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Land at 167 Heckmondwike Road, Dewsbury, WF13 3NS

Phase I Desk Study Report

January 2017

Report Title	Land at 167 Heckmondwike Road, Phase I Desk Study Report	**Site Address**	167 Heckmondwike Road, Dewsbury, WF13 3NS
Author	RB Geotechnical	**Contamination / Geotechnical**	Contamination and Geotechnical
Work Stage	Phase I Desk Study	**Report Date**	January 2017
Brief Description of the Report Contents	Review of desk top information to develop a preliminary conceptual site model in order to identify any potential contaminant receptor pathway pollutant linkages and associated environmental issues.		

Document Control

Project:	Land at 167 Heckmondwike Road
Client:	Lydian Developments Ltd
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Prepared and Issued by Ross Blake BSc MSc FGS, Engineer. Signed :

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Disclaimer

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1.0 Introduction

RB Geotechnical was commissioned by Mr Kevin Pratt of Lydian Developments Ltd to carry out a Phase I Desk Study for the Land at 167 Heckmondwike Road, Dewsbury. This Phase I Desk Study is to form part of a planning application for the proposed development comprising the construction of residential properties (detailed development proposals are yet to be finalised), however it is known that the final end use will be **Residential**.

1.1 Aims and Scope

The principal aims of this Phase I Desk Study, is to interpret information pertaining to the site, obtained during a desk based review of available data and a site walkover survey of the site.

The scope of this study is as follows:

- To carry out a site walkover;
- To provide general information on the site such as location and description;
- To discuss the geology, hydrogeology and hydrology at, and in the vicinity of, the site;
- To summarise the environmental setting of the site; e.g. landfills, permits and sensitive land uses;
- To summarise potential geotechnical risks associated with the site;
- To discuss and summarise any historical development that have occurred at the site and in the surrounding area.
- To assess potential contamination issues pertaining to the site with consideration of the site's historic use.
- To develop an initial conceptual model linking sources of potential contamination with pathways and receptors;

- To provide a preliminary risk assessment for the current and proposed end use of the site.

Please note that this Phase I Desk Study excludes an assessment of risks arising from asbestos, unexploded ordnance and/or invasive species.

1.2 Terms and Conditions

This report has been prepared for Lydian Developments Ltd in support of a planning application relating to the proposed development on the Land at 167 Heckmondwike Road, Dewsbury.

1.3 Sources of information

A site walkover survey was carried out on the 6th January 2017. Information on the site layout and current land use of the site is based primarily on information collected during this walkover.

An environmental database search was undertaken by others (GroundSure) to provide supplementary Environmental and Geotechnical information for the site and surrounding area. This was collated into an Insight Report by GroundSure and as such the potential for further data to exist cannot be ruled out.

The existing database and other sources of which this study is based comprise:

- GroundSure EnviroInsight Report, 167 Heckmondwike Road, 6th January 2017– Appendix A
- GroundSure GeoInsight Report, 167 Heckmondwike Road, 6th January 2017– Appendix B
- RB Geotechnical Site walkover survey carried out on 6th January 2017
- GroundSure 1:10,000 Historical Maps, 167 Heckmondwike Road, 6th January 2017– Appendix C
- GroundSure 1:2,500 Historical Maps, 167 Heckmondwike Road, 6th January 2017– Appendix C
- Environment Agency website (www.environment-agency.gov.uk);
- British Geological Survey (BGS) Geoindex website (www.bgs.ac.uk/geoindex)
- Coal Authority Interactive Viewer (www.mapapps2.bgs.ac.uk/coalauthority/home.html)
- Coal Authority Coal Mining Report, 167 Heckmondwike Road, 11th January 2017 – Appendix E

- Coal Authority Consultants Report, 167 Heckmondwike Road, 11th January 2017 – Appendix D

Although every effort has been made to ensure the accuracy of the information contained herein, no checks have been carried out to ensure the accuracy of information obtained from third parties and no liability can be accepted for any errors or misinterpretation of the third party information where it has been incorporated into this report.

2.0 Site Details

2.1 Site Location and Description

The site is situated approximately 2000m to the North West of Dewsbury town centre in West Yorkshire, at a 0.17ha size plot of roughly trapezoidal land by 167 Heckmondwike Road, WF13 3NZ. The National Grid Reference for the centre of the site is 422675, 422101. The current site layout is shown in Appendix D.

The site is currently occupied by areas of overgrown weeds and bushes, along with sections of tarmac and concrete hardstanding, with sections of old brick walls and floor slabs towards the South East corner of the site (in the place of the building which once stood). A number of trees also exist across the site.

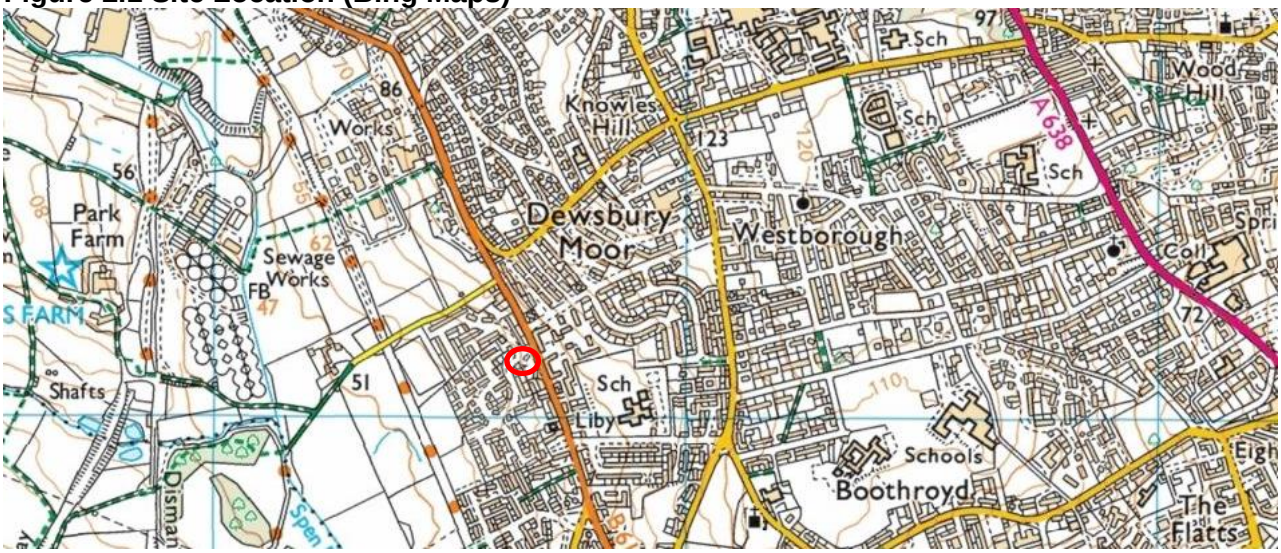
The Northern site boundary is marked by Spen View, Eastern site boundary by Heckmondwike Road and the Western site boundary by the back gardens of existing residential properties. The Southern site boundary is marked only by herras fencing, separating the site from another area of tarmac and old terraced car garages.

Topographically the site is at a lower elevation than Heckmondwike Road, and slopes down from the East towards the West.

Access to the site is off Spen View to the North.

The immediate surrounding area consists of mainly residential streets and houses. The approximate site location is shown by the red circle in Figure 2.1.

Figure 2.1 Site Location (Bing Maps)



2.2 Site Walkover Observations

A site walkover was carried out on 6th January 2017 by RB Geotechnical to assess the current site condition. Photographs from this site walkover are included in Appendix F.

The following observations were made during the site walkover:

- The site currently comprises a plot of land covered by tarmac, concrete and areas of grass and trees. No buildings exist on site; however there is evidence of past buildings in the form of standing brick wall, floor slabs and foundations. The site slopes quite steeply from the East down towards the West
- No obvious visual or olfactory signs of contamination sources were identified to be present anywhere on site during the site walkover.
- Access to the site is good and suitable for most construction plant;
- Services do exist on site, including manholes and likely gas and electric.

2.3 Proposed Development

As stated previously, at this stage finalised development proposals are yet to be confirmed, however it is understood that it will comprise a number of residential properties.

2.4 Site History

2.5 History of site and surrounding area

Information relating to the historical development of the site and the surrounding area has been obtained from Historical Ordnance Survey Maps (1:10,000 and 1:2,500). These are presented in Appendix C.

Historical maps show the Woolpack Inn to have been on the site since at least 1852, whereby during the years that followed, small scale demolition of out buildings took place, up until the present day, when the whole pub building was recently demolished.

The surrounding area has undergone largely residential development through the years. Collieries and other industrial uses have been mapped within 1000m of the site through the years, but have since become disused or ceased working.

Table 3.1 Summary of on-site and surrounding area history

Date	On-Site Features	Surrounding Area
1850 – 1931	The site contains a rectangular building in the South East corner labelled as The Wool Pack Inn. This building runs along the Eastern site boundary and slightly encroaches off the Southern boundary of the site. A small 'L' shaped building is shown to the North of the main pub building. The access to the pub is off Heckmondwike Road located to the East of the Site.	The areas surrounding the North and West of the site are occupied by open fields. Heckmondwike Road runs along the Eastern site boundary, with a scattering of houses also to the East of the site. What looks like terraced houses occupy the land adjacent to the Southern site boundary. Wool Mills are shown 150m to the South, and South East along with Mill ponds located 150m to the South West. A railway line runs roughly North West to South East at a distance of 250m to the South West of the Site. Collieries are mapped 260m to the South East and 1000m to the West of the site. A sewage works is also mapped 1000m to the North West of the site. By 1905 a sewage farm is also mapped 1000m to the South West of the site, and the two mentioned collieries are no longer shown, instead now labelled as 'Disused' and 'Old Shafts'. By 1931, another sewage works is also mapped approximately 1000m to the South West.
1931 - 1968	The 1933 map shows the small 'L' shaped building located adjacent to the North of the main pub building, to have been partly demolished. The rest of the site remains unchanged.	During this period, further residential development is noted mainly to the North and North East of the site. The area adjacent to the South of the site now has rows of what look like terraced garages. In addition chemical works, and other works buildings are mapped 380m to 500m to the North.
1968 –	The 1968 map shows the	A garage is shown 199m to the South. By 1992 Spen View is

Date	On-Site Features	Surrounding Area
1994	small building to the North of the main pub building to now be completely demolished, and now only a small square shaped outbuilding is shown. By 1993 this small outbuilding is also no longer shown.	shown adjacent to the Northern site boundary, along with new semi-detached and terraced houses to the North and West of the site. By 1994 access to the pub and car park is shown off Spen View to the North. The works buildings previously mapped to the North, are no longer shown by the early 1980s.
1994 – present day	The site remains unchanged up until 2014. Between 2014 and the present day, the main pub building has been demolished	Further slight residential development in surrounding area.

3.0 Geology, Hydrogeology and Hydrology

3.1 Geology

Information relating to the geology of the site has primarily been sourced from the GeoInsight Report and the BGS Geoindex website.

3.1.1 Made Ground

According to the published geological maps and information on the BGS GeoIndex website, Made Ground is not mapped beneath the site. However, it is likely the Made Ground will exist beneath the site associated with the construction of the buildings which one stood.

3.1.2 Superficial Deposits

No superficial deposits are mapped for the site. It is possible that a weathered bedrock material may exist above the solid intact bedrock.

3.1.3 Solid Geology

Geological maps indicate that the site is underlain by Interbedded mudstone, siltstone and sandstone of the Pennine Lower Coal Measures.

3.1.4 BGS Historical Boreholes

No BGS historical boreholes are available to view nearby to the site.

3.1.5 Faults and Seams

A fault is mapped 53m to the North East of the site, running North to South.

3.1.6 Radon

The GeoInsight Report indicates that the property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level. No Radon Protective Measures are therefore necessary.

3.2 Hydrogeology

The underlying mudstone/sandstone and siltstone of the Pennine Lower Coal Measures is classified as a Secondary A Aquifer. This indicates permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

3.2.1 Groundwater, Surface Water and Potable Water Abstraction Licences

The EnviroInsight Report indicates that there is one Groundwater Abstraction Licence within 1000m of the site, situated 612m to the North West. No Surface Water Abstraction Licences or Potable Water Abstraction Licences are mapped within 1000m of the site.

3.2.2 Soil Leaching Potential

The EnviroInsight Report indicates that the bedrock on site is of a High Urban Leaching Potential.

3.2.3 Discharge Consents

The EnviroInsight Report identifies no records of discharge consents within 500m of the site.

3.2.4 Pollution Incidents to Controlled Waters

The EnviroInsight Report shows no pollution incidents on site or within 500m of the site.

3.3 Hydrology

No surface water features exist on site, nor with 250m of the site. The EnviroInsight Report indicates that a land drain is situated 277m to the South West of the site (This is the nearest water feature). The River Spen is situated approximately 600m to the West of the site.

3.3.1 Water Quality

The EnviroInsight Report indicates that there is chemical water quality data available for the River Spen, whereby it was most recently assigned a Chemical Quality Grade of B.

3.3.2 Flood Risk

The EnviroInsight Report states that the site is at a **Very Low** risk of flooding from rivers and sea. It also states that there is the potential for groundwater flooding of the property situated below ground level, such as basements and other sub-surface infrastructure.

3.3.3 Source Protection Zones

There are no Source Protection Zones within 500m of the site.

4.0 Environmental Setting

4.1 Waste Treatment and Disposal

4.1.1 Landfill Sites

There are two recorded active landfill sites within 1000m of the site, situated 259m to the South West and 846m to the South West. Five historic landfill sites are noted within 1000m of the site, situated 373m to the South West, 769m to the West, 771m to the South West, 797m to the South and 908m to the North West.

4.1.2 Waste Management, Waste Treatment, Waste Transfer Facilities or Disposal Sites

There is one recorded waste treatment facility situated within 1000m of the site at 484m towards the South East.

4.2 Regulatory Permits, Incidents and Registers

4.2.1 Control of Major Hazard Sites /Notification of Installations Handling Substances

The EnviroInsight Report lists no Control of Major Hazard sites (COMAH) and one Notification of Installations Handling Substances (NIHHS) located 302m to the North West of the site.

4.2.2 Planning Hazardous Substance Consents

There are no records of Planning Hazardous Substance Consents and Enforcements located within 500m of the site.

4.2.3 Recorded Pollution Incidents

There are no recorded Pollution Incidents within 500m of the site.

4.3 Potentially Infilled Land

There are records of 73 potentially infilled land features within 500m of the site. These potentially infilled land features include an unspecified pit (situated 36m to the South East dated 1892), Unspecified Ground Workings situated 129m to the North East, Reservoirs and Ponds situated from 176m to 194m to the South, Collieries, Unspecified Heaps, Refuse Heaps, Pits, Sewage Works, Cuttings and other Ground Workings.

4.4 Sensitive Land Uses

The site is not within 1000m of any Designated Environmentally Sensitive Sites.

5.0 Potentially Contaminative Sites

5.1 Potentially Contaminative Land Uses

A total of 113 potentially contaminative historic land uses have been mapped within 500m of the site boundary. These comprise unspecified pits, mills, collieries, sewage works, engineering works, chemical works and other works buildings. The nearest current potential contaminative land uses are the vehicle hire service situated 86m to the South, the MOT garage situated 199m to the South and an electricity sub-station situated 249 to the South East.

5.2 Fuel Stations and Tanks

There are no active fuel stations within 500m of the site. There are no historical petrol and fuel sites situated within 500m of the site boundary. There are no tanks mapped on site, however a total of 59 historical tanks are noted within 500m of the site boundary, with the nearest situated 168m to the South.

5.2.1 Historical Garage and Motor Vehicle Repair

There are records showing one historical garage situated 200m to the South of the site. This is now the MOT station.

6.0 Geotechnical Assessment

6.1 Natural Ground Subsidence

The GeoInsight Report states that the site has a **Negligible** risk of Ground Dissolution of Soluble Rocks and Compressible Deposits, a **Very Low** risk of Shrink Swell Clay and Collapsible Deposits, and a **Low** risk of Landslides.

6.2 Ground Workings

A total of seven historical surface ground working features exist within 250m of the site, ranging from pits, reservoirs and ponds. The nearest being an Unspecified Pit located 36m to the South East. Thirteen historical underground workings are mapped within 1000m of the site, all of which are related to old mine shafts, with the nearest located 228m to the South East. A total of seven current ground workings are mapped within 1000m of the site, the nearest being at Dewsbury Moor Quarry situated 87m to the South East.

7.0 Mining

The Groundsure reports indicate that the site is within an area of potential coal mining. The Middleton Main Coal Seam is mapped 54m to the South West of the site running North to South. Upon obtaining a Coal Authority Coal Mining Report, it is apparent that the site is in an area that could be affected by underground mining in 3 seams of coal. The Consultants Coal Mining Report, has identified these seams as the Silkstone Coal Seam at a depth of 18.0mbgl, with an extraction thickness of 0.45m, the Black Bed Coal

Seam at a depth of 176m below ground level, with an extraction thickness of up to 0.76m, and the Better Bed Coal Seam, encountered at a depth of 218mbgl, with an extraction thickness of 0.69m.

8.0 Conceptual Site Model

8.1 Introduction

The information obtained from the desk top based study of the site has been collated and evaluated to develop a preliminary **Conceptual Site Model** (CSM) for the site to assess potential risks and any constraints on the proposed development arising from contamination which may be present. The CSM describes the relationship between contamination which may be present from past and current activities, both on and off site, which may affect the site, along with potential receptors of that contamination.

The site has been assessed in line with current UK guidelines, namely the Contaminated Land (England) Regulations 2000 and Part IIA of the Environmental Protection Act 1990 and follows the procedures set out in the Environmental Agency 'Model Procedures for the Management of Land Contamination – Contamination Land Report (CLR).11'.

CLR.11 provides the technical framework for structured decision making about land contamination and builds on previous work carried out under the Contaminated Land Research Programme of the former Department of the Environment. CLR 11 has adopted and refined the methodology and terminology that has been used in contaminated land risk assessment for a number of years.

CLR.11 defines the three essential elements to any risk:

- **A contaminant source** - a substance that is in, on or under land and has the potential to cause harm or to cause pollution of controlled waters.
- **A receptor** – in general terms, something that could be adversely affected by a contaminant, such as people, an ecological system, property or a water body.
- **A pathway** - a route or means by which a receptor can be exposed to, or affected by a contaminant.

Each of these elements can exist independently, but they create a risk only where they are linked together, so that a particular contaminant affects a particular receptor through a particular pathway. This kind of linked combination of source-pathway-receptor is described as a **Potential Pollutant Linkage (PPL)**.

It should be noted that at this preliminary stage, the assessment is based only on a desk-based study and site walkover survey. There exists the possibility that contaminants may be identified which are not necessarily present on site, and also contaminants may be present which are not yet identified. A quantitative assessment of the potential risk is not possible at this stage of the assessment.

This report presents a Preliminary Conceptual Site Model and Preliminary Risk Assessments for the site, based on the proposed **Residential** end use.

8.2 Potential Contamination Sources

8.2.1 On Site Sources

Historically the earliest available maps show the site to have always been the Woolpack Inn Pub. Demolition of outbuildings, and other parts of the main pub building has taken place over the years, along with the inclusion of hard standing car parking areas. The current state of the site is that the main pub building has been recently demolished, and now all that exists are sections of old brick walls, and concrete floor slabs, along with tarmac parking area.

Potential sources of on-site contamination may exist in the form of Made Ground created during the construction and demolition of the pub and associated buildings. In addition, the likely presence of underground services and utilities will also result in a likelihood of Made Ground existing beneath the site.

A large area of the site would have been used for car parking for the pub customers. It is a possibility that fuel leaks may have occurred over time, from parked vehicles. This may result in potential contaminants entering the soil.

8.2.2 Off Site Sources

A number of potential off-site sources of contamination have been identified within 250m (which is the general buffer for landfill gas based on Environment Agency policy). These include the MOT garage situated 200m to the South, which has the potential for any fuel spillages to enter the underlying groundwater of the Secondary A Aquifer that lies beneath the site. Other potential sources include a

number of areas of infilled land within 250m, such as ponds, pits and reservoirs, whereby the potential for ground gas accumulations may occur.

8.3 Potential Receptors

8.3.1 Human Receptors

Based on the proposed use of the site, on-site receptors include:

- Residents living in the new properties and using the new landscaped areas.
- Construction workers involved in the proposed development. Note that potential contamination risks to construction workers will be mitigated by appropriate risk assessments and mitigation measures required by Control of Substances Hazardous to Health (COSHH) and Construction, Design and Management (CDM) regulations.

8.3.2 Controlled Waters Receptors

The following on-site controlled waters receptors include:

- Groundwater within the underlying bedrock of the Pennine Lower Coal Measures (Secondary A Aquifer).

8.3.3 Buildings Receptors

The proposed new dwellings are potential receptors.

8.4 Potential Pathways

8.4.1 On-Site Human Receptors

Potential pathways to future human receptors on site include:

- Dermal contact or ingestion with contaminated soils;
- Inhalation of contaminants in soil derived dust;
- Migration and inhalation of gases and vapours outdoors or indoors;

- Contamination of drinking water pipes by contaminated soils/water leading to the ingestion of contaminated drinking water.

8.4.2 Controlled Waters

Potential pathways to on-site controlled water receptors (groundwater) include:

- Leaching of contaminants and/or migration of contaminants from the unsaturated zone of soils to groundwater (Secondary A Aquifer) in natural strata;
- Vertical migration of contaminants in shallow groundwater to deeper strata and aquifers;
- Lateral migration of impacted water through service conduits, drainage systems and possible perched groundwater pathways to surface water receptors.

8.4.3 Buildings

Potential pathways from off-site sources to the on-site property receptor include:

- Migration and accumulation of ground gas or vapours in buildings or structures.

8.5 Preliminary Risk Assessment

Based on the stated potential sources of contaminants identified and the receptors and pathways described, an assessment of the environmental risks has been made with reference to the significance and degree of risk. This assessment is based on consideration of whether the source contamination can reach a receptor and hence whether it is of a major or minor significance.

A preliminary Conceptual Site Model (CSM) of the Potential Pollutant Linkages (PPL) has been developed based on the information derived from this desk study for the site. This CSM has been used to identify potentially Relevant PPL's for the current and proposed end uses which have been assessed qualitatively using CIRIA 552 guidance, as described in Table 9.1 and Table 9.2.

Table 9.1 Methodology for Assessing Consequence of Harm

Consequence	Criteria
Severe	Short term (acute) risk to Human Health likely to result in "significant harm" as defined by the Environmental Protection Act 1990, Part IIa. Short term risk of pollution of sensitive water resource. Catastrophic damage to buildings / property
Moderate	Chronic damage to Human Health likely, over a long term, to result in "significant harm" as defined by the Environmental Protection Act 1990, Part IIa. Pollution of sensitive water resources
Mild	Health effects to Human Health that are unlikely to result in "significant harm" as defined by the Environmental Protection Act 1990, Part IIa. Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services. Damage to sensitive buildings / structures / services or the environment
Negligible	Non-permanent health effects to Human Health that are unlikely to result in "significant harm" as defined by the Environmental Protection Act 1990, Part IIa. Those that are easily prevented by means such as personal protective clothing. Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve.

Table 9.2 Methodology for Assessing Likelihood of Consequence Occurring

Probability	Criteria
Almost Certain	Circumstances are such that an event either appears very likely in the short term and almost inevitable over the long term or there is evidence of currently harm occurring
Likely	Circumstances are such that an event, whilst not inevitable, is possible in the short term and is likely to occur over the long term
Unlikely	Circumstances are such that it is possible an event could occur but it is by no means certain to occur even over a longer period, and it is less likely in the shorter term
Very Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable even in the medium to long term
Extremely Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are highly improbable even in the long term

Once the consequence and likelihood have been classified, these can then be compared to produce a risk category (using Table 9.3), ranging from **Very High Risk** to **Very Low Risk,** with the definitions summarised in Table 9.4.

Table 9.3 Comparison of Consequence and Likelihood

Consequence / Probability	Severe	Moderate	Mild	Negligible
Almost Certain	Very High Risk	High Risk	Moderate Risk	Low Risk
Likely	High Risk	Moderate Risk	Moderate/ Low Risk	Low Risk
Unlikely	Moderate Risk	Moderate/ Low Risk	Low Risk	Very Low Risk
Very Unlikely	Low Risk	Low Risk	Very Low Risk	Very Low Risk
Extremely Unlikely	Very Low Risk	Very Low Risk	Very Low Risk	Very Low Risk

Table 9.4 Definition of Classified Risks Posed by the identified PPL's

Risk	Criteria
Very High	There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without appropriate remediation action
High	Harm is likely to arise to a designated receptor from an identified hazard at the site without appropriate remediation action.
Moderate	It is possible that without appropriate remediation action, harm could arise to a designated receptor. It is relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely that such harm would be relatively mild
Low	It is possible that harm could arise to a designated receptor from an identified hazard. It is likely that, at works, if any harm were to be realised, any such effects would be mild.
Very Low	There is very low possibility that harm could arise to the receptor, but it is likely that this harm, if realised, would be mild at worst

In accordance with CLR11, professional judgement has been employed to evaluate the risk on a qualitative basis using available information.

A summary of the pollution linkages identified during the desk study are provided in Table 9.5.

Table 9.5 Conceptual Site Model of Potential Pollutant Linkages

Source	Receptor	Pathway	Risk
Contaminants in soil, soil derived dust, surface water run-off, groundwater, and as vapours/ground gas	Residential Home Owners	• Dermal contact or ingestion contaminants in soil-derived dust and entrained surface water run-off from areas where soil is exposed at the surface or where excavation takes place and in shallow groundwater in the natural strata if excavation takes place below the water table. • Inhalation of contaminants in soil derived dust from areas where soil is exposed at the surface of where excavation takes place. • Inhalation of soil and water derived vapours and ground gas outdoors • Inhalation of soil derived and water derived vapours and ground gas indoors where it may have accumulated in buildings and enclosed spaces.	Moderate/Low
	Construction Workers		Low
Contaminants in Soil	Groundwater within the Pennine Lower Coal Measures (Secondary A Aquifer)	• Leaching of contaminants and/or migration of free phase contaminants from the unsaturated zone soils to groundwater in the natural strata • Vertical migration of contaminants in shallow groundwater to deeper strata and aquifer	Low
Contaminants in soil, surface water runoff, groundwater and as vapours/ground gas	Surface Water	• Lateral migration of contaminants and/or migration of free phase contaminants present in the Made Ground via groundwater to surface water discharge • Lateral migration of contaminants and/or migration of free phase contaminants present in the Made Ground and entrained in surface water runoff	Low
Contaminants in soil, groundwater and as vapours/ground gas	Building	• Accumulation of soil and water derived vapours/and or ground gas in enclosed spaces	Low

9.0 Conclusions

The final development plan is yet to be confirmed, but it is to contain some form of residential development.

The earliest available historical maps show the site to contain the building of the Woolpack Inn Pub, along with small outbuildings. Over the years, the outbuildings have been demolished, and a car parking area has been created comprised of tarmac/concrete hardstanding. The current state of the site is that all pub buildings have now been demolished, and all that exists are the remains of brick walls and concrete floor slabs. The only potential sources of on-site contamination identified were from Made Ground where building construction and demolition has taken place over the years, and potential contaminants around the car parking areas due to fuel leakages.

The surrounding area initially consisted of open grassland to the West and North, with a scattering of collieries. Over the years the surrounding area has undergone extensive residential and in some areas industrial development. What was noted however is the number of areas of potential infilled land situated within a 250m radius of the site, which may have the potential to pose off-site sources of ground gas. The only real other form of potential off-site contamination identified was from the MOT garage situated 200m to the South of the site.

In summary, on the basis of the above listed contaminant sources it is concluded that:

- Contaminants may be present in, on or under the land at the site from both on site and off site sources; and
- Future on site receptors to this contamination have been identified as the construction workers, new residents, the new buildings, surface water and the groundwater.

A qualitative risk assessment of the identified potential pathways of contamination to the site have been summarised in Table 9.5. The following risks have been designated:

- Future Human Receptors – Moderate/Low Risk
- Construction Workers – Low Risk

- Groundwater – Low Risk
- Surface Water – Low Risk
- New Buildings – Low Risk

Based on the review of all available historical data, and the site walkover survey, it has been established that overall a **MODERATE/LOW** risk of potential pollutant linkage to the site exists. This risk has been identified due to the fact that there is the potential for contaminants to exist beneath the site within any Made Ground or from fuel leaks of any vehicles parked in the car parking areas. In addition a number of areas of infilled land exist relatively close to the site, whereby there is the potential for ground gas accumulations which may potentially migrate onto the site.

Additionally the other potential off-site source of contamination identified was from the MOT garage located 200m to the South of the site. It was again established that as the garage was at the same elevation as the site, the potential pathway of contamination (within the groundwater), is likely to flow down slope towards the River Spen, rather than to the site. Therefore, the risk from this off-site source was also deemed minimal.

Given the lack of site-specific quantitative information about ground conditions, the true estimated risks are difficult to confirm.

Upon assessing the coal mining legacy of the site, it is evident that possible shallow coal mine workings may exist beneath the site, namely within the Silkstone Coal Seam, which is encountered at a depth of 18.0mbgl. Mine workings have the potential to affect any new development and therefore must be dealt with accordingly.

10.0 Recommendations

Potential on-site and off-site sources of contamination have been identified on the site. It was established the main potential sources of contamination to the site end users is within potentially contaminated Made Ground resulting from demolition material, fuel leaks in the car parking area, and general backfill material, or from ground gases migrating to the site from identified areas of infilled land.

It is therefore recommended that an intrusive investigation be carried out to assess the potential for contamination within the shallow soils (namely around the current car parking areas and areas where demolition has or is to take place). This investigation should also include the installation of ground gas monitoring standpipe, to assess the risk of gas vapours migrating to the site from any infilled land.

Shallow coal seams are mapped beneath the site, which have the potential to have been worked in the past. It is therefore recommended that an intrusive investigation be carried out to assess the risk of potential mine workings. This investigation may comprise a handful of rotary open hole boreholes to depths of around 20.0mbgl. This will therefore allow an assessment of the thickness of intact rock above the coal seam (expected at 18.0mbgl), and an assessment of the coal seam itself to establish whether there is any evidence of mine workings.

Both the intrusive investigation for contamination purposes and coal mining purposes could be combined into one investigation, whereby gas monitoring standpipes are installed into the rotary open holes drilled to assess the coal mining risks.

Should soil contamination be identified during this ground investigation, further investigation may be required.

11.0 References

- BS 5930: (2015) Code of Practice for Site Investigations. British Standards Institution.
- BS 10175: (2011) Code of Practice for the Investigation of Potentially Contaminated Sites. British Standard Institution.
- CIRIA 552: (2001) Contaminated Land Risk Assessment, A guide to good practice