

REPORT ON SHALLOW MINING SITE INVESTIGATION WORKS

**UNDERTAKEN ON LAND AT
COPPICE SIDE, SWADLINCOTE DE11 9AA**

Prepared for:-

**LK Consult Limited
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On behalf of

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**Project Quality Assurance
Information Sheet**

***Report on Shallow Mining Site Investigation Works undertaken on Land at Coppice Side,
Swadlincote DE11 9AA.***

Report Number : TLC967

Report Status : Final

Survey Dates : 23rd to 25th February 2018

Report Date : March 2018

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1.0 INTRODUCTION

- 1.1 LK Consult Limited (LK Consult) has been appointed to support a Planning Application made by HB Villages Developments Ltd (Client), for the redevelopment of land at Coppice Side, Swadlincote DE11 9AA.
- 1.2 The development will include an assisted living apartment block with communal gardens and car parking. The Land Consultancy Limited (TLC) has not been provided with a proposed development layout plan.
- 1.3 Desk study researches undertaken by LK Consult¹ indicated that the property is situated within a Coal Authority defined Development High Risk Area and was at risk of being affected by time related ground subsidence associated with unrecorded potential shallow workings within several coal seams.
- 1.4 TLC was subsequently approached by LK Consult to review the potential for the site to be affected by shallow coal seams/workings, and to provide advice related to investigating the site using rotary drill holes.
- 1.5 In summary, LK Consult's remit to TLC included:
 - Scoping the amount of intrusive rotary drilling works required to investigate the site for shallow coal seams/workings;
 - Obtaining permission from The Coal Authority to carry out the rotary drilling work; and,
 - Producing a factual and interpretive report on the findings of the rotary drilling, indicating whether the site is affected by shallow coal seams/workings, and whether the consolidation of shallow mining related voids is necessary prior to development works proceeding.

1.6 Limitations

- 1.6.1 The assessment and interpretation of the factual data obtained as part of this investigation has been undertaken in accordance with generally accepted consulting practice, and in line with currently accepted national and international guidelines.
- 1.6.2 The conclusions and recommendations made in this report are limited to those which can be made based on the findings of this survey and information provided by third parties. TLC assumes all third-party data to be true and correct. No responsibility can be accepted by TLC for inaccuracies in the information supplied by any other party.
- 1.6.3 Ground conditions can change rapidly, especially in areas of Made Ground; however, it is assumed that the ground conditions observed are typical and representative of the site as a whole. The ground conditions have been determined from a limited number of exploratory holes, therefore only a small percentage of the total area of the property has been investigated. Conclusions drawn from the ground investigation should be read in this context. TLC cannot accept responsibility for any situations resulting from locally unforeseen ground conditions occurring between exploratory holes.
- 1.6.4 This report is written in the context of an agreed scope of works and should not be used in a different context. Furthermore, new information, improved practices and changes in

¹ LK Consult Report dated 31st July 2017, referenced LKC17 1266 and entitled 'Land off Coppice Side, Swadlincote', 'Desk Based Coal Mining Risk Assessment'.

legislation may require a re-interpretation of the report in whole or in part after its original submission. TLC reserves the right to alter its conclusions and recommendations in the light of further information which may become available. This report is provided for the sole use of the Client and is confidential to them and their professional advisors.

2.0 SITE LOCATION AND DESCRIPTION

- 2.1 The site is situated within a residential/commercial setting and is located to the west of, and is accessed from, Coppice Side, Swadlincote. The site can be centred approximately at the following coordinates: 430130E, 319260N. Site location plans are presented in Drawing Nos. TLC967/01a and 01b in Appendix A; a more detailed site layout plan is presented in Drawing No. TLC967/02.
- 2.2 Drawing No. TLC967/02 displays a depot building in the south-western corner of the site, and a residential building (and two small outbuildings) in the north eastern corner. It should be noted that these buildings are no longer present on site. However, the concrete floorslab to the depot building is still present.
- 2.3 The site has an area of $\approx 3,900\text{m}^2$ and is roughly square in shape. The majority of the site lies at an altitude of between 111-113m AOD and slopes down gently to the south-east. Roughly half of the western site boundary is formed by a stone gabion wall (≈ 4.0 - 4.5m high); land adjacent to the remaining south-western portion of this boundary rises up steeply (by ≈ 4.5 - 5.0m in elevation) and comprises of an overgrown and heavily wooded slope.
- 2.4 Land adjacent to the south-western portion of the southern boundary also comprises of a steep heavily overgrown and wooded slope (≈ 2 - 5m high). Land immediately north of the northern corner of the site is lower ($\approx 2\text{m}$) than the site at this point.
- 2.5 The area where the former residential buildings were located is $\approx 1.5\text{m}$ lower than adjacent site levels.
- 2.6 The site surface comprises predominantly of gravel, concrete and tarmac which is partly overgrown with grasses and other weeds. A bund comprising mainly of demolition rubble type materials is currently barring the gated access into the site from Coppice Side.
- 2.7 An Aldi superstore and residential property are found to the north of the site. Coppice side and a wooded area beyond are situated to the east of the site. Residential properties and Hastings Road are found to the south. Residential property and Alleyne Close are located to the west.

3.0 PUBLISHED GEOLOGY AND MINING SUMMARY

- 3.1 The likely site geology, as determined from British Geological Survey (BGS) mapping reviewed by LK Consult in their desk study report, is summarised in the table below.

MADE GROUND	None indicated.
DRIFT	None indicated.
ROCK	Pennine Lower Coal Measures (PLCM) – Undifferentiated strata comprising of cyclical sequences of mudstone, siltstone, sandstone, coal seams and seat earths.
ROCK DIP	No dips given for the site. Dips in the general area are variable (probably influenced by local faulting) with the following dips being recorded: 2-8° SE, 5° SW and 28° NE.
FAULTING	An ≈N-S trending fault (downthrowing to the NW) is indicated at or just beyond the E site boundary. Numerous further faults are present within 250m of the site.
COAL SEAMS	The P41 coal seam outcrops ≈65m to the N. The P39/P40 coal seam (i.e. comprising of 2no. leaves of coal) outcrops ≈45m to the N. A coal seam of uncertain nomenclature outcrops at or just beyond the SW site boundary.

- 3.2 Coal Authority (CA) data, contained within LK Consult Ltd's desk study is summarised below:

- The Coal Authority (CA) indicate that the property is in the likely zone of influence from workings in 9no. seams of coal at 140m to 440m depth which were last worked in 1964. The CA state that any ground movements from these coal workings should have stopped by now.
- The CA believes that the property is located in an area where coal is present at or close to the ground surface; the CA note that this coal may have been worked at some time in the past.
- The CA do not record the presence of known mine entries within, or within 20m of, the boundary of the property.
- The site (and surrounding area) are located within a CA defined 'Development High Risk Area', with respect to the potential for shallow mining related ground subsidence to occur.

- 3.3 LK Consult's desk study reviewed two available BGS borehole logs for holes sunk 21m and 29m south east of the site. The closer of the two boreholes encountered Made Ground (to 1.1m bgl), over silty CLAY (to 2.3m bgl) over COAL and SHALE (to 4.0m bgl). The other borehole recorded Made Ground (to 1.6m bgl), over silty CLAY (to 4.0m bgl); mudstone and sandstone were then encountered at 4m bgl.

- 3.4 Historical maps reviewed by LK Consult indicated the presence of several mine shafts in the area, with the closest being 88m to the east. Several pumping shafts were also formerly present to the south of the site.

- 3.5 To investigate the mining risk to the development, LK Consult advised that a programme of rotary drilling should be undertaken.

4.0 FIELDWORKS

4.1 Open Hole Rotary Drilling

- 4.1.1 Open hole rotary drilling to determine whether the site is affected by shallow coal seams/workings has been undertaken at three locations (RH1, RH2 and RH3) across the site.
- 4.1.2 Prior to drilling, permission to intersect shallow coal seams beneath the site was first obtained by TLC from the Coal Authority. The permission certificate is presented in Appendix C.
- 4.1.3 The drilling works were undertaken by Taylor Drilling Services Ltd between 23rd and 25th February 2018, using a Commachio 305 rotary drilling rig fitted with a pdc drill bit. The drilling utilised a recirculated water flush.
- 4.1.4 The drill holes were sunk at the locations indicated on Drawing No. TLC967/02 in Appendix A. All drill holes were terminated at a depth of 40.00mbgl.
- 4.1.5 The rotary holes were sited away from known service runs (as determined from service plans obtained by LK Consult and provided to TLC). Hole locations were then cleared with a cable avoidance tool. As a final check for services, hand pits were excavated to 1.20m depth. Rotary drilling commenced from the base of each hand pit.
- 4.1.6 During drilling operations, gas readings were taken at regular intervals from around the mouth of the drill hole and from around the rig. Gas monitoring was undertaken using a GA2000.
- 4.1.7 Upon reaching completion depth, all boreholes were backfilled with a mixture of arisings and bentonite. Rotary borehole records are shown in Appendix B.

5.0 GROUND CONDITIONS

5.1 Made Ground

5.1.1 Made Ground was recorded within each drill hole to depths of between 0.10m (RH2) and 5.50m (RH1). The following types of Made Ground were recorded:

- Topsoil (0.20m thick) was encountered at the surface of RH1. The topsoil overlay light brown CLAY to 1.20m bgl which in turn overlay ash and brick rich fill material. The ash and brick fill was penetrated at 5.50m bgl.
- Concrete (0.10m thick) was encountered at the surface of RH2. No further Made Ground soils were described at this position.
- Tarmac (0.10m thick) was recorded at the surface of RH3. The tarmac overlay ash and brick rich fill materials which were penetrated at 0.50m bgl.

5.2 Coal Measures Strata (CMS)

5.2.1 Significantly weathered CMS is considered to have been recorded below the Made Ground in RH2 (0.10-4.0m bgl) and RH3 (0.50-3.70m bgl).

5.2.2 This material was recovered as a light brown CLAY and is considered to represent completely/highly weathered mudstone.

5.2.3 Much more competent CMS was recorded beneath the clay layer (RH2 and RH3) and beneath the Made Ground in RH1. The CMS was proven to 40m depth within each drill hole.

5.2.4 A summary of the encountered CMS is presented in the table below:

Strata Type (Probable Coal Seam)	Depth to Base of Strata (bgl). Thickness of Strata indicated in Brackets. Notes/Observations Indicated		
	RH1	RH2	RH3
Weathered CMS (clay)	NR	4.00m (3.90m) 100% flush return	3.70m (3.20m) 100% flush returns
Light grey MUDSTONE	17.30m (11.80m) 100% flush returns	13.70m (9.70m) 100% flush returns	5.80m (2.10m) 100% flush returns
COAL / COAL WORKINGS Probable coal seam name: Uncertain	NR	NR	8.50m (2.70m) 0% flush returns Very broken drilling with voids. Coal workings.
COAL / COAL WORKINGS Probable coal seam name: P39	18.00m (0.70m) 100% flush returns Intact coal	16.00m (2.40m) 100% flush returns Intact coal	Steady drilling with occasional softer bands. 0% flush returns.
Light grey MUDSTONE	NR	17.00m (1.00m) 100% flush returns	
Dark grey MUDSTONE	19.20m (1.20m) 100% flush returns	NR	
COAL Probable coal seam name: P40	19.80m (0.60m) 100% flush returns Intact coal	19.50m (2.50m) 100% flush returns Intact coal	
Light grey MUDSTONE	23.50m (3.70m) 100% Flush return	25.00m (5.50m) 100% flush returns	
Dark grey MUDSTONE	29.50m (6.00m) 100% Flush return	26.00m (1.00m) 100% flush returns	
COAL Probable coal seam name: P41	NR	27.00m (1.00m) 100% flush returns Intact coal	
Light grey SANDSTONE with mudstone bands	40.00m (10.50m) 100% Flush return	40.00m (8.00m) 100% flush returns	

NR = Not Recorded

- 5.2.5 As can be seen from the above table, RH1 and RH2 are likely to have both encountered the P39/P40 coal. The P39 coal seam was encountered at depths of 13.60m (RH2) and 17.30m (RH1), and was observed to be up to 2.40m thick. A horizon of mudstone (≈1m thick) was then recorded below which the P40 coal seam (up to 2.50m thick) was encountered.
- 5.2.6 In RH2, a further coal seam (probably the P41 seam) was encountered at 26.00m bgl (1.00m thick).
- 5.2.7 No evidence for the presence of coal workings within the P39/P40 coal was recorded during the drilling of RH1 and RH2. Such evidence can include: a complete or partial loss of the flushing medium, a sudden dropping of the drill string, advancement of the drill string without rotation and broken/fast drilling.
- 5.2.8 In RH3, a 2.70m thick zone of broken drilling and voids was recorded at 2.70m bgl together with a complete loss of the flushing medium. It is highly likely that this zone represents workings within the coal seam whose identity is uncertain. Although steady drilling was reported below this zone to 40.00m depth, the drilling flushing medium did not return, so a positive identification of the sequence of encountered strata was not possible. However, it is likely that the strata penetrated comprised of mudstone and/or sandstone with the occasional bands of 'soft' drilling comprising of coal.
- 5.2.9 Given the drill hole observations, it is likely that the outcrop position of the coal seam of uncertain name is orientated WSW to ENE and located between the RH2 and RH3 drill hole positions; the rock dip is likely to be very gentle and down to the SSE.

5.3 Groundwater

- 5.3.1 It was not possible to record water strikes within the rotary boreholes due to the recirculated water flush that was being used.

5.4 Ground Gas

- 5.4.1 No detectable concentrations of methane, carbon dioxide, carbon monoxide or hydrogen sulphide, or any oxygen depletions were measured during drilling operations.

6.0 CONCLUSIONS

- 6.1 A desk study report, produced by LK Consult, indicated that the site would be underlain directly by Pennine Lower Coal Measures Strata (CMS) and that three coal seams (the P39/P40, the P41 and a coal seam of uncertain name) were all potentially present beneath the site at shallow depth (i.e. <30m bgl). The dip of the rock strata in the vicinity of the site is variable (probably due to local faulting). An approximately north-south trending fault is present at or close to the eastern site boundary. The Coal Authority (CA) indicate that the site is located within a Development High Risk Area, with respect to time dependent shallow mining related ground subsidence risk.
- 6.3 To investigate the shallow mining risk, 3no. rotary drill holes (RH1-3) were sunk beneath the site to 40m bgl. RH1, RH2 and RH3 were positioned in the northern, south-western and south-eastern corners of the site respectively.
- 6.4 Made Ground was recorded to depths of between 0.10m and 5.50m bgl. CMS was subsequently encountered beneath the Made Ground and proven to 40.00m bgl.
- 6.5 The top of the CMS was significantly weathered in RH2 (0.10-4.00m bgl) and RH3 (0.50-3.70m bgl) where it was encountered as a light brown CLAY. Much more competent material (i.e. rock) was recorded directly beneath the Made Ground in RH1 (at 5.50m bgl) and below the weathered material (in RH2 and RH3). The more competent material comprised predominantly of mudstone with subordinate sandstone and coal seams.
- 6.6 It is likely that the two leaves of coal comprising the P39/P40 coal were encountered within RH1 and RH2 at depths of 17.30m bgl and 13.60m bgl respectively. The two leaves of coal were separated by an ≈1m thick horizon of mudstone. In RH1 the two leaves of coal were 0.70m and 1.20m thick, and in RH2, the two leaves of coal were 2.40m and 2.50m thick.
- 6.7 A deeper coal seam (1.00m thick and probably the P41) was encountered in RH2 at 26.00m depth.
- 6.8 The P39/P40 and P41 coal seams were encountered in an intact condition and showed no evidence of having had been worked.
- 6.9 RH3 encountered a zone (2.70m thick) of probable workings (total loss of flush, broken drilling and voids) at 5.80m bgl. It is likely that these workings are within the coal seam of uncertain name. The outcrop position of this coal seam is likely be between RH2 and RH3 (i.e. WSW-ENE strike) – see Drawing No. TLC967/02 in Appendix A.
- 6.10 The dip of the rock strata is likely to be very shallow and down to the SSE.
- 6.11 A commonly used ‘rule of thumb’ for development taking place over undermined areas, is that >10x coal seam/extraction thickness of competent cover (i.e. rock), would need to be present over any workings to safeguard development from the effects of shallow mining related ground subsidence.
- 6.12 Therefore, there is clearly an insufficient amount of rock cover overlying the T39/P40 coal seam and the RH3 workings to satisfactorily mitigate against the shallow mining risk. The risk to the proposed development from potential workings within the P39/P40 coal seam is considered to be high. The risk to the proposed development from the workings encountered in RH3 is considered to be very high. It must be realised that although the P39/P40 (and P41) coal seam (s) was (were) encountered in an intact condition, the RH1 and RH2 drill holes may have intersected coal pillars left in place by the miners to support the roof of the workings. Absence of evidence within a drill hole for the presence of coal

workings within a coal seam should never be taken as proof that a coal seam has not been worked.

- 6.13 It is considered that the proposed development is at low risk of being affected by potential workings within the P41 coal seam encountered in RH2, as there is likely to be $\approx 10\times$ seam thickness of competent rock cover overlying this coal seam.

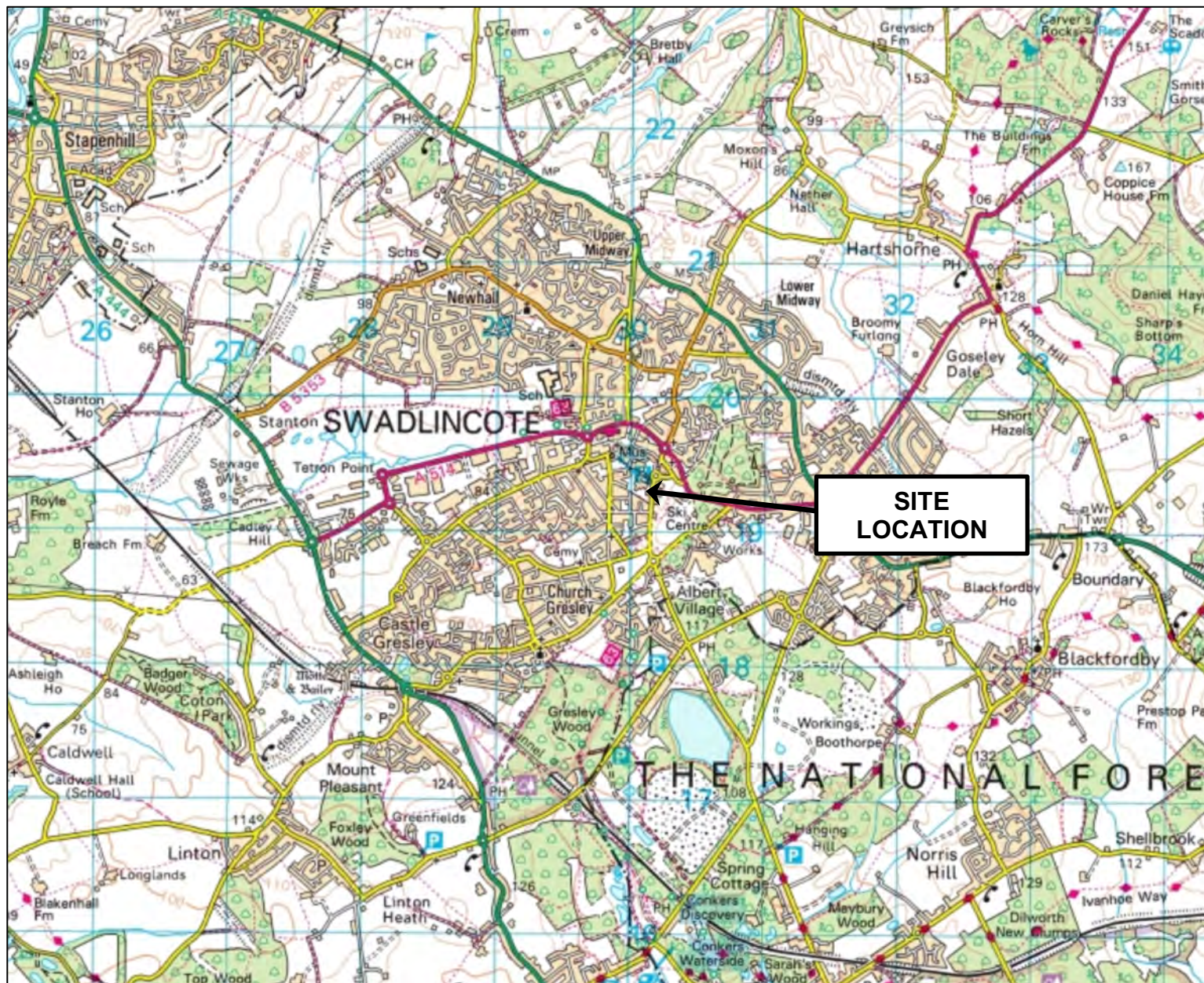
7.0 RECOMMENDATIONS

- 7.1 Based upon the results of this shallow mine workings site investigation, both the P39/P40 coal and the very shallow coal workings recorded within a coal seam (name uncertain) in the south-eastern corner of the site, pose a definite threat to surface ground stability as a result of the presence of unrecorded/recorded shallow mine workings. Stabilisation works are therefore advised to take place prior to development works proceeding.
- 7.2 The specification for the stabilisation works should be based on principles developed over a number of years and considering advice contained within:
- The Construction Industry Research and Information Association (CIRIA) Special Publication Number 32 "Construction Over Abandoned Mine Workings" 1984;
 - The Department of the Environment (DOE) Planning Policy Guidance Note Number 14 (1990) "Development on Unstable Land".
- 7.3 The general procedure to positively identify and treat shallow mine workings involves drilling boreholes on a regular grid pattern to depths that intercept the target coal horizon or mine workings.
- 7.4 A pulverised fuel ash (PFA)/cement grout is then injected under pressure and possible re-drilling into the relict broken ground to infill any remnant voids or workings. This will prevent future collapse or settlement. Grout takes may exceed 5 tonnes per borehole in broken previously mined ground.
- 7.5 The first stage of the treatment operations involves the drilling of a series of confirmatory primary boreholes (on a grid pattern, with 6m spacing in between drill holes) to provide further information on the depths/outcrops of the coal seams beneath the footprint of the proposed residences and to confirm the extents of zones of potential ground in stability. Pressure grouting is then carried out to stabilise any workings.
- 7.6 Drilling and grouting will need to take place beneath and beyond the footprint of the proposed building(s), areas of car parking and access ways, and is therefore likely to cover the majority of the site.
- 7.7 Where grout takes of more than 5 tonnes per borehole are recorded, then a secondary grid of grout holes should be scheduled surrounding the high grout take boreholes.
- 7.8 Permission to carry out the stabilisation works will need to be sought from The Coal Authority. A completion report detailing the works undertaken will also need to be produced and approved by The Coal Authority.
- 7.9 There remains a low risk of encountering unrecorded mine entries during the redevelopment of the site. Mine entries are likely to manifest as potentially square, rectangular or circular areas of dark deep Made Ground (which may or may not be brick lined and could potentially be capped – e.g. with a large block of concrete) surrounded by natural soils/weathered rock. If the presence of mine entries is suspected, the affected area should be cordoned off immediately and the advice of a coal mining engineer sought.

APPENDICES

APPENDIX A

DRAWINGS



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email: sfknott@thelandconsultancy.co.uk; www.thelandconsultancy.co.uk

Project:

Land at Coppice Side, Swadlincote DE11 9AA

Title:

Site Location Plan

Scale:

NTS

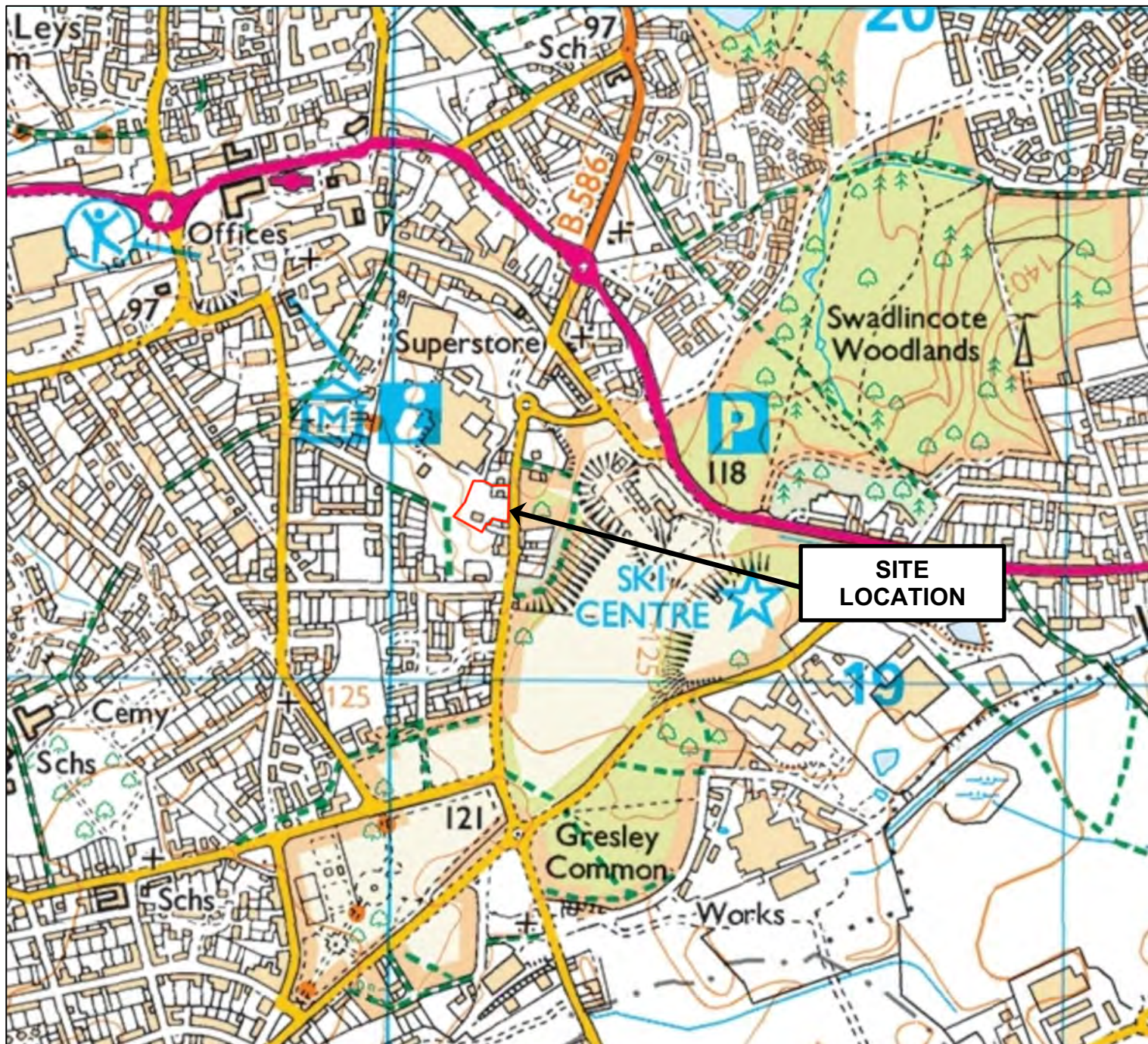
Drawn by:

SFK

Date:

19/01/2018

Drawing No.: TLC967/01a



**SITE
LOCATION**

THE LAND CONSULTANCY LIMITED

Fairweather House, 4 Parker Lane, Whitestake, Preston PR4 4JX
Tel: 01772 610609; M: 07771 800859
email: sfknot@thelandconsultancy.co.uk; www.thelandconsultancy.co.uk

Project:

Land at Coppice Side, Swadlincote DE11 9AA

Title:

Site Location Plan

Scale:

NTS

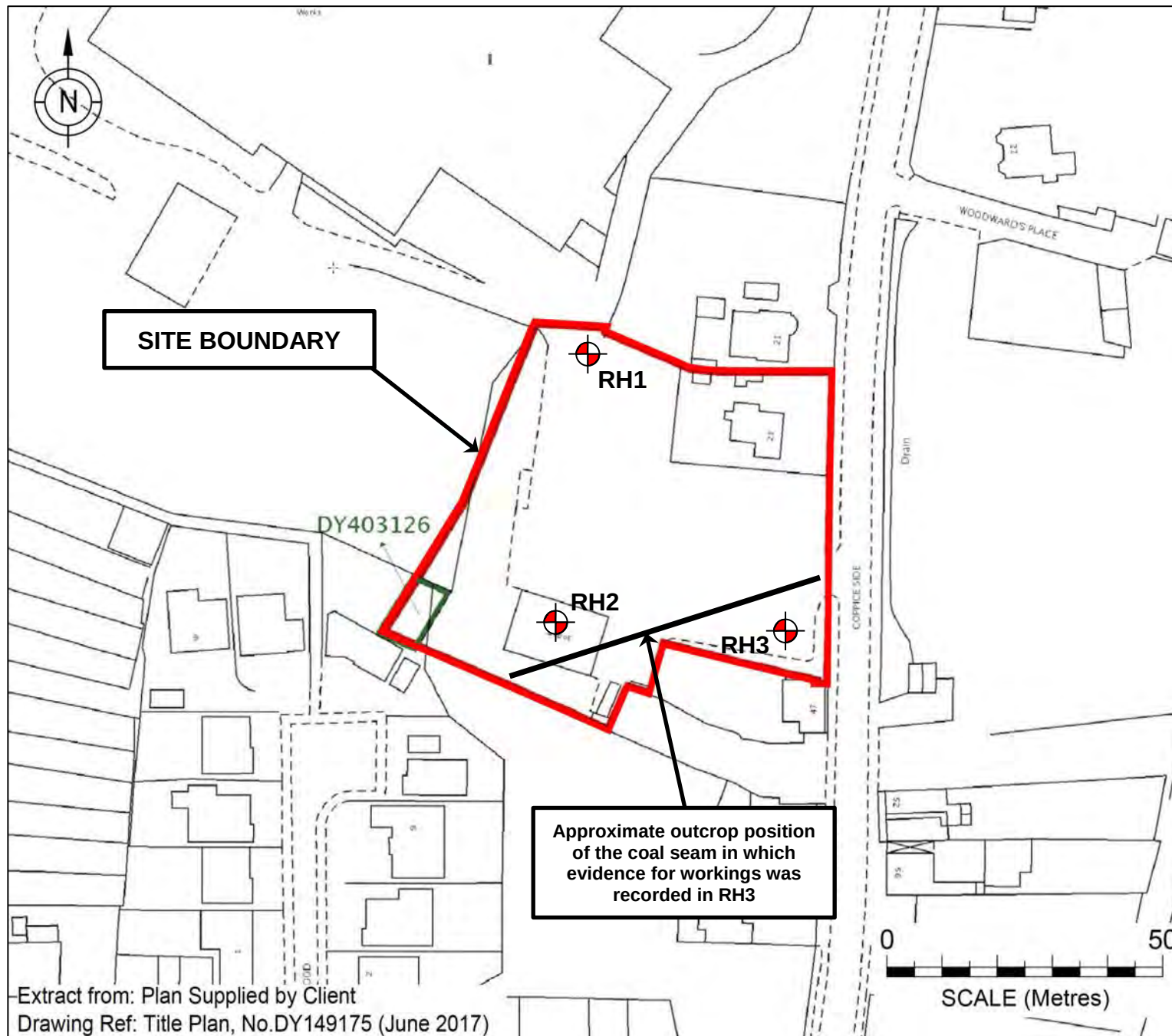
Drawn by:

SFK

Date:

19/01/2018

Drawing No.: TLC967/01b



Rotary Drill Hole Location

THE LAND CONSULTANCY LIMITED

Fairweather House, 4 Parker Lane, Whitestake, Preston PR4 4JX
Tel: 01772 610609; M: 07771 800859
email: sfknot@thelandconsultancy.co.uk; www.thelandconsultancy.co.uk

Project:

Land at Coppice Side, Swadlincote DE11 9AA

Title:

Site Boundary Plan showing Rotary Drill Hole Locations

Scale:

As Shown

Drawn by:

SFK

Date:

13/03/2018

Drawing No.: TLC967/02

APPENDIX B

ROTARY DRILL HOLE LOGS

[illegible]

[illegible]

[illegible]

[illegible]



The Coal
Authority

Permit to Enter or Disturb Coal Authority Mining Interests

Permit Reference Number 15496

Name and Address of Permit Holder:

*The Land Consultancy Limited
4 Parker Lane
Whitestake
Preston
PR4 4JX*

Site Location:

*Land at
Coppice Side
Swadlincote
DE11 9AA*

This certificate hereby grants the above named Permit Holder a Permit to carry out:-

A ground investigation by three rotary water flush boreholes to 40m or as necessary to determine the presence of shallow mine workings/coal seams and the risk they pose to intended future residential use of the site all within the Authority's mining interests at the identified site location for the period of 12 months from the granted date shown below. The granting of this Permit does not constitute advice given by the Authority in relation to the proposed operations. It is the Applicant's responsibility to obtain appropriate health, safety, environmental, technical and legal advice.

Signed: _____ Granted Date: **07/02/2018**

For and on behalf of The Coal Authority

Nominated Representative: Leigh Sharpe, Permitting Manager;

The Coal Authority, Permitting Office, 200 Lichfield Lane, Mansfield, Notts, NG18 4RG

Tel: 01623 637229; E-Mail: permissions@coal.gov.uk

APPENDIX C

COAL AUTHORITY PERMISSIONS CERTIFICATE