

The title "Preliminary Geoenvironmental Investigation" is written in white, sans-serif font over a photograph of a stream. The stream flows over rocks and is bordered by green grass and vegetation. The water is clear and reflects the surrounding greenery.

# Preliminary Geoenvironmental Investigation

## Land at Midland Road, Royston For Kier Living Northern

Report no: 2321/1

Date: July 2016



## MIDLAND ROAD, ROYSTON SUMMARY OF GEOENVIRONMENTAL ISSUES

<b>Job No.</b>	2321	<b>Site area/ha</b>	2.1 hectares (5.2 acres)
<b>Client:</b>	Kier Living Northern	<b>NGR:</b>	SE 362 116
<b>Site:</b>	Midland Road, Royston	<b>Nearest postcode:</b>	S71 4QN

The site is located off Midland Road, approximately 5.5km north east of Barnsley town centre, and currently comprises a predominantly empty parcel of land. The land lies adjacent to an ongoing construction site and some construction materials are stored in the east. Stockpiles of material are located across much of the west. Surfaces predominantly comprise rough grass and weeds; an area of tarmac hardstand (a former playground) is present in the south east.

The site was previously a school (Royston High School), which was initially developed in between 1933 and 1948, but had been vacated and demolished by 2013.

Lithos were commissioned by Kier Living to provide a preliminary geoenvironmental appraisal of the site, which it is understood is to be redeveloped with about 80 two storey residential dwellings; a proposed layout has been provided.

Lithos' investigation included an inspection of historical and geological maps and information provided by the BGS, Landmark, the Coal Authority, Barnsley Metropolitan Borough Council and the Environment Agency. In addition a site inspection has been carried out.

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

Issue	Remarks
Former uses	Formerly used as a school with associated playing fields, tarmac playgrounds & school buildings.
Hazardous gas	The generation potential of gas sources is considered likely to be Very Low, but this should be confirmed by a period of gas monitoring; initially 6 visits over a 3 month period. Basic radon protective measures required.
Mining & quarrying	It is considered likely that a sufficient thickness of competent cover lies above the Royston Coal (which in any case may not have been worked). However, consideration should be given to drilling to remove any residual uncertainty.
Flooding & drainage	Site lies within flood zone 1. Testing would determine whether soakaways would be a suitable means of surface water disposal.
Anticipated ground conditions	Veneer of made ground, with areas of deeper made ground beneath former buildings; some obstructions/relict foundations likely. Residual soils (firm to stiff gravelly clay) overlying Mexborough Rock Sandstone.
Anticipated contamination	Likely (probably minor) contamination within made ground & within construction compound.
Preparatory works	General site clearance.
Anticipated foundation solutions	Strip/trench footings (deepened in areas of made ground) founding into residual soils/sandstone bedrock.
Recommendations for ground investigation	Trial pits across site to confirm ground conditions & check for presence/significance of any contamination. Window sample boreholes To install monitoring wells in order to monitor for hazardous gas.

# CONTENTS

<b>1</b>	<b>INTRODUCTION.....</b>	<b>1</b>
1.1	THE COMMISSION AND BRIEF .....	1
1.2	THE PROPOSED DEVELOPMENT .....	1
1.3	REPORT FORMAT AND LIMITATIONS.....	1
<b>2</b>	<b>SITE DESCRIPTION .....</b>	<b>2</b>
2.1	GENERAL.....	2
2.2	SITE FEATURES .....	2
2.3	SITE OPERATIONS .....	3
<b>3</b>	<b>SITE HISTORY .....</b>	<b>5</b>
<b>4</b>	<b>ENVIRONMENTAL SETTING .....</b>	<b>6</b>
4.1	GENERAL.....	6
4.2	COAL & MINING.....	7
4.3	LANDFILLS .....	8
4.4	HAZARDOUS GAS .....	9
4.5	LAND CONTAMINATION - PART IIA & PLANNING .....	9
<b>5</b>	<b>PREVIOUS INVESTIGATION FINDINGS.....</b>	<b>11</b>
5.1	GENERAL.....	11
5.2	SUMMARY OF FINDINGS .....	11
<b>6</b>	<b>GROUND INVESTIGATION DESIGN .....</b>	<b>12</b>
6.1	ANTICIPATED GROUND CONDITIONS & POTENTIAL ISSUES .....	12
6.2	PRELIMINARY CONCEPTUAL SITE MODEL .....	13
6.3	GROUND INVESTIGATION DESIGN & STRATEGY .....	13
<b>7</b>	<b>CONCLUSIONS &amp; RECOMMENDATIONS .....</b>	<b>14</b>
7.1	GENERAL.....	14
7.2	MINING AND QUARRYING.....	14
7.3	HAZARDOUS GAS .....	15
7.4	FOUNDATIONS .....	15
7.5	HIGHWAY, DRAINAGE AND EXTERNAL WORKS ISSUES.....	16
7.6	CONTAMINATION.....	16
7.7	POTENTIAL DEVELOPMENT CONSTRAINTS .....	16

## APPENDICES

### Appendix A – General notes

01	Environmental setting
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### Appendix B – Drawings

Drawing	Title
2321/1	Site location plan
2321/2	Proposed layout
2321/3	Site features
2321/4	Site photos
2321/5	Preliminary conceptual site model

### Appendix C - Commission

### Appendix D – Historical OS plans\*

### Appendix E – Search responses\*

From	Date	Content
Landmark	20/07/2016	Envirocheck report
Coal Authority	20/07/2016	Non-residential mining report
BGS		Borehole log SE31SE46
Barnsley Metropolitan Borough Council	25/07/2016	Information on landfill at Royston

\* Some of this data is not included within the paper copy of this report; most is included in the PDF copy and all is included on the CD

## FOREWORD (preliminary geoenvironmental investigation report)

This report has been prepared for the sole use and reliance of the Client named on page 1 and cannot be relied upon by any other parties without the express written authorisation of Lithos Consulting Limited (Lithos). Any unauthorized third party relies on this report at their own risk and the authors owe them no duty of care.

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 only included within the "electronic", PDF Report on the accompanying CD.

The findings and opinions conveyed in any Desk Study section of the report (including review of any third party reports) are based on information obtained from the sources listed, which Lithos understands are reliable. All reasonable skill, care and diligence has been applied in examining the information obtained. However, Lithos accept no responsibility for inaccuracies in the data supplied or for opinions based on any such inaccurate data.

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.

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

**PRELIMINARY  
GEOENVIRONMENTAL INVESTIGATION  
OF LAND AT  
MIDLAND ROAD, ROYSTON**

## **1 INTRODUCTION**

### **1.1 The commission and brief**

- 1.1.1 Lithos Consulting were commissioned by Kier Living Northern to carry out a preliminary investigation of land off Midland Road, Royston.
- 1.1.2 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.
  - Assessment of anticipated ground conditions, including potential contaminants
  - Assessment of anticipated foundation and engineering issues associated with redevelopment for a residential end-use
  - Provision of recommendations for an appropriate ground investigation
- 1.1.3 This Preliminary Investigation comprised an inspection of historical and geological maps and information provided by the British Geological Survey, and the Landmark Information Group, the Coal Authority, and the Environment Agency. In addition a site inspection has been carried out by Lithos.
- 1.1.4 Primary aims of this investigation were to identify salient geoenvironmental issues affecting the site to enable design and costing of an appropriate intrusive investigation, and to support the submission of a planning application.

### **1.2 The proposed development**

- 1.2.1 It is understood that consideration is being given to redevelopment of the site with about 80 traditional 2 storey domestic dwellings, associated gardens, POS and adoptable roads and sewers.
- 1.2.2 An appraisal layout has been prepared by Geoff Perry Associates (Drawing reference A645-18, dated October 2015) which is reproduced here as Drawing No. 2321/2 in Appendix B.

### **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 2321/1 presented in Appendix B to this report. Site details are summarised in the table below.

Detail	Remarks
Location	5.5 km north east of Barnsley town centre
NGR	SE 362 116
Area	2.1 hectares (5.2 acre)
Known services	Underground electrical and gas utilities

### 2.2 Site features

2.2.1 Lithos completed a walkover survey of the site on the 21<sup>st</sup> July 2016.

2.2.2 Existing salient features, at the time of the walkover are presented on Drawing 2321/3 in Appendix B to this report, and summarised in the table below.

Feature	Remarks
Current access	Off Midland Road & via adjacent construction site
Topography	Relatively flat, generally slopes down to the north & east Low (c.0.6m) cut face along western boundary Several stockpile mounds in central west
Approximate areas	5,000m <sup>2</sup> building (now demolished) 3,500m <sup>2</sup> tarmac hardstand – access roads & footpaths 12,500m <sup>2</sup> rough grass & weeds
Nature of boundaries	North, south & east – steel palisade fencing with areas of heras fencing West – steel palisade fencing atop cut slope
Surrounding land uses	North – residential development under construction South – houses, church & Midland road with school & housing beyond East – ASDA supermarket with housing & health clinic beyond West – leisure centre, library & housing

2.2.3 A selection of site photographs is included on Drawing 2321/4.

2.2.4 The site comprises a single portion of land which is broadly rectangular in shape with two 'spurs' of land; one in the south western corner and one in the east. The spurs are surfaced by tarmac, and comprise access points for the site.

2.2.5 The site can be accessed off of Midland Road via a tarmac road way, which is secured by 8ft high steel palisade gates. The road is heavily overgrown by adjacent trees and shrubs, but is suitable for construction traffic. At the time of walkover a car was parked on the track blocking access, and the gate was unlocked and left slightly ajar.

2.2.6 Access could also be gained from the east through an adjacent construction site. At the time of walkover this access was secured by heras fencing panels.

2.2.7 Surfaces predominantly comprise long grasses with immature shrub and weed growth. The ground underfoot is generally rough and uneven. Anthropogenic materials (ie bricks, concrete etc) were frequently seen at surface. The centre of the site displayed poor plant growth.

- 2.2.8 The central south ease is occupied by several stockpiles of material. Inspection of the stockpile surface suggests the material comprises residual soils with demolition rubble. At the base of one of the stockpiles a c. 0.4m high brick and mortar wall was noted.
- 2.2.9 In the south east is a tarmac sports area. The area is surrounded by 8ft high wire fencing. The tarmac has been painted with several overlapping sports pitches and the fencing has football goals, cricket stumps and basketball/netball hoops built into it.
- 2.2.10 Several tarmac footpaths cross the north and east of the site. One footpath runs along much of the northern boundary and appears to be new (see Section 2.3). The remaining footpaths appear to be relatively old. Several of the footpaths run beneath the stockpiles.
- 2.2.11 The site's boundaries predominantly comprise 8ft high steel palisade fencing; a section in the north east is secured by heras fencing. The eastern spur is 'cut off' from the rest of the site by a heras fence and has no physical boundaries. The south western spur is 'cut off' from the site by an 8ft high palisade gate and is bordered by overgrown hedgerows.
- 2.2.12 Along the eastern boundary the adjacent land (occupied by a leisure centre) is topographically about 1.0m higher than site levels. The eastern boundary comprises a near vertical cut into a succession of made ground topsoil (about 400mm) overl natural residual soils (gravelly clay). The steel palisade fence sits atop this cut slope.
- 2.2.13 Immediately beyond the northern boundary a new housing development is under construction. Some houses are completed and inhabited by residents, whilst some are still under construction.
- 2.2.14 The east of the site appears to be in use as a general storage area; see Section 2.3
- 2.2.15 An electrical sub-station is located immediately beyond the south western corner. The sub-station appears to be modern and in good repair.
- 2.2.16 No living mature trees are present within the site boundary, although it is not known whether mature trees were felled during/following site clearance. A single dead tree is present in the central south west.
- 2.2.17 The western boundary is bordered by closely spaced mature and semi mature trees. The southern boundary is bordered by medium spaced shrubs and hedgerows within the adjacent gardens.

## 2.3 Site operations

- 2.3.1 At the time of walkover the site was predominantly empty and no site users were seen. However, it was apparent that activities associated with the adjacent construction site had recently taken place.
- 2.3.2 The tarmac path which runs along much of the northern boundary appeared to still be under construction. In areas only sub base was present, apparently awaiting placement of a tarmac top surface.
- 2.3.3 The road in the far east was used by residents and construction traffic at the adjacent construction site and completed new builds. Traffic appeared to range from small family cars to forklifts, dumper trucks and delivery lorries.
- 2.3.4 In the north east the construction materials and waste within the skip appeared to have been placed recently; machine tracks lead from the materials into the adjacent construction site through a heras fence gate.

2.3.5 Materials stored in the area comprised:

- Empty diesel fuel containers (25ltr plastic drums)
- Concrete beams (for construction of block & beam floors)
- Used wooden pallets
- Wood (for fencing)
- Scaffolding poles & boards
- Breeze blocks
- Metal safety fencing
- Plastic utility pipes
- Stockpiles of:
  - Made ground topsoil
  - Crushed limestone (sub base)
  - Demolition waste (concrete, breeze blocks, bricks ect.
- A large skip which appears to be filled with PVC plastic waste

### 3 SITE HISTORY

- 3.1 In order to investigate the development history and previous land uses at the site and immediate surrounding land, site centred extracts from Ordnance Survey (OS) plans dating back to 1854 have been examined. These plans are presented in Appendix D to this report.
- 3.2 In December 2012 Royston High School merged with the nearby Edward Sheerien School and renamed Carlton Community College. As a consequence of this merger, the school was relocated to a new purpose built building in Carlton.
- 3.3 The footprint of former school buildings are shown on Drawing 2321/8 in Appendix B to this report.
- 3.4 The table below provides a summary of the salient points relating to the history of the site with respect to the proposed end use. 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
1854	Site is greenfield divided into 4 sections by ?hedgerows with widely paced trees	Royston village, including Methodist chapel, 50m south west Senior Lane (now Midland Road) runs roughly east to west just beyond southern boundary
1893	Extreme south occupied with trees	Development & expansion of Royston village, including development of cottages immediately beyond the southern boundary <b>Old quarry 225m west*</b>
1906	Small <b>structures</b> (likely feeding troughs/shed) & trees in east	School developed 25m east Further housing developed immediately beyond southern boundary**
1919	Small <b>structures</b> (likely garden sheds) encroach into southern boundary	Large earthwork ?mound 100m north east. (nature unknown) Further development of Royston to the east and south west
1933	Small <b>structure</b> (likely garage/shed) in south western corner	
1948	<b>Royston Secondary School</b> comprising two large buildings developed in central west.	No significant changes
1956	No significant changes.	
1962	Further <b>school building</b> developed in centre of site	Further development of Royston to the south, east & west
1975	Trees no longer shown in east	
1981	Tarmac basketball area in south eastern corner Site no longer divided up by hedgerows	Quarry 225m west no longer shown Earthwork mound 100m north no longer shown
1991	Expansion of school with <b>two large buildings</b> in north & beyond site boundary	Further development of the surrounding area
2000		No significant changes
2006	No significant changes	School developed 50m south
2009		
2013	School buildings no longer shown	No significant changes
2016	No significant changes	

\* the impact of the historical quarry upon the site is discussed further in Section 4.4.

\*\* a single building is shown encroaching into the extreme south. This is likely a result of minor errors in mapping rather than development within the site boundary.

## 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. The responses received from the Coal Authority, and extracts from the Landmark Report are presented in Appendix E.

Issue	Data reviewed	
Geology	1:10,000 BGS map (Sheet SE31SE) BGS memoir 87 (Barnsley & BGS technical report WA/93/56* BGS Log: SE31SE46	Drift – none shown. Solid – Mexborough Rock (sandstone unit within Pennine Middle Coal Measures). Shallowest coal seam – Royston Coal (0.8m thick) anticipated at about 33m depth; see Section 4.2. Strata Dip - 14° north, downthrows to the north east. Faults – single fault orientated north west to south east crosses centre of site.
Mining	Coal Authority BGS maps	This site is located within a Coal Mining Development Low Risk Area. A CA Development High Risk Area runs immediately beyond the southern boundary. Past and present workings – none recorded at shallow depth. Mine entries – none within 20m of boundary. Further details in Section 4.2.
Quarrying	Historical OS plans	Historical quarry located about 225m south west.
Radon	Public Health England	The site lies in an area where between 5% and 10% of homes are estimated to be above the action level. Therefore basic measures required.
Hydrogeology	Environment Agency	Source Protection Zone? No. Aquifer none shown (Drift); Secondary A (Solid). Groundwater abstractions? None within 500m. Soil leaching potential – High leaching potential (cat. U). Pollution incidents? None of significance to site.
Hydrology	Envirocheck Report	Nearest watercourse(s) – 100m south east (un-named tertiary river) flows south east away from site. Pollution incidents? None of significance to site. Abstractions? None within 500m. Discharge consents? Several 450 – 500m south; sewage discharge pumping stations into tertiary rivers by Yorkshire Water Services Ltd
Flood risk	Environment Agency Envirocheck Report	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, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency).

\* BGS technical report refers to Sheet SE31NE which is the geological map located adjacent to Sheet SE31SE (this site's) northern boundary.

## 4.2 Coal & mining

### General

- 4.2.1 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 mining risk assessment required by the proposed planning application.
- 4.2.2 Geological maps and BGS Technical Report suggest that two coal seams underlie the site at shallow depth. These are the:
- (unnamed thin) coal
  - Royston Coal (about 0.8m thick) which outcrops about to the south\* and is anticipated to dip at 14° beneath the proposed development at depths of about 20m (in the south) to greater than 50m (in the north)
- \*depths calculated using trigonometry assuming 14° dip and outcrop of Royston Coal as shown on BGS map SE31SE. Note that the south of the site has been considered to be the edge of the area developed with housing NOT the 'spur' of land which an access road is located upon. The shallowest coal beneath the undeveloped 'spur' is likely to be around 15m.
- 4.2.3 The approximate outcrop of the Royston Coal is shown on Drawing 2321/9 in Appendix B.
- 4.2.4 The next shallowest coal seam is the Charlston Top Coal which is anticipated about 40m beneath the Royston Coal. The BGS log (BH SE31SE46), located about 180m north of the site, suggests the Charlston Top lies at about 70m bgl, this is about 25m shallower than might be anticipated based on seam outcrop and dip.
- 4.2.5 Although the BGS technical report refers to the adjacent map sheet (SE31NE), it does discuss historical recorded and unrecorded workings within the Royston and Charlston Top coal seams.
- 4.2.6 It should be noted that seam outcrops plotted on geological maps have been known to be inaccurate by distances in excess of 100m.
- 4.2.7 The site lies within a Low Risk Area - within the defined coalfield, but no known defined risks have been recorded by the CA; there may still be unrecorded issues.
- 4.2.8 A high risk area just beyond the southern boundary probably is probably associated with shallow historical workings in the Royston Coal Seam.

### CA mining report

- 4.2.9 A CA mining report states that:
- *The property is in a surface area that could be affected by underground mining in 8 seams of coal at 280m to 530m depth, and last worked in 1980 ... any movement in the ground due to coal mining activity should have stopped by now. This means that there are no recorded shallow mineworkings beneath the site. However;*
  - *However, the property is in an area where the Coal Authority believes there is coal at or close to the surface. This coal may have been worked at some time in the past. This comment probably relates to the Royston Coal Seam.*
  - *The property is not in the likely zone of influence of any present underground coal workings.*
  - *The property is not in an area for which the Coal Authority is determining whether to grant a licence to remove coal using underground methods.*
  - *There are no known mine entries within, or within 20 metres of, the boundary of the property.*

- *The Authority is not aware of any evidence of damage arising due to geological faults or other lines of weakness that have been affected by coal mining. This confirms the absence of any known significant geological faults below the site.*
- *The site is not within the boundary of an opencast site from which coal has been removed by opencast methods.*
- *The property is not within 800 metres of the boundary of an opencast site for which the Coal Authority is determining whether to grant a licence to remove coal by opencast methods.*
- *There is no record of a mine gas emission requiring action by the Coal Authority within the boundary of the property.*
- *The property is in an area where notices to withdraw support were given in 1952 and 1980. This notice probably refers to extraction within known workings beneath the site last worked in 1980.*
- *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. This means that the Coal Authority no longer have the entitlement to mine beneath the site.*

4.2.10 It should be noted that it did not become a statutory requirement to maintain and preserve plans of abandoned mines until the Mine (Coal) Regulations Act of 1872 and consequently there may be mineworkings beneath the site for which the Coal Authority have no records.

### Discussion

4.2.11 The shallowest workable coal seam anticipated beneath the site is the Royston Coal which is anticipated from about 20m depth. Assuming a coal (and hence workings) thickness of 0.8m; a safe thickness of competent cover is considered to be 8m of solid rock.

4.2.12 The CA does not hold any records of workings at shallow depth (less than 45m) beneath the site.

4.2.13 It is considered likely that a sufficient thickness of competent cover lies above the Royston Coal (which in any case may not have been worked). However, consideration should be given to drilling to remove any residual uncertainty.

### 4.3 Landfills

4.3.1 BGS mapping, the Environment Agency and the Landmark report record an area of landfill within, and immediately beyond, the north of the site. The landfill is named as 'Warren Walk, Royston, Barnsley' (SE 363 116 Ref. EAHLD04272). The landfill license is held by Barnsley Metropolitan Borough Council.

4.3.2 Lithos requested information from Barnsley Metropolitan Borough Council on the nature of the landfill, in order to assess its potential impact on the site.

4.3.3 Barnsley Metropolitan Borough Council state that they are '*unable to find any record of a landfill process occurring*', but that the land was '*regraded as part of drainage works to the school playing fields*'. Further, Barnsley MBC state that '*having reviewed the planning file... it does not appear that any imported material was used and material was exported from site in order to achieve desired levels*'.

4.3.4 It is apparent from correspondence with Barnsley MBC that the north of the site has been subject to some regrade which predominantly comprised lowering of levels and removal of spoil from site.

4.3.5 Further impacts of the landfill on the proposed development are discussed in Section 4.4.

## 4.4 Hazardous gas

### Methane & carbon dioxide

- 4.4.1 The site does lie within close proximity to the following features which could typically be considered sources of ground gas:
- A historic quarry is located less than 250m (225m) to the west and,
  - An area of historic landfill ('Warren Walk, Royston') is present in the north and just beyond the north of the site.
- 4.4.2 However consideration should be given to the exact nature of the sources.
- 4.4.3 The old quarry is located a significant distance beyond the site boundary. Review of historical maps shows that the quarry was never a significant size (with a maximum footprint of about 180m<sup>2</sup>) and appears to have never been backfilled. Given these factors the quarry is unlikely to generate a suitable volume of gas to reach into the sites boundary.
- 4.4.4 The landfill is not considered likely to contain degradable materials or significant thicknesses of made ground. Indeed, the area is reported (by Barnsley MBC) to have been subject to some regrade which predominantly comprised lowering of levels and removal of spoil from site.

### Radon

- 4.4.5 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. At present Approved Document C advocates basic measures for the probability banding 3% to 10% (full measures if >10%).
- 4.4.6 The Public Health England UK radon map and the Landmark report indicate that the site is in an area where between 5% and 10% of homes are estimated to be above the action level, and basic radon protection measures are required in new dwellings.
- 4.4.7 In accordance with BR211:2015, basic radon measures simply comprise a barrier (membrane) laid within the floor construction, which is linked to a damp-proof course (DPC) within the walls of the building. The DPC to cavity walls should be in the form of a cavity tray to prevent radon entering the building through the cavity. Sealing of joints in the barrier and sealing around service penetrations are also required. A 1200 gauge polythene membrane should suffice, and sub-floor ventilation is not essential.

## 4.5 Land contamination - Part IIA & planning

- 4.5.1 Local Authorities have responsibilities with respect to land contamination in the context both of Part IIA of the Environmental Protection Act 1990, and Planning.
- 4.5.2 The contaminated land regime in Part IIA was introduced specifically to address the historical legacy of land contamination. It applies where there is unacceptable risk, assessed on the basis of the current use and the relevant circumstances of the land. It is not directed to assessing risks in relation to a future use of the land that would require a specific grant of planning permission. This is primarily a task for the planning system, which aims to control development and land use in the future.

## Planning

- 4.5.3 As of 27<sup>th</sup> March 2012, Planning Policy Statement (PPS23) was replaced by the National Planning Policy Framework (NPPF). The NPPF includes the following with respect to contamination and site investigation:
- 4.5.4 'Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.
- 4.5.5 Planning policies and decisions should ensure that:
- The site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses, and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation;
  - After remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the environmental protection act 1990; and
  - Adequate site investigation information, prepared by a competent person, is presented'.
- 4.5.6 Annex 2 of the NPPF states that 'all investigations of land potentially affected by contamination should be carried out in accordance with established procedures (such as BS10175 - 2011, Code of Practice for the Investigation of Potentially Contaminated Sites)'.

## This site

- 4.5.7 The underlying Coal Measures are classified as a Secondary A aquifer. The nearest surface watercourse is an un-named tertiary river which flows in a southerly direction (away from the site), approximately 100m to the south east. Therefore, the site's environmental setting is considered to be low sensitivity.
- 4.5.8 With respect to human health, the proposed end use (residential) is sensitive.
- 4.5.9 Historical use of the site as a school is considered unlikely to have caused any significant ground contamination.
- 4.5.10 It is considered that the site should be suitable for the proposed use subject to implementation of appropriate preparatory works; see Section 6.

## 5 PREVIOUS INVESTIGATION FINDINGS

### 5.1 General

5.1.1 Lithos completed an exploratory ground investigation (a days' trial pitting) at the above site 10<sup>th</sup> June 2016. The agreed scope of works included contaminant testing of selected soil samples.

### 5.2 Summary of findings

5.2.1 Thirteen trial pits (TPs 1 to 13) were advanced to depths of 1.5m to 3.0m.

5.2.2 Fieldwork findings are summarised below.

Issue	Remarks
Made ground	Encountered in 11 pits, average thickness of 0.7m; maximum of 1.8m (TP11). Ash & clinker was encountered beneath former sports courts, while a mixture of essentially inert cohesive and granular made ground was identified across the majority of the site, likely associated with the creation of development platforms for the former school. Several bunds exist in the west of the site. One trial pit was advanced through a bund and encountered reworked clay, with very minor amounts of anthropogenic material.
Natural ground	Topsoil (typically 300mm in thickness), over cohesive residual soils (firm or stiff clays), with granular residual soils (clayey sands and/or gravels) only encountered in two pits (TPs 6 & 7). Bedrock was encountered in 11 pits from an average depth of 2.3m
Contamination	No visual\olfactory evidence of hydrocarbon contamination was noted
Groundwater & excavations	Groundwater was not encountered within any of the exploratory holes Spalling occurred in 4 trial pits. Shallow excavations through made ground are unlikely to remain stable during the construction phase in the short term. A land drain was encountered in TP3; ceramic drains (presumably associated with former school buildings) were encountered in TPs 4, 5 & 8; and french drains were encountered in TPs 9 & 10. These were all dry during site works, however these may provide pathways for water ingress into excavations in wetter periods.

5.2.3 Contaminant analysis was scheduled on 7 samples of made ground and 5 samples of recovered.

5.2.4 A bed of Ash & Clinker (c. 250mm thick) was encountered beneath former sports courts; an area of c. 2,000m<sup>2</sup>.

5.2.5 Two samples of Ash & Clinker were analysed for calorific value (CV). One sample (TP01) recorded 8.7MJ/kg while the other (TP02) recorded <1MJ/kg. Materials with CVs of less than 2MJ/kg are unlikely to burn while materials with CVs of greater than 10MJ/kg are almost certainly combustible.

5.2.6 Of the 10 samples of ground analysed for inorganic parameters, all can be classed as uncontaminated.

5.2.7 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 the proposed end-uses).

5.2.8 Burnt shale was noted in two trial pits, therefore aqueous sulphate testing was scheduled. The sulphate concentrations recorded were 920mg/kg and 38mg/kg.

5.2.9 No asbestos fibres were identified in any of the 13 samples screened.

5.2.10 Of the 10 samples analysed for organic parameters only 1 (a sample of Ash & Clinker from TP01), could be classified as contaminated. This sample yielded a significantly elevated concentration of benzo(a)pyrene.

5.2.11 In summary, the following ground-related abnormalities were identified:

- Possibly combustible Ash & Clinker underlies an area of approximately 2,000m<sup>2</sup> beneath former sports courts.
- At this stage, it would be prudent to assume that the Ash & Clinker will require isolation beneath 1000mm of inert cover. Elsewhere, a 600mm thickness of soil cover should suffice.
- Trees on and adjacent to the site will necessitate some over-deepening of foundations. Consideration will also need to be given to recently felled trees in the south of the site.
- Made ground was encountered across the site to an average depth of 0.7m (maximum of 1.8m), this will require some localised over-deepening of foundations.
- Soakaways are highly unlikely to provide a suitable means of surface water disposal at the site. Consequently there is likely to be a need for surface water balancing

5.2.12 It is anticipated that further ground investigation will be completed prior to development; see Section 6.

## 6 GROUND INVESTIGATION DESIGN

### 6.1 Anticipated ground conditions & potential issues

6.1.1 Based on the data reviewed in Section 4 (Environmental Setting) anticipated ground conditions are expected to comprise:

Anticipated condition	Remarks
Made ground	Veneer of made ground beneath areas of hardstand. Areas of deeper made ground associated with building foundations. Possible made ground associated with drainage & site regrade work (mapped landfill).
Natural soils	Veneer of Residual Soils (weathered coal measures). Likely comprising firm to stiff gravelly clay.
Bedrock	Coal Measures (interbedded mud, silt & sandstones) at shallow depth
Mineworkings	Anticipated at depth (>30m)
Groundwater	Anticipated at depth within bedrock

6.1.2 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. Made ground	1. Associated with drainage and regrade work (mapped landfill) 2. Beneath areas of hardstand & former school buildings
Potential off-site contamination sources	1. Adjacent landfill 2. Nearby old quarry	1. potential for leaching of contaminants and migration of ground gasses 2. potential for migration of ground gasses
Potential geotechnical hazards	1. relict buried obstructions 2. deep MG	1. foundations, old basements ect associated with former school buildings 2. associated with regrade & former school buildings
Other potential constraints	1. Underground electric and gas utilities	1. Run beneath west and centre of site

## 6.2 Preliminary conceptual site model

- 6.2.1 The historical plans show that the site has been occupied by a school; which is not considered likely to have caused significant ground contamination. However areas of deep made ground, and use of the site as a construction storage area might have given rise to some contamination.
- 6.2.2 A preliminary conceptual site model is presented as Drawing 2321/5 in Appendix B to this report. Clearly, the conceptual model will be subject to modification in light of data arising from the proposed intrusive ground investigation.

## 6.3 Ground investigation design & strategy

- 6.3.1 The preliminary conceptual site model has used as a basis for design of an appropriate ground investigation, the scope of which is summarised below.

Exploratory holes	Purpose
About 25 trial pits (13 already dug; see Section 5)	To determine the general nature of soils underlying the site, including the: <ul style="list-style-type: none"> <li>• nature, distribution and thickness of made ground</li> <li>• nature, degree and extent of contamination</li> <li>• proportion of undesirable elements eg biodegradable matter, foundations etc</li> <li>• suitability of the ground for founding structures and highways</li> </ul>
About 8 window sample boreholes	To install monitoring wells across the site in order to monitor for hazardous gas
Up to 5 rotary probeholes	Consideration should be given to drilling to remove any residual uncertainty associated with possible unrecorded mineworkings in the Royston Coal.

- 6.3.2 Proposed exploratory hole locations should be selected to provide a representative view of the strata beneath the site and to target potential areas of interest identified in Section 5 above. A nominal 45m grid spacing should be appropriate, with additional exploratory locations scheduled as necessary in light of the ground conditions actually encountered.
- 6.3.3 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.
- 6.3.4 The investigation should be undertaken in general accordance with:
  - BS5930:2015 "Code of practice for site investigation"
  - BS10175:2011+A1:2013 "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)
- 6.3.5 The in-situ shear strengths of any cohesive soils encountered should be determined by use of a hand-held shear vane.
- 6.3.6 The potential for soakaways should be reviewed in light of ground conditions actually encountered, and if considered likely (i.e. granular residual soils and/or sandstone bedrock), soakaway tests should be commissioned. Testing would also remove any ambiguity with respect to Yorkshire Water queries.
- 6.3.7 Routine geotechnical soils analysis (moisture content, Atterberg limits, pH, water soluble sulphate) should be scheduled on about 9 samples of natural soils.

- 6.3.8 Appropriate chemical analyses based on the findings of this Report should be allowed for. This is likely to comprise about 18 samples for a suite including heavy metals, asbestos ID, TOC, banded TPH (with supplementary speciation where appropriate), and speciated PAH. In the event that ground contamination is more significant or different to that anticipated, it might be necessary to carry out additional chemical testing.
- 6.3.9 It is considered likely that a sufficient thickness of competent cover lies above the Royston Coal (which in any case may not have been worked). However, consideration should be given to drilling to remove any residual uncertainty.
- 6.3.10 Five probeholes should be sufficient to determine whether or not old mineworkings are present in the Royston Coal and, if present, whether or not these 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.
- 6.3.11 It will be necessary to submit an application (with the associated fee) to the Coal Authority (CA) for 'Permission to enter CA mining interests'.
- 6.3.12 Given the proximity of surrounding housing (within 50m of much of the general site area), and in accordance with CA requirements it will be necessary to advance probeholes using water as the flushing medium (as reinforced by recent CA guidance on managing the risk of hazardous gas).
- 6.3.13 The generation potential of gas sources is considered likely to be Very Low. Therefore, in accordance with CIRIA Report C665, it would be prudent to initially allow for 6 visits over a 3 month period. A hazardous gas risk assessment should be issued on completion of monitoring.
- 6.3.14 On completion of the fieldwork and laboratory testing a comprehensive bound, factual and interpretative report should be issued. This should contain detailed engineering records, laboratory test results, copies of all relevant correspondence and drawings of the site. The report should also include qualitative risk assessment with respect to both controlled waters and human health.

## 7 CONCLUSIONS & RECOMMENDATIONS

### 7.1 General

- 7.1.1 It is understood that Kier Living are considering acquisition of the site with a view to redevelopment with housing. An appraisal layout, which shows about 80 proposed dwellings, has been provided and is reproduced here in Drawing 2321/2 in Appendix B.
- 7.1.2 The main issues considered in this report, and in particular in Sections 3 and 4 are based on a review of historical maps and available geological/environmental data. This report provides an assessment of geoenvironmental issues and implications associated with the proposed residential redevelopment of the site.

### 7.2 Mining and quarrying

- 7.2.1 The site lies within a Coal Authority Low Risk area, and it is considered likely that a sufficient thickness of competent cover lies above the Royston Coal (which in any case may not have been worked). However, consideration should be given to drilling to remove any residual uncertainty.

### 7.3 Hazardous gas

- 7.3.1 The site is in an area where between 5% and 10% of homes are above the action level for Radon, and basic radon protective measures will be required.
- 7.3.2 There is an area of recorded landfill both within and beyond the north eastern boundary. This landfill is not considered likely to contain degradable materials or significant thicknesses of made ground. Indeed, the area is reported (by Barnsley MBC) to have been subject to some regrade which predominantly comprised lowering of levels and removal of spoil from site.
- 7.3.3 The site is underlain at depth by coal seams and mineworkings, although due to the depth of the workings, this is considered to be of a very low risk.
- 7.3.4 The generation potential of gas sources is considered likely to be Very Low, but this should be confirmed by a period of gas monitoring; initially 6 visits over a 3 month period.

### 7.4 Foundations

- 7.4.1 The exploratory ground investigation already completed suggests a veneer of made ground overlies residual soils (predominantly firm or stiff clays), with bedrock likely from 2m to 3m. Before firm foundation recommendations can be given, it will be necessary to complete the ground investigation. However, tentative recommendations are provided below.
- 7.4.2 Made ground is not generally considered a suitable founding material and foundations should be taken through it, into underlying natural in-situ strata of adequate bearing capacity. Consequently, alternative foundation solutions will be required in any areas of deep made ground (greater than about 1.5m).
- 7.4.3 All concrete slabs and service ducts will require breaking out during the demolition of existing buildings. Foundations of plots that conflict with relict foundations should be taken to greater depth than the relict foundations and into natural ground of adequate bearing capacity.
- 7.4.4 Residual soils should provide sufficient bearing capacity to enable the adoption of strip footings for two storey housing. Reinforcement, as a precaution against differential settlement, is recommended only where foundation excavations encounter significant lateral and vertical variations in strata.
- 7.4.5 If rock is encountered at shallow depth, foundations should be placed entirely on rock and not partially on rock and partially on residual soil. This may, depending on surface gradient, necessitate significant over deepening of foundations.
- 7.4.6 Drawing 2321/9 shows the approximate line of the fault which crosses the centre of the site.
- 7.4.7 It should be noted that the line of a fault on a geological map is often very approximate, and it may be inaccurate by 10m or more. Furthermore, the presence of a fault is usually 'masked' by overlying drift or residual soils; they can only be seen where long trenches are excavated into bedrock.
- 7.4.8 NHBC like to see reinforcement of footings with one layer of B385 mesh placed 75mm above the base of the footing. Given the uncertainty regarding the precise line of the fault, it would be prudent to reinforce the footings of all plots within 25m of its assumed line.

7.4.9 Further advice should be sought if a significant weak zone is 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.

## 7.5 Highway, drainage and external works issues

7.5.1 Given the relatively level nature of the site, there should be no requirement for retaining walls, underbuild, tanking etc.

7.5.2 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.

7.5.3 Given ground conditions encountered during the exploratory investigation (made ground over cohesive residual soils), soakaways are considered unlikely to provide a viable solution for the disposal of surface water.

7.5.4 Alternative SUDS options (see CIRIA C697:2007 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.
- 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.

## 7.6 Contamination

7.6.1 The site's environmental setting is considered to be of low sensitivity. With respect to human health, the proposed end use (residential) is also sensitive.

7.6.2 Based on observations made during the exploratory investigation, it would be prudent to assume that the Ash & Clinker will require isolation beneath 1000mm of inert cover. Elsewhere, a 600mm thickness of soil cover should suffice.

## 7.7 Potential development constraints

7.7.1 The underground electrical utilities present a potential development constraint unless they can be relocated prior to or during development.

7.7.2 Northern Powergrid may seek to restrict changes in site level if the depth of cover above their utilities were adversely affected by any development proposals. This aspect requires further clarification.

**Appendix A**

**General Notes**

#### 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 from the Local Authority and by reference to current and historical OS plans. A coal mining report is obtained from the Coal Authority (CA).

In July 2011, the 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 areas of higher risk (known as the Coal Mining Development Referral Area) and lower risk (known as the Standing Advice Area). The Coal Mining Development Referral Areas contain a range of specific mining legacy risks to the surface, including mine entries; shallow coal workings; workable coal seam outcrops; mine gas; geological features; and previous surface mining sites. The Standing Advice Area is the remainder of the defined coalfield. In this area no known defined risks have been recorded; although there may still be unrecorded issues.

#### Landfills

Lithos obtain data from the Landmark Information Group, the Environment Agency and the Local Authority with respect to known areas of landfilling within 250m of the proposed development site. Reference is also made to historical OS plans, which are 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 through 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, 2007: "Radon: guidance on protective measures for new buildings", and to information from the BGS / HPA (Health Protection Agency) radon potential dataset provided by the Landmark Information Group. The level of protection needed is site-specific and is determined by reference to the maps contained in Annex A of BR211. These maps are derived from the Radon Atlas of England and Wales (2007), and indicate 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 (average annual radon concentration of 200 Bq.m-3), as follows:

- Unshaded grid squares where less than 3% of homes are estimated to be above the Action Level, and no radon protection is required in new dwellings
- Light grey shaded grid squares where between 3% & 10% of homes are estimated to be above the Action Level, and basic radon protection is required in new dwellings
- Dark grey shaded grid squares where greater than 10% of homes are estimated to be above the Action Level, and full radon protection is required
- Sites where either basic or full radon protective measures are required (i.e. Where greater than 3% of homes are estimated to be above the Action Level) are referred to as Radon Affected Areas

BR211 provides a preliminary indication of the measures required for a particular site, as the Annex A maps indicate the highest geological radon potential within each 1km grid square, but in many cases the radon potential varies considerably within the grid square. The Landmark information is more site-specific and therefore may allow the adoption of a lower level of protection than that indicated in the Annex A maps. Alternatively, a BR211 Radon Report can be obtained from the BGS in order to provide more site-specific information.

It should be noted that in July 2010 the Health Protection Agency (HPA) published new advice (Document RCE-15: "Limitation of Human Exposure to Radon"), in which they recommend that all new buildings, extensions, conversions & refurbished buildings in the UK include (at least) basic radon protective measures. The HPA also widened the definition of Radon Affected Areas to include areas where greater than 1% of homes are estimated to be above the Action Level.

#### Hydrogeology

Lithos obtain information from the Environment Agency (EA) and the Landmark Information Group 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 type 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 drift 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 drift deposits with an equally wide range of water permeability and storage. Secondary aquifers are subdivided into two 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 - has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type

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

Note: The maps only display the principal and secondary aquifers as coloured areas. All uncoloured areas on the bedrock designation 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 drift is present. To do this, it is necessary to consult the published geological survey maps.

For the purposes of our 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 drift overlies principal bedrock, an overall designation of principal is assumed)

The EA have also designated 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

Lithos obtain information from the Environment Agency and the Landmark Information Group with respect to:

- surface water quality
- recorded pollution incidents
- licensed abstractions (groundwater & surface waters)
- licensed discharge consents
- site susceptibility to flooding

### Generic notes – geoenvironmental Investigations

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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 six 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 provide 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 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 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

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 (or 1 in 200 year as appropriate), 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 consultant who can advise on appropriate mitigating measures; ie raising slab levels, provision of storage etc.

### COMAH & explosive sites

Lithos obtain information from the Landmark Information Group with respect to COMAH or explosive sites within 1km of the proposed development site. Lithos's 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 ground 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 targets.

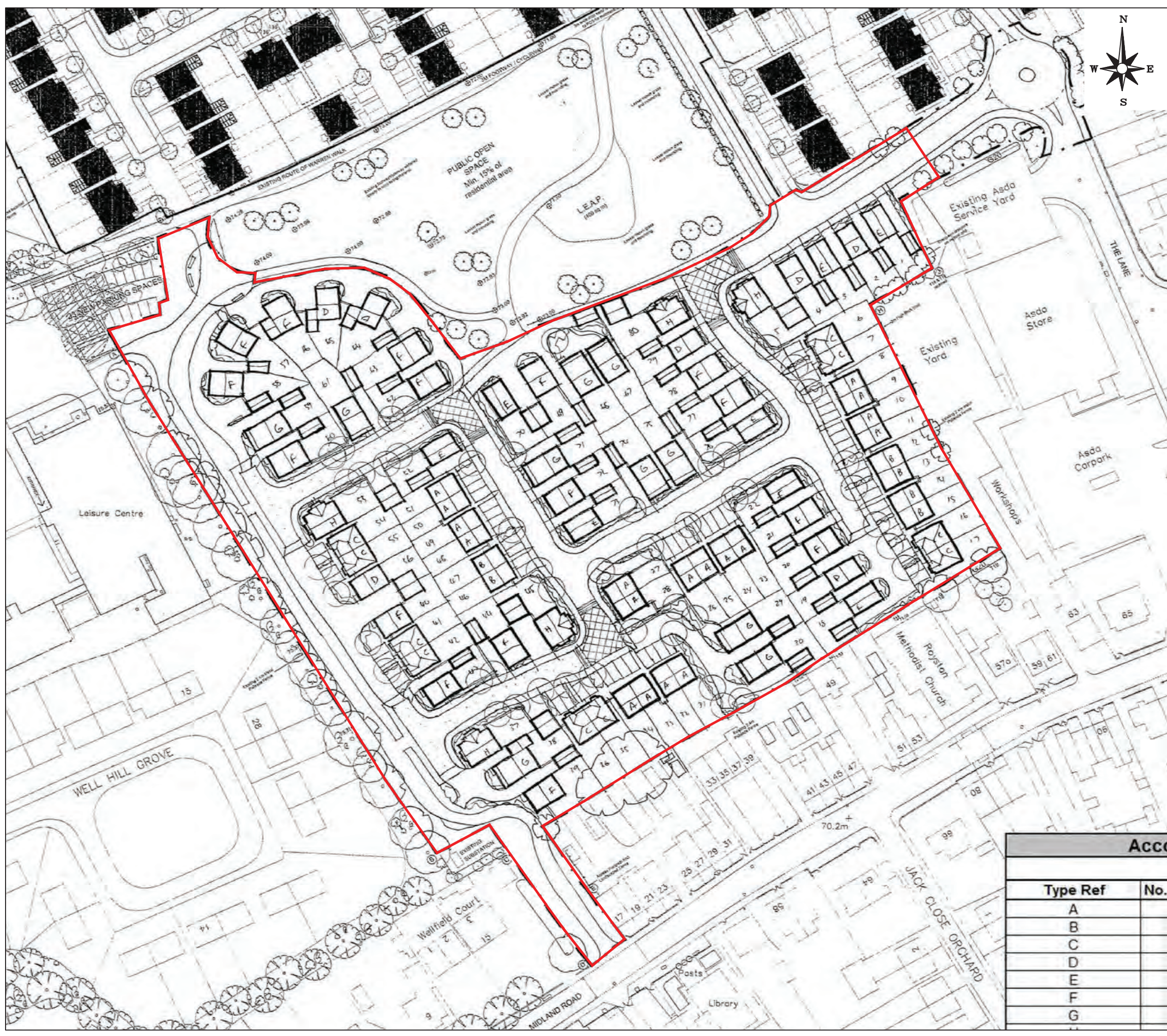
Potential pollutant linkages are shown on a preliminary conceptual site model, presented as a Drawing in an Appendix to this Geoenvironmental Report. The preliminary model is revised in light of data arising from the subsequent ground investigation.

**Appendix B**  
**Drawings**



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 info@lithos.co.uk www.lithos.co.uk Tel 01937 545330	CLIENT	JOB TITLE	DRAWING TITLE	DRAWN	DATE
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				REG	28 06 16
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				FOR APPROVAL <input type="checkbox"/>	FINAL <input checked="" type="checkbox"/>
			SCALE	SHEET	DRAWING NO.
			1:25,000	A4	2321/1
				REVISION	



NOTES

— APPROXIMATE SITE BOUNDARY

REPRODUCED FROM GEOFF PERRY ASSOCIATES LIMITED'S DRAWING 'APPRAISAL LAYOUT - MIDLAND ROAD, ROYSTON' Ref. A645-18 FOR KIER LIVING NORTHERN LTD. DATED OCTOBER 2015

REV.	DESCRIPTION	DATE

info@lithos.co.uk  
www.lithos.co.uk  
Tel 01937 545330

CLIENT

KIER LIVING NORTHERN LTD

JOB TITLE

MIDLAND ROAD, ROYSTON

Acco	
Type Ref	No.
A	
B	
C	
D	
E	
F	
G	

DRAWING TITLE

PROPOSED SITE LAYOUT

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CHECKED	REG	DATE	22/07/2016	FOR APPROVAL	DRAFT	<input type="checkbox"/>
				FINAL		<input checked="" type="checkbox"/>
SCALE	1:1,000	SHEET	A3	DRAWING NO.	2321/2	REVISION



NOTES

- GRASS & OVERGROWN AREAS
- TARMAC FOOTPATHS
- TARMAC HARDSTAND (ACCESS ROADS)
- TARMAC PLAY AREA
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE



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Tel 01937 545330

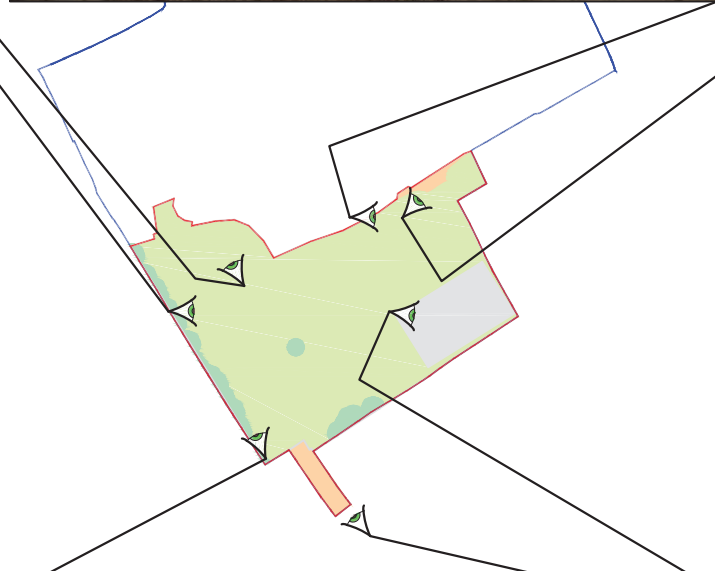
CLIENT  
**KIER LIVING NORTHERN LTD**

JOB TITLE  
**MIDLAND ROAD, ROYSTON**

DRAWING TITLE  
**SITE FEATURES**

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SCALE <b>1:1,000</b>	SHEET <b>A3</b>	DRAWING NO. <b>2321/3</b>	REVISION
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NOTES

- GRASS & OVERGROWN AREAS
- APPROXIMATE SITE BOUNDARY
- LOCATION & ORIENTATION OF PHOTOGRAPH

REV.	DESCRIPTION	DATE

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Tel 01937 545330

CLIENT

KIER LIVING  
NORTHERN LTD

JOB TITLE

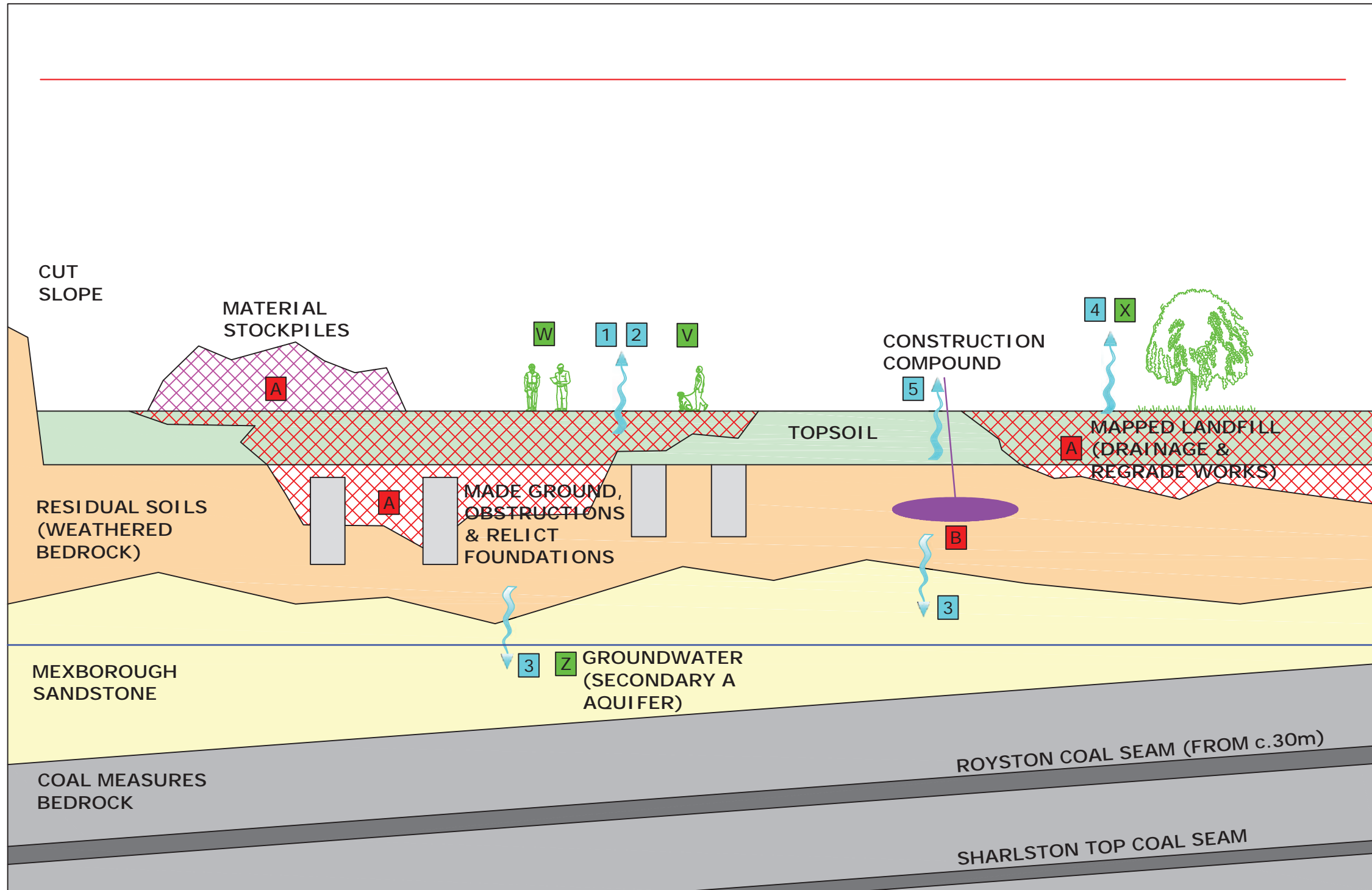
MIDLAND ROAD,  
ROYSTON

DRAWING TITLE

SITE PHOTOGRAPHS

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					FINAL	<input checked="" type="checkbox"/>

SCALE	NOT TO SCALE	SHEET	A3	DRAWING NO.	2321/4	REVISION	
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SOURCES	
<b>A</b>	MADE GROUND (INORGANICS)
<b>B</b>	LEAKAGE/SPILLAGE (ORGANICS)

PATHWAYS	
<b>1</b>	DERMAL CONTACT
<b>2</b>	INGESTION/INHALATION
<b>3</b>	LEACHING OF CONTAMINANTS
<b>4</b>	UPTAKE BY PLANTS
<b>5</b>	VOLATILISATION

RECEPTORS	
<b>V</b>	END USERS (RESIDENTS)
<b>W</b>	SITE WORKERS
<b>X</b>	VEGETATION
<b>Y</b>	SURFACE WATERS

NOTES

REV.	DESCRIPTION	DATE



info@lithos.co.uk  
www.lithos.co.uk  
Tel 01937 545330

CLIENT

KIER LIVING  
NORTHERN LTD

JOB TITLE

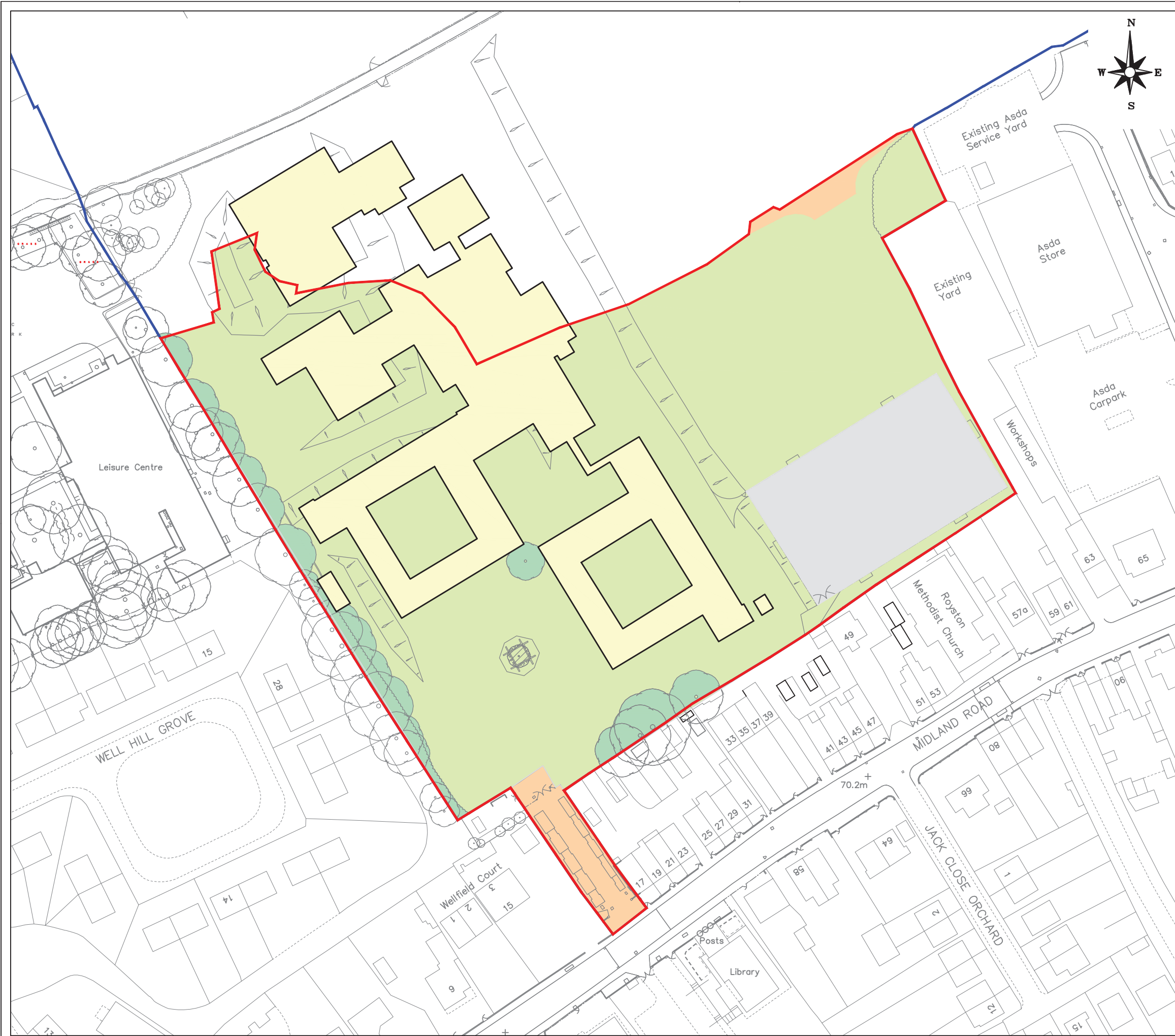
MIDLAND ROAD,  
ROYSTON

DRAWING TITLE


PRELIMINARY CONCEPTUAL SITE  
MODEL


DRAWN	GLM	DATE	25/07/2016	STATUS	FOR COMMENT	<input type="checkbox"/>
CHECKED	REG	DATE	25/07/2016	FOR APPROVAL	DRAFT	<input type="checkbox"/>
					FINAL	<input checked="" type="checkbox"/>

SCALE	Not to scale	SHEET	A3	DRAWING NO.	2321/5	REVISION	
-------	--------------	-------	----	-------------	--------	----------	--



NOTES

 FOOTPRINT OF FORMER SCHOOL BUILDINGS

 APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE



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www.lithos.co.uk  
Tel 01937 545330

CLIENT

KIER LIVING  
NORTHERN LTD

JOB TITLE

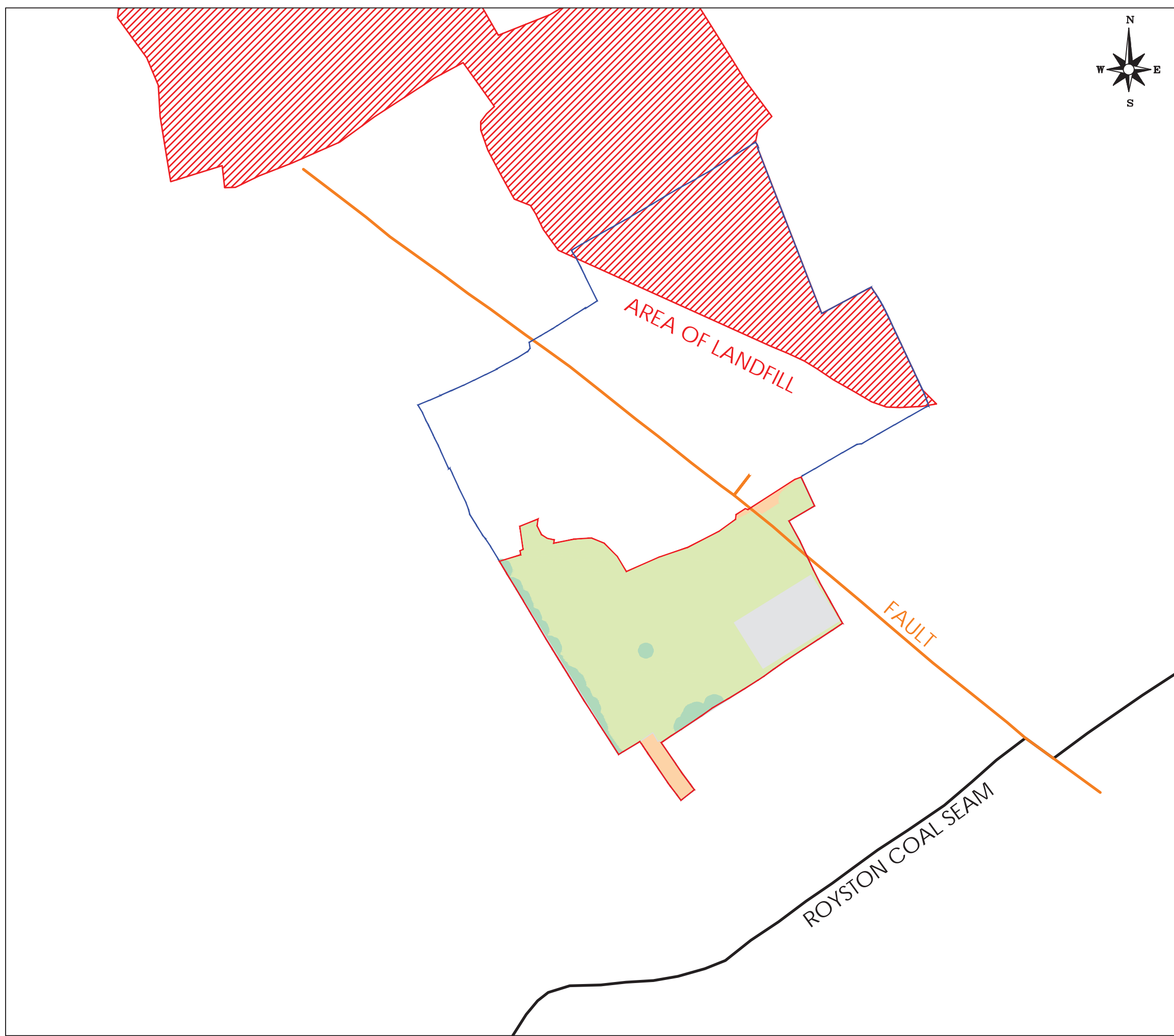
MIDLAND ROAD,  
ROYSTON





DRAWING TITLE

LOCATION OF HISTORICAL  
BUILDINGS

DRAWN	GLM	DATE	29 06 16	STATUS	FOR COMMENT	<input type="checkbox"/>
CHECKED	REG	DATE	29 06 16	FOR APPROVAL	DRAFT	<input type="checkbox"/>
					FINAL	<input checked="" type="checkbox"/>

SCALE	1:1000	SHEET	A3	DRAWING NO.	2321/8	REVISION	
-------	--------	-------	----	-------------	--------	----------	--



- NOTES
-  AREA OF HISTORIC LANDFILL
  -  APPROXIMATE LINE OF FAULT
  -  OUTCROP OF ROYSTON COAL
  -  APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE



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www.lithos.co.uk  
Tel 01937 545330

CLIENT

KIER LIVING  
NORTHERN LTD

JOB TITLE

MIDLAND ROAD,  
ROYSTON

DRAWING TITLE

EXPLORATORY HOLE LOCATIONS

DRAWN	GLM	DATE	29 06 16	STATUS	FOR COMMENT	<input type="checkbox"/>
CHECKED	REG	DATE	29 06 16	FOR APPROVAL	DRAFT	<input type="checkbox"/>
					FINAL	<input checked="" type="checkbox"/>

SCALE	1:2,500	SHEET	A3	DRAWING NO.	2321/9	REVISION	
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**Appendix C**  
**Commission**

002/2321/REG

30<sup>th</sup> November 2015

Mr D Cutts  
Kier Living Northern  
Unit 2180  
1st Floor, Thorpe Park  
Century Way  
Leeds  
LS15 8ZB



Registered in England 07068066

Parkhill  
Wetherby  
West Yorkshire  
LS22 5DZ

T 01937 545 330  
www.lithos.co.uk

Dear Dean

### Midland Road, Royston

Further to your recent invitation, please find attached our proposal for undertaking a site investigation on the above land. We understand that your proposed development will include about 80 traditional 2 storey domestic dwellings with associated gardens, POS and adoptable roads and sewers; a sketch layout has been prepared by Geoff Perry Associates.

Review of the drawing supplied suggests that the site consists of a single parcel of land of approximately 2.6 hectares north of Midland Road (B6248).

Brief review of Old Maps and Environment Agency data suggests the site:

- Has been occupied by a school & playing fields, from c. 1930s; but no buildings remain.
- Is within 250m of a known landfill site (Warren Walk); this landfill appears to extend beneath the north-east of the site itself.
- Is not within a groundwater source protection zone.

Brief examination of the relevant geological map suggests the site is underlain by a thin veneer of Boulder Clay, with Coal Measures bedrock at depth. This site is located within a Coal Mining Development Low Risk Area, therefore a mining report will be obtained (however, at this stage an intrusive mining investigation is considered unlikely to be required). A High Risk Area is located adjacent to south, but beyond Midland Road.

Our site investigation will be undertaken in accordance with UK good practice (as outlined in BS5930, BS10175, CLR11 etc), and 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 any past land uses have had any effect on the proposed development. In addition, published geological plans of the area will be examined. We will also visit site to undertake a walkover survey.

**Fieldwork:** We have allowed for two day's trial pitting and a day's window sampling using a mini percussion drilling rig. All trial pits and boreholes will be supervised and logged by an experienced geoenvironmental engineer.

The boreholes are primarily intended to enable the installation of gas wells.

Based on anticipated ground, soakaway tests are considered unlikely to provide a satisfactory solution for surface water drainage, although they would remove any ambiguity with respect to Yorkshire Water queries. Soakaway testing will be carried out in at least 5 pits in order to assess suitability of the ground for house and highway surface water drainage.



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.

The mechanical excavator will be equipped with a breaker to enable excavation through near-surface and buried concrete slabs and obstructions.

We will make every effort to compact arisings and 'sweep' them over each 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.

This investigation should yield sufficient data to enable a foundation zoning plan, and possibly a detailed Foundation Schedule. However, if ground conditions are found to be more variable than anticipated, a 'tighter' grid of pits will be necessary prior to preparation of a detailed Foundation Schedule. This proposal does not allow for the preparation of a detailed Foundation Schedule, but we will provide a quote on completion of the site investigation if requested.

Given the likely presence of an area of landfill, we have allowed for the installation of wells in 8 holes and monitoring for hazardous gas (and any shallow groundwater).

The generation potential of this gas source is considered likely to be Low. Therefore, in accordance with CIRIA Report C665, we have initially allowed for 9 visits over a 6 month period. A hazardous gas risk assessment will be issued on completion of monitoring.

This proposal has been put together without a visit to the site and it has been assumed that access is available for a JCB-type excavator.

**Soils testing:** This will comprise routine geotechnical soils analysis, including 9 moisture content & Atterberg limits, and 9 pH & water soluble sulphate.

This site is greenfield and the routes, formation level and total length, of proposed estate roads are known. However, proposed highways may be underlain oversized storage pipes, and therefore much of the natural ground beneath highways will be excavated. Consequently, we will simply estimate CBR values from strata descriptions and classification test results.

Appropriate chemical analyses, based on our knowledge of the site's history, have been allowed for; this will comprise 18 samples for a suite including heavy metals, speciated PAH, and banded TPH (with supplementary speciation as/where appropriate). In the event that ground contamination is more significant or different to that anticipated, it might be necessary to carry out additional chemical testing.

Within in our proposal we have allowed for the screening (ID) of 18 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:** In order to provide you with sufficient information to enable assessment of abnormal costs at the earliest opportunity we will issue a concise overview report within 3 days of fieldwork completion.

On completion of the desk study, fieldwork and laboratory testing a comprehensive bound, factual and interpretative report will be issued. This will contain detailed engineering records, 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 provide technically feasible options for redevelopment of the site with housing, including consideration of foundation types and treatment\removal of contamination.

Fieldwork could be commenced within 2 weeks of receipt of your written instruction to proceed. Our comprehensive geoenvironmental appraisal report will be issued within 4 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 copy of the final report will be issued to the relevant regulatory authorities on receipt of written instruction from yourselves.

**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.

Our proposal allows for submission of the report to the Local Authority and NHBC, and for submission of a single piece of subsequent correspondence with each regulator to address any queries they may have. Any further meetings, correspondence etc, would be chargeable.

We will submit invoices for this project at the milestones defined below:

- 1<sup>st</sup> milestone invoice (Items A to D) within 5 days of fieldwork completion, with exploratory hole logs and an interim letter report outlining our initial findings and preliminary recommendations report
- 2<sup>nd</sup> milestone invoice (Items E to G) on issue of the final SI report
- 3<sup>rd</sup> and final invoice (Item H) 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 be completed within 2 working days and therefore it is not considered reasonably practicable to provide formal welfare facilities, and our proposal makes no allowance for so doing.

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).

Most developers have copies of the necessary utility plans (including electricity, gas, water, drainage & telecom), and it would be appreciated if you could forward these prior to the proposed fieldworks. However, if you do not have the necessary plans, Lithos will obtain them direct from each of the utility companies.

**Terms & conditions:** This work will be undertaken in accordance with our Standard Terms and Conditions, a copy of which are enclosed.

You will note that in the last two columns of our costed proposal we have included an estimate of the proportion of the total cost of the works that could be eligible for Land Remediation Tax Relief (LRR).

It is hoped the above is sufficient for your present needs. However, should you require any further information, please contact the undersigned.

Yours sincerely

A handwritten signature in black ink, appearing to read "Mark Perrin".

Mark Perrin  
Director

**for and on behalf of  
LITHOS CONSULTING LIMITED**

**From:** Parkins, Ben [<mailto:Ben.Parkins@kier.co.uk>]  
**Sent:** 20 July 2016 08:31  
**To:** Reg  
**Cc:** Cutts, Dean  
**Subject:** Royston - Phase 1 GI

Morning Mark

Following our earlier conversation, can you please prepare the Phase 1 Ground Investigation for the Royston site.

Any problems, give me a shout.

Kind Regards

**Ben Parkins**  
Land Manager

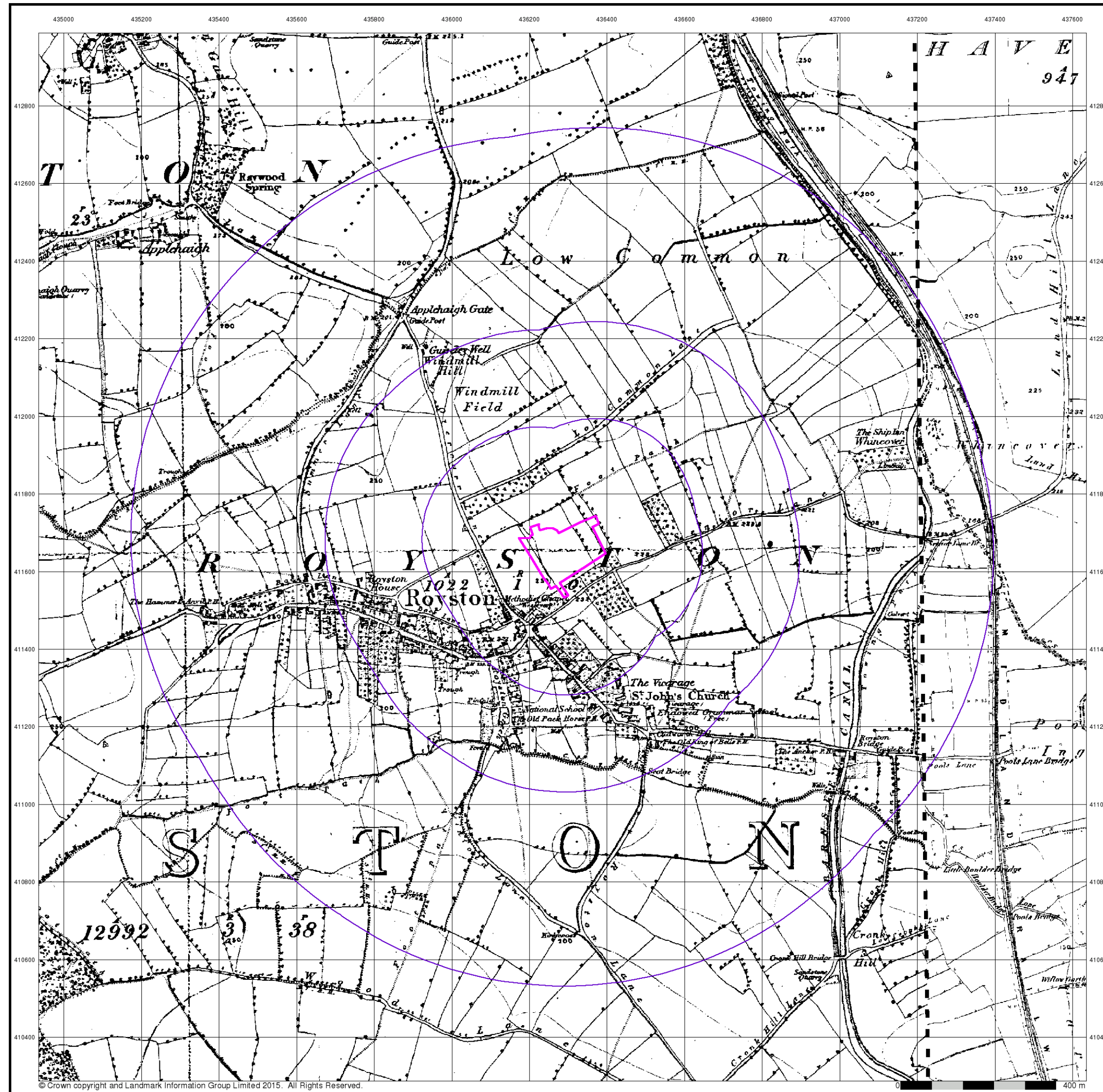
**Kier Living** | Unit 2180 Thorpe Park, Ground Floor, Century Way, Leeds, LS15 8ZB

T: 07976494247 | E: [ben.parkins@kier.co.uk](mailto:ben.parkins@kier.co.uk) | [www.kier.co.uk](http://www.kier.co.uk)

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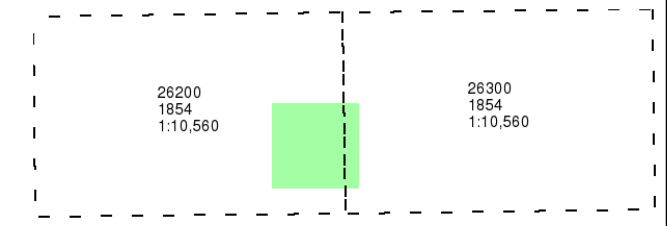
**Appendix D**  
**Historical OS Plans**



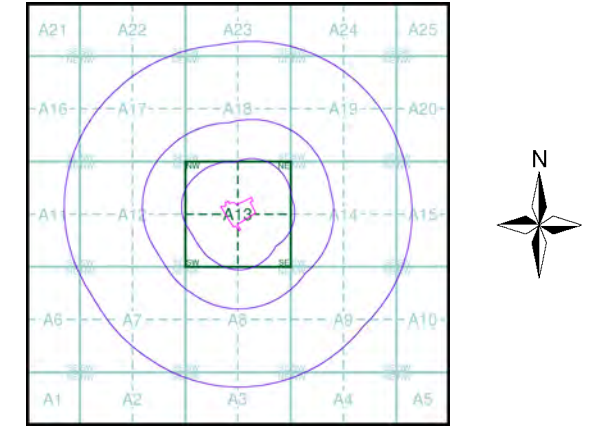
**Yorkshire**  
**Published 1854**  
**Source map scale - 1:10,560**

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**



**Order Details**  
 Order Number: 91332506\_1\_1  
 Customer Ref: 2321 GLM  
 National Grid Reference: 436290, 411650  
 Slice: A  
 Site Area (Ha): 2.29  
 Search Buffer (m): 1000

**Site Details**  
 1 Midland Road, Royston, BARNSELY, South Yorkshire, S71 4QN



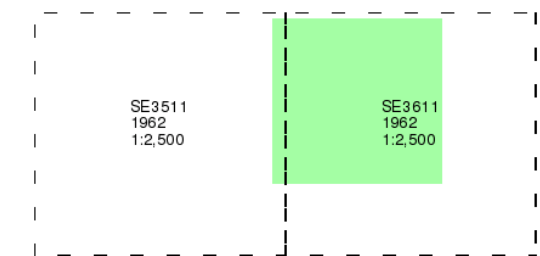
### Ordnance Survey Plan

Published 1962

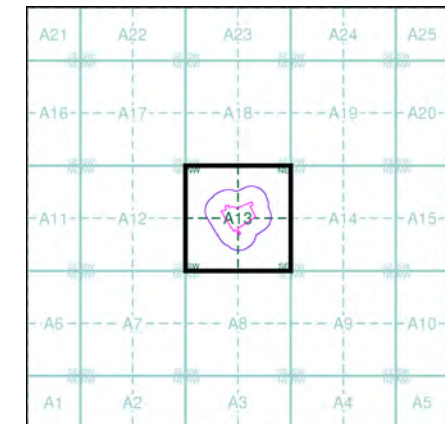
Source map scale - 1:2,500

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 and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below 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.

### Map Name(s) and Date(s)



### Historical Map - Segment A13



### Order Details

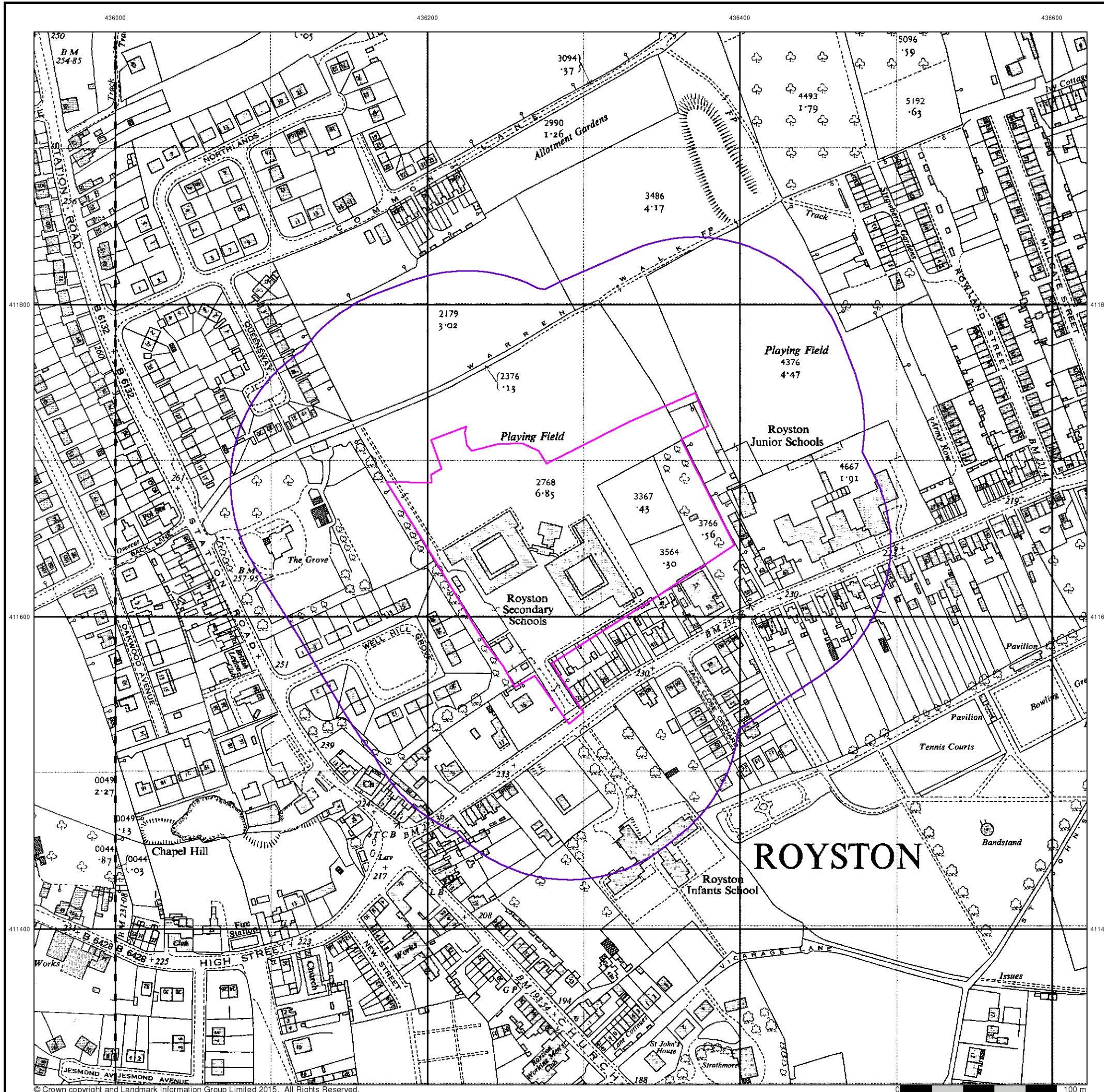
Order Number: 91332506\_1\_1  
Customer Ref: 2321 GLM  
National Grid Reference: 436290, 411650  
Slice: A  
Site Area (Ha): 2.29  
Search Buffer (m): 100

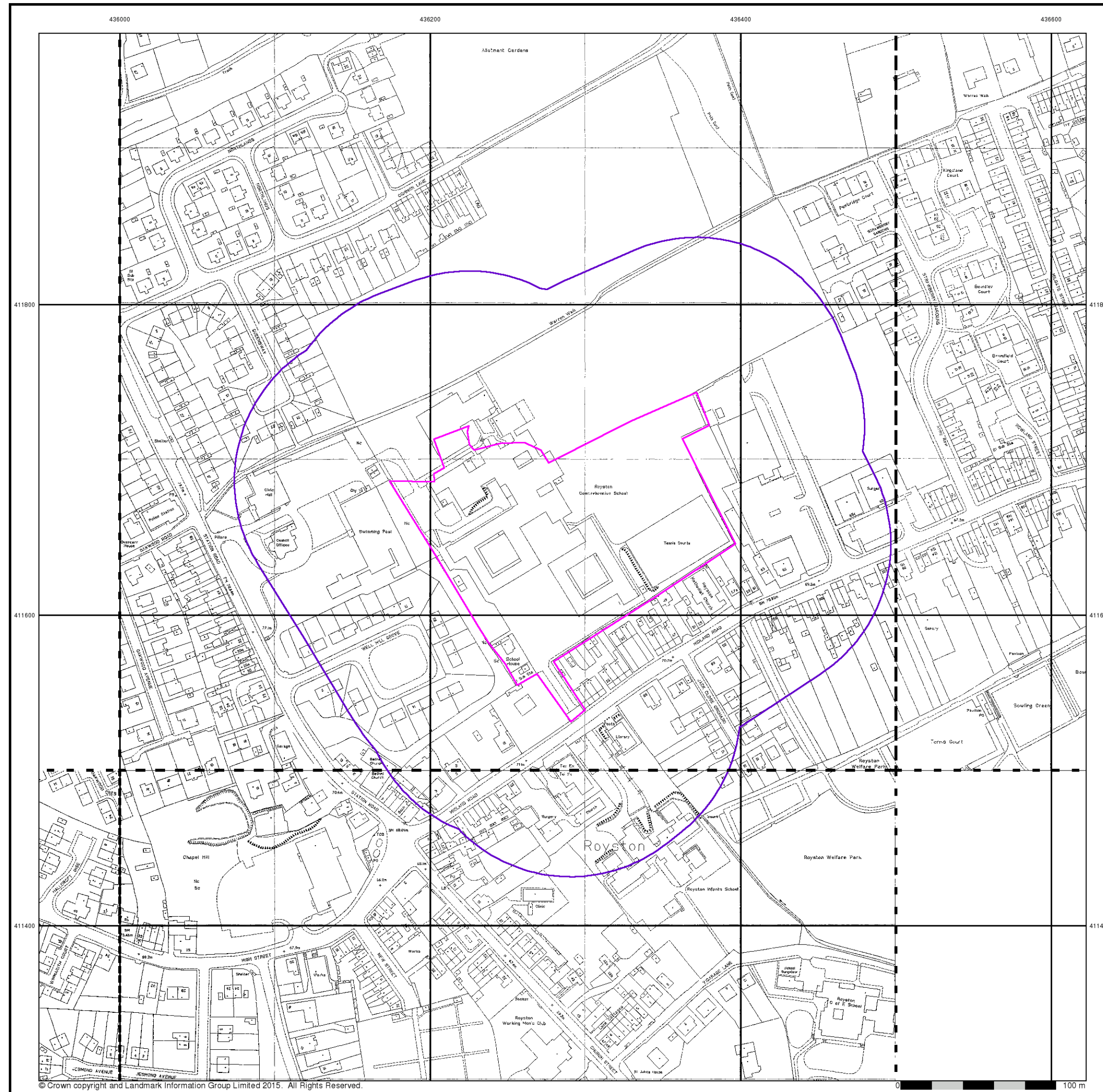
### Site Details

1 Midland Road, Royston, BARNSELY, South Yorkshire, S71 4QN



Tel: 0844 844 9952  
Fax: 0844 844 9951  
Web: www.envirocheck.co.uk





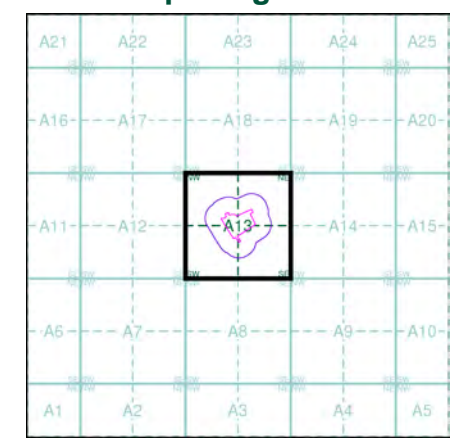
**Large-Scale National Grid Data**  
**Published 1993 - 1995**  
**Source map scale - 1:1,250**

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

**Map Name(s) and Date(s)**

SE3611NW	SE3611NE
1995	1995
1:1,250	1:1,250
SE3511SE	SE3611SW
1993	1994
1:1,250	1:1,250

**Historical Map - Segment A13**



**Order Details**

Order Number: 91332506\_1\_1  
 Customer Ref: 2321 GLM  
 National Grid Reference: 436290, 411650  
 Slice: A  
 Site Area (Ha): 2.29  
 Search Buffer (m): 100

**Site Details**

1 Midland Road, Royston, BARNSELY, South Yorkshire, S71 4QN



Tel: 0844 844 9952  
 Fax: 0844 844 9951  
 Web: www.envirocheck.co.uk

**Appendix E**  
**Search Responses & other Correspondence**



## Envirocheck<sup>®</sup> Report:

### Datasheet

#### Order Details:

**Order Number:**

91332506\_1\_1

**Customer Reference:**

2321 GLM

**National Grid Reference:**

436290, 411650

**Slice:**

A

**Site Area (Ha):**

2.29

**Search Buffer (m):**

1000

#### Site Details:

1 Midland Road  
Royston  
BARNSELY  
South Yorkshire  
S71 4QN

#### Client Details:

Mr G Morton  
Lithos Consulting Ltd  
Parkhill  
Walton Road  
Wetherby  
LS22 5DZ

Report Section	Page Number
Summary	-
Agency & Hydrological	1
Waste	14
Hazardous Substances	20
Geological	21
Industrial Land Use	25
Sensitive Land Use	34
Data Currency	35
Data Suppliers	40
Useful Contacts	41

## 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 Site Sensitivity maps 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 produced by querying the Landmark database to a distance defined by the client from a site boundary provided by the client.

In the attached 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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Information supplied from a joint dataset compiled by The British Geological Survey and Public Health England.

## Report Version v50.0

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
<b>Agency &amp; Hydrological</b>					
BGS Groundwater Flooding Susceptibility	pg 1	Yes	Yes	Yes	n/a
Contaminated Land Register Entries and Notices					
Discharge Consents	pg 1			6	16
Prosecutions Relating to Controlled Waters			n/a	n/a	n/a
Enforcement and Prohibition Notices					
Integrated Pollution Controls					
Integrated Pollution Prevention And Control					
Local Authority Integrated Pollution Prevention And Control					
Local Authority Pollution Prevention and Controls	pg 6			2	
Local Authority Pollution Prevention and Control Enforcements					
Nearest Surface Water Feature	pg 7		Yes		
Pollution Incidents to Controlled Waters	pg 7			2	10
Prosecutions Relating to Authorised Processes					
Registered Radioactive Substances					
River Quality	pg 9				2
River Quality Biology Sampling Points					
River Quality Chemistry Sampling Points					
Substantiated Pollution Incident Register	pg 9				1
Water Abstractions	pg 9				4 (*3)
Water Industry Act Referrals					
Groundwater Vulnerability	pg 11	Yes	n/a	n/a	n/a
Drift Deposits	pg 11	1	n/a	n/a	n/a
Bedrock Aquifer Designations	pg 11	Yes	n/a	n/a	n/a
Superficial Aquifer Designations			n/a	n/a	n/a
Source Protection Zones					
Extreme Flooding from Rivers or Sea without Defences				n/a	n/a
Flooding from Rivers or Sea without Defences				n/a	n/a
Areas Benefiting from Flood Defences				n/a	n/a
Flood Water Storage Areas				n/a	n/a
Flood Defences				n/a	n/a
Detailed River Network Lines	pg 12		Yes	Yes	n/a
Detailed River Network Offline Drainage					n/a

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
<b>Waste</b>					
BGS Recorded Landfill Sites	pg 14				1
Historical Landfill Sites	pg 14	1			8
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)					
Licensed Waste Management Facilities (Locations)					
Local Authority Landfill Coverage	pg 16	1	n/a	n/a	n/a
Local Authority Recorded Landfill Sites	pg 16				5
Potentially Infilled Land (Non-Water)	pg 16		1	1	1
Potentially Infilled Land (Water)	pg 17		1	4	4
Registered Landfill Sites	pg 17				5
Registered Waste Transfer Sites					
Registered Waste Treatment or Disposal Sites	pg 19				1
<b>Hazardous Substances</b>					
Control of Major Accident Hazards Sites (COMAH)					
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)					
Planning Hazardous Substance Consents	pg 20				1
Planning Hazardous Substance Enforcements					

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
<b>Geological</b>					
BGS 1:625,000 Solid Geology	pg 21	Yes	n/a	n/a	n/a
BGS Estimated Soil Chemistry	pg 21	Yes	Yes	Yes	Yes
BGS Recorded Mineral Sites	pg 23			1	
BGS Urban Soil Chemistry					
BGS Urban Soil Chemistry Averages					
Brine Compensation Area			n/a	n/a	n/a
Coal Mining Affected Areas	pg 23	Yes	n/a	n/a	n/a
Mining Instability	pg 23	Yes	n/a	n/a	n/a
Man-Made Mining Cavities					
Natural Cavities					
Non Coal Mining Areas of Great Britain	pg 23	Yes	Yes	n/a	n/a
Potential for Collapsible Ground Stability Hazards	pg 23	Yes		n/a	n/a
Potential for Compressible Ground Stability Hazards	pg 23		Yes	n/a	n/a
Potential for Ground Dissolution Stability Hazards				n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 23	Yes		n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 23		Yes	n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 23		Yes	n/a	n/a
Radon Potential - Radon Affected Areas	pg 24	Yes	n/a	n/a	n/a
Radon Potential - Radon Protection Measures	pg 24	Yes	n/a	n/a	n/a
<b>Industrial Land Use</b>					
Contemporary Trade Directory Entries	pg 25		8	23	20
Fuel Station Entries	pg 29			1	
Points of Interest - Commercial Services	pg 29		14	8	7
Points of Interest - Education and Health					
Points of Interest - Manufacturing and Production	pg 31		4	8	
Points of Interest - Public Infrastructure	pg 32		2	5	2
Points of Interest - Recreational and Environmental	pg 33			1	2
Gas Pipelines					
Underground Electrical Cables					