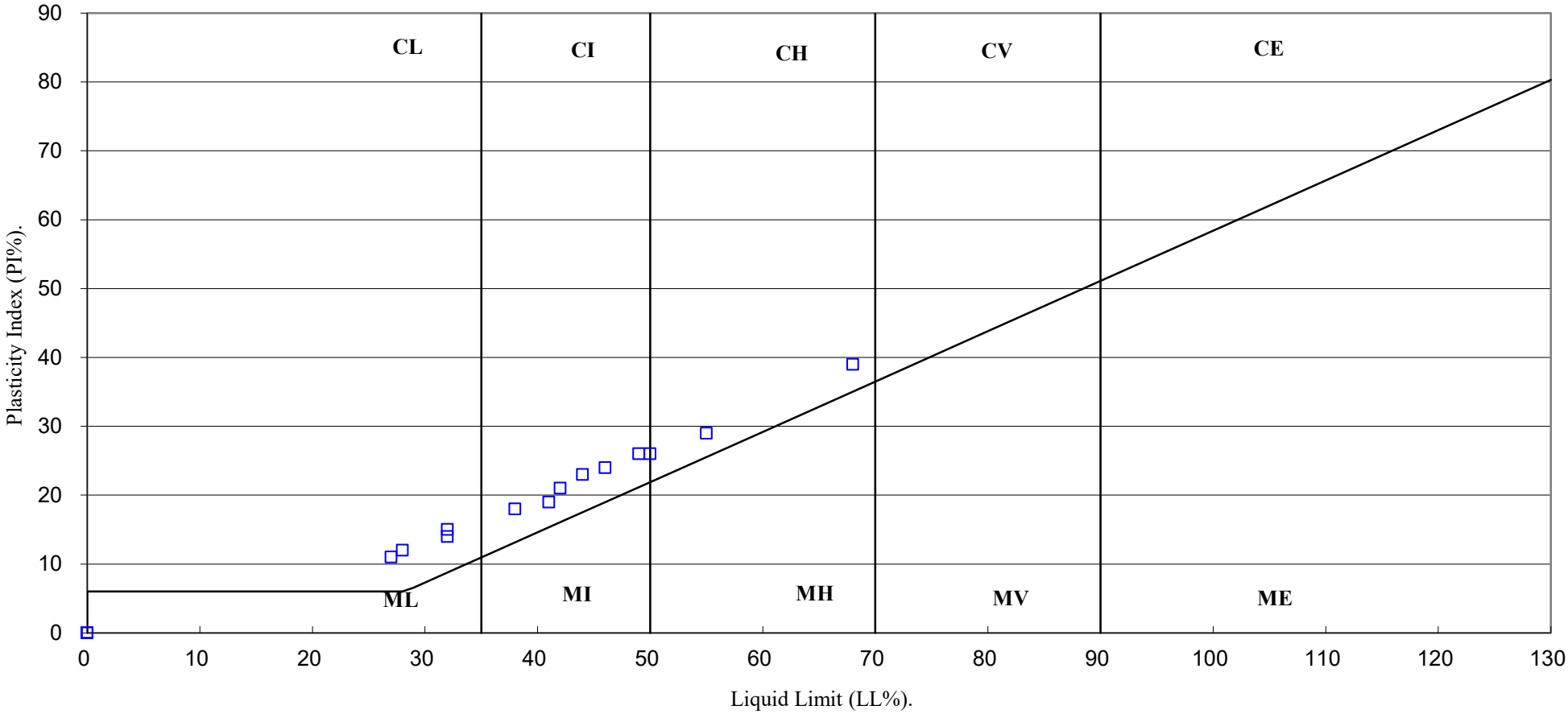
Contract No:

PSL21/0507

Client Ref:

3901

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043	PSL Professional Soils Laboratory	Dewsbury Riverside Central Gateway	Contract No: PSL21/0507 Client Ref: 3901

2531

ANALYTICAL TEST REPORT

Contract no: 92800(1)

Contract name: Dewsbury Riverside Central Gateway

Client reference: PSL21/0507

Clients name: Professional Soils Laboratory

Clients address: 5/7 Hexthorpe Road
Doncaster
DN4 0AR

Samples received: 25 January 2021

Analysis started: 25 January 2021

Analysis completed: 09 February 2021

Report issued: 09 February 2021

This is a supplementary report to report number 92800 issued 30 January 2021.

Notes:
Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
This report shall not be reproduced except in full, without prior written approval.
Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

Key:
U UKAS accredited test
M MCERTS & UKAS accredited test
$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing

Approved by:
Rachael Burton
Customer Support Squad Leader

Chemtech Environmental Limited

SOILS

Lab number			92800-1	92800-2	92800-3	92800-4	92800-5	92800-6
Sample id			TP501	TP502	TP504	TP505	TP506	TP508
Depth (m)			0.60	0.80	0.80	0.50	0.90	0.70
Date sampled			18/01/2021	18/01/2021	18/01/2021	18/01/2021	18/01/2021	18/01/2021
Test	**Method**	**Units**						
pH	CE004 [U]	units	8.1	8.0	8.0	8.1	8.2	8.1
Magnesium (2:1 water soluble)	CE061	mg/l Mg	-	-	-	-	-	-
Chloride (2:1 water soluble)	CE049 [U]	mg/l Cl	-	-	-	-	-	-
Nitrate (2:1 water soluble)	CE049 [U]	mg/l NO_3	-	-	-	-	-	-
Sulphate (2:1 water soluble)	CE061	mg/l SO_4	13	<10	11	12	<10	<10

Chemtech Environmental Limited

SOILS

Lab number			92800-7	92800-8	92800-9	92800-10	92800-11	92800-12
Sample id			TP510	TP510	TP511	TP511	TP511	TP512
Depth (m)			0.60	2.00	0.70	1.00	1.50	0.50
Date sampled			18/01/2021	18/01/2021	18/01/2021	18/01/2021	18/01/2021	18/01/2021
Test	**Method**	**Units**						
pH	CE004 [U]	units	8.0	6.3	5.7	6.1	5.8	6.6
Magnesium (2:1 water soluble)	CE061	mg/l Mg	-	-	-	2.3	-	-
Chloride (2:1 water soluble)	CE049 [U]	mg/l Cl	-	-	-	4.0	-	-
Nitrate (2:1 water soluble)	CE049 [U]	mg/l NO_3	-	-	-	22	-	-
Sulphate (2:1 water soluble)	CE061	mg/l SO_4	<10	30	43	23	68	14

Chemtech Environmental Limited

SOILS

Lab number			92800-13	92800-14	92800-15	92800-16	92800-17	92800-18
Sample id			TP513	TP515	TP515	TP515	TP517	TP518
Depth (m)			1.50	0.50	1.70	2.50	0.90	0.60
Date sampled			18/01/2021	18/01/2021	18/01/2021	18/01/2021	18/01/2021	18/01/2021
Test	**Method**	**Units**						
pH	CE004 [U]	units	5.8	5.3	5.6	5.4	6.8	7.1
Magnesium (2:1 water soluble)	CE061	mg/l Mg	-	-	-	-	-	-
Chloride (2:1 water soluble)	CE049 [U]	mg/l Cl	-	-	-	-	-	-
Nitrate (2:1 water soluble)	CE049 [U]	mg/l NO_3	-	-	-	-	-	-
Sulphate (2:1 water soluble)	CE061	mg/l SO_4	14	41	15	78	<10	13

Chemtech Environmental Limited

SOILS

Lab number			92800-19	92800-20	92800-21	92800-22	92800-23	92800-24
Sample id			TP521	TP521	TP522	TP523	TP523	TP524
Depth (m)			0.50	1.00	0.50	0.80	3.00	0.70
Date sampled			18/01/2021	18/01/2021	18/01/2021	18/01/2021	18/01/2021	18/01/2021
Test	**Method**	**Units**						
pH	CE004 [U]	units	7.4	6.5	7.9	5.5	5.5	6.7
Magnesium (2:1 water soluble)	CE061	mg/l Mg	-	-	-	-	6.4	-
Chloride (2:1 water soluble)	CE049 [U]	mg/l Cl	-	-	-	-	20	-
Nitrate (2:1 water soluble)	CE049 [U]	mg/l NO_3	-	-	-	-	20	-
Sulphate (2:1 water soluble)	CE061	mg/l SO_4	<10	20	<10	56	30	<10

Chemtech Environmental Limited

SOILS

Lab number			92800-25	92800-26	92800-27	92800-28	92800-29	92800-30
Sample id			TP524	TP526	TP527	TP529	TP530	TP530
Depth (m)			1.20	1.50	0.70	0.80	0.70	1.10
Date sampled			18/01/2021	18/01/2021	18/01/2021	18/01/2021	18/01/2021	18/01/2021
Test	**Method**	**Units**						
pH	CE004 [U]	units	5.5	5.7	6.5	6.1	6.1	5.8
Magnesium (2:1 water soluble)	CE061	mg/l Mg	-	-	-	-	-	-
Chloride (2:1 water soluble)	CE049 [U]	mg/l Cl	-	-	-	-	-	-
Nitrate (2:1 water soluble)	CE049 [U]	mg/l NO_3	-	-	-	-	-	-
Sulphate (2:1 water soluble)	CE061	mg/l SO_4	30	21	<10	26	30	27

Chemtech Environmental Limited

SOILS

Lab number			92800-31	92800-32
Sample id			TP530	TP530
Depth (m)			1.40	2.50
Date sampled			18/01/2021	18/01/2021
Test	**Method**	**Units**		
pH	CE004 [U]	units	5.4	4.9
Magnesium (2:1 water soluble)	CE061	mg/l Mg	-	2.4
Chloride (2:1 water soluble)	CE049 [U]	mg/l Cl	-	1.9
Nitrate (2:1 water soluble)	CE049 [U]	mg/l NO_3	-	19
Sulphate (2:1 water soluble)	CE061	mg/l SO_4	36	33

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received	U	-	units
CE061	Magnesium (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry		1	mg/l Mg
CE049	Chloride (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l Cl
CE049	Nitrate (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l NO_3
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry		10	mg/l SO_4

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments
Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.
For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.
Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
92800-1	TP501	0.60	N	
92800-2	TP502	0.80	N	
92800-3	TP504	0.80	N	
92800-4	TP505	0.50	N	
92800-5	TP506	0.90	N	
92800-6	TP508	0.70	N	
92800-7	TP510	0.60	N	
92800-8	TP510	2.00	N	
92800-9	TP511	0.70	N	
92800-10	TP511	1.00	N	
92800-11	TP511	1.50	N	
92800-12	TP512	0.50	N	
92800-13	TP513	1.50	N	
92800-14	TP515	0.50	N	
92800-15	TP515	1.70	N	
92800-16	TP515	2.50	N	
92800-17	TP517	0.90	N	
92800-18	TP518	0.60	N	
92800-19	TP521	0.50	N	
92800-20	TP521	1.00	N	
92800-21	TP522	0.50	N	
92800-22	TP523	0.80	N	
92800-23	TP523	3.00	N	
92800-24	TP524	0.70	N	
92800-25	TP524	1.20	N	
92800-26	TP526	1.50	N	
92800-27	TP527	0.70	N	
92800-28	TP529	0.80	N	
92800-29	TP530	0.70	N	
92800-30	TP530	1.10	N	

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments
Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.
For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.
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Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
92800-31	TP530	1.40	N	
92800-32	TP530	2.50	N	

Appendix K
Soakaway Test Results

SOIL INFILTRATION RATE IN ACCORDANCE WITH BRE DIGEST 365: 1991

Client:	Kirklees Metropolitan Borough Council
Engineer	G Morton
Job Name:	Dewsbury Riverside Central Gateway
Job No.:	3901

Date:	**12/01/2021**
Trial Pit No.	**531**
Test No.	**1**

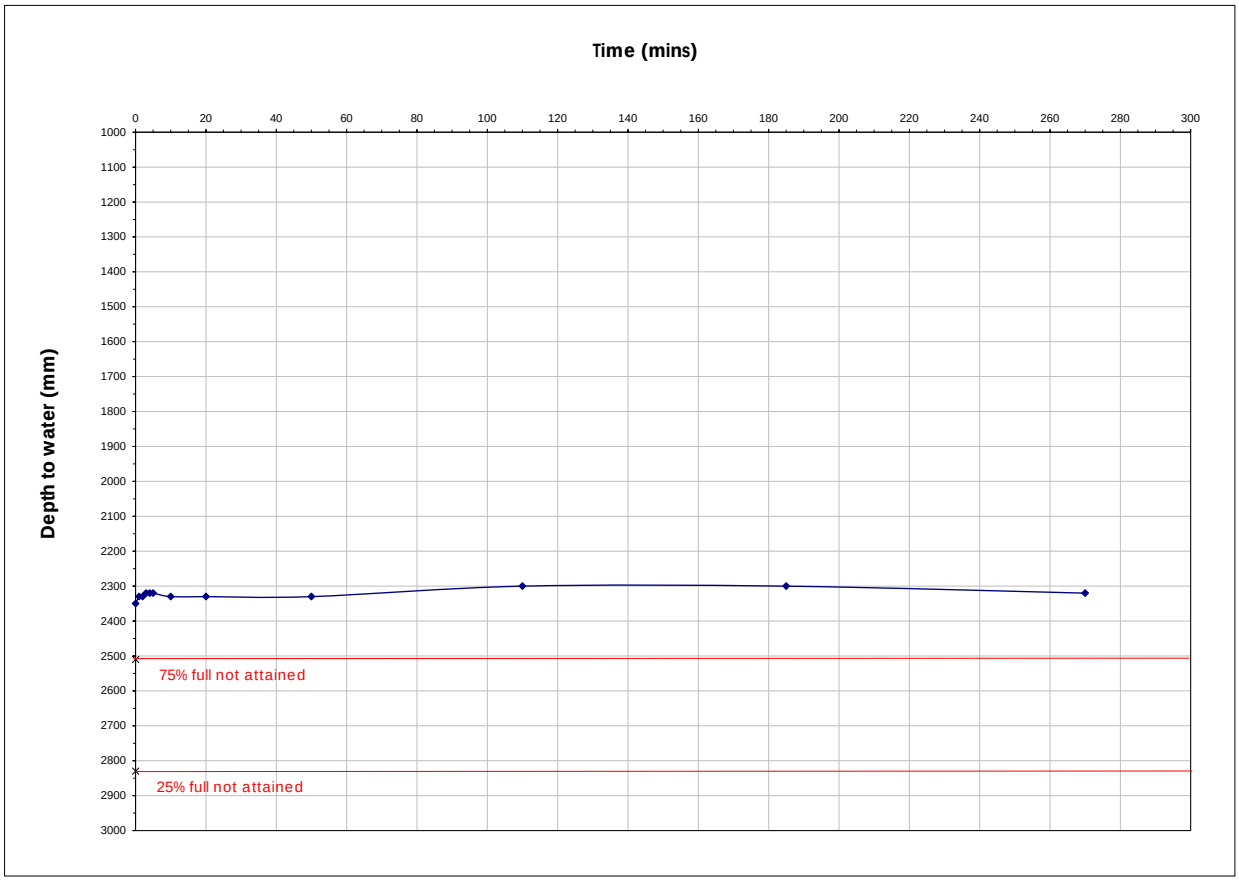
Time	Elapsed Time	Depth to water from ground level	
	(min)	(m)	(mm)
10:35	0	2.35	2350
10:36	1	2.33	2330
10:37	2	2.33	2330
10:38	3	2.32	2320
10:39	4	2.32	2320
10:40	5	2.32	2320
10:45	10	2.33	2330
10:55	20	2.33	2330
11:25	50	2.33	2330
12:25	110	2.30	2300
13:40	185	2.30	2300
15:05	270	2.32	2320

SOAKAWAY TRIAL PIT			
Dimensions		**(m)**	**(mm)**
Length	=	3.10	3100
Width	=	1.00	1000
Depth	=	2.99	2990

Effective Depth (% full)		**(mm)**	**(m)**
0.25	=	2830	2.83
0.50	=	2670	2.67
0.75	=	2510	2.51

Depth at start of test (mm)	=	2350
Depth at end of test (mm)	=	2330
Base area of pit	=	3.1
a_{p50} - 50% internal surface area inc. base	=	5.724
V_{p75-25} - Volume 75 - 25%	=	0.992

Read from the graph:		
$t_{p\ 75}$ (min)	=	N/A
$t_{p\ 25}$ (min)	=	N/A



Test did not attain 25% Effective depth. Unable to calculate soil infiltration rate

SOIL INFILTRATION RATE IN ACCORDANCE WITH BRE DIGEST 365: 1991

Client:	Kirklees Metropolitan Borough Council
Engineer	G Morton
Job Name:	Dewsbury Riverside Central Gateway
Job No.:	3901

Date:	**12/01/2021**
Trial Pit No.	**532**
Test No.	**1**

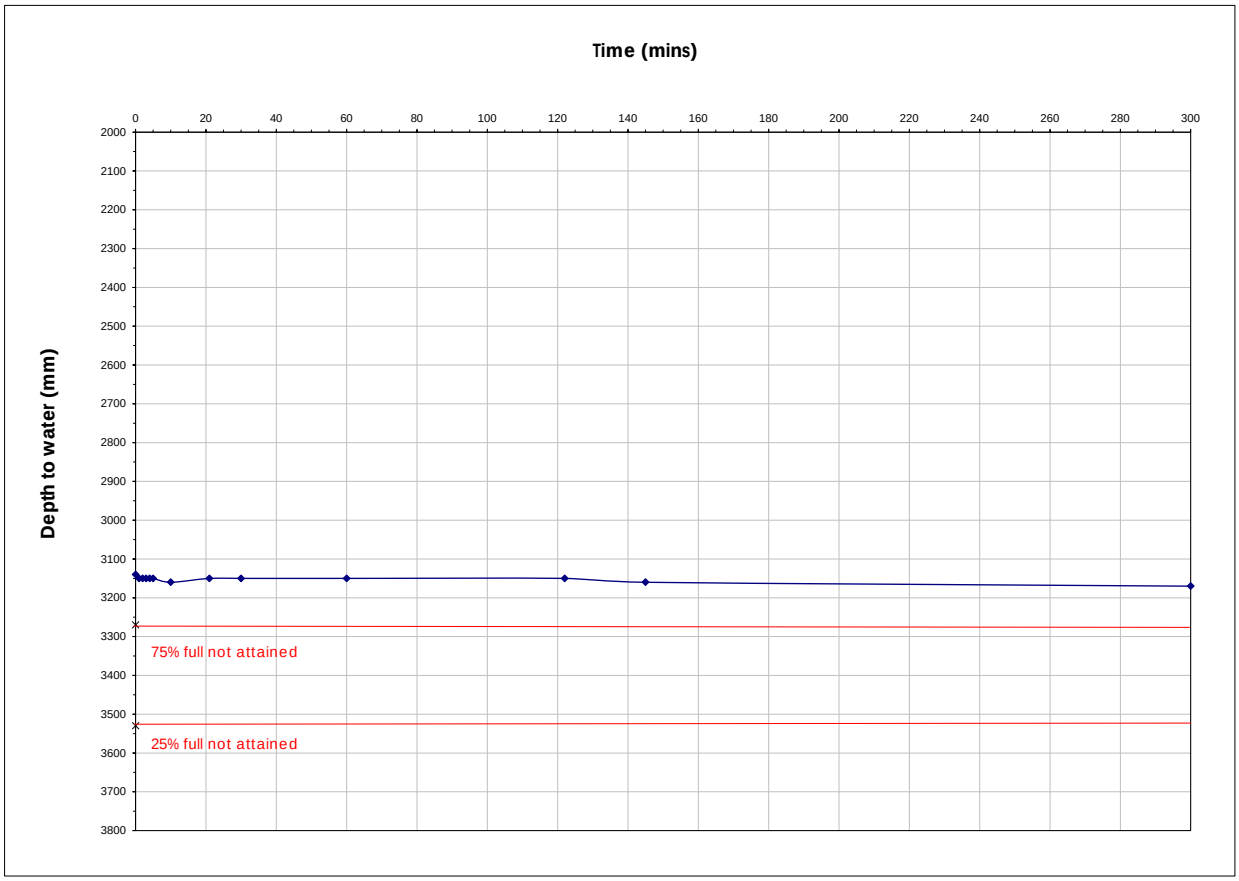
Time	Elapsed Time	Depth to water from ground level	
	(min)	(m)	(mm)
10:20	0	3.14	3140
10:21	1	3.15	3150
10:22	2	3.15	3150
10:23	3	3.15	3150
10:24	4	3.15	3150
10:25	5	3.15	3150
10:30	10	3.16	3160
10:41	21	3.15	3150
10:50	30	3.15	3150
11:20	60	3.15	3150
12:27	122	3.15	3150
13:45	145	3.16	3160
15:20	300	3.17	3170

SOAKAWAY TRIAL PIT			
Dimensions		**(m)**	**(mm)**
Length	=	2.40	2400
Width	=	1.00	1000
Depth	=	3.66	3660

Effective Depth (% full)		**(mm)**	**(m)**
0.25	=	3530	3.53
0.50	=	3400	3.40
0.75	=	3270	3.27

Depth at start of test (mm)	=	3140
Depth at end of test (mm)	=	3170
Base area of pit	=	2.4
a_{p50} - 50% internal surface area inc. base	=	4.168
V_{p75-25} - Volume 75 - 25%	=	0.624

Read from the graph:		
$t_{p\ 75}$ (min)	=	N/A
$t_{p\ 25}$ (min)	=	N/A



Test did not attain 25% Effective depth. Unable to calculate soil infiltration rate

SOIL INFILTRATION RATE IN ACCORDANCE WITH BRE DIGEST 365: 1991

Client:	Kirklees Metropolitan Borough Council
Engineer	G Morton
Job Name:	Dewsbury Riverside Central Gateway
Job No.:	3901

Date:	**12/01/2021**
Trial Pit No.	**533**
Test No.	**1**

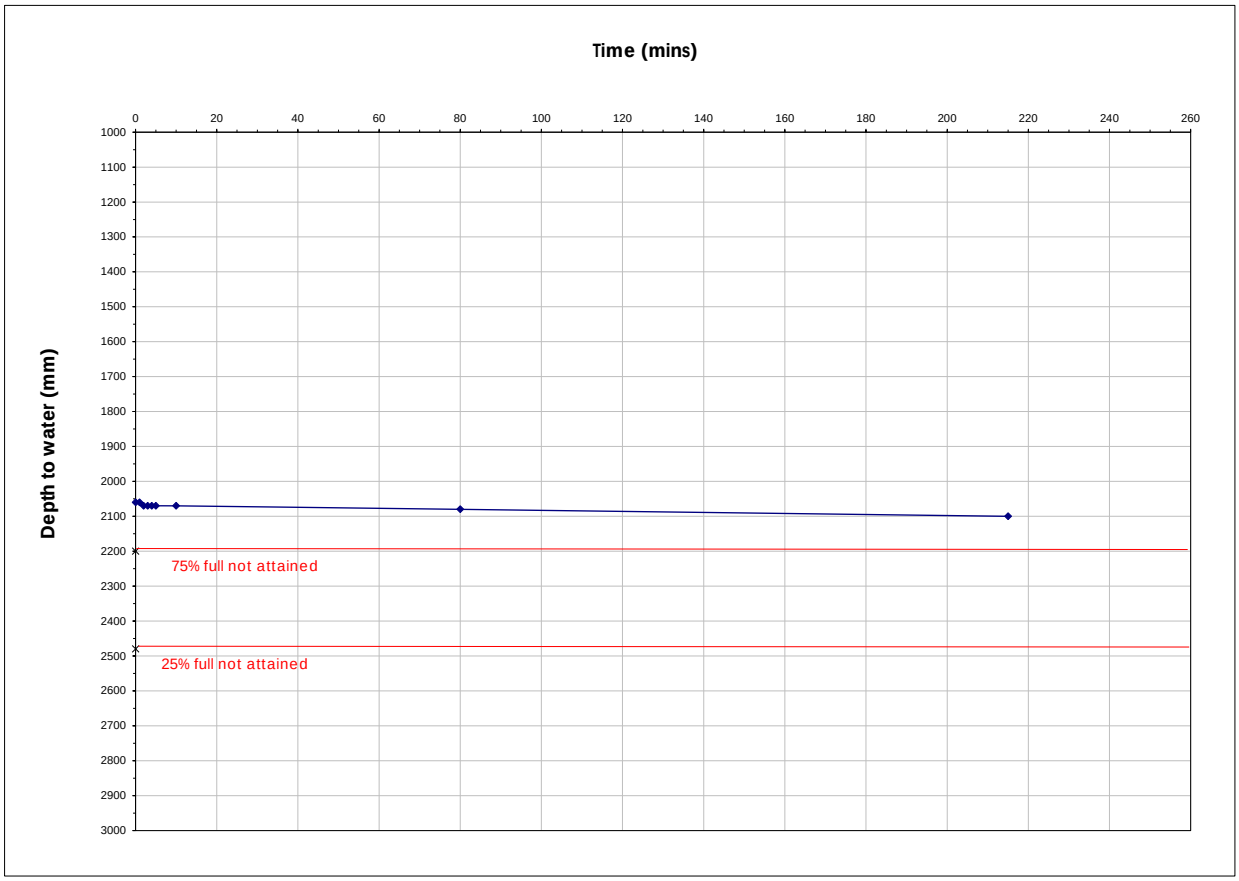
Time	Elapsed Time	Depth to water from ground level	
	(min)	(m)	(mm)
12:10	0	2.06	2060
12:11	1	2.06	2060
12:12	2	2.07	2070
12:13	3	2.07	2070
12:14	4	2.07	2070
12:15	5	2.07	2070
12:20	10	2.07	2070
13:30	80	2.08	2080
15:45	215	2.10	2100

SOAKAWAY TRIAL PIT			
Dimensions		**(m)**	**(mm)**
Length	=	2.90	2900
Width	=	1.00	1000
Depth	=	2.62	2620

Effective Depth (% full)		**(mm)**	**(m)**
0.25	=	2480	2.48
0.50	=	2340	2.34
0.75	=	2200	2.20

Depth at start of test (mm)	=	2060
Depth at end of test (mm)	=	2100
Base area of pit	=	2.9
a_{p50} - 50% internal surface area inc. base	=	5.084
V_{p75-25} - Volume 75 - 25%	=	0.812

Read from the graph:		
$t_{p\ 75}$ (min)	=	N/A
$t_{p\ 25}$ (min)	=	N/A



Test did not attain 25% Effective depth. Unable to calculate soil infiltration rate

SOIL INFILTRATION RATE IN ACCORDANCE WITH BRE DIGEST 365: 1991

Client:	Kirklees Metropolitan Borough Council
Engineer	G Morton
Job Name:	Dewsbury Riverside Central Gateway
Job No.:	3901

Date:	**12/01/2021**
Trial Pit No.	**534**
Test No.	**1**

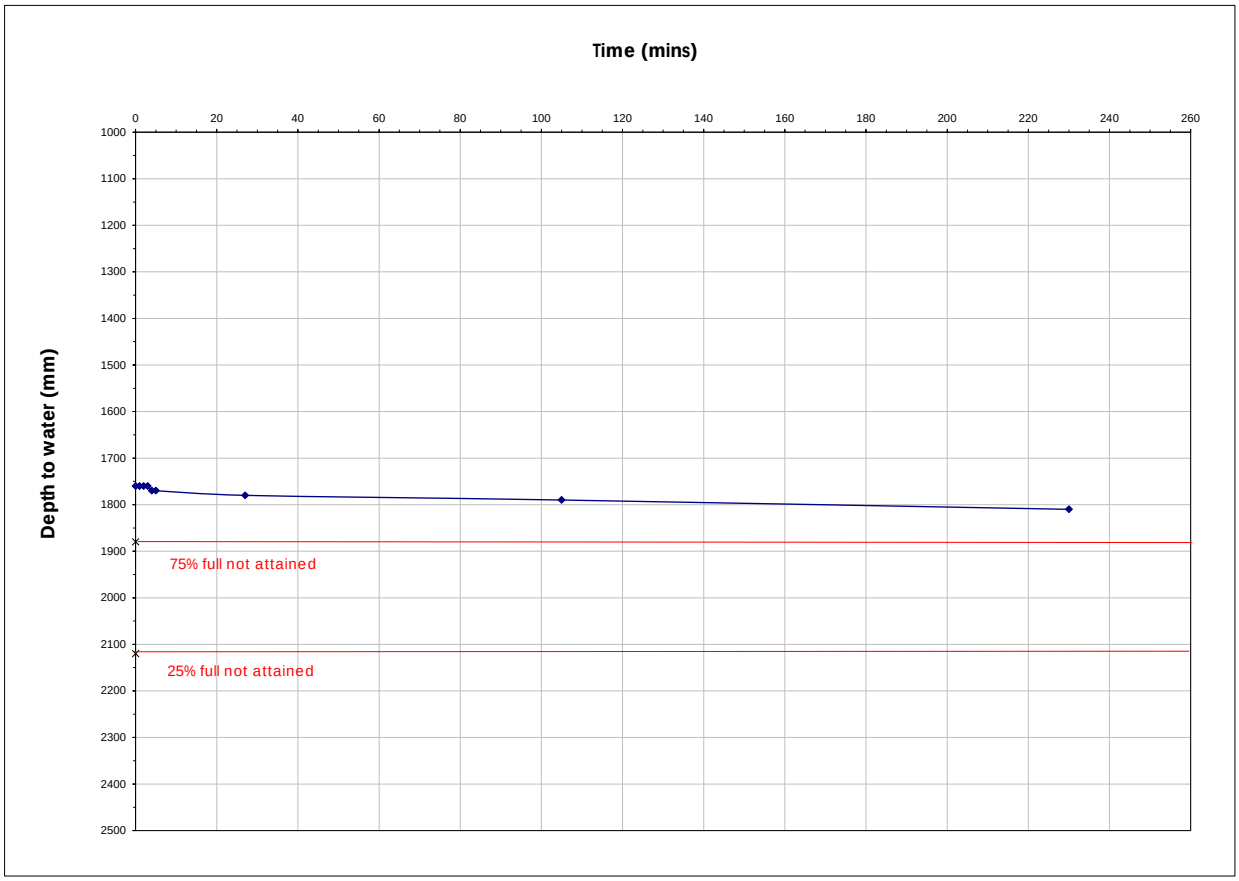
Time	Elapsed Time	Depth to water from ground level	
	(min)	(m)	(mm)
11:50	0	1.76	1760
11:51	1	1.76	1760
11:52	2	1.76	1760
11:53	3	1.76	1760
11:54	4	1.77	1770
11:55	5	1.77	1770
12:17	27	1.78	1780
13:35	105	1.79	1790
15:40	230	1.81	1810

SOAKAWAY TRIAL PIT			
Dimensions		**(m)**	**(mm)**
Length	=	3.00	3000
Width	=	1.00	1000
Depth	=	2.24	2240

Effective Depth (% full)		**(mm)**	**(m)**
0.25	=	2120	2.12
0.50	=	2000	2.00
0.75	=	1880	1.88

Depth at start of test (mm)	=	1760
Depth at end of test (mm)	=	1810
Base area of pit	=	3
a_{p50} - 50% internal surface area inc. base	=	4.92
V_{p75-25} - Volume 75 - 25%	=	0.72

Read from the graph:		
$t_{p\ 75}$ (min)	=	N/A
$t_{p\ 25}$ (min)	=	N/A



Test did not attain 25% Effective depth. Unable to calculate soil infiltration rate

Appendix L
Gas Monitoring Results

Job Title:				Job No:
Dewsbury Riverside Central Gateway				3901
Client:				Sheet :
Kirklees Council				1 of 11
Date:	Arrival Time:	Depart Time:	Operator:	
10/02/2021	09:00	15:50	Lander Latta	

LITHOS CONSULTING

Gas Monitoring Results:

Ambient Concentration (% Volume):	CH_4:	ND	CO_2:	ND	O_2:	20.6

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH_4	CO_2	CH_4	CO_2	O_2					
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m	
WS501	1.16	ND	ND	ND	ND	20.6	ND	ND	ND	2.25	Bailed 10:22 - 10:24 to 1.88m (3l). 1.73m dip at 10:28. Remonitored at 10:49.
WS502	1.40	ND	1.9	ND	1.9	18.5	ND	ND	ND	1.85	
WS503	0.72	ND	0.7	ND	0.7	20.1	ND	ND	ND	2.90	Bailed 09:36 - 09:40 to 2.70m (10l). 2.66m Dip at 09:47. Remonitored at 12:06.
WS504	1.45	ND	2.4	ND	2.4	19.0	ND	ND	ND	2.97	
WS508	1.28	ND	1.7	ND	1.7	19.6	ND	ND	ND	2.87	
WS513	ND	ND	0.7	ND	0.7	19.4	ND	ND	ND	1.30	
WS514	0.92	ND	2.0	ND	2.0	**15.5**	ND	ND	ND	1.62	
WS515	ND	ND	0.6	ND	0.6	19.3	ND	ND	ND	2.19	
PH502A	2.33	ND	1.0	ND	1.0	16.2	ND	ND	ND	5.11	
PH504A	2.20	ND	ND	ND	ND	19.1	ND	ND	ND	3.16	
PH506A	1.19	ND	0.4	ND	0.4	19.6	ND	ND	ND	4.15	Bailed 11:15 - 11:21 to 3.55m (15l). Remonitored at 14:41.
PH507A	3.32	ND	2.7	ND	2.7	**4.2**	-38.2	0.0	20.0	4.30	
PH509A	1.70	ND	0.3	ND	0.3	**12.2**	ND	ND	ND	4.30	
PH511A	0.98	ND	0.7	ND	0.7	18.4	110.2	0.0	100.0	4.37	Bailed 14:12 - 14:16 to 2.53m (15l). Remonitored at 15:12.
PH513A	ND	ND	1.0	ND	1.0	17.6	ND	ND	ND	4.86	Valve open on arival. Closed at 14:29. Monitored at 15:20.
PH514A	2.49	ND	0.7	ND	0.7	19.0	ND	ND	ND	4.37	Valve open on arival. Closed at 11:27. Monitored at 14:50.
PH516A	1.42	ND	0.6	ND	0.6	18.3	ND	ND	ND	3.38	Valve open on arival. Closed at 14:02. Monitored at 15:05.
PH517A	2.79	ND	0.8	ND	0.8	18.4	ND	ND	ND	3.81	Valve open on arival. Closed at 15:02. Monitored at 15:24.
PH518A	3.45	ND	0.9	ND	0.9	19.3	ND	ND	ND	4.66	Valve open on arival. Closed at 11:32. Monitored at 14:54.
PH522A	1.61	ND	0.8	ND	0.8	18.0	ND	ND	ND	4.26	Valve open on arival. Closed at 11:38. Monitored at 15:29.
PH524A	1.41	NR	NR	NR	NR	NR	NR	NR	NR	4.13	Bailed 13:48 - 13:53 to 3.57m (15l). Remonitored at 15:32.
PH526A	1.30	ND	0.2	ND	0.2	19.4	ND	ND	ND	4.35	Valve open on arival. Closed at 13:40. Monitored at 15:40.
PH528A	3.11	ND	0.1	ND	0.1	19.2	-71.5	0.0	40.0	3.94	
PH530A	1.19	ND	ND	ND	ND	19.4	10.9	0.0	10.0	3.10	Bailed 11:47 - 11:51 to 2.58m (12l). Remonitored at 13:24.
PH531A	4.04	ND	ND	ND	ND	**14.3**	ND	ND	ND	4.35	

Equipment Used:

Gas Data GFM436 Infrared Gas Analyser
Geotechnical Instruments Dipmeter

Next Calibration Date

22/02/2021

Key

ND	None Detected
NR	Not Recorded
1.0	Recorded value does not breach trigger levels
5.0	Recorded value breaches trigger level 1
10.0	Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (Thornhill Dewsbury village Station)							CH_4	CO_2	O_2
	Temp (°C):	- 2 to 2		Barometric Pressure Trend:			Rising						
Time:	09:00	13:24	15:50	00:04	08:59	13:24	15:49	17:59	19:59	Trigger level 1	1.0	5.0	16.0
Pressure (mb):	1007	1010	1009	1001	1007	1009	1010	1012	1013	Trigger level 2	5.0	10.0	10.0
	Weather Conditions:		Clear/ Light Breeze										
	Surface Ground Conditions:		Frozen										

Remarks:

Job Title:				Job No:
Dewsbury Riverside Central Gateway				3901
Client:				Sheet :
Kirklees Council				2 of 11
Date:	Arrival Time:	Depart Time:	Operator:	
10/02/2021	09:00	15:50	Lander Latta	

LITHOS CONSULTING

Gas Monitoring Results:

Ambient Concentration (% Volume):	CH_4:	ND	CO_2:	ND	O_2:	20.6

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH_4	CO_2	CH_4	CO_2	O_2					
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m	
WS501	1.30	ND	0.1	ND	0.1	20.0	ND	ND	ND	2.25	Remonitored at 10:49.
WS502	1.40	ND	1.9	ND	1.9	18.5	ND	ND	ND	1.85	
WS503	2.61	ND	0.4	ND	0.4	19.4	ND	ND	ND	2.89	Remonitored at 12:06.
WS504	1.45	ND	2.4	ND	2.4	19.0	ND	ND	ND	2.97	
WS508	1.28	ND	1.7	ND	1.7	19.6	ND	ND	ND	2.87	
WS513	ND	ND	0.7	ND	0.7	19.4	ND	ND	ND	1.30	
WS514	0.92	ND	2.0	ND	2.0	**15.5**	ND	ND	ND	1.62	
WS515	ND	ND	0.6	ND	0.6	19.3	ND	ND	ND	2.19	
PH502A	2.33	ND	1.0	ND	1.0	16.2	ND	ND	ND	5.11	
PH504A	2.20	ND	ND	ND	ND	19.1	ND	ND	ND	3.16	
PH506A	2.63	ND	0.2	ND	0.2	19.7	120.0	0.0	120.0	4.22	Remonitored at 14:41.
PH507A	3.32	ND	2.7	ND	2.7	**4.2**	-38.2	0.0	20.0	4.30	
PH509A	1.70	ND	0.3	ND	0.3	**12.2**	ND	ND	ND	4.30	
PH511A	0.89	ND	0.3	ND	0.3	19.7	117.4	0.0	100.0	4.36	Remonitored at 15:12.
PH513A	ND	ND	1.0	ND	1.0	17.6	ND	ND	ND	4.86	Valve open on arival. Closed at 14:29. Monitored at 15:20.
PH514A	2.49	ND	0.7	ND	0.7	19.0	ND	ND	ND	4.37	Valve open on arival. Closed at 11:27. Monitored at 14:50.
PH516A	1.42	ND	0.6	ND	0.6	18.3	ND	ND	ND	3.38	Valve open on arival. Closed at 14:02. Monitored at 15:05.
PH517A	2.79	ND	0.8	ND	0.8	18.4	ND	ND	ND	3.81	Valve open on arival. Closed at 15:02. Monitored at 15:24.
PH518A	3.45	ND	0.9	ND	0.9	19.3	ND	ND	ND	4.66	Valve open on arival. Closed at 11:32. Monitored at 14:54.
PH522A	1.61	ND	0.8	ND	0.8	18.0	ND	ND	ND	4.26	Valve open on arival. Closed at 11:38. Monitored at 15:29.
PH524A	2.98	ND	0.4	ND	0.4	19.0	120.0	0.0	130.0	4.17	Remonitored at 15:32.
PH526A	1.30	ND	0.2	ND	0.2	19.4	ND	ND	ND	4.35	Valve open on arival. Closed at 13:40. Monitored at 15:40.
PH528A	3.11	ND	0.1	ND	0.1	19.2	-71.5	0.0	40.0	3.94	
PH530A	2.01	ND	ND	ND	ND	19.9	ND	ND	ND	3.10	Remonitored at 13:24.
PH531A	4.04	ND	ND	ND	ND	**14.3**	ND	ND	ND	4.35	

Equipment Used:	Next Calibration Date
Gas Data GFM436 Infrared Gas Analyser Geotechnical Instruments Dipmeter	22/02/2021

Key	
ND	None Detected
NR	Not Recorded
1.0	Recorded value does not breach trigger levels
5.0	Recorded value breaches trigger level 1
10.0	Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (Thornhill Dewsbury village Station)							CH_4	CO_2	O_2
	Temp (°C):	- 2 to 2		Barometric Pressure Trend:			Rising						
Time:	09:00	13:24	15:50	00:04	08:59	13:24	15:49	17:59	19:59	Trigger level 1	1.0	5.0	16.0
Pressure (mb):	1007	1010	1009	1001	1007	1009	1010	1012	1013	Trigger level 2	5.0	10.0	10.0
	Weather Conditions:		Clear/ Light Breeze										
	Surface Ground Conditions:		Frozen										

Remarks:

Job Title:				Job No:
Dewsbury Riverside Central Gateway				3901
Client:				Sheet :
Kirklees Council				3 of 11
Date:	Arrival Time:	Depart Time:	Operator:	
23/02/2021	09:15	15:30	Lander Latta	

LITHOS CONSULTING

Gas Monitoring Results:

Ambient Concentration (% Volume):	CH_4:	ND	CO_2:	ND	O_2:	20.5

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH_4	CO_2	CH_4	CO_2	O_2					
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m	
WS501	1.22	ND	0.8	ND	0.8	19.9	-4.5	0.0	10.0	2.20	
WS502	1.74	ND	1.7	ND	1.7	19.0	ND	ND	ND	1.85	
WS503	2.21	ND	1.8	ND	1.8	18.3	ND	ND	ND	2.87	
WS504	1.93	ND	2.3	ND	2.3	18.9	ND	ND	ND	2.96	Bailed 09:51 - 09:53 to 2.85m (2l). 2.04m Dip at 12:44.
WS508	1.40	ND	1.3	ND	1.3	19.6	ND	ND	ND	2.87	Bailed 09:38 - 09:40 to 2.79m (3l). 2.65m Dip at 12:41.
WS513	ND	ND	0.9	ND	0.9	19.2	ND	ND	ND	1.30	
WS514	1.33	ND	2.9	ND	2.9	**16.0**	ND	ND	ND	1.61	
WS515	ND	ND	2.6	ND	2.6	**11.1**	ND	ND	ND	2.18	
PH502A	2.16	ND	0.5	ND	0.5	17.1	6.3	0.0	5.0	5.08	Bailed 10:33 - 10:39 to 4.67m (15l). 4.41m Dip at 11:11.
PH504A	2.42	ND	ND	ND	ND	19.5	ND	ND	ND	3.16	Bailed 11:20 - 11:23 to 2.85m (4l). 2.86m Dip at 11:36.
PH506A	2.18	ND	0.8	ND	0.8	19.1	113.4	0.0	350.0	4.09	
PH507A	4.19	ND	4.2	ND	4.2	**2.8**	ND	ND	ND	4.30	
PH509A	1.71	ND	0.5	ND	0.5	**12.6**	ND	ND	ND	4.29	Bailed 14:49 - 14:55 to 2.70m (15l). 1.80m Dip at 15:05.
PH511A	1.27	ND	0.6	ND	0.6	20.1	-9.8	0.0	10.0	4.37	
PH513A	ND	ND	0.4	ND	0.4	**10.0**	ND	ND	ND	4.87	
PH514A	3.53	ND	1.1	ND	1.1	16.4	ND	ND	ND	4.36	Bailed 11:48 - 11:51 to 4.10m (4l). 4.08m Dip at 12:10.
PH516A	1.63	NR	NR	NR	NR	NR	NR	NR	NR	3.36	Valve open on arrival. Bailed 14:34 - 14:37 to 2.84m (10l). Monitored at 15:12.
PH517A	3.20	ND	3.9	ND	3.9	**9.5**	ND	ND	ND	3.80	
PH518A	3.90	ND	0.7	ND	0.7	19.7	ND	ND	ND	4.67	Bailed 12:03 - 12:07 to 4.36m (2l). 4.31m Dip at 12:17.
PH522A	3.00	ND	1.8	ND	1.8	**10.4**	ND	ND	ND	4.26	Bailed 12:23 - 12:27 to 3.94m (7l). 3.82m Dip at 14:26.
PH524A	2.16	ND	2.4	ND	2.4	**12.7**	90.2	0.0	40.0	4.16	
PH526A	1.34	ND	0.6	ND	0.6	18.6	ND	ND	ND	4.35	Bailed 14:16 - 14:21 to 3.47m (15l). 3.34m Dip at 15:21.
PH528A	3.84	ND	1.0	ND	1.0	**15.3**	3.1	0.0	5.0	3.93	
PH530A	1.27	ND	ND	ND	ND	20.0	-7.1	0.0	5.0	3.13	Bailed 10:08 - 10:11 to 2.37m (10l). Remonitored at 12:33.
PH531A	4.10	ND	ND	ND	ND	**16.0**	ND	ND	ND	4.36	

Equipment Used:	Next Calibration Date
Gas Data GFM436 Infrared Gas Analyser Geotechnical Instruments Dipmeter	22/02/2021

Key

ND	None Detected
NR	Not Recorded
1.0	Recorded value does not breach trigger levels
5.0	Recorded value breaches trigger level 1
10.0	Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (Thornhill Dewsbury village Station)							CH_4	CO_2	O_2
	Temp (°C):	8 to 12		Barometric Pressure Trend:			Falling						
Time:	09:15	13:48	15:30	00:04	09:14	12:49	15:29	17:59	19:59	Trigger level 1	1.0	5.0	16.0
Pressure (mb):	1005	1002	1002	1007	1003	1002	1002	1000	1002	Trigger level 2	5.0	10.0	10.0
	Weather Conditions:		Overcast/ Windy										
	Surface Ground Conditions:		Damp										

Remarks:

Job Title:				Job No:
Dewsbury Riverside Central Gateway				3901
Client:				Sheet :
Kirklees Council				4 of 11
Date:	Arrival Time:	Depart Time:	Operator:	
23/02/2021	09:15	15:30	Lander Latta	

LITHOS CONSULTING

Gas Monitoring Results:

Ambient Concentration (% Volume):	CH_4:	ND	CO_2:	ND	O_2:	20.5

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH_4	CO_2	CH_4	CO_2	O_2					
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m	
WS501	1.22	ND	0.8	ND	0.8	19.9	-4.5	0.0	10.0	2.20	
WS502	1.74	ND	1.7	ND	1.7	19.0	ND	ND	ND	1.85	
WS503	2.21	ND	1.8	ND	1.8	18.3	ND	ND	ND	2.87	
WS504	1.93	ND	2.3	ND	2.3	18.9	ND	ND	ND	2.96	Bailed 09:51 - 09:53 to 2.85m (2l). 2.04m Dip at 12:44.
WS508	1.40	ND	1.3	ND	1.3	19.6	ND	ND	ND	2.87	Bailed 09:38 - 09:40 to 2.79m (3l). 2.65m Dip at 12:41.
WS513	ND	ND	0.9	ND	0.9	19.2	ND	ND	ND	1.30	
WS514	1.33	ND	2.9	ND	2.9	**16.0**	ND	ND	ND	1.61	
WS515	ND	ND	2.6	ND	2.6	**11.1**	ND	ND	ND	2.18	
PH502A	2.16	ND	0.5	ND	0.5	17.1	6.3	0.0	5.0	5.08	Bailed 10:33 - 10:39 to 4.67m (15l). 4.41m Dip at 11:11.
PH504A	2.42	ND	ND	ND	ND	19.5	ND	ND	ND	3.16	Bailed 11:20 - 11:23 to 2.85m (4l). 2.86m Dip at 11:36.
PH506A	2.18	ND	0.8	ND	0.8	19.1	113.4	0.0	350.0	4.09	
PH507A	4.19	ND	4.2	ND	4.2	**2.8**	ND	ND	ND	4.30	
PH509A	1.71	ND	0.5	ND	0.5	**12.6**	ND	ND	ND	4.29	Bailed 14:49 - 14:55 to 2.70m (15l). 1.80m Dip at 15:05.
PH511A	1.27	ND	0.6	ND	0.6	20.1	-9.8	0.0	10.0	4.37	
PH513A	ND	ND	0.4	ND	0.4	**10.0**	ND	ND	ND	4.87	
PH514A	3.53	ND	1.1	ND	1.1	16.4	ND	ND	ND	4.36	Bailed 11:48 - 11:51 to 4.10m (4l). 4.08m Dip at 12:10.
PH516A	2.78	ND	0.1	ND	0.1	20.3	28.8	0.0	30.0	3.37	Monitored at 15:12.
PH517A	3.20	ND	3.9	ND	3.9	**9.5**	ND	ND	ND	3.80	
PH518A	3.90	ND	0.7	ND	0.7	19.7	ND	ND	ND	4.67	Bailed 12:03 - 12:07 to 4.36m (2l). 4.31m Dip at 12:17.
PH522A	3.00	ND	1.8	ND	1.8	**10.4**	ND	ND	ND	4.26	Bailed 12:23 - 12:27 to 3.94m (7l). 3.82m Dip at 14:26.
PH524A	2.16	ND	2.4	ND	2.4	**12.7**	90.2	0.0	40.0	4.16	
PH526A	1.34	ND	0.6	ND	0.6	18.6	ND	ND	ND	4.35	Bailed 14:16 - 14:21 to 3.47m (15l). 3.34m Dip at 15:21.
PH528A	3.84	ND	1.0	ND	1.0	**15.3**	3.1	0.0	5.0	3.93	
PH530A	1.80	ND	ND	ND	ND	20.2	ND	ND	ND	3.14	Remonitored at 12:33.
PH531A	4.10	ND	ND	ND	ND	**16.0**	ND	ND	ND	4.36	

Equipment Used:	Next Calibration Date
Gas Data GFM436 Infrared Gas Analyser Geotechnical Instruments Dipmeter	22/02/2021

Key

ND	None Detected
NR	Not Recorded
1.0	Recorded value does not breach trigger levels
5.0	Recorded value breaches trigger level 1
10.0	Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (Thornhill Dewsbury village Station)							CH_4	CO_2	O_2
	Temp (°C):	8 to 12		Barometric Pressure Trend:			Falling						
Time:	09:15	13:48	15:30	00:04	09:14	12:49	15:29	17:59	19:59	Trigger level 1	1.0	5.0	16.0
Pressure (mb):	1005	1002	1002	1007	1003	1002	1002	1000	1002	Trigger level 2	5.0	10.0	10.0
	Weather Conditions:		Overcast/ Windy										
	Surface Ground Conditions:		Damp										

Remarks:	

Job Title:				Job No:
Dewsbury Riverside Central Gateway				3901
Client:				Sheet :
Kirklees Council				5 of 11
Date:	Arrival Time:	Depart Time:	Operator:	
09/03/2021	09:40	14:20	Lander Latta	

LITHOS CONSULTING

Gas Monitoring Results:

Ambient Concentration (% Volume):	CH_4:	ND	CO_2:	ND	O_2:	20.4

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH_4	CO_2	CH_4	CO_2	O_2					
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m	
WS501	1.31	ND	0.6	ND	0.6	20.0	3.5	0.0	3.0	2.25	
WS502	1.75	ND	2.3	ND	2.3	17.5	ND	ND	ND	1.86	
WS503	1.99	ND	2.2	ND	2.2	17.6	ND	ND	ND	2.86	
WS504	2.42	ND	3.1	ND	3.1	18.0	ND	ND	ND	2.95	
WS508	2.46	ND	1.3	ND	1.3	19.9	ND	ND	ND	2.88	
WS513	ND	ND	0.9	ND	0.9	19.5	ND	ND	ND	1.30	
WS514	1.46	ND	**5.0**	ND	**5.0**	**11.0**	ND	ND	ND	1.60	
WS515	ND	ND	2.1	ND	2.1	**13.2**	ND	ND	ND	2.18	
PH502A	2.62	ND	2.0	ND	2.0	**14.0**	ND	ND	ND	5.09	
PH504A	2.54	ND	ND	ND	ND	16.6	ND	ND	ND	3.14	
PH506A	1.96	ND	0.6	ND	0.6	19.2	-5.2	0.0	5.0	4.06	Bailed 10:59 - 11:04 to 3.39m (14l). Remonitored 11:51. Flow continued to fall very slowly. Water level was likely still rising.
PH507A	4.17	ND	4.1	ND	4.1	**2.4**	ND	ND	ND	4.28	
PH509A	1.85	ND	0.6	ND	0.6	**13.4**	ND	ND	ND	4.20	
PH511A	1.53	ND	0.9	ND	0.9	18.5	ND	ND	ND	4.33	
PH513A	ND	ND	1.4	ND	1.4	**15.2**	ND	ND	ND	4.85	
PH514A	4.09	ND	1.7	ND	1.7	**16.0**	ND	ND	ND	4.37	
PH516A	1.99	ND	1.0	ND	1.0	18.1	ND	ND	ND	3.37	
PH517A	3.25	ND	4.4	ND	4.4	**4.4**	ND	ND	ND	3.81	
PH518A	4.56	ND	0.8	ND	0.8	19.6	ND	ND	ND	4.66	
PH522A	4.37	ND	2.4	ND	2.4	**13.4**	ND	ND	ND	4.26	
PH524A	2.03	ND	3.6	ND	3.6	**9.1**	34.1	0.0	15.0	4.12	
PH526A	1.83	ND	1.8	ND	1.8	**13.7**	85.7	0.0	25.0	4.32	
PH528A	3.81	ND	0.9	ND	0.9	18.4	4.2	0.0	10.0	3.81	
PH530A	1.31	ND	ND	ND	ND	19.8	47.5	0.0	20.0	3.06	Bailed 10:21 - 10:26 to 2.44m (10l). Remonitored at 12:06.
PH531A	4.03	ND	1.0	ND	1.0	16.7	ND	ND	ND	4.03	

Equipment Used:	Next Calibration Date
Gas Data GFM436 Infrared Gas Analyser Geotechnical Instruments Dipmeter	22/02/2021

Key

ND	None Detected
NR	Not Recorded
1.0	Recorded value does not breach trigger levels
5.0	Recorded value breaches trigger level 1
10.0	Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (Thornhill Dewsbury Village Station)							CH_4	CO_2	O_2
	Temp (°C):	7 to 10		Barometric Pressure Trend:			Falling						
Time:	09:40	12:12	14:20	00:04	09:39	12:14	14:19	17:59	19:59	Trigger level 1	1.0	5.0	16.0
Pressure (mb):	1008	1005	1004	1009	1008	1007	1005	1002	1001	Trigger level 2	5.0	10.0	10.0
	Weather Conditions:		Overcast/ Light Breeze										
	Surface Ground Conditions:		Dry										

Remarks:

Job Title:				Job No:
Dewsbury Riverside Central Gateway				3901
Client:				Sheet :
Kirklees Council				6 of 11
Date:	Arrival Time:	Depart Time:	Operator:	
09/03/2021	09:40	14:20	Lander Latta	

LITHOS CONSULTING

Gas Monitoring Results:

Ambient Concentration (% Volume):	CH_4:	ND	CO_2:	ND	O_2:	20.4

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH_4	CO_2	CH_4	CO_2	O_2					
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m	
WS501	1.31	ND	0.6	ND	0.6	20.0	3.5	0.0	3.0	2.25	
WS502	1.75	ND	2.3	ND	2.3	17.5	ND	ND	ND	1.86	
WS503	1.99	ND	2.2	ND	2.2	17.6	ND	ND	ND	2.86	
WS504	2.42	ND	3.1	ND	3.1	18.0	ND	ND	ND	2.95	
WS508	2.46	ND	1.3	ND	1.3	19.9	ND	ND	ND	2.88	
WS513	ND	ND	0.9	ND	0.9	19.5	ND	ND	ND	1.30	
WS514	1.46	ND	**5.0**	ND	**5.0**	**11.0**	ND	ND	ND	1.60	
WS515	ND	ND	2.1	ND	2.1	**13.2**	ND	ND	ND	2.18	
PH502A	2.62	ND	2.0	ND	2.0	**14.0**	ND	ND	ND	5.09	
PH504A	2.54	ND	ND	ND	ND	16.6	ND	ND	ND	3.14	
PH506A	2.57	ND	0.2	ND	0.2	20.0	119.4	8.3	300.0	4.08	Remonitored 11:51. Flow continued to fall very slowly. Water level was likely still rising.
PH507A	4.17	ND	4.1	ND	4.1	**2.4**	ND	ND	ND	4.28	
PH509A	1.85	ND	0.6	ND	0.6	**13.4**	ND	ND	ND	4.20	
PH511A	1.53	ND	0.9	ND	0.9	18.5	ND	ND	ND	4.33	
PH513A	ND	ND	1.4	ND	1.4	**15.2**	ND	ND	ND	4.85	
PH514A	4.09	ND	1.7	ND	1.7	**16.0**	ND	ND	ND	4.37	
PH516A	1.99	ND	1.0	ND	1.0	18.1	ND	ND	ND	3.37	
PH517A	3.25	ND	4.4	ND	4.4	**4.4**	ND	ND	ND	3.81	
PH518A	4.56	ND	0.8	ND	0.8	19.6	ND	ND	ND	4.66	
PH522A	4.37	ND	2.4	ND	2.4	**13.4**	ND	ND	ND	4.26	
PH524A	2.03	ND	3.6	ND	3.6	**9.1**	34.1	0.0	15.0	4.12	
PH526A	1.83	ND	1.8	ND	1.8	**13.7**	85.7	0.0	25.0	4.32	
PH528A	3.81	ND	0.9	ND	0.9	18.4	4.2	0.0	10.0	3.81	
PH530A	1.91	ND	ND	ND	ND	20.1	ND	ND	ND	3.06	Remonitored at 12:06.
PH531A	4.03	ND	1.0	ND	1.0	16.7	ND	ND	ND	4.03	

Equipment Used:	Next Calibration Date
Gas Data GFM436 Infrared Gas Analyser Geotechnical Instruments Dipmeter	22/02/2021

Key

ND	None Detected
NR	Not Recorded
1.0	Recorded value does not breach trigger levels
5.0	Recorded value breaches trigger level 1
10.0	Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (Thornhill Dewsbury Village Station)							CH_4	CO_2	O_2
	Temp (°C):	7 to 10		Barometric Pressure Trend:			Falling						
Time:	09:40	12:12	14:20	00:04	09:39	12:14	14:19	17:59	19:59	Trigger level 1	1.0	5.0	16.0
Pressure (mb):	1008	1005	1004	1009	1008	1007	1005	1002	1001	Trigger level 2	5.0	10.0	10.0
	Weather Conditions:		Overcast/ Light Breeze										
	Surface Ground Conditions:		Dry										

Remarks:

Job Title:				Job No:
Dewsbury Riverside Central Gateway				3901
Client:				Sheet :
Kirklees Council				7 of 11
Date:	Arrival Time:	Depart Time:	Operator:	
25/03/2021	10:33	13:27	Lander Latta	

LITHOS CONSULTING

Gas Monitoring Results:

Ambient Concentration (% Volume):	CH_4:	ND	CO_2:	ND	O_2:	20.6

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH_4	CO_2	CH_4	CO_2	O_2					
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m	
WS501	1.20	ND	1.7	ND	1.7	18.8	ND	ND	ND	2.23	
WS502	1.75	ND	2.4	ND	2.4	17.4	ND	ND	ND	1.84	
WS503	1.75	ND	2.2	ND	2.2	18.1	ND	ND	ND	2.88	
WS504	2.06	ND	3.6	ND	3.6	**8.7**	ND	ND	ND	2.89	
WS508	1.68	ND	0.7	ND	0.7	20.1	ND	ND	ND	2.87	
WS513	ND	ND	0.9	ND	0.9	19.5	ND	ND	ND	1.30	
WS514	1.14	ND	3.7	ND	3.7	**15.4**	ND	ND	ND	1.56	
WS515	ND	ND	2.7	ND	2.7	**13.2**	ND	ND	ND	2.18	
PH502A	2.79	ND	2.3	ND	2.3	**13.2**	116.2	0.0	30.0	5.09	
PH504A	2.23	ND	ND	ND	ND	16.1	ND	ND	ND	3.13	
PH506A	1.69	ND	0.7	ND	0.7	19.4	119.9	4.0	720.0	3.98	Flow continued to fall very slowly. Bailed 11:58 - 12:04 to (11l). Remonitored at 12:58. Flow continued to fall very slowly.
PH507A	3.92	ND	3.9	ND	3.9	**1.0**	21.0	0.0	15.0	4.30	
PH509A	1.70	ND	1.5	ND	1.5	**13.1**	ND	ND	ND	4.17	
PH511A	1.39	ND	1.4	ND	1.4	**15.1**	47.1	0.0	25.0	4.39	
PH513A	4.85	ND	2.3	ND	2.3	**14.0**	ND	ND	ND	4.87	
PH514A	3.08	ND	1.6	ND	1.6	16.2	ND	ND	ND	4.34	
PH516A	1.79	ND	1.3	ND	1.3	17.6	ND	ND	ND	3.38	
PH517A	2.91	ND	4.4	ND	4.4	**3.5**	ND	ND	ND	3.80	
PH518A	3.97	ND	1.0	ND	1.0	18.7	ND	ND	ND	4.63	
PH522A	2.16	ND	3.6	ND	3.6	**10.9**	ND	ND	ND	4.27	
PH524A	1.85	ND	3.9	ND	3.9	**5.6**	74.4	0.0	40.0	4.12	
PH526A	1.58	ND	2.1	ND	2.1	**11.1**	106.9	0.0	15.0	4.32	
PH528A	3.82	ND	0.9	ND	0.9	19.5	3.3	0.0	3.0	3.94	
PH530A	1.26	ND	0.4	ND	0.4	19.6	-10.7	0.0	15.0	3.04	Bailed 11:07 - 11:11 to 2.43 (6l). Remonitored at at 13:20.
PH531A	3.97	ND	0.6	ND	0.6	17.3	ND	ND	ND	4.37	

Equipment Used:

Gas Data GFM436 Infrared Gas Analyser
Geotechnical Instruments Dipmeter

Next Calibration Date

22/02/2021

Key

ND	None Detected
NR	Not Recorded
1.0	Recorded value does not breach trigger levels
5.0	Recorded value breaches trigger level 1
10.0	Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (Earlsheaton Station)									
	Temp (°C):	11 to 13		Barometric Pressure Trend:			Falling				CH_4	CO_2	O_2
Time:	10:33	12:38	13:27	00:04	05:59	10:34	12:39	13:29	18:59	Trigger level 1	1.0	5.0	16.0
Pressure (mb):	1009	1002	1005	999	997	997	996	996	993	Trigger level 2	5.0	10.0	10.0
	Weather Conditions:		Sunny/ Breezy										
	Surface Ground Conditions:		Dry										

Remarks:

Job Title:				Job No:
Dewsbury Riverside Central Gateway				3901
Client:				Sheet :
Kirklees Council				8 of 11
Date:	Arrival Time:	Depart Time:	Operator:	
25/03/2021	10:33	13:27	Lander Latta	

LITHOS CONSULTING

Gas Monitoring Results:

Ambient Concentration (% Volume):	CH_4:	ND	CO_2:	ND	O_2:	20.6

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH_4	CO_2	CH_4	CO_2	O_2					
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m	
WS501	1.20	ND	1.7	ND	1.7	18.8	ND	ND	ND	2.23	
WS502	1.75	ND	2.4	ND	2.4	17.4	ND	ND	ND	1.84	
WS503	1.75	ND	2.2	ND	2.2	18.1	ND	ND	ND	2.88	
WS504	2.06	ND	3.6	ND	3.6	**8.7**	ND	ND	ND	2.89	
WS508	1.68	ND	0.7	ND	0.7	20.1	ND	ND	ND	2.87	
WS513	ND	ND	0.9	ND	0.9	19.5	ND	ND	ND	1.30	
WS514	1.14	ND	3.7	ND	3.7	**15.4**	ND	ND	ND	1.56	
WS515	ND	ND	2.7	ND	2.7	**13.2**	ND	ND	ND	2.18	
PH502A	2.79	ND	2.3	ND	2.3	**13.2**	116.2	0.0	30.0	5.09	
PH504A	2.23	ND	ND	ND	ND	16.1	ND	ND	ND	3.13	
PH506A	2.42	ND	0.3	ND	0.3	20.7	120.0	24.0	300.0	3.98	Bailed 11:58 - 12:04 to (11l). Remonitored at 12:58. Flow continued to fall very slowly.
PH507A	3.92	ND	3.9	ND	3.9	**1.0**	21.0	0.0	15.0	4.30	
PH509A	1.70	ND	1.5	ND	1.5	**13.1**	ND	ND	ND	4.17	
PH511A	1.39	ND	1.4	ND	1.4	**15.1**	47.1	0.0	25.0	4.39	
PH513A	4.85	ND	2.3	ND	2.3	**14.0**	ND	ND	ND	4.87	
PH514A	3.08	ND	1.6	ND	1.6	16.2	ND	ND	ND	4.34	
PH516A	1.79	ND	1.3	ND	1.3	17.6	ND	ND	ND	3.38	
PH517A	2.91	ND	4.4	ND	4.4	**3.5**	ND	ND	ND	3.80	
PH518A	3.97	ND	1.0	ND	1.0	18.7	ND	ND	ND	4.63	
PH522A	2.16	ND	3.6	ND	3.6	**10.9**	ND	ND	ND	4.27	
PH524A	1.85	ND	3.9	ND	3.9	**5.6**	74.4	0.0	40.0	4.12	
PH526A	1.58	ND	2.1	ND	2.1	**11.1**	106.9	0.0	15.0	4.32	
PH528A	3.82	ND	0.9	ND	0.9	19.5	3.3	0.0	3.0	3.94	
PH530A	1.83	ND	0.2	ND	0.2	19.0	ND	ND	ND	3.08	Remonitored at at 13:20.
PH531A	3.97	ND	0.6	ND	0.6	17.3	ND	ND	ND	4.37	

Equipment Used:	Next Calibration Date
Gas Data GFM436 Infrared Gas Analyser Geotechnical Instruments Dipmeter	22/02/2021

Key

ND	None Detected
NR	Not Recorded
1.0	Recorded value does not breach trigger levels
5.0	Recorded value breaches trigger level 1
10.0	Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (Earlsheaton Station)							CH_4	CO_2	O_2
	Temp (°C):	11 to 13		Barometric Pressure Trend:			Falling						
Time:	10:33	12:38	13:27	00:04	05:59	10:34	12:39	13:29	18:59	Trigger level 1	1.0	5.0	16.0
Pressure (mb):	1009	1002	1005	999	997	997	996	996	993	Trigger level 2	5.0	10.0	10.0
	Weather Conditions:		Sunny/ Breezy										
	Surface Ground Conditions:		Dry										

Remarks:

Job Title:				Job No:
Dewsbury Riverside Central Gateway				3901
Client:				Sheet :
Kirklees Council				9 of 11
Date:	Arrival Time:	Depart Time:	Operator:	
30/04/2021	09:00	15:15	Lander Latta	

LITHOS CONSULTING

Gas Monitoring Results:

Ambient Concentration (% Volume):	CH_4:	ND	CO_2:	ND	O_2:	20.7

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH_4	CO_2	CH_4	CO_2	O_2					
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m	
WS501	1.89	ND	1.7	ND	1.7	18.8	ND	ND	ND	2.24	
WS502	1.74	ND	1.8	ND	1.4	18.8	ND	ND	ND	1.83	
WS503	1.84	ND	1.2	ND	1.2	19.1	ND	ND	ND	2.88	
WS504	2.77	ND	4.3	ND	4.3	**4.1**	ND	ND	ND	2.87	
WS508	1.81	ND	0.7	ND	0.7	19.8	ND	ND	ND	2.88	
WS513	ND	ND	0.8	ND	0.8	19.8	ND	ND	ND	1.28	
WS514	1.39	ND	3.7	ND	3.7	17.3	ND	ND	ND	1.46	
WS515	ND	ND	4.4	ND	4.4	**10.8**	ND	ND	ND	2.17	
PH502A	2.81	ND	3.0	ND	3.0	**11.4**	67.0	0.0	15.0	5.09	
PH504A	2.16	ND	0.3	ND	0.3	19.7	ND	ND	ND	3.14	
PH506A	2.75	ND	0.8	ND	0.8	19.2	ND	ND	ND	3.93	
PH507A	4.17	ND	4.6	ND	4.6	**1.1**	ND	ND	ND	4.27	
PH509A	2.19	ND	2.4	ND	2.4	**14.2**	ND	ND	ND	4.17	
PH511A	3.41	ND	2.6	ND	2.6	16.4	ND	ND	ND	4.34	
PH513A	ND	ND	1.1	ND	1.1	18.0	ND	ND	ND	4.87	
PH514A	4.27	ND	2.1	ND	2.1	19.5	ND	ND	ND	4.37	
PH516A	2.19	ND	0.7	ND	0.7	20.2	ND	ND	ND	3.37	
PH517A	3.77	ND	4.0	ND	4.0	**10.9**	ND	ND	ND	3.81	
PH518A	ND	ND	1.3	ND	1.3	19.8	ND	ND	ND	4.62	
PH522A	3.74	ND	3.3	ND	3.3	**14.9**	ND	ND	ND	4.26	
PH524A	2.76	ND	2.9	ND	2.9	**15.0**	-20.7	0.0	15.0	4.16	Valve open on arrival. Closed at 10:06. Monitored at 14:55
PH526A	1.61	ND	2.6	ND	2.6	**8.6**	-68.7	0.0	20.0	4.30	
PH528A	3.75	ND	1.8	ND	1.8	17.5	0.6	0.0	2.0	3.91	
PH530A	1.54	ND	0.4	ND	0.4	18.6	-68.4	0.0	25.0	3.02	
PH531A	4.05	ND	0.9	ND	0.9	19.9	ND	ND	ND	4.31	

Equipment Used:	Next Calibration Date
Gas Data GFM436 Infrared Gas Analyser Geotechnical Instruments Dipmeter	22/02/2021

Key

ND	None Detected
NR	Not Recorded
1.0	Recorded value does not breach trigger levels
5.0	Recorded value breaches trigger level 1
10.0	Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (Batley Station)							CH_4	CO_2	O_2
	Temp (°C):	7 to 12		Barometric Pressure Trend:			Steady						
Time:	09:00	13:22	15:15	00:00	09:00	13:25	15:20	18:00	20:00	Trigger level 1	1.0	5.0	16.0
Pressure (mb):	1010	1011	1008	1017	1016	1015	1015	1015	1016	Trigger level 2	5.0	10.0	10.0
	Weather Conditions:		Sunny/ Breezy										
	Surface Ground Conditions:		Dry										

Remarks:

Job Title:				Job No:
Dewsbury Riverside Central Gateway				3901
Client:				Sheet :
Kirklees Council				10 of 11
Date:	Arrival Time:	Depart Time:	Operator:	
19/05/2021	09:10	15:15	Lander Latta	

LITHOS CONSULTING

Gas Monitoring Results:

Ambient Concentration (% Volume):	CH_4:	ND	CO_2:	ND	O_2:	20.7

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH_4	CO_2	CH_4	CO_2	O_2					
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m	
WS501	1.14	ND	1.6	ND	1.6	18.4	ND	ND	ND	2.24	Bailed 10:53 - 10:55 to 1.98m (2l). Remonitored at 11:18.
WS502	1.78	ND	0.9	ND	0.9	19.9	ND	ND	ND	1.84	
WS503	1.67	ND	2.2	ND	2.2	18.7	ND	ND	ND	2.87	
WS504	1.25	ND	2.5	ND	2.5	**4.2**	17.5	0.0	5.0	2.89	
WS508	1.39	ND	0.9	ND	0.9	19.7	ND	ND	ND	2.85	
WS513	ND	ND	1.2	ND	1.2	19.3	ND	ND	ND	1.27	
WS514	0.85	ND	3.1	ND	3.1	17.1	ND	ND	ND	1.52	
WS515	ND	ND	2.9	ND	2.9	**15.2**	ND	ND	ND	2.16	
PH502A	2.76	ND	3.4	ND	3.4	**9.0**	119.4	0.0	30.0	5.08	
PH504A	2.12	ND	0.3	ND	0.3	19.2	ND	ND	ND	3.14	
PH506A	1.53	ND	0.9	ND	0.9	18.5	119.8	0.0	600.0	3.88	Bailed 10:30 - 10:36 to 3.12m (11l). Remonitored at 11:35.
PH507A	3.68	ND	4.0	ND	4.0	**2.3**	-10.4	0.0	15.0	4.28	
PH509A	1.72	ND	1.4	ND	1.4	**15.2**	ND	ND	ND	4.18	
PH511A	1.20	ND	2.2	ND	2.2	**15.6**	38.4	0.0	40.0	4.29	
PH513A	ND	ND	1.1	ND	1.1	18.0	ND	ND	ND	4.85	
PH514A	3.32	ND	1.9	ND	1.9	19.0	ND	ND	ND	4.37	
PH516A	1.57	ND	0.5	ND	0.5	19.6	-0.8	0.0	5.0	4.34	
PH517A	3.72	ND	2.3	ND	2.3	**15.1**	ND	ND	ND	3.78	
PH518A	3.82	ND	0.9	ND	0.9	19.5	ND	ND	ND	4.62	
PH522A	2.06	ND	2.8	ND	2.8	**8.6**	ND	ND	ND	4.23	
PH524A	2.67	ND	4.5	ND	4.5	**9.4**	114.7	0.0	70.0	4.10	
PH526A	1.62	ND	2.4	ND	2.4	**9.4**	56.0	0.0	10.0	4.28	
PH528A	3.76	ND	1.0	ND	1.0	18.7	-64.0	0.0	80.0	3.86	
PH530A	1.56	ND	0.8	ND	0.8	19.8	14.7	0.0	10.0	4.01	
PH531A	4.05	ND	1.3	ND	1.3	18.6	ND	ND	ND	4.32	

Equipment Used:	Next Calibration Date
Gas Data GFM436 Infrared Gas Analyser Geotechnical Instruments Dipmeter	22/02/2021

Key	
ND	None Detected
NR	Not Recorded
1.0	Recorded value does not breach trigger levels
5.0	Recorded value breaches trigger level 1
10.0	Recorded value breaches trigger level 2

	Site Data:			Weather Station Data (Ossett Station)					
	Temp (°C):	12 to 15		Barometric Pressure Trend:			Rising		
Time:	09:10	13:26	15:15	00:00	09:00	13:30	15:15	18:00	20:00
Pressure (mb):	1010	1012	1011	1014	1016	1018	1019	1018	1019
	Weather Conditions:		Sunny/ Rain/ Cloudy/ Windy						
	Surface Ground Conditions:		Damp						

	CH_4	CO_2	O_2
Trigger level 1	1.0	5.0	16.0
Trigger level 2	5.0	10.0	10.0

Remarks:

Job Title:				Job No:
Dewsbury Riverside Central Gateway				3901
Client:				Sheet :
Kirklees Council				11 of 11
Date:	Arrival Time:	Depart Time:	Operator:	
19/05/2021	09:10	15:15	Lander Latta	

LITHOS CONSULTING

Gas Monitoring Results:

Ambient Concentration (% Volume):	CH_4:	ND	CO_2:	ND	O_2:	20.7

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH_4	CO_2	CH_4	CO_2	O_2					
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m	
WS501	1.72	ND	0.3	ND	0.3	20.6	ND	ND	ND	2.25	Remonitored at 11:18.
WS502	1.78	ND	0.9	ND	0.9	19.9	ND	ND	ND	1.84	
WS503	1.67	ND	2.2	ND	2.2	18.7	ND	ND	ND	2.87	
WS504	1.25	ND	2.5	ND	2.5	**4.2**	17.5	0.0	5.0	2.89	
WS508	1.39	ND	0.9	ND	0.9	19.7	ND	ND	ND	2.85	
WS513	ND	ND	1.2	ND	1.2	19.3	ND	ND	ND	1.27	
WS514	0.85	ND	3.1	ND	3.1	17.1	ND	ND	ND	1.52	
WS515	ND	ND	2.9	ND	2.9	**15.2**	ND	ND	ND	2.16	
PH502A	2.76	ND	3.4	ND	3.4	**9.0**	119.4	0.0	30.0	5.08	
PH504A	2.12	ND	0.3	ND	0.3	19.2	ND	ND	ND	3.14	
PH506A	1.73	ND	0.7	ND	0.7	20.2	120.0	0.0	600.0	3.90	Remonitored at 11:35.
PH507A	3.68	ND	4.0	ND	4.0	**2.3**	-10.4	0.0	15.0	4.28	
PH509A	1.72	ND	1.4	ND	1.4	**15.2**	ND	ND	ND	4.18	
PH511A	1.20	ND	2.2	ND	2.2	**15.6**	38.4	0.0	40.0	4.29	
PH513A	ND	ND	1.1	ND	1.1	18.0	ND	ND	ND	4.85	
PH514A	3.32	ND	1.9	ND	1.9	19.0	ND	ND	ND	4.37	
PH516A	1.57	ND	0.5	ND	0.5	19.6	-0.8	0.0	5.0	4.34	
PH517A	3.72	ND	2.3	ND	2.3	**15.1**	ND	ND	ND	3.78	
PH518A	3.82	ND	0.9	ND	0.9	19.5	ND	ND	ND	4.62	
PH522A	2.06	ND	2.8	ND	2.8	**8.6**	ND	ND	ND	4.23	
PH524A	2.67	ND	4.5	ND	4.5	**9.4**	114.7	0.0	70.0	4.10	
PH526A	1.62	ND	2.4	ND	2.4	**9.4**	56.0	0.0	10.0	4.28	
PH528A	3.76	ND	1.0	ND	1.0	18.7	-64.0	0.0	80.0	3.86	
PH530A	1.56	ND	0.8	ND	0.8	19.8	14.7	0.0	10.0	4.01	
PH531A	4.05	ND	1.3	ND	1.3	18.6	ND	ND	ND	4.32	

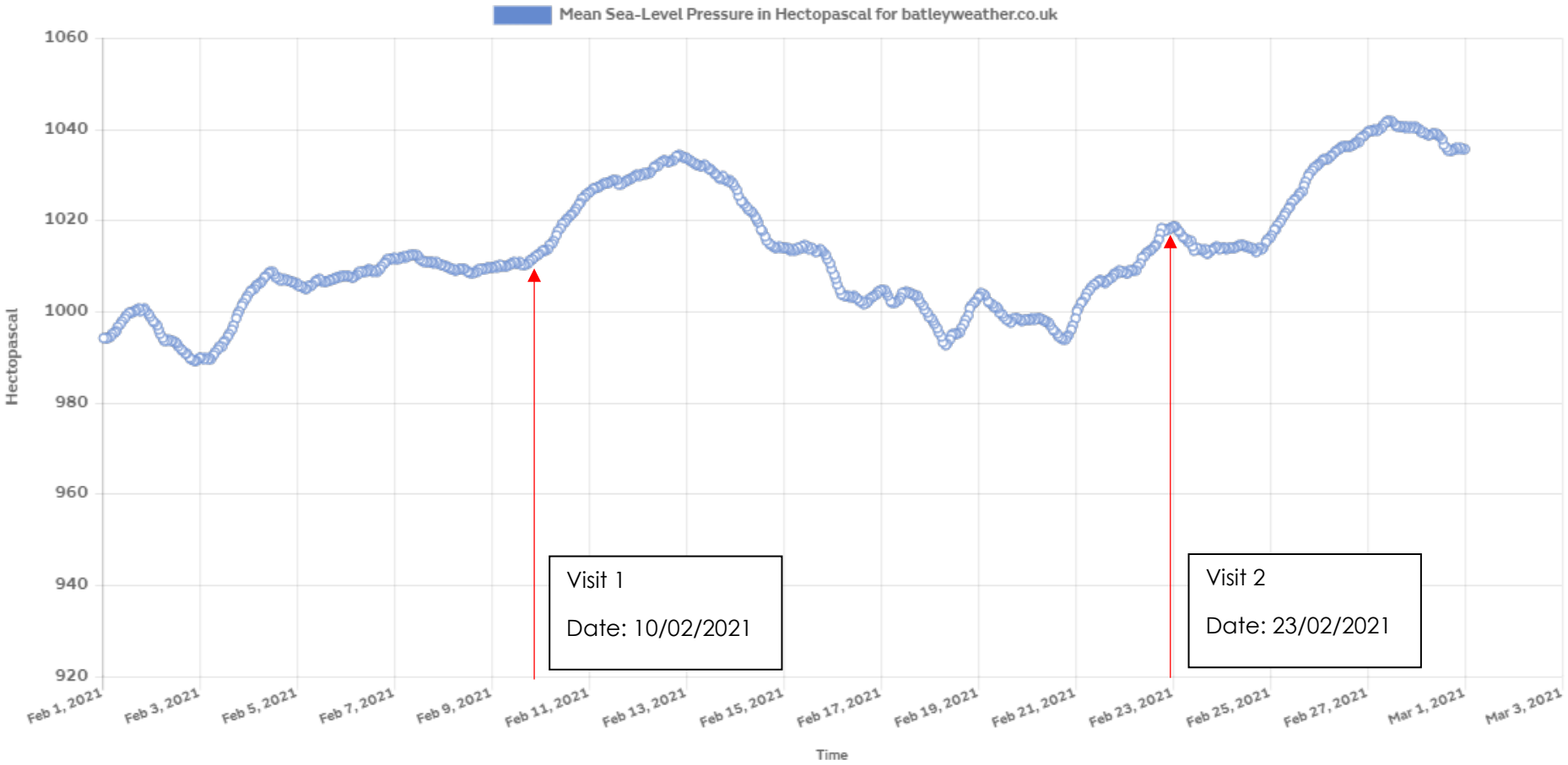
Equipment Used:	Next Calibration Date
Gas Data GFM436 Infrared Gas Analyser Geotechnical Instruments Dipmeter	22/02/2021

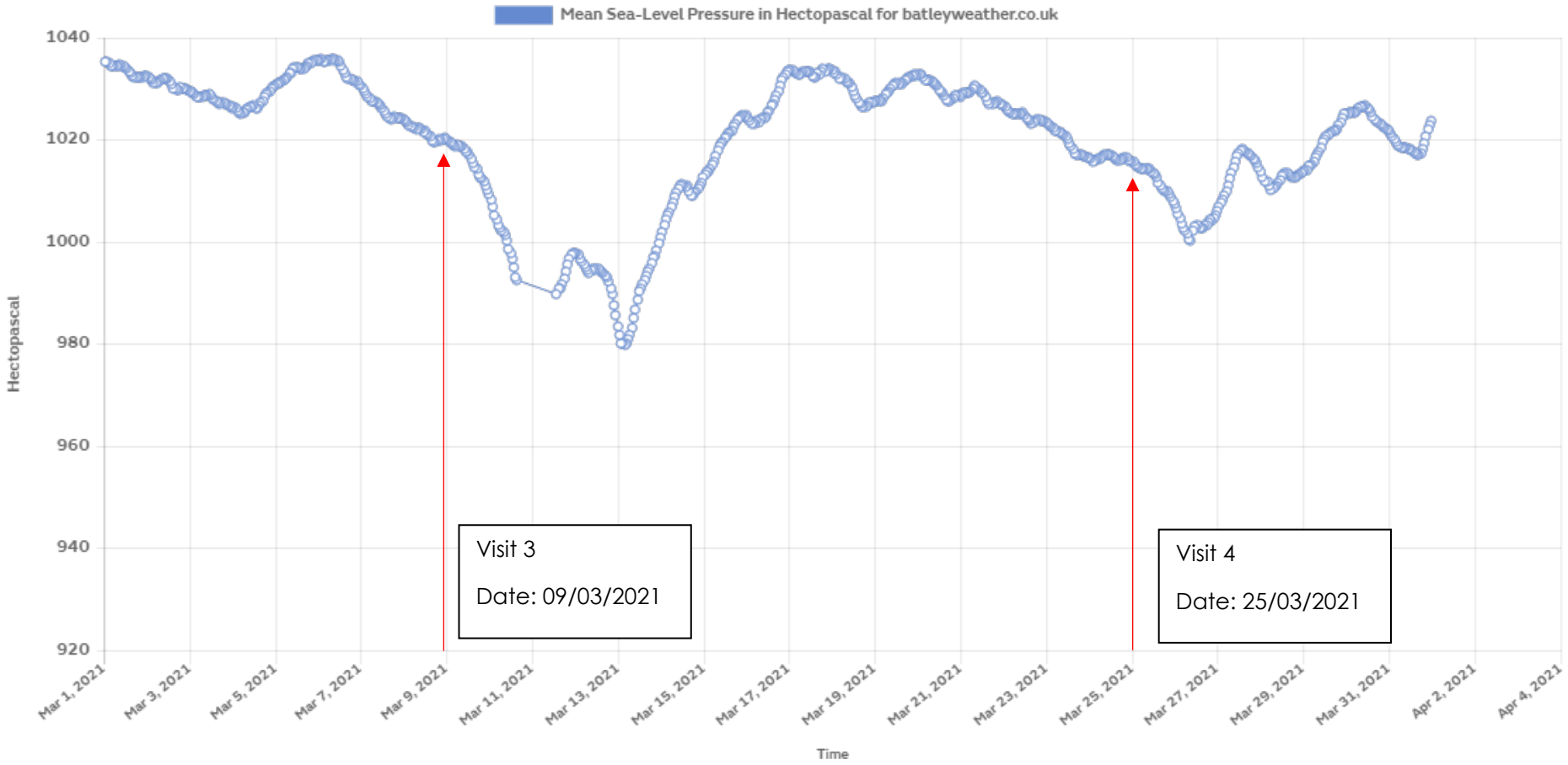
Key	
ND	None Detected
NR	Not Recorded
1.0	Recorded value does not breach trigger levels
5.0	Recorded value breaches trigger level 1
10.0	Recorded value breaches trigger level 2

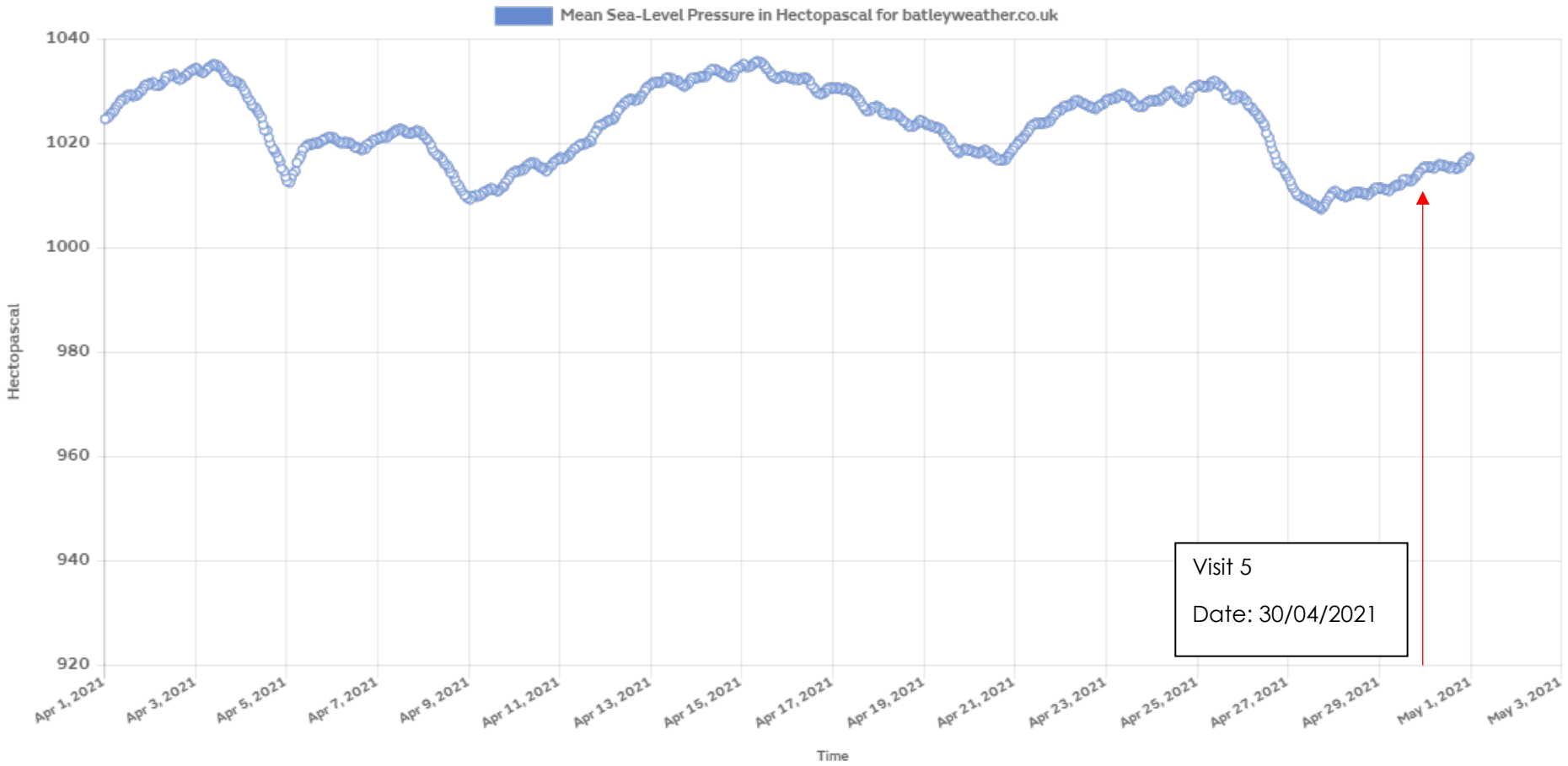
	Site Data:			Weather Station Data (Ossett Station)					
	Temp (°C):	12 to 15		Barometric Pressure Trend:			Rising		
Time:	09:10	13:26	15:15	00:00	09:00	13:30	15:15	18:00	20:00
Pressure (mb):	1010	1012	1011	1014	1016	1018	1019	1018	1019
	Weather Conditions:		Sunny/ Rain/ Cloudy/ Windy						
	Surface Ground Conditions:		Damp						

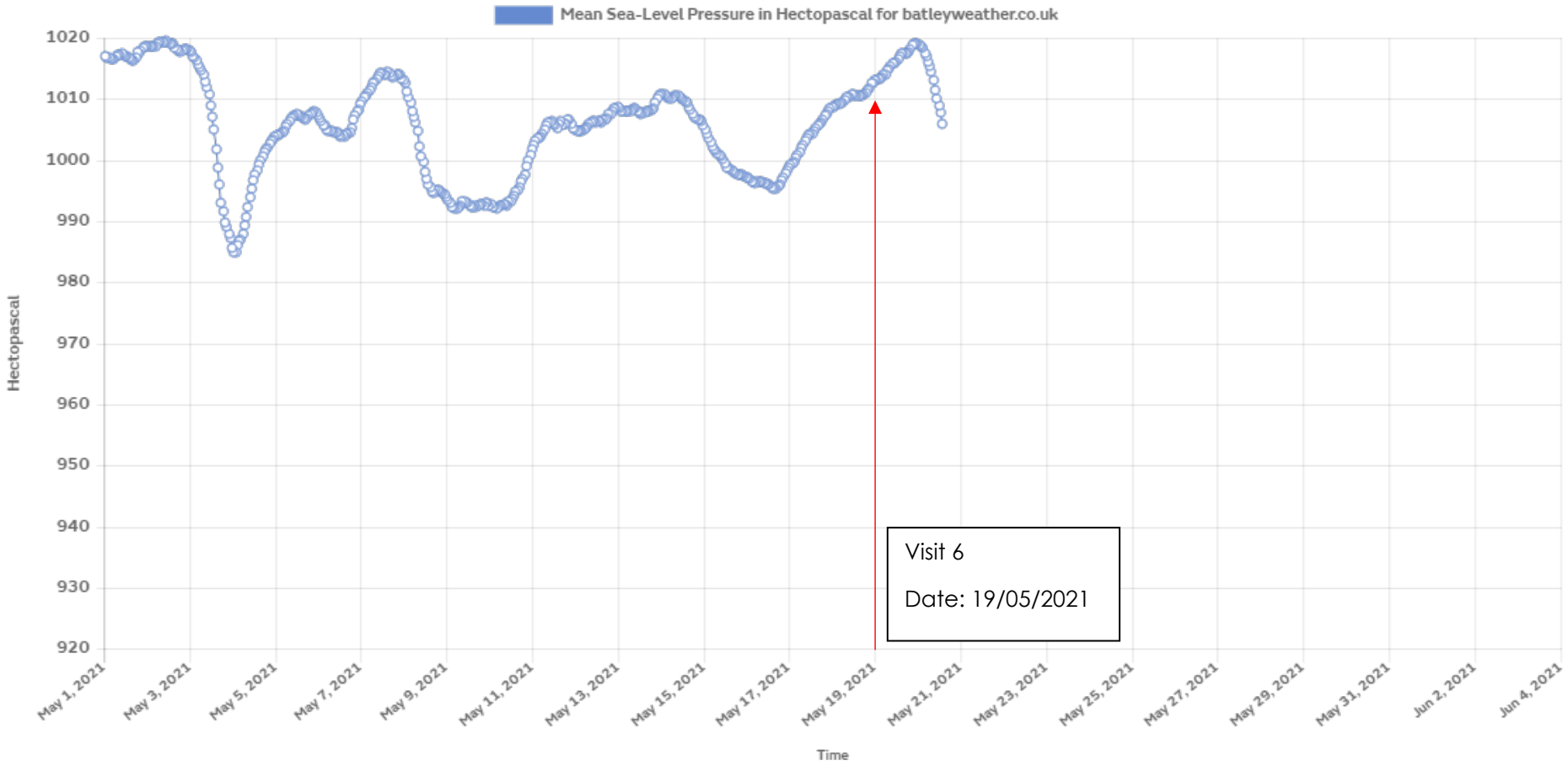
	CH_4	CO_2	O_2
Trigger level 1	1.0	5.0	16.0
Trigger level 2	5.0	10.0	10.0

Remarks:


Mean Sea-Level Pressure in Hectopascal for batleyweather.co.uk
Hectopascal
1060
1040
1020
1000
980
960
940
920
Feb 1, 2021
Feb 3, 2021
Feb 5, 2021
Feb 7, 2021
Feb 9, 2021
Feb 11, 2021
Feb 13, 2021
Feb 15, 2021
Feb 17, 2021
Feb 19, 2021
Feb 21, 2021
Feb 23, 2021
Feb 25, 2021
Feb 27, 2021
Mar 1, 2021
Mar 3, 2021
Time
Visit 1
Date: 10/02/2021
Visit 2
Date: 23/02/2021


Mean Sea-Level Pressure in Hectopascal for batleyweather.co.uk
Hectopascal
1040
1020
1000
980
960
940
920
Mar 1, 2021
Mar 3, 2021
Mar 5, 2021
Mar 7, 2021
Mar 9, 2021
Mar 11, 2021
Mar 13, 2021
Mar 15, 2021
Mar 17, 2021
Mar 19, 2021
Mar 21, 2021
Mar 23, 2021
Mar 25, 2021
Mar 27, 2021
Mar 29, 2021
Mar 31, 2021
Apr 2, 2021
Apr 4, 2021
Time
Visit 3
Date: 09/03/2021
Visit 4
Date: 25/03/2021


Mean Sea-Level Pressure in Hectopascal for batleyweather.co.uk
Hectopascal
1040
1020
1000
980
960
940
920
Apr 1, 2021
Apr 3, 2021
Apr 5, 2021
Apr 7, 2021
Apr 9, 2021
Apr 11, 2021
Apr 13, 2021
Apr 15, 2021
Apr 17, 2021
Apr 19, 2021
Apr 21, 2021
Apr 23, 2021
Apr 25, 2021
Apr 27, 2021
Apr 29, 2021
May 1, 2021
May 3, 2021
Time
Visit 5
Date: 30/04/2021


Mean Sea-Level Pressure in Hectopascal for batleyweather.co.uk
Hectopascal
1020
1010
1000
990
980
970
960
950
940
930
920
May 1, 2021
May 3, 2021
May 5, 2021
May 7, 2021
May 9, 2021
May 11, 2021
May 13, 2021
May 15, 2021
May 17, 2021
May 19, 2021
May 21, 2021
May 23, 2021
May 25, 2021
May 27, 2021
May 29, 2021
May 31, 2021
Jun 2, 2021
Jun 4, 2021
Time
Visit 6
Date: 19/05/2021

Appendix M
Yorkshire Water Contaminated Land Assessment Form

Contaminated Land Assessment Form

Introduction

In January 2011, UK Water Industry Research (UKWIR) published “Guidance for the selection of Water Supply Pipes to be used in Brownfield Sites” (UKWIR 2010 Ref 10/WM/03/21). The aim of this publication is to ensure that the correct materials are selected for Water Pipes to be used below ground in Brownfield Sites. It supersedes the Water Regulations Advisory Scheme (WRAS) Information and Guidance Note 9-04-03 “Laying Pipes in Contaminated Land” which has now been withdrawn.

The UKWIR guidance is for use by Water Companies, Self-Lay Organisations, Developers and Consultants during the planning, designing and construction of water mains and/or services in Brownfield Sites. The guidance defines a Brownfield Site as “Land or premises that have not previously been used or developed. They may also be vacant or derelict. However, they are not necessarily contaminated.” UKWIR state the guidance does not apply to Greenfield Sites, however YW reserve the right to apply relevant sections of the publication to Greenfield Sites that may potentially be contaminated.

Contamination Risk Assessment

Please complete the form below to allow us to assess the risk of contamination of the drinking water supply from chemicals within the soil. Yorkshire Water now lays all its water mains and service pipes in plastic. Many organic compounds (i.e. Phenols, Fuels and other hydrocarbons) can either permeate through the walls of plastic pipes into the water supply or dissolve and weaken the pipe causing water leaks.

As a minimum a desk top study (Preliminary Risk Assessment) shall be provided to YW that sets out whether the land through which the Water Pipes are to be laid may be affected by contamination. For those sites where land contamination may be present, appropriate testing shall be undertaken on existing ground materials and remediated materials. The testing requirements are as described below:

Testing Requirements

The tests that are required on all sites where the potential for contamination has been established through the desk top study and where water pipes are proposed to be laid must be undertaken by bodies with accreditation from UKAS (United Kingdom Accreditation Service) and where possible MCERTS (Environment Agency’s Monitoring Certification Service).

The tests on soil/water samples shall be those to detect and report on the levels of the following contaminant groups and chemical characteristics: **VOC’s, SVOC’s, Mineral Oil compounds C10-C40, Conductivity, pH** and **Redox potential** (as stipulated in the UKWIR guidance Appendix G).
If the previous function of the site involved the use, storage, manufacture or disposal of any of the following elements, appropriate testing for these substances will be required:

Ethers, Nitrobenzene, Ketones, Aldehydes and Amines. Please note UKWIR guidance states the presence of Amines on any site precludes the use of Polyethylene pipework.

Sufficiency of Testing

Samples taken must be representative of the soil conditions in which the Water Pipes are proposed to be laid (normally Water Pipes are laid at a depth between 0.7m and 1.3m below finished ground level). As a result samples must be taken at least 500mm below the base of the proposed pipe where the proposed location is known. If the proposed location is unknown then samples must be taken at intervals between the surface level and 1.5m from below finished ground level as a minimum. Where appropriate groundwater sampling and groundwater monitoring will also be necessary (see UKWIR guidance).

Further guidance on representative sampling is contained within BS10175:2011 “Code of practice for the Investigation of Potentially Contaminated Sites”.

The table in section 3 lists the contaminants and their respective levels which can permeate or damage plastic water pipes with consequent risk to the water supply. Where soil analysis results indicate levels of these contaminants above the maximum allowable concentration shown, then Yorkshire Water will determine that all mains and service pipes are laid in suitable materials resistant to the risks posed by those contaminants. Where sites have been used for any of the activities listed in Section 2 all mains and services shall be laid in suitable permeation resistant pipe systems due to the high risk of these contaminants being present.

Health & Safety Assessment

The UKWIR guidance does not cover Health & Safety considerations as part of any operational activities undertaken on Brownfield Sites. In order to maintain the safety of our staff, service partners and customers YW will also assess the site based on the EA CLEA (Contaminated Land Exposure Assessment) guidelines.

In order to comply with Yorkshire Water’s Health & safety requirements please review the following information relating to trigger values for Health & Safety considerations when laying Water Pipes in contaminated Land.

	Contaminant	Mg/Kg		Contaminant	Mg/Kg
Inorganic	Arsenic	32	Organic	Benzene	0.33
	Nickel	130		Toulene	610
	Mercury	170		Ethylbenzene	350
	Selenium	35		Xylene	230
	Cadmium	10		Phenol	420

Topsoil across the whole site, and made ground recovered from the far northeast and west includes concentrations of arsenic in excess of the above screening value, however none of the samples tested returned any other inorganic contaminants in excess of the above screening values.

Given the absence of petroleum sources made ground and Topsoil from across the site has not been tested for BTEX of phenols to date, although on consideration of the conceptual site model it is unlikely that these contaminants would be present in significant concentrations.

1. Your Details

Company Name	Contact Name
Lithos Consulting Ltd	George Morton

Site Address	Contact Number
Land south of Ravenshall Road, Dewsbury	01937 545338

2. The Previous Use of the Site

Please indicate below the previous uses of the site being developed

The majority of the site is greenfield; arable farmland, with localised underground coal mining.

The far-northeast is occupied by allotment gardens, a car park which is attached to a nursery and Ravensthorpe School (associated buildings, parking and outdoor play areas).

The far-west has been subject to opencast coal mining and subsequent backfilling with materials comprising Ash & Clinker, reworked natural soils and Burnt Shale. To date investigation in the west has been minimal and further made ground types may be present. However at this stage no development is proposed in the west.

Please indicate if the site (or part of it) has previously been used for any of the following activities:

	Chemicals Manufacture		Paint or Ink Manufacture
	Explosives / Ordnance Manufacture		Railway Land / Railway Engineering
	Fuel Filling Stations / Storage		Scrap metals
	Metal Finishing / Treating		Shipbuilding & Repair
	Mechanical Engineering Works		Vehicle Repair Garages
	Oil & Gas Refineries / Storage		Vehicle Manufacturing

We have no knowledge of any of the above processes having taken place across this site.

3. Contaminants

Please complete the table below with the highest concentrations in mg/kg of each or any of the contaminants listed. The information should be extracted from your soil reports already undertaken, if any of the contaminants were not tested for, this should be declared on the form along with the reasons for this. If you have any difficulty interpreting the results of your soil sample analyses and transposing them into the table, then you should consult the body who undertook the sampling and reporting. If there are more than 3 sample locations with associated test results please copy the table for each location and label each with the sample reference and its location on a site plan.

Laboratory Name:		Date	Concentration	
Group No.	Parameter group	Unit	Depth (m)	Detection Limit
1	Extended VOC suite (with TIC)	mg/kg	N/A	0.5
1a	BTEX & MTBE	mg/kg	N/A	0.1
2	Extended SVOC suite (with TIC)	mg/kg	N/A	2
2e	Phenols	mg/kg	N/A	2
2f	Cresols and chlorinated phenols	mg/kg	N/A	2
3	Mineral Oils C_{11}-C_{20}	mg/kg	2,130 - WS507 at 0.1m	10
4	Mineral Oils C_{21}-C_{40}	mg/kg	7,000 – WS507 at 0.1m	500
5	Corrosive (Conductivity, Redox & pH)		N/A	
	Conductivity	µS/cm	N/A	
	Redox	Volt	N/A	
	pH	pH	6.5 to 9.4	
2a	Ethers	mg/kg	N/A	0.5
2b	Nitrobenzene	mg/kg	N/A	0.5
2c	Ketones	mg/kg	N/A	0.5
2d	Aldehydes	mg/kg	N/A	0.5
6	Amines	mg/kg	N/A	Any presence

At the time of investigation, the proposed route(s), and total length, of pipeline were unknown. Consequently, to date laboratory testing of soil samples in line with UKWIR guidance was not undertaken. Sampling within 15m of proposed water supply pipes could be undertaken, once infrastructure design have been completed.

However the only areas of significant organic contamination have been encountered in the far-northeast (beneath allotment gardens & the nursery car park) and in the far-west where no development is proposed. The majority of the site's area is greenfield and no significant contamination has been found to date.

Consequently, given the site's history, and ground conditions encountered, the use of 'standard' polyethylene pipes should be acceptable across the site with the exception of the far northeast where further testing is advised; there may be a need for the use of Protectaline mains with plastic coated copper hose connections subject to the findings of the further testing.

DO NOT include a copy of your soil report with your application, if you do not complete the table above your application will be returned to you.

Please include a site plan highlighting the locations of the above sample points.

Please see Lithos' Drawing 3901/6.

4. Remediation of the site

Please indicate below any remediation work that will be undertaken on the site to remove / mitigate the effect of any contaminants identified in the soil report. Please include the nature and depth of any remediation work.

n/a

5. Can I use plastic pipe if I undertake remediation works?

Yes, as long as the remediation work either removes the contaminated soil or reduces the level of contaminants below trigger levels. Moving contaminated material so that it is under roads and footpaths is not acceptable as this is the likely location of the water mains.

As water mains are lad to a depth of 0.9m to the top of the pipe, any contaminated soil to a depth of 1.3m must be removed. We will require post remediation sampling results confirming contamination has fallen below the trigger levels prior to releasing any works to our Service Partners.

If contamination is found all water mains and services on the site must be laid in a suitable barrier pipe. Yorkshire Water will not change the agreed mains material after the agreement has been signed by all parties. So please ensure your remediation proposals are made clear at this stage.

6. Declaration

I hereby confirm that the information provided in this form is true and I understand that should the site conditions change from those indicated in this report that I may incur additional costs.

Your Signature	Date
	04/03/2021

Your Name & Title (PLEASE PRINT	Role in organisation
GEORGE MORTON CGeol FGS BSc (hons)	Senior Engineer

Please return this completed form with your application to Developer Services,
Yorkshire Water Services Ltd, PO Box 52, Bradford BD3 7YD

References

BS10175:2011 “Investigation of Potentially Contaminated Sites Code of Practice
UK Water Industry Research (UKWIR) “ Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites” (Ref 10/WM/03/21)