



Specification for the Consolidation of Abandoned
Mine Workings

Don Street, Middleton



PERFORMANCE SPECIFICATION FOR CONSOLIDATION OF ABANDONED MINE WORKINGS

Don Street
Middleton

Prepared for:



KELLEN
HOMES

Report Ref: 14-554-R6- Rev 1

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Don Street, Middleton

Performance Specification for Consolidation of Abandoned Mine Workings

February 2023

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EXECUTIVE SUMMARY

Site Address	Don Street, Middleton, Manchester, M24 2DB
National Grid Reference	E 388480, N 406300
Site Area	10.43 Ha.
Background	E3P has been instructed by Kellen Homes to prepare a Performance Specification for the Consolidation of Abandoned Mine Workings that will facilitate safe residential development at the site located at Don Street, Manchester. This E3P specification has been produced in due consideration of the geoenvironmental site assessment of ground stability risk associated with abandoned mine workings previously undertaken by E3P. The subject site is currently disused open land. Kellen Homes intends to redevelop the site for low-rise residential housing with associated private gardens, areas of Public Open Space (POS), adopted estate road & infrastructure, pavements / private drive and drainage systems. Due to significant level differences across the landholding, it is anticipated that the proposed development will include a significant enabling works process to cut and fill the site to a suitable level and construct a platform.
Coal Mining	Parcel A The western sector will require drill and grouting by a specialist contractor in order to significantly reduce the risk of instability at the surface in the event of collapse of underlying coal workings within the Cannel and Higher Bent Seams. The eastern sector could not be fully investigated, however there is potential for shallow unrecorded workings, therefore it is recommended that proof drilling is undertaken in this area when possible. Parcel B & C No evidence of coal workings have been identified. It is assumed that the coal seams within this area are below unstable deep granular deposits and the bedrock is heavily disturbed by the fault, therefore it wasn't practicable to mine coal in these areas in the 18th and 19th centuries prior to mechanisation. No further works are required in Parcels B & C of the site unless coal workings are found within the Higher Bent within Parcel A and are traced across into Parcel B&C. Parcel D & E Drill and grouting is required on the western side of the site to the Cannel Coal and Higher Bent. As rock cover increases to the east the grid can widen in line with the level of risk identified. No shafts have been recorded across the entire subject site however, there is the possibility of encountering unrecorded shafts during mine stabilisation, remediation, civil engineering, foundation works.



SUMMARY OF CONSOLIDATION & STABILISATION WORKS

Consolidation of shallow workings in coal seam	Due to variable risks posed by coal mining beneath the site, the specific program for the different areas varies as specified below: Cannel Seams (Parcel A and D) – Drill and Grout on a 6 m x 6 m primary grid across the proposed buildings footprints, with treatment extending up to 3 m beyond the plot line, where workings are identified secondary boreholes will then be drilled at 4.5 m infill centres across the area of stabilisation and subsequent tertiary 3m grid based on grout takes (>5 tonne) across the proposed buildings footprints, with treatment extending up to 3 m beyond the plot line. 10 m drill and grout grid beneath proposed adopted highways, estate roads and driveway will be required. High Bent Seam – Proof drilling is to be undertaken on a plot by plot basis to confirm the locations where coal has not been extracted. Where coal or voids are present then drill and grouting on 6 m x 6 m below plots, with treatment extending up to 3 m beyond the plot line, where workings are identified secondary boreholes will then be drilled at 4.5 m infill centres across the area of stabilisation and subsequent tertiary 3m grid based on grout takes (>5 tonne) across the proposed buildings footprints, with treatment extending up to 3 m beyond the plot line. 10 m drill and grout grid beneath proposed adopted highways, estate roads and driveway will be required. The boreholes will serve as injection points where grout will be pumped under pressure into the workings to consolidate the voids in accordance with the specification herein. Where necessary, tertiary boreholes will be drilled on a 3 m grid where grout take is high and completion pressure cannot be achieved within a grout hole. Works will be considered to be completed when the required borehole grid and pressure grouting has achieved the performance specification. Validation test boreholes will be drilled to confirm consolidation at locations and centres to be dictated by the supervising engineer. The stabilisation works will be undertaken by injecting a PFA/cement grout into the workings via the boreholes. Works are to be completed in accordance with CA permit and under the supervision of geotechnical engineer.
Utility Infrastructure	A high pressure gas main is present just beyond the northern boundary of this parcel. It must be noted that prior to any drill and grout works, Cadent, National Grid and UU need to be consulted and works approved.



Invasive Species	Prior to any drill and grout works an invasive species plan needs to be refer to and considered to ensure that invasive species are not spread by these works.
Protection of controlled waters	In order to ensure no negative impact to controlled waters during the drill and grout works, samples of the River Irk will be taken in accordance with RE-7 within E3P Remediation and Enabling Works Strategy (ref: 14-554-R2 REV10 dated Feb 2023). Where any impact is identified, drill and grout works will cease whilst the impact is assessed.



TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
1. INTRODUCTION	6
1.1. Background	6
1.2. Report Objectives	6
1.3. Previous Works	6
1.4. Redevelopment Plan	6
1.5. Summary of Parties Involved	7
1.6. Site Details	7
1.7. Site Summary	8
1.8. Summary of Reported Ground Conditions	10
1.8.1. Topsoil	10
1.8.2. Made Ground	10
1.8.3. Drift	11
1.8.4. Solid	12
1.8.5. Groundwater	12
2. SYNOPSIS OF COAL MINING ISSUES	13
2.1. Background	13
2.2. Desk Study Review of Coal Mining	13
2.2.1. Coal Mining Information	14
2.2.2. Coal Authority Plan	16
2.2.3. Coal Mining Geology	16
2.2.4. Mine Abandonment Plans	17
2.2.5. Coal Mining Risk Assessment	18
2.2.6. Parcel A	18
2.2.7. Parcel B	19
2.2.8. parcel c	19
2.2.9. Parcel D	20
2.2.10. Parcel E	20
2.2.11. Scope of E3P Intrusive Ground Investigation	21
2.2.12. Summary of Ground Investigation Works	21
2.3. Summary of Coal Mining Issues	22
2.4. Parcel A	22
2.5. Parcel B & C	23
2.6. Parcel D & E	23
3. GENERAL SPECIFICATION FOR MINE STABILISATION WORKS	24
3.1. Overarching Scope of Works	24
3.2. Supervision and Validation	24
3.3. Constituent Materials for Grouting	24
3.3.1. Storage and Use of Materials	25
3.3.2. Grouting Plant	25
3.3.3. Grout Mixes	25
3.3.4. Grout Properties and Testing	25
3.4. treatment of workings in shallow coal seam	26
3.4.1. drilling Procedures for Shallow Workings in coal seam	26
3.4.2. Grouting Procedures for Shallow Workings in coal seam	27
3.4.3. In-Situ Testing	28
3.5. Records – Coal Seam, Shafts & Plugs	28



APPENDIX I LIMITATIONS.....	31
APPENDIX II GLOSSARY	33
APPENDIX III DRAWING	36



1. INTRODUCTION

1.1. BACKGROUND

E3P has been instructed Kellen Homes to develop a Performance Specification for the Consolidation of Abandoned Mine Workings to facilitate the safe and regulatory compliant stabilisation of the land to facilitate the proposed residential development at the site.

1.2. REPORT OBJECTIVES

The objectives of this report are as follows.

- ✿ Prepare an overview of identified issues associated with abandoned mine workings.
- ✿ Evaluate feasible consolidation and stabilisation options.
- ✿ Define the proposed scope of works for the stabilisation of abandoned mine workings within the sectors of the site that have been determined to be at risk from a future subsidence event.
- ✿ Set out the validation criteria and protocols required to demonstrate the successful implementation of the mine stabilisation works with sufficient supporting information, test data and independent quality control to ensure successful implementation of the works.

1.3. PREVIOUS WORKS

The following phases of geoenvironmental investigations have previously been carried out at the site:

- ✿ E3P – Remediation and Enabling Works Strategy – Report Reference: 14-554-R2 – June 2021
- ✿ E3P – Phase I & II Geoenvironmental Assessment – Report Ref: 14-554-R1- May 2021
- ✿ E3P – Remediation and Enabling Works Strategy – Report Reference: November 2014
- ✿ Coopers – Site Investigation Report. Report Reference: 5639si, dated 28th May 2013.
- ✿ REFA Consulting Engineers – Ground Investigation Report. Report Reference: 05122, dated September 2006; and,

1.4. REDEVELOPMENT PLAN

Kellen Home intends to construct a low-rise residential development with associated gardens, estate roads and infrastructure. Drawing 14-554-002- (Appendix III) identifies the proposed development layout.



1.5. SUMMARY OF PARTIES INVOLVED

FUNCTION/INTEREST	NAME OF PARTY
Local Planning Authority	Rochdale MBC
Developer	Kellen Homes
Geotechnical Consultant	E3P
Main Contractor	Kellen Homes
Mine Stabilisation Contractor	TBC
Regulatory	Coal Authority
Highways Authority	Rochdale MBC

1.6. SITE DETAILS

Site Address	Land Off Don Street, Middleton, Manchester, M22 2GG
Grid Reference	E388415, N406151
Site Area	10.43Ha

All acronyms used within this report are defined in the Glossary presented in Appendix II.

A site location plan is presented in Appendix III as Drawing 14-554-001.



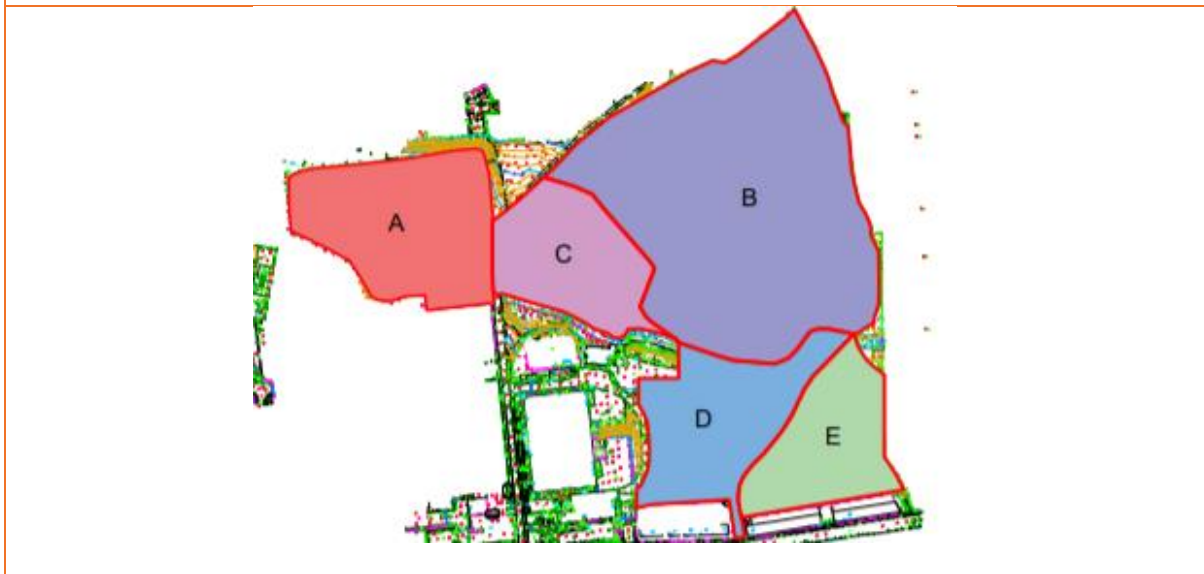
1.7. SITE SUMMARY

For ease the site has been divided into the following 5 No. discrete parcels in line with the previous report completed by Coopers in 2013. The parcels are:

- ✿ **Area A** - the former Rex Mill,
- ✿ **Area B** - former playing fields,
- ✿ **Area C** - apron between Rex Mill and former playing fields,
- ✿ **Parcel D** - Wagon/trailer park, open ground and Hexpol car park
- ✿ **Parcel E** - Wooded area in the south eastern corner of the site.

A plan showing the defined parcels is presented within Figure 1.1.

FIGURE 1.1 SITE AREAS PLAN



OVERALL SITE SUMMARY

The site comprises an irregular shaped parcel of land with the River Irk flowing east west through the centre of the site. The area in the south there is an area that is currently used as HGV Parking, parking for the adjacent offsite Hexpol Building and open soft landscaped land.

From the northern end of Donn Street you can access parcels A, B and C.

Access to D&E is from a new junction on road to the immediate south of the site.

The area to the north of the river is rough, soft landscaping with a football field in the north east.

The site gently slopes down toward the River Irk from the north and south, steepening in gradient in proximity to the river embankment which is indicative is historical infilling to the landform.

Japanese knotweed and Himalayan Balsam have been identified along the banks of the River Irk.



A site features plan is included as Drawing 14-554-004 (Appendix III).

PARCEL A

Parcel A also known as (the Rex Mill site) is predominantly level, with remnant concrete hardstanding. The majority of the site is covered in self-seeded sapling woodland and undulating disturbed ground within the central and eastern areas.

The site is bounded by a bund along the eastern boundary along Don Street and the River Irk along the south of the site. The River Irk is bounded by stone and brick retaining walls on either side. The western boundary is defined by a line of poplar trees and the north boundary by a drainage sough, beyond which a gabion wall and a shallow wooded slope.

A high pressure gas main is present just beyond the northern boundary of this parcel.

It must be noted that prior to any drill and grout works, Cadent, National Grid need to be consulted and works approved.

PARCEL B

Parcel B also known as (Former playing field area) is situated within the north eastern portion of the wider site development. The playing field area is poorly maintained split into 3 tiers that get higher in topography to the north east. There is a fall of circa 11m from the north eastern corner of the site down toward the River Irk.

Small areas of asphalt are present in the Northernmost area related to former car parking for the sports pitches.

PARCEL C

Parcel C has recently undergone clearance however there is a bund along the western boundary of the site. The north eastern area of the site is noted to be very boggy with self seeding saplings with the eastern boundary defined by a slope up to the playing fields that form parcel B.

Japanese knotweed has previously been identified in this area of the site however, its current condition is unknown.

Prior to any drill and grout works an invasive species plan needs to be refer to and considered to ensure that invasive species are not spread by these works.

PARCEL D

Parcel D has also recently undergone site clearance with all the vegetation removed, however the hard standing in the north and south of the site remains. The site slopes up through the centre of the site toward the south by circa 3m, with the northern boundary defined by the River Irk and southern boundary by the properties to the south.



PARCEL E

Parcel E is an area of soft standing that has recently been cleared of vegetation except for area around a pond in the east. The site slopes down from the south to north by circa 3m as per parcel D however, the slopes in the very south eastern corner are relatively steep and may require assessment if any drill and grout works are required in this area.

A footpath crosses the site from north west to south east.

1.8. SUMMARY OF REPORTED GROUND CONDITIONS

E3P has prepared a detailed Site Investigation Report (Report Ref: 14-554r1) dated May 2021. The summary of reported ground conditions is presented here.

The ground investigation comprised mechanically excavated trial pits, window sample boreholes, cable percussive boreholes, rotary open holes and environmental monitoring installations.

1.8.1. TOPSOIL

Parcel A

None

Parcel B & C

Topsoil was encountered in the north of Parcel B (playing fields) to a maximum proven depth of 0.80 m bgl. This topsoil is deemed to be potentially reworked as part of the levelling in this area in preparation of the ground for a playing field.

Parcel D & E

Reworked topsoil of dark brown slightly clayey medium sand or dark grey sandy clay with rootlets was noted across the eastern sector to depths of between 0.08 m and 0.40 m bgl.

1.8.2. MADE GROUND

Parcel A

Made Ground deposits were encountered within all exploratory hole locations to depths of between ground level and in excess of 5.45 m bgl although, in general, Made Ground was encountered to a depth of less than 1.00 m bgl.

Significant obstructions in the form of former foundations were encountered throughout the former mill site.

Across the site Made Ground deposits generally comprised of a red sandy gravel with frequent cobbles of brick or a dark/light brown slightly clayey gravelly sand with gravel of brick, mudstone, concrete, glass and ash.

A significant hydrocarbon odour and sheens were encountered in 3 locations one of which was in the location of the former tanks.



Parcel B & C

Made Ground was encountered within the majority of exploratory holes to a maximum proven depth of 5.90 m bgl.

The southern area of parcel B (former landfill) was found to comprise a brown sandy gravelly clay with inert wastes including brick, concrete, occasional coal, polythene sheeting, tyres, slag and vegetation including tree stumps. The former landfill was proven to a maximum depth of 4.00m in CP303 with potential that it does proceed beyond this to beyond 5.45m in WS311 however, this borehole was inconclusive due to poor recovery.

Towards the north of Parcel B, Made Ground was noted to comprise a re-worked sand fill which deepened towards the west to a maximum encountered thickness of 1.50 m. There were no significant anthropogenic materials encountered within this stratum.

Within the historic Coopers investigation, an area of fill was encountered to a maximum proven depth of 2.60 m bgl in the area of the former pond on the northern boundary of Parcel B. This comprised circa 0.60 m of ash and clinker overlain by circa 1.30 m of reworked clay, reworked sand and topsoil. It was noted that the centre of the pond was not accessible therefore deeper Made Ground may be present in this location. E3P were unable to investigate this area further due to proximity to a medium pressure gas main.

In the western area (Parcel C) the Made Ground comprised a clay bound brick fragmented backfill to a maximum proven depth of 2.70 m bgl. Occasional ash and clinker were also encountered.

Parcel D & E

Made Ground deposits were encountered within all exploratory hole locations to a maximum proven depth of 5.45m in WS401.

The shallow Made Ground deposits generally comprise asphalt, concrete or a reworked topsoil of dark brown slightly clayey medium sand with rootlets.

The deeper Made Ground deposits generally comprise brown to black gravelly clay or brown to dark grey gravelly coarse sand. Gravel comprised mudstone, concrete and brick.

Slight hydrocarbon odours were noted in the Made Ground in TP409 at 1.60 m and in TP411 between 0.20 m to 2.50 m bgl.

The deeper Made Ground deposits generally comprise brown to black gravelly clay or brown to dark grey gravelly coarse sand. Gravel comprised mudstone, concrete and brick.

Slight hydrocarbon odours were noted in the Made Ground in TP409 at 1.60 m and in TP411 between 0.20 m to 2.50 m bgl.

1.8.3. DRIFT

Parcel A

The drift deposits varied across the site however, the majority of the site is underlain by granular deposits with sporadic beds of clay within in the upper 3 metres.

The granular deposits varied in density from very loose to becoming dense typically beyond 3m bgl, it is assumed that the loose deposits are caused by the shallow groundwater on the site.



Parcel B & C

Drift deposits across the Parcel B and C were encountered between ground level to a maximum proven depth of 28.00 m bgl. Deposits encountered typically comprise a loose to medium dense SAND or SAND and GRAVEL with occasional bands of silty CLAY within some locations.

PEAT deposits were noted within three exploratory hole locations in the Coopers Report within the west (Parcel C) between the depths of 1.30 m bgl and 3.00 m bgl with a maximum proven thickness of 0.30 m. E3P encountered PEAT within one exploratory hole location (WS301) within Parcel C at a thickness of 0.20 m. However, within these areas E3P did identify organic alluvial silts at ~2.00m that will require further delineation & geotechnical analysis.

Parcel D & E

The drift deposits are varied, generally comprising soft low strength to stiff high strength sandy CLAY and loose to medium dense clayey medium SAND to a maximum proven depth of 32.80 m bgl (RB408).

The rotary boreholes generally recorded granular drift deposits at depth, comprising light brown fine to medium SAND with occasional bands of clay and gravel.

1.8.4. SOLID

Parcel A

The solid bedrock geology was encountered between 3.90m and 14.90m bgl. The solid geology comprises grey MUDSTONE interbedded with grey SANDSTONE and coal bands. Generally, the bedrock deepens from west to east with no significant topographical variance at the surface.

Parcel B & C

The solid bedrock geology was encountered between 17.80 m and 28.00 m bgl and comprised light-grey MUDSTONE which is interbedded with grey SANDSTONE with occasional traces of coal.

Parcel D & E

The solid bedrock geology was encountered as SILTSTONE in RB408 between 32.80 m and 47.00 m bgl.

1.8.5. GROUNDWATER

Parcel A

Groundwater that is likely in hydraulic continuity with the River Irk was encountered across the site between 1.00m and 2.00m bgl.

Parcel B & C

Groundwater that is likely in hydraulic continuity with the River Irk was generally encountered between 2.00m and 4.00m bgl.

Parcel D & E

Perched groundwater was encountered as seepages between 1.90 m and 5.00 m bgl.



2. SYNOPSIS OF COAL MINING ISSUES

2.1. BACKGROUND

E3P has completed several phases of assessment and investigation to determine the potential for unrecorded abandoned mine workings at a shallow depth beneath the site and the subsequent potential for these workings to represent a ground instability risk associated with collapse and consolidation of the substratum.

2.2. DESK STUDY REVIEW OF COAL MINING

The Envirocheck report states the site is in an area that may be affected by coal mining.

A CA mining report was obtained (Ref: 51002345434001) dated 6th January 2021.

The CA operates a risk-based approach to the assessment of potential instability issues associated with future development of land located within the predefined CA consultation areas. This risk-based approach subdivides the potential risk into “low” and “high” risk categories.

The risk categories can be defined as:

Low-Risk Sites – Deemed to be land where coal mining has taken place, however it was at such depth not to pose a risk to new development and it therefore contains no known recorded risks and as such no further assessment is required.

For low-risk sites, the CA categorically states:

If your proposed development is within the Development Low Risk Area there is no need for you to submit any coal mining information with your planning application and The Coal Authority will not be consulted by the LPA. The LPA will include our Standing Advice as an informative note within the decision notice.

High-Risk Sites – Deemed to be landholdings located within an area known to contain legacy risks that include:

-  Mine entries (shaft or adit);
-  Shallow coal workings (recorded and probable);
-  Workable coal seam outcrops;
-  Mine gas sites and areas;



- ✳ Recorded coal-mining-related hazards;
- ✳ Geological features (fissures and break lines); and
- ✳ Former surface mining sites (sometimes using historic opencast extraction methods).

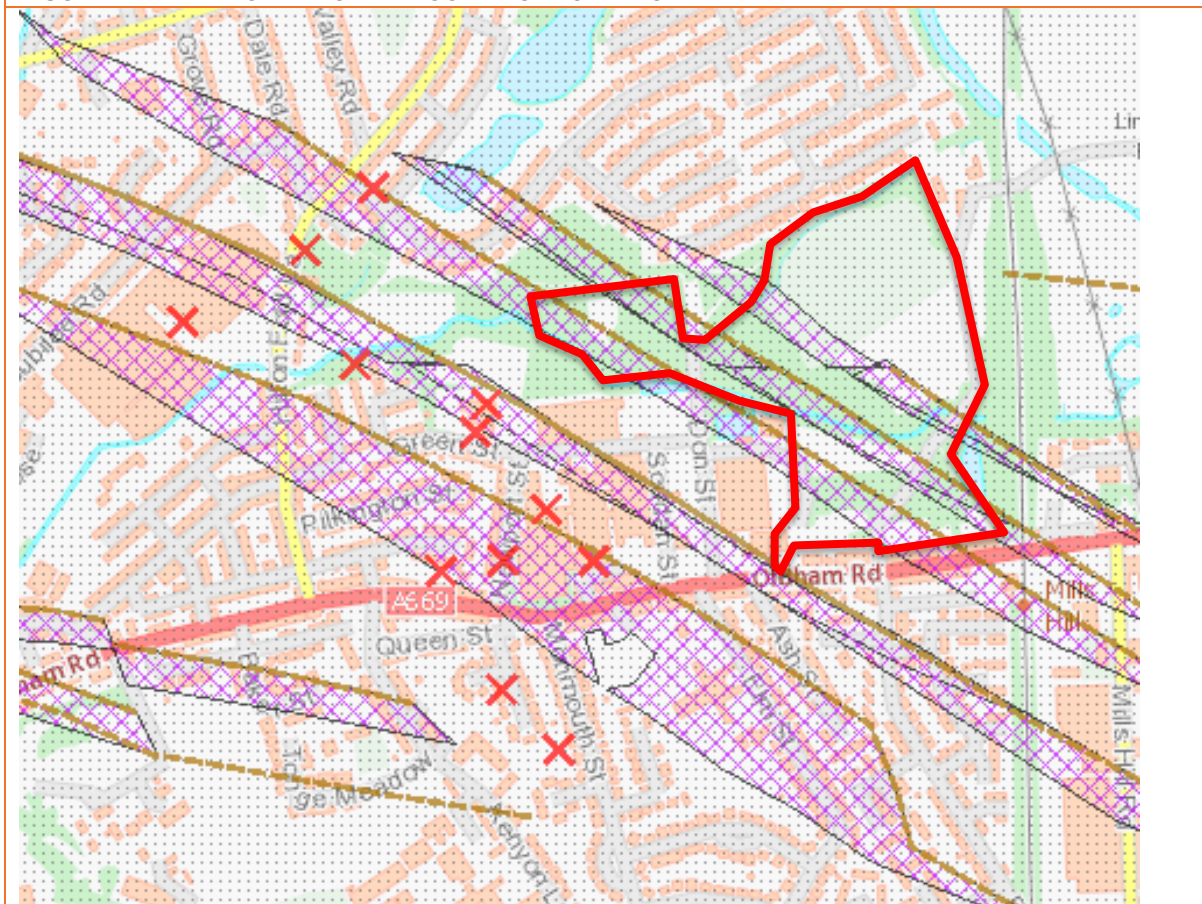
2.2.1. COAL MINING INFORMATION

Prior to the enactment of the Coal Mines Regulation Act (1872), which came into force on the 1st January 1883, there was no statutory requirement to record the extent of abandoned mine workings and as such the CA has no knowledge of extensive workings throughout the UK Coal Fields where shallow workings are present at a depth that could result in a subsidence event in the future (through successive cavitation) associated with failure of support mechanism.

To determine if a site may have unrecorded or recorded coal mine workings requires the consideration of a wide range of information and E3P has completed a review of relevant information in relation to potential coal mining activities.

In the first instance, E3P has reviewed the Coal Authority Online Viewer and an excerpt of this is presented as Figure 2.1. This map shows that the site has multiple coal seams subcropping beneath the site with associated development high risk area.

FIGURE 2.1 EXCERPT OF THE COAL AUTHORITY ONLINE VIEWER



As the site is within an area affected by Coal Mining E3P have consulted with the Coal Authority who have provided a Consultant Coal Mining Report for the site (ref: 51002345434001).



Table 2.1 provides a summary of pertinent coal mining information with this report.

TABLE 2.1 COAL MINING INFORMATION

SOURCES OF INFORMATION	SUMMARY
Known Past Underground Mining	Lower Bent – 16° degrees dip – Extraction Thickness: 80cm at 26m in 1857 Lower Bent – 16° degrees dip – Extraction Thickness: 80cm at 40m in 1857 Half Yard – 15.9° degrees dip – Extraction Thickness: 100cm at 82m in 1851 Half Yard – 16° degrees dip – Extraction Thickness: 100cm at 92m in 1851
Probable Unrecorded workings	YES
Spine Roadways at Shallow Depth	No
Mine Entries within 100m of the site	None
Mine Abandonment plans	Yes
Known outcrops	Cannel – Workable: Yes Higher Bent – Workable: Yes Lower Bent - Workable: Yes Plodder – Workable: Yes
Faults / Fissures	In the north of the wider site
Opencast mines	None
Coal Authority Managed Tips	No
Remediated Sites	No
Coal Mining Subsidence	1 claim within 50m of the property (South)
Mine Gas	No
Mine Water	No
Future Underground Mining	None
Coal Authority Development Advice	The site is within an area of coal mining activity.
Historical Ordnance Survey Mapping	A review of the 1:10,000 Ordnance Survey mapping from circa 1850, which has records of mine workings that predate the Mining & Regulation Act of 1872, identified the following features indicative of historical mine workings in proximity to the application site: Tongue Colliery – 250m West

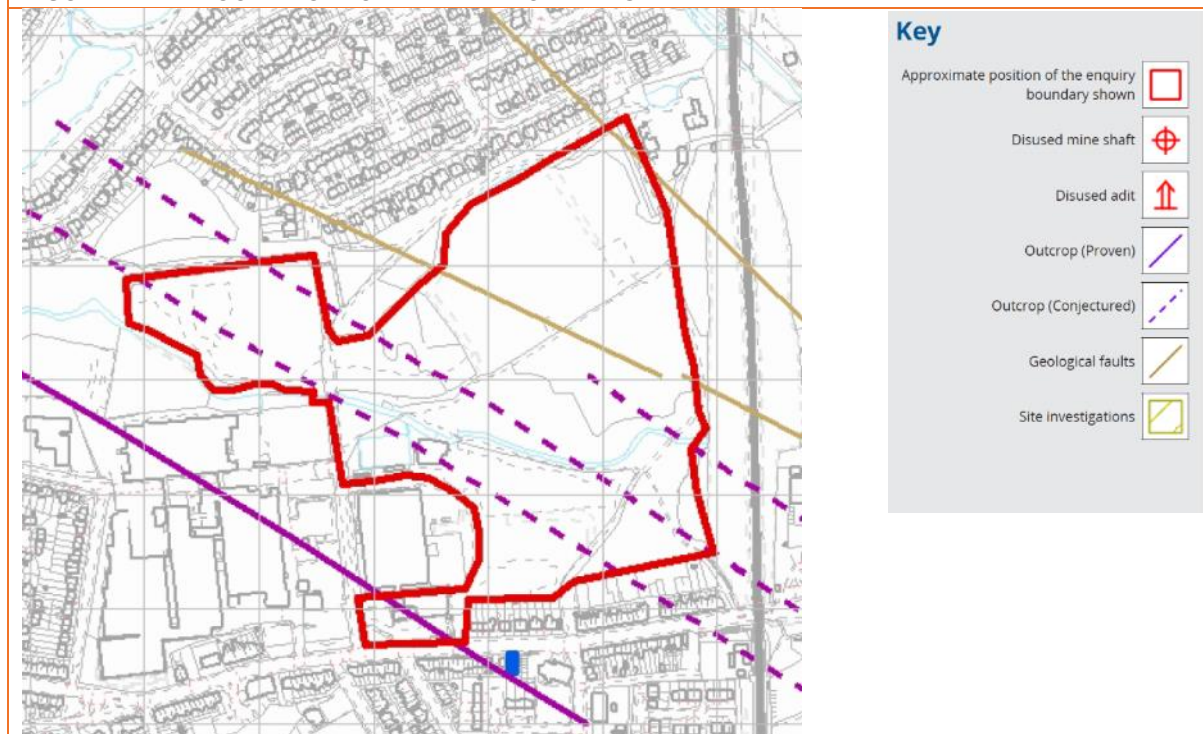


SOURCES OF INFORMATION	SUMMARY
	In consideration of the historical mining features in proximity to the site and potential for coal close to the surface it is considered possible that coal extraction has occurred, underlying the site at relatively shallow depths; further investigation would be required to determine the extent and depth of any worked seams.
Historical Site Investigations	Historical site investigations have been undertaken across the site. Voids and evidence of workings have been encountered at shallow depth (~13.5m) within the north west of the site (Parcel A) but not anywhere else on the subject site.

2.2.2. COAL AUTHORITY PLAN

The Coal Authority plan referenced: MR-LARGE-PLOT-5100234543001 shows the coal seams beneath the site along within the fault through the site.

FIGURE 2.2 COAL AUTHORITY PLAN FOR THE SITE

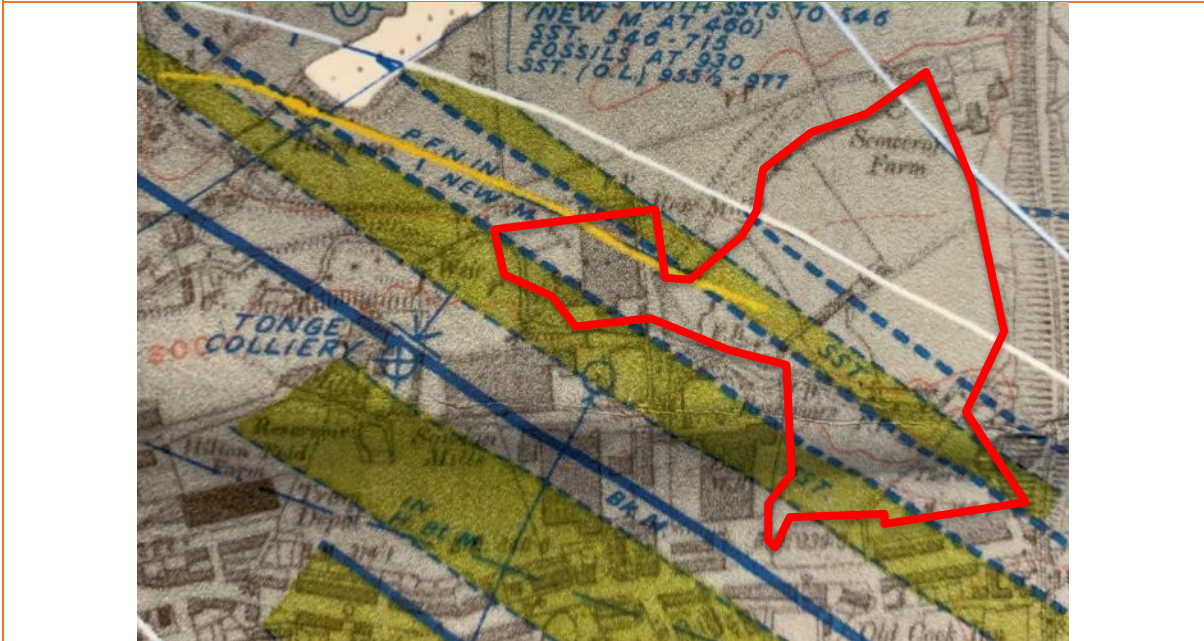


2.2.3. COAL MINING GEOLOGY

Figure 2.3 is a photograph of the 1:10,000 plan for the site which shows the Lower Bent Seam as the most eastern subcrop, west of this is then the Higher Bent and Cannel Coal beneath the site. The coal seams are disrupted by a fault which passes through Parcel A, B and C. The rock is dipping at ~15° south west.

A below ground mine shaft is shown below Don Street (outside of the redline boundary) between two coal mines.

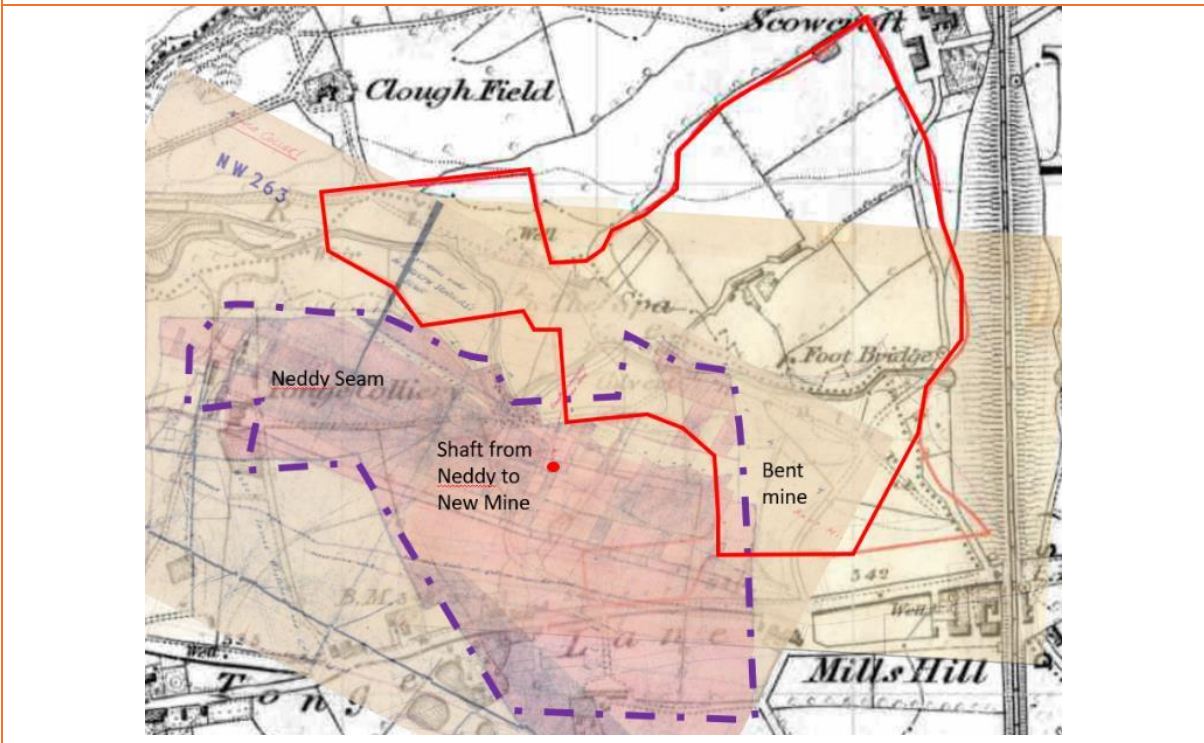
FIGURE 2.3 PHOTOGRAPH OF THE 1:10,000 PLAN FOR THE SITE



2.2.4. MINE ABANDONMENT PLANS

Mine abandonment plans are available for the site for the Neddy Mine, New Mine and Bent Mine. These abandonment plans show the extent of known workings below the site as shown by the purple boundary within Figure 2.4.

FIGURE 2.4- EXTENT OF KNOWN MINE WORKINGS



2.2.5. COAL MINING RISK ASSESSMENT

This risk assessment comprises a desk-based review of all available information on coal mining issues that are relevant to the application site deemed to be located within a high-risk area. This includes:

-  Interpretation of information to identify and assess the risks to the proposed development from coal mining legacy, including the cumulative impact of issues;
-  Setting out appropriate mitigation measures to address the coal mining legacy issues affecting the site, including any necessary remedial works and/or demonstrate how coal mining issues have influenced the proposed development; and
-  Demonstrating 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.

The coal mining risk assessment is summarised in Table 2.5.

2.2.6. PARCEL A

TABLE 2.5 SUMMARY OF COAL MINING RISK ASSESSMENT – PARCEL A

COAL MINING RISK ASSESSMENT	YES/NO	RISK ASSESSMENT
Recorded Underground Coal Mining at Shallow Depth (< 30 m)	YES	High
Recorded Underground Coal Mining at Shallow Depth (> 30 m)	No	Low
Evidence of Unrecorded Surface Extraction of Coal Outcrop	No	Low
Unrecorded Underground Coal Mining at Shallow Depth (< 30 m)	Yes	High
Mine Entries (Shaft/Adits)	No	Low
Coal Mining Geology – Fractures/Fissures	No	Low
Recorded Gas Emissions	No	Low
Recorded Mining Surface Hazard	No	Low
Surface Mining (Opencast)	No	Very Low/Low

Based on the above, a high risk of unrecorded coal mining at shallow depth has been identified within Parcel A and the Cannel Seam. The CA, as a statutory consultee, will require a series of rotary open holes across the site to determine the presence of any coal on site and to understand the nature of any coal workings.

No shafts have been recorded across the entire subject site however, there is the possibility of encountering unrecorded shafts during mine stabilisation, remediation, civil engineering, foundation works.



2.2.7. PARCEL B

TABLE 2.6 SUMMARY OF COAL MINING RISK ASSESSMENT – PARCEL B

COAL MINING RISK ASSESSMENT	YES/NO	RISK ASSESSMENT
Recorded Underground Coal Mining at Shallow Depth (< 30 m)	No	Low
Recorded Underground Coal Mining at Shallow Depth (> 30 m)	No	Low
Evidence of Unrecorded Surface Extraction of Coal Outcrop	No	Low
Unrecorded Underground Coal Mining at Shallow Depth (< 30 m)	Yes	High
Mine Entries (Shaft/Adits)	No	Low
Coal Mining Geology – Fractures/Fissures	No	Low
Recorded Gas Emissions	No	Low
Recorded Mining Surface Hazard	No	Low
Surface Mining (Opencast)	No	Very Low/Low

Based on the above, a high risk of unrecorded coal mining at shallow depth has been identified within Parcel B and the Bent Seam. The CA, as a statutory consultee, will require a series of rotary open holes across the site to determine the presence of any coal on site and to understand the nature of any coal workings.

No shafts have been recorded across the entire subject site however, there is the possibility of encountering unrecorded shafts during mine stabilisation, remediation, civil engineering, foundation works.

2.2.8. PARCEL C

TABLE 2.7 SUMMARY OF COAL MINING RISK ASSESSMENT – PARCEL C

COAL MINING RISK ASSESSMENT	YES/NO	RISK ASSESSMENT
Recorded Underground Coal Mining at Shallow Depth (< 30 m)	No	Low
Recorded Underground Coal Mining at Shallow Depth (> 30 m)	No	Low
Evidence of Unrecorded Surface Extraction of Coal Outcrop	No	Low
Unrecorded Underground Coal Mining at Shallow Depth (< 30 m)	Yes	High
Mine Entries (Shaft/Adits)	No	Low
Coal Mining Geology – Fractures/Fissures	No	Low
Recorded Gas Emissions	No	Low
Recorded Mining Surface Hazard	No	Low
Surface Mining (Opencast)	No	Very Low/Low

Based on the above, a high risk of unrecorded coal mining at shallow depth has been identified within Parcel C and the Bent Seams. The CA, as a statutory consultee, will require a series of rotary open holes across the site to determine the presence of any coal on site and to understand the nature of any coal workings.



No shafts have been recorded across the entire subject site however, there is the possibility of encountering unrecorded shafts during mine stabilisation, remediation, civil engineering, foundation works.

2.2.9. PARCEL D

TABLE 2.8 SUMMARY OF COAL MINING RISK ASSESSMENT – PARCEL D

COAL MINING RISK ASSESSMENT	YES/NO	RISK ASSESSMENT
Recorded Underground Coal Mining at Shallow Depth (< 30 m)	Yes	High
Recorded Underground Coal Mining at Shallow Depth (> 30 m)	Yes	High
Evidence of Unrecorded Surface Extraction of Coal Outcrop	No	Low
Unrecorded Underground Coal Mining at Shallow Depth (< 30 m)	Yes	High
Mine Entries (Shaft/Adits)	No	Low
Coal Mining Geology – Fractures/Fissures	No	Low
Recorded Gas Emissions	No	Low
Recorded Mining Surface Hazard	No	Low
Surface Mining (Opencast)	No	Very Low/Low

Based on the above, a high risk of unrecorded coal mining at shallow depth has been identified within Parcel D in the Cannel and Bent Seams. The CA, as a statutory consultee, will require a series of rotary open holes across the site to determine the presence of any coal on site and to understand the nature of any coal workings.

No shafts have been recorded across the entire subject site however, there is the possibility of encountering unrecorded shafts during mine stabilisation, remediation, civil engineering, foundation works.

2.2.10. PARCEL E

TABLE 2.9 SUMMARY OF COAL MINING RISK ASSESSMENT – PARCEL E

COAL MINING RISK ASSESSMENT	YES/NO	RISK ASSESSMENT
Recorded Underground Coal Mining at Shallow Depth (< 30 m)	Yes	High
Recorded Underground Coal Mining at Shallow Depth (> 30 m)	No	Low
Evidence of Unrecorded Surface Extraction of Coal Outcrop	No	Low
Unrecorded Underground Coal Mining at Shallow Depth (< 30 m)	Yes	High
Mine Entries (Shaft/Adits)	No	Low
Coal Mining Geology – Fractures/Fissures	No	Low
Recorded Gas Emissions	No	Low
Recorded Mining Surface Hazard	No	Low
Surface Mining (Opencast)	No	Very Low/Low



Based on the above, a high risk of unrecorded coal mining at shallow depth has been identified within Parcel E in the Lower Bent Seam. The CA, as a statutory consultee, will require a series of rotary open holes across the site to determine the presence of any coal on site and to understand the nature of any coal workings.

No shafts have been recorded across the entire subject site however, there is the possibility of encountering unrecorded shafts during mine stabilisation, remediation, civil engineering, foundation works.

2.2.11. SCOPE OF E3P INTRUSIVE GROUND INVESTIGATION

In due consideration of the potential presence of a subcrop within the Cannel Seam, Lower Bent and Higher Bent Seams and related potential shallow mine workings a series of rotary boreholes have been advanced in accordance with Coal Authority Permission ref: 21421 to assess the potential presence of shallow workings within this seams and the potential for ground instability to induce a future subsidence event within the proposed development.

2.2.12. SUMMARY OF GROUND INVESTIGATION WORKS

Rotary boreholes have been advanced at the locations detailed within the E3P Exploratory Borehole Location Plan (Drawing 14-554-005 in Appendix III) at positions to interject the potential coal seams and assess the potential for any workings.

TABLE 2.10 ROTARY BOREHOLE SUMMARY

ROTARY BOREHOLE	DEPTH TO ROCKHEAD (m bgl)	DEPTH TO COAL (m bgl)	EVIDENCE OF MINING ACTIVITY/SEAM	REMARKS
RB201	3.30	3.30 And 27.80	-	600mm thick 1200mm thick
RB202	5.00	20.00	-	800mm thick
RB204	7.10	19.10	-	900mm thick
RB206	14.90	N/A	-	Loss of flush within sands but the continued hard drilling did not encounter evidence of workings
RB207	4.80	-	Possible workings 7.80–10.00m	Soft drilling encountered at 7.80-10.00m. Hard drilling encountered at 10.00m
RB208	11.90	27.90	-	1100mm thick
RB301	15.60	N/A	N/A	Soft drilling encountered at 7.80-10.00m. Hard drilling encountered at 10.00m Borehole lost flush within the dry sands above bedrock
RB302	17.90	N/A	N/A	N/A
RB303	19.10	N/A	N/A	N/A



ROTARY BOREHOLE	DEPTH TO ROCKHEAD (m bgl)	DEPTH TO COAL (m bgl)	EVIDENCE OF MINING ACTIVITY/SEAM	REMARKS
RB304	20.70	N/A	N/A	N/A
RB305	22.90	N/A	N/A	N/A
RB306	25.00	N/A	N/A	Holes drilled blind due to loss of flush in overlying sands but no evidence of coal workings was encountered.
RB307	22.80	N/A	N/A	
RB308	25.50	N/A	N/A	
RB309	24.00	N/A	N/A	
RB310	26.30	N/A	N/A	
RB311	27.20	N/A	N/A	
RB312	28.00	N/A	N/A	N/A
RB401	21.50	N/A	N/A	Holes drilled blind due to loss of flush in overlying sands but no evidence of coal workings was encountered.
RB402	21.00	N/A	N/A	
RB403	24.50	N/A	N/A	
RB404	26.30	N/A	N/A	
RB405	29.40	N/A	N/A	
RB406	22.10	N/A	N/A	
RB407	29.00	N/A	N/A	
RB408	32.80	N/A	N/A	
RB409	21.90	N/A	N/A	

For the purposes of this assessment, the names of the coal seams are inferred as best as possible. As for the purposes of assessing the risk from mine workings, the names of the seams are not critical.

2.3. SUMMARY OF COAL MINING ISSUES

2.4. PARCEL A

The western sector will require drill and grouting by a specialist contractor in order to significantly reduce the risk of instability at the surface in the event of collapse of historical working within underlying coal seams including the Cannel and Higher Bent Seams.

The eastern sector could not be fully investigated, however there is potential for shallow unrecorded workings, therefore it is recommended that proof drilling is undertaken in this area when possible.



2.5. PARCEL B & C

No evidence of coal workings have been identified. It is assumed that the coal seams within this area are below unstable deep granular deposits and the bedrock is heavily disturbed by the fault, therefore it wasn't practicable to mine coal in these areas in the 18th and 19th centuries prior to mechanisation.

No further works are required in Parcels B & C of the site unless coal workings are found within the Higher Bent within Parcel A and are traced across into Parcel B&C.

2.6. PARCEL D & E

Drill and grouting is required on the western side of the site to the Cannel Coal and Higher Bent. As rock cover increases to the east the grid can widen in line with the level of risk identified.

A detailed drill and grout specification was recommended.



3. GENERAL SPECIFICATION FOR MINE STABILISATION WORKS

3.1. OVERARCHING SCOPE OF WORKS

Due to variable risks posed by coal mining beneath the site, the specific for different areas varies as specified below:

Cannel Seams (Parcel A and D) – Drill and Grout on a 6 m x 6 m primary grid across the proposed buildings footprints, with treatment extending up to 3 m beyond the plot line, where workings are identified secondary boreholes will then be drilled at 4.5 m infill centres across the area of stabilisation and subsequent tertiary 3m grid based on grout takes (>5 tonne) across the proposed buildings footprints, with treatment extending up to 3 m beyond the plot line. 10 m drill and grout grid beneath proposed adopted highways, estate roads and driveway will be required..

High Bent Seam – Proof drilling is to be undertaken on a plot by plot basis to confirm the locations where coal has not been extracted. Where coal or voids are present then drill and grouting on 6 m x 6 m below plots, with treatment extending up to 3 m beyond the plot line, where workings are identified secondary boreholes will then be drilled at 4.5 m infill centres across the area of stabilisation and subsequent tertiary 3m grid based on grout takes (>5 tonne) across the proposed buildings footprints, with treatment extending up to 3 m beyond the plot line. 10 m drill and grout grid beneath proposed adopted highways, estate roads and driveway will be required.

The boreholes will serve as injection points where grout will be pumped under pressure into the workings to consolidate the voids in accordance with the specification herein.

Where necessary, tertiary boreholes will be drilled on a 3 m grid where grout take is high and completion pressure cannot be achieved within a grout hole.

Works will be considered to be completed when the required borehole grid and pressure grouting has achieved the performance specification.

Validation test boreholes will be drilled to confirm consolidation at locations and centres to be dictated by the supervising engineer.

The stabilisation works will be undertaken by injecting a PFA/cement grout into the workings via the boreholes.

3.2. SUPERVISION AND VALIDATION

The client will appoint a resident supervising engineer, who will be in attendance at the outset of the works and on a part-time basis thereafter to monitor the completion of the project to ensure compliance with the performance specification and criteria documented herein.

The mine stabilisation contractor will appoint a site manager or suitably qualified foreman of the works, subject to agreement with the supervising engineer prior to instigation.

3.3. CONSTITUENT MATERIALS FOR GROUTING

Water shall be from the mains supply or other source approved by the resident engineer (RE) and supplied by the client.

Cement shall be Portland cement complying with BS 12.



PFA complying with BS EN 12715:2000 shall be conditioned hopper ash, or dry powder ash, or a type suitable as a constituent for grout and obtained from an approved supplier.

Sand shall generally comply with BS 882 and be of a grading suitable for use in the contractor's plant and approved by the RE.

Pea gravel shall comply with BS 882, and be of grading approved by the RE. Thixotropic admixtures shall be bentonite or another admixture approved by the RE.

3.3.1. STORAGE AND USE OF MATERIALS

Storage of materials shall be such as to prevent contamination and deterioration. Cement shall be kept in a dry location, and the sequence of deliveries recorded so that cement can be used in rotation.

PFA shall be stored within a predefined area and will be kept dampened to mitigate against fugitive dust.

3.3.2. GROUTING PLANT

The contractor shall submit to the RE, for approval, details of the proposed method of mixing, and pumping of grout to the injection points, together with the means of monitoring grouting pressures and the quantities injected.

The materials shall be introduced into the mixer via approved methods (volume batching).

The grout mixer shall be capable of producing a homogenous grout mix, with all particles being thoroughly wetted without segregation and suitably viscous to ensure the required flow and subsequent consolidation.

3.3.3. GROUT MIXES

In due consideration to the proposed residential development of the site, the filling material (grout) shall generally consist of a PFA: cement grout, which should be mixed in the proportions of up to 10:1 where water is present.

Representative cubes will be formed from grout mixes with crushing strengths of not less than 1 MN/m² at 28 days.

Note: the 7-day test is performed to indicate that the 28-day strength is achievable, i.e. a 7-day value of about 0.4.5MN/m² is considered to be on target to achieve the required 28 strength criteria.

Where excessive lateral flow of grout is anticipated or when voids greater than 500 mm are encountered, the RE may order or agree to the addition of sand or pea gravel to the mix in accordance with CIRIA SP32.

The specified grout mix shall have the minimum water content consistent with effective pumping.

The actual proportions to be used initially for the various grouts shall be agreed with the RE, paying due regard to the conditions met in drilling and the results of any trial grouting carried out before work commences.

3.3.4. GROUT PROPERTIES AND TESTING

With water/(cement and PFA) ratios generally in the range of 0.4 to 0.45, (including the moisture in the aggregates), the mixes proposed should produce "pumpable grout" with flowability readings of between 300 to 600 mm, when measured in a meter of the "Colcrete" type.



The sample for the flowability test shall be obtained by the grouting contractor at the point of injection, i.e. from the end of the tremie pipe.

A minimum of two flowability tests per week shall be performed by the contractor, as directed by the RE, with results to be provided in a timely manner to ensure appropriate review.

A minimum of two bleed capacity tests shall be performed by the contractor per shift or as directed the RE. The sample of grout for the test shall be taken from the point of injection, i.e. the end of the tremie pipe.

Bleed capacity shall be measured in a clear plastic or glass graduated cylinder which has an internal diameter not less than 75 mm and with a volume of approximately 1000 ml. After placing the grout, a cover shall be placed over the cylinder to avoid evaporation. Bleed capacity shall be read at hourly intervals for neat cement grout, and readings should continue for not less than 3 hours. For PFA: cement grouts, readings should continue for not less than 6 hours.

The contractor shall prepare two sets of test cubes of grout per week, or as directed by the RE, with all testing to be commenced within 48 hours of samples/cubes being obtained.

Each cube shall be of 100 mm side, or as agreed with the RE, and shall be taken from the grout at the point of injection, i.e. the end of the tremie pipe.

At the instruction of the RE, the contractor shall arrange for them to be tested by crushing at 7 and 28 days in accordance with BS 1881.

The testing shall be carried out by an independent UKAS-Accredited laboratory or as agreed with the RE.

As stated previously, mixes shall produce cubes with crushing strengths of not less than 1 MN/m² at 28 days.

If the RE considers that the results of the test indicate that a change of mix proportions is required, then the contractor shall make such modifications as the RE may direct.

3.4. TREATMENT OF WORKINGS IN SHALLOW COAL SEAM

3.4.1. DRILLING PROCEDURES FOR SHALLOW WORKINGS IN COAL SEAM

The drilling and grouting grid will be as follows:

- ❖ **Plots (+3.0m offset):** 6m Primary grid.
- ❖ **Plots (+3.0m offset)** Secondary holes to be drilled and grouted where workings identified in primary 6m grid (equates to grouting at 4.50m²);
- ❖ **Tertiary grid** Tertiary 3.0m grid where grout takes exceed >5 tonne within a grout hole over a 24 hour period.
- ❖ **Highways, estate road, private drives and Hardstanding:** 10m staggered grid;
- ❖ **Gardens & Landscaping:** No drill and grout unless grout take is >10T per hole on the adjacent primary grid which will then trigger 10m staggered grid across area of concern.

All boreholes to be used for the injection of grout, including those which strike coal pillars, shall be drilled by rotary or rotary percussive techniques down to a minimum of 0.5 m beyond the base of the old workings in the seam, or the floor of the seam itself, whichever is greater.



The drilling system and flushing medium to be used shall be as instructed on The Coal Authority licence, and approved by the RE. The contractor shall allow for the provision of appropriate dust suppression for those holes that are to be drilled near sensitive receptors (e.g. nearby houses, highways, active commercial properties, car parks and public footpaths).

Boreholes drilled for the treatment of the plots will ensure that treatment extends up to 3 m out-with the building footprint, based upon anticipated grout flows.

The minimum diameter of the holes shall be 75 mm, unless otherwise specified by the RE. When it is impracticable to drill at the minimum diameter for the full depth, the diameter of the boreholes shall be increased in the upper lengths.

Boreholes shall be temporarily cased through superficial deposits down to the rockhead and, if directed by the RE, down through the rock strata. The boreholes shall be kept open until grout injection into the workings and rock is complete.

Where a borehole proves abortive because it becomes obstructed, it shall be re-drilled in a suitable location as directed by the RE, at a large diameter, and re-cased.

Boreholes shall be formed in general accordance with the locations shown on the plan in Appendix III (Drawing 14-554-014).

Any deviation from this proposed layout, including the drilling of additional secondary and tertiary holes, shall be recorded by the contractor and a revised borehole location plan provided to the RE.

3.4.2. GROUTING PROCEDURES FOR SHALLOW WORKINGS IN COAL SEAM

The aim of the stabilisation work is to substantially fill any old workings within the Cannel Seam and Higher Best Seam as well as any voids or broken ground found within the overlying strata in order to prevent the development of crown holes at the surface\foundation level.

Perimeter grout walls, if required, shall be formed by filling boreholes with a viscous grout comprising appropriate proportions of cement, PFA, sand or pea gravel and water. The mix, proportions and method must be agreed with the RE.

Pressure need not be applied to the grout in affected boreholes unless required by the RE.

Unless specified otherwise, the section of the perimeter wall at the deepest part of the seam shall be constructed first.

Immediately prior to grouting each borehole, the contractor shall check that it is unobstructed to the required depth to receive the tubing or tremie pipes for grout injection. Obstructions shall be dealt with as described in the drilling procedures in Section 3.4.

Grout shall be injected into each hole via an approved flexible tube, or series of steel tubes, placed to the base of the hole or to such other depth to receive the tubing or pipes for grout.

Grouting shall proceed upwards from the base of each borehole to the base of the surface deposits. It is not intended that, as a general rule, significant quantities of grout shall be injected into the surface deposits unless specified otherwise. This requirement will be subject to review by the RE.

The grout shall be injected at the approved rates until grout appears near the point of injection, when the borehole shall be deemed complete. If this criteria is reached quickly, the grout tubes shall be lifted to check that a local obstruction is not preventing the flow of the grout into the strata.



Pressure shall be applied to the grout in every borehole. If grout has not appeared at the point of injection after 5 tonnes of grouting materials have been introduced, then sand and/or pea gravel (gravel which passes through a 6.33 mm sieve and is retained on a 2.36 mm sieve) may be added to the mix or placed down the borehole.

Treatment of adoptable highways will generally be undertaken as per the plots although, should a borehole within the highway accept more than 6 tonnes of grout, then treatment within the hole will be suspended for 12 hours. Thereafter, further grout will be injected in 2 tonne batches. If pressure has not been achieved, or grout appeared, after a total of 10 tonnes of grout has been placed, then a review of the borehole grid spacing, grout mix and materials used will be undertaken.

All boreholes within the highway will be filled under hydrostatic pressure and, once complete, will be pressurised utilising a pneumatic packer to the appropriate pressure.

The contractor shall take all necessary precautions, including making all reasonable liaison with the client, to ascertain the positions and depths of underground services and drains passing through the site, making full allowance for working around and protecting live services and drains.

The contractor shall be responsible for maintaining close liaison with the local authority and the public utility authorities to avoid any disruption of the existing services.

When introducing grout into any borehole, the contractor shall ensure, by regular inspections throughout the day, that the grout is not entering adjacent drains, services, culverts and ducts.

In the event that any such leakage is detected, the contractor shall immediately suspend the grouting operations and commence to remove any accumulated grout.

3.4.3. IN-SITU TESTING

When directed by the RE, the contractor shall test the consolidated ground for permeability and strength.

Permeability by grout acceptance testing shall be checked by drilling test holes in positions to be selected by the RE and injecting grout at pressures appropriate to the depth, all in accordance with the requirements for infilling grouting. If the RE considers that the quantities of grout accepted are excessive, then further holes shall be drilled and grouted at the rates and prices agreed.

After testing, boreholes shall be completed in accordance with the requirements for grouting infill holes.

In general, test holes will be undertaken along the adoptable highways adjacent to boreholes exhibiting grout taken in excess of 6 tonnes.

3.5. RECORDS – COAL SEAMS

The contractor shall prepare and keep available for inspection on site, plans showing the positions of all boreholes, daily drilling records, and the total amounts of grout injected.

The plans shall be updated daily in conformity with the records detailed herein. On completion of the works, the contractor shall give copies of the plans and sections to the RE within one week of completion of the programme of grouting.

As works proceed, the contractor shall maintain separate daily records for drilling, for grouting and for materials and plant received in a form to be approved by the RE. The daily records signed by the contractor's agent shall be submitted each day to the RE for their agreement.



The contractor shall provide one copy of the agreed record for the RE's retention and keep a further copy available for inspection on site.

Daily drilling records shall be provided for each borehole and contain the following information:

- ✳ Job title and location;
- ✳ Borehole reference number;
- ✳ Date;
- ✳ Contractor's name;
- ✳ Plant in use, crew members and hours worked;
- ✳ Method of boring or drilling;
- ✳ Type, diameter and depth of casing used;
- ✳ Diameter and depth of hole at the beginning and end of each working day or shift;
- ✳ Loss of any flushing medium during drilling;
- ✳ Standing time, with reason, or time lost overcoming obstructions;
- ✳ Details of underground services located;
- ✳ Details of any settlement or ground heave;
- ✳ Daily and cumulative length drilled;
- ✳ Depth to each major change of stratum;
- ✳ Description, with identification, of the stratum and whether it is intact or broken;
- ✳ Each depth at which groundwater is encountered (if apparent), the depth to which it rose and any steps taken to stop the flow;
- ✳ Depths at which any samples are taken;
- ✳ Details and results of any permeability tests instructed by the RE;
- ✳ Details of any voids or suspected workings;
- ✳ Details of any emissions of gas, water, etc.; and
- ✳ Depth of completed borehole.

Daily grouting records shall be provided for each borehole and contain the following information:

- ✳ Job title and location;
- ✳ Borehole reference number;
- ✳ Date;
- ✳ Contractor's name;
- ✳ Plant in use, crew members and hours worked;
- ✳ Details of type of injection, grout-line dimensions and length of standpipes inserted;
- ✳ Type of grout mix and volumetric quantity injected, including total quantity by weight of each type of grouting material introduced;
- ✳ Grout pressures recorded, with the corresponding depths;
- ✳ The results of all flow and bleed tests;
- ✳ Details of casing abandoned;
- ✳ Details of grouting materials delivered to the site and a running total of each of the materials delivered;
- ✳ The nature, frequency and results of all inspections of services to check for grout penetration; and
- ✳ Details of all stoppages or delays and any other relevant information.

The daily records of materials and plant received shall show in particular that day's quantities by weight of each type of material and cumulative quantities. With the daily records, the contractor shall submit to the RE copies of receipts or invoices for all materials delivered and shall keep them on site until the works are complete.

Notwithstanding the information listed above, the contractor shall provide any other information required by the RE.



On completion of the drill and grout program, the RE shall prepare a validation report containing copies of borehole records, a borehole location plan, procedures followed during the works, the results of validation boreholes and pressure tests, and a record of any deviation from this specification.

4. PROTECTION OF CONTROLLED WATERS

In order to ensure no negative impact to controlled waters during the drill and grout works, samples of the River Irk will be taken in accordance with RE-7 within E3P Remediation and Enabling Works Strategy (ref: 14-554-R2 REV10 dated Feb 2023). Where any impact is identified, drill and grout works will cease whilst the impact is assessed.

END OF REPORT



APPENDIX I

LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between E3P and the client as indicated in Section 1.2.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information, it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover, reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover, no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.
5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.
6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials, this is for indicative purposes only and do not constitute or replace full and proper surveys.
8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
9. E3P cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by E3P is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by E3P in this connection without their explicit written agreement there to by E3P.
10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.



APPENDIX II

GLOSSARY

TERMS

ACM	Asbestos-containing material	MMP	Materials management plan
ADS	Acoustic design statement	ND	Not detected
AST	Above-ground storage tank	NDP	Nuclear density probe
BGS	British Geological Survey	NMP	Noise management plan
BSI	British Standards Institute	NPSE	Noise policy statement for England
BTEX	Benzene, toluene, ethylbenzene, xylenes	NR	Not recorded
CA	Coal Authority	PAH	Polycyclic aromatic hydrocarbon
CBR	California bearing ratio	PCB	Polychlorinated biphenyl
CIEH	Chartered Institute of Environmental Health	PI	Plasticity index
CIRIA	Construction Industry Research Association	PID	Photo ionisation detector
CLEA	Contaminated land exposure assessment	POS	Public open space
CML	Council of Mortgage Lenders	PPE	Personnel protective equipment
CoC	Contaminants of concern	ProPG	Professional practice guidance
CSM	Conceptual site model	QA	Quality assurance
DNAPL	Dense non-aqueous phase liquid (chlorinated solvents, PCB)	SGV	Soil guideline value
DWS	Drinking water standard	SPH	Separate-phase hydrocarbon
EA	Environment Agency	SPT	Standard penetration test
EQS	Environmental quality standard	SVOC	Semi-volatile organic compound
FFL	Finished floor level	TPH	Total and speciated petroleum hydrocarbon
GAC	General assessment criteria	TPH CWG	Total Petroleum Hydrocarbon (Criteria Working Group)
GL	Ground level	UKWIR	United Kingdom Water Infrastructure Risk
GSV	Gas screening value	UST	Underground storage tank
HCV	Health criteria value	VCC	Vibro-concrete column
ICSM	Initial conceptual site model	VOC	Volatile organic compound
LEL	Lower explosive limit	VRSC	Vibro-replacement stone columns
LMRL	Lower method reporting limit	VSC	Vibro-stone columns
LNAPL	Light non-aqueous phase liquid (petrol, diesel, kerosene)	WHO	World Health Organisation
MCV	Moisture condition value	WRAP	Waste and Resources Action Programme



Don Street, Middleton

Performance Specification for Consolidation of Abandoned Mine Workings

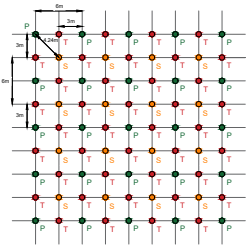
February 2023

MIBK	Methyl isobutyl ketone	WTE	Water table elevation
m	Metres	ppm	Parts per million
km	Kilometres	mg/m³	Milligram per metre cubed
% v/v	Percent volume in air	m bgl	Metres below ground level
mb	Millibars (atmospheric pressure)	m bcl	Metre below cover level
l/hr	Litres per hour	mAOD	Metres above ordnance datum (sea level)
µg/l	Micrograms per litre (parts per billion)	kN/m²	Kilonewtons per metre squared
ppb	Parts per billion	µm	Micrometre
mg/kg	Milligrams per kilogram (parts per million)		



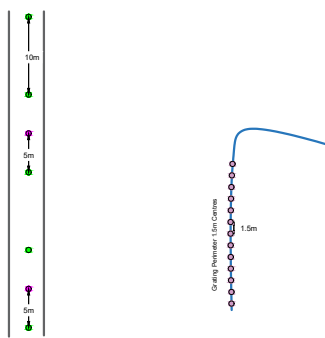
APPENDIX III

DRAWING



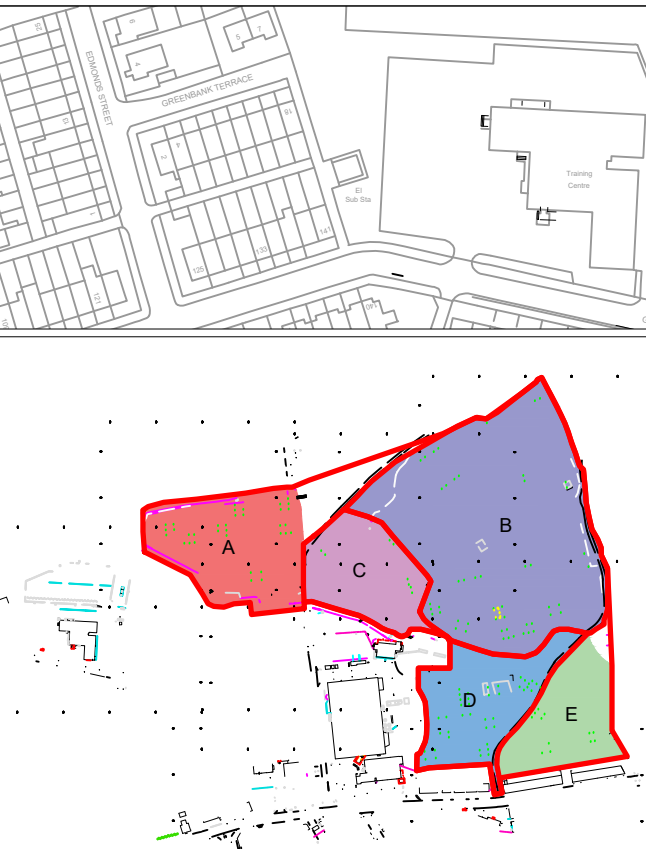
Typical detail on hole where grout take is high:

- P= Primary holes to be drilled on a 6m grid
- S= Secondary grid holes to be drilled and grouted where evidence of potential workings are identified within the primary 6m grid. (Equates to 4.25m)
- T= Tertiary boreholes drilled on a 3m grid, where grout take is high in the secondary holes, and completion pressure cannot be achieved within a grout hole.



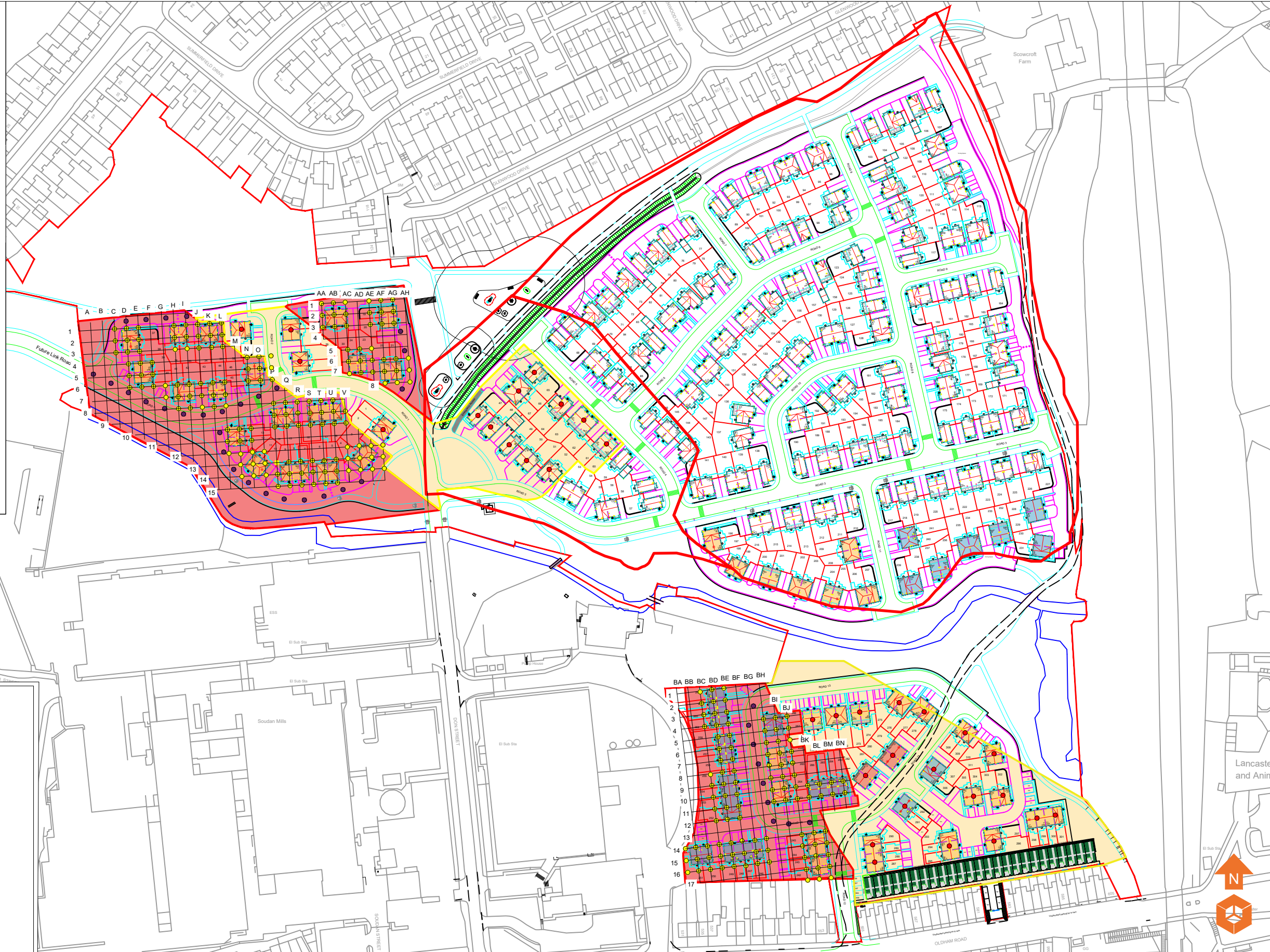
● Site boundary perimeter Grouting (if required) 1.50m centres.

● Roads 10m centred primary boreholes reducing to 5m centres where grout takes are in excess of 10 tonne.



Zones:

- Red Zone:** Drill and grout proposed structures on a primary grid of 6m x 6m, secondary grid overlapping 6m x 6m to effectively provide a 4.24m grid from centre hole. Subject to grout takes being in excess of 5 tonnes, plots will require a tertiary 3m grid to be completed. Where grout takes are in excess of 10 tonnes garden areas will require grouting on a 6m grid. 10m Drill and grout grid beneath proposed adopted highways, estate roads and driveway will be required and reduced to 4m centres where grout takes are in excess of 10 tonnes. For level of shallow dipping workings up to 20m depth, the treatment grid should extend 3m to 4.5m outside of the foundation footprint. For level or shallow dipping workings up to 50m depth, the treatment grid should extend to 6m outside of the foundation footprint.
- Yellow Zone:** Proof drilling is to be undertaken on a plot by plot basis to confirm the locations where coal has not been extracted. Where coal or voids are present then drill and grouting as per the grid method proposed for the purple zone will be required.



Notes:				
P1	REVF	16.01.2023	HM	SE
P1	REVE	10.01.2023	HM	SE
P1	REVD	09.01.2023	EB	SE
P1	REVC	06.01.2023	EB	SE
P1	REVB	18.11.2022	HM	SE
P1	REVA	10.10.2022	EB	SE
Phase	Issue	Date	Drawn	Checked

Client:	
Kellen Homes	
Job Title:	
Donn Street, Middleton	

Job No:	14-554
Drawing No:	014
Date:	16.01.2023
Scale:	NTS@ A3
Drawing Title:	
Drill and Grout Plan (Full Site)	



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