REPORT C6138 Rev 1
OCTOBER 2015

PRELIMINARY APPRAISAL REPORT (DESK STUDY)

of land off
CARRS LANE, CUDWORTH, BARNSLEY

prepared for
BARRATT & DAVID WILSON HOMES

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SITE:	CARRS LANE, CUDWORTH, BARNSLEY		
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C6138/04	Preliminary Conceptual Site Model	NTS

NTS: Not to Scale

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EXECUTIVE SUMMARY

Introduction	Sirius Geotechnical and Environmental Ltd were commissioned by Barratt & David Wilson Homes (BDW), to undertake a preliminary appraisal report (desk study) at land off Carr Lane, Cudworth, Barnsley, South Yorkshire (the "site"). This desk study has been completed to assist with planning purposes, determine potential ground constraints and allow confirmation of a suitable scope of site investigation works. It is understood that BDW are considering developing the site for a low-rise residential end-use, comprising 263 two storey residential properties and 15 bungalows, with private gardens, areas of soft landscaping, Public Open Space (POS), areas of hardstanding, and highways. No loadings or development levels were known at the time of writing. **Sirius has previously compiled a desk study for the site in September 2014 (Report Ref: C6138). Since the issue of the report the development layout, including the south eastern and south western site boundaries, have altered slightly and subsequently the development area has reduced. This current report makes reference to the updated development layout, however the conclusions and recommendations given within are based on the original, larger development area. Therefore this desk study should be read with consideration to the revised development layout plan.**
Site Details	The site forms an irregular shaped plot of land, which broadly slopes downwards from north to south east, with an elevation difference of c. 23m. Locally, within the northern part of the site, there is an approximate elevation difference of between c. 9-16m, with the downward slope recorded from the central portion of the site to the east and west. The site generally comprises a set of agricultural fields defined by a combination of semi-mature / mature trees and low-lying shrubs. A set of electricity pylons are recorded within the southern portion of the site, aligned east to west and north to south. An unknown brick structure was identified to the sites north eastern portion. A rough footpath is recorded to run through the north western portion of the site, orientated north to south. Along the sites northern and north eastern perimeters, are a number of areas of fly-tipped material including wood, soil, plastic, fabrics, glass, brick and concrete.
Site History	Review of historical Ordnance Survey maps indicates that the site was occupied by agricultural fields since at least c. 1854. A number of buildings and a pump (latterly demolished) were shown to the sites south eastern portion between c. 1854 and 1955. Significant off-site features include a former railway line, with historic associated airshaft / mine entry, gasometer and goods shed to the immediate west of the site. In addition, to the west / north west was a quarry. A reservoir was shown to the immediate north west of the site between c. 1906 and 1984, which was later infilled and is referred to as a historical landfill site.
Anticipated Ground Conditions	Topsoil, over Glass Houghton Rock (sandstone) or Pennine Middle Coal Measures strata (typically mudstone). A fault, trending south west / north east, is conjectured to outcrop within the north western part of the site, downthrowing strata to the north west. The Sharlston Low and Top Coal Seams are both recorded to outcrop on and in close proximity to the site.

	No made ground is shown to underlie the site, although it may be locally identified within the south eastern portion of the site, in the area of the former buildings and pump. Whilst superficial deposits have not been recorded on site, Alluvial Soils are present in the vicinity of Small Bridge Dike to the west.
Mining & Quarrying	Based on published geological mapping and information contained within a Coal Authority mining report, a potential risk to surface stability is considered to exist at the site from possible shallow unrecorded coal workings. If mine workings are proven within influencing distance of the surface, they will require to be consolidated through rotary drilling and pressure grouting. The Coal Authority mining report indicates no mine entries on site. However, from review of historical OS plans and the Coal Authority mining report, there is a former mine entry / airshaft located c. 20m to the south west of the site. It is unknown if any measures have been taken to treat the mine entry / adit / airshaft. Inspection of historical OS plans has identified the presence of a quarry / quarry high wall to the north western / western perimeter of the site. In addition several former quarries (latterly infilled) have been identified within the vicinity of the site. The possibility of encountering unrecorded mine entries / quarrying / pitting within the site cannot be discounted. It is therefore recommended that a topsoil strip be undertaken prior to development to inspect for any such features and that all excavations are examined. If such features are encountered, works should cease and the advice of a suitably qualified consultant be sought. With regards to the former quarry high wall located to the sites north western boundary, it would be prudent to undertake a visual assessment of the rock face in order to ascertain the stability of the feature and any potential risks on the development site.
Foundations	Foundation solutions are dependent on the presence / absence of mined coal within influencing distance of the surface. Assuming that mine workings do not affect surface stability, reinforced spread foundations (ie. strip/trench fill) should be viable across the majority of the site. However, if shallow mineworkings are present within influencing distance of the surface, ground stabilisation will be required (or coal removal) and alternative foundation solutions maybe required. A site investigation is required to confirm ground conditions and foundation requirements.
Contamination	The preliminary conceptual site model indicates that pollutant linkages are possible to a variety of receptors. Potential heavy metals, pesticides, asbestos, organic and inorganic contaminants, in topsoil and locally in the made ground may pose a potential risk to construction workers, site end-users and controlled waters. Risks related to these potential linkages are currently given a qualitative assessment of “low through to moderate”. The precise nature of the risks should be investigated further through site investigation.
Gas Risk	A risk from hazardous gas sources, located both on and off site, exists. To confirm the situation regarding hazardous gases on site a gas investigation would be required to determine the need or otherwise for gas protection measures in future buildings. According to the BGS, radon protective measures are <u>not</u> required for the site.

Further Works	The following ground investigation works are recommended to allow foundation design and determination of any potential contamination constraints, and abnormal costs, in relation to the proposed development: • Trial pitting to investigate shallow soil and groundwater conditions beneath the site and to allow recovery of soil samples for testing. • Trial trenching in order to try to determine the location of the reported fault and Sharlston Low and Top Coal Seams which outcrop on site. • Insitu infiltration tests. • Window samples boreholes to allow confirmation of geotechnical parameters of the shallow soils, and allow the installation of gas/groundwater monitoring wells in selected boreholes. Standard Penetration Tests (SPTs) to be undertaken within selected boreholes. • Rotary probing to investigate for the presence / absence of workable coal within influencing distance of the surface. • Chemical and geotechnical laboratory testing to adequately categorise the shallow soils. • Gas monitoring (6 visits over 3 months). • Reporting. Intrusive ground investigation works should be carried out by a suitably qualified geoenvironmental consultant. An ecological survey should be carried out to confirm if any invasive plant species are present on site. Advice should also be sought from an appropriately qualified highway and drainage engineers to assess the impact of the site gradient on development aspirations. Owing to the presence of a quarry high wall and retaining wall feature to the sites western / north western boundary it is recommended that visual assessment by suitable qualified consultant is undertaken to ascertain the condition and stability of these features and their potential risks on the proposed development.

The executive summary given above is an overview of the key findings and conclusions of the report. There may be other information contained within the body of the report which puts into context the findings of the executive summary. No reliance should be placed on the executive summary in isolation.

1. INTRODUCTION

Sirius Geotechnical and Environmental Ltd (Sirius) were commissioned by Barratt & David Wilson Homes (BDW), to undertake a preliminary appraisal report (desk study) at land off Carrs Lane, Cudworth, Barnsley, South Yorkshire (the "site").

The desk study has been completed to assist with planning purposes, determine potential ground constraints and allow confirmation of a suitable scope of site investigation works.

It is understood that BDW are considering developing the site for a low-rise residential end-use, comprising 263 two storey residential properties and 15 bungalows, with private gardens, areas of soft landscaping, Public Open Space (POS), areas of hardstanding, and highways. A proposed development layout plan (as reproduced from Urban Design Revision D, dated 23rd September 2015) is included in Appendix A, as Drawing No. C6138/02. No loadings or development levels were known at the time of writing.

Sirius has previously compiled a desk study for the site in September 2014 (Report Ref: C6138). Since the issue of the report the development layout, including the south eastern and south western site boundaries, have altered slightly and subsequently the development area has reduced. This current report makes reference to the updated development layout, however the conclusions and recommendations given within are based on the original, larger development area. Therefore this desk study should be read with consideration to the revised development layout plan.

The objectives of this appraisal were to:

- Establish the historical development of the site and surrounding area from a review of available historical Ordnance Survey (OS) maps;
- Establish the environmental setting of the site;
- Determine whether historical activities could give rise to significant ground contamination;
- Evaluate whether past mining or other extractive industries could have an influence on the site;
- Determine the potential risk to the development from hazardous ground gas sources, including radon;

- Provide, where possible, provisional recommendations for foundations, and measures to deal with potential contamination; and,

- Provide recommendations for intrusive works required to confirm the ground conditions below the site and the contamination status of the shallow soils, and, from this, foundation solutions and measures to deal with any contamination.

This investigation includes an assessment of information provided by Landmark Information Group (LIG), the British Geological Survey (BGS) and the Coal Authority (CA).

A site inspection (walk over survey) was undertaken by a Sirius geoenvironmental engineer on 29th August 2014.

This report presents and interprets the factual information reviewed during this investigation and presents a Preliminary Conceptual Site Model (PCSM) from which ground-related hazards and risks have been assessed.

It has been assumed in the production of this report that the site is to be developed for a low-rise (two storey) residential with gardens end-use. In addition, it is assumed that ground levels will not change significantly from those existing at the time of writing. If this is not the case, then amendments to the recommendations made in this report may be required.

Where the report refers to the potential presence of invasive plants (such as Japanese Knotweed) or asbestos-containing materials (ACMs), such observations are for information only and should be verified by a suitably qualified expert.

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2. SITE DETAILS AND DESCRIPTION

Table 2.1 Current Site Overview

Location	The site is located off Carrs Lane, Cudworth, approximately 4km north east of Barnsley town centre. A site location plan is included as Drawing No. C6138/01 within Appendix A.
National Grid Reference	438650mE, 408150mN.
Topography and Features	The site forms an irregular shape, with its long axis running north to south. The site broadly slopes downwards from north to south east, with an approximate elevation difference of up to c. 23m. Locally, within the northern part of the site, there is an approximate elevation difference of between c. 9-16m, with the downward slope recorded from the central portion of the site to the east and west. The north western perimeter of the site forms part of a presumed historical quarry high wall; vertical remnants of the quarry high wall are visible. The quarry high wall has an elevation difference of between c. 1.50m and 20m between the site and the base of the quarry / former dismantled railway line to the west (see sections 3.1 and 3.2 for further details). In addition, along part of the sites western / north western boundary is a c. 0.50m to c. 1.50m high brick retaining wall. The retaining wall was noted to be in relatively 'good' condition, apart from some minor evidence of cracking. Access to the site is via Carrs Lane, to the south east and Newlands Avenue to the north west, both by vehicular traffic. A rough footpath is recorded off Newland Avenue, aligned north to south, from the residential estate to the former dismantled railway line. The site generally comprises a set of agricultural fields, defined by a combination of semi-mature / mature trees and low-lying shrubs. The field to the south eastern portion of the site is generally covered in grass, whilst the field to the western and central portions are covered in old crops

	(harvested). The field along the northern portion of the site has recently been ploughed / cultivated. A set of electricity pylons are recorded within the southern portion of the site, aligned east to west and north to south. A Yorkshire Water manhole cover was identified within the north western portion of the site. An unknown brick structure was identified to the sites north eastern portion, within an area of dense vegetation. Along the northern and north eastern perimeters of the site, in close proximity to the off-site residential properties, are a number of areas of fly-tipped materials including wood, soil, plastic, fabrics, glass, brick, concrete etc. In addition, to the south eastern perimeter were a number of discarded telegraph poles. Evidence of a small bonfire was noted to the sites northern perimeter.
Approximate Site Area	12.4 hectares.
Site Boundaries	The site boundaries are generally delineated by a combination of wooden panelled and metal palisade fencing, brick, stone and concrete walls, and semi-mature and mature trees, hedges and shrubs. The site is predominantly surrounded by residential dwellings to the north, and east. To the sites southern boundary is a large grassed field, beyond which is Small Bridge Dike, aligned north west to south east. Ring Farm, a stable's is recorded to the south east. To the west of the site is a dismantled railway line, which is currently utilised as a public footpath. This feature is in a cutting to the north and an embankment to the south of the site.
Current Land Use	Agricultural fields.
Invasive Plant Species	None noted. An ecological survey should be carried out to confirm if any invasive plant species are present, most specifically around the perimeter of the site and where the fields are delineated by dense vegetation.

The main site features are shown on Drawing No. C6138/03, within Appendix A.

3. ENVIRONMENTAL SETTING

3.1. Introduction

Published environmental, geological and historical data relating to the site has been reviewed. A summary of relevant information is provided below and a copy of the LIG Envirocheck report is included in Appendix B. A copy of the CA mining report is included in Appendix C.

3.2. Historical Development

Table 3.1 presents a summary of the site history from 1854 to 2014 as illustrated on historic OS maps. Only information pertinent to the proposed development is described.

Table 3.1 Historical Development

Map Dates	On-Site Features	Off-Site Features (only features within 500m that may affect the site are listed)
1854 - 1894	The site appears to comprise a number of agricultural fields. Several buildings are recorded within the south eastern portion of the site. Within the 1894 OS map, a pump is shown in proximity to one of the buildings. Two small areas of woodland / orchard are shown to the south eastern and eastern portions of the site.	The site is shown to be located within a predominantly rural area, on the western edge of the village of Cudworth. Residential properties associated with the village of Cudworth are shown to the east and north east of the site. Carrs Lane is shown to the immediate east of the site, aligned north / south. A railway line, referred to as Midland Railway, is shown to the immediate west of the site, aligned north west / south east. Cudworth Station, and a number of associated buildings, including a goods shed, water columns, pump, crane and a gasometer are shown within c. 10-200m to the west / north west of the site. The railway line appears to be a cutting to the north and an embankment to the south of the site. Along the north western boundary, associated with the railway, is a quarry. Ring Farm is shown c. 80m to the south east of the site. A footpath is shown c. 100m to the north, aligned east / west. Small Bridge Dike is shown (at its closet point) c. 20m to the south west of the site, aligned north west / south east (within later maps this is confirmed as the flow direction). A number of wells and pumps are shown between c. 10-300m from the site. Two old quarries are shown between c. 120m and c.

Map Dates	On-Site Features	Off-Site Features (only features within 500m that may affect the site are listed)
		200m to the north east of the site. Further quarries (sandstone) are shown between c. 250m and c. 500m to the north east and north west of the site. Lund Wood is shown c. 70m to the south west and Birk Ing Wood is shown c. 190m to the south east of the site.
1906	A small building is shown to the sites eastern perimeter, associated with one of the nearby residential properties.	An airshaft is shown c. 20m to the south western boundary of the site. A reservoir is shown adjacent to the north western perimeter of the site. The gasometer is no longer shown to the west of the property. The railway line to the immediate west has further expanded, with the construction of a footbridge. An area of marshland is shown c. 100m to the south of the site.
1931 - 1948	No significant changes to the site.	A number of residential properties are shown to the immediate north and north east and c. 280 to the south east of the site. The airshaft to the south west of the site is no longer present and has presumably been infilled. Birch Ing Wood no longer recorded.
1955 - 1996	The buildings to the south eastern portion of the site are no longer shown.	Further residential properties and associated garages have been constructed to the immediate north / north west of the property. The 1961 – 1977 OS maps show Cudworth Station as disused. The reservoir to the north west is no longer recorded after 1984. A pond is shown c. 100m to the east of the site. By the 1976-1977 OS maps the pond has been infilled. The 1970 – 1984 OS map shows the former quarry to the north east of the site, has been presumably infilled. The 1993 OS map indicates that the railway line has been partly dismantled to the west of the site. Further residential development shown within 1993 OS mapping to the east of the site.
2006 - present	The site generally forms a similar layout as presently exists.	The railway line has been fully dismantled to the west of the site. The reservoir and presumed garages to the north west of the site have been developed upon, with a number of residential dwellings.

3.3. **Published Geological Information**

A summary of available published geological information is provided in Table 3.2.

Table 3.2 Geological Summary

Sources of Information	BGS 1:10,000 scale Sheet SE 30 NE. LIG (Envirocheck) report. CA mining report ref. 51000608546001, dated 15th August 2014. BGS lexicon of named rock units. BGS on-line borehole records.
Made Ground / Worked Ground	Although no made ground is indicated on the geological plans, made ground deposits are likely to be locally encountered within the south eastern portion of the site, owing to the presence of a number of former buildings. A number of areas of worked and made ground are recorded within 500m of the site. Made Ground forming part of the dismantled railway line is shown along the western boundary of the site. Further areas of made / worked ground are identified along the former railway line, between c. 350m and 450m. Worked ground comprising "mainly railway and road cuttings, quarries and brick pits" is shown c. 200m to the north east of the site, which may be associated with a number of former quarries. A further area of worked / made / infilled ground comprising "backfilled opencast coal sites and quarries" is shown c. 400m to the north east of the site.
Superficial Geology	No superficial deposits are shown to underlie the site; however the BGS map sheet does indicate the presence of Alluvial Deposits in the vicinity of the Small Bridge Dike c. 20m, to the west (at its nearest point) to the site. Alluvial soils typically comprise "soft to firm unconsolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel".
Solid Geology	The solid geology comprises a combination of sandstone (Glass Houghton Rock) and undifferentiated strata (Pennine Middle Coal Measures). The Glass Houghton Rock is recorded across the majority of the site, with the Pennine Middle Coal Measures shown within the western portion of the site. Glass Houghton Rock comprises *'brown and grey micaceous sandstone'*.

	Pennine Middle Coal Measures comprise *'interbedded grey mudstone, pale grey sandstone and commonly coal seams, with a bed of mudstone containing marine fossils at the base'*. The BGS plans record the strata within the general surrounding area to dip at between 3° and 4° towards the east.	
Faults	A south west to north east orientated fault is conjectured within the north western portion of the site, downthrowing strata to the north west.	
BGS Borehole Records	A number of BGS rotary borehole records are recorded within 250m of the site. Four borehole records (SE30NE10-11, 29 and 92) are recorded between c. 90m and c. 175m to the west and south of the site. The closest record SE30NE10 indicates made ground to c. 1.20m below ground level (bgl), which is in-turn underlain by yellow mottled clay to c. 3.60m bgl,. The made ground and cohesive deposits are underlain by "shale, grit and rock" to c. 88.0m bgl, below which is a 0.30m thick band of coal, which is in-turn underlain by further rock, grit and shale. A second record within similar proximity (SE30NE11) indicates drift deposits to c. 3.56m bgl, which are in-turn underlain by the Woolley Edge Rock to c. 35.30m bgl, variable coal seams are recorded to c. 196.39m bgl. The coal seams are underlain by rock and further coal seams to c. 265.60m bgl. A further two records shown c. 170m to the west and c. 175m to the south of the site indicate mudstone with variable bands of coal, c. 0.02m to 0.72m thick.	
Mining and Quarrying	**Coal Seams:**	The Sharlston Low Coal Seam (reported to be 0.30m to 0.48m thick on the vertical section provided within the 1:10,000 scale map) is conjectured to outcrop in a north / south direction within the western portion of the site dipping to the east (below the site). The Sharlston Top Coal Seam (reported to be 0.69m to 1.07m thick on the vertical section of the 1:10,000 scale map) is shown to outcrop on and / or around the eastern boundary of the site again dipping to the east (away from the site). No workable coal seams are recorded at shallow depths below the Sharlston Low Coal.

	Coal Mining:	*According to the Coal Authority (CA); the site is within the likely zone of influence from workings in seven seams of coal at 250m to 660m depth, and last worked in 1991. Any ground movement from these workings should have stopped by now.* • *In addition, the property is in an area where the CA believes there is coal at or close to the surface. This may have been worked at some time in the past.* • *The property is not in the likely zone of influence of any present underground coal workings.*
	Mine Entries:	The CA report states that '*there is one known coal mine entry within, or within 20 metres of, the boundary of the property*'. This feature is recorded c. 20m to the south west of the site. *There is no record of what steps, if any, have been taken to treat the mine entry. Records may therefore be incomplete. Consequently, there may exist in the local area mine entries of which the CA has no knowledge.* Review of the historical OS maps indicates a former airshaft located c. 20m to the south west of the site. This coincides with the presence of the mine entry.
	Opencast Coal Mining:	The CA report states that '*the property does not lie within 200 metres of the boundary of an opencast site from which coal has been removed by opencast methods*'.
	Coal Mining Subsidence:	There has been one damage notice or claim for alleged subsidence damage to the property to the immediate east of the site (40 Carrs Lane, Cudworth) in September 1995. However, the claim was rejected. A further two claims are recorded within c. 50m to the east of the site boundary
	Quarries:	From historical OS maps several presumed sandstone

		quarries have been noted within c. 100m and 1km of the site. In addition, to the immediate north west / west of the site, in proximity to the former Cudworth railway station is a former quarry. The LIG Envirocheck report confirms the presence of a number of ceased sandstone quarries; the nearest is located 195m to the north east (opencast).
	Non-Coal Mining:	The LIG Envirocheck report states that a "highly unlikely" risk exists associated with non-coal mining.

A coal mining risk assessment has been completed for the site and copy of this report is contained within Appendix D.

3.4. Hydrology and Hydrogeology

A summary of available information pertaining to hydrology and hydrogeology is presented in Tables 3.3 to 3.5.

Table 3.3 Surface Water Features

	Presence/location	**Comments**
Environment Agency (EA) GQA Classified Watercourses	The closest watercourse to the site, classified under the EA GQA scheme, is Small Bridge Dike ('Primary River') located 41m to the south west.	Review of the EA website indicates that the current ecological data of the watercourse is classified as 'bad'. The ecological quality is predicted in 2015 to improve to 'moderate'.

	Presence/location	Comments
Unclassified Watercourses	There are four unclassified surface watercourses recorded within 500m of the site.	These features relate to a number of tributaries and drainage channels associated with Small Bridge Dike. The closest feature is recorded 181m to the west, and relates to a 'Tertiary River'. The other features are shown between 300m and 500m to the south east and north west of the site, these are classified as, 'Primary Rivers', 'Secondary Rivers', 'Tertiary Rivers' and an 'Extended Culvert'.
Licensed Surface Water Abstractions	There are two surface water abstraction licenses within 1km.	The licenses are recorded 739m and 743m to the north west, for general industrial use. Both licenses are referred to as 'lapsed / revoked'.
Flood Risk Status	The site does not lie within an indicative flood plain at risk of flooding from rivers and sea (Zones 2 and 3). However, the site is located c. 29m to the north east of an indicative floodplain at risk of flooding from rivers and sea (Zones 2 and 3). This is associated with Small Bridge Dike.	

Table 3.4 Groundwater Occurrence and Abstraction

	Presence/location	**Comments**
Licensed Groundwater Abstractions	There are no licenses recorded within 1km of the site.	The closest license is located 1199m to the west of the site, for cooling purposes, taken from a borehole. The license is referred to as 'revoked'.
Source Protection Zones (within 500m)	The site is not located within 500m of a source protection zone.	

Table 3.5 Groundwater Vulnerability Status

	Environment Agency Classification
Soil Classification	Under the aquifer classification system developed by the EA the solid geology is classified as a Secondary A Aquifer. The Alluvial Deposits recorded in proximity to Small Bridge Dike are also referred to as a Secondary A Aquifer. Secondary A Aquifers are defined as '*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.

3.5. Landfilling and Waste Management

Table 3.6 Waste Management Activities

	Presence / Location / Comments
Historic Landfills (within 500m)	According to information provided within the LIG Envirocheck report, there are three historical landfill sites within 1km of the property. The closest record is shown 1m to the west of the property and is referred to as 'Newlands Avenue', in the location of the former reservoir. The waste materials deposited are not known. This area has now been developed with housing.

	Presence / Location / Comments
	There is one landfill site recorded 29m to the south west of the property and is referred to as 'former Cudworth railway station', which deposited inert material. A further record is shown 285m to the south east of the property, which deposited wastes including inert, commercial/industrial and household materials.
Local Authority/BGS/EA Recorded Landfills	There are 10 Local Authority Landfill Sites within 1km of the property. The closest is recorded on the site boundary, to the immediate west, presumably associated with the former reservoir.
Registered Landfill Sites	There are six registered landfill sites within 1km of the property; the closest facility is located 103m to the west, referred to as 'former Cudworth railway station', which accepted wastes including inert non-combustible construction / demolition wastes.
Other Licensed Waste Management Facilities (within 500m)	There is one inactive Licensed Waste Management Facility recorded within 500m of the property, this is associated with the 'former Cudworth railway station'. There are no Registered Waste Treatment or Disposal Site within 500m of the property; the closest facility is located 528m to the north west for the disposal of building and demolition wastes and excavation materials.
Walkover Evidence of Fly-Tipping on Site?	Yes. Evidence of some fly-tipping was recorded to the site's northern and north eastern boundaries, comprising soil, glass, wood, plastic, fabric, brick, concrete etc.
Ground Gas Risk Assessment Required?	Yes. Hazardous ground gas associated with: • Local, areas of deep made ground? • Mine gases associated the presence of shallow coal seams on site. • Off-site sources, including deep made ground associated with the infilled railway cutting, infilled reservoir, infilled waste quarries and

	Presence / Location / Comments
	infilled ponds (some of which are licensed landfills). • Marsh gases associated with the alluvial/organic soils recorded to the west of the site.

3.6. **Radon Risk**

To determine whether the site is at risk from radon gas, the BRE Document "BRE 211 - Radon: Guidance on the protective measures for new dwellings" together with the National Radiological Protection Board (NRPB) "Radon Atlas of England and Wales" have been referenced.

These documents, together with a geological assessment contained within the LIG report, which includes information obtained from the Health Protection Agency and British Geological Survey, state that the site lies within an area in which **no radon protective measures are necessary** for the construction of new dwellings or extensions.

3.7. **Other**

Other potentially contaminative activities or environmental constraints are listed below. The entries relate to activities within approximately 250m of the site, with the exception of Control of Major Accident Hazard (COMAH) and Notification of Installations Handling Hazardous Substances (NIHHS) facilities, where the assessment is extended to a distance of approximately 1km.

- There are three discharge consents within 250m of the site; the closest is located 64m to the south east of the property and relates to sewage discharge – storm water overflow / storm tank (water company) to a freshwater stream / river, namely Small Bridge Dike. The license is referred to as 'revoked'. A further two consents both located 149m to the south east of the property relate to sewage discharges – pumping station (water company) to a freshwater stream / river, namely Small Bridge Dike, the licenses are referred to as 'modified' and transferred', respectively.

- There is one local authority pollution prevention and control within 250m of the site. The entry is recorded to the immediate west of the site, for a mobile screening and crushing processes. The license is referred to as 'permitted'.

- There are 16 pollution incidents to controlled waters within 250m of the property. The closest, which involved mud / clay / soil, occurred at a location 90m south east of the site in 1993 and was described as “Category 3 - Minor Incident”.

- There are no active trades within 250m of the site. There are, however, three inactive trades within 250m of the property, these include a printers, automation systems and equipment and electrical engineers.

- The south western portion of the site is located within an area of adopted green belt.

4. PREVIOUS INVESTIGATIONS

No previous reports relating to this site have been made available.

5. PRELIMINARY CONCEPTUAL SITE MODEL

Based on the desk study, a combined preliminary conceptual site model and conceptual exposure model (PCSM) has been developed for the proposed future land use. This summarises the understanding of surface and sub-surface features, the potential contaminant sources, transport pathways and receptors in order to assess potential pollutant linkages.

A qualitative risk assessment has also been made of the likelihood of any complete pollutant linkage and its potential significance. The preliminary conceptual site model is presented in schematic form as Drawing No. C6138/04, in Appendix A.

In summary, the preliminary CSM has identified the following potential pollutant linkages which could result in an unacceptable risk to the proposed end-use:

- Ingestion, inhalation of dust and dermal contact with potential heavy metals, asbestos fibres, hydrocarbons (including Polycyclic Aromatic Hydrocarbons – PAH / Total Petroleum Hydrocarbons - TPH) and pesticides in topsoil and locally made ground posing a **low to moderate** risk to site end users, adjacent site users and construction workers.

- Possible leachable (and mobile) heavy metals and organic contaminants in topsoil and locally made ground posing a **low** risk to controlled waters (underlying Secondary A Aquifer and Small Bridge Dike).

- Risk from hazardous ground gas sources including mine gases and marsh gases, located both on and off-site, posing a **moderate** risk to site end-users and construction workers.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1. General

This preliminary appraisal has been performed at land off Carrs Lane, Cudworth, Barnsley, South Yorkshire.

It is understood that BDW are considering developing the site for a low-rise residential end-use, comprising 263 two storey residential properties and 15 bungalows, with private gardens, areas of soft landscaping, Public Open Space (POS), areas of hardstanding, and highways. No loadings or development levels were known at the time of writing.

This report has been compiled to assist with planning purposes for the proposed residential end-use, assuming development levels will remain broadly as existed at the time of the preliminary investigation.

Advice should be sought from appropriately qualified highway and drainage engineers to assess the impact of the site gradient on development aspirations.

6.2. Flood Risk

According to the LIG Envirocheck report and the EA website, the site does not lie within an area at risk from flooding from rivers and sea (Zones 2 or 3).

6.3. Geotechnical

Mining and Quarrying

On the basis of information provided by the CA and inspection of available geological plans, the possibility of shallow unrecorded coal workings affecting surface stability cannot be discounted.

The presence/absence of shallow mine workings needs to be confirmed through rotary probing, to allow determination of any ground consolidation requirements (i.e. drilling and pressure grouting) and foundation solutions.

The CA mining report indicates that no mine entries are recorded to exist within the site. However, the CA mining report and from review of historical OS plans has highlighted the presence of a former mine entry / adit / airshaft located c. 20m to the south west of the site. It is unknown if any steps have been taken to treat the mine entry / adit / airshaft. It is recommended that a soil strip (if considered viable based on the proven thickness of topsoil / made ground present) be undertaken

in the vicinity of the former mine entry / adit / airshaft, along the south western site boundary, as part of the enabling works in order to confirm its absence within the development area.

The possibility of encountering unrecorded mine entries (including bell pits) within the site cannot be discounted, it is therefore recommended that a topsoil strip be undertaken prior to development to inspect for any such features. Additionally all excavations should be examined for evidence of mine entries / bell pits. If a mine entry is suspected works should cease and the advice sought of a suitably qualified consultant.

Inspection of historical OS plans has revealed evidence of a former quarry / quarry high wall to the sites north western / western perimeter, in addition to a number of former sandstone quarries within the vicinity of the site. As such the possibility of encountering unrecorded quarries / opencast workings / pits on site cannot be wholly discounted. It is recommended that all excavations be examined for evidence of such features. If evidence of an infilled quarry / pit / opencast workings is suspected works should cease and the advice sought of a suitably qualified consultant.

With regards to the former quarry high wall located to the sites north western boundary it would be prudent to undertake a visual assessment of the rock face by a suitably qualified Engineer in order to ascertain the stability of the feature and the potential risk of impacting the development site, particularly if residential properties are proposed in its proximity.

Foundations

Published geological information indicates that the majority of the site is underlain by the Glass Houghton Rock - Sandstone unit, with the Pennine Middle Coal Measures (PMCM) shown within the western portion of the site. The Sharlston Low and Sharlston Top Coal Seams are recorded to outcrop on or around the western and eastern portion of the site, respectively.

An unnamed fault, aligned approximately north east / south west, is conjectured to cross the western part of the site, with the downthrow to the north west.

No made ground is shown to underlie the site on published maps, however made ground may be locally identified within the south eastern portion of the site, owing to the presence of former buildings.

No superficial deposits are recorded to underlie the site; however Alluvial Soils are shown on published maps in close proximity (c. 20m) to the west of the site, associated with the presence of Small Bridge Dike.

Foundation solutions are very much dependant on the presence / absence of mined coal within influencing distance of the surface. Assuming that mine workings do not affect surface stability, spread foundations (strip/trench fill) should be viable for lightly loaded structures across much of the site, founded into either the Glass Houghton Rock (sandstone) or the PMCM strata of suitable bearing capacity. However, if mine workings within influencing distance of the surface are identified, ground stabilisation will be required (or coal removal) and alternative foundation solutions may be required.

Alternative foundation solutions may also be required if deep made ground, or loose / soft natural soils i.e. Alluvial Soils are encountered on site.

Overall the nature and depth of foundations will be dependent on loadings, development levels and the detailed site geology, including:

- Location and thickness of made ground or reworked soils.
- Presence/absence of workable coal within influencing distance of the surface.
- Location and extent of any relict foundations and other buried structures.
- Bearing capacity of the natural strata.
- Groundwater levels.
- Proximity to trees where potentially shrinkable soils are present.

A ground investigation is required to confirm ground conditions and foundation requirements.

If mine entries and / or shallow mine workings are proven within influencing distance of the surface, these will need to be treated (see above); additionally foundations may need to be designed to accommodate risk posed by residual movement. Foundation design will depend upon the depth to treated workings.

Reinforcement of foundations which are constructed over the fault (if encountered) may be required.

Other Considerations

Assessment of the suitability / stability of the retaining structure to the sites north western / western perimeter (if to be maintained and incorporated into the proposed development) within context of the proposed development levels is recommended.

Similarly, should earthworks (comprising cut and fill operations) be undertaken at the site, consideration will have to be given to the potential risk of undermining existing neighbouring buildings, adjacent highways and existing slopes.

6.4. Contamination

Risk Evaluation for the Proposed Land Use (Residential with gardens)

The preliminary conceptual site model indicates that pollutant linkages are possible to a variety of receptors. Potential heavy metals, petroleum hydrocarbons, asbestos fibres and pesticides may pose potential risks to human health (construction workers and site end-users) and controlled waters (Secondary A Aquifer / Small Bridge Dike). Risks related to these potential linkages are currently given qualitative assessments of **low through to moderate.** The precise nature of the risks should be investigated further through site investigation.

A Phase II (intrusive) geoenvironmental / contamination investigation should be undertaken to confirm the presence or otherwise of contaminants sources and quantify the risks to identified receptors.

6.5. Hazardous Ground Gases

A risk from hazardous gas sources, including mine gas, landfill gas and marsh gas, located both on and off-site, exists. To confirm the situation regarding hazardous gases on site, from potential on and off-site sources, a hazardous gas investigation would be required to determine the need or otherwise for gas protection measures in future buildings.

According to the BRE, radon protective measures are **not** required for the site.

6.6. Invasive Plants

Invasive plant species were not observed during the site walkover; although parts of the site / field perimeter were overgrown limiting access and we are not ecological specialists. For this reason it

is recommended that a specialist be commissioned to confirm the presence/absence of invasive plants, and any implications on development.

6.7. **Services**

Given the potential for coal at or close to the ground surface at the site, calorific values may be elevated within shallow soils, and as such appropriate protection of services with the potential to generate heat may be necessary. This should be investigated further through site investigation.

6.8. **Soakaways**

Based on the anticipated ground conditions, i.e. sandstone and mudstone, the use of soakaway drainage may potentially be viable. Site specific ground conditions should be investigated further through site investigation.

Should ground conditions be considered potentially viable for soakaway drainage, insitu infiltration tests could be completed in order to derive infiltration rates and aid drainage design.

Owing to the sites sensitivity i.e. underlain by a Secondary A Aquifer, it is recommended that the Local Authority and EA be consulted with respect to any proposed soakaway drainage for the site should soakaways be considered viable.

7. FURTHER INVESTIGATION

The following ground investigation works are recommended to allow foundation design and determination of any potential contamination constraints, and, abnormal costs, in relation to the proposed development:

- Window sample boreholes to investigate near surface soil and groundwater conditions and to allow recovery of soil samples for testing. Standard Penetration Tests (SPTs) to be undertaken within selected boreholes in order to provide geotechnical data for the underlying soils.
- Trial pitting / trial trenching to investigate shallow soil and groundwater conditions beneath the site and to allow recovery of soil samples for testing. Selected trial pit locations will incorporate trial trenching in order to attempt to determine the location of the conjectured fault and coal outcrops.
- Insitu infiltration tests.
- Rotary probing to investigate for the presence / absence of workable coal within influencing distance of the surface (and its thickness / collapse status).
- Chemical and geotechnical laboratory testing to adequately categorise the shallow soils/groundwater.
- Installation of gas / groundwater monitoring wells in selected window sample boreholes, specifically targeted along the site boundaries proximate to off-site landfill sites, and also to monitor mine gas and marsh across the site.
- Gas monitoring - 6 No. monitoring rounds over a 3 month period.
- Reporting.

Intrusive ground investigation works should be carried out by a suitably qualified geoenvironmental consultant.

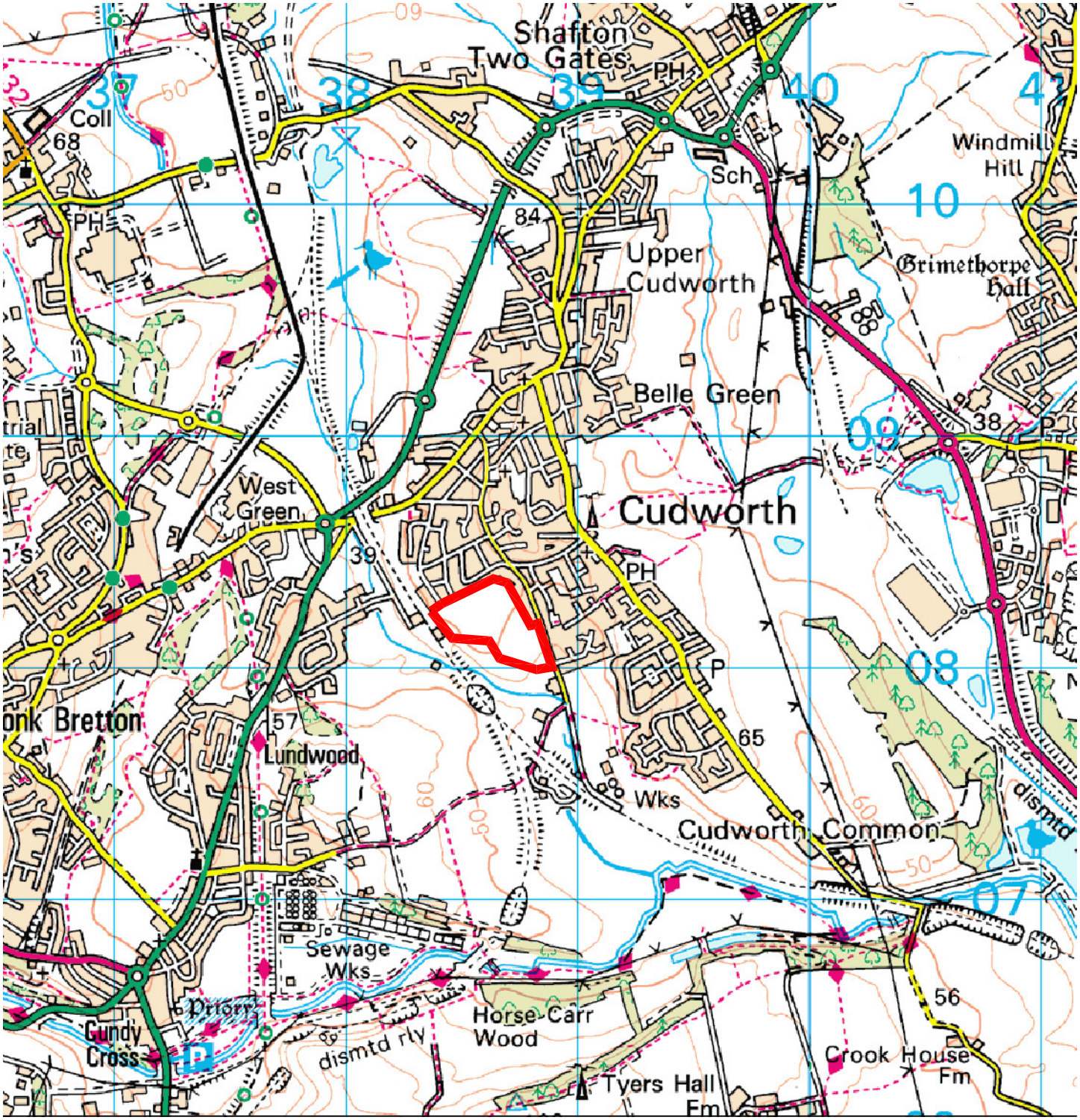
An ecological survey should be carried out to confirm if any invasive plant species are present on site.

Advice should be sought from appropriately qualified highway and drainage engineers to assess the impact of the site gradient on development aspirations.

Owing to the presence of a quarry high wall and retaining wall feature to the sites western / north western boundary it is recommended that a visual assessment by a suitable qualified consultant is undertaken to ascertain the condition and stability of these features and their potential risks on the proposed development.

APPENDIX A

FIGURES AND DRAWINGS



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NOTES

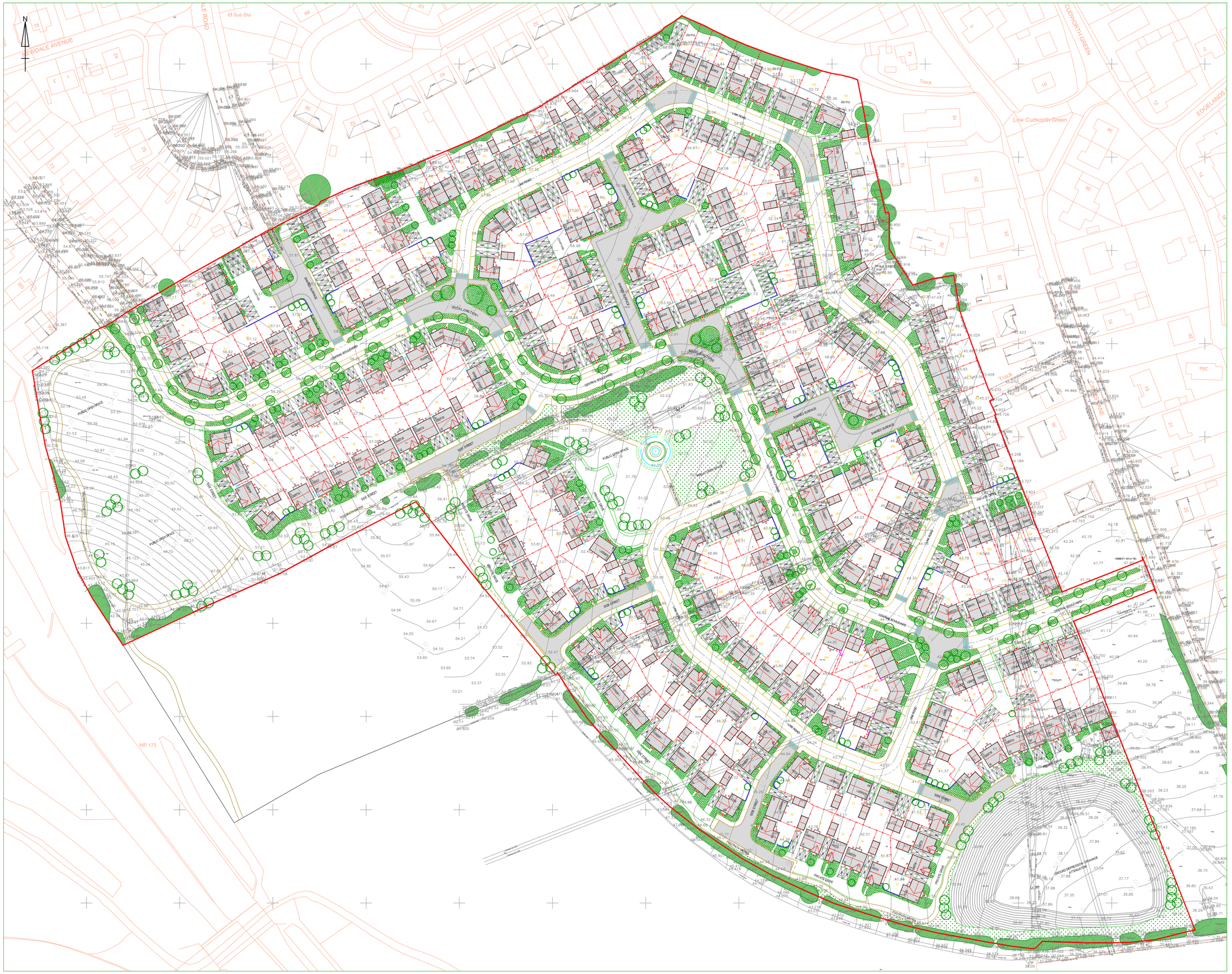
Approximate Site Location

REVISION	
0	For Information
A	>>
B	>>
C	>>
D	>>

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CLIENT	DRAWING NO.	REVISION NO.
Barratt & David Wilson Homes	C6138/01	0
SITE: Carrs Lane, Cudworth, Barnsley	DRAWN BY: DT	APPROVED BY: JL
DRAWING TITLE: Site Location Plan	DATE: September 2014	SCALE: 1:25,000

A4



NOTES

Approximate Site Boundary

REVISION

1	New Planning Layout
A	>>
B	>>
C	>>
D	>>

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CLIENT

Barratt & David Wilson Homes

SITE

Carrs Lane,
Cudworth,
Barnsley

DRAWING TITLE

Proposed Development Layout

DRAWING NO.	REVISION NO.
C6138/02	1
DRAWN BY	**APPROVED BY**
JL	MB
DATE	**SCALE**	**PAPER SIZE**
October 2015	1:1250	A2



View of Fly-Tipping



View to South West



View to East



View of Unknown Brick Structure



View to West



View to North West

Approximate Location of Former Reservoir as Seen on OS Mapping Between C.1906 - C. 2006

Location of Former Quarry

Sharlston Top Coal

Pollutant Incident to Controlled Water, Involving Sewage Between 1996 - 1997 as Seen in LIG Report

Approximate Location of Presumed Quarry / Quarry High Wall as Seen on Historical OS Mapping

Ploughed Field

Sharlston Low Coal

Approximate Location of Brick Retaining Wall

Old Crop

Old Crop

Sharlston Low Coal

Historical Gasometer as Seen on OS Maps (1893-1894)

Approximate Location of Air Shaft as Seen on Historical OS Mapping Between C. 1906 - 1932. Also Refered to as a Dissused Adit/Mine Entry on Coal Authority Mining Report

Approximate Location of Former Buildings on OS Mapping between C.1854 - 1955

Grassed Field

Grassed Field

As Refered to in LIG Report as Historical Landfill Site

Approximate Route of Former Railway Line + Associated Infastructure As Seen on OS Mapping Between C. 1854 - 1993

Pollutant Incident to Controlled Water, Involving Mud/Soil/Clay Between 1996 - 1997 as Seen in LIG Report

Ring Farm

Burton Abbey Farm

Stubbal Bridge

Bridge Dike

Burn Dikes & Weird Ditch

NOTES

- Approximate Site Boundary
- Flow Direction
- Site Access
- Overhead Cables
- General Site Slope
- Local Site Slope
- Old Telegraph Poles
- Yorkshire Water Manhole
- Fly-Tipped Material - Including Soil, Wood, Plastic, Cardboard, Metal, Glass, Fabric
- Rough Footpath
- Unknown Brick Stucture
- Fault as Seen on BGS Map Sheet (Cross Mark on Downthrowing Side)
- Coal Outcrop (approximate positions taken from 1:10,000 scale geological sheet)

REVISION	
1	New Planning Layout
A	>>
B	>>
C	>>
D	>>

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SITE

Carrs Lane, Cudworth, Barnsley

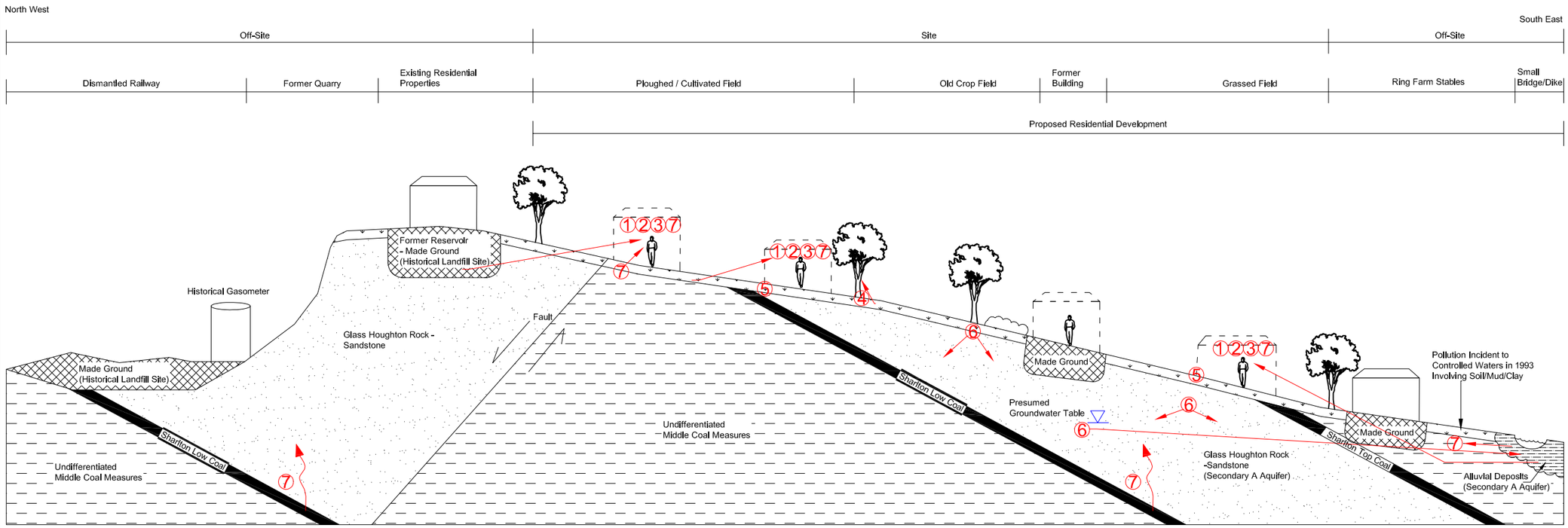
DRAWING TITLE

Site Features Plan (Showing Historical / Geological Features)

DRAWING NO.	REVISION NO.
C6138/03	1

DRAWN BY	APPROVED BY
DT	JL

DATE	SCALE	PAPER SIZE
October 2015	1:2000	A2



Contamination Sources	Contamination Pathways	Potential Receptors	Likelihood of significant pollutant linkage
Elevated metals, organic and inorganic contaminants, including asbestos, hydrocarbons and pesticides, in topsoil and locally made ground.	1 Direct and indirect inhalation 2 Inhalation of contaminated particles / dust 3 Dermal Contact	Future site users, construction site workers and adjacent land users	Low to Moderate
	4 Plant Uptake	Gardens and landscaping	Low
	5 Direct contact with construction materials	Sulphate attack on buried concrete, other construction materials and buried services	Low to moderate
Leachable and mobile metals, organic and inorganic contaminants within topsoil and locally made ground.	6 Leaching to controlled waters	Secondary A Aquifer & Small Bridge Dike	Low
Ground gas from on and off-site sources.	7 Generation and accumulation of gas	Future site users, construction workers, built environment	Moderate

NOTES

REVISION

1	New Planning Layout
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SITE

Carrs Lane, Cudworth, Burnley

DRAWING TITLE

Preliminary Conceptual Site Model

DRAWING NO.	REVISION NO.
C6138/04	1
DRAWN BY: DT	APPROVED BY: JL
DATE: October 2015	SCALE: NTS
PAPER SIZE: A3	