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Rotary Borehole Site Investigation Report

LOCATION	Proposed Development, 147 Jubilee Road, Middleton, Rochdale M24 2LY
ISSUE DATE	October 2017
FOR	Rachael Levy
CLIENT REF.	
OUR REF.	G17402

Prepared by

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Checked by

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Principal Geotechnical Engineer

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1. Introduction

In accordance with your instruction, Geoinvestigate Ltd carried out an intrusive rotary borehole site investigation on a vacant plot of land on Jubilee Road, Middleton, Rochdale.

It is proposed to infill the gap between two buildings with a new building. National Grid Reference SDE 87872 06581 denotes the approximate centre of the site.

The purpose of this investigation was to investigate the site for the possible presence of shallow abandoned underground coal mine workings beneath the site. Therefore this investigation is limited to this aspect only.

A possible shallow or near surface mining risk at the site had been identified in a mining report provided by the Coal Authority and subsequent Coal Mining Risk Assessment carried out by Ross Nicolson of Geoinvestigate report number G17356. This is discussed in section 2 below.

2. Coal Authority Mining Report

The Coal Authority (CA) and excerpts of the Geoinvestigate reports are provided in Appendix 2.

The main findings of the reports are;

There are **no known mine entries** within 20metres of the boundary of the property, however there is a warning by the CA that additional/hidden mine entries could exist in the local area.

The property is within the likely zone of influence from workings on the surface from past underground workings. Also, the property is in an area where the Coal Authority **believe there is coal at or close to the surface**. (and that) This coal may have been worked in the past.

The 2017 report (by Geoinvestigate) concluded that the site may be underlain at shallow depth by the Plodder coal seam noted to outcrop some 20m to the North East of the site dipping beneath the site at shallow depth, followed by the Higher Bent (HBt) coal seam and the Lower Bent (LBt) coal seam with the Arley coal seam at depth.

The report concluded that *'a site investigation should take place to access the presence of shallow coal mining at the site'* therefore it was considered that drilling should be carried out at the site to try and ascertain if any workings were present within the shallow coal seams.

In light of the possible presence of shallow coal workings below the site, the Client commissioned Geoinvestigate to carry out a borehole investigation to evaluate this possible hazard to the development.

3. Scope of Intrusive Investigation

3.1 Scope of Works

In line with the following borehole drilling investigation was carried out at the site to establish if abandoned coal mine-workings were present in the underlying strata;

- The sinking of two (2) boreholes (RH1 and RH2) to a depth of 30m with supervision of the drilling works by a qualified geotechnical engineer. The boreholes were rapidly driven to depth using Geoinvestigate's proprietary new high speed Microdrilling system.

- Provision of an interpretative report including site plan and borehole logs.

Microdrill's small volume water injection system offers a safer method of investigating coal mine workings minimising the risk of combustion or explosion of coal and mine gases and the migration of hazardous gases into nearby buildings.

Gas monitoring was carried out during drilling to measure concentrations of Oxygen O^2 and potentially toxic and explosive levels of Carbon dioxide CO^2, Methane CH^4 & Carbon Monoxide CO in the ground.

The ground conditions encountered in the boreholes (as described by the driller) are shown on the borehole logs provided in Appendix 1.

The current report focuses only on the mining situation beneath the site. It does not deal with the condition of the surface drift layer (made ground and natural soils) which cover the site.

3.2 Drilling Technique

The condition of the ground with regard to strength and rock type was assessed by the drillers using the variations in drilling progress, drilling flush pressure, "feel", and the nature of the arisings (drill debris) returned to surface in the water flush and whether the flush itself was returned. No rock cores were recovered from the boreholes.

The primary purpose of the boreholes in this investigation was to identify variations in rock strength and rock type and to highlight possible geotechnical hazards such as voids or broken / weak strata which might indicate abandoned mine workings or upward void migration.

4. Encountered Ground Conditions

4.1 RH1 and RH2

The boreholes encountered overburden to a depth of 3.20m underlain by siltstone with sandstone inclusions to depths of 8.30m and 8.50m. In RH1 solid sandstone was then noted with RH2 encountering fractured sandstone likely indicative of a fault line shown (on the BGS mapping) to run directly beneath the site. Below this mudstone with sandstone inclusions was encountered to a depth of 30.00m where the boreholes terminated.

No hazardous gas concentrations were noted from readings taken from the boreholes during drilling.

No broken ground or voids were encountered in the boreholes.

Water flush was lost below depths of 3.20m in both boreholes.

5 Review of Ground Conditions.

The boreholes suggest that the drift deposits extend to a depth of 3.20m below which siltstone with sandstone inclusions was encountered. RH1 noted solid sandstone between the depths of 8.50m and 16.20m with RH2 encountering fractured sandstone between similar depths. Below this mudstone with sandstone inclusions was found to a depth in excess of 30.00m

The possible geological fault found in RH2 between the depths of 8.30m and 15.70m could have caused the coal to be "faulted out" given that no coal seams were present from 3.20m and the base of the boreholes at 30.00m. However, it is more likely that, due to the absence of coal in RH1 where no possible faulting was observed, that no coal seams were present at shallow depths at the site.

No voids, cavities or broken ground indicative of the presence of mine workings were encountered in the boreholes and as such workings are not expected to occur below the site within the 30.00m depth of the borehole investigation.

Given the above, together with the information from the previous CMRA, carried out by Geoinvestigate it has been concluded that although previous information suggests that the named coal seams above have been worked in the locality, no evidence of working was shows in the boreholes drilled.

6 Conclusions

At the positions drilled, no mine workings were encountered at shallow depth below the site between rock head which commences at a depth around 3.20m and the base of the boreholes at 30.00m.

In conclusion, the drilling has confirmed that no special foundations or ground treatments would be required to mitigate the risk to the site in terms of subsidence, or collapse due to the sites past coal mining legacy.

END OF REPORT

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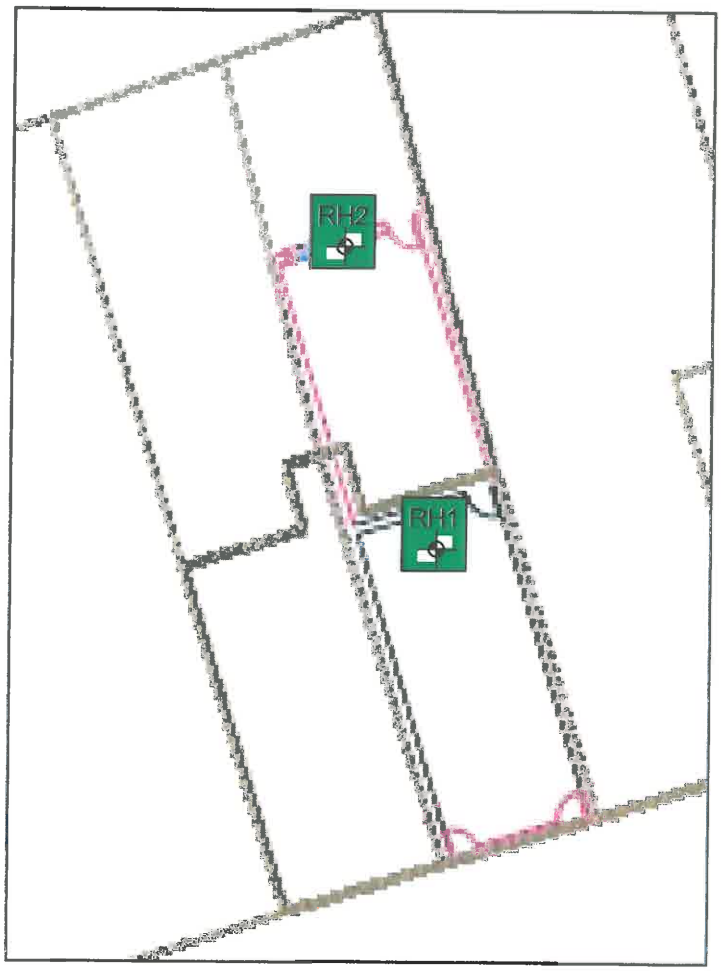
APPENDIX 1

Site Plan & Borehole Logs

GEOINVESTIGATE Ltd.

OUR REF: G17402	YOUR REF:	SITE PLAN (NOT TO SCALE)
DATE: 16/10/17	LOCATION: 147 Jubilee Road, Middleton, Rochdale M24 2LY	



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GEOINVESTIGATE Ltd.

Your Ref. **Our Ref.** G17402 **RH No.1** **Sheet No. 1 of 2**
Location: 147 Jubilee Road, Middleton, Rochdale, M24 2LY **DATE:** 16-10-17

Depth (m)	Description of Strata	Thick -ness	Legend	Gas Well	Sample	Test Type Result	Flush	Depth to Water	Depth (m)
3.20	Brown DRIFT	3200					Lost return at 3.20m		2.50
8.50	SILTSTONE, SANDSTONE inclusions	5300							5.00 / 7.50
16.2	SANDSTONE	7700							10.00 / 12.50 / 15.00
30.0	MUDSTONE, SANDSTONE inclusions	13800							17.50 / 20.00 / 22.50 / 25.00

Remarks: Casing to 1.00m
Microdrill rotary open hole borehole to 30.00m
No cores recovered from borehole
No gas detected from borehole on completion
Lost flush at 3.20m. No voids encountered.

Key:
Slotted Pipe
Plain Pipe
Bentonite
Gravel Filter

O Disturbed sample
Cv Shear vane
W Water sample
S Standard Penetration Test
C Cone Penetration Test

RH1

GEOINVESTIGATE Ltd.

Your Ref. **Our Ref.** G17402 **RH No.1** **Sheet No. 2 of 2**
Location: 147 Jubilee Road, Middleton, Rochdale, M24 2LY **DATE**: 16-10-17

Depth (m)	Description of Strata	Thick -ness	Legend	Gas Well	Sample	Test Type Result	Flush	Depth to Water	Depth (m)
	MUDSTONE, SANDSTONE inclusions	13800							27.50
30.0									30.00
	Rotary hole terminated at 30.00m								

Remarks: Casing to 1.00m
Microdrill rotary open hole borehole to 30m
No cores recovered from borehole
No gas detected from borehole on completion
Flush lost at 3.20m. No voids encountered.

Key:
Slotted Pipe
Plain Pipe
Bentonite
Gravel Filter

O Disturbed sample
Cv Shear vane
W Water sample
S Standard Penetration Test
C Cone Penetration Test

RH1

GEOINVESTIGATE Ltd.

Your Ref. **Our Ref.** G17402 **RH No.2** **Sheet No. 1 of 2**

Location: 147 Jubilee Road, Middleton, Rochdale, M24 2LY **DATE:** 16/10/17

Depth (m)	Description of Strata	Thick -ness	Legend	Gas Well	Sample	Test Type Result	Flush	Depth to Water	Depth (m)
3.20	Brown DRIFT	3200					Lost return at 3.20m		2.50
8.30	SILTSTONE, SANDSTONE inclusions	5100							5.00
15.7	Fractured / faulted SANDSTONE	7400							7.50
30.0	MUDSTONE, SANDSTONE inclusions	14300							10.00
									12.50
									15.00
									17.50
									20.00
									22.50
									25.00

Remarks: Casing to 1.00m
Microdrill rotary open hole borehole to 30.00m
No cores recovered from borehole
No gas detected from borehole on completion
Lost flush at 3.20m. No voids encountered.

Key:
Slotted Pipe
Plain Pipe
Bentonite
Gravel Filter

O Disturbed sample
Cv Shear vane
W Water sample
S Standard Penetration Test
C Cone Penetration Test

RH2

GEOINVESTIGATE Ltd.

Your Ref. **Our Ref.** G17402 **RH No.2** **Sheet No. 2 of 2**
Location: 147 Jubilee Road, Middleton, Rochdale, M24 2LY **DATE:** 16-10-17

Depth (m)	Description of Strata	Thick -ness	Legend	Gas Well	Sample	Test Type Result	Flush	Depth to Water	Depth (m)
	MUDSTONE, SANDSTONE inclusions	14300							27.50
30.0									30.00
	Rotary hole terminated at 30.00m								

Remarks: Casing to 1.00m
Microdrill rotary open hole borehole to 30m
No cores recovered from borehole
No gas detected from borehole on completion
Flush lost at 3.20m. No voids encountered.

Key:
- Slotted Pipe
- Plain Pipe
- Bentonite
- Gravel Filter

O Disturbed sample
Cv Shear vane
W Water sample
S Standard Penetration Test
C Cone Penetration Test

RH2

APPENDIX 2

Coal Authority Coal Mining Report

& Geoinvestigate CMRA (Report Number G17042)

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Coal Mining Risk Assessment

LOCATION	147 Jubilee Road, Middleton, Rochdale, M24 2LY
ISSUE DATE	4th September 2017
FOR	Rachel Levy
CLIENT REF.	
OUR REF.	G17356

Prepared by

Ross Nicolson BSc (Hons) MSc (Eng) CEng MIMMM Principal Geotechnical Engineer

COAL MINING RISK ASSESSMENT: 147 Jubilee Road, Middleton, Rochdale M24 2LY. Geoinvestigate ref. G17356, 1st September 2017.

1. INTRODUCTION

Name of Applicant: Rachel Levy

Issuing Company: Geoinvestigate Ltd, Units 4 & 5, Terry Dicken Industrial Estate, Stokesley, North Yorkshire TS9 7AE

Competent Person: Ross Nicolson BSc (Hons.) Eng. Geol., MSc Eng., CEng IOM^3 - Principal Geotechnical Engineer

Site Location and Description:

The boundary shown in red on the Coal Authority report provided in Appendix A corresponds with the planning application. It assumed that the current gap between existing corner shops is to be infilled with a new building.

National Grid Reference SDE 87872 06581 denotes the approximate centre of the plot. The plot is a 22m long x 4.5m wide strip. Google Satellite and Street View imagery shows the site was originally covered by roof and was probably a single storey shop. Subsequently the roof has been removed and the front of the plot boarded-up. The rear of the strip appears to have been a small garden. Small single and two storey shops are present on either side of the development site. Two storey semi-detached and terrace housing is present in the surrounding area.

Ground level at the site lies at an elevation of about 94m AOD.

A review of historical OS maps dating back to 1841 shows the site was farmland/undeveloped land up to 1952. Circa 1841 Tonge Colliery was present well to the southeast of the site while "coal pits" were present to the northeast. Sometime between 1960 and 1977 the front of the property was first occupied by a building, presumably a shop. The surrounding area was developed with housing between 1922 and 1932. Another gap larger site exists to the west of the site on the same shop row.

The reason for the demolition of building which previously occupied the site and the presence of another gap site next door but one to this is unknown.

The map record provides no evidence that the development site has been subject to surface mining activity though historical mine working has occurred in the distant vicinity.

Description & Layout of Proposed Development:

It is proposed to erect a building on the plot.

Risk Methodology Applied

This document and the risk assessment methodology adopted herein is based on CA publication RISK BASED APPROACH TO DEVELOPMENT MANAGEMENT - GUIDANCE FOR DEVELOPERS Version 3, 2014 and Version 4 - 2017. The template contained therein is adopted with minor amendments made by Geoinvestigate Limited.

Scope of the Coal Mining Risk Assessment

The purpose of this Coal Mining Risk Assessment Report is to:

- Present a desk-based review of selected items of available information reviewed on the coal mining issues which are relevant to the application site;
- Use that information to identify and assess the risks to the proposed development from coal mining legacy, including the cumulative impact of issues;

- Set out appropriate mitigation measures to address the coal mining legacy issues affecting the site, including any necessary further intrusive site investigation works and/or remedial works and/or demonstrate how coal mining issues have influenced the proposed development;
- Demonstrate to the Local Planning Authority that the application site is, or can be made, safe and stable to meet the requirements of national planning policy with regard to development on unstable land.

2. SOURCES OF INFORMATION USED TO INFORM THIS REPORT

The following sources of information have been used and form the basis of the risk assessment of coal mining issues provided in this report. Relevant reports/extracts have been appended.

- An up-to-date Coal Mining Report from the CA dated 22nd August 2017 referenced 51001593281001.
- Geological information on the bedrock and superficial geology obtained from the British Geological Survey (BGS) Sheet 85 Manchester at 1:50000 scale.
- The Coal Authority's online interactive map viewer.
- A site history based on limited Ordnance Survey map records of the area dating back to 1841.
- Historic borehole logs obtained from the BGS archive.
- Google Street View and Satellite images.

3. IDENTIFICATION AND ASSESSMENT OF SITE SPECIFIC COAL MINING ISSUES

The table below summarises the potential risks associated with coal mining legacy for the proposed development site, identified from list sources of information.

Coal Mining Issues	Yes	No	Risk Assessment/Remarks
Past underground coal mining	**Yes**		*The CA report in Appendix A lists mine workings in one seam of coal at a depth of 136m beneath the property.* *Historical mine working at a depth of 136m would not normally be expected to affect surface stability. As such this issue needs no further assessment in this report.*
Probable unrecorded shallow workings	**Yes**		*The CAs interactive map viewer shows the site falls within a DHRA or development high risk area with regard to coal mining legacy* *The CAs interactive map viewer confirms that the site falls within an area of "probable shallow coal mine working".* *The CA define Probable Workings as underground workings for which no recorded plan exists but where **IT IS LIKLEY** that workable coal at shallow depths **HAS BEEN MINED** before records were kept.* *Consequently the possible occurrence of shallow coal mine working beneath the development requires further consideration in this report.*
Outcrops		**No**	*No. The CAs interactive map viewer shows coal outcrop (identified by the CA as the Plodder Coal) 15.8m to the northeast of the site.*
Spine roadways at shallow depth		**No**	*None recorded*
Future underground mining		**No**	*None recorded*
License details (AOR)		**No**	*None recorded*
Section 46 notices		**No**	*None recorded*
Geology		**No**	*No faults, fissures or breaklines recorded*
Mine entries		**No**	*None recorded*
Court orders		**No**	*None recorded*
Worked out opencast sites		**No**	*None recorded.*
Coal mining related hazards		**No**	*None recorded*

Coal mining subsidence		**No**	*The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres, since 31 October 1994* *There is no current stop notice delaying the start of remedial works or repairs to the property* *The Coal Authority is not aware of any request having been made to carry out preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.*

***Note** For those coal mining issues above identified as "yes" a more detailed discussion and assessment should be made of the risks, both individually and cumulatively, to the application site and the proposed development.*

DETAILED DISSCUSSION & ASSESSMENT RESPONSE

1. The Coal Authority's interactive map viewer shows the site falls within a Development High Risk Area (DHRA) raising serious concern about ground instability arising from mine workings and hazardous mine gases as well as other potential coal legacy hazards.
2. The CA report in Appendix A states that the site is underlain by Probable unrecorded shallow workings
3. The CAs interactive map viewer shows the site falls within an area where there has been PROBABLE shallow coal mine working.
4. *The CA define Probable Workings as underground workings for which no recorded plan exists but where **IT IS LIKLEY** that workable coal at shallow depths **HAS BEEN MINED** before records were kept.*
5. The location of the site is shown on the extract of BGS geology map Sheet 85 Manchester presented in Appendix B.
6. The tentative elevation of the site relative to the vertical geology column is shown on the map inset.
7. CA mining panel information in the vicinity of the site records dip and dip direction of 7.8 & 15.9 degs to dir. 210 & 207 degs or SSW respectively.
8. A dip arrow on the geological map an appreciable distance to the southwest of the site records a dip of 16 degs to SW/SSW
9. There are no BGS boreholes in the near vicinity of the site that might assist in shedding light on the coal mining geology beneath it.
10. Borehole log SD8NE 6 some 180m to the west of the site shows drift/clay to 3.66m depth. No coal seams are recorded in this borehole which extended to 78m depth at this locality. The borehole log is included as Appendix C.
11. Bedrock within the site would be expected to lie at similar, shallower or greater depth than Log 6.
12. The BGS geology map indicates that the site is underlain by an unknown thickness of glaciofluvial sheet deposits comprising sand and gravel.
13. Assuming that the Plodder Coal seam outcrop occurs some 15.8 to 20m to the northeast of the site and the seam dips under the property at 16 degrees then this coal seam would lie at a depth of 4.7m to 6m below the site.
14. However if the drift is deeper than 6m or dip was shallower (say 8 degs) this coal seam would be absent and there would be no mine working at very shallow depth in the Plodder Coal below the development.
15. Continuing the assumption that the coal ouctrop is in fact the Plodder then the Higher Bent (HBt) coal seam would according the vertical geology column be expected to occur below the site at a depth of 33m. At this depth mine working in the HBt would be unlikely to impact surface stability within the development site.
16. Alternatively the BGS geology map suggests that the site may be located towards the base of a sandstone unit and therefore the nearby coal outcrop to the NE of the site might be the HBt rather than the Plodder. If this were so mine workings in the HBt may occur at 26m depth with mine workings in the LBt at 43m depth.
17. Alternatively given that according to the CA report the Arley Coal seam occurs at 135m depth below the site the vertical geology column suggests that the YB coal seam may occur at or close to surface or at very shallow depth below the site followed by the Hy seam at 25m depth and the Smith Coal at 75m depth.

18. In all 3 of the foregoing scenarios the presence of mine workings at 25m to 37m depth below the site is unlikely to be problematic assuming bedrock is close to surface and the workings if present do not exceed 1.5m or 2m thickness.
19. Of concern however is the possible occurrence of very shallow coal mine working at 6m depth or so or perhaps several metres deeper if the coal outcrop shown nearby to the northeast of the site lies further east than anticipated.
20. A further scenario worthy of consideration is that the geological fault shown to lie immediately below the property on the BGS geology map or close to it has caused the coal to be "faulted-out" and therefore absent below the site or the coal has been rendered unminable by fault disturbance and fracturing. In both instances because of faulting mine workings could be absent at shallow depth beneath the property.
21. From the foregoing it is clear that there is in this instance considerable uncertainty about bedrock depth at the site and whether the property is underlain by minable coal and if so whether mine workings exist at shallow depth in this coal.
22. Because of this uncertainty drilling is required to confirm bedrock depth and the absence of shallow coal seams and mine workings below the development site.
23. Hazardous gases associated with coal seams and underground coal workings are unlikely to pose a significant risk to the development in this instance because firstly typically across the UK coalfields gas is rarely a problem, secondly with regard to this property there is no record of a site specific gas problem.
24. However because workings may exist in coal at very shallow or shallow depth below the site and a geological fault occurs immediately below the site or close by, it is our opinion that the gas risk should be raised from Low to Moderate until proven otherwise by drilling and gas monitoring.
25. No mine entries are recorded by the CA within an influencing distance of the development site.
26. The risk of additional or other mine entries occurring within the site is considered by us to be Very LOW but not negligible. If an additional mine entry/s are found during subsequent investigations of the site or during construction groundworks the appropriate remedial action can be taken then including notifying the Coal Authority.
27. **In light of the foregoing this CMRA desk study has shown that there are potentially significant coal mining stability and mine gas hazards to the proposed development.**
28. **Consequently further exploratory coal legacy drilling and gas monitoring and perhaps other mitigation measures may be required to properly assess the safety of this site and make it safe.**

4. MITIGATION STRATEGY PROPOSED

Notes *This section is the key part of the Coal Mining Risk Assessment Report. It should explain how the coal mining issues have influenced the proposed layout and design of the development. The mitigation strategy will set out and illustrate with plans where necessary how the on-site issues identified in section 3 will be dealt with to ensure safety and stability of the development. This should include the assessment of mine gas and the necessary mitigation measures required as necessary. You may wish to refer to the Construction Industry Research and Information Association (CIRIA) publication Special Publication 32 "Construction over Abandoned Mine Workings"*

Where the desk-based assessment cannot conclude with certainty the extent of the coal mining risks on the site; details of further proposed on-site intrusive investigation works should be set out.

However, it is of paramount importance that this does not simply evade the issue and therefore place the Local Planning Authority in a position where it cannot be satisfied that coal mining legacy could give rise to some doubt that planning permission could not be granted.

MITIGATION RESPONSE

1. To properly determine the coal mining risk at this site it is proposed to drill boreholes to target depths up to 30m (but not necessarily reaching 30m) to locate possible coal and ironstone mine workings beneath the development site.
2. Borehole depths will be subject to adjustment by the supervising Competent Person on-site and depending on the geological conditions encountered (namely depth to rockhead, seam thickness and

ratio of rock cover to seam thickness) found during drilling and therefore may be terminated less than 30m.

3. A minimum of two boreholes is required in the vicinity of the new building.
4. The main purpose of the borehole investigation is to confirm the possible presence shallow coal seams beneath the site and if present to establish whether these seams contain mine workings.
5. If mine shafts are found during the intrusive site exploration works or during the subsequent construction groundworks the appropriate remedial action can be taken then. In addition the CA should be notified.
6. If mine workings are clearly confirmed to be absent, or beyond an influencing depth of the surface development it is unlikely that ground treatment/stabilisation by injection grouting or special foundation design measures will be required in respect of coal mining legacy.
7. The requirement for gas protection measures and the level of gas protection will be determined by a risk assessment based on a source - pathway - receptor model. This will depend on the gas concentrations found during coal legacy drilling together with the configuration of the site geology - particularly the nature and thickness of the drift/soil cover and the presence (or potential) for fissures or other pathways to exist.
8. A **Coal Authority Permit** must be obtained prior to the commencement of drilling at this site.
9. A risk assessment has been carried out in the section below (**The Coal Authority Permit**) for the exploratory site drilling works. In accordance with the RA drilling must be carried out using **small volume water injection flush** as this carries Low or Negligible risk of causing explosion or creating, releasing or causing hazardous gases to move upwards into nearby occupied housing and buildings. Gas monitoring must be carried out during drilling and boreholes must be sealed at the end of drilling.
10. The drilling flush used at this site MUST be that that stated in this CMRA - namely WATER and no other.
11. The drilling contractor/site manager should be warned that the CA operate permit compliance checks on drill sites and that a change in drilling fluid may be a breach of contract and may be liable to prosecution.
12. A 2nd specialist report will required on the findings of the coal drilling investigation finalising the scope of the mitigation measures needed (if any) to safeguard the development from coal mining related ground instability and hazardous gases.
13. **On the basis of the work to date, we are of the opinion that the mining stability risks posed by the strata beneath this site from coal mining legacy can be mitigated by routinely adopted measures and should not preclude the planning permission being registered.**

The Coal Authority Permit

Note *The report should state whether enquiries have been made or will be made; whether a permit application has been submitted or if a permit has already been obtained from the Coal Authority for the mitigation and/or further site investigation works.*

RESPONSE

A Coal Authority Permit needs to be obtained for further intrusive exploratory drilling works (as recommended above) which will disturb or enter any coal seams or coal mine workings present beneath the site.

Drilling Risk Assessment

In order to obtain a permit a coal drilling risk assessment has been carried out in accordance with Section 6 of CA publication: *"Guidance on Managing the Risk of Hazardous Gases when Drilling, or Piling near Coal"* which deals with the risks posed by various drill flushing mediums and different drilling Scenarios or Situations.

Situation Assessed: The site has been assessed to fall within **"Unworked coal or coal workings; High or UNKNOWN risk of hazardous gases being created/ generated; Occupied property within risk area"**. Therefore it is concluded that an Undetermined/Unknown hazardous gas risk exists at this site. In accordance with Table 6.2.7 Water Flush falls within Low risk while Air, Mist and Foam flush all fall within High & High to Medium risk categories respectively. In this situation water flush is by far the safest drilling medium available and should ONLY be used.

6.2.7 Table of Risks for Different Drilling Scenarios						
Situation	Air flush	Mist flush	Foam flush	Water flush	Mud flush	Additional controls
• Unworked coal or coal workings • High or unknown risk of hazardous gases being present / created • Occupied property within risk area	HIGH	HIGH / MED'M	HIGH / MED'M	LOW	LOW	• Monitoring at rig and other open holes. • Seal boreholes as soon as possible.

Air, Mist and Foam flush are much less safe than water or mud.

Outcome: For safer drilling small volume water injection drill flush is should ONLY be used. The stipulation in this instance of water flush only for exploratory drilling accords with the CA's own internally managed and licensed safe exploratory coal drilling protocol.

Drill Flush to be used when drilling: Permit application must state WATER only, as mud though safe is too messy.

Other precautions: Gas monitoring to be carried out during drilling. Boreholes to be sealed as soon as possible.

5. CONCLUSION

Notes *The Coal Authority would expect the Coal Mining Risk Assessment Report to conclude with a brief summary of risks and the remedial measures required for the proposed development site. The report should demonstrate a clear strategy for addressing the coal mining legacy and how the requirements of national planning policy with regard to development on unstable land have been addressed.*

OUR RESPONSE

The Coal Authority have identified this site as falling within a Development High Risk Area (DHRA) where there is potentially a serious risk to surface development from mining related ground instability and hazardous mine gases arising from past coal mining legacy.

The site is identified by the Coal Authority as one where there is PROBABLE shallow coal mine working.

The CA define Probable Workings as underground workings for which no recorded plan exists but where **IT IS LIKLEY** that workable coal at shallow depths **HAS BEEN MINED** before records were kept.

This CMRA has indicated that 1 coal seam containing mine workings at very shallow depth may occur beneath the development site.

Therefore potentially coal mining legacy poses significant risk to surface stability in the proposed development area requiring further assessment.

Because of this exploratory drilling is required to establish the depth of the coal seam beneath the site and whether this seam contains mine workings and hazardous mine gases.

The boreholes will also establish bedrock depth below the property this being an important factor in evaluating the impact of mine working depth on surface stability.

Gas monitoring must be carried out during drilling.

Notwithstanding, on the basis of the work to date, we are of the opinion that the coal mining legacy risks posed by this site can be mitigated by routinely adopted engineering/design measures (as outlined in our mitigation proposal above) and therefore should not preclude the planning permission being registered.

In order to finalise what (**if any**) mitigation measures are required it will be necessary to carry out further intrusive borehole investigations into the geological sequence to establish this sequence beneath this site and particularly the presence or absence of coal and workings in coal and hazardous ground gases.

The sinking of exploratory boreholes will be required at the site to do this.

A safe method of sinking boreholes which will reduce the risk to drill operators and the public has been proposed. A Coal Authority Permit will be required before drilling takes place. This must state that only water flush will be used for drilling.

Depending on the outcome of the additional coal mining legacy investigation it may be necessary to stabilise these seams/workings using routine drilling and grouting techniques and/or adopt special foundations design measures and perhaps install gas protection measures.

In conclusion we see no reason why Planning Permission should not be granted in the interim and that these works form a condition on the planning approval.

Appendices:

A. CA Report ref 51001593281001 dated 22nd August 2017.
B. Extract of BGS bedrock geology map Sheet 85 Manchester at 1:50000 scale
C. BGS Borehole log SD80NE 6.

Other historical OS maps, borehole logs, site images and photographs have not been included because it was considered that they did not provide significant useful additional information.

APPENDIX A
COAL AUTHORITY REPORT

The Coal Authority

Resolving the **impacts** of mining

Non-Residential Coal Mining Consultants Report



147 JUBILEE ROAD, MIDDLETON, ROCHDALE, M24 2LY

Date of enquiry:	22 August 2017
Date enquiry received:	22 August 2017
Issue date:	22 August 2017
Our reference:	51001593281001
Your reference:	G17356

Non-Residential Coal Mining Consultants Report

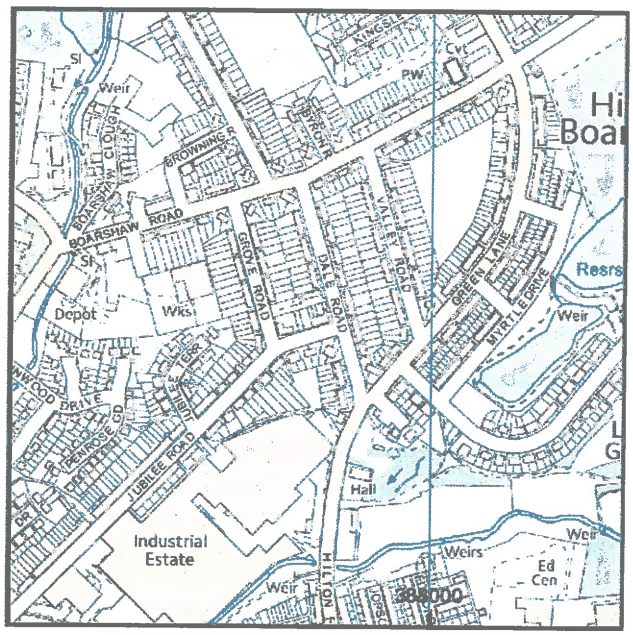
This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

GEOINVESTIGATE

Enquiry address

147 JUBILEE ROAD, MIDDLETON, ROCHDALE, M24 2LY



Approximate position of property

Map data

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NG18 4RG

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/thecoalauthority
/coalauthority

Detailed findings

Past underground coal mining

Colliery	Seam	Mineral	Panel	Depth (m)	Direction to working	Disposition	Extraction thickness (cm)	Year
unnamed	ARLEY	Coal	3W5I	136	N	0.1	150	1874

Probable unrecorded shallow workings

Yes.

Outcrops

Seam name	Mineral	Thin indicator	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
PLODDER	Coal	False	15.8	74	124

Spine roadways at shallow depth

None recorded.

Future underground mining

None recorded.

Licence details (AOR)

None recorded.

Section 46 notices

None recorded.

Geology

No faults, fissures or breaklines recorded.

Mine entries

None recorded.

Court orders
None recorded.

Worked out opencast sites
None recorded.

Coal mining related hazards
None recorded.

Coal mining subsidence
The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres, since 31 October 1994.

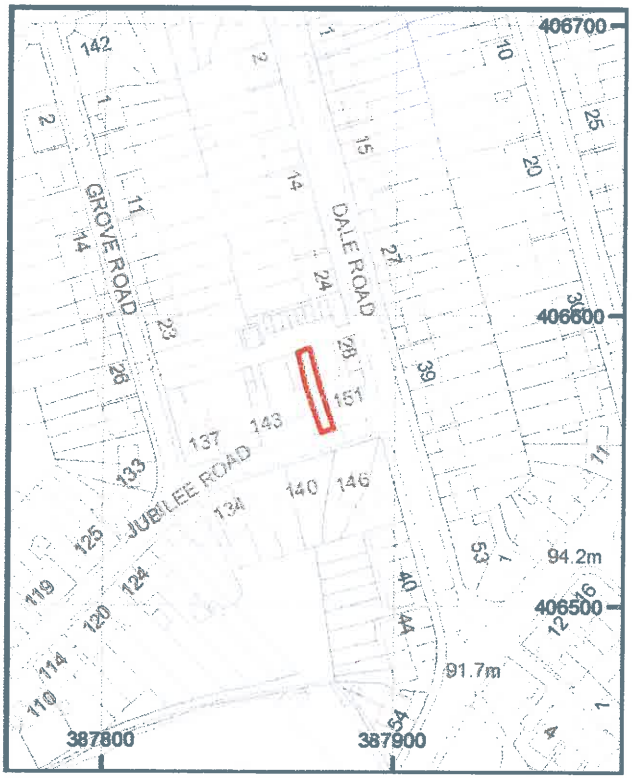
There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

Enquiry boundary

Key

Approximate position of enquiry boundary shown



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/thecoalauthority
/coalauthority

Map data

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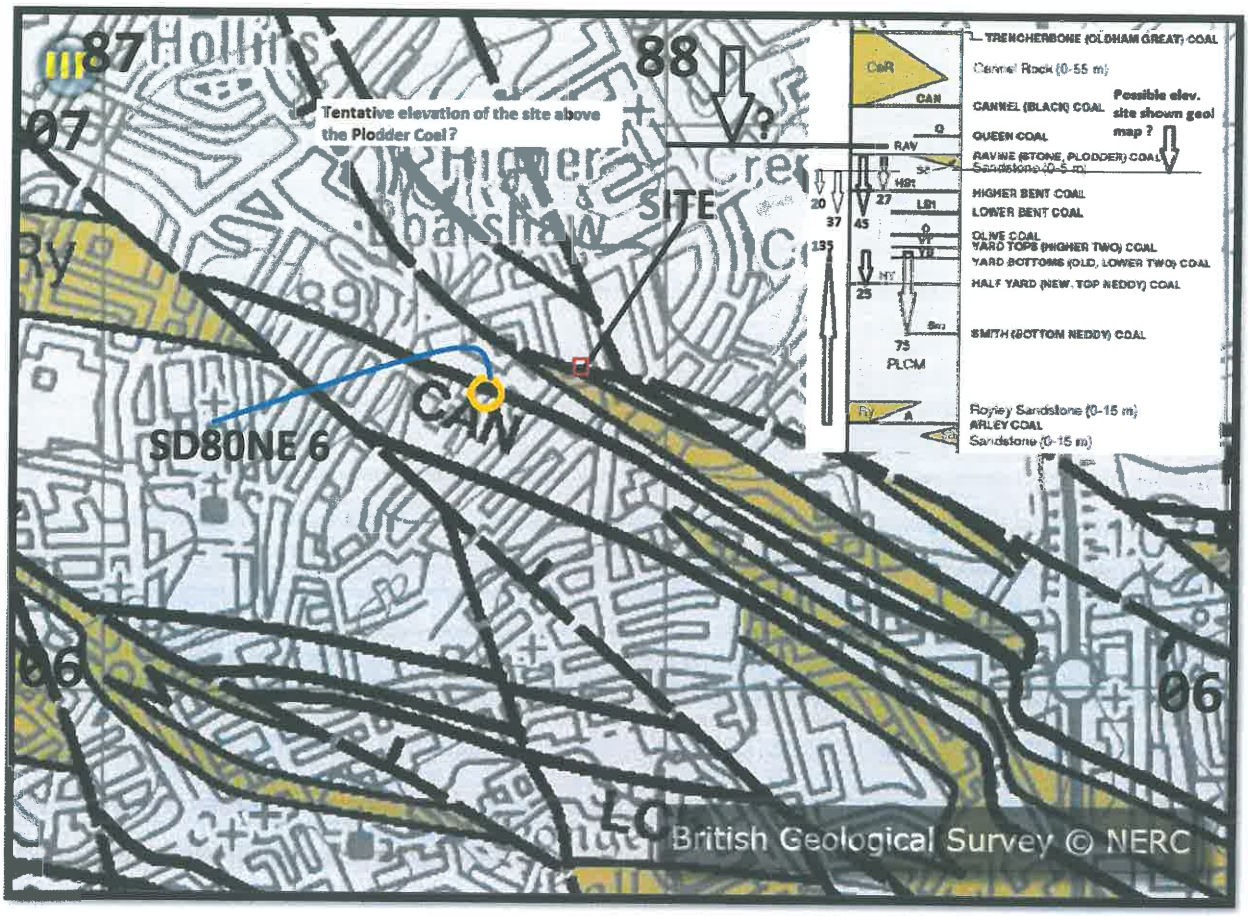
VAT receipt

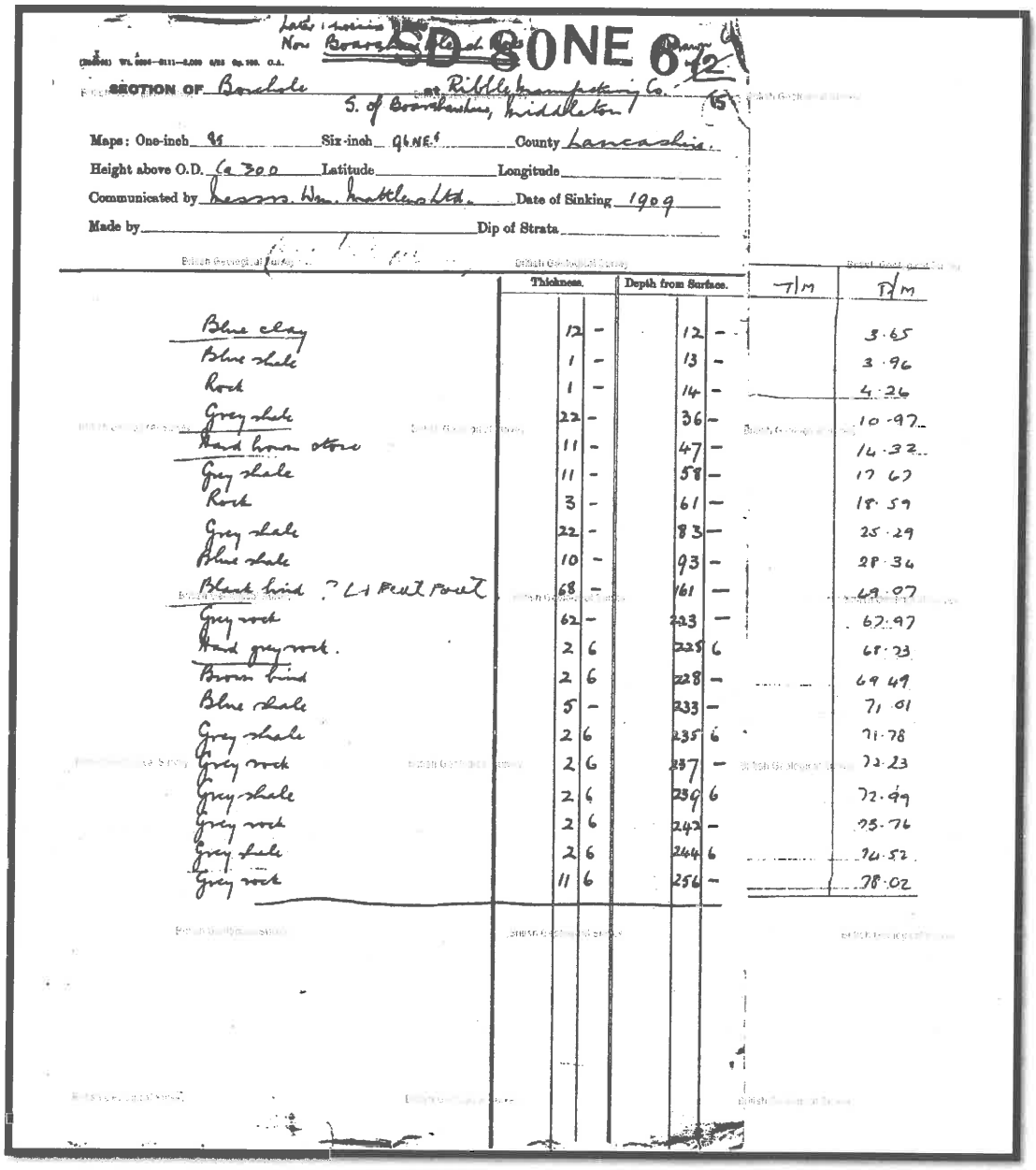
Issued by	The Coal Authority 200 Lichfield Lane Mansfield Nottinghamshire NG18 4RG
Tax point date	22 August 2017
Issued to	GEOINVESTIGATE TERRY DICKEN INDUSTRIAL ESTATE TERRY DICKEN INDUSTRIAL ESTATE, ELLERBECK WAY STOKESLEY NORTH YORKSHIRE TS9 7AE
Property search for	147 JUBILEE ROAD MIDDLETON ROCHDALE M24 2LY
Reference number	51001593281001
Date of issue	22 August 2017
Cost	£101.70
VAT @ 20%	£20.34
Total received	£122.04
VAT registration	598 5850 68

APPENDIX B
EXTRACT OF GEOLOGY MAP



APPENDIX C
BGS LOG SD80NE 6

Later: [illegible]
Now Boarshaw [illegible]



SD 80NE 6

SECTION OF Borehole at Ribble Manufacturing Co.
S. of Boarshaw Hills, Middleton

Maps: One-inch 85 Six-inch 96NE 6 County Lancashire.

Height above O.D. Ca 300 Latitude Longitude

Communicated by Messrs. Wm. Mattlews Ltd. Date of Sinking 1909

Made by Dip of Strata

	Thickness.		Depth from Surface.		T/M	T/M
Blue clay	12	-	12	-		3.65
Blue shale	1	-	13	-		3.96
Rock	1	-	14	-		4.26
Grey shale	22	-	36	-		10.97
Hard brown stone	11	-	47	-		14.32
Grey shale	11	-	58	-		17.67
Rock	3	-	61	-		18.59
Grey shale	22	-	83	-		25.29
Blue shale	10	-	93	-		28.34
Black bind ? L & Feet Foot	68	-	161	-		49.07
Grey rock	62	-	223	-		67.97
Hard grey rock.	2	6	225	6		68.73
Brown bind	2	6	228	-		69.49
Blue shale	5	-	233	-		71.01
Grey shale	2	6	235	6		71.78
Grey rock	2	6	237	-		72.23
Grey shale	2	6	239	6		72.99
Grey rock	2	6	242	-		73.76
Grey shale	2	6	244	6		74.52
Grey rock	11	6	256	-		78.02