

# **A1 in Northumberland: Morpeth to Ellingham**

**Scheme Number: TR010041**

## **6.8 Environmental Statement – Appendix 11.6 Coal Mining Risk Assessment**

**Part B**

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed  
Forms and Procedure) Regulations 2009

June 2020

Infrastructure Planning

Planning Act 2008

**The Infrastructure Planning  
(Applications: Prescribed Forms and  
Procedure) Regulations 2009**

**The A1 in Northumberland: Morpeth to Ellingham  
Development Consent Order 20[xx]**

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**Environmental Statement - Appendix**

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<b>Regulation Reference:</b>	APFP Regulation 5(2)(a)
<b>Planning Inspectorate Scheme Reference</b>	TR010041
<b>Application Document Reference</b>	TR010041/APP/6.8
<b>Author:</b>	A1 in Northumberland: Morpeth to Ellingham Project Team, Highways England

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Rev 0	June 2020	Application Issue

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# 1 INTRODUCTION

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## 1.1 SCOPE AND OBJECTIVE OF THE REPORT

WSP has been commissioned by Highways England to undertake an assessment of the risks posed by historic coal mining, to the A1 in Northumberland: Alnwick to Ellingham; known hereafter as 'The Scheme', which forms part of the Department for Transport's (DfT) Road Investment Strategy (RIS).

A Ground Investigation Report (GIR) is to be produced for the scheme, in accordance with HD22/08. The majority of the site is not considered to be at risk of hazards associated with historic coal mining. However, five Development High Risk Areas (DHRAs), as defined by the Coal Authority, exist within the scheme red line boundary, one impinging beneath a track to Rock South Farm and the others in the area of Heckley Fence associated with various historic coal mining hazards.

This report presents the coal mining information in further detail, providing an assessment of the risk of the potential historic coal mining hazards across the scheme.

The format of this report is based on the model report template in the Coal Authority's Risk based approach to development management.

The scope of the works undertaken are as follows:

- Collate and review readily available information, including geological Coal Authority and ground investigation data;
- Produce a ground model for the scheme, focussing on the distribution of coal seams and recorded coal workings likely to affect the proposed improvement works;
- Assess the risks posed to the improvement works by historic coal mine workings;
- Identify potential mitigation measures to reduce the risks to acceptable levels.

## 1.2 SITE DESCRIPTION AND LOCATION

Two areas were identified as being of interest, at the track to Rock South Farm, and Heckley Fence. These locations are described below.

The DHRA at Rock South Farm is located approximately 350m south of Rock Midstead. The DHRA, located in proximity to a watercourse and a small woodland, known as the Kiln Plantation, traverses agricultural land and the track to Rock South Farm. In the currently proposed scheme layout, a new access track is to be constructed parallel to the existing track. The existing track shall remain, for use by pedestrians and horse-rider. the track is to be upgraded. The new track will not require the construction of significant earthworks. Minor cutting and embankment is with a maximum cutting of approximately 1.5m and embankment of 1.6m.

The DHRAs at Heckley Fence, are located on flat agricultural land to the east of the mainline. One of the DHRAs is in close proximity to the probable location of an overbridge. The overbridge structure is anticipated to comprise approach embankments and piled foundations. The location of the DHRAs and Geohazard Plans can be found in Appendix B and Appendix C.

## 2 SOURCES OF INFORMATION

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A Preliminary Sources Study Reports (PSSR) issued by Jacobs in 2017 (Ref. 1) and ground investigation factual reports from historic and recent ground investigations (GI) across the scheme, were used to compile information on historic coal mining of the seams. The following sources were used in the reports, and have been reviewed as part of the assessment of mining risk:

- BGS 1:50 000 1982 (Drift Geology) Geological Map Sheet 6 Alnwick 1982;
- BGS 1:50 000 1975 (Solid Geology) Geological Map Sheet 6 Alnwick 1975;
- CON29M Non-Residential Mining Report – Ref: 51001291374001;
- Historic and 2018 Ground Investigations.

In addition to these, further information was gathered from the following to aid the coal mining risk assessment:

- Coal Authority Interactive Map Viewer (Ref. 2)
- National Library of Scotland (Ref. 3)

### 3 IDENTIFICATION AND ASSESSMENT OF SITE SPECIFIC COAL MINING

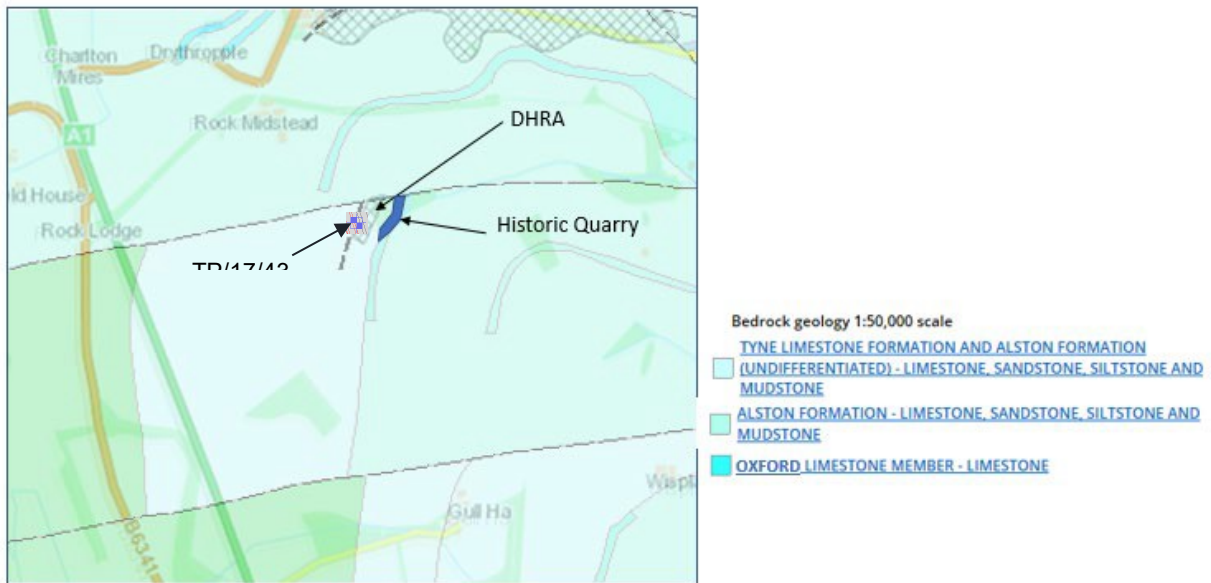
#### 3.1 FEATURES IDENTIFIED

##### ROCK SOUTH FARM TRACK

The ground conditions at the DHRA at Rock South Farm typically comprise of glacial till to at least 2.3m bgl. However, in close proximity to the watercourse, in TP/17/43 (2018), alluvium was observed to at least 2.7m bgl. There is no ground investigation data available for depths greater than 2.7m bgl. According to the BGS, the bedrock of Tyne Limestone and Alston Formation comprising siltstone, sandstone, limestone and mudstone has a typical dip of 6-10 degrees to the south-south-west. An inferred north-east to south-west coal seam underlies the area, dipping at an unknown angle to the south-east, beneath the track. The BGS map indicates the DHRA may be associated with the inferred coal seam, located west of the Kiln Plantation.

The following potential mining hazard was identified. This is further assessed in this report:

- Coal outcrops (where a workable coal seam is present at or close to the surface) were highlighted in the Coal Authority Interactive Map Viewer.



**Figure 3-1 - Bedrock and Development High Risk Area (DHRA) map at Rock South Farm (British Geological Survey Onshore GeoIndex)**

##### HECKLEY FENCE

No GI data is available directly at the location of the DHRAs near Heckley Fence. However, the ground conditions nearby indicate glacial till to approximately 5.0m bgl, underlain by a series of sandstone, mudstone and limestone layers, with a 0.15m thick coal seam at 12.27m bgl

encountered in BH/17/13 (2018). Occasional made ground and alluvium was also observed at shallow depths in the superficial deposits. The BGS map indicates the DHRA and associated mining risk are likely related to the nearby inferred coal seam, with a north-east south-west trajectory with unknown dip to the south-east.

The following potential mining hazards were identified. These are further assessed in this report:

- Probable shallow coal mine workings for which no recorded plans exist, were highlighted in the Coal Authority Interactive Map Viewer. However, it is considered likely that any workable coal, at shallow depths of less than 50 mbgl, was mined before records were kept;
- Coal outcrops (where a workable coal seam is present at or close to the surface) were highlighted in the Coal Authority Interactive Map Viewer;
- Mine entry shafts were identified on the Coal Authority Interactive Map viewer;
- Mine entries with Potential Zone of Influence were identified on the Coal Authority Interactive Map viewer

Figure 3-2 shows identified coal mining hazards and geology within the red-line boundary in the area of Heckley Fence.





**Shallow Coal**

- Buried coal resource overlain by up to 50m overburden
- Primary opencast coal resource area
- Secondary opencast coal resource area
- Tertiary opencast coal resource area

**Deep Coal**

- Deep coal at more than 1200m
- Deep coal between 50m and 1200m

**Linear features 1:50,000 scale**

- Coal\_seam\_Inf

**Bedrock geology 1:50,000 scale**

- [TYNE LIMESTONE FORMATION AND ALSTON FORMATION \(UNDIFFERENTIATED\) - LIMESTONE, SANDSTONE, SILTSTONE AND MUDSTONE](#)
- [ALSTON FORMATION - LIMESTONE, SANDSTONE, SILTSTONE AND MUDSTONE](#)
- [OXFORD LIMESTONE MEMBER - LIMESTONE](#)

**Map Key**

**Mine Entry**

- Adit
- Gutter Pit
- Shaft

**Probable Shallow Coal Mine Workings**

- Coal Outcrops

**Figure 3-2 - Geology and coal mining hazards within the red-line boundary at Heckley Fence (BGS Onshore GeoIndex, Coal Authority Intervative Map Viewer)**

## 3.2 ASSESSMENT OF RISK

A non-residential CON29M mining report was acquired by Jacobs for input into the PSSR. The report did not pick up any mining related risks across the length of the scheme, or within approximately 120m of the A1 and Rock South Farm track alignment.

### ROCK SOUTH FARM TRACK COAL OUTCROPS

As seen in Figure 3-1, the coal outcrops are consistent with the inferred coal seam identified by the BGS. However, based on the GI undertaken in the area, no evidence was identified to indicate particularly shallow coal seams, or outcrops at the location.

A historic quarry to the east of the track, seemingly picks out the Oxford Limestone member. Historic maps (Ref 3) indicate a lime kiln to have existed just south of the quarry, this would infer that the coal may have been locally quarried for this use.

Due to the proposed construction at this location, the risk of hazards associated with historic mining is considered to be low.

### HECKLEY FENCE

#### Probable Shallow Coal Mine Workings

As seen in Figure 3-2, an inferred coal seam, identified in the BGS map, approximately 200m from the existing A1, indicates a dip to the south-east with an unknown dip angle. An abandoned pit shaft was also identified in the BGS Sheet Map 6, at the southern extent of the coal sea, in the area identified as having probable shallow coal mine workings and tertiary opencast coal resource. (Please refer to Appendix B.)

Exploratory holes, undertaken as part of the recent GI at Heckley Fence, did not encounter any voids or broken ground and typically gave a maximum return flush of 95%. However, between 14m and 15m bgl in BH/17/14 0% flush was returned. This coincided with extremely weak mudstone, therefore instead of indicating potential voiding, this may reflect the drilling causing the break-up and washing out of the weak strata.

Coal was only observed as a thin 0.15m thick seam in BH/17/13, between 12.27m and 12.42m bgl, a similar thickness to those observed elsewhere across the scheme. However, based on the South-easterly dip direction of the coal seam, and its inferred termination approximately 200m east of BH/17/13, it is possible that the encountered coal is a minor section of a larger coal seam and may not be representative of the coal which may be present in the area, though this is not backed up by observed evidence.

A review of the CON29M report did not highlight any risk of shallow coal mine workings within 100m of the A1. A further review of historic mapping, dating back to the 1850s also does not show any evidence of historic coal mining.

Though none of the exploratory holes or published data have provided conclusive evidence of there being coal workings in the affected area, it is considered that there still remains a risk of shallow coal workings in the vicinity of Heckley Fence.



## **Coal Outcrops**

The coal outcrops are consistent with the above-mentioned inferred coal seam identified by the BGS. The minor coal seam identified in BH/17/13 at approximately 12.3m bgl, suggests it is not a workable seam. However as previously discussed, it is possible that the encountered seam may not be representative of the coal present in the area. No further positive evidence of coal was observed, providing no conclusive evidence of coal outcrops in the area.

## **Mine Entry Shafts and Mine Entries with Potential Zone of Influence**

The CON29M report did not pick up any known risk of mine entries. However, three mine entry shafts were identified on the Coal Authority Interactive Map Viewer, with a further shaft identified near the track at Heckley Fence (please refer to Appendix B).

The three shafts are located approximately 300m south of the inferred coal seam. The further abandoned shaft, identified on the BGS Sheet Map, is located at the southern edge of the inferred coal seam (though this was not identified in either of the online Map viewers, as seen in Figure 1). It is possible that the shaft on the BGS mapping and the CA mapping are the same feature, transposed at slightly different locations on the two sets of mapping.

As previously mentioned, no strong evidence of workable seams was encountered during the ground investigation, located within 200m of the identified mine entries.

## 4 MITIGATION STRATEGY

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### 4.1 GENERAL

The choice of suitable mitigation measures is dependent on the risk owners attitude towards the risk. Appropriate measures will balance the probability of the risk and the likely impact should it occur, with the cost and practicality of removing or reducing the probability of the risk.

Based on the available information to date, three key mining related risks to sections of the scheme are mine entries, shallow workings and coal outcrops.

### 4.2 MINE ENTRIES

Based on the available information, mine entry shafts are likely to be located south of Heckley Fence. Though the CON29M report and PSSR did not highlight any risk of shafts or mine workings in the area, it is recommended that further investigation be carried out at and in the vicinity of Heckley Fence and the proposed area of construction in the form of trial pitting and/or boreholes, to identify potential historic mine entries, workings and their extents.

Near the area of potential mine shafts, a diversion of an existing 20kV over-head line (OHL) is proposed, however in the DHRA the electric route is to be retained, where wooden pylons carry the distribution line. It is recommended that, if new pylons are to be installed, and should shafts be identified during the GI, the pylons should be located to avoid the area of shafts (it should be noted that the existing pylons roughly coincide with the area where the shafts are depicted). If this is not possible, treatment of any shafts should be carried out, and consist of their filling, using either backfill and additional grouting where backfill alone is considered to be inadequate or capping if the shaft is found to be of significant depth.

The potential mine shaft at the track of Heckley Fence as depicted on the BGS mapping is considered to be east of the proposed overbridge and approach embankments. However, should the presence of a mine shaft be confirmed, treatment will still be required in the nature of either backfilling and grouting or capping if the shaft is found to be of significant depth, to avoid any possibility of future collapse.

It would also be considered sensible for the Contractor to avoid the areas of mine entries as much as is possible during construction to avoid further risk.

### 4.3 SURFACE COAL/ COAL OUTCROPS

Though coal outcrops were identified by the Coal Authority at Rock South track and Heckley Fence, no evidence was observed in the exploratory holes to confirm their presence. There is therefore considered to be a low risk of encountering coal outcrops.

### 4.4 SHALLOW MINING

Given the lack of evident shallow workings across the site, in general it is considered that there is a low risk of encountering shallow coal workings across the site. However, it is possible that shallow coal workings are present within the red-line boundary.

It should be highlighted that no structures are proposed along the track to Rock South Farm. The work is to comprise the construction of a track on the western edge of the existing track, with minor

earthworks associated, therefore any unexpected mining features would relate to the management of risk to the track. However, at Heckley Fence, where an overbridge structure with associated embankments is proposed, should mining features be encountered, more considerable treatment works will be required. It is therefore recommended that at Heckley Fence further ground investigation be carried out, to the east of the A1, to gain further information on the location of any voids or worked coal seams.

If evidence of shallow workings were encountered, and treatment deemed to be necessary, then a grid of grouted probe holes is recommended, to infill any voids of broken ground. The probes would likely be drilled to within 2m below the anticipated seam depth, and a 'grout curtain' be used to prevent the migration of grout outside of the footprint of the structure and earthworks.

A high strength geogrid beneath embankment or road pavement foundation to control settlement in the case of surface movement due to the collapse of any unrecorded workings could also be utilised as required. This may represent a cost-effective solution where mining underlies proposed modified farm tracks.

It is expected that the Design and Build Contractor provide full details of any required remedial measures as part of the CA's permitting system prior to any treatment. Records of any treatment would be detailed in the scheme Geotechnical Feedback Report as set out in HD 22/08.

## 5 REFERENCES

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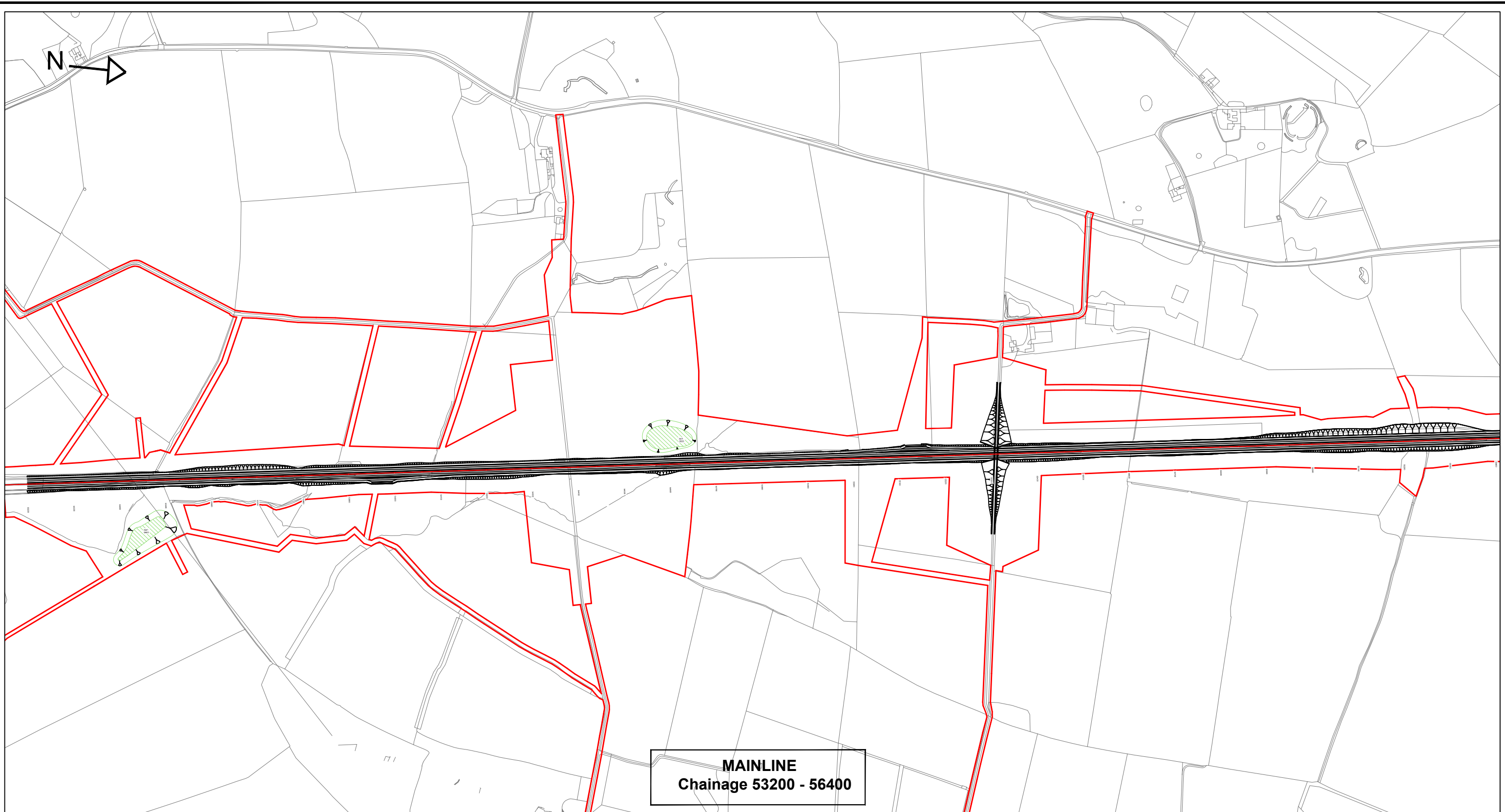
1. A1 in Northumberland. Alnwick to Ellingham. Preliminary Sources Study Report. Version 3.0. HAGDMS No. 29384. January 2017. Jacobs
2. Coal Authority Interactive Map Viewer <http://mapapps2.bgs.ac.uk/coalauthority/home.html>
3. National Library of Scotland <http://maps.nls.uk>
4. Risk based approach to development management' Version 4. 2017, The Coal Authority,
5. Highways Agency (2008) HD 22/08 - Managing Geotechnical Risk. DMRB 4.1.2. The Stationary Office. 2008. Highways Agency.
6. CIRIA C758. Construction over abandoned mine workings. 2002. PR Healy, JM Head.

# Appendix A

## **DRAWINGS**

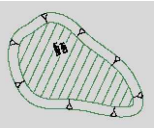






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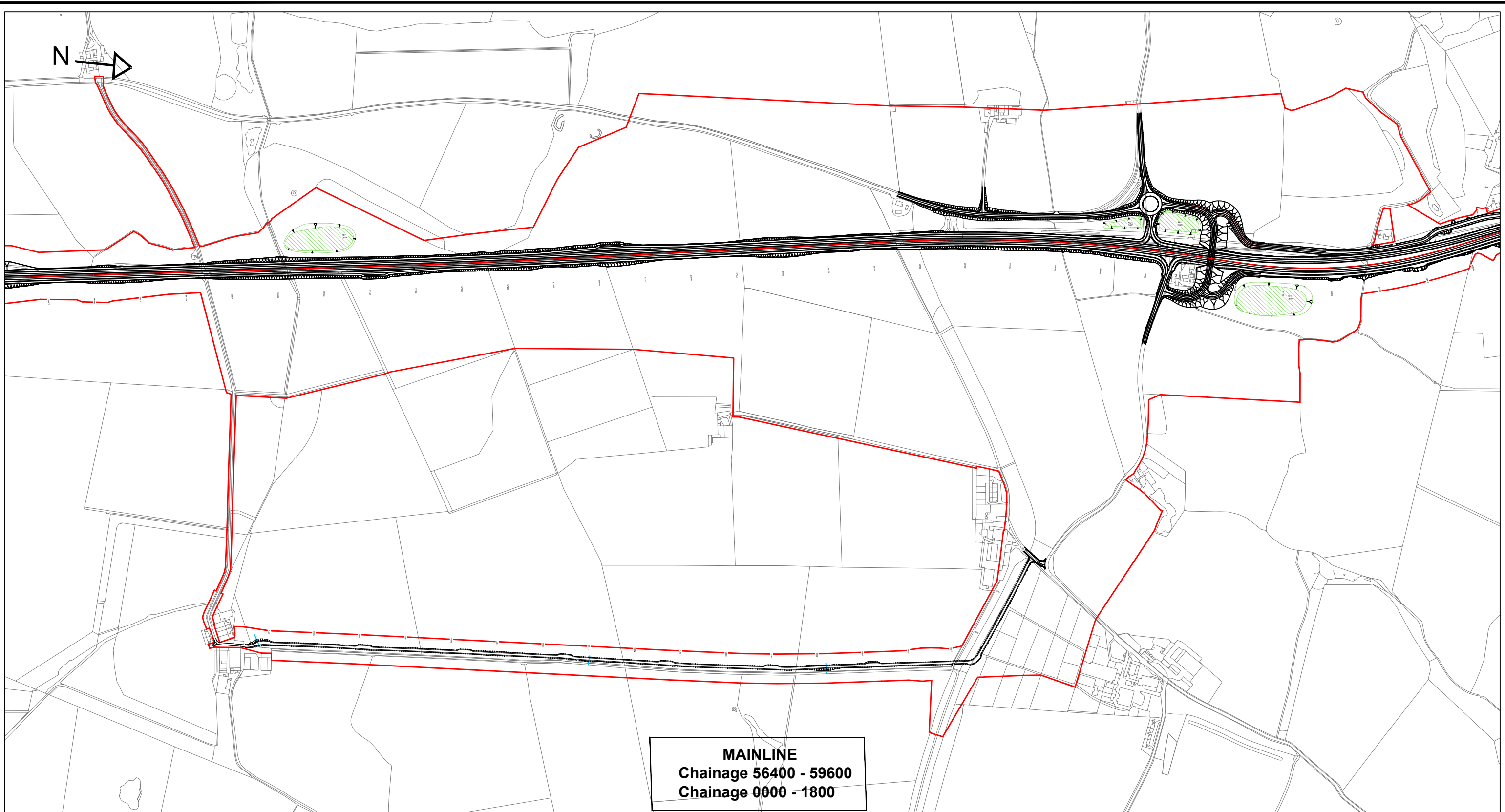
**NOTES**

- Proposed Highway Alignment as of May 2019.
- Red Line Boundary as of May 2019
-  Proposed Detention Basin as of May 2019

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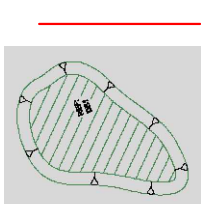




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**NOTES**

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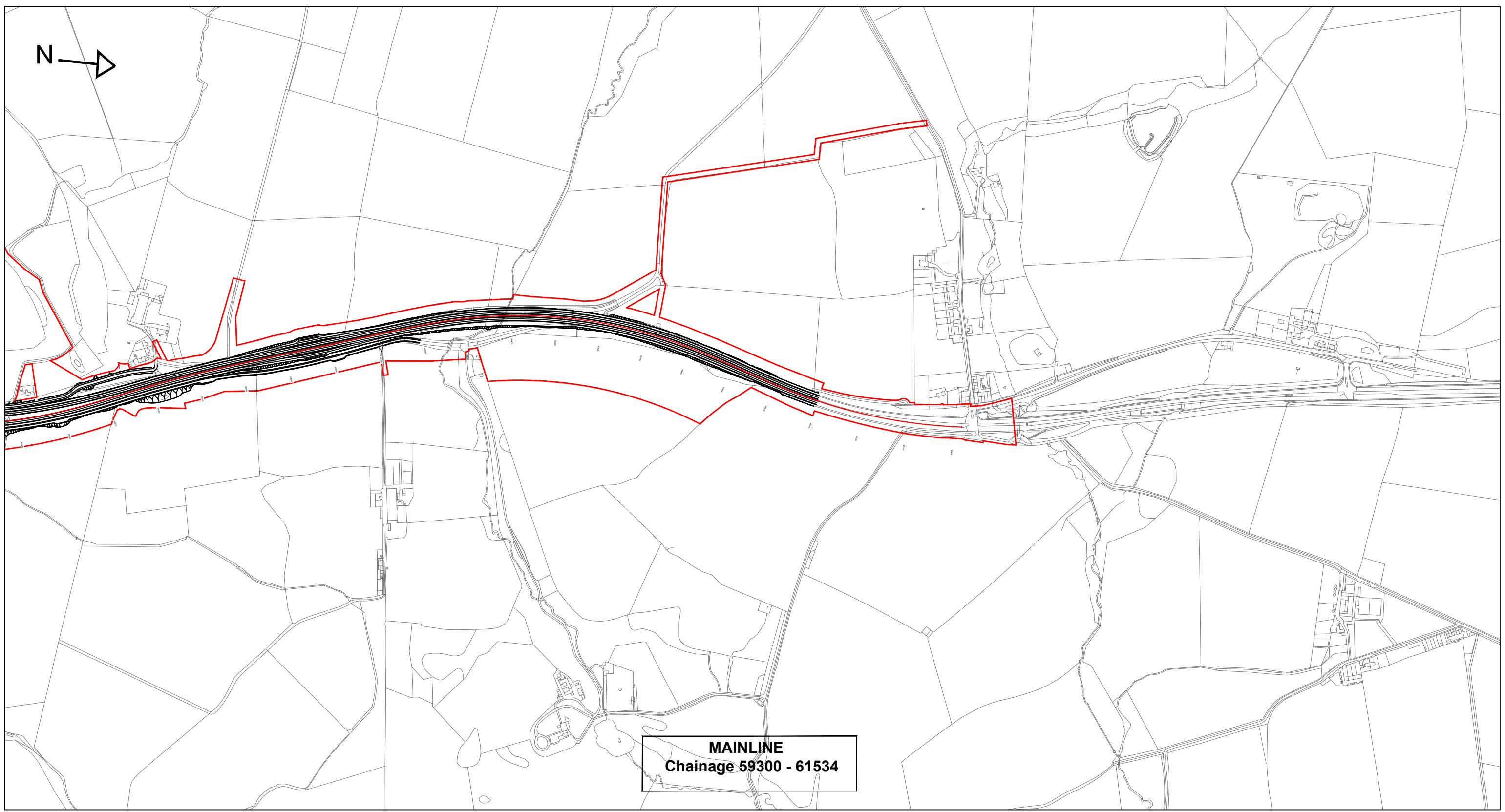
Red Line Boundary as of May 2019

Proposed Detention Basin as of May 2019

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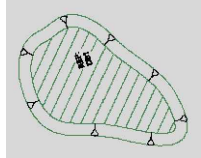


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NOTES

- Proposed Highway Alignment as of May 2019.

— Red Line Boundary as of May 2019



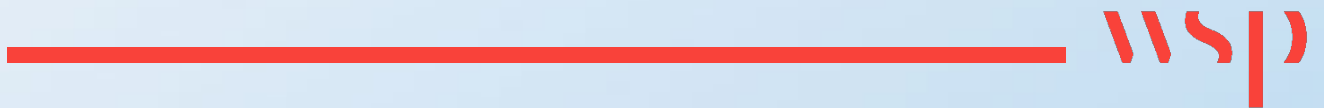
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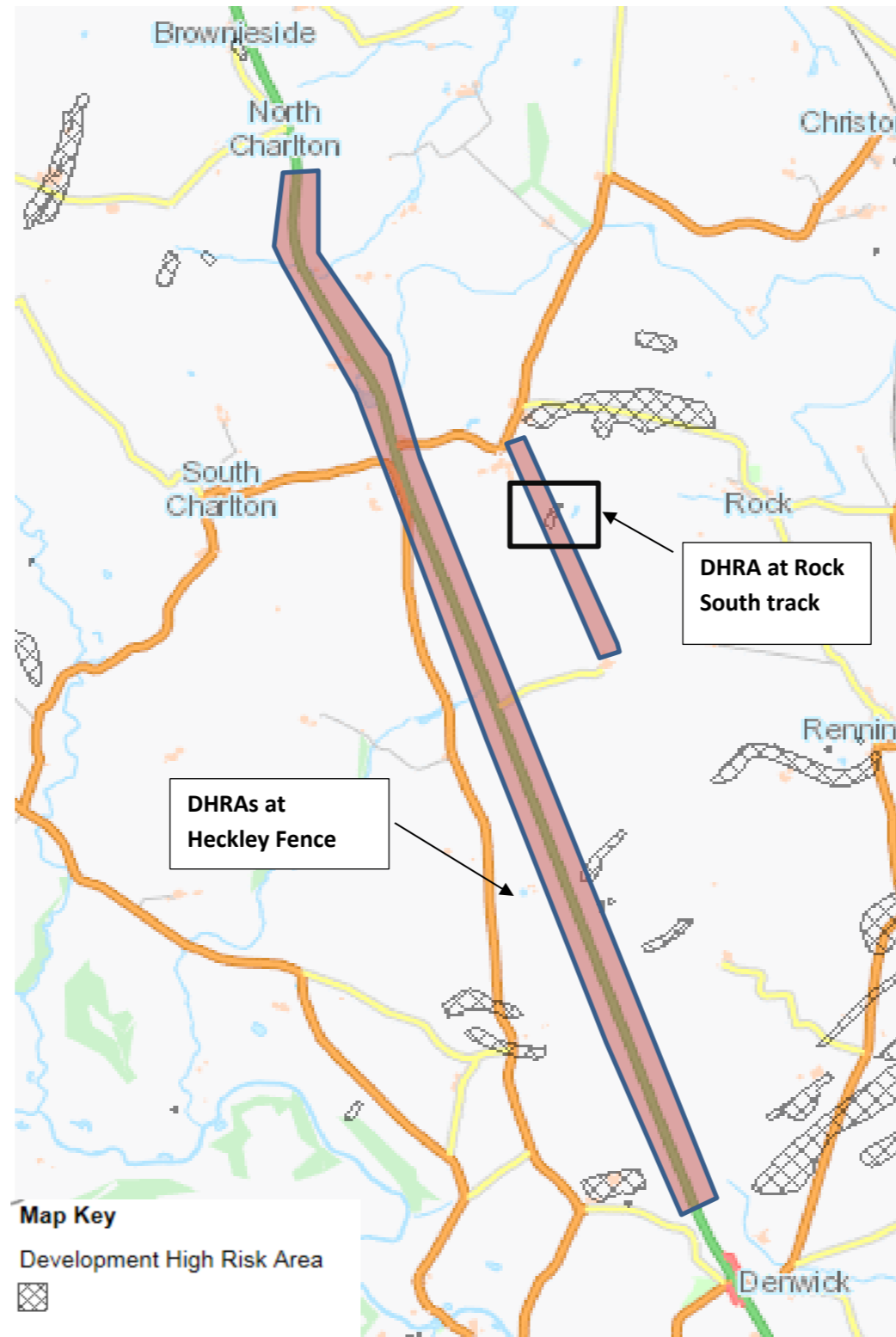
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# Appendix B

**DATA FROM BGS**





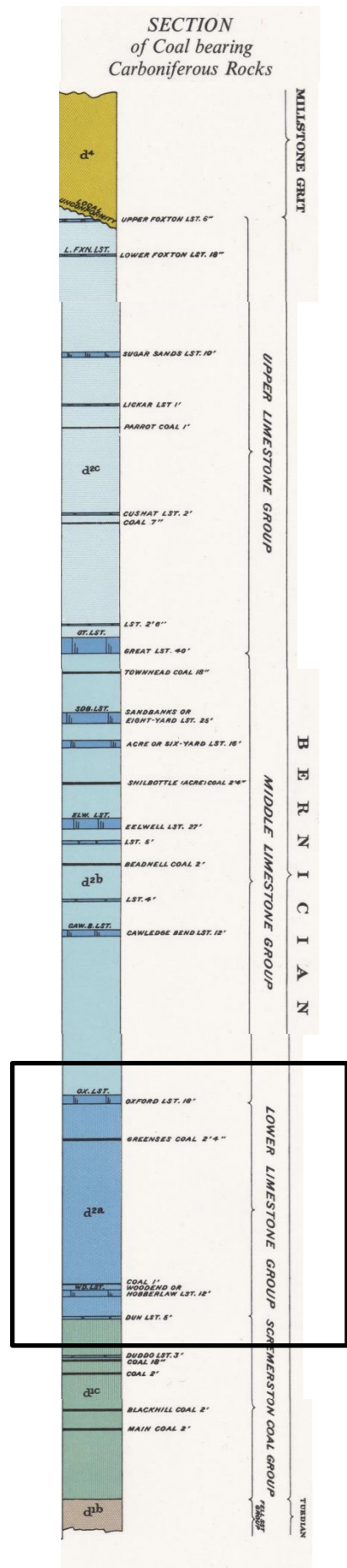
### Location of Development High Risk Areas

(Coal Authority Interactive Viewer, 2019.

<http://mapapps2.bgs.ac.uk/coalauthority/home.html>)



SECTION  
of Coal bearing  
Carboniferous Rocks

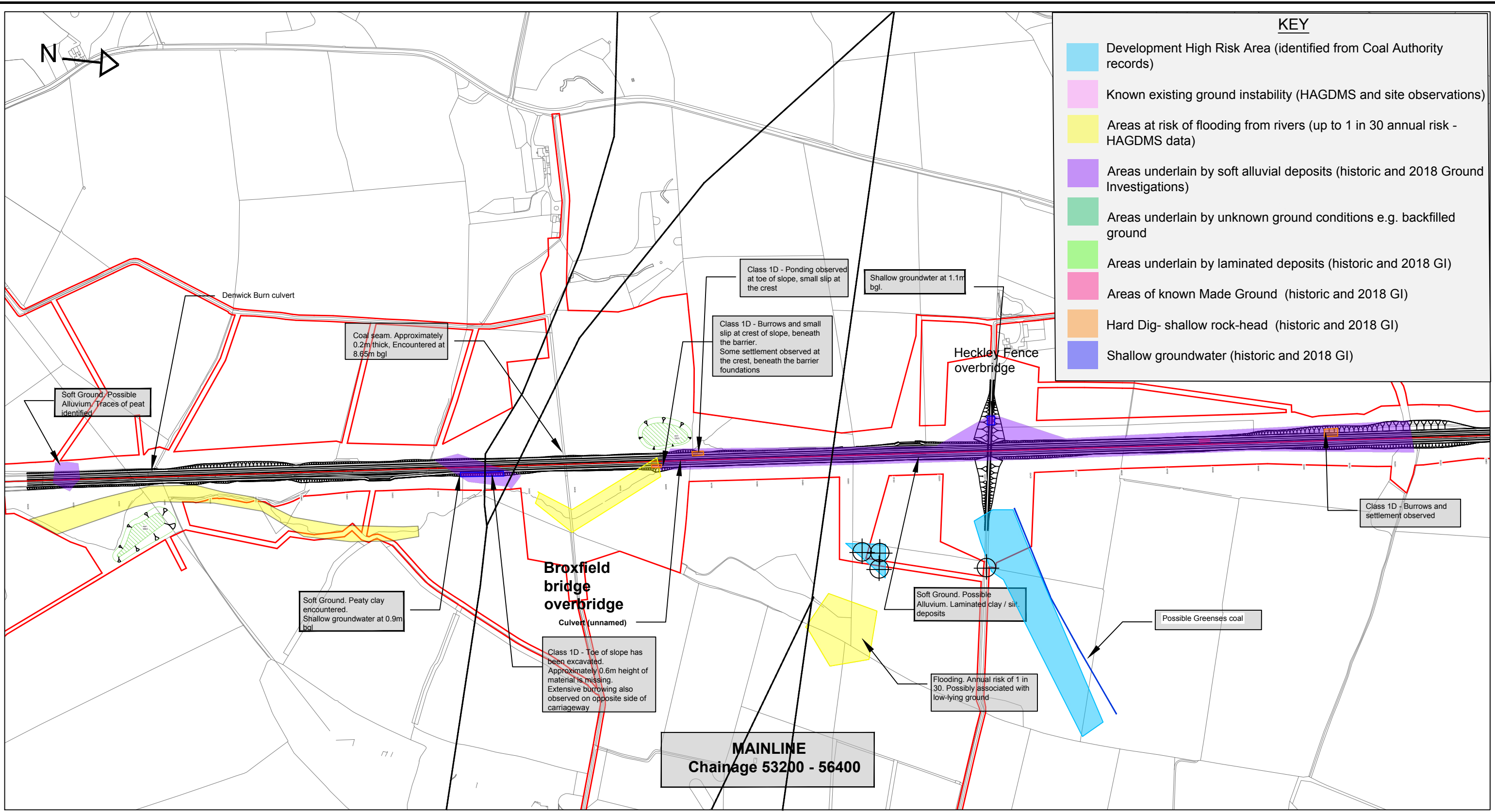


**Heckley Fence**  
Red-Line Boundary and Alignment, May 2019  
BGS Map Sheet 6. Alnwick. 1975 Scale 1:50 000

# Appendix C

## **GEOHAZARD PLANS**





**KEY**

- Development High Risk Area (identified from Coal Authority records)
- Known existing ground instability (HAGDMS and site observations)
- Areas at risk of flooding from rivers (up to 1 in 30 annual risk - HAGDMS data)
- Areas underlain by soft alluvial deposits (historic and 2018 Ground Investigations)
- Areas underlain by unknown ground conditions e.g. backfilled ground
- Areas underlain by laminated deposits (historic and 2018 GI)
- Areas of known Made Ground (historic and 2018 GI)
- Hard Dig- shallow rock-head (historic and 2018 GI)
- Shallow groundwater (historic and 2018 GI)

- NOTES**
1. To be read in conjunction with the A1 A2E Ground Investigation Report and A2E Factual Ground Investigation Report
  2. For indicative cross-sections please refer to long section drawings

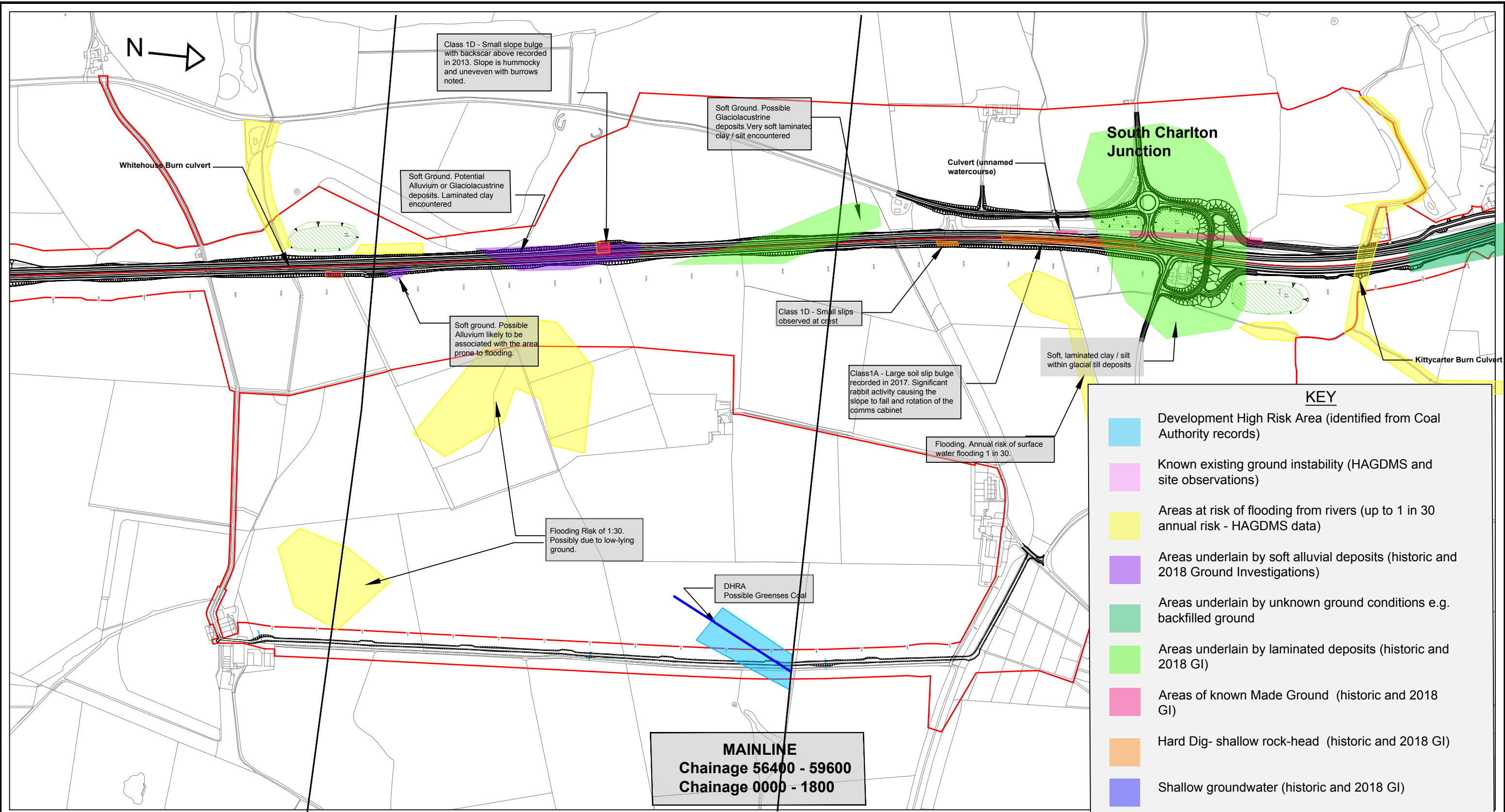
— Red Line Boundary      Possible Mine shafts  
 Proposed Detention Basin  
— Inferred Fault  
— Inferred Coal Seam

Rev.	Date	Description	By	Eng' Chk	Disc' Chk	App'd

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A2E Section	Type ID	DR Direction	CE Type	000001 Role Number
				PW Stage Code <b>3</b>





**NOTES**

- To be read in conjunction with the A1 A2E Ground Investigation Report and A2E Factual Ground Investigation Report
- For indicative cross-sections please refer to long section drawings

Red Line Boundary     Possible Mine shafts  
 Proposed Detention Basin  
 Inferred Fault  
 Inferred Coal Seam

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Suitability: **ISSUE**     Status: **S1**

8 First Street, Manchester M15 4RP

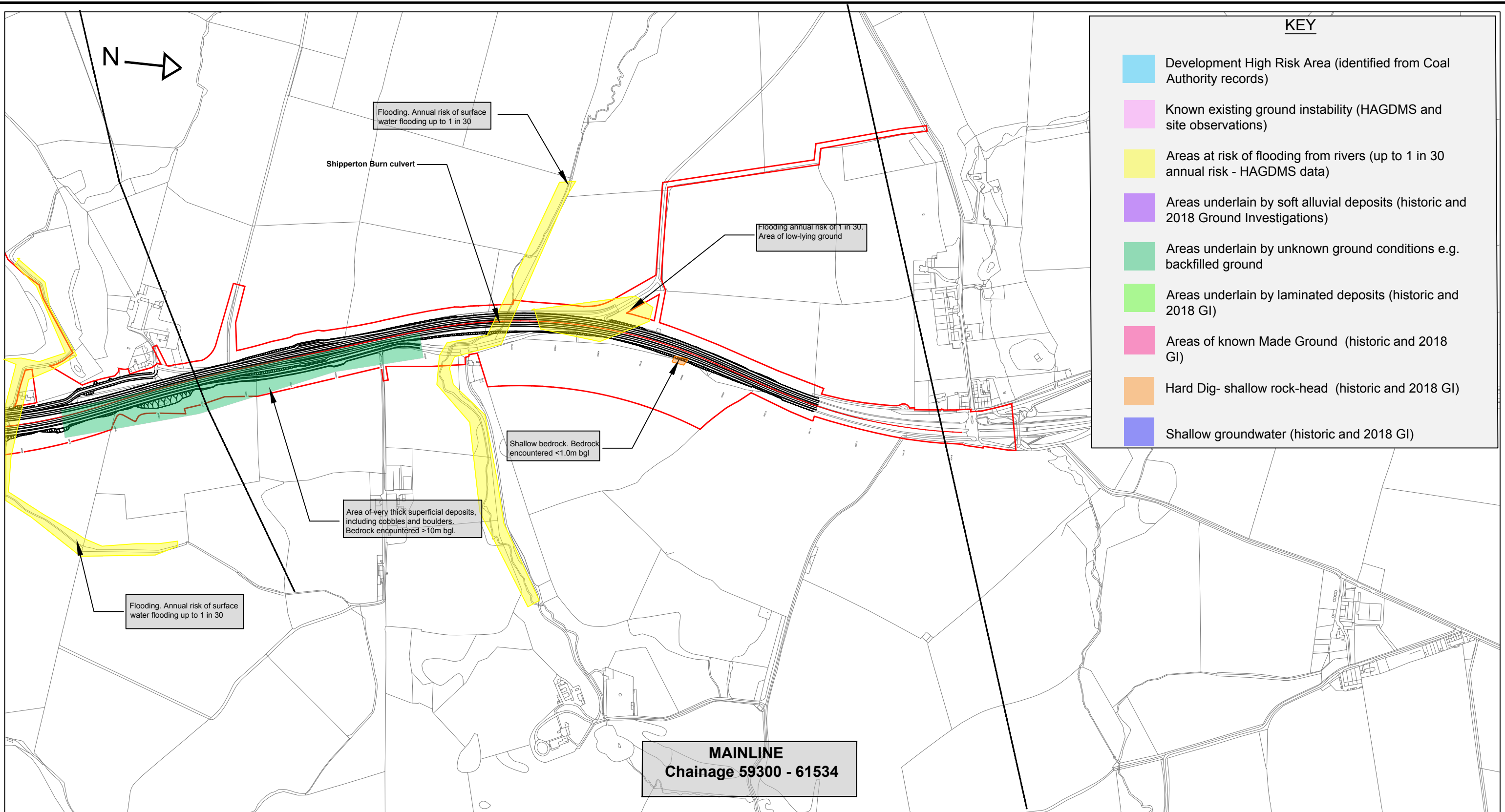
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Client:

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KEY	
	Development High Risk Area (identified from Coal Authority records)
	Known existing ground instability (HAGDMS and site observations)
	Areas at risk of flooding from rivers (up to 1 in 30 annual risk - HAGDMS data)
	Areas underlain by soft alluvial deposits (historic and 2018 Ground Investigations)
	Areas underlain by unknown ground conditions e.g. backfilled ground
	Areas underlain by laminated deposits (historic and 2018 GI)
	Areas of known Made Ground (historic and 2018 GI)
	Hard Dig- shallow rock-head (historic and 2018 GI)
	Shallow groundwater (historic and 2018 GI)

**NOTES**

- To be read in conjunction with the A1 A2E Ground Investigation Report and A2E Factual Ground Investigation Report
- For indicative cross-sections please refer to long section drawings

Red Line Boundary     Possible Mine shafts  
 Proposed Detention Basin  
 Inferred Fault  
 Inferred Coal Seam

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A2E	Section	DR	CE	000003	PW Stage Code	3			

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