

# soiltechnics

environmental and geotechnical consultants

Proposed residential development  
Florida Farm  
St Helens

Preliminary Investigation Report  
(Desk study and site reconnaissance)

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Florida Farm  
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St Helens  
WA11 0UZ**

**PRELIMINARY INVESTIGATION REPORT  
(Desk study and site reconnaissance report)**

|                                                            |                                                                                     |                                                                                                                                                |
|------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
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| Drawn by                                                   |                                                                                     | FGS                                                                                                                                            |



## Aerial photograph of site



Approximate site boundaries edged in pink

## Report status and format

| Report section | Principal coverage                | Report status |          |
|----------------|-----------------------------------|---------------|----------|
|                |                                   | Revision      | Comments |
| 1              | Executive summary                 |               |          |
| 2              | Introduction                      |               |          |
| 3              | Desk study information            |               |          |
| 4              | Preliminary engineering appraisal |               |          |
| 5              | Chemical contamination            |               |          |
| 6              | Gaseous contamination             |               |          |
| 7              | Future investigations             |               |          |

## List of drawings

| Drawing | Principal coverage                  | Status   |          |
|---------|-------------------------------------|----------|----------|
|         |                                     | Revision | Comments |
| 01      | Site Location Plan                  |          |          |
| 02      | Plan showing existing site features |          |          |

## List of appendices

| Appendix | Content                                                    |
|----------|------------------------------------------------------------|
| A        | Copy of Envirocheck data base                              |
| B        | Copy of statutory undertakers records                      |
| C        | Definitions of geo-environmental terms used in this report |
| D        | Initial conceptual model                                   |
| E        | Copies of coal mining and mine entry interpretive reports  |
| F        | Copy of correspondence received from Environmental Health  |

# 1 Executive summary

We recommend the following executive summary is not read in isolation to the main report which follows.

| Topic                        | Summary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Abnormals                                                                                                |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Site conditions              | The site is located on the northern periphery of Haydock, approximately 18-20 hectares in area and roughly rectangular in shape. The majority of the site was presently in use as arable farm land with a small area in the centre of the site occupied by a farm house, farm buildings and gardens, known as Florida Farm. In addition an area of disused land covered in dense vegetation formed the south-western corner of the site. Topographical levels generally fall by approximately 10m from north to south across the site.                                                                                                           |                                                                                                          |
| Proposals                    | Construction of a large number of residential dwellings together with gardens, landscaped areas and access roads                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                          |
| Investigations               | Limited at this stage to collection, presentation and review of desk study information. Preliminary Coal Mining Risk Assessment report also completed for the site (ref R-STN3680NM-G02).                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                          |
| History of the site          | Majority of the site has been recorded as arable land, with the current farm buildings recorded in some form from the earliest historical maps and the south-western part of the site recorded as vegetated land, possibly even a quarry, with small buildings recorded during recent years. A number of relatively small coal pits, and later shafts, have been recorded locally across the site, in addition to a track/road in the western most field. In more recent times a tennis court was recorded in the north-eastern corner of the site, with a small pond likely to have been backfilled adjacent to the south-west of Florida Farm. | Coal mining legacy                                                                                       |
| Ground conditions            | Soils (geological sequence)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Strata. Typical Soil type Approximate depth to base                                                      |
|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Made Ground Unknown Unknown                                                                              |
|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Devensian Till Clay 9m to 17m                                                                            |
|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Pennine Middle Coal Measures Formation Mudstone, siltstone, sandstone and coal Up to 80m                 |
|                              | Groundwater and Geohydrology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Strata. Aquifer designation Likely permeability Groundwater                                              |
|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Devensian Till Secondary undifferentiated Low Unlikely                                                   |
|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Pennine Middle Coal Measures Formation Secondary A Permeable in fractures Possibly within basal deposits |
| Land stability               | North-eastern part of the site potentially affected by past mine workings associated with the Higher and Lower Florida coal seams. Further details provided in our Preliminary Coal Mining Risk Assessment report (ref R-STN3680NM-G02).                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                          |
| Soil classification          | Cohesive Devensian Till likely to be shrinkable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                          |
| Possible foundation solution | Trench fill foundations considered feasible for new build providing shallow naturally deposited Devensian Till is encountered. If deep Made Ground is present (associated with two large areas of potentially infilled ground recorded onsite) then deeper foundations or alternative solutions (piles) will be required. Slab construction dependent on the findings of the site investigation.                                                                                                                                                                                                                                                 | Potentially deep Made Ground                                                                             |
| Effect of agriculture        | Site predominantly arable and has been cropped for some years. Together with the presence of near surface potentially shrinkable cohesive Devensian Till, seasonal variation in moisture content may extend to some 2.0m. Site specific assessment required to determine effect on foundation depths.                                                                                                                                                                                                                                                                                                                                            | Potentially moisture depleted soils                                                                      |
| Soakaway feasibility         | Devensian Till unlikely to exhibit sufficient permeability.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                          |
| Contamination Chemical       | Risk of harm being caused to identified receptors considered to be low-moderate related to coal mining legacy, potential infilled land (inc quarry), use of agricultural chemicals and minor areas of historic development.                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                          |

|                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Gas                                                   | Gases associated with potential mine workings unlikely to migrate to surface and effect receptors. Potential gases associated with areas of infilled ground onsite could be a risk, however, can only be quantified following intrusive investigations in such areas                                                                                                                                                                                                                 |
| Future investigations                                 | On site borehole / trial pit investigations required to determine actual ground conditions and parameters for design and construction of the development as well as quantify risk assessments. Further, more localised intrusive investigations potentially required in areas subject to mining.                                                                                                                                                                                     |
| Statement with respect to NPPF paragraphs 120 and 121 | Site not considered to present unacceptable risks from pollution, however, could be an issue with localised land instability associated with mine workings (refer to Preliminary Coal Mining Risk Assessment report R-STN3680NM-G02 for further details). Remediation to render the site fit for purpose with respect to chemical contamination considered unlikely. If infilled land is present, gas monitoring would be recommended and possible gas protection measures required. |

## 2 Introduction

|     |                                           |
|-----|-------------------------------------------|
| 2.1 | Objectives                                |
| 2.2 | Client instructions and confidentiality   |
| 2.3 | Site location and scheme proposals        |
| 2.4 | Report format and investigation standards |
| 2.5 | Status of this report                     |
| 2.6 | Report distribution                       |

### 2.1 Objectives

- 2.1.1 This report describes a desk study (preliminary investigation) carried out for a site located at Florida Farm, Slag Lane, Haydock, St Helens, WA11 0UZ.
- 2.1.2 This report has been prepared to support a planning application for the development and where possible address paragraphs 120 and 121 of the National Planning Policies framework.

### 2.2 Client instructions and confidentiality

- 2.2.1 This report was prepared in July and August 2016 acting on instructions received through Barratt Homes Manchester.
- 2.2.2 This report has been prepared for the sole benefit of our above named instructing client, but this report, and its contents, remains the property of Soiltechnics Limited until payment in full of our invoices in connection with production of this report.

### 2.3 Site location and scheme proposals

- 2.3.1 The National Grid reference for the site is 354832, 397393. A plan showing the location of the site is presented on Drawing 01.
- 2.3.2 We understand that proposals are for the construction of a large number of residential dwellings together with gardens, landscaped areas and access roads constructed to standards allowing adoption by the local highway authority. At this point in time the project is in the preliminary stages of design and outline proposals are not available.

### 2.4 Report format and investigation standards

- 2.4.1 Sections 2 to 3 of this report describe the factual aspects of the investigation with Section 4 presenting an engineering appraisal of desk study information relating to project proposals. Section 5 provides a risk assessment of likely chemical contamination with section 6 describing a similar risk assessment in relation to gaseous contamination. Section 7 outlines a strategy for future ground investigations required to progress the scheme to detailed design and construction.

- 2.4.2 This report describes both contamination and geotechnical aspects of the site. The desk study process followed the principles of BS10175: 2011 'Investigation of potentially Contaminated Sites – Code of Practice' and limited to a preliminary investigation as described in this document.

## 2.5 Status of this report

- 2.5.1 This report is final based on our current instructions, however as the project progresses this report may require amendment.

## 2.6 Report distribution

- 2.6.1 This report has been prepared to assist in the design and planning process of the development and normally will require distribution to the following parties, although this list may not be exhaustive:

| Table summarising parties likely to require information contained in this report |                                                                                                                         |
|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Party                                                                            | Reason                                                                                                                  |
| Client                                                                           | For information / reference and cost planning                                                                           |
| Developer / Contractor / project manager                                         | To ensure procedures are implemented, programmed and costed                                                             |
| Planning department                                                              | To support a planning application                                                                                       |
| Environment Agency                                                               | If ground controlled waters are affected and obtain approvals to any remediation strategies                             |
| Independent inspectors such as NHBC / Building Control                           | To ensure procedures are implemented and compliance with building regulations                                           |
| Project design team                                                              | To progress the design                                                                                                  |
| Principal Designer (PD)                                                          | To advise in construction risk identification and management under the Construction (design and management) regulations |
| Table 2.6                                                                        |                                                                                                                         |

## 3 Desk study information and site observations

|      |                                                                                   |
|------|-----------------------------------------------------------------------------------|
| 3.1  | General                                                                           |
| 3.2  | Description of the site                                                           |
| 3.3  | Injurious and invasive weeds and asbestos                                         |
| 3.4  | History of the site                                                               |
| 3.5  | Geology and geohydrology of the area                                              |
| 3.6  | Landfill and infilled ground                                                      |
| 3.7  | Radon                                                                             |
| 3.8  | Flood risk                                                                        |
| 3.9  | Enquiries with statutory undertakers                                              |
| 3.10 | Enquiries with Local Authority Building Control and Environmental Health Officers |

### 3.1 General

3.1.1 We have carried out a desk study which was limited to a review of readily available information including:

- a) Review of published Ordnance Survey maps dating back to 1849 at various published scales
- b) Inspection of geological maps produced by the British Geological Survey together with relevant geological memoirs
- c) Consultation with Statutory Undertakers
- d) Site reconnaissance
- e) Other relevant published documents

3.1.2 We have obtained old Ordnance Survey maps using the Envirocheck database system. In addition to retrieval of historical and current Ordnance Survey data, Envirocheck provide information compiled from outside agencies including: -

|                                        |                                  |
|----------------------------------------|----------------------------------|
| Ordnance Survey                        | Centre for Ecology and Hydrology |
| Environment Agency                     | Countryside Council for Wales    |
| Scottish Environment Protection Agency | Scottish Natural Heritage        |
| The Coal Authority                     | Natural England                  |
| British Geological Survey              | Health Protection Agency         |

3.1.3 The study did not extend to research of meteorological information or consultation with other interested parties such as English Heritage (ancient monuments), Ordnance Survey (survey control points), Planning Authorities or Archaeological Units.

3.1.4 A copy of records produced by Envirocheck is presented in Appendix A. Envirocheck produce a wealth of factual database information. Although we can provide a discussion on each of the database topics, this would produce a very lengthy document, but some of these discussions would not be relevant to the aims of this report. As a consequence we have extracted some of the relevant topics and discussed them in this section of the report.

3.1.5 The data presented in the following report sections has primarily been extracted from the Envirocheck report.

## 3.2 Description of the site

3.2.1 The site is located on the northern periphery of Haydock, approximately 3.5km to the north-east of St Helens town centre, approximately 18-20 hectares in area and roughly rectangular in shape. The majority of the site, at the time of our reconnaissance, was presently in use as arable farm land with a small area in the centre of the site occupied by a farm house, farm buildings and gardens, known as Florida Farm. In addition an area of disused land covered in dense vegetation formed the south-western corner of the site.

3.2.2 The site reconnaissance was undertaken in fine weather on the 13<sup>th</sup> of July 2016. Further site reconnaissance was undertaken in the south-western part of the site when access was made available on Friday 12<sup>th</sup> August 2016, undertaken in fine weather. At this time the majority of the site was surfaced with a mixture of grass and hay, while the western field and field to the south east of the farm were under crop. Such areas were typically firm under foot. The area around the farm buildings was covered with a combination of gravel, cobble stones and bituminous material, the latter observed to be in a state of disrepair. Slag Lane crossed the site from the north, where it joins with East Lancashire Road (A580), to the south east and was surfaced with bituminous material.

3.2.3 Topographical levels generally fell by approximately 10m from north to south across the site (~1 in 29). At the eastern boundary to the western most field, there was a localised heavily vegetated 'ravine' feature, with levels falling steeply by approximately 5m, carrying a small stream at its base flowing to the south-west into Clipsley Brook. The highest part of the western most field was located approximately 5m above the majority of the site.

3.2.4 Buildings associated with Florida Farm were located centrally on the site. The farmhouse was present at the eastern end of the area of buildings, with a small grassed area of gardens located immediately adjacent to the east. The farmhouse was of two story brick construction, while the farm buildings themselves were a combination of brick and steel framed construction up to two stories in height. No significant chemical storage was evident on site at the time of the reconnaissance. A small amount of farming machinery and a number of caravans were present on external hardstanding.

- 3.2.5 No evidence of historic mine shafts were noted at the time of the reconnaissance, with the exception of a shaft in the western field located close to the northern site boundary and adjacent to the A580, which has been capped with a square concrete slab approximately 8m in width.
- 3.2.6 An area of thick vegetation was present in the south western corner of the site, essentially segregated from the arable fields by the channel of Clipsley Brook, flowing east to west. Within this area the remains of disused building were noted. A series of mature trees and vegetation were present along the northern and southern boundaries of the site typically 15m to 20m in height, reaching heights of 30m in the small garden area adjacent to the farmhouse.
- 3.2.7 The site was bound to the north by the A580 East Lancashire Road, while immediately beyond the site to the east, west and south were areas of residential housing. A small stream, Clipsley Brook, separates the site from the housing to the south – the channel of which was relatively shallow and mostly concealed by vegetation at the time of the site reconnaissance. The houses beyond this were located on ground some 3-4m higher than the site. Localised areas of poor drainage were evident in the eastern part of the site, with a large pond of stagnant water present in the southern section of the eastern most field.



Photograph 1

View from Slag Lane looking south-west and showing farm buildings



Photograph 2

View from Slag  
Lane looking  
north over the  
eastern field and  
showing pond.



Photograph 3

View of the field  
to the south of  
Florida Farm  
looking south



Photograph 4

View of the  
western most  
looking west



Photograph 5

Concrete cap to  
mineshaft in the  
western most  
field, looking west

3.2.8 A plan showing observed site features is presented on Drawing 02.

### 3.3 Injurious and invasive weeds and asbestos

#### 3.3.1 Injurious and invasive weeds

##### 3.3.1.1 The following weeds are controlled under the Weeds Act 1959:

Common Ragwort,  
Spear Thistle,  
Creeping or Field Thistle,  
Broad leaved Dock  
Curled Dock

##### 3.3.1.2 Whilst it is not an offence to have the above weeds growing on your land, you must:

Stop them spreading to agricultural land, particularly grazing areas or land used for forage, like silage and hay  
Choose the most appropriate control method for the your site  
Not plant them in the wild

Should you allow the spread of these weeds to another parties land, Natural England could serve you with an Enforcement Notice. You can also be prosecuted if you allow animals to suffer by eating these weeds.

##### 3.3.1.3 In addition to the above, you must not plant in the wild or cause [certain invasive and non-native plants](#) to grow in the wild as outlined in the Wildlife and Countryside act 1981. It is an offence under section 14(2) of the act to 'plant or otherwise cause to grow in the wild' any plants listed in schedule 9, part II. This can include moving contaminated soil or plant cuttings. The offence carries a fine or custodial sentence of up to 2 years. The most commonly found invasive, non-native plants include:

Japanese knotweed  
Giant hogweed  
Himalayan balsam  
Rhododendron ponticum  
New Zealand pigmyweed

You are not legally obliged to remove these plants or to control them. However, if you allow Japanese knotweed to spread to another parties land, you could be prosecuted for causing a private nuisance.

##### 3.3.1.4 The presence of such weeds on site may have considerable effects on the cost / timescale in developing the site. Japanese knotweed can cause significant damage to buildings, roads and pavements following development, if untreated prior to development.

##### 3.3.1.5 Our investigations exclude surveys to identify the presence of injurious and invasive weeds. We did not observe any obvious evidence the above species, however, we recommend specialists in the identification and procedures to deal with injurious and invasive weeds are appointed prior to commencement of any works on site.

### 3.3.2 Asbestos

- 3.3.2.1 Our investigations exclude surveys to identify the presence or indeed absence of asbestos on site. It should be noted however, that during the site reconnaissance we did not observe any obvious evidence of potential asbestos containing materials. This information does not constitute a site specific risk assessment and we recommend specialists in the identification and control / disposal of asbestos are appointed prior to commencement of any works on site or, if appropriate, purchase of the site.

## 3.4 History of the site

- 3.4.1 An attempt to trace the history of the site has been carried out by obtaining copies of old Ordnance Survey maps provided by Envirocheck. The recent history of the site based on published Ordnance Survey maps is summarised on the following table: -

| Summary description of site history from Ordnance Survey maps |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Date                                                          | Onsite                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Offsite                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 1849                                                          | Buildings and pond recorded on site in the area of present day Florida Farm, in addition to Slag Lane. Site recorded as arable land. Two old coal pits recorded in the western part of the site, in addition to one in the north-eastern part of the site. Well in eastern part of the site. Track recorded across the southern part of the site, running in an east-west direction. Possible quarry or vegetated area in the south-western part of the site. Stream flowing through centre of the site from north-east to south-west concurrent to present day. | Offsite areas recorded as open undeveloped spaces and woodland areas. Small housing area recorded 100m south. Sandstone quarries recorded adjacent to the south-west and 100m to the north. Large number of 'old coal pits' and 'coal pits' recorded surrounding the site. Black Brook Colliery recorded 1km to the south-west with quarry nearby to the north. Haydock New Colliery recorded approx. 800m to the south. Haydock Colliery recorded 500m to the south-east and 800m to the east. Pewfall Colliery recorded 800m to the north. |
| 1894                                                          | Two 'old shafts' recorded in the western part of the site, with one recorded adjacent to the northern site boundary (including a pond) concurrent to present day concrete cap. Old smithy cottages recorded on eastern site boundary. Track/road running across western field from south west to north east. Clipsley Brook recorded adjacent to southern boundary. Buildings to the centre of the site now called 'Florida Farm'.                                                                                                                               | Expansion of domestic housing development to the south. Leigh Pit colliery and mineral railway recorded 100m to the south-east. Sandstone quarries no longer recorded. Haydock, Haydock New, Black Brook Collieries no longer recorded. Expansion of Pewfall Colliery to the north. 'Old Garswood Pit' recorded 900m to the north-west. Unclassified colliery recorded 500m to the east. Old brick field recorded 120m to the west of the site.                                                                                              |
| 1908-1909                                                     | No significant changes. Small building recorded in south-western part of the site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Blackbrook Colliery (Garswood Park Pits) recorded in area of old brick field. Unclassified colliery now named Haydock Colliery. Associated engine and wagon shops recorded 1km to the south-east.                                                                                                                                                                                                                                                                                                                                            |
| 1928-1929                                                     | No significant changes. Minor expansion of Florida Farm buildings. One of the old shaft in western part of the site no longer recorded.                                                                                                                                                                                                                                                                                                                                                                                                                          | Leigh Pit, Pewfall and Haydock Collieries are no longer recorded/recorded as disused. Further domestic housing development to the south and east. Cemetery recorded some 400m to the south. Old smithy cottages on eastern site boundary no longer recorded. Hollin Hey Colliery now recorded in area of Old Garswood Pit to the north-west.                                                                                                                                                                                                 |

| Summary description of site history from Ordnance Survey maps |                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Date                                                          | Onsite                                                                                                                                                                                                                             | Offsite                                                                                                                                                                                                                                                                                                                                             |
| 1938-1939                                                     | No significant changes.                                                                                                                                                                                                            | East Lancashire Road recorded immediately adjacent to the north. Housing and roads recorded adjacent to southern site boundary.                                                                                                                                                                                                                     |
| 1951                                                          | No significant changes. Road/track no longer present.                                                                                                                                                                              | No significant changes. Hollin Hey Colliery no recorded as disused. Area of open cast mining recorded 900m to the north-west and 700m to the north-east of the site.                                                                                                                                                                                |
| 1956                                                          | No significant changes.                                                                                                                                                                                                            | No significant changes.                                                                                                                                                                                                                                                                                                                             |
| 1960                                                          | No significant changes. Minor expansion of Florida Farm buildings. Further buildings recorded in the south-western part of the site.                                                                                               | Small domestic development immediately adjacent to the west. Residential and commercial buildings present to adjacent to the east. Possible car park associated with such buildings recorded in far eastern part of the site. Expansion of residential to the south. Unclassified works recorded 120m to the north-west and 250m to the south-east. |
| 1965                                                          | No significant changes.                                                                                                                                                                                                            | No significant changes.                                                                                                                                                                                                                                                                                                                             |
| 1970-1971                                                     | No significant changes. Other disused shaft in the western part of the site no longer recorded. South-western part of the site now segregated into parcels of land. Tennis court recorded in the north-eastern corner of the site. | Further development of domestic housing to the south.                                                                                                                                                                                                                                                                                               |
| 1972-1973                                                     | No significant changes.                                                                                                                                                                                                            | No significant changes.                                                                                                                                                                                                                                                                                                                             |
| 1975                                                          | No significant changes.                                                                                                                                                                                                            | No significant changes. Large number of depots and works recorded 500m to the north-east.                                                                                                                                                                                                                                                           |
| 1981-1983                                                     | No significant changes. Pond no longer recorded adjacent to Florida Farm.                                                                                                                                                          | No significant changes.                                                                                                                                                                                                                                                                                                                             |
| 1990                                                          | No significant changes.                                                                                                                                                                                                            | No significant changes. Expansion of residential development immediately adjacent to the south-east.                                                                                                                                                                                                                                                |
| 1992-1993                                                     | No significant changes. Removal of some buildings in the south-western part of the site and footbridge recorded over Clipsley Brook.                                                                                               |                                                                                                                                                                                                                                                                                                                                                     |
| 1995-1996                                                     | No significant changes. Minor redevelopment to buildings to Florida Farm.                                                                                                                                                          | No significant changes.                                                                                                                                                                                                                                                                                                                             |
| 1999                                                          | No significant changes. Minor redevelopment to buildings to Florida Farm.                                                                                                                                                          | No significant changes.                                                                                                                                                                                                                                                                                                                             |
| 2001                                                          | No significant changes.                                                                                                                                                                                                            | No significant changes. Expansion of open cast mining 900m to the north-west.                                                                                                                                                                                                                                                                       |
| 2006                                                          | No significant changes.                                                                                                                                                                                                            | No significant changes.                                                                                                                                                                                                                                                                                                                             |
| 2016                                                          | No significant changes.                                                                                                                                                                                                            | No significant changes.                                                                                                                                                                                                                                                                                                                             |
| Table 3.4.1                                                   |                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                     |

### 3.5 Geology and geohydrology of the area

#### 3.5.1 Geology of the area

3.5.1.1 Envirocheck reproduce geological map extracts taken from the British Geological Survey (BGS) digital geological map of Great Britain at 1:50,000 scale (ref Appendix A). A summary of the recorded geological information for the site is presented in Table 3.5.1.below:-

| Summary of Geology and likely aquifer containing strata |                        |                       |                                         |                        |                                |
|---------------------------------------------------------|------------------------|-----------------------|-----------------------------------------|------------------------|--------------------------------|
| Strata                                                  | Bedrock or Superficial | Approximate thickness | Typical soil type                       | Likely permeability    | Likely aquifer designation     |
| Devensian Till                                          | Superficial            | 9m to 17m             | Clay, sand, silt and gravel             | Impermeable            | Secondary Undifferentiated (r) |
| Pennine Middle Coal Measures Formation                  | Bedrock                | Up to 80m             | Mudstone, siltstone, sandstone and coal | Permeable in fractures | Secondary A (r)                |
| Pennine Lower Coal Measures Formation                   | Bedrock                | >100m                 | Mudstone, siltstone, sandstone and coal | Permeable in fractures | Secondary A (r)                |

**Table 3.3.1**

(r) recorded aquifer designation  
(a) assumed aquifer designation

3.5.1.2 It should be noted that the BGS 1:50,000 scale map of the area records the Higher Florida coal seam at crop in the western part of the site, with the Lower Florida coal seam recorded offsite immediately adjacent to the western site boundary. Further details on coal seams in the area are provided in our Preliminary Coal Mining Risk Assessment Report (ref R-STN3680NM-PMRA01).

3.5.1.2 Superficial deposits are the youngest geological deposits formed during the Quaternary, which extends back about 2.6 million years. They rest on older deposits or rocks referred to as bedrock. Soil types and assessments of permeability are based on geological memoirs, in combination with our experience of investigations in these soil types.

3.5.1.3 Secondary A aquifers are predominantly permeable layers capable of supporting water supplies at a local rather than strategic scale. In some cases, Secondary A aquifers can form an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

3.5.1.4 Secondary undifferentiated aquifer is a designation used when it is not possible to attribute fully one of either Secondary A or Secondary B, due to the variable nature of the soils. The unit will therefore be a mix of both, which are defined as follows:

Secondary A can be defined as: 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.

Secondary B can be defined as: layers which may store limited amounts of ground water. These groundwater stores are generally the water bearing parts of former aquifers.

### 3.5.2 Water abstractions

3.5.2.1 One active ground water and three active surface water abstraction points are located within 2000m of the site. The groundwater abstraction point lies 1596m to the south of the site, used for farming purposes. The closest surface water abstraction point lies 1227m to the south-west of the site, with water abstracted from a canal, the details of which are not supplied.

3.5.2.2 The site is not located within a zone protecting a potable water supply abstracting from a principal aquifer (i.e. a source protection zone).

### 3.5.3 Coal mining and brine extraction

3.5.3.1 The site is located within an area where coal has been extracted (Coal Mining Reporting Area). As a consequence, we have instructed the Coal Authority to carry out a search of their records centred on the development site. The report indicates that the site is located in an area that could be affected by underground mining in 6 seams of coal at 60m to 470m below ground level, last worked in 1920. It is indicated that any ground movement associated with such working's should have stopped, however, the site is located in an area where there is coal at or close to the surface which may have been worked in the past. Furthermore, 13 mine entries are recorded either onsite or within 20m of the site boundary. A copy of the Non-Residential Mining report is presented in Appendix E, together with a copy of the Interpretative Mine Entry report. Coal Mining is discussed in greater detail in our Preliminary Coal Mining Risk Assessment Report (ref R-STN3680NM-PCMA01).

3.5.3.2 The Non-Residential Mining report further states that three damage notices or claims relating to alleged subsidence were made between March 1998 and February 2012, associated with the area of the existing farm house and gardens of Florida Farm. The claims were, however, rejected and further information is presented in our Preliminary Coal Mining Risk Assessment Report (ref R-STN3680NM-PCMA01).

3.5.3.3 The report does also indicate that the site has been subject to remedial works, by or on behalf of the Coal Authority, under its Emergency Surface Hazard Call Out procedures. This is associated with the shaft reference 354397-005 as detailed in the Interpretative Mine Entry report, which was remediated by the Closed Collieries Team and capped with concrete.

### 3.5.4 Shallow mining and natural subsidence hazards

3.5.4.1 The British Geological Survey present hazard ratings for shallow mining and natural subsidence hazards. The site has the following ratings;

| Table summarising mining and subsidence hazards                  |           |
|------------------------------------------------------------------|-----------|
| Hazard                                                           | Rating    |
| Non Coal Mining Areas of Great Britain                           | No hazard |
| Potential for collapsible ground stability hazard                | Very low  |
| Potential for compressible ground stability hazard               | No hazard |
| Potential for ground dissolution stability hazard                | No hazard |
| Potential for landslide ground stability hazard                  | Very low  |
| Potential for running sand ground stability hazard               | Very low  |
| Potential for shrinking or swelling clay ground stability hazard | Very low  |
| Table 3.5.4                                                      |           |

3.5.4.2 In addition to the above hazard ratings, a report completed by Ove Arup and Partners in December 1991, commissioned by the Department of the Environment (DoE) indicates where mining should be borne in mind when considered planning and development of land. The site is recorded as lying in an area of inconclusive rock (coal) mining as indicated by the report. Coal Mining is discussed in greater detail in our Preliminary Coal Mining Risk Assessment Report (ref R-STN3680NM-PMRA01).

### 3.5.5 Borehole records

3.5.5.1 The British Geological Survey (BGS) retain records of boreholes formed from ground investigations carried out on a nationwide basis. The location of boreholes with records held by the BGS is recorded on the borehole map contained in Appendix E. We do not normally obtain copies of these records but can do on further instructions. There is normally a charge made by the BGS for retrieving and copying these records.

## 3.6 Landfill and infilled ground

3.6.1 There is one historic landfill site located within 1km of the site. This is associated with Clipsley Lane landfill site (former railway cutting), located 596m to the south east of the site. The site is also a Local Authority recorded site. No information of its period of operation or received wastes is available. There are also 31 areas recorded as potentially infilled land, 13 of which are recorded within 500m of the site and 2 located on site. The onsite areas of infilled land may be associated with former unrecorded pits/quarries which pre-date earliest historical maps, or related to the backfilling/remediation of shafts recorded onsite.

- 3.6.2 There are also 6 BGS Recorded Mineral Sites within 1km of the site, including opencast quarrying and deep mining. The nearest mineral site is related to an opencast sandstone quarry located 52m to the southwest of the site as noted on historical maps. The following table summarises these mineral sites:

| Summary of mineral sites |             |          |           |                |
|--------------------------|-------------|----------|-----------|----------------|
| Mineral site             | Type        | Location | Commodity | Licence status |
| Stanley Bank             | Opencast    | 52m SW   | Sandstone | Ceased         |
| Smithy Wood              | Opencast    | 112m NE  | Sandstone | Ceased         |
| Leigh Pit                | Underground | 263m E   | Coal      | Ceased         |
| Haydock Colliery         | Underground | 479m SW  | Coal      | Ceased         |
| Princess Pit Occs        | Opencast    | 112m SE  | Sandstone | Ceased         |
| Blackbrook Sand Pit      | Opencast    | 787m S   | Sand      | Ceased         |

Table 3.6.2

- 3.6.3 With reference to Appendix F, the Local Authority record a landfill site 18m to the south-east of the site, associated with Leigh Pit. It is thought to contain colliery spoil. Similarly, Princess Pit is recorded 170m to the south-east containing similar waste.

## 3.7 Radon

- 3.7.1 With reference to the Building Research Establishment (BRE) publication “Radon: guidance on protective measures for new buildings” (2007), the site is located where no protection is considered necessary.
- 3.7.2 The Building Research Establishment publication applies to all new buildings, conversions and refurbishments whether they be for domestic or non-domestic use.
- 3.7.3 It is noteworthy that the BRE and BGS / HPA information is based on statistical analysis of measurements made in dwellings in combination with geological units, which are known to emit radon. Therefore there is a risk for actual radon levels at the site to exceed the levels assessed by the BGS / HPA / BRE. Currently, the only true method of checking actual radon levels is by measurement within a building on the site over a period of several months. It should be noted that it is not currently a requirement of the Building Regulations to test new buildings for radon, however the BRE recommends testing on completion or occupation of all new buildings (domestic and non-domestic), extensions and conversions. Should you wish to undertake radon monitoring following completion of the development, we can provide proposals.

## 3.8 Flood risk

- 3.8.1 Very localised parts of the site are located within a fluvial flood plain. A small area in the south-western part of the site is located in a Flood Zone 2 and 3, with small areas in the eastern and south-eastern part of the site recorded in a Flood Zone 2.
- 3.8.2 It should be noted that this information does not constitute a site specific Flood Risk Assessment (FRA), and a full FRA may be required for the development to support a planning application or satisfy planning conditions.

### 3.9 Enquiries with statutory undertakers

3.9.1 We have contacted the following Statutory Undertakers (SUs) to obtain copies of their records in order to avoid damaging their apparatus during our fieldwork activities: -

- a) BT Openreach Ltd
- b) Electricity North West
- c) National Grid
- d) United Utilities

3.9.2 Copies of responses received prior to publication of this report are presented in Appendix B. These records have been obtained solely for the purposes described above. Some of these records have been obtained from the Internet and from our database without contacting the statutory undertaker direct. Occasionally, SU information is recorded on drawings larger than A3, and thus cannot be easily presented in this report. In such cases we will copy the correspondence but not incorporate the drawing in this report, and maintain the records on our office file.

3.9.3 In addition, we have visited the Linesearch web site ([www.linesearchbeforeudig.co.uk](http://www.linesearchbeforeudig.co.uk)), which provides a report on national grid networks (National Gas and Electricity Transmission Networks). Again a copy of their report is presented in Appendix B.

3.9.4 Normally Statutory Undertakers drawings record the approximate location of their services. We recommend further on site investigations be undertaken to confirm the position of the apparatus and thus establish the effect on the proposed development and the necessity or otherwise for the permanent or temporary diversion of the service to allow the construction of the development to safely and successfully proceed.

3.9.5 It should be noted that 11kv overhead electricity lines cross the site from in the area of the existing farm, down to the south-west and beyond into a residential area. Furthermore a low voltage underground cable runs along the western extent of the farm. We are not aware that the supply to such services has been capped offsite and as such they should be treated as live until further information indicates otherwise. It should also be noted that an abandoned sewer is recorded within the southern part of the eastern field, which then runs along Slag Lane, across the entrance to the site and over the East Lancashire Road.

3.9.6 It should be noted that statutory undertakers' records normally exclude private services.

### 3.10 Enquiries with local authority building control and environmental health officers

3.10.1 We have contacted Local Authority Building Control to determine if they are aware of any issues in the local area regarding foundations and subsidence, however, at the time of writing we are yet to receive a response. This report will be updated if any pertinent information is received.

3.10.2 We have contacted Chris Culley, Scientific Officer (Contaminated Land) in Environmental Protection Department at St Helens Council who reports that neither the site nor adjacent sites are recorded on their contaminated land public register, however, the general area has been subject to industrial activities which may have produced sources of contamination worthy of further consideration. A copy of the correspondence is presented in Appendix F.

## 4 Engineering appraisal

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|     |                                        |
|-----|----------------------------------------|
| 4.1 | General description of the development |
| 4.2 | Ground and site conditions             |
| 4.3 | Coal mining                            |
| 4.4 | Construction considerations            |

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### 4.1 General description of the development

- 4.1.1 The following assessments are made on the investigatory data presented in the preceding sections of this report and are made with reference to the specific nature of the development. Should scheme proposals change then it may be necessary to review the investigation and report.
- 4.1.2 We understand that proposals are for the construction of a large number of residential dwellings together with gardens, landscaped areas and access roads constructed to standards allowing adoption by the local highway authority. At this stage the project is in the preliminary stages of design and outline proposals are not available.
- 4.1.3 Clearly on site borehole / trial pit investigations will be necessary to determine actual ground conditions, tailored to suit the proposed development once the scheme has been advanced in design. The following paragraphs provide some indication of possible foundation solutions based on anticipated ground conditions and development in advance of any on site investigations.

### 4.2 Ground and site conditions

- 4.2.1 Historically the majority of the site has been recorded as arable land, with the current farm buildings recorded in some form from the earliest historical maps. The stream which runs through the centre of the site has been recorded from the earliest maps, with the south-western part of the site recorded as vegetated land, possibly even a quarry, with small buildings recorded during recent years. A number of relatively small coal pits and later shafts have been recorded locally across the site, in addition to a track/road in the western most field (the latter no longer present from the 1950s). In more recent times a tennis court was recorded in the north-eastern corner of the site, with a small pond likely to have been backfilled adjacent to the south-west of Florida Farm.

- 4.2.2 Based on the above, there is inevitably likely to be some localised areas of Made Ground present associated with previous development, particularly if the south-western area of the site was subject to quarrying. As outlined in Section 3.6, Envirocheck also record two large areas of potentially infilled ground; one in the western most field and one between Slag lane and the East Lancashire Road in the northern part of the site. It is unclear at this point in time what these areas relate to as there is no evidence of quarrying on historical maps. It is possible that quarrying activities in such areas predate the earliest historical maps of 1849, however, in our opinion, such areas are most likely to relate to the localised shafts and coal pits recorded on historical maps which have been backfilled/remediated. The depth of potential areas of Made Ground across the site is not known, and clearly needs investigating.
- 4.2.3 Geological records indicate the site is underlain by Devensian Till deposits. Such deposits are likely to consist of clays, extending to depths of between 9m and 17m based on mine shaft records, overlying mudstones, siltstones, sandstones and coals of the Pennine Middle Coal Measures Formation. Typically the cohesive Devensian Till soils will be plastic and thus subject to volume changes due to variations in water content.
- 4.2.4 There are a number of trees which border the site, in addition to bordering the stream which flows through the site, covering the majority of the south-western part of the site and locally around the existing site of Florida Farm. It is not understood at the stage if such vegetation will be retained as part of the development. Water demands of these trees are likely to affect the water content and thus volume of plastic soils.

## 4.3 Coal mining

- 4.3.1 As outlined in Section 3.5.3, there is a possibility that shallow coal workings exist below the site, associated with the Higher Florida coal seam which crops at the surface of bedrock in the western part of the site, with the Lower Florida coal seam recorded at bedrock surface offsite but immediately adjacent to the west. We have obtained relevant abandonment plans of known coal workings in the area, with further information provided in our Preliminary Coal Mining Risk Assessment Report (ref R-STN3680NM-PCMA01).

## 4.4 Construction considerations

- 4.4.1 Typically Devensian Till deposits are capable of supporting concentrated foundation loads and, subject to on-site investigations (boreholes/ trial pits) trench fill concrete foundations are likely to be appropriate. It is considered unlikely that groundwater would be present within such deposits. Foundations may require localised depending where Made Ground deposits are identified.

- 4.4.2 The cohesive Devensian Till will exhibit plasticity, thus their volume will be influenced by changes in water content. Foundations need to be taken down to soils whose water content, thus volume, is stable to avoid adverse foundation movements. Typically seasonal changes in water content occur to depths of up to 1m, but vegetation (trees and hedges) increase this depth requiring deeper foundations. Subject to soil plasticity characteristics, and location of foundations in proximity to existing trees, and tree types (water demands), again in a worst case scenario a piled foundation may become an economic solution.
- 4.4.3 We recommend an intrusive ground investigation is carried out to establish ground conditions and thus, identify an appropriate and suitable foundation solution for the proposed development. A tree survey conducted by a qualified arboriculturalist is also recommended.
- 4.4.4 The site is predominantly arable and largely under crop (barley) at the time of our site reconnaissance. With reference to BS8004-1986 "Code of practice for – Foundations", Section 3.2.8 comments on the effect of seasonal weather changes on the shrinking and swelling of clay soils. BS8004 comments that, in areas of heavy over consolidated clay, the seasonal drying in hot summers, usually with complete replenishment of ground water during the winter, occurs to a depth of 1.5m to 2.0m under crops and grass pastures where irrigation is not practiced. During the winter months it is possible that as the clay soils replenish then the soils could swell.
- 4.4.5 The only way to determine, with a degree of certainty, the actual level of moisture depletion would be to undertake investigations following final harvest of the site, and a subsequent winter season allowed to lapse to enable rehydration of the soils. Clearly, in practise this is unlikely to be practicably achievable, however, a series of laboratory tests can be undertaken locally across the site which will provide an indication as to the current state of moisture depletion of near surface clay soils and the effects that this may have on overall foundations depths. Further investigations may be recommended following analysis of initial test data, which could be undertaken prior to construction to assess the depth and magnitude of moisture depletion and thus determine the minimum depth of foundations.
- 4.4.6 Given the likelihood of the presence of clay soils at the site, the use of traditional soakaway systems is unlikely to be achievable and alternative means of disposal will need to be sought.
- 4.4.7 Inevitably some soils at the site will require excavation and removal off site. It is important that soils likely to be removed from site are classified for offsite disposal as this may have a severe impact on development costs, particularly if they are not classified as inert.
- 4.4.8 It may be possible to use a ground bearing floor slab where buildings are remote from trees and floor levels are close to naturally deposited soils capable of supporting such a construction. Alternatively suspended floor will be required.

- 4.4.9 Devensian Till deposits are unlikely to contain pyrite and thus the likelihood of such soils being chemically aggressive towards buried concrete is considered to be low. We recommend samples of soils from across the site that will potentially be in contact with concrete are chemically tested as a precaution to determine the aggressive concrete (AC) and design sulphate (DS) classes following BRE Special Digest 1:2005 'Concrete in aggressive ground'. If soils are determined as aggressive towards concrete, higher than normal cement contents may be required in foundation concrete.

## 5 Chemical contamination

|     |                                                              |
|-----|--------------------------------------------------------------|
| 5.1 | Contaminated land, regulations and liabilities               |
| 5.2 | Objectives and procedures                                    |
| 5.3 | Development characterisation and identified receptors        |
| 5.4 | Identification of pathways                                   |
| 5.5 | Assessment of sources of contamination                       |
| 5.6 | Initial conceptual model                                     |
| 5.7 | Risk assessment summary and recommendations                  |
| 5.8 | Statement with respect to National Planning Policy Framework |

### 5.1 Contaminated land, regulation and liabilities

#### 5.1.1 Statute

5.1.1.1 Part IIA of the Environment Protection Act 1990 became statute in April 2000. The principal feature of this legislation is that the hazards associated with contaminated land should be evaluated in the context of a site-specific risk based framework. More specifically contaminated land is defined as:

“any land which appears to the local authority in whose area it is situated to be in such a condition, by reasons of substances in, on or under the land, that:

- a) Significant harm is being caused or there is a significant possibility of such harm being caused; or
- b) Pollution of controlled waters is being or is likely to be caused”.

5.1.1.2 Central to the investigation of contaminated land and the assessment of risks posed by this land is that:

- i) There must be contaminants(s) at concentrations capable of causing health effects (Sources).
- ii) There must be a human or environmental receptor present, or one which makes use of the site periodically (Receptor); and
- iii) There must be an exposure pathway by which the receptor comes into contact with the environmental contaminant (Pathway).

5.1.1.3 In most cases the Act is regulated by Borough or District Councils and their role is as follows:

- i) Inspect their area to identify contaminated land
- ii) Establish responsibilities for remediation of the land
- iii) See that appropriate remediation takes place through agreement with those responsible, or if not possible:
  - by serving a remediation notice, or
  - in certain cases carrying out the works themselves, or

in certain cases by other powers

iv) keep a public register detailing the regulatory action which they have taken

5.1.1.4 For “special” sites the Environment Agency will take over from the Council as regulator. Special sites typically include:-

Contaminated land which affects controlled water and their quality  
Oil refineries  
Nuclear sites  
Waste management sites

5.1.2 Liabilities under the Act

5.1.2.1 Liability for remediation of contaminated land would be assigned to persons, organisations or businesses if they caused, or knowingly permitted contamination, or if they own or occupy contaminated land in a case where no polluter can be found.

5.1.3 Relevance to predevelopment conditions

5.1.3.1 For current use, Part IIA of the Environmental Protection Act 1990 provides the regulatory regime. The presence of harmful chemicals could provide a ‘source’ in a ‘pollutant linkage’ allowing the regulator (local authority or Environment Agency) to determine if there is a significant possibility of harm being caused to humans, buildings or the environment. Under such circumstances the regulator would determine the land as ‘contaminated’ under the provision of the Act requiring the remediation process to be implemented.

5.1.4 Relevance to planned development

5.1.4.1 The developer is responsible for determining whether land is suitable for a particular development or can be made so by remedial action. In particular, the developer should carry out an adequate investigation to inform a risk assessment to determine:

- a) Whether the land in question is already affected by contamination through source – pathway – receptor pollutant linkages and how those linkages are represented in a conceptual model
- b) Whether the development proposed will create new linkages e.g. new pathways by which existing contaminants might reach existing or proposed receptors and whether it will introduce new vulnerable receptors, and
- c) What action is needed to break those linkages and avoid new ones, deal with any unacceptable risks and enable safe development and future occupancy of the site and neighbouring land?

5.1.4.2 Building control bodies enforce compliance with the Building Regulations. Practical guidance is provided in Approved documents, one of which is Part C, ‘Site preparation and resistance to contaminants and moisture’ which seeks to protect the health, safety and welfare of people in and around buildings, and includes requirements for protection against harm from chemical contaminants.

5.1.5 Pollution of controlled waters

5.1.5.1 Part IIA of the Environment Protection Act 1990, defines pollution of controlled waters as

‘The entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter’

5.1.5.2 Paragraphs A36 and A39 of statutory guidance (DETR 2000) further define the basis on which land may be determined to be contaminated land on the basis of pollution of controlled waters.

‘Before determining that pollution of controlled waters is being, or likely to be, caused, the Local Authority should be satisfied that a substance is continuing to enter controlled waters, or is likely to enter controlled waters. For this purpose, the local authority should regard something as being likely when they judge it more likely than not to occur’

‘Land should not be designated as contaminated land where:

- a) A substance is already present in controlled waters:
- b) Entry into controlled waters of that substance from the land has ceased, and
- c) It is not likely that further entry will take place.

Substances should be regarded as having entered controlled waters where:

- a) They are dissolved or suspended in those waters; or
- b) If they are immiscible with water, they have direct contact with those waters, or beneath the surface of the waters’

5.1.5.3 Controlled waters are defined in statute to be:

‘territorial waters which extend seawards for 3 miles, coastal waters, inland freshwaters, that is to say, the waters in any relevant lake or pond or of so much of any relevant river or watercourse as is above the freshwater limit, and groundwaters, that is to say, any waters contained in underground strata.’

5.1.6 Further information

5.1.6.1 The above provides a brief outline as regards current statute and planning controls. Further information can be obtained from the Department for the Environment, Food and Rural Affairs (DEFRA) and their Web site [www.defra.gov.uk](http://www.defra.gov.uk).

## 5.2 Objectives and procedures

### 5.2.1 Objectives

5.2.1.1 This report section discusses investigations carried out with respect to chemical contamination issues relating to the site. The investigations were carried out to determine if there are any liabilities with respect to Part IIA of the Environment Protection Act. As stated in Section 2.4.2, the investigation process followed the principles of BS10175: 2011 'Investigation of potentially contaminated sites – Code of Practice', but limited to a desk study (preliminary investigation)

5.2.1.2 This section of the report produces 'Conceptual models' based on desk study information obtained to date. The conceptual model is constructed by identification of contaminants and establishment of feasible pathways and receptors. The conceptual model allows a risk assessment to be derived. Depending upon the outcome of the risk assessment it may be necessary to carry out remediation and/or further investigations with a view to eliminating, reducing or refining the risk of harm being caused to identified receptors. If appropriate, our report will provide recommendations in this respect.

5.2.1.3 Definition of terms used in the preceding paragraph and subsequent parts of this section of the report are presented in Appendix C.

### 5.2.2 Procedure to assess risks of chemical contamination

5.2.2.1 For the purposes of presenting this section of this report, we have adopted the following sequence in assessing risks associated with chemical contamination.

Table outlining sequence to assess risk associated with chemical contamination

| Conceptual model element | Contributory information                               | Outcome                                                                                       |
|--------------------------|--------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Receptor                 | Development categorisation                             | Identification of receptors at risk of being harmed<br>Criteria for risk assessment modelling |
| Pathways                 | Geology and ground conditions<br>Development proposals | Identification of critical pathways from sources to receptors                                 |
| Source                   | Previous site history<br>Desk study information        | Identification of a chemical source                                                           |

Table 5.2.2

5.2.2.2 We have adopted, in general, the procedures described in CIRIA C552 'Contaminated land risk assessment - a guide to good practice' in deriving a risk assessment. Initially we have carried out a 'phase 1 assessment' based on desk study information and site reconnaissance, to produce an initial conceptual model and thus a preliminary risk assessment. This model / assessment is then used to target future fieldwork activities and laboratory testing, ultimately allowing the conceptual model to be updated and risk assessments to be refined.

## 5.3 Development characterisation and identified receptors

### 5.3.1 Site characterisation

5.3.1.1 The nature of the site has a significant influence the likely exposure pathways between potentially contaminated soils and potential receptors. The following table summarises elements which characterise the site based on desk study information.

| Summary of site characteristics |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Element                         | Source / criteria | Characteristic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Current land use                | Observations      | Site currently predominantly agricultural, with Florida Farm located centrally and area to the south-west disused.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Future land use                 | Advice            | Proposed domestic housing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Site history                    | Desk study        | Majority of the site has been recorded as arable land, with the current farm buildings recorded in some form from the earliest historical maps in addition to the stream which runs through the centre. The south-western part of the site recorded as vegetated land, possibly even a quarry, with small buildings recorded during recent years. A number of relatively small coal pits and later shafts have been recorded locally across the site, in addition to a track/road in the western most field. In more recent times a tennis court was recorded in the north-eastern corner of the site, with a small pond likely to have been backfilled adjacent to the south-west of Florida Farm. |
| Geology                         | Desk study        | Possible localised Made Ground overlying Devensian Till (clays) overlying mudstone, siltstones, sandstones and coals of the Pennine Middle Coal Measures Formation. Higher Florida coal seam recorded at surface of bedrock in the western part of the site.                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Ground water                    | Aquifer potential | Secondary Undifferentiated aquifer in the Devensian Till deposits and Secondary A aquifer in Pennine Middle Coal Measures Formation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                 | Abstractions      | One active groundwater abstraction point lies 1596m to the south of the site, used for farming purposes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Surface waters                  | Location          | Clipsley Brook forms southern site boundary. Smaller stream recorded through the centre of the site flowing north-east to south-west.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                 | Abstractions      | The closest surface water abstraction point lies 1227m to the south-west of the site, with water abstracted from a canal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Table 5.3.1                     |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

## 5.3.2 Identified receptors

5.3.2.1 The principal receptors subject to harm caused by any contamination of the proposed development site are as follows.

| Principle Receptor | Detail                                                               |
|--------------------|----------------------------------------------------------------------|
| Humans             | Users of the current site                                            |
|                    | End user of the developed site                                       |
|                    | Construction operatives and other site investigators                 |
| Vegetation         | Plants and trees, both before and after development                  |
| Controlled waters  | Surface waters (Rivers, streams, ponds and above ground reservoirs)  |
|                    | Ground waters (used for abstraction or feeding rivers / streams etc) |
| Building materials | Materials in contact with the ground                                 |
| Table 5.3.2        |                                                                      |

This section of the report assesses those receptors listed above. Section 10 provides a risk assessment in relation to building materials.

## 5.3.3 Human receptors

5.3.3.1 The Contaminated Land Exposure Assessment (CLEA) model can be used to derive guideline values, against which land quality data can be compared to allow an assessment of the likely impacts of soil contamination on humans. The parameters used within the model can be chosen to allow guideline values to be derived for a variety of land uses and exposure pathways. For example, a construction worker is likely to be exposed in different ways and for different durations than an adult in a residential setting.

5.3.3.2 As the current site is predominantly used for arable farming the adult is considered an appropriate adult receptor. Following completion of the residential development the critical site user (receptor) is considered to be a child under the age of 6 years. This criterion has been used in the conceptual model for the current and future site use. Our assessment also considers construction operatives as adult receptors.

## 5.3.4 Vegetation receptors

5.3.4.1 Soil contaminants can have an adverse effect on plants if they are present at sufficient concentrations. The effects of phytotoxic contaminations include growth inhibition, interference with natural processes within the plant and nutrient deficiencies.

5.3.4.2 There are a number of trees which border the site, in addition to bordering the stream which flows through the site, covering the majority of the south-western part of the site and locally around the existing site of Florida Farm. It is not understood at the stage if such vegetation will be retained as part of the development, however, is considered to be present to some extent. Vegetation will therefore be considered a viable receptor.

### 5.3.5 Water receptors

5.3.4.1 The site lies in an area designated as a Secondary undifferentiated aquifer contained in the underlying Devensian Till deposits which are likely to be cohesive in nature and unlikely to contain groundwater. Clipsley Brook forms the southern site boundary, with a further unnamed stream flowing through the centre of the site in a north-east to south-west direction. On this basis, given the likely impermeable nature of the near surface Devensian Till deposits, groundwater will not be considered a viable receptor. Due to the presence of water courses on site and forming the southern site boundary, surface water will be considered a viable receptor.

### 5.3.6 Building materials.

5.3.6.1 Building materials in contact with the ground such as concrete foundations and water supply pipes, are receptive to damage caused by aggressive ground conditions. Generally risks and preventative measures are impossible to establish at the desk study stage and investigations are required to manage any identified risks. At this stage this receptor group are not considered further.

### 5.3.7 Summary of identified receptors

5.3.7.1 Based on the above assessments, the following table summarises identified and critical receptors.

| Table summarising identified (viable) receptors |                                                                       |                               |                                     |                    |
|-------------------------------------------------|-----------------------------------------------------------------------|-------------------------------|-------------------------------------|--------------------|
| Principle Receptor                              | Detail                                                                | Viable and critical receptors |                                     |                    |
|                                                 |                                                                       | Viability and justification   | Critical receptor                   |                    |
| Humans                                          | Users of the current site                                             | Yes                           | Site used for farming               | Adult              |
|                                                 | End user of the developed site                                        | Yes                           | Gardens accessible to children      | Child              |
|                                                 | Construction operatives and other site investigators                  | Yes                           |                                     | Adult              |
| Vegetation                                      | Current site                                                          | Yes                           | Trees on site                       | Vegetation         |
|                                                 | Developed site                                                        | Yes                           | Trees to remain                     | Vegetation         |
| Controlled waters                               | Surface waters (Rivers, streams, ponds and above ground reservoirs)   | Yes                           | Stream onsite and adjacent to south | Surface waters     |
|                                                 | Ground waters (used for abstraction or feeding rivers / streams etc.) | No                            | Clay soils likely                   | Groundwater        |
| Building materials                              | Materials in contact with the ground                                  | Yes                           | Not considered further              | Building materials |
| Table 5.3.7                                     |                                                                       |                               |                                     |                    |

## 5.4 Identification of pathways

### 5.4.1 Pathways to human receptors

5.4.1.1 Guidance published by the Environment Agency in Science Report SC050021/SR3 'Updated technical background to the CLEA model' provides a detailed assessment of pathways and assessment and human exposure rates to source contaminants. In summary, there are three principal pathway groups for a human receptor:

| Table summarising likely pathways      |                                          |
|----------------------------------------|------------------------------------------|
| Principal pathways                     | Detail                                   |
| Ingestion through the mouth            | Ingestion of air-borne dusts             |
|                                        | Ingestion of soil                        |
|                                        | Ingestion of soil attached to vegetables |
|                                        | Ingestion of home grown vegetables       |
| Inhalation through the nose and mouth. | Inhalation of air-borne dusts            |
|                                        | Inhalation of vapours                    |
| Absorption through the skin.           | Dermal contact with dust                 |
|                                        | Dermal contact with soil                 |

Table 5.4.1

5.4.1.2 The site is currently used as arable land, with a small number of farm buildings located centrally. On this basis all of the above will be considered as potential pathways with the exception of those associated with vegetables for current land use.

5.4.1.3 The site will be redeveloped for residential use which will contain domestic type gardens. Based on such all of the above pathways will be considered for future site use. A summary of our pathway assessment is presented in Section 5.4.4.

### 5.4.2 Pathways to vegetation

5.4.2.1 Guidance published by the Environment Agency in Science Report SC050021/SR (Evaluation of models for predicting plant uptake of chemicals from soil) provides a detailed assessment of plant uptake pathways. In summary, plants are exposed to contaminants in soils by the following pathways:

Passive and active uptake by roots.  
Gaseous and particulate deposition to above ground shoots.  
Direct contact between soils and plant tissue.

5.4.2.2 All of the above routes of exposure are considered to be present for vegetation.

### 5.4.3 Pathways to controlled waters

5.4.3.1 A number of pathways exist for the transport of soil contamination to controlled waters. A summary of these pathways is presented below:

Percolation of water through contaminated soils.  
Near-surface water run-off through contaminated soils.

### Saturation of contaminated soils by flood waters.

5.4.3.2 The subject site is anticipated to be underlain by Devensian Till (clays) to depths of 9m to 17m which are not likely to contain a productive aquifer and also exhibit negligible permeability. Whilst unlikely to contain groundwater or allow percolation of water, such soils will promote near surface water run off through potentially contaminated soils, which could feasibly migrate into the stream recorded onsite and adjacent to the south.

5.4.3.3 Very localised areas in the south-west, east and south-east are recorded in Flood zones 2 and 3, therefore, saturation of contaminated soils by flood waters will be considered a potential pathway as a precaution.

### 5.4.4 Summary of identified likely pathways

5.4.4.1 Based on the above assessments, the following table summarises likely pathways of potential chemical contaminants at the site to identified receptors.

| Table of likely pathways                       |                   |                                                       |
|------------------------------------------------|-------------------|-------------------------------------------------------|
| Receptor group                                 | Critical receptor | Pathway                                               |
| Proposed site users                            | Child             | Ingestion air-borne dusts                             |
|                                                |                   | Ingestion of soil                                     |
|                                                |                   | Ingestion of soil attached to vegetables              |
|                                                |                   | Ingestion of home grown vegetables                    |
|                                                |                   | Inhalation air-borne dusts                            |
|                                                |                   | Inhalation of vapours                                 |
|                                                |                   | Dermal contact with dust                              |
|                                                |                   | Dermal contact with soil                              |
| Current site users and construction operatives | Adult             | Ingestion of air-borne dusts                          |
|                                                |                   | Ingestion of soil                                     |
|                                                |                   | Inhalation of air-borne dusts                         |
|                                                |                   | Inhalation of vapours                                 |
|                                                |                   | Dermal contact with dust                              |
| Vegetation                                     |                   | Dermal contact with soil                              |
|                                                |                   | Root uptake, deposition to shoots and foliage contact |
| Controlled waters                              | Groundwater       | Saturation of contaminated soils by flood waters      |
|                                                | Surface water     | Near-surface water run-off through contaminated soils |

Table 5.4.4

## 5.5 Assessment of sources of chemical contamination

### 5.5.1 Introduction

5.5.1.1 Initially, potential sources of contamination are assessed using the following elements of the investigation process.

1. History of the site
2. Desk study information
3. Geology
4. Site reconnaissance

These elements will dictate a relevant soil/water testing regime to quantify possible risks of any identified contaminative sources which may harm identified receptors. At this stage however our assessment is restricted to desk study information.

5.5.2 Source assessment – History of the site

5.5.2.1 The history of the site and its immediate surroundings based on published historical maps is described in Section 3.

5.5.2.2 Based on published historical maps, the majority of the site has been recorded as arable land, with the current farm buildings recorded in some form from the earliest historical maps. The stream which runs through the centre of the site has also been recorded from the earliest maps, with the south-western part of the site recorded as vegetated land, possibly even a quarry, with small buildings recorded during recent years. A number of relatively small coal pits and later shafts have been recorded locally across the site, in addition to a track/road in the western most field (the latter no longer present from the 1950s). In more recent times a tennis court was recorded in the north-eastern corner of the site, with a small pond likely to have been backfilled adjacent to the south-west of Florida Farm.

5.5.2.3 It is likely that the former coal pits and shafts have been backfilled to some extent, probably with locally sourced reworked naturally deposited soils (given the time period it is likely that any mad made materials present in the soils are limited) and possibly with some mine arising's, coal or ashes. If the south-western part of the site was indeed quarried, then again this may have been backfilled with similar materials. There may also be some similar material associated with the former road/track onsite. Subsequently, contaminants associated with these works are anticipated to be limited to commonly occurring contaminants such as metals and Polycyclic Aromatic Hydrocarbons (PAHs).

5.5.2.4 Immediately adjacent sites were generally associated with coal mining. A number of collieries were recorded locally, with associated mineral railways, in addition to pits, brick fields, small quarries, and in later years a series of unclassified works buildings and depots. Given the presence of impermeable Devensian Till in the area, it is considered unlikely that any associated contamination would have feasibly migrated to site and affected near surface soils.

5.5.3 Source assessment – Desk study information

5.5.3.1 Envirocheck presents a detailed database of environmental information in relation to the site including;

Pollution incidents  
Landfill sites and infilled ground  
Trading activities

#### 5.5.3.2 Pollution incidents

5.5.3.2.1 Based on the Envirocheck data (refer Appendix A), there are two pollution incidents recorded onsite, in addition to a further ten incidents recorded within 100m of the site. The two incidents recorded onsite relate to the release of a miscellaneous pollutant which turned Clipsley Brook a 'milky white' colour, in addition to oils, both categorised as minor incidents and dated 1998. Given the severity of the incidents it is considered unlikely that any residual contamination would significantly affect near surface soils at the site.

#### 5.5.3.3 Landfill sites and infilled ground

5.5.3.3.1 There is one historic landfill site located within 1km of the site. This is associated with Clipsley Lane landfill site (former railway cutting), located 596m to the south east of the site. The site is also a Local Authority recorded site. No information of its period of operation or received wastes is available. Given the distance to the site, any potential contaminants are considered unlikely to migrate and affect near surface soils at the site.

5.5.3.3.2 There are also 31 areas recorded as potentially infilled land, 13 of which are recorded within 500m of the site and 2 located on site. These are likely to coincide with the Leigh Pit and Princess Pit landfills outlined by the Local Authority. The onsite areas of infilled land may be associated with former unrecorded pits/quarries which pre-date earliest historical maps, or related to the backfilling/remediation of shafts recorded onsite. As a precaution, we have assumed that the areas of potentially infilled ground onsite could be backfilled with materials which would provide a source of contamination.

#### 5.5.3.4 Trading activities

5.5.3.4.1 Envirocheck reports a small number of active trade directories within 100m of the site. The closest is recorded 8m to the northwest of the site and associated with a vehicle repair garage. Given the scale of the trading activity, it is considered unlikely that any significant chemical contamination would be generated onsite, which could also feasibly migrate to the subject site.

#### 5.5.4 Source assessment – Site reconnaissance

5.5.4.1 A full description of the site and observed adjacent land uses is provided in Section 3 of this report. A plan summarising observations made on site during our site reconnaissance visit is presented on Drawing 02.

5.5.4.2 We did not observe any obvious evidence of any current or recent activities on site or adjacent sites, which provide a potential source of chemical contamination. The buildings associated with Florida Farm were not noted to contain significant quantities of chemicals, and only a small amount plant/machinery was present. No above ground fuel tanks were noted.

5.5.4.3 The site has been subject to arable farming for a number of years and it is considered likely that some form of fertiliser and/or pesticides/insecticides have been used. Chemicals which are likely to persist over time within soils associated with such land use would be limited to metals and some organic contaminants such as PAHs. We have considered such usage as a potential source of contamination.

## 5.5.5 Source assessment – Geology

5.5.5.1 The geological map of the area indicates the topography local to the site is formed in deposits of Devensian Till overlying bedrock of the Pennine Middle Coal Measures Formation. Typically, and in our experience, these deposits do not exhibit any abnormal concentrations of naturally occurring chemical contaminants.

## 5.5.6 Source assessment - summary

5.5.6.1 Based on the paragraphs above, we have identified the following potential sources of contamination:

| Table summarising results of source assessment                                 |                       |                                                                |                               |                                             |
|--------------------------------------------------------------------------------|-----------------------|----------------------------------------------------------------|-------------------------------|---------------------------------------------|
| Source                                                                         | Origin of information | Possible contaminant                                           | Probability of risk occurring | Likely extent of contamination              |
| <b>On site</b>                                                                 |                       |                                                                |                               |                                             |
| Mining activities – shafts, pits, possible quarry                              | Desk study            | Reworked natural soils, with coals, ash – some metals and PAHs | Likely                        | Local to areas of former pits/shafts/quarry |
| General Made Ground associated with minor areas of development across the site | Desk Study            | Metals, ACM, PAH's                                             | Likely                        | Local to development                        |
| Infilled ground in western and north-eastern parts of the site                 | Desk Study            | Reworked natural soils, with coals, ash – some metals and PAHs | Possible                      | Western and north-eastern parts of the site |
| Historic and recent use of fertilisers/pesticides/insecticides                 | Site reconnaissance   | Persistent metals and PAHs                                     | Likely                        | Site wide                                   |
| Table reference 5.5.6                                                          |                       |                                                                |                               |                                             |

## 5.6 Initial Conceptual Model

5.6.1 Based on our assessment of potential contaminative sources, identified receptors and viable pathways to receptors described in preceding paragraphs, we have produced an initial conceptual model in the form of a table which is presented in Appendix D.

5.6.2 Based on the conceptual model the initial assessment of risk of chemical contamination causing harm to identified receptors does not exceed the low / moderate category in a number of instances, but this is solely based on desk study information. Clearly investigations are required to quantify and refine risks, but at this stage significant remediation considered unlikely.

## 5.7 Risk assessment summary and recommendations

5.7.1 Based on our assessments described above, we can provide the following summary and recommendations for each identified receptor.

5.7.2 Current site users

5.7.2.1 Whilst potential sources of chemical contamination has been identified on site, we are of the opinion that the site is likely to represent a low risk of causing harm to the health of identified current users of the site.

5.7.2 End users

5.7.2.1 Potential sources of chemical contamination have been identified onsite and are limited to activities associated with mining/quarrying, minor development, farming and potential infilling. These sources are anticipated to be isolated in a small number of locations. Consequently we are of the opinion that the site represents a low-moderate risk of causing harm to the health of end users and intrusive works are required to determine the composition of soils onsite, supplemented by appropriate laboratory testing.

5.7.3 Construction operatives and other site investigators

5.7.3.1 The risk of damage to health of construction operatives and other site investigators is, in our opinion, low-moderate, and would be minimised by taking adequate hygiene precautions on site. Such precautions would be:-

- Wearing protective clothing particularly gloves to minimise ingestion from soil contaminated hands.
- Avoiding dust by dampening the soils during the works.
- Wearing masks if processing produce dust.

5.7.3.2 Guidance on safe working practices can be obtained from the following documents

- The Health and Safety Executive Publication "Protection of Workers and the General Public during the Development of Contaminated Land" (HMSO) and
- "A Guide to Safer Working on Contaminated Sites" (CIRIA Report 132).

5.7.3.3 In addition, reference should be made to the Health and Safety Executive. In all cases work shall be undertaken following the requirements of the Health and Safety at Work Act 1974 and regulations made under the Act including the COSHH regulations.

5.7.4 Controlled waters

5.7.4.1 Potential sources of chemical contamination have been identified as outlined in paragraph 5.7.2.1 above. Consequently we are of the opinion that the site represents a low-moderate risk of causing harm to water receptors and intrusive works are required to determine the composition of soils onsite, supplemented by appropriate laboratory testing.

5.7.5 Vegetation

5.7.5.1 Potential sources of chemical contamination have been identified as outlined in paragraph 5.7.2.1 above. Consequently, whilst existing vegetation onsite appeared to be healthy, we are of the opinion that the site potentially represents a low-moderate risk of causing harm to vegetation and intrusive works are required to determine the composition of soils onsite, supplemented by appropriate laboratory testing.

5.8 Statement with respect to National Planning Policy Framework

5.8.1 Based on investigations completed to date with respect to chemical contamination, providing the above recommendations are satisfactorily completed, we are of the opinion the proposed development will be safe and suitable for use for the purpose for which it is intended thus meeting the requirements of the National Planning Policy Framework section 121, and compliant with the Building Regulations Part C, 'Site preparation and resistance to contaminants and moisture'.

## 6 Gaseous contamination

|     |                                                              |
|-----|--------------------------------------------------------------|
| 6.1 | Legislative framework                                        |
| 6.2 | General                                                      |
| 6.3 | Assessment of source of gases                                |
| 6.4 | Conclusion                                                   |
| 6.5 | Statement with respect to National Planning Policy Framework |

### 6.1 Legislative framework

- 6.1.1 There is currently a complex mix of documentation relating to legislative and regulatory procedures on the issue of contamination, and it is not considered a purpose of this report to discuss the detail of these regulations. Essentially, Government Policy is based on 'suitable for use approach', which is relevant to both the current and proposed future use of land. For current use Part IIA of the Environmental Protection Act 1990 provides the regulatory regime (see Section 5.1 above). The presence of harmful soil gases could provide a 'source' in a 'pollutant linkage' allowing the regulator (Local Authority) to determine if there is a significant possibility of harm being caused to humans, buildings or the environment. Under such circumstances the regulator would determine the land as 'contaminated' under the provision of the Act requiring the remediation process to be implemented with the Environment Agency responsible for enforcement.
- 6.1.2 The Town and Country Planning (General Development Procedure) Order 1995, requires the planning authority to consult with the Environment Agency before granting planning permission for development on land within 250 metres of land which is being used for deposit of waste, (or has been at any time in the last 30 years) or has been notified to the planning authority for the purposes of that provision.
- 6.1.3 Building control bodies enforce compliance with the Building Regulations. Practical guidance is provided in Approved documents, one of which is Part C, 'Site preparation and resistance to contaminants and moisture' which seeks to protect the health, safety and welfare of people in and around buildings, and includes requirements for protection against harm from soil gas.

### 6.2 General

- 6.2.1 The following assessment relates to the potential for, and the effects of, gases generated by biodegradable matter. A separate, but related class of problem involves migration of vapour phase of hydrocarbons resulting from spillages of petroleum and solvents, but will be considered during future site investigations. The potential for the development to be affected by Radon Gas is considered in Section 3 above. The principal ground gases are carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>). The following table provides a summary of the effects of these gases when mixed with air.

| Significant gas concentrations in air |                         |                                                               |
|---------------------------------------|-------------------------|---------------------------------------------------------------|
| Gas                                   | Concentration by volume | Consequence                                                   |
| Methane                               | 0.25%                   | Ventilation required in confined spaces                       |
|                                       | 5%                      | Potentially explosive when mixed with air                     |
|                                       | 30%                     | Asphyxiation                                                  |
| Carbon Dioxide                        | 0.5%                    | 5 hour long term exposure limit (LTEL) (HSE workplace limit)  |
|                                       | 1.5%                    | 15 min short term exposure limit (STEL) (HSE workplace limit) |
|                                       | >3%                     | Breathing difficulties                                        |
|                                       | >5%                     | Death can occur                                               |

Table 6.2.1

6.2.2 Following the current Building Regulations Approved Document C1, Section 2 'Resistance to Contaminates' (2004 incorporating 2010 and 2013 amendments) a risk assessment approach is required in relation to gaseous contamination based on the source-pathway-receptor conceptual model procedure. We have adopted procedures described in the following reference documents for investigation and assessments of risk of the development being affected by landfill type gases (permanent gases) and if appropriate the identification of mitigation measures.

BS10175:2011 'Investigation of potentially contaminated sites- Code of Practice'

BS8576:2013 'Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)'

BS8485:2015 'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'

CIRIA Report C665 'Assessing risks posed by hazardous ground gases to buildings' (2007)

NHBC report No 10627-R01(04) 'Guidance on development proposals on sites where methane and carbon dioxide are present' (January 2007)

CL:AIRE Research Bulletin RB17 'A pragmatic approach to ground gas risk assessment' (November 2012)

6.2.3 An assessment of the risk of the site being affected by ground gases is based on the following aspects.

- a) Source of the gas
- b) Investigation information
- c) Migration feasibility
- d) Sensitivity of the development and its location relative to the source

## 6.3 Assessment of source of gases

### 6.3.1 General sources

#### 6.3.1.1 The following table summarises the source of gases and parameters for producing gases

| Source and control of gases |                                                                                    |
|-----------------------------|------------------------------------------------------------------------------------|
| Type                        | Parameters affecting the rate of gassing                                           |
| Landfills                   | Portion of biodegradable material, rate reduces with time.                         |
| Mine workings               | Flooding reduces rate of gassing                                                   |
| Dock silt                   | Portion of organic matter                                                          |
| Carbonate deposits          | Ground / rainwater (acidic) reacts with some carbonates to produce carbon dioxide. |
| Soils / rocks               | Portion of organic matter                                                          |

Table 6.3.1

The rate of decomposition in gas production is also related to atmospheric conditions, pH, temperature, and water content / infiltration.

#### 6.3.1.2 The site is not located within a dockland environment and near surface soils are unlikely to exhibit high carbonate content, then potential gas sources are limited to landfills, soils with a high proportion of organic matter and mine workings.

### 6.3.2 Landfill and infilled ground sources

#### 6.3.2.1 Waste Management Paper 27 (1991) produced by the Department of the Environment 'Control of Landfill Gases' contains the recommendation to avoid building within 50m of a landfill site actively producing large quantities of landfill type gases and to carry out site investigations within a zone 250m beyond the boundary of a landfill site. No distinction is made between sites of differing ground conditions, but the paper does not advocate the site is safe beyond the 250m zone, dependant, of course, upon the type of landfill and potential for migration of landfill gases.

#### 6.3.2.2 No landfills are present within 596m of the site. However, 6 recorded mineral sites are present within 1km of the site, the nearest of which is located 52m to the south-west of the site, and the possibility cannot be discounted that these have been used for waste deposition with material which could produce landfill type gases.

#### 6.3.2.3 There are also 31 areas recorded as potentially infilled land, 13 of which are recorded within 500m of the site and 2 located on site. The areas of infilled land recorded onsite are present in the western and north-eastern part of the site and may be associated with former unrecorded pits/quarries which pre-date earliest historical maps, or related to the backfilling/remediation of mine shafts/coal pits recorded historically onsite. Again, as no records are available in relation to the areas of infilled land, we would have to adopt a worst case scenario and assume that materials which have the potential to generate landfill type gases have been used onsite. The Local Authority also indicates a landfill containing colliery spoil adjacent to the south-east (Leigh Pit).

6.3.2.4 In addition, the south-western part of the site may have been subject to quarrying activities, likely to be associated with the exploitation of sandstone. Similarly, adjacent areas of land have also been subject to the exploitation of sandstone and may have been restored with materials which have the potential to generate landfill type gases.

### 6.3.3 Mine workings

6.3.3.1 In addition to the above, and with reference to our Preliminary Coal Mining Risk Assessment Report (ref R-STN3680NM-PCMA01), mine workings are known to exist below the north-eastern part of the site, associated with the exploitation of the Higher and Lower Florida coal seams. These seams are also known to have a history of spontaneous combustion. Such worked seams may contain significant quantities of mine gas which is worthy of further consideration.

### 6.3.4 Soil conditions

6.3.4.1 With the exception of those areas as discussed in Section 6.3.2 above, based on anticipated ground conditions we are of the opinion that soils at the site are unlikely to exhibit significant concentrations of organic matter with the potential to produce elevated quantities of carbon dioxide and / or methane gas.

6.3.4.2 With the exception of mine workings as discussed in Section 6.3.3, based on an assessment of 'deep' geological conditions we are of the opinion that it is likely that the subject site would be affected by significant quantities of carbon dioxide and methane generated by soils/rocks at depth.

### 6.3.5 Source assessment summary

6.3.5.1 The following table summarises the possibility of a source of landfill type gases.

| Source assessment summary |                     |                                                                                                                                                                                                                                      |
|---------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Potential source origin   | Viability of source | Evidence                                                                                                                                                                                                                             |
| Landfills                 | Unlikely            | Desk study information                                                                                                                                                                                                               |
| Infilled ground           | Possible            | Desk study information – 2 large areas of infilled ground recorded onsite, former coal pits/shafts, in addition to possible quarry to the south-west and immediately adjacent sites which have been subject to quarrying activities. |
| Mine workings             | Likely              | Desk Study information –workings known to exist in the north-eastern part of the site related to mining of the Higher and Lower Florida coal seams                                                                                   |
| Dock silt                 | Unlikely            | Site remote from dockland environment                                                                                                                                                                                                |
| Carbonate deposits        | Unlikely            | Recorded and observed soil conditions do not indicate high concentrations of carbonates                                                                                                                                              |
| Soils / rocks             | Unlikely            | Soils unlikely to exhibit high concentrations of organic matter                                                                                                                                                                      |
| Table 6.3.5               |                     |                                                                                                                                                                                                                                      |

## 6.4 Conclusion

- 6.3.4.1 Based on the above it there is a possibility of a source of potential landfill gases which may affect the subject site. On this basis, it is considered necessary to consider possible pathways for migration of ground gases, from this potential source to the site.

## 6.4 Gas migration

- 6.4.1 Geological maps record the topography of the area is formed in deposits of Devensian Till comprising clays to depths of in excess of 7m (based on mine shaft records). Based on published memoirs and in our experience, these deposits are effectively impermeable and would significantly restrict both lateral and vertical migration of landfill type gases. On this basis it is considered unlikely that the potential source of landfill type gases associated with mine workings would feasibly migrate to the surface into proposed dwellings. There could be a preferential pathway via the mine shafts recorded across site as we are not aware they have been remediated (with the exception of one) based on records obtained from the Coal Authority (further details provided in Preliminary Coal Mining Risk Assessment report ref R-STN3680NM-PCMA01), however, providing dwellings are not constructed immediately above such shafts, the risk of any gases affecting the site are considered to be low.
- 6.4.2 Whilst not recorded on historical maps, assuming that the two large areas of potentially infilled land onsite may have comprised of pits/quarries, and have been restored to current surface with materials which could produce landfill type gases, there is direct pathway for gases to migrate into any dwellings construction in such areas of the site. In addition, if the south-western part of the site has been subject to quarrying activities, a similar pathway may also exist.

## 6.5 Conceptual model

- 6.5.1 Based on the above, there is a potential source of landfill type gases associated with the large areas of potentially infilled ground, and, assuming these are present and restored to current surface levels, a feasible direct migration pathway into proposed dwellings constructed in such areas. Our conceptual model is tabled below. On this evidence we are of the opinion that the site is potentially at risk of being affected by ground gases (carbon dioxide / methane) sufficient to potentially cause harm to human end users of the site, construction operatives or indeed buildings. On this basis, investigations are required following procedures described in CIRIA report C665, to quantify the risk, and if appropriate, identify mitigation measures selected with reference to documents listed in section 6.2.2 above.

| Conceptual model                                                                                   |                                             |                                                   |
|----------------------------------------------------------------------------------------------------|---------------------------------------------|---------------------------------------------------|
| Potential source origin                                                                            | Potential pathway                           | Receptors at risk                                 |
| 2 large areas of infilled ground recorded onsite, in addition to possible quarry to the south-west | Direct via backfill into proposed dwellings | End users<br>Construction operatives<br>Buildings |
| Table 6.5.1                                                                                        |                                             |                                                   |

## 6.8 Statement with respect to National Planning Policy Framework

- 6.8.1 Providing the recommendations described above are satisfactorily completed meeting the requirements of nationally recognised guidance, we are of the opinion the proposed development will be safe and suitable for use for the purpose for which it is intended, thus meeting the requirements of the National Planning Policy Framework section 121, and compliant with the Building Regulations Part C, 'Site preparation and resistance to contaminants and moisture'.

## 7 Future investigations

- 7.1 Investigations comprising boreholes and / or trial pits are required to progress this project for the design and construction stages. The objectives of the investigations are as follows

| Topic                      | Objective                                                                   | Investigation                                                                                                                                        |
|----------------------------|-----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Coal mining                | Determine likelihood of presence of historic workings, shafts and coal pits | Undertake desk based Preliminary Investigation Report (refer to R-STN3680NM-PCM01). If risk exceeds the low category, undertake intrusive site works |
| Ground conditions          | Determine soil profiles                                                     | Trial pits / boreholes                                                                                                                               |
| Foundations                | Identify appropriate foundation solutions (buildings and pavements)         | Trial pits / boreholes with appropriate laboratory testing                                                                                           |
| Effect of agriculture      | Determine effects of crops on soils and thus foundation depths              | Trial pits / boreholes with appropriate laboratory testing                                                                                           |
| Soakaways                  | Feasibility                                                                 | Infiltration testing                                                                                                                                 |
| Chemical contamination     | Refine risk assessments                                                     | Trial pits / boreholes with appropriate laboratory testing                                                                                           |
| Gaseous contamination      | Refine risk assessments                                                     | Review on completion of site investigations                                                                                                          |
| Soils for offsite disposal | Classification                                                              | Laboratory testing of any Made Ground and soils possibly affected by contamination.                                                                  |

Table 7.1