



Harworth Estates Limited

Thoresby Area B – Residential Phases 1 and 2 Development (Area B)

Interpretative Geo-Environmental Report

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EXECUTIVE SUMMARY

| <i>The information given in this summary is necessarily incomplete and is provided for initial briefing purposes only. The summary must not be used as a substitute for the full text of the report.</i> | |
|--|---|
| Site location and description | <p>The site is located approximately 10km north-east of Mansfield, off Ollerton Road, Edwinstowe, Nottinghamshire NG21 9PS, centred at National Grid reference 463384, 367197. Thoresby Area B is to be released for residential development over four Phases – Development Phases 1 to 4. The Thoresby Area B site extends to c.38 hectares and forms the southern part of the wider 150-hectare former Thoresby Colliery site.</p> <p>The Area B site is irregular in shape occupying 38 hectares. It comprises a series of agricultural fields, a former coal stocking yard with a railway cutting and embankment located along the western and northern sides of the site.</p> <p>Surface elevations vary between approximately 72m AOD in the north-west, reducing towards the south east corner at approximately 48m AOD.</p> |
| Proposed development | <p>The Thoresby Area B site is being considered for redevelopment over four separate phases (Phases 1 to 4) with a total of approximately 608 residential plots, light commercial units to the eastern side of the site and a primary school along the western margin.</p> |
| Purpose of assessment | <p>The objective of the work is to support a planning application and to provide data required for the design of the reclamation of the site for house building. This interpretative geo-environmental report is therefore limited to the interpretation of data relating to the Phase 1 and Phase 2 (residential) development areas only within Area B.</p> |
| Ground Conditions | |
| Geology | <p>Ground conditions generally comprise Made Ground of colliery spoil (reworked mudstones and siltstones) underlying the former Coal Stocking Yard that makes up the north-western corner of the Phase 1 development area. Underlying any Made Ground and the remainder of the Phase 1 and Phase 2 development areas is the weathered Chester Formation. This is described as pinkish red to buff grey medium to coarse pebbly sandstone with subordinate ventricular beds of reddish brown mudstone. There are no documented superficial deposits recorded to underlie the site and none were encountered.</p> |
| Hydrogeology | <p>The hydrogeology of the site is likely to be characterised by the presence of an unconfined deep principal aquifer comprising the Chester Formation of the Sherwood Sandstone Group. The Chester Formation is classified as principal aquifer. The soils beneath the site are classified as having high H2 and HU leaching potential. The site lies within a currently designated zone 3 'total catchment' groundwater Source Protection Zone</p> <p>Anticipated depth to the groundwater table is in the order of 21 to 31m below the existing ground level.</p> |

| | |
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| <p>Potentially contaminative uses on site and in surrounding area</p> | <p>Identified potentially contaminative uses considered are as follows:</p> <ul style="list-style-type: none">)] Agricultural use of pesticides and herbicides on the southernmost agricultural fields)] Contaminated soils from infill Coal Stocking Yard area)] Contaminated soils from infilled railway sidings, pit head buildings and transformers in Area A to the immediate north of Area B)] Contaminated soils from infill coal stocking area (Phases 1 and 4 development areas))] Contaminated soils from former Rexco plant coke works located in Area A to the immediate north of Area B)] Organic material within soils from infilled railway sidings, Coal Stocking Yard |
| <p>SITE ASSESSMENT</p> | |
| <p>Site investigation</p> | <ul style="list-style-type: none">)] Exploratory holes were completed by RSK across the whole of the Thoresby Area B site and are reported in of RSK's 'Thoresby Area B – Factual Report' ref. 301924R01(00).)] Across the Phase 1 and 2 development areas 16 mechanically excavated trial pits; 7 windowless sampler boreholes; 7 dynamic probes and 8 soakage tests were conducted.)] Selected soil samples were collected and tested for a suite of determinants.)] A ground gas monitoring programme from installed monitoring wells was undertaken. |
| <p>Refined conceptual site model</p> | <p>Following refinements to the Initial Conceptual Site Model (ICSM) ICSM, the complete linkages taken forward to the Generic Quantitative Risk Assessment (GQRA) stage is as follows:</p> <ul style="list-style-type: none">)] Linkage 1. Oral, dermal and inhalation exposure (including fibre inhalation) ingestion of home-grown produce by future residential end users;)] Linkage 2. Impact of organic contaminants on potable water supply pipes;)] Linkage 3. On-site (or off-site) ground gas generation affecting future residential end users and infrastructure by gas migration and build-up in confined spaces, and inhalation |
| <p>CONCLUSIONS AND RECOMMENDATIONS</p> | |
| <p>Environmental assessment</p> | <ul style="list-style-type: none">)] The soils underlying the southern agricultural fields, that make up the majority of the Phase 1 and 2 development areas, do not exceed appropriate GACs and thus may be regarded as suitable for the proposed end use with respect to the considered exposure pathways.)] Concentrations exceeding the adopted GACs within the Colliery Spoil Made Ground and sands and gravels underlying the Coal Stocking Yard area of the Phase 1 development area are localised, with isolated occurrences of arsenic and benzene. It should be noted that these exceedances are not from samples gained directly from the Phase 1 and |

| | |
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| | <p>Phase 2 development areas, but from samples of Made Ground from investigation locations to the north of the Phase 1 development area but considered to be representative of the typical colliery spoil Made Ground of the former Coal Stocking Yard that underlies part of the Phase 1 development area.</p> <ul style="list-style-type: none">) An allowance for an adequate capping layer should be made in this part of the Phase 1 development area underlain by the Coal Stocking Yard to break the potential pathway.) One Made Ground - Coal Stocking Yard Sand and Gravel sample recorded concentrations above the UKWIR GAC for BTEX. This result indicates polyethylene (PE) and polyvinyl chloride (PVC) water supply pipes are expected to be not to be suitable in this discrete area of the Phase 1 development area underlain by the Coal Stocking Yard unless remedial measures are implemented that mitigate the risk or negated by any further assessment that may be required by the relevant water supply company.) Based on the GSVs Phase I and Phase II development areas have been characterised as Green. As such there is no requirement for gas protection measures to be adopted for the Phase 1 and Phase 2 development areas. |
| <p>Geotechnical assessment</p> | <ul style="list-style-type: none">) Foundations: Development Phase 1 coal stocking yard area - Reinforced (mesh) deep trench foundations may be adopted to penetrate through the made ground and to found in the underlying medium dense to dense Chester Formation with suspended floor slabs, designed to an allowable bearing pressure of 100 KN/m²; Development Phase 1 agricultural field area: conventional lightly reinforced (mesh) strip/ trench fill type foundations may be adopted with either ground bearing or suspended floor slabs, designed to an allowable bearing pressure of 100 KN/m²; Development Phase 2 agricultural field area: Where depths to the underling medium dense to dense granular soils of the Chester Formation allow conventional lightly reinforced (mesh) strip/ trench fill type foundations may be adopted with suspended floor slabs, designed to an allowable bearing pressure of 100 KN/m². In areas where the engineered backfill exceeds the depths to which trench fill type foundations may be economic then a reinforced rafted foundation solution, founded in the engineered backfill, may prove to be more economical.) Concrete classification: Phase 1 Development coal stocking yard area – The Design Sulphate (DS) class in The Colliery Spoil made ground underlying the north western corner of the Phase 1 Development area is DS-4, and the aggressive chemical environment for concrete (ACEC) is AC-3s; Phase 1 and Phase 2 Development agricultural field areas – The Design Sulphate (DS) Class for the re-worked Chester Formation sands and gravels sourced from the Western Ridge area that may be used as fill to be imported into the Phase 2 Development area is DS1, and the aggressive chemical environment for concrete (ACEC) is AC-1s Phase 2 Development - imported granular fill from western ridge - The Design Sulphate (DS) Class for the re-worked Chester Formation sands and gravels sourced from the Western Ridge area that may be used as fill |

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| | <p>to be imported into the Phase 2 Development area is DS1, and the aggressive chemical environment for concrete (ACEC) is AC-1s</p> <p>) Coal Stocking Yard Colliery Spoil combustion: The CV values are above the threshold that would be considered unlikely to be combustible, they are well below the CV that would be considered at risk of smouldering. The loss on ignition results are all well less than 25%. Therefore, it is not considered that the colliery spoil is potentially combustible</p> |
| Recommendations / Further work | <p>) A Remedial Method Statement will be required to outline the needed mitigation and verification requirements to make the north western area of Phase 1 Development area underlain by the Coal Stocking Yard suitable for its intended use.</p> <p>) A separate controlled waters risk assessment should be undertaken across the wider Thoresby Area A and Area B areas to address the potential pollutant linkages with respect to groundwater and surface waters.</p> |

1 INTRODUCTION

RSK Environment Limited (RSK) was commissioned by Harworth Estates Ltd (Harworth) to carry out a geo-environmental assessment of the land at Thoresby Area B. Harworth, the landowner and developer, is working to deliver in the region of 608 new homes with commercial space, local retail and community facilities including associated infrastructure and primary school and country park across the wider former colliery site.

The current report is limited to Area B only, with the intrusive investigation specific to two proposed development areas within Area B, which are discussed further below.

This report is subject to the RSK service constraints given in Appendix A.

A summary of legislation and policy relating to contaminated land is provided in Appendix B.

This report should be read in conjunction with RSK's 'Thoresby Area B – Factual Report' ref. 301924R01(00).

1.1 Aim

The aim of the work is to support a planning application and to provide data required for the design of the reclamation of the site for its intended mixed use.

1.2 Scope of works

The scope of the investigation and layout of this report has been designed with consideration of CLR11 (Environment Agency, 2004) and BS 10175: 2013 (BSI, 2013) and guidance on land contamination reports issued by the Environment Agency (EA) (2010a).

The contents of this report relate to the ground investigation carried out to an agreed brief as set out in RSK's proposal letter T301924L01 (dated 14 July 2017).

The site investigation is limited to the southern part of the former Thoresby Colliery site referred to as Area B as shown on Figure 2. A report containing the factual data of the site investigation across Thoresby Area B has been issued previously: RSK ref. 301924R01(00) 'Thoresby Area B – Factual Report' dated April 2018.

The masterplan for the overall Thoresby redevelopment (including Area A which is outside the scope of the current report) is shown in Figure 3.

Thoresby Area B is to be released for residential development over four Phases – development Phases 1 to 4 and shown on Figure 4.

The current interpretative geo-environmental report is limited to the interpretation of data relating to the Phase 1 and Phase 2 (residential) development areas only which are located within Area B. Further geo-environmental interpretative reports relating to Area B will be issued specifically for the Phase 3 and 4 (residential) development areas and for the areas of commercial and school redevelopment.

1.3 Background

Thoresby Area B, located off Ollerton Road, Edwinstowe Nottinghamshire (Figure 1), extends to approximately 38 hectares and forms the southern part of the 150-hectare former Thoresby Colliery site as shown on Figure 2.

The masterplan for the overall Thoresby Colliery redevelopment (including Area A which is outside the scope of the current report) is shown in Figure 3. The current master plan for Thoresby Area B includes the development of approximately 608 residential plots, light commercial units and a primary school with associated infrastructure as shown on Figure 4.

1.4 Existing reports

The following report pertaining to the site were made available for review:

-) Rogers Leask Environmental; Former Thoresby Colliery Phase 1 Desk Study Report, P-16-424, dated 14 December 2016.

In addition, a report containing the factual data of the RSK site investigation across the entirety of Thoresby Area B has already been issued:

-) RSK ref. 301924R01(00) 'Thoresby Area B – Factual Report' dated April 2018.

1.5 Limitations

The comments given in this report and the opinions expressed are based on the observed ground conditions encountered during the site work and on the results of field and laboratory testing. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of Made Ground not detected between exploratory locations and the thickness and quality of Made Ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows may vary from those reported due to seasonal, or other, effects.

Asbestos is often present in soils in discrete areas. Whilst asbestos-containing materials have not been locally encountered during the RSK fieldworks or supporting laboratory analysis, the history of the site indicates that asbestos may be present in soils and could be encountered during more extensive ground works.

2 THE SITE

2.1 Site location and setting

Thoresby Area B (herein after referred to 'Area B') is located approximately 10km to the north-east of Mansfield, off Ollerton Road, Edwinstowe, Nottinghamshire NG21 9PS, centred at National Grid reference 463384, 367197. The location of the site is shown in Figure 1. Area B extends to c.38 hectares and forms the southern part of the wider 150-hectare former Thoresby Colliery site as shown on Figure 2.

A summary of the surrounding site land uses is provided within Table 1.

Table 1: Site setting

| | |
|----------------------|--|
| To the north: | Thoresby Area A - the buildings and spoil heaps of the former Thoresby Colliery. |
| To the east: | A treed plantation with access tracks and two residential properties to the far south-east |
| To the south: | Ollerton Road, beyond which are the agricultural fields of Black Hills Farm. |
| To the west: | Agricultural land with residential properties fronting onto Ollerton Road to the far south-west. |

2.2 Site Description and site walkover

Area B was visited on 20 November 2017 to undertake a site walkover. Potentially significant environmental and geotechnical issues arising from the survey are summarised in the site description below.

Area B is irregular in shape and occupies c.38 hectares. It comprises a series of agricultural fields, a former coal stocking yard with a railway cutting and embankment located along the western and northern sides of the site.

Surface elevations vary between approximately 72m AOD in the north-west, reducing towards the south-east corner at approximately 48m AOD.

Japanese knotweed is a non-native, highly invasive species and spreads via rhizomes (underground 'stems') rather than seeds in the UK. It is found in a range of habitats across the UK including roadsides, riverbanks and derelict land.

Japanese knotweed was not identified during the site walkover or during the site works. However, Japanese knotweed is difficult to identify outside the growing season (March to September/October). As the site works were conducted outside of the growing season it is possible that any Japanese knotweed present may not have been identified and, as such, we recommend that the site be resurveyed during the growing season.

Area B is divided by an asphalt access road that runs northward off Ollerton Road to the former colliery buildings located in Area A to the north of Area B.

Area B can be divided into five main areas (as shown on Figure 5 – Site Features Plan) based on current and historic land uses:

Southern agricultural fields: three agricultural fields front onto Ollerton Road. The tree lined former colliery access road divides the western and central field. The central and eastern fields are divided by a ditch. All three fields had been harvested prior to the site investigation works. The central field has vehicular gated access off Ollerton Road. The western field has vehicular access off the former colliery access road. The eastern field has access off the central field. The western field, aka locally known as the ‘Pringle Field’, has a distinct dip toward its centre, with the south-eastern boundary being approximately 8m below the level of Ollerton Road to its south. The central and eastern fields have a slight fall to the south-east and are generally at a similar level to Ollerton Road to the south.

North-western field:

At the time of the site investigation, the north-western field was set to rough grass land. It is accessed at its south-eastern corner from the former colliery central driveway. It is bounded on all sides by trees and hedgerows. It slopes from its north-east and north-west corners to a point roughly halfway along the southern boundary.

Coal Stocking Yard:

The former Coal Stocking Yard is located in the north-east of Area B. At the time of the site walkover, it contained numerous coal stockpiles and was in the process of being cleared. The coal stocking yard slopes from north to south. It contains two settling ponds (that drain the surface runoff from the area to the north of the site) in its south-eastern corner that are situated on two different levels, separated by retaining wall and steep banks (slopes of 1:2). The Coal Stocking Yard is bounded to the south by an earth bund approximately 3.5m high and slopes of approximately 1:2 that separates it from the agricultural fields to the south. It is understood that this earth bund will be removed during the redevelopment works.

Railway Cutting:

A disused railway cutting runs around the western side of Area B for approximately 700m. This is up to 7m deep in places and had standing water in it at its north-eastern end. The railway tracks and underlying ballast were still in place during the site walkover. The banks of the cutting were becoming overgrown with grass and shrubbery.

Western Ridge:

A strip of land measuring roughly 360m north-south and 70m east-west forms the final portion of Area B. This is formed into a ridge running north-south, with slopes of approximately 1 in 4 to 1 in 5 to its sides.

The layout of the site with the main features is presented as Figure 5.

2.3 Proposed development

Area B is being considered for redevelopment over four separate phases (Phases 1 to 4 as shown on Figure 4) with a total of approximately 608 residential plots, light commercial units to the eastern side of the site and a primary school along the western margin. For

context, Thoresby Area A to the north includes further residential development, local retail, community facilities and large areas of public open space and country park. The proposed layout of the site as a whole (i.e. Area A and Area B) is shown on Figure 3.

2.4 Review of existing reports

The Rogers Leask Environmental (RLE) Phase 1 Desk Study Report dated 14 December 2016 (RLE 2016) provides a Phase 1 preliminary risk assessment based on a site walkover and review of environmental database information (a Groundsure Geo Insight Report Ref. EMS-388146_519527 dated 17 October 2016), available historical maps, geological data, and a Coal Authority CON29M Non-Residential Mining Report Ref. 51001268768001 dated 17 October 2016). The RLE desk study report covers the whole of the former Thoresby colliery site (i.e. Area A and Area B inclusive).

The RLE desk study report concludes:

The wider Thoresby Colliery site was initially agricultural fields up until 1925 when the Thoresby colliery opened with the sinking of the No 1 and No2 shafts in the central pithead area of the site (Area A). Development of the colliery included the establishment pit head buildings (Area A), a mineral railway and sidings (partly in Area B), a coal preparation plant (Area A), coal storage area to the south of the pithead (Area B), spoil tip areas to the west, north and east of the pithead (Area A), and a Rexco Smokeless Fuel Plant (coking works) operational between 1959 and 1989 (Area A). Since closure of the colliery in 2015 decommissioning, and demolition of site buildings, has been undertaken and the spoil heaps to the west, north and east (Area A) of the pit head area are undergoing restoration works to form woodland and acid grassland habitats as part of the future redevelopment of the site.

The qualitative contamination risk assessment of the desk study identified: Made Ground with buried concrete structures is likely to be present across the area of the former pithead (Area A) with localised pockets of asbestos organic and metal contamination. Made Ground across the raised levels of the coal storage area (in Area B) may be similarly contaminated and colliery spoil materials may also possess elevated calorific values; the area of the former coking works (Area A) is potentially contaminated with polycyclic aromatic hydrocarbons (PAHs), coal tar, phenols, cyanide and other organic products and as no information is available on the demolition or clearance of this area RLE assumed that no remediation occurred on decommission.

The above potential sources of contamination may present a risk to controlled waters, with the underlying principal aquifer (within a Zone 3 Source Protection Zone) and the River Maun 200m to the south of the site being high sensitivity-controlled waters receptors. The areas of the agricultural fields (Area B) were concluded unlikely to be contaminated due to their historic agricultural usage.

Ground gas issues were considered by RLE to be moderate in the former pithead, railway siding and coking works areas (Area A) and low for the remainder of the site.

With regard to mining issues it was stated that the two colliery shafts were to be treated and retained in the 'heart of the community' amenity area (in Area A). It was considered that the longwall mining methods used at depths exceeding 480m bgl would have caused

immediate subsidence of the overlying strata and RLE reported that it is considered by the Coal Authority that any future ground movement should have ceased

3 PRELIMINARY RISK ASSESSMENT

3.1 Ground conditions

3.1.1 Geology

Published records (British Geological Survey, website) for the area indicated the geology of Area B to be characterised by the succession recorded in Table 2.

Table 2: Published geology at the site

| Geological unit | BGS Lithological Description | BGS estimated thickness (m) |
|--|---|-----------------------------|
| Superficial deposits | | |
| No superficial deposits are recorded to underlie the site. | | |
| Bedrock – Sherwood Sandstone Group | | |
| Chester Formation | Pinkish red to buff grey medium to coarse pebbly sandstone with subordinate ventricular beds of reddish brown mudstone. | 50 to 627 |

The existing topography and history of development of Area B suggests that, in addition to these natural strata, Made Ground should be expected beneath some areas of the site.

Six borehole records were downloaded from the British Geological Survey website to provide further information regarding ground conditions in the vicinity of Area B. Copies of these are included in Appendix C.

3.1.2 Radon

The environmental database report (GroundSure Geo Insight report, dated 17 October 2016 contained within RLE (2016)) indicates that Areas A and B are not located within an 'Affected Area' as defined by the Documents of the National Radiological Protection Board (Radon Atlas of England and Wales, NRPB-W26-2002) and therefore the risk of significant ingress of radon into structures on-site is considered low. This is supported by a more recent search (November 2018) of www.ukradon.org.

3.1.3 Mining and quarrying

The RLE (2016) desk study report contains a Coal Authority CON29M Non-Residential Mining Report. Evidence has been sought to identify any mining and quarrying operations, past and present, which have taken place in the vicinity of Areas A and B. The sources of information referenced in this element of the desk study include:

-) RLE (2016) desk study report, which includes:
 - o GroundSure Geo Insight report, dated 17 October 2016
 - o Coal Authority CON29M Non-Residential Mining Report, dated 17 October 2016.
-) old Ordnance Survey maps and plans

) geological maps

The Coal Authority CON29M Non-Residential Mining Report indicates that Areas A and B lie within the likely zone of influence on the surface from workings at approximately 480m to 800m depth, the last date of working being 2010. According to the report, ground movement resulting from these past workings should now have ceased. The site is not in an area where the Coal Authority has plans to grant a license to remove coal using either underground or opencast methods

Two colliery coal shafts are located within 50m to the north of Area B, in the area of the former pithead buildings in Area A (mine entry refs. 463367-001 and 463367-002). It is understood from Harworth Estates that both shafts have been infilled and are to be capped and incorporated into the 'heart of the community' development.

3.1.4 Landfilling and land reclamation

Evidence has been sought to identify any landfilling or land reclamation operations, past and present, which have taken place within a 250m vicinity of the site. The sources of information referenced in this element of the desk study include:

-) RLE (2016) desk study report, which includes
 - o GroundSure Geo Insight report, dated 17 October 2016
 - o a Coal Authority CON29M Non-Residential Mining Report, dated 17 October 2016.
-) old Ordnance Survey maps and plans
-) geological maps

There is an EA licensed waste site held for the Thoresby Colliery site itself, held by UK Coal Thoresby Ltd for mining waste operations.

With reference to the historical data there have clearly been several phases of construction, demolition and earthwork on the site, including cuttings (Area B), the colliery pit head area itself, spoil heaps and slurry ponds. Therefore, the presence of Made Ground should be expected.

Based on the above datasets, there are no further records of landfill sites (former or current) within 250 m of the site.

3.2 Hydrogeology

3.2.1 Aquifer characteristics

Based on the published geological map referred to above, the hydrogeology of Area B is likely to be characterised by the presence of an unconfined deep principal aquifer comprising the Chester Formation of the Sherwood Sandstone Group.

The anticipated depth to the groundwater table is in the order of 21 to 31m below ground level (bgl) (estimate from BGS borehole logs) as summarised in Table 3.

Reference to BGS 'Hydrogeology Map of the Northern East Midlands' dated 1981 indicates ground water levels (in 1978) within the Sherwood Sandstone Group to be at approximately 40m AOD, which is consistent with the groundwater levels from the BGS borehole logs. It shows a regional groundwater flow toward the west-northwest.

Table 3: BGS Borehole Catalogue groundwater levels

| BGS Ref. | Referenced name | Coordinates | Borehole Depth (m) | Depth to water (m) |
|-----------|-------------------------------|----------------|--------------------|--------------------|
| SK66NW9/A | Thoresby colliery Ollerton | 463531, 367591 | 580.9 | Not noted |
| SK66NW36 | Thoresby colliery 2 | 463520, 367518 | 688.54 | Not noted |
| SK66NW30 | Thoresby colliery well (no.2) | 463368, 367430 | 70 | 21.3 |
| SK66NW123 | Thoresby colliery | 463330, 367540 | 126 | 33.9 |
| SK66NW32 | Rexco no.1 water well | 463003, 367629 | 74.71 | 31.43 |

It is also possible that localised perched water may also be present in the Made Ground.

3.2.2 Vulnerability of groundwater resources

Area B has been classified by the EA website to overlie a:

-) principal aquifer: layers of rock or drift deposit that have high intergranular and/or fracture permeability (usually providing a high level of water storage). They may support water supply and/or river base flow on a strategic scale

The soils beneath Area B are classified as having high H2 and HU leaching potential.

H2 – deep, permeable, coarse textured soils which readily transmit a wide range of pollutants because of their rapid drainage and low attenuation potential

HU – soil information for urban areas and restored mineral workings. These soils are therefore assumed to be highly permeable in the absence of site specific information.

3.2.3 Risk from rising groundwater levels (groundwater flooding)

Rising groundwater levels can affect foundations and structures and may result in flooding if not controlled properly. In certain areas, groundwater levels are rising owing to reduced groundwater abstraction by industry.

The environmental database report indicates that British Geological Survey (BGS) data indicates Area B is within an area susceptible to Clearwater flooding relating to the unconfined aquifer underlying the site. However, the BGS confidence rating for this susceptibility is classified as low based on the amount and precision of the information used in the BGS assessment, and in such an area of low confidence the susceptibility result should be treated with more caution.

3.2.4 Licensed groundwater abstraction

The environmental database report indicates that there are eight historical licenses for the abstraction of groundwater for the use as process waters from three boreholes in the west of the Area A part of the Thoresby Colliery site; there are none within Area B. Those within Area A relate to license no. 03/28/70/0081 for three boreholes (Ref A, B and C) for process water that expired in 2015.

There are a further three active licenses - Amen Corner boreholes a, b and c (ref. 03/28/70/0065) operated by Seven Trent Water Ltd recorded approximately 1500m south of Area B for abstraction of water for potable supply.

In terms of aquifer protection, the EA generally adopts a three-fold classification of source protection zones (SPZ) for public supply abstraction wells.

- J zone 1 or 'inner protection zone' is located immediately adjacent to the groundwater source and is based on a 50-day travel time from any point below the water table to the source. It is designed to protect against the effects of human activity and biological/chemical contaminants that may have an immediate effect on the source
- J zone 2 or 'outer protection zone' is defined by a 400-day travel time from a point below the water table to the source. The travel time is designed to provide delay and attenuation of slowly degrading pollutants.
- J zone 3 or 'total catchment' is the area around the source within which all groundwater recharge is presumed to be discharged at the source.

Information available within the environmental database report indicates that Area B lies within a currently designated zone 3 'total catchment' groundwater Source Protection Zone.

3.3 Hydrology

3.3.1 Surface watercourses

The nearest identified surface watercourse/feature to Area B is the River Maun located approximately 200m to the south.

The EA biological and chemical quality grade of the water quality in the stretch of the River Maun nearest to Area B ('Edwinstowe Stw to confluence r. Meden'), as reported in the environmental database report is summarised in Table 4.

Table 4: EA biological and chemical quality grade of the water quality in River Maun

| River quality Grade | NGR | Distance from site (m) | Year | | | | |
|--|----------------|------------------------|------|------|------|------|------|
| | | | 2005 | 2006 | 2007 | 2008 | 2009 |
| Biological quality | 464000, 366900 | 234m south | D | D | B | B | B |
| Chemical quality | 464000, 366900 | 234m south | C | B | B | B | B |
| Note: results are graded from A ('Very good' to F 'Bad') | | | | | | | |

The environmental database report indicates that there are fourteen currently licensed surface water abstractions within a 2-km radius of Areas A and B. The nearest is located approximately 160m to the south Area B from the river Maun and is operated by Naish Farms Ltd for spray irrigation purposes.

The environmental database report indicates that there are thirteen discharge consents within 500m of the boundary of Areas A and B. The closest two, 180m to the south of Area B discharge to the River Maun and relate to Thoresby Colliery for the discharge of trade

discharge – mineral workings under permit no. EPRXP3995VN. The further eleven records relate to sewage discharge – final / treated effluent, by Severn Trent Water (under various versions of permit no. T/70/20380/R) 200m to the south of Area B to the River Maun.

There are no significant recorded pollution incidents to controlled waters in the vicinity of Areas A or B which may have affected Area B.

3.3.2 Surface water abstractions

There are seven active licenses recorded within approximately 1000m of Areas A and B, with a further eight within 2km of the site identified, using the environmental database report. The closest seven are detailed in Table 5.

Table 5: Surface water abstractions

| Reference | Distance and orientation from site | Comment |
|----------------|--|--|
| 03/28/70/0103 | 161m south from River Maun at Edwinstowe | Operated by Naish Farms Ltd for spray irrigation |
| 03/28/70/0023 | 189m south from Edwinstowe – River Maun/flood dyke | Operated by FOX for spray irrigation |
| 03//28/70/0089 | 198m south from Hazel Grove Farm – River Maun | Operated by Naish Farms Ltd for spray irrigation |
| 03/28/70/0024 | 232m south from Carr Brecks Farm – River Maun (reach B) | Operated by FOX for spray irrigation |
| 03/28/70/0024 | 415m south from Carr Brecks Farm – River Maun (point) | Operated by FOX for spray irrigation |
| 03/28/70/0024 | 717m south from Carr Brecks Farm – Rainworth Water Reach A | Operated by FOX for spray irrigation |
| 03/28/70/0037 | 1003m south The Mill, Ollerton, River Maun | Operated by METTAM for milling and water power other than electricity generation |

3.3.3 Site drainage – Areas A and B

There are a number of settlement lagoons and ponds across the wider Area A that form part of the engineered landform of the former colliery spoil heaps. These lagoons and ponds drain via a series of gulley's to a ditch that runs around the eastern side of the former pit head buildings which in turn runs into a series of holding storm tanks and silt settlement pond before discharge through a pipe that runs along the line of the two easternmost agricultural fields in the south of Area B (to the east of the Phase 1 development area) for eventual discharge to the River Maun to the south.

Surface water from the hardstanding areas of Area A is collected via a series of gullies and discharges into this same series of holding storm tanks and silt settlement pond before discharge. Surface water infiltrates freely across the open areas of the north western field, railway cutting, western ridge and the southern agricultural fields. There is

a shallow dry ditch that runs along the southern boundaries of the southern agricultural fields. During site works it was observed that in the Coal Stocking Yard (to the north of Phase 1 development area in Area B) excess surface water surface that was not infiltrating through the surface, but ponding, was being periodically over pumped into the series of holding storm tanks and silt settlement pond in Area A before discharge. It is understood that surface water from the site access road is discharged via a series of gullies to soakage pits located in the fields to the east and west of the access road. No plans showing the location of these surface water soakage pits were available for review.

3.3.4 Preliminary flood risk assessment

The indicative floodplain map for the area, published by the EA, and provided in the 2016 environment database report shows that Area B does not lie within a designated floodplain. The risk of flooding each year has been assessed by the EA as very I (less than 1 in 1000) chance of flooding in any given year.

A flood risk assessment (FRA) is outside the scope of this report.

3.4 History of Thoresby Colliery and surrounding area

The history of the land-use and development of the former colliery and surrounding area has been assessed based on the following sources:

-) historical maps within the environmental database from 1884 to 2014; and
-) plans gained from the on-site records and archive.

A full account of the history of the former colliery is provided in RLE (2016). A summary of the site history from the RLE report is provided below:

Thoresby Colliery was established in 1925 with the sinking of the No.1 and No.2 shafts and is first shown on the 1938 historical map. Prior to the establishment of the colliery the site was a series of agricultural fields and woodland with a house (Cockglode) immediately to the east of the Phase 1 and Phase 2 development areas in Area B.

The colliery expanded significantly in the 1950s with additional buildings (in Area A), large areas of railway sidings in the pithead area (in both Area A and Area B) and an aerial ropeway in the north-east of the site (in Area A) for tipping of arisings.

The historical map of 1968 shows a Rexco Smokeless Fuel (coking works) established in the south-western area of Area A, north of the railway cutting in Area B. A small rectangular building is shown on the southern side of the north-western field in Area B. A slurry pond is shown to the north-east of the pit head buildings in Area A.

By 1988 the sidings area of the mineral railway has been reduced and the area infilled. The Rexco plant is no longer shown in the historical plan of 1988. The small rectangular building in the southern side of the north-western field in Area B is no longer shown. Spoil tipping is shown to have moved from the north-east to across the north and north-west of Area A. The former slurry pond in Area A is no longer shown to the north-east of the pit head buildings but has been replaced with a slurry pond to the east of the pit head building complex.

-) UK Coal Ltd for Screening, grading, mixing, loading and unloading of coal, coke, coal products and petroleum

3.7 Initial conceptual site model

The information presented in previous sections has been used to compile an initial CSM for Area B. The identified potential sources of contamination, associated contaminants and receptors have been considered with plausible pathways that may link them. The resulting potential pollutant linkages are considered in Section 3.7.4. The risk classification has been estimated in accordance with information in Appendix D.

3.7.1 Summary of potential contaminant sources

Potential sources and contaminants of concern are summarised in Table 7. The majority of potentially contaminative sources at the former Thoresby Colliery site are located within Area A, which will be the subject of a separate report.

Table 7: Potential sources and types of contamination

| Potential sources | Contaminants of concern |
|--|--|
| On-site historical i.e. Phase 1 and 2 development areas within Area B - | |
| Agricultural use of pesticides on the southernmost agricultural fields | Pesticides (plant protection products and biocides) |
| Contaminated soils from infill coal stocking area (partial encroachment into the northern part of Area B Phase 1) | Fuel oils, lubricating oils, heavy metals, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), sulphates, asbestos, etc. |
| Off-site historical i.e. Area A and Phase 3 and 4 development areas within the northern part of Area B | |
| Contaminated soils from infilled railway sidings, pit head buildings and transformers in Area A | Fuel oils, lubricating oils, heavy metals, PAHs, PCBs, ethylene glycol, ash, sulphate, pesticides and asbestos |
| Contaminated soils from infill Coal Stocking Area (Phases 1 and 4 development areas) and north-western agricultural field (Phase 3 development area) | Fuel oils, lubricating oils, heavy metals, polychlorinated biphenyls (PCBs), PAHs, sulphates, asbestos, etc. |
| Contaminated soils from former Rexco plant coking works located in Area A | Hydrocarbons, petroleum spirit, ethylene glycol, methyl tertiary butyl ether (MTBE), oil and waste oil, chlorinated and non-chlorinated solvents, asbestos, sulphuric acid, cyanide, coal tar, metal and metal compounds |
| Gas sources and gas generation potential in line with BS8576 | |
| Organic material within soils from infilled railway sidings, coal stocking yard and areas of unknown fill (if present) | Carbon dioxide, methane |

3.7.2 Sensitive receptors

Sensitive receptors relevant to Area B include:

-) future site occupants, residential end users
-) vegetation
-) potable water supply pipes
-) groundwater beneath the site (principal aquifer)
-) ecological receptors (off-site Birklands and Bilhaugh SSSI in the northern part of Area A)
-) surface watercourses (River Maun 200m to the south of Area B).

Please note that construction workers and future maintenance workers have not been identified in the conceptual model as receptors because risks are considered to be managed through health and safety procedures according to the CDM Regulations.

3.7.3 Summary of plausible pathways

The plausible pathways are summarised below:

-) oral, dermal and inhalation exposure with impacted soil, soil vapour and dust/fibres, ingestion of home-grown produce ground gas and soil gas inhalation
-) vertical and lateral migration including leaching
-) root uptake leading to phytotoxicity
-) chemical attack of infrastructure (including water supply pipes) and buildings.

3.7.4 Potentially complete pollutant linkages

The outline conceptual model for Area B is shown schematically in Figure 6 and an estimate of the risk associated with each linkage is summarised in Table 8. The risk classification has been undertaken in accordance with CIRIA C552 (Rudland et al., 2001), a summary of which is included in Appendix D.

RLE (2016) identified potential sources of contamination and receptors then considered the plausible pathways for the entirety of the former Thoresby Colliery (i.e. Areas A and B), but primarily focused on the area of the former colliery buildings to the south of Area A as shown in Figure 2. The RLE (2016) report also included Phase 1 and 2 development areas which are the focus of the current interpretative Geo-Environmental report.

A summary of the potentially complete pollutant linkages specifically associated with Phase 1 and 2 development areas within Area B is presented in Table 8. Consideration has also been given to the pollutant linkages presented in RLE (2016).

Table 8: Summary of Complete linkages for Area B Phase I and 2 development areas

| Source | Pathway(s) | Receptor | Consequence / Severity | Probability | Potential Risk | Justification |
|--|---|---|------------------------|-------------|-----------------|---|
| <u>Onsite</u> Pesticides used on agricultural fields | Oral, dermal and inhalation exposure, ingestion of home-grown produce | Future residential user | Medium | Unlikely | Low | Parts of Phase I and 2 are currently, and have historically, been used as agricultural land and it is considered that recent and current use of pesticides will have been subject to statutory control regarding the products used, their active chemical constituents and their application to land or vegetation. Highly persistent forms are now relatively rare. |
| | Leaching, vertical and lateral migration | River Maun / principal aquifer | Medium | Unlikely | Low | Historic use of pesticides, which was not subject to statutory control, has potentially occurred at the site but the extent of this is not known. However, the conceptual site model does not include any specific historic sources of pesticides (such as areas of manufacture or storage or a more specific land use where intensive application of pesticides may have occurred). |
| <u>Onsite</u> Contaminated soils within Coal Stocking Yard (encroaching into the northern part of Phase 1 development area) | Oral, dermal and inhalation exposure, ingestion of home-grown produce, fibre inhalation | Future residential user | Medium | Likely | Moderate | The former Coal Stocking Yard encroaches into the northern part of the Phase I development area and there is the potential for associated contaminants to cause chronic damage to human health through various exposure pathways. |
| | Chemical attack of potable water supply pipes / Ingestion of impacted potable water. | Potable water supply pipes | Medium | Likely | Moderate | The former Coal Stocking Yard encroaches into the northern part of the Phase I development area and there is the potential for organic contaminants to permeate potable water supply pipes in affected parts of Phase I with the potential to cause chronic damage to human health. |
| | Leaching, vertical and lateral migration | River Maun | Medium | Unlikely | Low | The former Coal Stocking Yard encroaches into the northern part of the Phase I development area, which is over 250m from the nearest surface water course. It is unlikely the extent of the Coal Stocking Yard within the Phase I development area will be a significant source of contaminants to the River Maun in the context of other identified sources located within Area A to the north of Area B. Plausible linkages associated with sources within Area A will be considered in a separate controlled waters risk assessment covering Area A and Area B as a whole. |
| | | Underlying principal aquifer and Zone 3 (total catchment) SPZ | Medium | Unlikely | Low | The former Coal Stocking Yard encroaches into the northern part of the Phase I development area but the majority of potential contaminant sources of relevance to the principal aquifer are within Area A and outside the scope of the current report. The anticipated depth to groundwater is over 20m. It is considered the probability of the area of the former Coal Stocking Yard within the Phase I development area impacting the principal aquifer is unlikely. |

| | | | | | | |
|---|---|--|--------|----------------|---------------------|---|
| | | | | | | Plausible linkages associated with sources within Area A will be considered in a separate controlled waters risk assessment covering Area A and Area B as a whole. |
| | Chemical attack | Buried foundations | Mild | Likely | Moderate/Low | Potential contaminants associated with the former Coal Stocking Yard in the northern part of the Phase 1 development area may result in aggressive conditions for foundations causing damage to structures. |
| | Root uptake leading to phytotoxicity | Site flora | Mild | Low likelihood | Low | Based on the historic uses of the Phase 1 and 2 development area it is not anticipated that over a longer period an event would occur that would result in phytotoxicity of plants associated with the proposed development. |
| | Site run-off/ drainage / dust deposition | Ecological receptors | Mild | Low likelihood | Low | There are no on-site designated ecological receptors, although there is an off-site SSSI located within Area A to the north. It is not anticipated the proposed Phase 1 and 2 developments would result in an adverse effect on the off-site ecological receptors. |
| <u>On-site</u> Ground gas associated with unknown fill materials within the former Coal Stocking Yard areas (or areas of unknown fill) | Gas migration and build-up in confined spaces | Proposed on-site residential buildings | Severe | Low likelihood | Moderate | The former Coal Stocking Yard encroaches into the northern part of the Phase 1 development area and there is the potential for areas of Made Ground and unknown fill associated with previous activities at the former Thoresby Colliery. Potential sources and migration pathway cannot be discounted. Risks associated with ground gas migration and build-up in the sub-floor void / confined spaces is acute and therefore a severity rating of severe has been applied. |
| | Gas migration and build-up in confined spaces | Future residential users | Severe | Low likelihood | Moderate | |
| <u>Offsite</u> Areas of Made Ground or unknown fill | Gas migration and build-up in confined spaces | Future residential users | Severe | Low likelihood | Moderate | There is the potential for off-site sources of ground gases that have the potential to migrate to the Phase 1 and 2 development areas within Area B. Potential sources and migration pathway cannot be discounted. Risks associated with ground gas migration and build-up in the sub-floor void / confined spaces is acute and therefore a severity rating of severe has been applied. |
| | Gas migration and build-up in confined spaces | Proposed on-site residential buildings | Severe | Low likelihood | Moderate | |

The current RSK intrusive investigation was designed to provide information on ground conditions and ground gas to further investigate the potential pollutant linkages with a potential risk of moderate/low or above, identified in the initial CSM with respect to human health receptors only.

The potential pollutant linkages with respect to controlled waters (River Maun and the principle aquifer) in relation to the entire site (i.e. Areas A and B, see Figure 2) will be evaluated in a separate controlled waters risk assessment.

3.7.5 Data gaps and uncertainties

There are a number of data gaps and uncertainties associated with the desk study information reviewed for Area B:

-) Historical changes in ground levels across the subject Area B including in the area of the former railway sidings, former Coal Stocking Yard and north-western agricultural field;
-) The operation and management of wastes associated with the Rexco plant in Area A, which may have implications for Area B;
-) The decommissioning of the Rexco plant and movement of associated materials in Area A, which may have implications for Area B;

4 SITE INVESTIGATION METHODOLOGY

RSK carried out intrusive investigation work and subsequent ground gas monitoring between November 2017 and January 2018 to further investigate the potential pollutant linkages (relevant to human health only) identified in the initial CSM and to inform on geotechnical constraints.

4.1 Objectives

The specific objectives of the investigation in relation to Phase 1 and 2 development areas within Area B were as follows:

- to establish the ground conditions including the extent and thickness of any made ground
- to investigate specific potential sources of contamination identified in initial CSM
- to determine groundwater depth and flow direction, if encountered
- to determine the ground gas regime
- to assess geotechnical properties of soils

4.2 Sampling strategy and methodology

The techniques adopted for the investigation were chosen considering the anticipated ground conditions, existing land use and the proposed development. The investigation was targeted to identify potential impact from identified sources of contamination and any areas of suspected infill. It also included non-targeted locations across the southern agricultural fields.

Trial pitting was used across the majority of Area B to provide quality exposures of shallow soils for description and good quality samples for laboratory testing. A window sampling rig was used in areas where deeper penetration was anticipated to be required and to enable the installation of shallow ground gas and groundwater (if encountered) monitoring wells.

4.3 Fieldwork summary in Phase 1 and Phase 2 development areas

The investigation and the soil descriptions were carried out in general accordance with BS5930: 2015 - Code of Practice for Ground Investigations. The exploratory hole logs and other site work records are presented in Appendix C to F of RSK's 'Thoresby Area B – Factual Report' ref. 301924R01(00).

The locations of the intrusive investigations in relation to both the site features and the Phase 1 and Phase 2 development areas are shown in Figure 7.

The ground investigation fieldwork was conducted at various stages between 21 November 2017 and 29 January 2018. An exploratory hole location plan is presented as Figure 7., covering all four development phases of Area B.

Table 9: Summary of fieldwork in Phase 1 and Phase 2 development areas

| Item | Date | |
|---|----------|----------|
| | Start | End |
| 15 Trial Pits | 21.11.17 | 2.02.18 |
| 8 Windowless Sample Boreholes | 20.11.17 | 15.12.17 |
| 8 Dynamic Probes (advanced immediately adjacent to the windowless sample boreholes) | 20.11.17 | 15.12.17 |
| 8 soakage testing on selected trial pits | 12.12.17 | 14.12.17 |
| 6 rounds of ground gas and groundwater monitoring | 5.01.17 | 29.01.18 |

4.4 Health, safety and environment considerations

The intrusive works were completed in line with RSK's Safety, Health, Environment and Quality Management Systems (SHEQMS), which is accredited to ISO9001: 2008 (Quality Management System standard), ISO14001:2004 (Environmental Management Systems standard) and OHSAS18001:2007 (Occupational Health and Safety Management Systems standards).

Prior to conducting intrusive works, service plans for the site were obtained and a specialist contractor attended site to scan and clear for underground services at proposed exploratory hole locations.

4.5 Methodology

4.5.1 Supervision and logging

An experienced RSK engineer supervised all intrusive works. The investigation and the recorded soil descriptions were completed in general accordance with BS5930: 2015 - Code of Practice for Ground Investigations.

4.5.2 Trial pits

Fifteen mechanically excavated trial pits were undertaken across the Phase 1 and Phase 2 development areas by either a wheel based JCB-3CX or a 16 Tonne tracked excavator in order to inspect and record to inspect near surface materials or structures, and to obtain soil samples for laboratory analysis.

The trial pits were positioned to provide an adequate coverage and to provide information with regard to the ground conditions.

Where cohesive deposits were encountered, hand shear vane tests were undertaken.

At locations considered to be close to final grade level, Clegg hammer tests were completed at a shallow depth, typically at 0.5m below existing ground level, in order to determine an indicative California Bearing Ratio (CBR). The purpose of the test is to ascertain parameters for the structural design of road pavements.

On completion, stockpiled arisings were replaced and compacted in layers. Due to 'bulking', the backfilled excavations are often left proud of the surrounding surface. This resulting 'hump' settles with time.

The trial pit logs are presented in Appendix C of RSK's 'Thoresby Area B – Factual Report' ref. 301924R01(00).

4.5.3 Windowless sampling

Eight windowless sampler boreholes were positioned across the Phase 1 and Phase 2 development areas to provide an adequate coverage and to provide information with regard to the ground conditions.

During sinking of each borehole, Standard Penetration Tests (SPT) are undertaken at 1.0m intervals in accordance with Part 9 of BS 1377:1990 (BSI, 1990).

Upon reaching the required depth, a gas or groundwater monitoring standpipe was installed inside of the borehole, and filter material and/or bentonite pellets added.

Where a groundwater or gas monitoring standpipe was not required the borehole was backfilled with bentonite pellets, arising or other approved material.

The windowless sampling logs are presented in Appendix E of RSK's 'Thoresby Area B – Factual Report' ref. 301924R01(00).

4.5.4 Dynamic Probing

Eight dynamic probes were advanced adjoining each windowless sampling location. The purpose of this was to correlate to strata descriptions gained by adjoining windowless sampling locations. Dynamic probing is a method of testing the ground by driving a steel rod fitted with a cone into the ground and measuring the number of hammer blows required to achieve measured increments of penetration.

During dynamic probing, a disposable ('lost') metal cone is placed on the end of the drive rod. The rod, which is marked into 100mm long sections, is then driven into the ground. The number of hammer blows required to achieve each 100mm increment of penetration is recorded by the operators.

Once the 1.00m long drive has been completed a further 1.00m long probe rod is added. The process of adding rods is repeated until the required depth is achieved or an obstruction is encountered. The rods are withdrawn by a hydraulically driven ram mounted on the mast and the individual rods unscrewed as they are recovered.

The results from the Dynamic Probing exercise are presented in Appendix F of RSK's 'Thoresby Area B – Factual Report' ref. 301924R01(00).

4.5.5 Survey

The ground levels and co-ordinates of each of the exploratory holes were surveyed using GPS during the service clearance works prior to commencement of the intrusive works. The ground level and co-ordinates of each exploratory hole is provided in the appropriate exploratory hole log in Appendices C to F of RSK's 'Thoresby Area B – Factual Report' ref. 301924R01(00).

4.5.6 Sampling strategy

4.5.6.1 Soil sampling for geotechnical laboratory analysis

Soil samples collected for geotechnical laboratory analysis were placed into a variety of containers appropriate to the anticipated testing suite required in accordance with BS EN ISO 22475-1:2006. Sampling comprised disturbed samples during window sampling and trial pitting; and disturbed samples and undisturbed U100 samples during sinking of the boreholes.

Samples were stored in accordance with the RSK quality procedures to maintain sample integrity and preservation and to minimise the chance of cross contamination.

4.5.6.2 Soil sampling for environmental laboratory analysis

Soil samples collected for environmental laboratory analysis are placed into a variety of containers appropriate to the anticipated testing suite required. Samples were stored in accordance with the RSK quality procedures to maintain sample integrity and preservation and to minimise the chance of cross contamination and transported to the laboratory in chilled cool boxes.

4.5.6.3 Water sampling for laboratory analysis

Groundwater/Perched water sampling was not undertaken as insufficient groundwater was encountered at all monitoring locations.

4.5.7 Ground gas and groundwater monitoring

RSK undertook a programme consisting of six spot ground gas monitoring rounds.

An infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO₂), methane (CH₄) and oxygen (O₂) in percentage by volume, while hydrogen sulphide (H₂S) and carbon monoxide (CO) were recorded in parts per million. Initial and steady state concentrations were recorded.

In line with BS8576:2013 “Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs)”, each monitoring well installed within a windowless sampler borehole has been installed with a dual gas taps were installed.

Depths to groundwater were recorded using an electronic dip meter. All available monitoring data are contained within Appendix G of RSK’s ‘Thoresby Area B – Factual Report’ ref. 301924R01(00). The relevant monitoring data is summarised in Section 5.4 of this report.

4.5.8 Infiltration testing

Soakaway tests were carried out in eight trial pits to establish the infiltration rate of the underlying Chester Formation across the Phase 1 and Phase 2 development areas. The tests were carried out generally in accordance with the method described in BRE Digest 365 (BRE, 2016). This involved filling the pits with water from a tanker and recording the drop-in water level with time as the water soaked into the ground. The data are presented in Appendix H of RSK’s ‘Thoresby Area B – Factual Report’ ref. 301924R01(00) including the calculations in accordance with BS 5930 (BSI, 1999).

5 GROUND CONDITIONS

5.1 Ground conditions

Area B may be divided into the five areas based on current and historic land uses as specified in Section 2; two of those areas are relevant to the current report covering Phase 1 and 2 development areas. For each relevant area the ground conditions recorded during the RSK site investigation are summarised for each stratum in the following subsections.

The descriptions of the strata encountered, notes regarding visual or olfactory evidence of contamination, list of samples taken, field observations of soil and groundwater, in-situ testing and details of monitoring well installations are included on the exploratory hole records presented in Appendices C, D and E of RSK's 'Thoresby Area B – Factual Report' ref. 301924R01(00). The provided descriptions presented on the exploratory hole logs are based on visual and physical examination of the samples together with any relevant in-situ and laboratory test results.

5.1.1 Southern agricultural fields: Phase 1 and 2 development areas: TP201 to TP213, WS201 to WS206, DP201 to DP206

5.1.1.1 Topsoil

Topsoil was encountered to depths of ranging from 0.3mbgl to 0.5mbgl. It comprised gravelly silty organic SAND. Gravel is rounded fine to coarse quartzite.

5.1.1.2 Chester Formation:

The weathered Chester Formation was encountered at depths ranging from 0.35mbgl to 0.5mbgl to the maximum depth of the deepest trial pits TP202 and TP210 at 3.1bgl. It comprised compact orange brown to red brown silty fine to coarse SAND with frequent gravel. Gravel is fine to coarse rounded quartzite. The sand became increasingly dense with depth with refusals encountered in window sample holes at approximately 2.0mbgl.

Although outside of the Phase 1 and 2 development area it is noted that at TP217 (see Figure 7), which encountered similar ground conditions, the sides of the trial pit collapsed during excavation. Therefore, the position was re-dug (as TP217A) to allow the construction of a square sided pit suitable for soakage testing.

5.1.1.3 Groundwater

Groundwater was not encountered at any of the investigation locations across the agricultural field portion of the Phase 1 or Phase 2 development areas including to the maximum depth of the deepest trial pit TP210 at 3.10m bgl

5.1.2 Coal Stocking Yard: (part of) Phase 1 development area: TP124, WS114 and WS119, and CP114 and CP119

5.1.2.1 Bund materials

Trial pit TP124 was located within the bund to the south of the Coal Stocking Yard. It encountered a thin mantle / dressing (0.25m thick) of dark blackish grey slightly sandy

very gravelly clay was encountered over orangish brown slightly gravelly silty fine to coarse SAND. Gravel was sub angular fine to coarse extremely weak friable sandstone and rounded fine to coarse quartzite.

5.1.2.2 *Made Ground*

A slightly variable made ground was encountered across the three locations TP124, TP125 WS114 and WS119. A thin mantle of dark greyish black slightly sandy gravelly clay was encountered to 0.25m. This was underlain by made ground comprising dark grey slightly silty sandy clayey angular to sub angular fine to coarse gravel of weak mudstone and rare coal, with discontinuous lenses of orange brown slightly silty fine to coarse sand to 1.25m and rare metal, rope and timber fragments. This was in turn underlain in TP123 by black very silty fine to medium sand with a sulphurous odour to 1.60m.

5.1.2.3 *Chester Formation*

The weathered Chester Formation was encountered in the three exploratory locations at depths ranging from 1.2mbgl to 2.2mbgl. It generally comprised orange brown slightly gravelly fine to coarse SAND. Gravel is fine to coarse sub rounded quartzite.

5.1.2.4 *Groundwater*

Groundwater was not encountered at any of the investigation locations across the former Coal Stocking Yard portion of the Phase 1 development area including to the maximum depth of the deepest window sample location WS119 at 2.40m bgl. For reference, at location TP133 to the north of the Phase 1 development area, groundwater was encountered as a slight seepage at 0.8m bgl within the Made Ground.

5.1.3 **Evidence of contamination**

No olfactory evidence of contamination was encountered during the investigation.

The results of the environmental laboratory testing undertaken on selected samples are summarised in Section 5.2 of this report.

5.2 **Summary of environmental laboratory results**

A summary of the completed environmental laboratory results is provided below. Soil analytical results are presented within Appendix J of RSK's 'Thoresby Area B – Factual Report' ref. 301924R01(00).

5.2.1 **Topsoil**

5.2.1.1 *Topsoil - Southern agricultural fields*

Seven soil topsoil samples were taken across the entire area of the southern agricultural fields (which include the Phase 1 and 2 development areas), and analysed for a range of contaminants, with five samples specific to the Phase 1 and 2 development areas. A total of ten samples were analysed for pH, acid soluble sulphate and total sulphate across the Phase 1 and 2 development areas. A summary of these results, specific to the Phase 1

and 2 development areas, is presented in Table 10. Laboratory certificates of analysis are presented in Appendix J of RSK's Thoresby Area B – Factual Report' ref. 301924R01(00).

Table 10: Summary of environmental soil results from - Topsoil - Southern Agricultural Fields - Phase 1 and 2 development areas

| Determinant | No. of Samples Tested | Concentration Range (mg/kg) | |
|------------------------|-----------------------|-----------------------------|---------|
| | | Maximum | Minimum |
| Asbestos screen and ID | 5 | NAD | NAD |
| Arsenic | 5 | <1 | <1 |
| Cadmium | 5 | <0.5 | <0.5 |
| Copper | 5 | 11 | 7 |
| Chromium (total) | 5 | 16 | 9 |
| Lead | 5 | 28 | 17 |
| Mercury (total) | 5 | <0.17 | <0.17 |
| Nickel | 5 | 8 | 5 |
| Selenium | 5 | <1 | <1 |
| Zinc | 5 | 34 | 24 |
| Acenaphthene | 5 | 0.01 | 0.01 |
| Acenaphthylene | 5 | <0.01 | <0.01 |
| Anthracene | 5 | <0.02 | <0.02 |
| Benzo(a)anthracene | 5 | 0.09 | 0.05 |
| Benzo(a)pyrene | 5 | 0.12 | 0.05 |
| Benzo(b)fluoranthene | 5 | 0.15 | 0.05 |
| Benzo(ghi)perylene | 5 | <0.05 | <0.05 |
| Benzo(k)fluoranthene | 5 | <0.07 | <0.07 |
| Chrysene | 5 | 0.12 | 0.07 |
| Dibenzo(ah)anthracene | 5 | <0.04 | <0.04 |
| Fluoranthene | 5 | 0.12 | 0.12 |
| Fluorene | 5 | <0.01 | <0.01 |
| Indeno(123-cd)pyrene | 5 | 0.07 | 0.03 |
| Naphthalene | 5 | 0.28 | 0.03 |
| Phenanthrene | 5 | 0.21 | 0.05 |
| Pyrene | 5 | 0.09 | 0.09 |
| Total Aliphatics | 5 | 3.1 | 3.1 |
| Total Aromatics | 5 | 6.4 | 0.1 |
| Benzene | 5 | <0.01 | <0.01 |
| Toluene | 5 | <0.01 | <0.01 |
| Ethyl Benzene | 5 | <0.01 | <0.01 |
| o Xylene | 5 | <0.01 | <0.01 |
| m & p Xylene | 5 | <0.01 | <0.01 |

| Determinant | No. of Samples Tested | Concentration Range (mg/kg) | |
|--|-----------------------|-----------------------------|---------|
| | | Maximum | Minimum |
| MTBE | 5 | <0.01 | <0.01 |
| pH | 0 | n/a | n/a |
| pH BRE | 0 | n/a | n/a |
| Sulphate BRE (acid sol) | 0 | n/a | n/a |
| Sulphur BRE (total) | 0 | n/a | n/a |
| TOC | 0 | n/a | n/a |
| Note: NAD – no asbestos detected. n/a – not applicable | | | |

5.2.2 Made ground

5.2.2.1 Made ground – Coal Stocking Yard – Colliery Spoil

Seventeen colliery spoil Made ground samples were taken across the entire area of the Coal Stocking Yard (which covers the Phase 1 and 4 development areas) and analysed for a range of contaminants. Only two locations WS114 and WS119 are located in the Phase 1 development areas. Samples from these two exploratory hole locations were not submitted for laboratory analysis. Therefore, a summary of all of the laboratory results recorded across the Colliery Spoil Made Ground encountered across the whole of the Coal Stocking Yard area (i.e. not just that within the Phase 1 development areas) is summarised in Table 11.

Table 11: Summary of environmental soil results from made ground - Made ground – Coal Stocking Yard - Colliery spoil

| Determinant | No. of Samples Tested | Concentration Range (mg/kg) | |
|------------------------|-----------------------|-----------------------------|---------|
| | | Maximum | Minimum |
| Asbestos screen and ID | 17 | NAD | NAD |
| Arsenic | 17 | 63 | 1 |
| Cadmium | 17 | 0.8 | 0.5 |
| Copper | 17 | 27 | 4 |
| Chromium (total) | 17 | 35 | 7 |
| Lead | 17 | 37 | 7 |
| Mercury (total) | 17 | 0.68 | 0.21 |
| Nickel | 17 | 31 | 4 |
| Selenium | 17 | 2 | 1 |
| Zinc | 17 | 81 | 8 |
| Acenaphthene | 17 | 0.12 | 0.02 |
| Acenaphthylene | 17 | 0.05 | 0.05 |
| Anthracene | 17 | 0.22 | 0.02 |
| Benzo(a)anthracene | 17 | 0.14 | 0.14 |

| Determinant | No. of Samples Tested | Concentration Range (mg/kg) | |
|--|-----------------------|-----------------------------|---------|
| | | Maximum | Minimum |
| Benzo(a)pyrene | 17 | 0.09 | 0.09 |
| Benzo(b)fluoranthene | 17 | 0.09 | 0.09 |
| Benzo(ghi)perylene | 17 | 0.09 | 0.09 |
| Benzo(k)fluoranthene | 17 | <0.07 | <0.07 |
| Chrysene | 17 | 0.13 | 0.07 |
| Dibenzo(ah)anthracene | 17 | <0.04 | <0.04 |
| Fluoranthene | 17 | 0.12 | 0.12 |
| Fluorene | 17 | 0.21 | 0.01 |
| Indeno(123-cd)pyrene | 17 | <0.03 | <0.03 |
| Naphthalene | 17 | 3.08 | 0.04 |
| Phenanthrene | 17 | 0.94 | 0.05 |
| Pyrene | 17 | 0.15 | 0.08 |
| Total Aliphatics | 17 | 75.1 | 1.3 |
| Total Aromatics | 17 | 49.6 | 3.6 |
| Benzene | 17 | 0.27 | 0.07 |
| Toluene | 17 | 0.3 | 0.05 |
| Ethyl Benzene | 17 | 0.07 | 0.07 |
| o Xylene | 17 | 0.12 | 0.12 |
| M & p Xylene | 17 | 0.21 | 0.06 |
| MTBE | 17 | <0.05 | <0.05 |
| pH | 17 | 9.86 | 3.51 |
| pH BRE | 10 | 7.7 | 3.98 |
| Sulphate BRE (acid sol) | 10 | 3.01 | 0.08 |
| Sulphur BRE (total) | 10 | 3.36 | 0.04 |
| TOC | 8 | 17.2 | 1.66 |
| Calorific Value (Gross/Total) | 5 | 6130 | 2420 |
| Loss on ignition (550degC) | 5 | 18.8 | 11.2 |
| Note: NAD – no asbestos detected. n/a – not applicable | | | |

5.2.3 Chester Formation

Seven soil samples were taken from the Chester Formation underlying topsoil across the wider Area B site and analysed for a range of contaminants. Only four locations TP204, TP205, TP207 and TP212 are located in the Phase 1 and 2 development areas. A summary of these results specific to the Phase 1 and 2 development areas is presented in Table 12.

Table 12: Summary of environmental soil results from Chester Formation

| Determinant | No. of Samples Tested | Concentration Range (mg/kg) | |
|------------------------|-----------------------|-----------------------------|---------|
| | | Maximum | Minimum |
| Asbestos screen and ID | 4 | NAD | NAD |
| Arsenic | 4 | <1 | <1 |
| Cadmium | 4 | <0.5 | <0.5 |
| Copper | 4 | 5 | 3 |
| Chromium (total) | 4 | 8 | 6 |
| Lead | 4 | 11 | 3 |
| Mercury (total) | 4 | <0.17 | <0.17 |
| Nickel | 4 | 8 | 6 |
| Selenium | 4 | <1 | <1 |
| Zinc | 4 | 20 | 12 |
| Acenaphthene | 4 | <0.01 | <0.01 |
| Acenaphthylene | 4 | <0.01 | <0.01 |
| Anthracene | 4 | <0.02 | <0.02 |
| Benzo(a)anthracene | 4 | <0.04 | <0.04 |
| Benzo(a)pyrene | 4 | <0.04 | <0.04 |
| Benzo(b)fluoranthene | 4 | <0.05 | <0.05 |
| Benzo(ghi)perylene | 4 | <0.05 | <0.05 |
| Benzo(k)fluoranthene | 4 | <0.07 | <0.07 |
| Chrysene | 4 | <0.06 | <0.06 |
| Dibenzo(ah)anthracene | 4 | <0.04 | <0.04 |
| Fluoranthene | 4 | <0.08 | <0.08 |
| Fluorene | 4 | <0.01 | <0.01 |
| Indeno(123-cd)pyrene | 4 | <0.03 | <0.03 |
| Naphthalene | 4 | 0.11 | 0.11 |
| Phenanthrene | 4 | <0.03 | <0.03 |
| Pyrene | 4 | <0.07 | <0.07 |
| Total Aliphatics | 4 | <0.1 | <0.1 |
| Total Aromatics | 4 | 3.1 | 3.1 |
| Benzene | 4 | <0.01 | <0.01 |
| Toluene | 4 | <0.01 | <0.01 |
| Ethyl Benzene | 4 | <0.01 | <0.01 |
| o Xylene | 4 | <0.01 | <0.01 |
| M & p Xylene | 4 | <0.01 | <0.01 |
| MTBE | 4 | <0.01 | <0.01 |
| pH | 10 | 8.6 | 8.19 |
| pH BRE | 10 | 8.51 | 7.76 |

| Determinant | No. of Samples Tested | Concentration Range (mg/kg) | |
|--|-----------------------|-----------------------------|---------|
| | | Maximum | Minimum |
| Sulphate BRE (acid sol) | 10 | 0.02 | 0.02 |
| Sulphur BRE (total) | 10 | <0.01 | <0.01 |
| Note: NAD – no asbestos detected. n/a – not applicable | | | |

5.3 Summary of Geotechnical In-situ Testing Laboratory Analysis

During the site works in-situ geotechnical testing was undertaken at suitable locations. The in-situ geotechnical testing comprised:

-) SPTs windowless sampling boreholes
-) Dynamic probing at a position adjacent to each windowless sampling borehole
-) California Bearing Ratio (CBR) in selected trial pits

A programme of geotechnical laboratory testing was scheduled to provide the parameters necessary for the budgetary design of the development including foundations and infrastructure. Geotechnical laboratory test results can be found in Appendix I of RSK's 'Thoresby Area B – Factual Report' ref. 301924R01(00).

Geotechnical laboratory testing comprised the following:

-) Moisture content
-) Liquid and plastic limits
-) Particle density
-) Particle size distribution by wet sieving
-) Particle size distribution by sedimentation
-) Compaction testing
-) Maximum Dry Density
-) California Bearing Ratio (CBR)
-) Moisture Condition Value (MCV)

A summary of the completed geotechnical in-situ and laboratory testing results for each type of soil encountered is provided below.

5.3.1 Made ground

5.3.1.1 Reworked Natural Materials (bund surrounding Coal Stocking Yard)

The reworked natural materials from (bund surrounding Coal Stocking Yard) were tested for a particle size distribution PSD parameters. A summary of the results is included in Table 13.

Table 13: Summary of geotechnical PSD laboratory test results for reworked natural materials - bund surrounding Coal Stocking Yard

| Soil parameters | No of samples | Range |
|--|---------------|-------|
| Particle size distribution: gravel fraction | 1 | 19 |
| Particle size distribution: sand fraction | 1 | 74 |
| Particle size distribution: silt/clay fraction | 1 | 7 |

5.3.1.2 Reworked Colliery Spoil (Coal Stocking Yard)

Reworked colliery spoil was encountered to varying depths across the Coal Stocking Yard ranging from 0.05mbgl to 5.70mbgl.

The colliery spoil was generally found to comprise a cohesive soil with a significant proportion of granular matrix. From onsite observation, it would appear that this material has not been engineered.

Only two locations WS114 and WS119 are located in the Phase 1 and 2 development areas. Samples from these locations were not submitted for laboratory analysis. Therefore, a summary of all of the laboratory results recorded across the Colliery Spoil Made Ground encountered across the whole of the Coal Stocking Yard area (i.e. not just that within the Phase 1 and 2 development area) is summarised in Table 14.

Table 14: Summary of in-situ and geotechnical laboratory test results for Coal Stocking Yard colliery spoil

| Soil parameters (and units) | No of samples | Range | Average |
|--|---------------|-------------|---------|
| Moisture content (%) | 5 | 6.5 - 23 | 15.7 |
| Maximum Dry Density (Mg/m ³) using 4.5kg rammer | 3 | 1.98 – 2.04 | 2.00 |
| Optimum moisture content (Mg/m ³) using 4.5kg rammer | 3 | 7.8 – 8.0 | 7.9 |
| Remoulded CBR | 3 | 11 - 51 | 32 |
| Particle size distribution: cobbles fraction | 4 | 4 - 6 | 5 |
| Particle size distribution: gravel fraction | 4 | 34 – 63 | 45.7 |
| Particle size distribution: sand fraction | 4 | 26 - 35 | 30.7 |
| Particle size distribution: silt/clay fraction | 4 | 11- 37 | 21.0 |
| SPT 'N' values | 1 | 28 | n/a |

5.3.2 Weathered Bedrock (Chester Formation)

The weathered upper layers of the Chester Formation were encountered across Area B. It is considered that samples obtained from this stratum across the Area B site are representative of the same strata underlying the Phase 1 and 2 development areas. Therefore, a summary of the in-situ and laboratory test results gained across the Thoresby Area B in this stratum is presented in Table 15.

Table 15: Summary of in-situ and laboratory test results for Chester Formation

| Soil parameters (and units) | No of samples | Range | Average |
|--|---------------|-------------|---------|
| Maximum Dry Density (Mg/m ³) using 4.5kg rammer | 5 | 1.86 – 2.11 | 1.98 |
| Optimum moisture content (Mg/m ³) using 4.5kg rammer | 5 | 7.6 – 12 | 9.7 |
| Particle size distribution: gravel fraction | 11 | 3 - 36 | 13.8 |
| Particle size distribution: sand fraction | 11 | 51 -91 | 75.6 |
| Particle size distribution: silt/clay fraction | 11 | 6 - 21 | 10.5 |
| SPT 'N' values | 19 | 12 - >50 | 14.9 |
| CBR | 20 | 3 -13.2 | 5.9 |

5.3.3 Results of soakaway testing

It is considered that the in-situ soakage testing undertaken in the Chester Formation across the southern agricultural fields are representative of the same strata underlying the Phase 1 and 2 development areas. Therefore, a summary of the results of all the soakaway testing undertaken across the southern agricultural fields are summarised in Table 16.

Table 16: Soakaway test results

| Trial pit | Geological unit | Test result (m/s) |
|-----------|-------------------|-------------------|
| TP201 | Chester Formation | 9.35E-06 |
| TP203 | Chester Formation | 1.17E-05 |
| TP205 | Chester Formation | 1.95E-05 |
| TP207 | Chester Formation | 1.09E-05 |
| TP208 | Chester Formation | 6.91E-06 |
| TP209 | Chester Formation | 2.62E-05 |
| TP211 | Chester Formation | 4.86E-06 |
| TP213 | Chester Formation | 2.39E-06 |
| TP217a | Chester Formation | 2.21E-05 |
| TP219 | Chester Formation | 3.17E-05 |

| | | |
|---|-------------------|----------|
| TP321 | Chester Formation | 5.27E-07 |
| TP320 | Chester Formation | 2.18E-05 |
| TP316 | Chester Formation | 1.59E-05 |
| Notes: minimum 5.27E-07, maximum 3.17E-5, mean 1.46E-05 | | |

The data are presented in Appendix H of RSK's 'Thoresby Area B – Factual Report' ref. 301924R01(00) including the calculations in accordance with BS 5930 (BSI, 1999).

5.4 Ground gas regime

Six rounds of ground gas monitoring were conducted 3, 11, 16, 23, 26 and 29 of January 2018 in monitoring wells located within the Phase 1 and 2 development areas. The results of the ground gas monitoring carried out are given in Appendix G of RSK's Thoresby Area B – Factual Report' ref. 301924R01(00). The minimum and maximum results for monitoring locations located in the Phase 1 and 2 development areas are summarised in Table 17.

The range of atmospheric pressure over the six monitoring rounds completed was 983mbar to 1011mbar and this was recorded to be falling at the time of one round on 23.1.18 from 998mbar to 996mbar.

Table 17: Summary of ground gas monitoring results

| Monitoring well | Response zone/strata | Number of monitoring visits | Maximum Methane (%) | Maximum Carbon dioxide (%) | Minimum Oxygen (%) | Maximum Flow rate (l/hr) |
|---|----------------------|-----------------------------|---------------------|----------------------------|--------------------|--------------------------|
| WS114 | MG CS | 6 | <0.1 | 2.9 | 10.0 | <0.1 |
| WS201 | CF | 6 | <0.1 | 1.5 | 17.9 | 1.7 |
| WS202 | CF | 6 | <0.1 | 1.2 | 19.8 | 3.5 |
| WS203 | CF | 6 | <0.1 | 1.1 | 19.0 | 2.5 |
| WS204 | CF | 6 | <0.1 | 1.2 | 19.3 | 0.5 |
| WS205 | CF | 6 | <0.1 | 2.4 | 18.9 | 4.0 |
| WS206 | CF | 6 | <0.1 | 2.7 | 16.7 | 2.0 |
| WS207 | CF | 6 | <0.1 | 1.4 | 19.1 | 1.6 |
| WS208 | CF | 6 | <0.1 | 3.5 | 16.5 | 0.2 |
| Note: MG CS – Made Ground colliery spoil CF – Chester Formation | | | | | | |

5.5 Uncertainties and data gaps

The completed site investigation and positioning of the exploratory holes was based on the proposed development as provided by the Client within the Illustrative Master Plan (see Figure 3). Due to access constraints, it was not possible to investigate portions of the Phase 1 and 2 development areas, which has led to the following uncertainties.

-) Ground conditions beneath the central roadway (separating Phase 1 and Phase 2) serving the former pit head buildings
-) Depth of infill under the bund separating the Coal Stocking Yard to the north of Area B and the southern agricultural fields;
-) Depth to and quality of groundwater underlying the site in the underlying principal aquifer (due to the scope limitations of the current report);
-) The operation and management of wastes associated with the Rexco plant in Area A and the potential impacts for Area B (if any);
-) The decommissioning of the Rexco plant and movement of associated materials in Area A and the potential impacts for Area B (if any);

5.6 Refined Conceptual Site Model

The intrusive investigation showed that the conditions on site were generally in accordance with the initial CSM the following refinements are considered relevant. As previously stated, potential off-site sources that may impact on groundwater beneath both Areas A and B will be evaluated as part of a separate controlled waters risk assessment covering the entire former Thoresby Colliery.

5.6.1 Ground gas generation

The underlying natural soils encountered at shallow depths across the southern agricultural fields (Phase 1 and 2 development areas), and also across the wider Area B including the north-western field and railway cutting, and at greater depth beneath Made Ground within the north-western field, Coal Stocking Yard and western ridge, and are considered to have a very low gas generation potential in accordance with BS8576 (BSI, 2013).

It is considered that the coal measures underlying the Chester Formation occur at too great a depth to be a plausible source of ground gas.

When considering potential off-site sources of ground gas, Made Ground encountered within the north-western field and railway cutting, outside the Phase 1 and Phase 2 development areas, is generally granular with a low organic and putrescible content and was encountered to relatively shallow depth and is thus considered to have a low gas generation potential. Similarly, although of greater depth, the granular Made Ground encountered in the western ridge outside the Phase 1 and Phase 2 development areas, has a low organic and putrescible content, and is thus considered to have a low gas generation potential.

Cohesive colliery spoil Made Ground underlying the whole of the Coal Stocking Yard may be a potential diffuse source of ground gas from the organic content.

5.6.2 Complete pollutant linkage for further assessment

A summary of the complete linkages taken forward to the GQRA stage is as follows:

-) Linkage 1 – Oral, dermal and inhalation exposure (including fibre inhalation) ingestion of home-grown produce by future residential end users
-) Linkage 2 – Ingress of organic contaminants to potable water supply pipes and ingestion of potable water by future residential end user, and chemical attack of potable water supply pipes
-) Linkage 3 – On-site (or off-site) ground gas generation affecting future residential end users and infrastructure by gas migration and build-up in confined spaces, and inhalation.

6 QUANTITATIVE RISK ASSESSMENT (QRA)

In line with CLR11 (EA, 2004), there are two stages of quantitative risk assessment, generic and detailed. The GQRA comprises the comparison of soil, groundwater, soil gas and ground gas results with generic assessment criteria (GAC) that are appropriate to the linkage being assessed. This comparison can be undertaken directly against the laboratory results or following statistical analysis depending upon the sampling procedure that was adopted.

6.1 Linkages for assessment

Section 5 presents the refined conceptual model which identified the linkages that required assessment. These linkages together with the method of assessment are presented in Table 18.

Table 18: Linkages for generic quantitative risk assessment

| Potentially relevant pollutant linkage | Assessment method |
|--|--|
| 1 - Oral, dermal and inhalation exposure (including fibre inhalation) ingestion of home-grown produce by future residential end users | Human health GAC in Appendix E for a proposed residential end use with home-grown since proposed end use includes residential gardens |
| 2 - Ingress of organic contaminants to potable water supply pipes and ingestion of potable water by future residential end user, and chemical attack of potable water supply pipes | Comparison of soil data to GAC in Appendix F for plastic water supply pipes using UKWIR (2010) guidance. |
| 3 - On-site (or off-site) ground gas generation affecting future residential end users and infrastructure by gas migration and build-up in confined spaces, and inhalation | Gas screening values (GSV) have been calculated using maximum methane and carbon dioxide concentrations with maximum flow rates recorded at the site. The GSV have been compared with the generic Traffic Lights, as presented within the NHBC ground gases guide (Boyle and Witherington, 2007) and the aforementioned CIRIA report C665, owing to the development comprising low-rise housing with suspended floors. |

6.2 Methodology and results

The methodology and results of the GQRA are presented for each relevant pollutant linkage in turn.

Samples were initially scheduled for laboratory analysis to characterise the entire Area B and were not scheduled on the basis of the four development phases. As such, to adequately characterise strata within Phase 1 or Phase 2 development areas (the subject of the current report), samples from the same strata but from outside the Phase I or Phase

2 development areas have been incorporated into the sample group. This is explained further in subsequent sections.

6.2.1 Linkage 1. Oral, dermal and inhalation exposure (including fibre inhalation) ingestion of home-grown produce by future residential end users

In order to assess the soil results against the appropriate GAC, the soil results have been split into appropriate data sets. A conservative soil organic matter (SOM) of 1% has been used in the assessment with the exception of the Coal Stocking Yard colliery spoil where a SOM of 6% was used in the assessment.

As an initial assessment of each dataset, all soil results in each dataset have been directly compared against the GAC for residential with home-grown produce presented in Appendix E. It is noted that the conceptual site model does not identify any plausible sources of Chromium VI (hexavalent) on or in the vicinity of Area B and therefore recorded total chromium concentrations have been compared directly to the GAC for Chromium III (trivalent) as an initial assessment.

Laboratory result certificates are included within Appendix J of RSK's 'Thoresby Area B – Factual Report' ref. 301924R01(00), and a combined summary table of all available laboratory results compared to the appropriate GACs is included within Appendix E of the current report.

For the purposed of this assessment the soils underlying the Phase 1 and Phase 2 development areas have been split into datasets based on both their location and the soils description as summarised Section 5.1 – Ground conditions:

1. Topsoil - Southern Agricultural Fields (TP201, TP205, TP207, TP210, TP211 plus TP215 and TP219 from the Southern Agricultural Fields to the immediate east of the Phase I development area;
2. Chester Formation;
3. Made Ground - Coal Stocking Yard Colliery Spoil;
4. Sands and Gravels – Coal Stocking Yard Colliery Spoil

Table 19 below summarises the reported exceedances from the investigation of soils underlying the Phase 1 and Phase 2 development areas. Only those determinants where exceedances of the residential with home-grown produce GAC have been reported are included within the table. No exceedances of the GACs were reported in the Topsoil dataset or the Chester Formation dataset.

The data screening sheets are presented in Appendix E.

Table 19: Summary of environmental soil results

| Zone/ material | Determinant | No. of Samples Tested | Unit | GAC | No. of Sample > GAC | Concentration Range | | Location / depth of maximum exceedance |
|---|------------------|-----------------------------|-------|------------------------------------|---------------------------|---------------------|------|---|
| | | | | | | Min | Max | |
| Made ground – Coal Stocking Yard Colliery Spoil | Arsenic | 17 | mg/kg | 37 | 1 | <1 | 63 | TP127 0.5m |
| Made Ground – Coal Stocking Yard Colliery Spoil | Chromium (total) | 17 | mg/kg | 21 – hexavalent 910 - trivalent | 2 0 | 4 | 27 | TP129 at 1.3m TP126 at 0.6m |
| Sands and gravels – Coal Stocking Yard Colliery Spoil | Chromium (total) | 6 | mg/kg | 21 – hexavalent 910 - trivalent | 1 0 | 9 | 36 | TP136 at 3m |
| Sands and Gravels – Coal Stocking Yard Colliery Spoil | Benzene | 6 | mg/kg | 0.87 | 1 | <0.05 | 3.03 | TP123 at 1.4m |

6.2.1.1 Arsenic

One soil sample from the Made Ground Coal Stocking Yard colliery spoil recorded a concentration above the GAC for of 37 mg/kg; TP127 at 0.50m (63 mg/kg). TP217 (located within Phase 4 development area) was included within the dataset to provide a comprehensive assessment of this material. The second highest reported arsenic concentration within the dataset was 30mg/kg in TP141 at 0.5 mg/kg.

6.2.1.2 Chromium

Two soil samples from the Made Ground Coal Stocking Yard Colliery Spoil recorded concentrations above the GAC for total Chromium up to 27mg/kg. (a single sample from the Sands and Gravels Coal Stocking Yard Colliery Spoil recorded concentrations above the GAC for total chromium up to 36 mg/kg).

However, as the CSM did not identify any potential sources of hexavalent chromium, the GAC for trivalent chromium has been adopted (910mgm/kg), leading to the conclusion there are no reported exceedances of this GAC.

6.2.1.3 Benzene

A single sample from the Sands and Gravels Coal Stocking Yard Colliery Spoil recorded concentrations above the GAC for benzene up to 3.03mg/kg. This result was associated with a sulphurous odour on soil sample collection. It is noted that a soil sample from 0.6m at the same location (in the Made Ground dataset) recorded benzene at concentrations below the limits of detection and other petroleum hydrocarbon fractions were reported below the GAC.

6.2.1.4 General remarks

In summary, two exceedances of GACs (arsenic and benzene) were reported in the above datasets which were compiled to characterise the strata present within the Phase I and Phase II development areas. Based on the above assessment, concentrations exceeding the adopted GACs are localised and are an isolated occurrence of arsenic within the Colliery Spoil Made Ground and of benzene within the Sands and Gravels, both underlying the Coal Stocking Yard.

It should be noted that the arsenic exceedance is not from a sample gained directly from the Phase 1 and Phase 2 development areas, but from a sample of Made Ground from an investigation location to the north (within Phase 4 of Area B), but is considered to be representative of the typical Colliery Spoil Made Ground of the former Coal Stocking Yard that underlies the northern part of the Phase 1 development area. It is considered that an allowance for an adequate capping layer should be made in this part of the Phase 1 development area to break the potential pathway.

The requirement for this mitigation may be negated either if additional investigation and risk assessment is undertaken to delineate the extent of the identified exceedance. However, the Made Ground would not be suitable for use at the surface in residential gardens and therefore any requirement for a suitable depth (typically 450 mm) of clean cover as a growing medium would break this potential linkage.

The benzene exceedance at a depth of 1.4m is not considered to be representative of widespread contamination in Sands and Gravels with overlying soils reporting lower concentrations and concentrations below the relevant GAC. It is not considered this single exceedance requires further assessment nor does it pose a potential risk to human health at this depth.

6.2.2 Linkage 2. Impact of organic contaminants on potable water supply pipes

For initial assessment purposes, the results of the investigation have been compared with the GAC presented in Appendix F for this linkage, which are reproduced from *UKWIR Report 10/WM/03/21. Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* (UKWIR, 2010).

One soil sample (TP123 at 1.4m) from the Made Ground - Coal Stocking Yard Sand and Gravel dataset recorded concentrations above the UKWIR GAC for BTEX.

The results indicate that a relevant linkage may exist associated with organic contaminants within the Sand and Gravel in the Coal Stocking Yard and therefore pollutant polyethylene (PE) and polyvinyl chloride (PVC) water supply pipes are expected to be not to be suitable in this discrete area of the development unless remedial measures are

implemented that mitigate the risk. Across the remainder of the Phase 1 and Phase 2 development areas either PE or PVC water supply pipes would be suitable, although further assessment may be required by the Water Undertaker.

It should be noted that at the time of this investigation the routes of water supply pipes had not been established, hence the investigation and sampling strategy may not be fully compliant with UKWIR recommendations. Consequently, a targeted investigation and specific sampling/analytical strategy may be required. In addition, it is recommended that the relevant water supply company be contacted at an early stage to confirm its requirements for assessment, which may not necessarily be the same as those recommended by UKWIR.

6.2.3 Linkage 3. On-site (or off-site) ground gas generation affecting future residential end users and infrastructure by gas migration and build-up in confined spaces, and inhalation

The results have been assessed in accordance with the guidance provided in BS8576, NHBC guidance and *CIRIA Report C665*. In the assessment of risks and selection of appropriate mitigation measures, both reports highlight the importance of the conceptual model.

6.2.3.1 General

CIRIA C665 identifies two types of development, termed Situation A (modified Wilson and Card method), appropriate to all development excluding traditional low-rise construction, and Situation B (National House-Building Council, NHBC) only appropriate to traditional low-rise construction with ventilated sub-floor voids.

Both methods are based on calculations of the limiting borehole gas volume flow for methane and carbon dioxide, renamed as the gas screening value (GSV). The GSV (litres of gas per hour) is calculated by multiplying borehole flow rate (litres per hour) and gas concentration (percent by volume).

In both situations, it is important to note that the GSV thresholds are guideline values and not absolute. The GSV thresholds may be exceeded in certain circumstances, if the site conceptual model indicates it is safe to do so. Similarly, consideration of additional factors such as very high concentrations of methane, should lead to consideration of the need to adopt a higher risk classification than the GSV threshold indicates.

The site is to be redeveloped with low rise residential housing with suspended slabs and ventilated sub floor voids and therefore falls under Situation B.

Situation B is a characterisation system developed by the NHBC (Boyle and Witherington, 2007), which relates only to low rise housing development constructed with a clear ventilated underfloor void. The system provides a risk-based approach that is designed to allow an identification of the required gas protection measures for low-rise housing by comparing the measured gas emission rates to generic "Traffic Lights". The Traffic Lights include typical maximum concentrations that are provided for initial screening purposes and risk-based GSVs for situations where the typical maximum concentrations are exceeded. Based on the typical maximum gas concentrations and the GSVs, the appropriate Traffic Light, ranging from Green through Amber 1 and Amber 2 to Red, is determined from Table 8.7 of CIRIA C665.

6.2.3.2 Assessment of data

The site is intended to be redeveloped with low rise residential housing with suspended slabs and ventilated sub floor voids and therefore falls under Situation B. The GSV calculations for each borehole are included in Appendix G. The gas monitoring data has identified a maximum methane concentration of <0.1% and a maximum concentration of carbon dioxide of 3.5% in WS208. A maximum gas flow rate of 4 l/hr has been recorded (WS205). Using the highest flow rate recorded at any monitoring well location and the highest methane and carbon dioxide concentrations recorded at any monitoring well the maximum calculated GSV for methane is 0.0 l/hr and for carbon dioxide is 0.14l/hr. The maximum GSVs calculated at any individual monitoring location is 0.0l/hr for methane and 0.09 l/hr for carbon dioxide at WS205.

Based on the GSVs the site has been characterised as Green. As such there is no requirement for gas protection measures to be adopted for the Phase 1 and Phase 2 development areas based on the data collected to date.

6.2.4 Phytotoxicity

The plausible pollutant linkages presented previously included root uptake leading to phytotoxicity, which was assigned a risk classification of Low. However, the topsoil data lends itself to an assessment of phytotoxicity and the data screening results are presented in Appendix E. The results indicate that the relevant GACs have not been exceeded for the topsoil dataset and therefore a relevant pollutant linkage is unlikely to exist associated with phytotoxic effects.

6.3 Environmental assessment conclusions

The relevant pollutant linkages that require further action are:

Linkage 1. Direct contact, ingestion and inhalation of impacted soil by future residential end users

Two exceedances of GACs (arsenic and benzene) were reported in the datasets which were compiled to characterise the strata present within the Phase I and Phase II development areas. Based on the assessment, concentrations exceeding the adopted GACs are localised and are an isolated occurrence of arsenic within the Colliery Spoil Made Ground and of benzene within the Sands and Gravels, both underlying the Coal Stocking Yard.

It should be noted that the arsenic exceedance is not from a sample gained directly from the Phase 1 and Phase 2 development areas, but from a sample of Made Ground from an investigation location to the north (within Phase 4 of Area B), but is considered to be representative of the typical Colliery Spoil Made Ground of the former Coal Stocking Yard that underlies the northern part of the Phase 1 development area. It is considered that an allowance for an adequate capping layer should be made in this part of the Phase 1 development area underlain by the Coal Stocking Yard to break the potential pathway.

The requirement for this mitigation may be negated either if additional investigation and risk assessment is undertaken to delineate the extent of the identified exceedance. However, the Made Ground would not be suitable for use at the surface in residential

gardens and therefore any requirement for a suitable depth (typically 450 mm) of clean cover as a growing medium would break this potential linkage.

The benzene exceedance at a depth of 1.4m is not considered to be representative of widespread contamination in Sands and Gravels with overlying soils reporting lower concentrations and concentrations below the relevant GAC. It is not considered this single exceedance requires further assessment nor does it pose a potential risk to human health at this depth.

The soils underlying the southern agricultural fields (that make up the proposed Phase 1 and 2 development areas) do not exceed appropriate GACs and thus may be regarded as suitable for the proposed end use with respect to this exposure pathway.

Linkage 2. Impact of organic contaminants on potable water supply pipes

One Made Ground - Coal Stocking Yard Sand and Gravel sample recorded concentrations above the UKWIR GAC for BTEX. The result indicate that a relevant linkage may exist associated with organic contaminants within the Sand and Gravel in the Coal Stocking Yard and therefore polyethylene (PE) and polyvinyl chloride (PVC) water supply pipes are expected to be not to be suitable in this discrete area of the development unless remedial measures are implemented that mitigate the risk. Across the remainder of the Phase 1 and Phase 2 development areas either PE or PVC water supply pipes would be suitable. It should be noted that at the time of this investigation the routes of water supply pipes had not been established, hence the investigation and sampling strategy may not be fully compliant with UKWIR recommendations thus the relevant water supply company should be contacted as they may require further assessment.

7 GEOTECHNICAL TESTING

7.1 General

Geotechnical testing was completed during the site investigation works and laboratory testing was scheduled on selected soil samples to provide the parameters necessary for the budgetary design of the development including foundations and infrastructure.

The Phase 1 development area comprises two parts: the majority is a former agricultural field fronting onto Ollerton Lane, with a small section of the south west corner of the former coal stocking yard. These areas are separated by an 8m high bund. The development phases are shown in Figure 4. The investigation locations are shown on Figure 7.

For the Area B Phase 1 Development area It should be noted that no actual geotechnical laboratory testing was undertaken on samples underlying the part of the Phase 1 Development Area within the former coal stocking yard (the three locations TP124, WS114 and WS119). However, similar reworked colliery spoil made ground was encountered across the remainder of coal stocking yard area and a summary of the geotechnical laboratory test results from soil samples taken from these soils is presented in Table 14.

7.2 Completed geotechnical testing

In-situ testing comprised the following:

-) Hand Vane (HV)
-) Standard Penetration Testing (SPT)
-) Dynamic Probing (DP)

Completed geotechnical testing comprised the following:

-) Moisture content
-) Liquid and plastic limits
-) Particle density
-) Particle size distribution (PSD) by wet sieving
-) Particle size distribution (PSD) by sedimentation
-) Compaction testing
-) Maximum Dry Density (MDD) / Optimum Moisture Content (OMC)
-) Undrained triaxial

Geotechnical laboratory test results can be found in Appendix I of RSK's Thoresby Area B – Factual Report' ref. 301924R01(00). In-situ testing are included on the exploratory hole records presented in Appendix E, F, G and H of RSK's Thoresby Area B – Factual Report' ref. 301924R01(00).

7.3 Summary of geotechnical testing

For the purpose of discussion, the completed geotechnical laboratory testing has been summarised for each stratum in the following subsections.

7.3.1 Laboratory Testing: Bund materials

In the Phase 1 development Area of Area B one PSD test was undertaken on samples obtained from coal stocking yard bund soils.

A summary of the in-situ and laboratory test results in this stratum across the whole of the Area B site is presented in Table 20.

Table 20: Summary of laboratory test results for coal stocking yard bund soils

| Soil parameters | No of samples | Range | Average |
|--|---------------|-------|---------|
| Particle size distribution: gravel fraction | 1 | 19 | 19 |
| Particle size distribution: sand fraction | 1 | 74 | 74 |
| Particle size distribution: silt/clay fraction | 1 | 7 | 7 |

7.3.2 Laboratory Testing: coal stocking yard - Colliery Spoil

No samples from the three locations TP124, WS114 and WS119 located in the Phase 1 development area of the former coal stocking yard were submitted to the laboratory for geotechnical analysis. However, similar reworked colliery spoil made ground was encountered across the remainder of coal stocking yard area and a summary of the geotechnical laboratory test results from soil samples taken from these soils is presented in Table 14.

Table 21: Summary of in-situ and geotechnical laboratory test results for coal stocking yard colliery spoil

| Soil parameters | No of samples | Range | Average |
|--|---------------|-------------|---------|
| Moisture content (%) | 5 | 6.5 - 23 | 15.7 |
| Maximum Dry Density (Mg/m ³) using 4.5kg rammer | 3 | 1.98 – 2.04 | 2.00 |
| Optimum moisture content (Mg/m ³) using 4.5kg rammer | 3 | 7.8 – 8.0 | 7.9 |
| Remoulded CBR | 3 | 11 - 51 | 32 |
| Particle size distribution: cobbles fraction | 4 | 4 - 6 | 5 |
| Particle size distribution: gravel fraction | 4 | 34 – 63 | 45.7 |
| Particle size distribution: sand fraction | 4 | 26 - 35 | 30.7 |

| Soil parameters | No of samples | Range | Average |
|--|---------------|--------|---------|
| Particle size distribution: silt/clay fraction | 4 | 11- 37 | 21.0 |
| SPT 'N' values | 1 | 28 | n/a |

7.3.3 Laboratory Testing - Weathered Bedrock (Chester Formation)

The weathered upper layers of the Chester Formation were encountered across the Phase 1 and 2 development areas. It is considered that this formation is consistent across the whole of Area B, and as such a summary of the in-situ and nine PSD tests laboratory test results in this stratum across the whole of the Area B site is presented in Table 23.

A summary of the in-situ and laboratory test results specifically in the Phase 1 development area of Area B in this stratum is presented in Table 22

Table 22: Summary of in-situ and laboratory test results for Chester Formation

| Soil parameters | No of samples | Range | Average |
|--|---------------|-------------|---------|
| Maximum Dry Density (Mg/m ³) using 4.5kg rammer | 5 | 1.86 – 2.11 | 1.98 |
| Optimum moisture content (Mg/m ³) using 4.5kg rammer | 5 | 7.6 – 12 | 9.7 |
| Particle size distribution: gravel fraction | 11 | 3 - 36 | 13.8 |
| Particle size distribution: sand fraction | 11 | 51 -91 | 75.6 |
| Particle size distribution: silt/clay fraction | 11 | 6 - 21 | 10.5 |
| SPT 'N' values | 19 | 12 - >50 | 14.9 |
| CBR | 20 | 3 -13.2 | 5.9 |

Table 23: Summary of in-situ and laboratory test results for Chester Formation specifically in the Phase 1 development area of Area B

| Soil parameters | No of samples | Range | Average |
|--|---------------|-------|---------|
| Maximum Dry Density (Mg/m ³) using 4.5kg rammer | 1 | 1.87 | 1.87 |
| Optimum moisture content (Mg/m ³) using 4.5kg rammer | 1 | 12 | 12 |
| Particle size distribution: gravel fraction | 2 | 9-19 | 14 |
| Particle size distribution: sand fraction | 2 | 74-79 | 77 |

| Soil parameters | No of samples | Range | Average |
|--|---------------|-----------|---------|
| Particle size distribution: silt/clay fraction | 2 | 7-12 | 10 |
| SPT 'N' values from Window sample locations | 4 | 10 to >50 | 33 |
| CBR | 0 | - | - |

8 GEOTECHNICAL ASSESSMENT

8.1 Foundation recommendations

For the purpose of discussion, this geotechnical assessment has divided the Phase 1 and Phase 2 development areas and the Phase 1 development area into a further two parts: that underlain by the agricultural field fronting onto Ollerton Lane, and that underlain by a small section of the south west corner of the former coal stocking yard.

8.1.1 Phase 1 Development area -coal stocking yard

The coal stocking yard area underlying The Phase 1 development area is underlain by variable cohesive made ground (reworked colliery spoil) to depths between 1.20m to 2.20m bgl, which in turn was underlain by Chester Formation granular soils that are in a medium dense to dense state. Groundwater was not encountered and thus it is considered the water table at least 3 metres below existing site level.

Therefore, lightly reinforced (mesh) deep trench foundations may be adopted to penetrate through the made ground and to found in the underlying medium dense to dense Chester Formation with suspended floor slabs, designed to an allowable bearing pressure of 100 KN/m²

8.1.2 Phase 1 Development area - agricultural field area

The agricultural field area underlying The Phase 1 development area is underlain by Chester Formation granular soils that are in a medium dense to dense state from a depth of approximately 0.8m. Water table at least 3 metres below existing site level.

Therefore, conventional lightly reinforced (mesh) strip/ trench fill type foundations may be adopted with either ground bearing or suspended floor slabs, designed to an allowable bearing pressure of 100 KN/m².

A foundation zoning plan for the Phase 1 development area (drawing ref. 881496 60-01 'Phase 1 Development Foundation Appraisal') has been produced and is included in Appendix H.

8.1.3 Phase 2 Development area - agricultural field area

The agricultural field area underlying The Phase 2 Development area is underlain by Chester Formation granular soils that are in a medium dense to dense state from a depth of approximately 0.6m. Water table at least 3 metres below existing site level

SCP drawing ref. 17109 - 0500 - 007 – 'Architects Masterplan - Phase 2' (provided in Appendix H) provides levels on the proposed Phase 2 roads. This indicates a cut of reducing of levels of up to approximately 1.2m on the western boundary to an increase in levels of up to approximately 2.25 to 3.00m in the central and south eastern corner of the Phase 2 development area. It is understood the source of the infill is to be the reworked granular sands and gravels (originally Chester Formation) encountered across the Western Ridge Area of Area A.

Where depths to the underlying medium dense to dense granular soils of the Chester Formation allow conventional lightly reinforced (mesh) strip/ trench fill type foundations may be adopted with either suspended floor slabs, designed to an allowable bearing pressure of 100 KN/m². In areas where the engineered backfill exceeds the depths to which trench fill type foundations may be economic then a reinforced rafted foundation solution, founded in the engineered backfill, may prove to be more economical. In addition, excavation instability issues within the engineered granular sand and gravel infill may require temporary support to allow the construction of deep trench foundations.

8.2 Chemical attack by sulphur-bearing minerals

Sulphur-bearing minerals may release sulphate and sulphide ions under certain conditions, which can have the following deleterious effects on infrastructure and earthworks:

-) chemical attack of any buried concrete or other construction materials
-) expansive reaction of finished earthworks, with consequences for overlying structures
-) volume reduction of finished earthworks, with consequences for overlying structures

This assessment of the potential for chemical attack on buried concrete at the site is based on *BRE Special Digest 1: Concrete in aggressive ground*, which represents the most up-to-date guidance on this topic currently available in the UK.

For the purpose of this assessment this site can be divided into the Phase 1 and Phase 2 development areas and the Phase 1 development area into a further two parts: that underlain by the agricultural field fronting onto Ollerton Lane, and that underlain by a small section of the south west corner of the former coal stocking yard.

8.2.1 Phase 1 and 2 Development area - agricultural field areas

From the described consistency of the natural sands and gravels of the Chester Formation encountered across the whole of the southern agricultural fields area it is considered that, for the purposes of concrete classification for the Phase 1 and 2 Development areas, that laboratory results from across the whole of the southern agricultural fields area are representative of those soils underlying Phase1 and 2 Development areas.

For the purposes of concrete classification, the natural Chester Formation sands and gravels underlying the Phase 1 and 2 Development areas is considered to be classed as natural ground unlikely to contain pyrite.

Based on the characteristic water-soluble sulphate concentration in the soil of 22mg/l (SO₄), the Design Sulphate (DS) Class in the natural Chester Formation sands and gravels underlying the Phase 1 and 2 Development areas is DS1, as determined from Table C1 of *BRE Special Digest 1*.

Based on the static groundwater conditions and the characteristic pH value of 8 measured in the natural Chester Formation sands and gravels underlying the Phase 1 and 2 Development areas, the aggressive chemical environment for concrete (ACEC) is AC-1s.

8.2.2 Phase 1 Development - coal stocking yard

The desk study and site walkover indicate that, for the purposes of assessing the aggressive chemical environment of the site, the colliery spoil materials underlying the coal stocking yard area of the Phase 1 Development should be considered as comprising brownfield ground which may contain pyrite.

No samples from the three locations TP124, WS114 and WS119 located in the Phase 1 development area of the former coal stocking yard were submitted to the laboratory for suitable sulphate analysis. However, similar reworked colliery spoil made ground was encountered across the remainder of coal stocking yard area and the results of these laboratory test results have been used for this assessment as it is deemed these are representative of the similar colliery spoil found under the north western corner of the Phase 1 Development area.

All laboratory test results show SO_4 less than 3000 mg/l and although two of the eighteen samples tested have a pH of less than 5.5, the characteristic pH is 7 (which is greater than 5.5).

As this made ground is considered likely to contain pyrite, (it being a re-worked colliery spoil material), the characteristic percentage of oxidisable sulphide (OS) in the soil has been calculated as 1.39%, which is above the 0.3% limit set in *BRE Special Digest 1*. As such, the soil can be considered pyritic.

Based on the characteristic water-soluble sulphate and total potential sulphate concentrations in the soil of 739mg/l (SO_4) and 1.8% (SO_4), with both sulphate concentrations modified to include the characteristic concentrations of chloride (212mg/l) and nitrate (<0.4mg/l), the Design Sulphate (DS) class in The Colliery Spoil made ground underlying the north western corner of the Phase 1 Development area is DS-4, as determined from Table C2 of *BRE Special Digest 1*.

Based on the static groundwater conditions and the characteristic pH value of 7 measured in the Colliery Spoil made ground underlying the north western corner of the Phase 1 Development area, the aggressive chemical environment for concrete (ACEC) is AC-3s.

8.2.3 Phase 2 Development - imported granular fill from western ridge

It is understood that the southern area of Phase 2 may be made up to formation level with granular materials sourced from the Western Ridge area of Thoresby Area B (as shown on Figure 5). From the described consistency of these reworked sands and gravels (originally from the Chester Formation) encountered across the Western Ridge Area it is considered that, for the purposes of concrete classification for the Phase 2 Development area, that laboratory results from this granular fill across the Western Ridge Area that may be representative of the fill to be imported into the Phase 2 Development area.

For the purposes of concrete classification these reworked Chester Formation sands and gravels are considered to be classed as brown field ground unlikely to contain pyrite. Laboratory tests show SO_4 less than 3000 mg/l (125mg/l) and pH greater than 5.5 (7).

Based on the characteristic water-soluble sulphate concentration of the soil of 22mg/l (SO_4), the Design Sulphate (DS) Class for the re-worked Chester Formation sands and gravels sourced from the Western Ridge area that may be used as fill to be imported into

the Phase 2 Development area is DS1, as determined from Table C2 of *BRE Special Digest 1*.

Based on the static groundwater conditions and the characteristic pH value of 7 measured in the re-worked Chester Formation sands and gravels sourced from the Western Ridge area, the aggressive chemical environment for concrete (ACEC) is AC-1s.

8.3 Geotechnical hazards

8.3.1 Phase 1 and 2 Development areas

8.3.1.1 Slope stability

Abrupt changes in slope may pose hazards and geotechnical constraints for development. Generally, a slope gradient between 1:3 and 1:7 will likely require specific assessment, while gradients greater than 1:3 should be considered generally unfeasible for residential development, without specialist foundation techniques being applied

The Phase 1 and 2 Development areas have topography with gradient less than 1:7.

The slope to the south of the Phase 2 Development has a slope that exceeds 1:7. However it is outside the Phase 2 Area Development and it is understood that the height difference and gradient of the slope will be reduced with the establishment of the Phase 2 development platform.

At the time of the site investigation the bund to the north of Phase 1 had a slope that exceeded 1:7. However, it is understood that prior to the sale of the Phase 1 and Phase 2 development areas, this bund will be removed and relocated to the north of the Phase 1 Development area outside the site area and the slopes shall be engineered to a stable gradient..

8.3.1.2 Coal Stocking Yard Colliery Spoil combustion

Colliery spoil combustion is a common occurrence on spoil heaps formed by loose tipping of Coal Measure soils containing a high proportion of carbonaceous materials.

Calorific value (CV) and Loss of ignition is used for assessing combustibility.

Calorific value testing involves measuring the quantity of heat released from a sample on combustion. Reference to ICRCL guidance Note 61/84 'Notes on the fire hazards of contaminated land', it is generally considered that materials with a CV of 10 MJ/kg or greater are almost certainly combustible, whilst samples with a CV of 2 MJ/kg or less are unlikely to be combustible. A CV of 7MJ/kg or greater are considered to be at risk at smouldering. (ICRCL Guidance Note 61/84 – Guidance Notes on the Fire Hazard of Contaminated Land, 2nd Edition -1986)

Samples with a Loss of ignition of 25% or greater are generally considered combustible.

One sample from the three locations TP124, WS114 and WS119 located in the Phase 1 development area of the former coal stocking yard was submitted to the laboratory for loss on ignition and calorific value analysis. Similar reworked colliery spoil made ground was encountered across the remainder of coal stocking yard area and the results of these

additional laboratory test results have been used for this assessment as it is deemed these are representative of the similar colliery spoil found under the Phase 1 Development area.

Table 24: Coal Stocking Yard colliery spoil Summary of Calorific Value and Loss of ignition laboratory testing

| Determinant | Unit | No. of Samples Tested | Range of Results | |
|-------------------------------|-------|-----------------------|------------------|--------|
| | | | Min | Max |
| Loss on ignition (550degC) | % w/w | 5 | 2.4 | 6.1 |
| Calorific Value (Gross/Total) | MJ/kg | 5 | 1.200 | 15.573 |

Based on the results, though the CV values are above the 2 MJ/kg threshold that would be considered unlikely to be combustible, they are well below the CV of 7MJ/kg that would be considered at risk of smouldering and the loss on ignition results are all well less than 25%. Therefore, it is not considered that the colliery spoil is potentially combustible.

8.3.1.3 Variable soils

Founding surfaces should be inspected and proof rolled to identify soft spots prior to construction of foundations and filling, where practical shallow soft spots should be removed.

Where Made Ground or soft spots are encountered at deeper founding depths, or a foundation is to span two soils of variable properties, foundations will require further deepening or additional reinforcement/ change in foundation design to encounter suitably competent natural soils or limit differential settlements to acceptable levels.

8.4 Excavations

8.4.1 Phase 1 Development area - Coal Stocking Yard -Colliery spoil

The coal stocking yard area underlying The Phase 1 Development area is underlain by variable cohesive made ground (reworked colliery spoil) to depths between 1.20m to 2.20m bgl. Some trial pits within the colliery spoil became unstable during excavation. Considering the nature of the materials encountered across the wider Coal Stocking Yard area (out with the specific Phase 1 Development area), it is recommended that some form of shoring be employed during the excavations to prevent collapse, and ingress of deleterious materials.

8.4.2 Phase 1 and Phase 2 Development area - agricultural field areas

The trial pits advanced through the medium dense to dense Chester Formation granular soils generally remained stable during excavation, which indicates that foundation excavations should remain stable in the short term. Unstable excavations were noted in one trial pit located out with the Phase 1 and Phase 2 development areas: at TP217.

In the event that excavations are to remain open for longer periods, consideration should be given to the use of trench support systems.

Groundwater was not encountered at any of the investigation locations across the agricultural field portion of the Phase 1 or Phase 2 Development areas including to the maximum depth of the deepest trial pit TP210 at 3.10m bgl.

It is noted that excavation became difficult with a JSB 3CX using a toothless 2' wide bucket at depths exceeding 2.6m bgl.

Within the areas of Phase 2 Development that are to be infilled there may be excavation instability issues within the engineered granular sand and gravel infill which may require temporary support to enable the construction of deep trench foundations.

8.5 Roads and hardstanding

8.5.1 California bearing ratio (CBR)

In pavement design terms, the groundwater conditions are anticipated to comprise a low water table, i.e. at least 1 m below the pavement formation level.

The results of in-situ testing and resulting CBR values from in-situ clegg hammer testing are provided within Appendix C of RSK's Thoresby Area B – Factual Report' ref. 301924R01(00).

In-situ CBRs within the Phase 1 and 2 Development agricultural field areas trial pits range from 3.8% to 13.2%. A CBR value of 5% may be adopted for the Phase 1 and 2 Development agricultural field areas.

8.5.2 Frost-heave susceptibility

The sub-grade frost-susceptibility is determined using the criteria set out in Appendix 1 of TRRL (1970) Report Road Note 29.

8.5.2.1 Colliery spoil

Colliery discard is very susceptible to frost heave and therefore should not be used in the top 450 mm of road construction.

8.5.2.2 Phase 1 and 2 Development agricultural field areas

The granular soils may be regarded as being non-frost heave susceptible.

Where the sub-grade is considered to be frost-susceptible, the thickness of sub-base must be sufficient to give a total thickness of non-frost-susceptible pavement construction over the soil of not less than 450 mm.

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

9.1.1 Environmental

Linkage 1. Direct contact, ingestion and inhalation of impacted soil by future residential end users

Two exceedances of GACs (arsenic and benzene) were reported in the datasets which were compiled to characterise the strata present within the Phase I and Phase II development areas. Based on the assessment, concentrations exceeding the adopted GACs are localised and are an isolated occurrence of arsenic within the Colliery Spoil Made Ground and of benzene within the Sands and Gravels, both underlying the Coal Stocking Yard.

It should be noted that the arsenic exceedance is not from a sample gained directly from the Phase 1 and Phase 2 development areas, but from a sample of Made Ground from an investigation location to the north (within Phase 4 of Area B), but is considered to be representative of the typical Colliery Spoil Made Ground of the former Coal Stocking Yard that underlies the northern part of the Phase 1 development area. It is considered that an allowance for an adequate capping layer should be made in this part of the Phase 1 development area underlain by the Coal Stocking Yard to break the potential pathway.

The requirement for this mitigation may be negated either if additional investigation and risk assessment is undertaken to delineate the extent of the identified exceedance. However, the Made Ground would not be suitable for use at the surface in residential gardens and therefore any requirement for a suitable depth (typically 450 mm) of clean cover as a growing medium would break this potential linkage.

The benzene exceedance at a depth of 1.4m is not considered to be representative of widespread contamination in Sands and Gravels with overlying soils reporting lower concentrations and concentrations below the relevant GAC. It is not considered this single exceedance requires further assessment nor does it pose a potential risk to human health at this depth.

The soils underlying the southern agricultural fields (that make up the proposed Phase 1 and 2 development areas) do not exceed appropriate GACs and thus may be regarded as suitable for the proposed end use with respect to this exposure pathway.

Linkage 2. Impact of organic contaminants on potable water supply pipes

One Made Ground - Coal Stocking Yard Sand and Gravel sample recorded concentrations above the UKWIR GAC for BTEX. The result indicates that a relevant linkage may exist associated with organic contaminants within the Sand and Gravel in the Coal Stocking Yard and therefore polyethylene (PE) and polyvinyl chloride (PVC) water supply pipes are expected to be not suitable in this discrete area of the development unless remedial measures are implemented that mitigate the risk. Across the remainder of the Phase 1 and Phase 2 development areas either PE or PVC water supply pipes would be suitable. It should be noted that at the time of this investigation the routes of water supply pipes had not been established, hence the investigation and sampling strategy may not be fully

compliant with UKWIR recommendations thus the relevant water supply company should be contacted as they may require further assessment. Based on the GSVs the site has been characterised as Green. As such there is no requirement for gas protection measures to be adopted for the Phase 1 and Phase 2 Development areas.

It should be noted that the potential pollutant linkages with respect to groundwater and surface waters were not specifically addressed in this report but shall be addressed in a separate controlled waters risk assessment.

9.1.2 Geotechnical

9.1.2.1 Foundations

9.1.2.1.1 Phase 1 Development coal stocking yard area:

Reinforced (mesh) deep trench foundations may be adopted to penetrate through the made ground and to found in the underlying medium dense to dense Chester Formation with suspended floor slabs, designed to an allowable bearing pressure of 100 kN/m²

9.1.2.1.2 Phase 1 Development agricultural field area:

conventional lightly reinforced (mesh) strip/ trench fill type foundations may be adopted with either ground bearing or suspended floor slabs, designed to an allowable bearing pressure of 100 kN/m².

9.1.2.1.3 Phase 2 Development agricultural field area:

Levels will be reduced by approximately 1.2m on the western boundary and increased in levels of with engineered fill to approximately 2.25 to 3.00m above current ground levels in the central and south eastern corner of the Phase 2 development area. Where depths to the underlying medium dense to dense granular soils of the Chester Formation allow conventional lightly reinforced (mesh) strip/ trench fill type foundations may be adopted with suspended floor slabs, designed to an allowable bearing pressure of 100 kN/m². In areas where the engineered backfill exceeds the depths to which trench fill type foundations may be economic then a reinforced rafted foundation solution, founded in the engineered backfill, may prove to be more economical.

9.1.2.2 Chemical attack by sulphur-bearing mineral

9.1.2.2.1 Phase 1 and 2 Development - agricultural field areas

The natural Chester Formation sands and gravels underlying the Phase 1 and 2 Development areas is considered to be classed as natural ground unlikely to contain pyrite. The Design Sulphate (DS) Class in the natural Chester Formation sands and gravels underlying the Phase 1 and 2 Development areas is DS1, the aggressive chemical environment for concrete (ACEC) is AC-1s.

9.1.2.2.2 Phase 1 Development - coal stocking yard

The colliery spoil materials underlying the coal stocking yard area of the Phase 1 Development area should be considered as comprising brownfield ground which may contain pyrite and the laboratory testing results confirm this. The Design Sulphate (DS)

class in The Colliery Spoil made ground underlying the north western corner of the Phase 1 Development area is DS-4, and the aggressive chemical environment for concrete (ACEC) is AC-3s.

9.1.2.2.3 Phase 2 Development - imported granular fill from western ridge

It is understood that the southern area of Phase 2 may be made up to formation level with granular materials sourced from the Western Ridge area of Thoresby Area B. These reworked Chester Formation sands and gravels are considered to be classed as brown field ground unlikely to contain pyrite. The Design Sulphate (DS) Class for the re-worked Chester Formation sands and gravels sourced from the Western Ridge area that may be used as fill to be imported into the Phase 2 Development area is DS1, and the aggressive chemical environment for concrete (ACEC) is AC-1s.

9.1.2.2.4 Coal Stocking Yard Colliery Spoil combustion

The CV values are above the 2 MJ/kg threshold that would be considered unlikely to be combustible, they are well below the CV of 7MJ/kg that would be considered at risk of smouldering and the loss on ignition results are all well less than 25%. Therefore, it is not considered that the colliery spoil is potentially combustible

9.2 Recommendations

9.2.1.1 Remedial Method Statement

A Remedial Method Statement will be required to outline the needed for mitigation and verification requirements to make the site north western area of Phase 1 Development area underlain by the Coal Stocking Yard suitable for its intended use.

9.2.1.2 Additional site investigation (SI)

The potential pollutant linkages with respect to groundwater and surface waters were not specifically addressed in this report. A separate controlled waters risk assessment should be undertaken across the wider Thoresby Area A and Area B areas to address the potential pollutant linkages with respect to groundwater and surface waters.

BIBLIOGRAPHY

- AGS Interim Guidance (2013), 'Site investigation and asbestos risk assessment for the protection of site investigation and geotechnical laboratory personnel', February.
- Boyle, R. A. and Witherington, P. J. (2007), 'Guidance on Evaluation of Development Proposals on Sites where Methane and Carbon Dioxide are Present', National House-Building Council and RSK Group.
- British Geological Survey (2010), Sheet Number 155, Solid & Drift Edition, 1:50 000.
- British Standards Institution (BSI) (1990), 'BS 1377:1990. Methods of test for soils for civil engineering purposes'.
- British Standards Institution (2015), 'BS 5930:2015. Code of practice for ground investigations'.
- British Standard Institution (BSI) (2015), 'BS 8485:2015. Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings '.
- British Standards Institution (2013), 'BS 10175:2013. Investigation of potentially contaminated sites: Code of practice'.
- British Standards Institution (2013), BS8576:2013. Guidance on investigations for ground gas – permanent gases and volatile organic compounds (VOCs)
- Building Research Establishment (BRE) (2001), *BRE Report 414. Protective measures for housing on gas-contaminated land* (London: BRE).
- Building Research Establishment (2005), *BRE Special Digest 1: Concrete in aggressive ground* (London: BRE).
- Chandler R. J. and Forster A., (2001) CIRIA Report C570, Engineering in Mercia Mudstone.
- Chartered Institute for Environmental Health and Land Quality Management (2009), 'The LQM/CIEH Generic Assessment Criteria for Human Health', second edition.
- Chartered Institute of Environmental Health (CIEH) and CL:AIRE (2008), *Guidance on Comparing Soil Contamination Data with a Critical Concentration* (London: CIEH).
- CIRIA (2014). Good practice on the testing and verification of protection systems for buildings against hazardous ground gases
- CL:AIRE (2009), *Soil Generic Assessment Criteria for Human Health Risk Assessment* (London: CL:AIRE).
- CL:AIRE (2011), *CL:AIRE Code of Practice. The Definition of Waste: Development Industry Code of Practice, Version 2* (London: CL:AIRE).
- Department for Environment, Food and Rural Affairs (2010), *The River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Directions 2010* (London: HMSO).
- Environment Agency (2004), *Model Procedures for the Management of Contaminated Land. Contaminated Land Report Number 11 (CLR11)*, September (Bristol: Environment Agency).
- Environment Agency (2006a), 'Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination'.

Environment Agency (2009a), Contaminated Land Exposure Assessment (CLEA) software, version 1.06.

Environment Agency (2009b), *Human health toxicological assessment of contaminants in soil. Science Report – Final SC050021/SR2*, January (Bristol: Environment Agency).

Environment Agency (2009c), 'Science Report SC050021/benzene SGV, toluene SGV, ethylbenzene SGV, xylene SGV, mercury SGV, selenium SGV, nickel SGV, arsenic SGV, cadmium SGV, phenol SGV, dioxins, furans and dioxin like PCBs SGVs', 'Supplementary information for the derivation of SGV for: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin- like PCBs', and 'Contaminants in soil: updated collation of toxicological data and intake values for humans: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin- like PCBs', March 2009, May 2009 and September 2009.

Environment Agency (2009d), *Science Report – SC050021/SR3. Updated technical background to the CLEA model* (Bristol: Environment Agency).

Environment Agency (2010a), 'GPLC1 – Guiding Principles of Land Contamination', 'GPLC2 – Frequently Asked Questions, Technical Information, Detailed Advice and References', and 'GPLC3 – Reporting Checklists', all March.

Environment Agency (2010b), 'Horizontal Guidance Note H1 - Environmental risk assessment for permits'.

Environment Agency (2011) Chemical Standards Database.

Environment Agency (no date) Freshwater environmental quality standards.

Environment Agency www.environment-agency.gov.uk/.

Environmental Permitting (England and Wales) Regulations 2010 (London: HMSO).

Hartless, R. (1991), 'BRE Report 212: Construction of new buildings on gas-contaminated land', Building Research Establishment.

Hazardous Waste Regulations 2005 (London: HMSO).

National House-Building Council (1999), 'Chapter 5.2: Suspended Ground Floors' in *NHBC Standards*, revised September 1999, effective January 2000.

Norbury, D. (2010), *Soil and Rock Description in Engineering Practice* (Caithness: Whittles).

RLE (2016), Phase 1 Desk Study Report dated 14 December 2016.

Rudland, D. J., Lancefield, R. M. and Mayell, P. N. (2001), *CIRIA C552. Contaminated Land Risk Assessment: A Guide to Good Practice* (London: CIRIA).

The Building Regulations (revised December 2004) 'Approved Document C. Department of the Environment and The Welsh Office'.

Transport and Road Research Laboratory (1970), 'TRRL Road Note 29 (Appendix 1). Road pavement design'.

Transport and Road Research Laboratory (1984), 'TRRL Report LR1132 (Table C1)'.

Water Framework Directive (2000/60/EC).

Wilson, S. A. and Card, G. B. (1999), 'Reliability and risk in gas protection design', *Ground Engineering*, February: 33–6.

Wilson, S., Oliver, S., Mallet, H., Hutchings, H. and Card, G. (2007), *CIRIA Report C665: Assessing risks posed by hazardous ground gases to buildings* (London: CIRIA).


World Health Organization (2004), *Guidelines for drinking-water quality*, 3rd edn (Geneva: WHO).

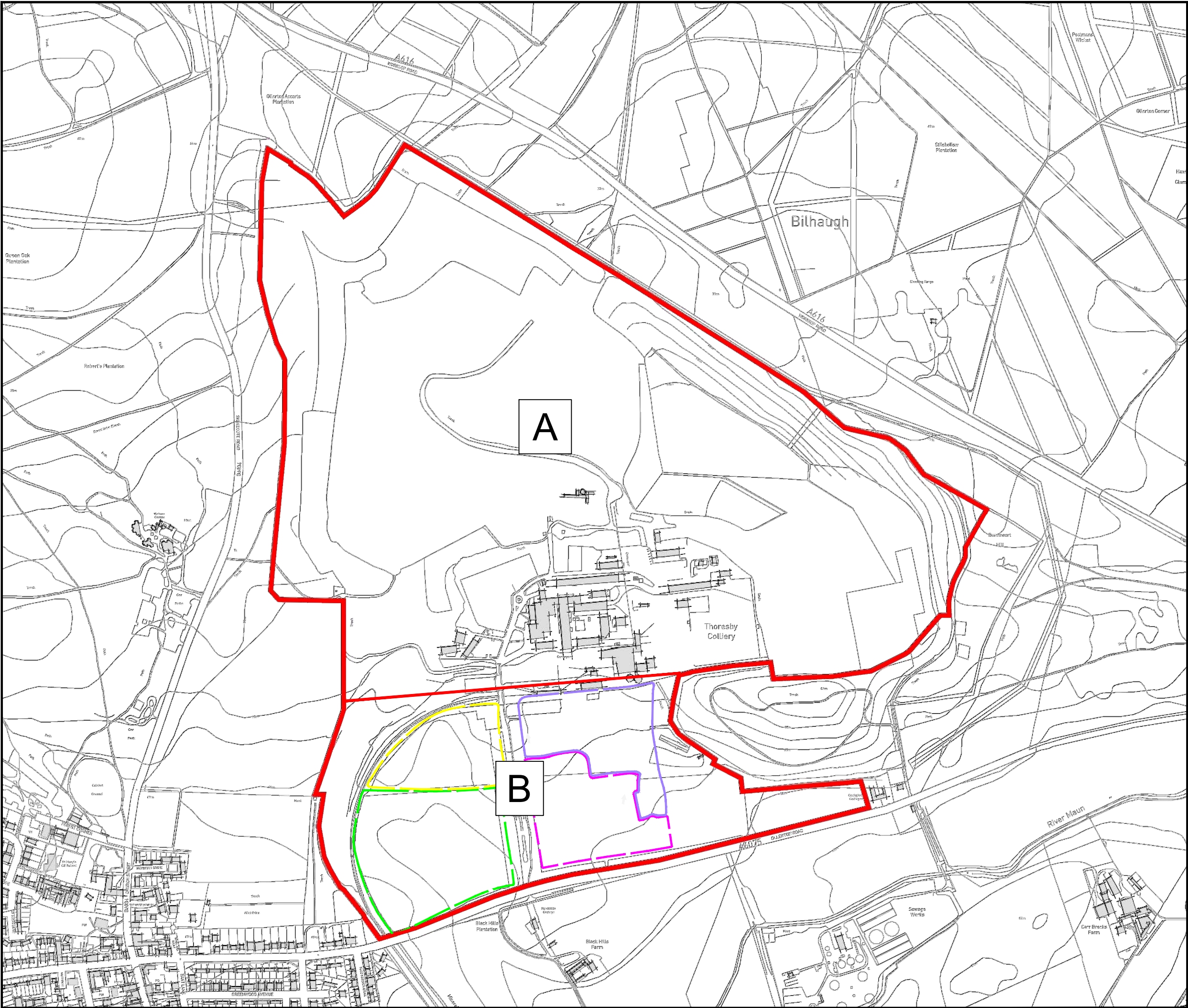
WRc plc (2002), 'Polycyclic Aromatic Hydrocarbons (PAH): Priorities for Environmental Quality Standard Development, R&D Technical Report P45'.

FIGURES



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| <div></div> <div>12 Royal Scot Road Pride Park Derby DE24 8AJ</div> <div>Tel: +44 (0)1332 542740 Fax: +44 (0)1332 542760 Web: www.rsk.co.uk</div> | | | | | Client HARWORTH ESTATES | | | | | | | | | | | | | | |
| | | | | | Project Title THORESBY AREA B - PHASES 1 AND 2 | | | | | | | | | | | | | | |
| | | | | | Drawing Title SITE LOCATION PLAN | | | | | | | | | | | | | | |
| Drawn HD | | Date 31.10.18 | | Checked AJ | | Date 31.10.18 | | Approved AJ | | Date 31.10.18 | | Project No. 301924 | | Drawing File 301924-R02(00)D001A | | | | | |
| Scale 1:50000 | | | | Orig Size A4 | | | | Dimensions — | | | | Drawing No. FIGURE 1 | | | | | | Rev. A | |



LEGEND:

- Site boundary
- Residential Development Phase 1 boundary (up to 150 dwellings)
- Residential Development Phase 2 boundary (approximate)
- Residential Development Phase 3 boundary (approximate)
- Residential Development Phase 4 boundary (approximate)



NOTES
Base plan from Pegasus Design, Drawing No. EMS2709_004, Revision B, Dated 07.09.16.

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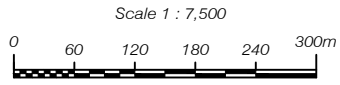
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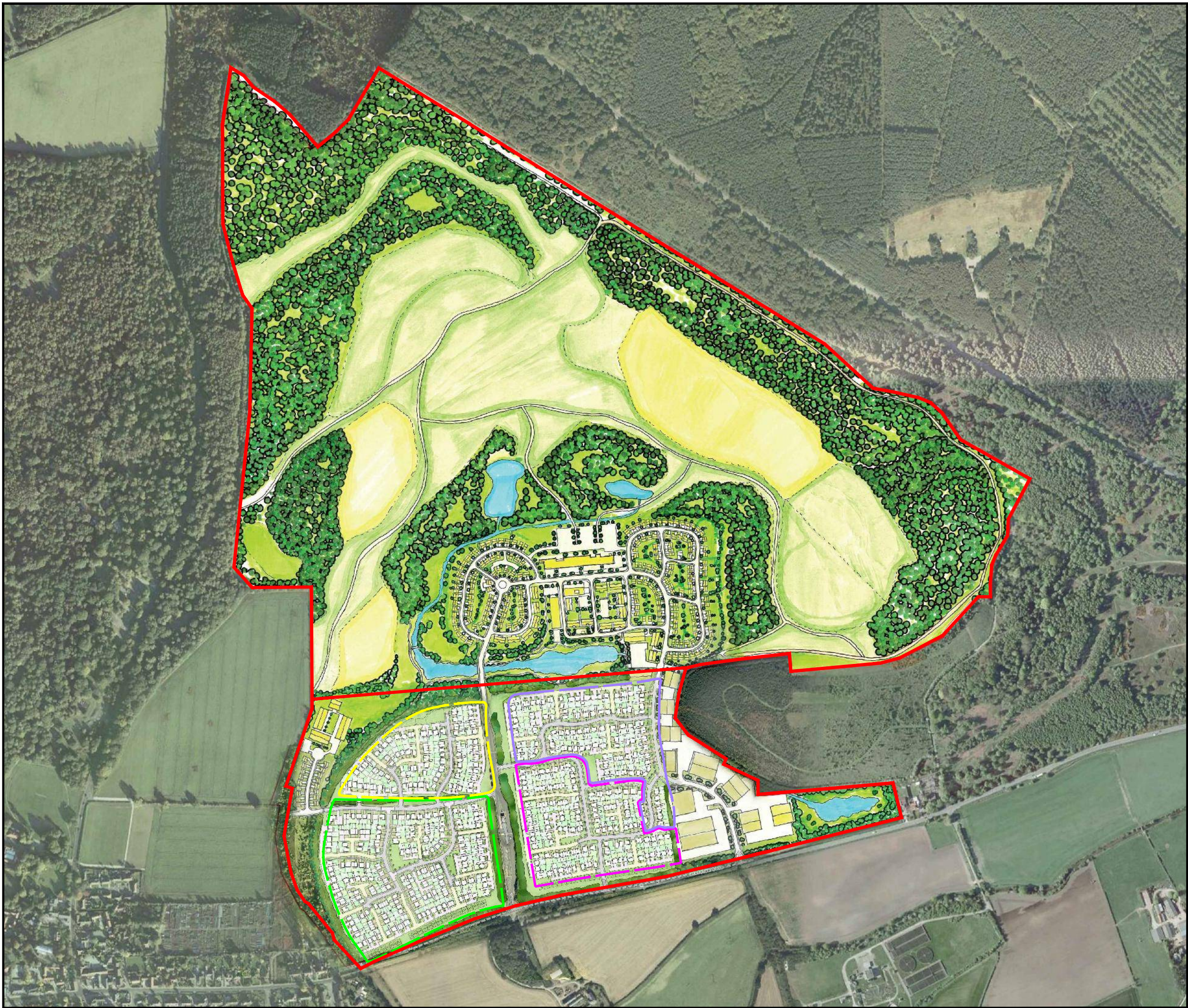
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TITLE
SITE LAYOUT

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DRAWING FILE: 301924-R02(00)D002A

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LEGEND:

- Site boundary
- Residential Development Phase 1 boundary (up to 150 dwellings)
- Residential Development Phase 2 boundary (approximate)
- Residential Development Phase 3 boundary (approximate)
- Residential Development Phase 4 boundary (approximate)



NOTES

Base plan from Leonard Design Architects
'Proposed Masterplan', Dwg No. 010 0519,
Rev P00, Dated 21.12.16.

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| TITLE | | FORMER THORESBY COLLIERY ILLUSTRATIVE MASTER PLAN | |
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| FIGURE 3 | | | |



LEGEND:

- APPROXIMATE EXTENT OF HARWORTH OWNERSHIP (FROM TITLE PLAN)
- LOCATION OF TEMPORARY CONSTRUCTION ACCESS
- LOCATION OF SALES AREA
- LOCATION OF TEMPORARY SALES ACCESS
- PROPOSED SITE LEVELS (AS PROPOSED BY SCS)
- APPROXIMATE LOCATION OF NEW PUMP STATION
- EXTENT OF OFF-PHASE 1 FOUL DRAINAGE TO BE 'UNITED'
- EXISTING FOUL CONNECTION POINT

- Residential Development Phase 1 boundary (up to 150 dwellings)
- Residential Development Phase 2 boundary (approximate)
- Residential Development Phase 3 boundary (approximate)
- Residential Development Phase 4 boundary (approximate)

NOTES

Base plan from STEN Architects 'Phase 1 Constraints Plan', Dwg No. 1832-100, Dated 11.07.18

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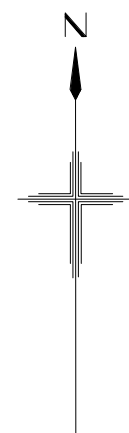
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| | | FIGURE 4 | |



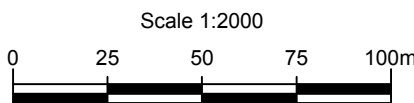
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 - Northwestern Field
 - Coal stocking yard
 - Railway cutting
 - Western ridge

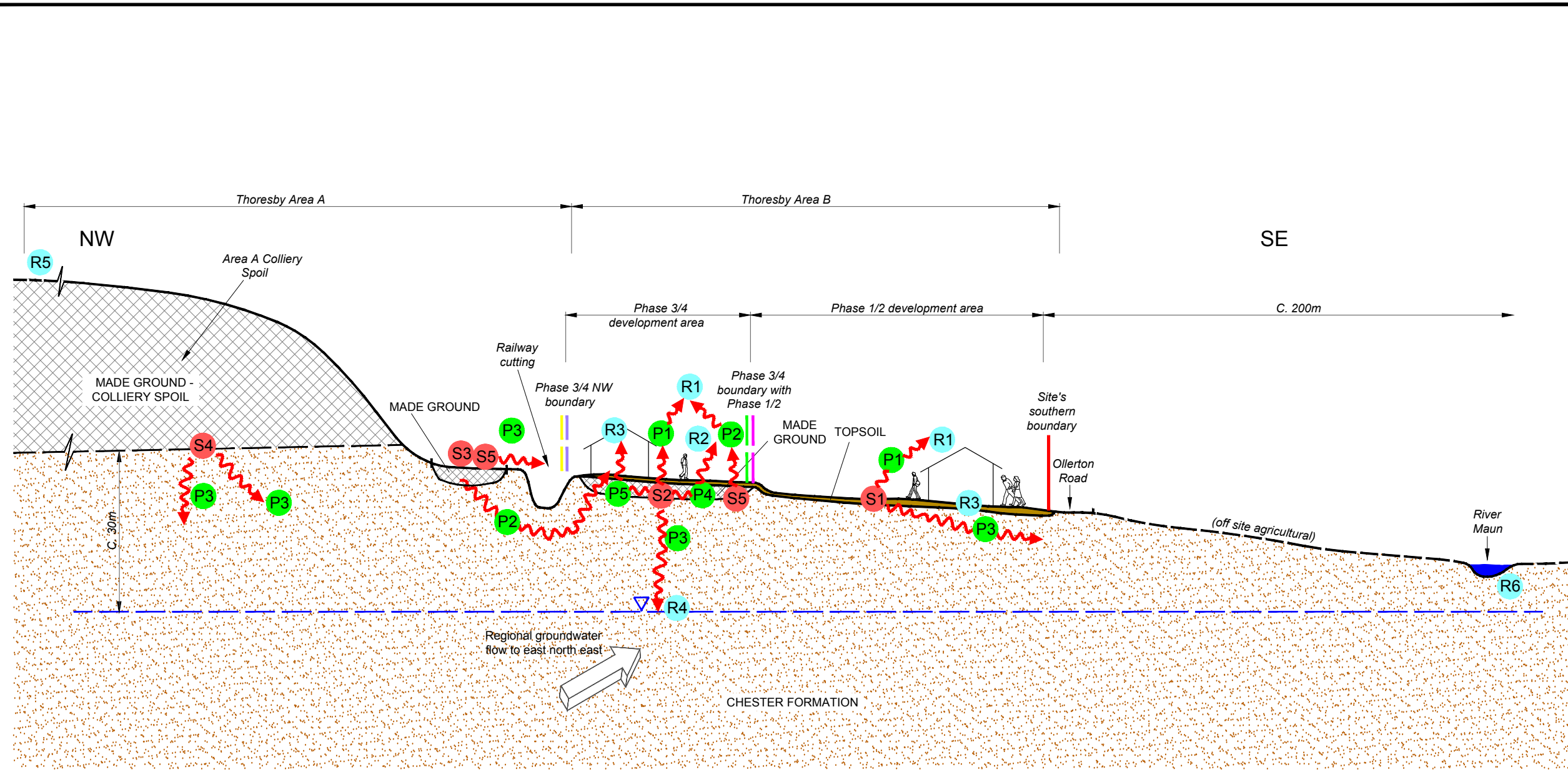


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POTENTIAL SOURCES OF POLLUTION

- S1** Pesticides on the southernmost agricultural fields, residential development (Phases 1 and 2)
- S2** Contaminated soils from infill Coal Stocking Area and north-western agricultural field
- S3** Contaminated soils from infilled railway sidings, pit head buildings and transformers
- S4** Contaminated soils from former Rexco plant coking works located in Area A
- S5** Organic material within soils from infilled railway sidings, Coal Stocking Yard or unknown fill

PLAUSIBLE PATHWAYS

- P1** Oral, dermal and inhalation exposure with impacted soil, soil vapour and dust / fibres, ingestion of home-grown produce
- P2** Ground gas and soil gas inhalation
- P3** Lateral and vertical migration including leaching
- P4** Root uptake leaching to phytotoxicity
- P5** Chemical attack of infrastructure (including water supply pipes) and buildings

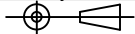

POTENTIAL SENSITIVE RECEPTORS

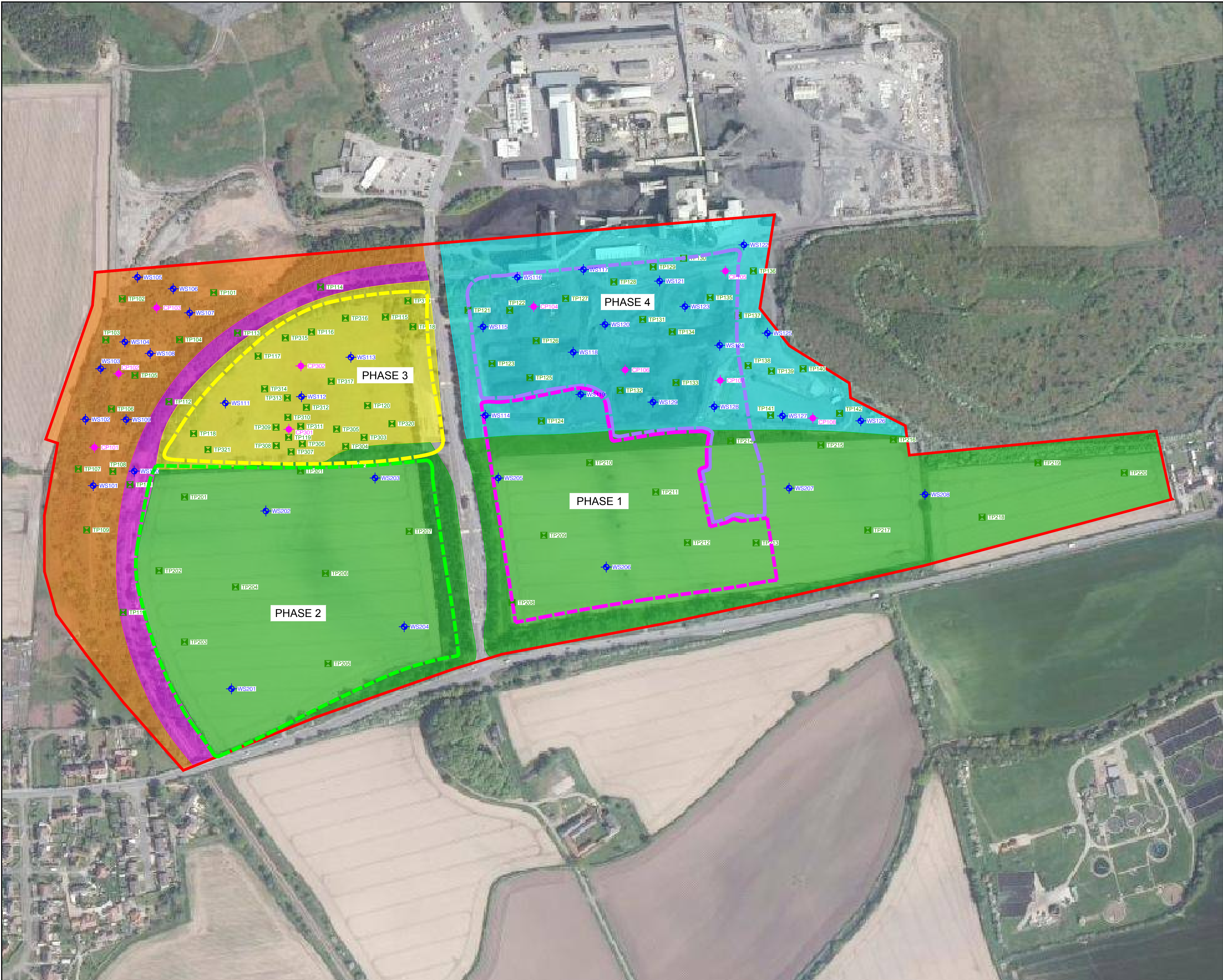
- R1** Future site occupants, residential end users
- R2** Vegetation
- R3** Potable water supply pipes
- R4** Groundwater beneath the site
- R5** Egological receptors (off-site Birklands and Bilhaugh SSSI in the northern part of Area A)
- R6** Surface watercourses (River Maun C. 200m to the south of Area B)

LEGEND:

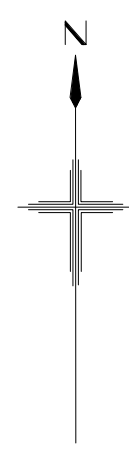
- S1** Sources
- P1** Pathways
- R1** Receptors
- Potential contamination pathways
- Topsoil
- MG - Made ground
- Chester Formation

NOTE:
Diagrammatic - not to scale

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| THORESBY AREA B - PHASES 1 AND 2 | | | | | |
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| CONCEPTUAL SITE MODEL | | | | | |
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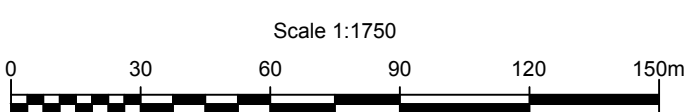
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 - Trial pit location
 - Window sample location
 - Cable percussion location
 - Southern agricultural fields
 - Northwestern Field
 - Coal stocking yard
 - Railway cutting
 - Western ridge
 - Residential development Phase 1 boundary
 - Residential development Phase 2 boundary (approximate)
 - Residential development Phase 3 boundary (approximate)
 - Residential development Phase 4 boundary (approximate)



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| TITLE | | EXPLORATORY HOLE LOCATIONS | |
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| HD | 31.10.18 | FIGURE 7 | A |



APPENDIX A

SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for Harworth Estates Limited (the "client") in accordance with the appointment framework between RSK and Harworth Estates. The Services were performed by RSK with the skill and care ordinarily exercised by a reasonable environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the client.
2. Other than that expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.
3. Unless otherwise agreed in writing the Services were performed by RSK exclusively for the purposes of the client. RSK is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. **Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.**
4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.
5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.
6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials.
7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a walk-over survey of the site together with RSK's interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The Services are also based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely. The Services clearly are limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the walk-over survey. Further RSK was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services. RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the client and RSK.
8. The intrusive environmental site investigation aspects of the Services is a limited sampling of the site at pre-determined borehole and soil vapour locations based on the operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and RSK] [based on an understanding of the available operational and historical information,] and it should not be inferred that other chemical species are not present.
9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (boreholes, trial pits etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.

APPENDIX B

SUMMARY OF LEGISLATION AND POLICY RELATING TO CONTAMINATED LAND

Part IIA of the Environmental Protection Act 1990 (EPA) and its associated Contaminated Land Regulations 2000 (SI 2000/227), which came into force in England on 1 April 2000, formed the basis for the current regulatory framework and the statutory regime for the identification and remediation of contaminated land. Part IIA of the EPA 1990 defines contaminated land as 'any land which appears to the Local Authority in whose area it is situated to be in such a condition by reason of substances in, on or under the land, that significant harm is being caused, or that there is significant possibility of significant harm being caused, or that pollution of controlled waters is being or is likely to be caused'. Controlled waters are considered to include all groundwater, inland waters and estuaries.

In August 2006, the Contaminated Land (England) Regulations 2006 (SI 2006/1380) were implemented, which extended the statutory regime to include Part IIA of the EPA as originally introduced on 1 April 2000, together with changes intended chiefly to address land that is contaminated by virtue of radioactivity. These have been replaced subsequently by the Contaminated Land (England) (Amendment) Regulations 2012, which now exclude land that is contaminated by virtue of radioactivity.

The intention of Part IIA of the EPA is to deal with contaminated land issues that are considered to cause significant harm on land that is not undergoing development (see Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance, April 2012). This document replaces Annex III of Defra Circular 01/2006, published in September 2006 (the remainder of this document is now obsolete).

Water Framework Directive (WFD)

The Water Framework Directive 2000/60/EC is designed to:

-) enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands that depend on the aquatic ecosystems
-) promote the sustainable use of water
-) reduce pollution of water, especially by 'priority' and 'priority hazardous' substances
-) ensure progressive reduction of groundwater pollution.

The WFD requires a management plan for each river basin be developed every six years.

Groundwater Directive (GWD)

The 1980 Groundwater Directive 80/68/EEC and the 2006 Groundwater Daughter Directive 2006/118/EC of the WFD are the main European legislation in place to protect groundwater. The 1980 Directive is due to be repealed in December 2013. The European legislation has been transposed into national legislation by regulations and directions to the Environment Agency.

Environmental Permitting Regulations (EPR)

The Environmental Permitting (England and Wales) Regulations 2010 provide a single regulatory framework that streamlines and integrates waste management licensing, pollution prevention and control, water discharge consenting, groundwater authorisations, and radioactive substances regulation. Schedule 22, paragraph 6 of EPR 2010 states: 'the regulator must, in exercising its relevant functions, take all necessary measures - (a) to prevent the input of any hazardous substance to groundwater; and (b) to limit the input of non-hazardous pollutants to groundwater so as to ensure that such inputs do not cause pollution of groundwater.'

Water Resources Act (WRA)

The Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009 updated the Water Resources Act 1991, which introduced the offence of causing or knowingly permitting pollution of controlled waters. The Act provides the Environment Agency with powers to implement remediation necessary to protect controlled waters and recover all reasonable costs of doing so.

Priority Substances Directive (PSD)

The Priority Substances Directive 2008/105/EC is a 'Daughter' Directive of the WFD, which sets out a priority list of substances posing a threat to or via the aquatic environment. The PSD establishes environmental quality standards for priority substances, which have been set at concentrations that are safe for the aquatic environment and for human health. In addition, there is a further aim of reducing (or eliminating) pollution of surface water (rivers, lakes, estuaries and coastal waters) by pollutants on the list. The WFD requires that countries establish a list of dangerous substances that are being discharged and EQS for them. In England and Wales, this list is provided in the River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010. In order to achieve the objectives of the WFD, classification schemes are used to describe where the water environment is of good quality and where it may require improvement.

Planning Policy

Contaminated land is often dealt with through planning because of land redevelopment. This approach was documented in Planning Policy Statement: Planning and Pollution Control PPS23, which states that it remains the responsibility of the landowner and developer to identify land affected by contamination and carry out sufficient remediation to render the land suitable for use. PPS23 was withdrawn early in 2012 and has been replaced by much reduced guidance within the National Planning Policy Framework (NPPF).

The new framework has only limited guidance on contaminated land, as follows:

-) *"planning policies and decisions should also ensure that:*
- *the site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation;*
 - *after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and*



- *adequate site investigation information, prepared by a competent person, is presented”.*

APPENDIX C

BRITISH GEOLOGICAL SURVEY BOREHOLE RECORDS



**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

BGS ID: 234925 : BGS Reference: SK66NW9/A

British National Grid (27700) : 463531,367591

[Report an issue with this borehole](#)



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11932) Wt. 90370/0370 10,000 9/39 A. & E.W. Ltd. Gp. 685

RECORD OF SHAFT OR BORE FOR MINERALS

Name and Number of Shaft or Bore given by Geological Survey:
THORESBY COLLIERY: No. 1 Shaft

Name and Number given by owner (if different from above):

Town or Village Ollerston Date of sinking 1928

Exact site 1 mile W of Ollerston
 (Sketch map, see over)

Purpose for which made COAL

Level at which bore commenced relative to O.D. 228 ft. If not down here, state if horizontal or up

Made by Francis Combe & Co. for Messrs. Bolsover Colliery Co.

Information from Bolsover Co. per Notts. Coal Survey Laboratory Date received 1941

Specimens Details of marker bands, see Edwards & Hubblefield, G.J.G. 5 Dip of strata 1945 ft. 216-232

County Nottingham

Quarter Sheet 19 SW

1" N.S. G.S. Map 48

1" O.S. G.S. Map A

Whether Confidential CONFIDENTIAL

A sketch-map or tracing from a large-scale map is desirable.

SKIDONW/9A

| GEOLOGICAL CLASSIFICATION | DESCRIPTION | THICKNESS | | DEPTH | |
|---------------------------|---|-----------|-----|-------|-----|
| | | FT. | in. | FT. | in. |
| Superficial | Soil | | 9 | | 9 |
| | Brown sand with pebbles | 2 | 7 | 3 | 4 |
| | Red Sandstone w. pebbles | 113 | 1 | 116 | 5 |
| | Light red coarse ditto | 14 | 2 | 130 | 7 |
| | Yellowish red " " | 101 | 9 | 232 | 4 |
| | Red sandstone | 55 | 1 | 287 | 5 |
| | Light red coarse sst. w. pebbles & marl packets | 19 | 5 | 306 | 10 |
| | Sandst., red | 92 | 10 | 399 | 8 |
| | " " , w. marl bands | 11 | 2 | 410 | 10 |
| | " " & grey, w. marly bands | 9 | 6 | 420 | 4 |
| Burker Passages | " " , w. marl partings | 4 | 6 | 424 | 10 |
| | Limestone, grey | 4 | 11 | 429 | 9 |
| | Sandst., yellow & red | 18 | 7 | 448 | 4 |
| | " , red & grey, w. marl (faulty on N. side) | 45 | 6 | 493 | 10 |
| | " & marly sandst., red | 28 | 0 | 521 | 10 |
| | Marl, red, w. grey sst. & Limest. bands | 15 | 9 | 537 | 7 |
| | Sandst., red & grey | 9 | 4 | 546 | 11 |
| | Marl & marly sandst., red & grey | 9 | 1 | 556 | 0 |
| | Sandst., red & grey, w. marl bands | 43 | 7 | 599 | 7 |
| | Marly sandst., red & grey | 21 | 5 | 621 | 0 |
| U. Noq. Lst | Sandst. | 7 | 3 | 628 | 3 |
| | Limestone, red & brown | 6 | 3 | 634 | 6 |
| | " , grey, w. shale bands | 30 | 0 | 664 | 6 |
| | " , dark grey & blue, w. blue shale partings | 130 | 6 | 795 | 0 |
| | Shale, blue: some fossils | 15 | 11 | 810 | 11 |
| | BRECCIA 18 in. | 1 | 6 | 812 | 5 |
| | Stone bind, grey | 1 | 2 | 813 | 7 |
| | Bind, red & dark | | 7 | 814 | 2 |
| | Rock, grey | 6 | 9 | 820 | 11 |

| | | | | | |
|---|-----------------------------|---------------------------|-----------------------------|-----------------------------|----|
| 1199'3" | Bind, red & dark | | 11 | 821 | 10 |
| | Rock, grey | 3 | 1 | 824 | 11 |
| | Bind, red & brown | 5 | 9 | 830 | 8 |
| | " , dark blue | 5 | 8 | 836 | 4 |
| | COAL & bat 3 in. | | 9 | 837 | 1 |
| | Clunch & stone clunch, grey | 2 | 1 | 839 | 2 |
| <p>1199'3" 1 - Clamford Off. Edwards (1967 p. 257-60)</p> <p>GEOLOGICAL SURVEY AND MUSEUM, SOUTH KENSINGTON, LONDON, S.W.7. <i>APB</i> Borehole SK66NW9/A, 1901</p> | | | | | |
| | | G.S.M. Office File No. | Site marked on 6" Map by | Site marked on 1" Map by | |
| | | | | 31/4/78 | |



**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

BGS ID: 234961 : BGS Reference: SK66NW30

British National Grid (27700) : 463368,367430

[Report an issue with this borehole](#)

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2 NO. BOREHOLES.

RECORD OF WELL

At THORESBY COLLIERY
EDWINSTOW

Town or Village THORESBY
County NOTTINGHAMSHIRE

For Survey use only Licence No.
SK 66 NW/30 N. 14653

113/ 59 B+C

Six-inch sheet NORTS. 19SW/W Six-inch National Grid sheet SK 66 NW (6337 6743)

State whether owner, tenant, builder, contractor, consultant, etc.:—
NATIONAL COAL BOARD
(Nos 329+330)

Address (if different from above).....

Level of ground surface above sea level (O.D.).....ft. If well top is not at ground level, state how far above: *ft. below:ft.

SHAFT.....ft.; diameter.....ft.; HEADINGS (please attach details—dimensions and directions)
(70 m) (300 mm)

BORE 230 ft.; diameter of bore: at top 12 in.; at bottom 12 in. (300 mm)

Full details of permanent lining tubes (position, length, diameter, plain, slotted etc.).....
(33 ft) 10M x 380mm Plain Casing
(930 ft) 70M x 300 mm Slotted Casing (P.V.C.)

Water struck at depths of (70 ft) ft. below well top.

Rest level of water 21.30 M above* well top. Suction at 65 M. Yield on 5 hours* test pumping at 24,000 galls. per hr. with depression to 35 M below well top. (37.884 4/5)

Recovery to rest level in 24 mins* Capacity of pump 30,000 g.p.h. Date of measurements June 1979

DESCRIPTION OF PERMANENT PUMPING EQUIPMENT:

Make and/or type Buhai Pleser Q 82 Motive power Electricity
(11.5 ft)

Capacity 30,000 galls. per hour (37.884 4/5) Suction at 65 M. below well top.

Amount pumped.....galls. per day. Estimated consumption.....galls. per week.

Well made by..... Date of sinking May/June 1979

Information from FORAKY LTD.

ADDITIONAL NOTES ANALYSIS (please attach copy if available)

For Survey use only
Date Received 11.9.79
Section 6
Pumping test
Observ. well
Recorder
E.R. log
Site marked on
1" map 0
5" map NG. 0
(use symbol)

British Geological Survey

British Geological Survey

British Geological Survey

Record forwarded
to D.G. Y.E.M.
date

LOG OF STRATA OVERLEAF.

2/11/89 0949 W.14813-2.17

GEOLOGICAL SURVEY,
WATER DIVISION,
SOUTH KENSINGTON,
LONDON, S.W.7.



**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

BGS ID: 234963 : BGS Reference: SK66NW32

British National Grid (27700) : 463003,367629

[Report an issue with this borehole](#)

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British Geological Survey

RECORD OF WELL

For Institute use only. Licence No.
N.

At .. REXCO N°1
(THORESBY COLLIERY).....
 Town or Village EDWINSTOWE.....
 County NOTTINGHAMSHIRE.....

SK 66 NW / 32

British Geological Survey

EXACT SITE

OF WELL

Six-inch National Grid sheet and reference....SK...66NW 463008 53E 367631 38AFor .. N.C.B......State whether owner, tenant, builder, contractor, consultant, etc.: OWNER.....

Address (if different from above)

British Geological Survey

Level of ground surface above sea level (O.D.).....ft (or m) 76.90.....m)

*DELETE

If borehole top is not at ground level state how far above: * ..ft (.....m)

AS

SHAFT.....ft (.....m); diameter.....ft (.....m);

NECESSARY

HEADINGS (please attach details—dimensions and directions)

BORE.....ft (.....m); diameter: at top.....in (.....mm);

at bottom.....in (.....mm)

British Geological Survey

Full details of permanent lining tubes (position, length, inner and outer diameters, plain slotted etc.)

.....10m x 3.75mm.....
74.04m starting at 0.22m above ground level
of perforated casing.....

British Geological Survey

Water struck at depths offt (.....m) below well top boreholeRest level of water.....ft (.....m) above borehole well top. Suction atft (.....m)

TEST

Yield on.....hours* test pumping at: 25000 galls per hour.....(.....l/s) with

CONDITIONS

depression to 49.23m (.....m) below borehole well top. Recovery to rest level in 20 days hoursCapacity of pump. 30000 g.p.h. (.....l/s)Date of measurements. 4-3-81 to 8-5-81

DESCRIPTION OF PERMANENT PUMPING EQUIPMENT:

British Geological Survey

NORMAL

Make and/or type BRITISH PLEUGER B.B.H...... Motive power. ELECTRICITY

CONDITIONS

Capacity 30000 galls (.....m³) per hour. Suction atft (.....m)below borehole well top. Amount pumped.....galls (.....m³) per day. Estimatedconsumption.....galls (.....m³) per weekborehole Well made by NATIONAL COAL BOARD..... Date of sinking. FEBRUARY 1981

ADDITIONAL NOTES ANALYSIS (please attach copy if available)

British Geological Survey

LOC OF

STRATA

OVERLEAF

INSTITUTE OF GEOLOGICAL SCIENCES
 HYDROGEOLOGY UNIT
 EXHIBITION ROAD
 LONDON SW7 2DE

BGS 2194 10 000 7/79

British Geological Survey

British Geological Survey

Received from

.....

.....

Date

Observation well.....

Recorder.....

ER log

Site marked on

1" map

6" map—Grid Sheet (use symbol)

Copy to.....

.....

Date.....



**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

BGS ID: 234964 : BGS Reference: SK66NW33

British National Grid (27700) : 463000,367628

[Report an issue with this borehole](#)

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113 B

For Institute use only Licence No. 15081

RECORD OF WELL

At **REXCO N°2**
(THRESBY COLLIERY)

Town or Village **EDWINSTONE**

County **NOTTINGHAMSHIRE**

SK 66 NW/33

113/33B

Six-inch National Grid sheet and reference **SK 66 NW E 4630085 N 3676285**

For **N.C.B.** **SK 6300 6763**

State whether owner, tenant, builder, contractor, consultant, etc.: **OWNER**

Address (if different from above)

Level of ground surface above sea level (O.D.) **249** ft (**75.90** m)

DELETE If well top is not at ground level state how far above **0.30** ft (**0.30** m)

AS SHAFT **10m** ft (**3.75** m); diameter **15** in (**375** mm)

NECESSARY HEADINGS (please attach details—dimensions and directions)

BORE **229 1/2** ft (**70.0** m); diameter at top **15** in (**375** mm); at bottom **15** in (**375** mm)

Full details of permanent lining tubes (position, length, inner and outer diameters, plain slotted etc.):

6B 5.5m starting at 0.30m above ground level of perforated casing

Water struck at depths of **31.43m** ft (**65.0** m) below well top

Rest level of water **31.43m** ft (**65.0** m) below well top. Suction at **65.0** ft (**65.0** m)

Yield on **31.43m** ft (**65.0** m) below well top. Suction at **65.0** ft (**65.0** m)

depression to **31.43m** ft (**65.0** m) below well top. Recovery to rest level in **31.43** mins

Capacity of pump **31.43** g.p.h. (**31.43** l/s)

Date of measurements

DESCRIPTION OF PERMANENT PUMPING EQUIPMENT:

Make and/or type **BRITISH REUGER 08L** Motive power **ELECTRICITY**

Capacity **30,000** galls (**30,000** m³) per hour. Suction at **65.0** ft (**65.0** m)

below well top. Amount pumped **30,000** galls (**30,000** m³) per day. Estimated consumption **30,000** galls (**30,000** m³) per week

Well made by **NATIONAL COAL BOARD** Date of sinking **MAY 1981**

ADDITIONAL NOTES ANALYSIS (please attach copy if available)

Mo lg. will be Pleistocene Sandstone Group.

ES. 21 1981.

LOG OF STRATA

OVERLEAF

INSTITUTE OF GEOLOGICAL SCIENCES
HYDROGEOLOGY UNIT
EXHIBITION ROAD
LONDON SW7 2DE

Received from **N.C.B.**

Date

Observation well

Recorder

ER log

Site marked on

1" map

6" map—Grid Sheet

(use symbol)

Copy to **Y.I.E.M.**

Date

SECTION OF Thoresby Colliery No. 2 Shaft

PURPOSE Coal Exploitation

EXACT SITE E. 43533 N. 767522

LEVEL AT WHICH Shaft COMMENCED RELATIVE TO O.D. +225.3'

DATE OF SINKING OR BORING Original 1925-8, Deepening 1947-9

SINKER OR BORER Re-examination of sinking dirk by M. Lock, N.C.B. Geologist.

6-inch Map

B/H
Regd. No.

(County, Sheet and Qtr.)

SK.66.NW. 136

302

(Nat. Grid, Sheet and Qtr.)

Attach tracing from a map or sketch map if possible

| GEOLOGICAL CLASSIFICATION | NATURE OF STRATA | THICKNESS | | DEPTH | |
|------------------------------|--|-----------|-----|-------|-----|
| | | FEET | IN. | FEET | IN. |
| | Soil (no sample) | | 10 | | 10 |
| | Brown Sand and pebbles (no sample) | 2 | 6 | 3 | 4 |
| SSG | Coarse red Sandstone with pebbles | 103 | 8 | 107 | 0 |
| | Sandstone red-brown | 178 | 2 | 285 | 2 |
| | Sandstone, yellow | | 9 | 285 | 11 |
| | Marl, red, micaceous sand 8" @ 286'8" | 1 | 1 | 287 | 0 |
| Um 3 | Sandstone, red-brown, conglomeratic in part, white 6" at base. | 66 | 3 | 353 | 3 |
| | Marl, red | | 5 | 353 | 8 |
| | Sand, white | | 2 | 353 | 10 |
| Um 2 | Sandstone, red-brown, micaceous in part | 66 | 11 | 420 | 9 |
| | Limestone, grey | 6 | 5 | 427 | 2 |
| | Sandstone, yellow-grey | 4 | 9 | 431 | 11 |
| | Sandstone, coarse | 6 | 8 | 438 | 7 |
| | Marl, red-brown | 8 | 11 | 447 | 6 |
| M/M | Sand, grey and red | 1 | 3 | 448 | 9 |
| | Sand, grey with marl bands (no sample) | 2 | 3 | 451 | 0 |
| | Sandstone, red | 19 | 10 | 470 | 10 |
| | Marl, red, with grey sandstone bands | 27 | 4 | 493 | 2 |
| Um 1 | Sandstone, red and grey, grey limestone 2'5" @ 519'5" marly in part. | 122 | 5 | 620 | 7 |
| | Limestone, grey | 52 | 0 | 672 | 1 |
| | Blue Shale and Limestone | 133 | 8 | 806 | 3 |
| | Sandstone, grey coarse | | 3 | 806 | 6 |
| | Breccia | 1 | 1 | 807 | 1 |
| | Sandstone, grey | 11 | 5 | 819 | 0 |
| | Mudstone, yellow and pink | 15 | 1 | 834 | 1 |
| | Mudstone, grey, laminated | | 4 | 834 | 5 |
| | COAL and bat | | 4 | 834 | 9 |
| | Seat Earth, Siltstone, grey | 1 | 9 | 834 | 6 |
| | Sandstone, pink and yellow, mottled | 2 | 3 | 838 | 9 |
| | Blue Bind, dark and Ironstone (no sample) | 4 | 11 | 843 | 6 |
| | Seat Earth, Mudstone, dark grey | 2 | 2 | 845 | 0 |
| | Mudstone, grey, plenty planes | 1 | 2 | 847 | 5 |
| | Sandstone, laminated, carbonaceous, micaceous partings. | 2 | 10 | 850 | 3 |
| | Siltstone, grey | 5 | 3 | 855 | 6 |
| | Sandstone, light grey, massive, fine to medium, felspar | 1 | 3 | 856 | 9 |
| | Siltstone, grey, laminated | 8 | 11 | 865 | 8 |
| | Sandstone | 1 | 4 | 867 | 0 |
| | Siltstone, grey, medium to coarse | 1 | 3 | 863 | 3 |
| | Grey Stone Bind (no sample) | | 8 | 868 | 11 |
| | Siltstone, grey, laminated, Calamites | 13 | 4 | 882 | 3 |
| | Mudstone, light grey, abundant Ectheria | 1 | 8 | 883 | 11 |
| | COAL | | 10 | 884 | 19 |
| | Clunch, grey (no sample) | 2 | 9 | 887 | 6 |
| | Seat Earth Siltstone, grey | 2 | 5 | 889 | 11 |
| | Siltstone, grey, laminated | | 11 | 890 | 10 |
| | COAL and bat | | 2 | 891 | 0 |

11323 WL30370/0370 0.001 9/30 A.A.W.J.A. Op.485 SK 66 NW 19

RECORD OF SHAFT OR BORE FOR MINERALS 113

County **Staffs.**

Quarries Sheet **1954**

1" N.S. Geol. Map **113**

1" O.S. Geol. Map **48A**

Whether Confident **CONFIDENTIAL**

SK66/27A

A sketch-map or tracing from a large-scale map is desirable.

Name and Number of Shaft or Bore given by Geological Survey:
THORESBY COLLIERY: No. 1 Shaft.

Name and Number given by owner (if different from above):
Edwards & Sons

Town or Village **Ollerton.** Date of sinking **1928.**

Exact site **1 mile W. of Ollerton.**
(Sketch map see over)

Purpose for which made **COAL.**

Level at which bore commenced relative to O.D. **228 ft.** If not down bore, state if horizontal or up.

Made by **Francis Cummins & Co.** for Messrs. **Bolsover Colliery Co.**

Information from **Bolsover Co. per Notts. Coal Survey Laboratory** Date received **1941**

Specimens of marker bands, see **Edwards & Sons, 4 J.G. Dip of strata 216-232.**

| GEOLOGICAL CLASSIFICATION | DESCRIPTION | THICKNESS | | DEPTH | |
|---------------------------|---|-----------|-----|-------|-----|
| | | FT. | in. | FT. | in. |
| Subfiscial | Soil | | 9 | | 9 |
| | Brown sand with pebbles | 2 | 7 | 3 | 4 |
| | Red Sandstone w. pebbles | 113 | 1 | 116 | 5 |
| | Light red coarse ditto | 14 | 2 | 130 | 7 |
| | Yellowish red " " | 101 | 9 | 232 | 16 |
| | Red sandstone | 55 | 1 | 287 | 5 |
| | Light red coarse sst. w. pebbles & marl pockets | 19 | 5 | 306 | 12 |
| | Sandst., red | 92 | 10 | 399 | 8 |
| | " " w. marl bands | 11 | 2 | 410 | 10 |
| | " " & grey, w. marly bands | 9 | 6 | 420 | 1 |
| U. Mag. Lst | " " w. marl partings | 4 | 6 | 426 | |
| | Limestone, grey | 4 | 11 | 429 | 9 |
| | Sandst., yellow & red | 18 | 7 | 447 | 1 |
| | " red & grey, w. marl (fauilly on N. side) | 45 | 6 | 493 | 1 |
| | " & marly sandst., red | 28 | 0 | 521 | 10 |
| | Marl, red, w. grey sst. & Limest. bands | 15 | 9 | 537 | 7 |
| | Sandst., red & grey | 9 | 4 | 546 | 11 |
| | Marl & marly sandst., red & grey | 9 | 1 | 556 | 0 |
| | Sandst., red & grey, w. marl bands | 43 | 7 | 599 | 7 |
| | Marly sandst., red & grey | 21 | 5 | 621 | 3 |
| L M L | Sandst. | 7 | 3 | 628 | 3 |
| | Limestone, red & brown | 6 | 3 | 634 | 6 |
| | " grey, w. shale bands | 30 | 0 | 664 | 6 |
| | " dark grey & blue, w. blue shale partings | 130 | 6 | 795 | 0 |
| | Shale, blue: some fossils | 15 | 11 | 810 | 11 |
| | BRECCIA 18 in. | 1 | 6 | 812 | 5 |
| | Stone bind, grey | 1 | 2 | 813 | 7 |
| | Bind, red & dark | 7 | | 814 | 2 |
| | Rock, grey | 6 | 9 | 820 | 11 |
| | Bind, red & dark | | 11 | 821 | 10 |
| L P M | Rock, grey | 3 | 1 | 824 | 11 |
| | Bind, red & brown | 5 | 9 | 830 | 8 |
| | " dark blue | 5 | 8 | 836 | 1 |
| | COAL & bit 9 in. | | 9 | 837 | 1 |
| | Clunch & stone clunch, grey | 2 | 1 | 839 | |
| | | | | 1199 | 3 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Westphalian C | | | | | |
| | | | | | |
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SSG & URM

Banker & Passage Beds

U. Mag. Lst

M P M

L M L

L P M

B P B

Westphalian C

Westphalian B

GEOLOGICAL SURVEY AND MUSEUM
SOUTH KENSINGTON,
LONDON, S.W.7.

G.S.M. Office
File No.

Site marked
on 6" Map by

Site marked
on 1" Map by

see also 113/313-e

Bottom of Shaft 1905 10

Classified after Edwards (1967, p. 257-60)
rev. A.C. Benfield 31.8.78

Sheet Mem (1967)
p. 257

NO. 1. Water-borehole i.e. 113/54 A has been transferred from 113/42 C



**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

BGS ID: 234963 : BGS Reference: SK66NW32

British National Grid (27700) : 463003,367629

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SK 66 NW / 36


SECTION OF Thoresby Colliery No. 2 Shaft

6-inch Map

2/1

| GEOLOGICAL CLASSIFICATION | NATURE OF STRATA | THICKNESS | | DEPTH | |
|---------------------------|--|-----------|-----|-------|-----|
| | | FEET | IN. | FEET | IN. |
| | Seat Earth Siltstone, grey, 91'0", 93'2", green-grey, 93'2", 94'10" with sphacrosiderite | 3 | 10 | 894 | 10 |
| | Siltstone, grey laminated | 3 | 0 | 897 | 10 |
| | Sandstone, off white, slightly greenish, massive. | 17 | 6 | 915 | 4 |
| | Sandstone, light grey, abundant, micaceous silty papery laminae | 1 | 0 | 916 | 4 |
| | Conglomerate Sandstone, iron cemented | 10 | | 917 | 2 |
| | Sandstone, light grey, abundant plant debris | 25 | 4 | 942 | 6 |
| | Siltstone, grey, massive, ferns | 1 | 6 | 944 | 0 |
| | Sandstone, off white, coaly laminae | 11 | 8 | 955 | 8 |
| | Sandstone, grey, laminated | 8 | 11 | 964 | 7 |
| | Sandstone, off white, massive | 1 | 1 | 965 | 8 |
| | Sandstone and Siltstone, papery laminae | 4 | 5 | 970 | 1 |
| | Sandstone, off white, conglomeratic, few planty laminae. | 29 | 4 | 999 | 5 |
| | Siltstone, grey roots | 6 | 1 | 1005 | 6 |
| | COAL | 5 | | 1005 | 11 |
| | Siltstone, grey roots | 4 | 10 | 1010 | 9 |
| | Mudstone, dark grey, shaly, fish | 4 | | 1011 | 1 |
| | COAL | 1 | 7 | 1012 | 8 |
| | Dirt & Coal 9" Coal 4" (No sample) | 1 | 1 | 1013 | 5 |
| | Seat Earth, Siltstone, grey | 3 | 5 | 1017 | 2 |
| | Siltstone, light grey, papery laminae | 4 | 5 | 1021 | 7 |
| | Siltstone, grey laminated | 9 | 1 | 1030 | 8 |
| | COAL | 1 | 4 | 1032 | 0 |
| | Seat Earth, black | | 6 | 1032 | 6 |
| | Seat, Earth, Siltstone, grey, Ironstone nodules. | 3 | 1 | 1035 | 7 |
| | Siltstone, grey | 2 | 10 | 1038 | 5 |
| | Bat | | 5 | 1038 | 10 |
| | Seat Earth, Siltstone, light grey | 2 | 1 | 1040 | 11 |
| | Mudstone, grey | 30 | 4 | 1071 | 3 |
| | Siltstone, dark grey, carbonaceous with coal streaks | 4 | 7 | 1075 | 10 |
| | Seat Earth Siltstone, grey | 1 | 5 | 1077 | 3 |
| | Sandstone, grey, silty micaceous layers, roots | 8 | 10 | 1086 | 1 |
| | Siltstone, grey, laminated | 3 | 3 | 1089 | 4 |
| | COAL | 7 | | 1089 | 11 |
| | Seat Earth Siltstone, grey | 6 | 5 | 1096 | 4 |
| | Siltstone, grey, laminated, roots | 13 | 11 | 1110 | 3 |
| | Seat Earth, Mudstone, dark grey, coal streaks | 6 | | 1110 | 9 |
| | Seat Earth Sandstone, light grey | 6 | | 1111 | 3 |
| | Sandstone, silty, light grey, laminated | 5 | | 1111 | 8 |
| | Siltstone, fine, dark grey | 10 | | 1112 | 6 |
| | Siltstone, grey | 11 | 4 | 1123 | 10 |
| | Shale, black carbonaceous, thin shelled mussels | 11 | | 1124 | 9 |
| | Seat Earth, grey | 3 | 5 | 1128 | 2 |
| | COAL | 8 | | 1128 | 10 |
| | Siltstone, grey, plants | 2 | 3 | 1131 | 1 |
| | Seat Earth Siltstone grey | 8 | 11 | 1140 | 0 |
| | Siltstone, grey | 5 | 2 | 1145 | 2 |
| | Shale, black carbonaceous | 1 | 0 | 1146 | 2 |
| | Mudstone, grey | 39 | 8 | 1185 | 10 |
| | Cank | 1 | 6 | 1187 | 4 |
| | Mudstone, grey | 3 | 2 | 1190 | 6 |
| | COAL | 3 | | 1190 | 9 |
| | Bat | | 2 | 1190 | 11 |
| | Seat Earth grey | 9 | 9 | 1200 | 8 |
| | Siltstone, grey | 18 | 7 | 1219 | 3 |
| | Seat Earth, Siltstone, light grey | 4 | 9 | 1224 | 0 |
| | Mudstone, grey | 9 | 1 | 1233 | 1 |
| | Seat Earth, Mudstone, dark grey | 3 | | 1233 | 4 |
| | Siltstone, grey, fine | 4 | 6 | 1237 | 10 |
| | Bat | | 2 | 1238 | 0 |
| | COAL | 3 | | 1238 | 3 |

P622A-34

| | | |
|---|--------------------------------------|---------------------|
|  | Contract THORNSBY COLLIERY | Job ref. |
| | | Calc. Sheet No. |
| | | Date |

| NATURE OF STRATA | DEPTH (m) | THICKNESS (m) |
|--|-----------|---------------|
| | | 0.0. |
| SOIL & SUB-SOIL (SANDY LOAM & PEBBLES. | 1.0 | |
| | | 1.0. |
| SANDSTONE (S.S.) RED-BROWN OCCASSIONAL PEBBLE BANDS. | 85.0. | |
| | | 86.0. |
| SS.-RED BROWN FEW THIN MARL BANDS. | 20.0 | |
| | | 1.06 |
| S.S. RED-BROWN. | 20.0. | |
| | | 1.26 |



**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

BGS ID: 234961 : BGS Reference: SK66NW30

British National Grid (27700) : 463368,367430

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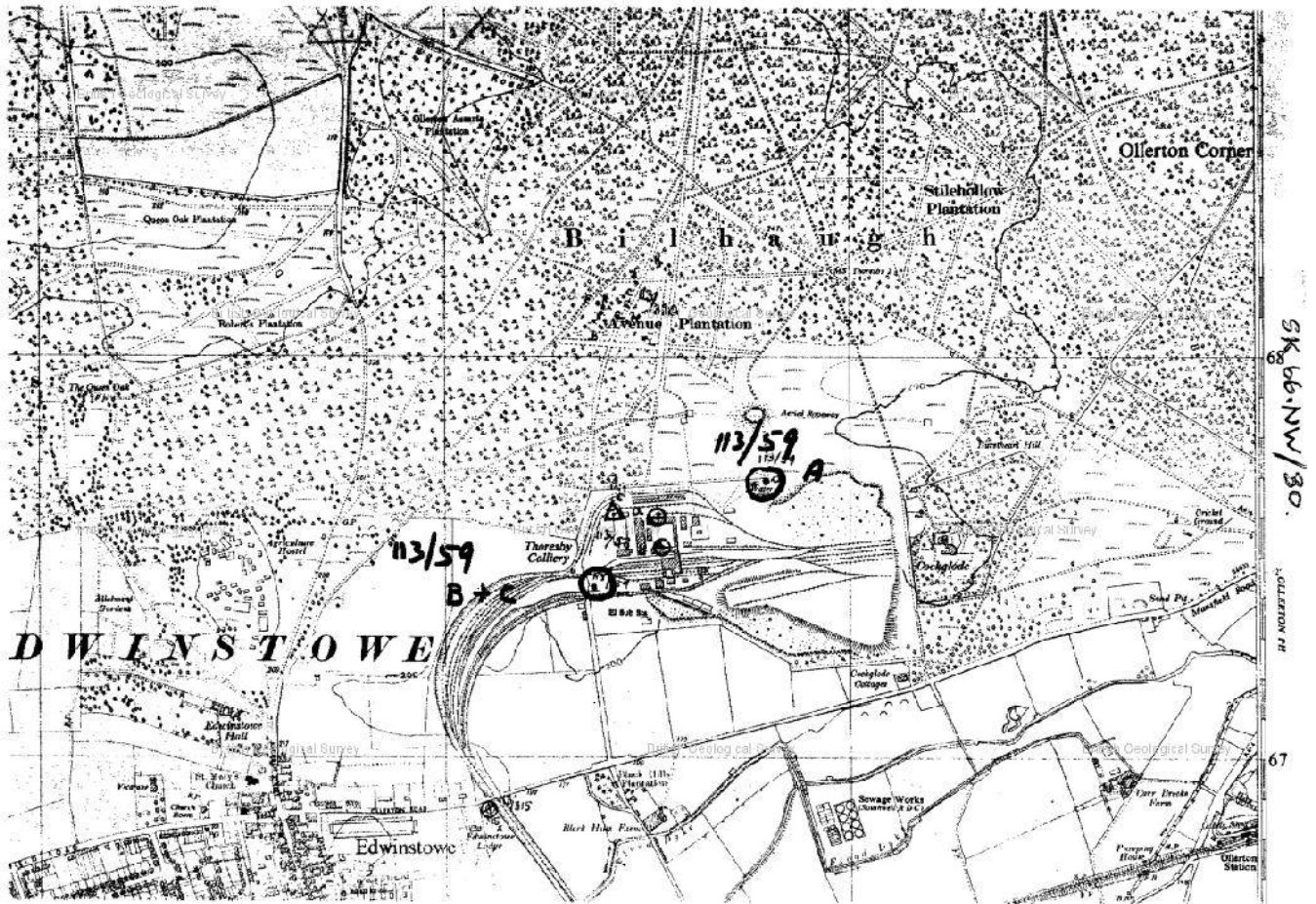
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SK 66 NW / 36

SECTION OF

Thoresby Colliery No. 2 Shaft

British Geological Survey 8-inch Map

B7

| GEOLOGICAL CLASSIFICATION | NATURE OF STRATA | THICKNESS | | DEPTH | |
|---------------------------|--|-----------|-----|-------|----|
| | | FEET | IN. | FEET | |
| | Seat Earth, Siltstone, grey | 3 | 10 | 1242 | 1 |
| | Siltstone, grey | 24 | 5 | 1266 | 6 |
| | COAL and dirt | | 8 | 1267 | 2 |
| | Seat Earth, Siltstone, brown | | 10 | 1268 | 0 |
| | Sandstone, light grey, roots in top 3'1" | 6 | 4 | 1274 | 4 |
| | COAL | | 7 | 1274 | 11 |
| | Seat Earth Siltstone, grey | 2 | 11 | 1277 | 10 |
| | Siltstone, grey, roots | 5 | 1 | 1282 | 11 |
| | Siltstone, grey | 3 | 10 | 1286 | 9 |
| | COAL | | 1 | 1286 | 10 |
| | Seat Earth, Siltstone, grey | 6 | 1 | 1292 | 11 |
| | Strong grey bind (no sample) | 6 | 7 | 1299 | 6 |
| | Siltstone, grey part with roots and ironstone nodules | | 10 | 1300 | 4 |
| | Sandstone, off white | 5 | 7 | 1305 | 11 |
| | Siltstone, grey, plants | | 6 | 1306 | 5 |
| | Siltstone, grey | 6 | 4 | 1312 | 9 |
| | Siltstone, dark grey, laminated | | 2 | 1312 | 11 |
| | Seat Earth, Siltstone, light grey | 5 | 10 | 1318 | 9 |
| | Siltstone, grey, laminated, roots | 4 | 4 | 1323 | 1 |
| | Siltstone, dark grey, fine, roots | 1 | 5 | 1324 | 6 |
| | Canaloid Mudstone, black, xxxxxxx | | 6 | 1325 | 0 |
| | xxxxxxx Black Bind (no sample) | 3 | 10 | 1328 | 10 |
| | COAL | 1 | 0 | 1329 | 10 |
| | Seat Earth, Siltstone, grey | 5 | 5 | 1335 | 3 |
| | Siltstone, grey, massive | 2 | 0 | 1337 | 3 |
| | Sandstone, off white, few carbonaceous, micaceous partings, rib and furrow | | 6 | 1337 | 9 |
| | Siltstone, grey | 7 | 6 | 1345 | 3 |
| | Mudstone, dark grey, shaly, fish, thin shelled mussels | | 10 | 1346 | 1 |
| | Siltstone, grey, coarse | | 5 | 1346 | 6 |
| | Shale, black, Estheria , fish | 1 | 0 | 1347 | 6 |
| | COAL | | 8 | 1348 | 2 |
| | Bit & Dirt | | 3 | 1348 | 5 |
| | Seat Earth, dark grey | 3 | 11 | 1352 | 4 |
| | Sandstone, light grey, roots | 10 | 10 | 1363 | 2 |
| | Siltstone, grey | 29 | 9 | 1392 | 11 |
| | COAL | 3 | 5 | 1396 | 4 |
| | Seat Earth Mudstone, black | 1 | 3 | 1397 | 7 |
| | Siltstone, grey, ferns | 2 | 3 | 1399 | 10 |
| | Sandstone, light grey | 1 | 2 | 1401 | 0 |
| | Siltstone and Sandstone, grey, papery laminae | 8 | 1 | 1409 | 1 |
| | Mudstone, grey, finely micaceous | 13 | 1 | 1422 | 2 |
| | COAL | 1 | 4 | 1423 | 6 |
| | Seat Earth Mudstone, brown-grey | | 9 | 1424 | 3 |
| | Seat Earth Siltstone, grey | 2 | 9 | 1427 | 0 |
| | Sandstone, off white, roots | 5 | 2 | 1432 | 2 |
| | Sandstone, off white, massive | 3 | 4 | 1435 | 6 |
| | Sandstone, and coarse Siltstone, papery laminae | 3 | 4 | 1438 | 10 |
| | Sandstone, off white, massive | 6 | 0 | 1444 | 10 |
| | Mudstone, grey | 2 | 1 | 1446 | 11 |
| | Mudstone, dark grey, shaly | | 11 | 1447 | 10 |
| | COAL | | 10 | 1448 | 8 |
| | Seat Earth Mudstone, black | | 11 | 1449 | 7 |
| | Seat Earth Siltstone, grey, Ironstone nodules | 2 | 7 | 1452 | 2 |
| | Siltstone, grey | 2 | 9 | 1454 | 11 |
| | Siltstone, grey, coarse | | 10 | 1455 | 9 |
| | Bit | 2 | 5 | 1458 | 2 |
| | Seat Earth Mudstone, dark grey | | 5 | 1458 | 7 |
| | Seat Earth Siltstone, grey | 3 | 2 | 1461 | 9 |
| | Sandstone, light grey, slightly laminated | 4 | 0 | 1465 | 9 |
| | Siltstone, grey, massive, plants | 4 | 2 | 1469 | 11 |
| | Siltstone, grey | 8 | 10 | 1478 | 9 |
| | Siltstone, grey, abundant ferns | 2 | 2 | 1480 | 11 |
| | COAL | | 4 | 1481 | 3 |
| | Mudstone, dark grey, coal streaks | 1 | 1 | 1482 | 4 |

F632A-OM



**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

BGS ID: 234925 : BGS Reference: SK66NW9/A

British National Grid (27700) : 463531,367591

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~~SINKING~~
RECORD of WELL or BORING (continued)

at **Thoresby Colliery** County **Notts** **113** **SK66/27A**

Survey No. **113** 1:25,000 geol. map **113**

| GEOLOGICAL CLASSIFICATION. | NATURE OF STRATA. | THICKNESS | | DEPTH | |
|----------------------------|-------------------------------------|-----------|---------|-------|---------|
| | | Feet. | Inches. | Feet. | Inches. |
| ③ | Brought forward | | | 849 | 2 |
| | Stone bind, grey | 10 | 1 | 849 | 3 |
| | Clunch, grey | 4 | 5 | 853 | 8 |
| | <u>Dirt & COAL</u> 4 in. | | 4 | 854 | 0 |
| | Clunch, grey | 3 | 1 | 857 | 1 |
| | Rock | 3 | 2 | 860 | 3 |
| | Bind, blue | 4 | 7 | 864 | 10 |
| | Rock | 2 | 5 | 867 | 3 |
| | Blue bind w. ironst. : fossils | 24 | 3 | 891 | 6 |
| | Black bind | 1 | 8 | 893 | 2 |
| | <u>COAL</u> 8 in. | | 8 | 893 | 10 |
| | Clunch & stone clunch | 3 | 11 | 897 | 9 |
| | Bind, blue, w. ironst. | 2 | 4 | 900 | 1 |
| | <u>COAL</u> 1 in. | | 1 | 900 | 2 |
| | Clunch | | 11 | 901 | 1 |
| | Rock w. bands of stone bind | 23 | 7 | 924 | 8 |
| | Rock w. streaks of bind near bottom | 48 | 2 | 972 | 10 |
| | Stone bind | 3 | 11 | 976 | 9 |
| | Rock | 16 | 9 | 993 | 6 |
| | Rock & stone bind | 17 | 8 | 1011 | 2 |
| | Bind, blue, w. ironst. | 6 | 6 | 1017 | 8 |
| | <u>COAL</u> 3 in. | | 3 | 1017 | 11 |
| | Clunch, grey | 5 | 9 | 1023 | 8 |
| | <u>COAL</u> 17 in. | | | | |
| | { dirt 7 " | | | | |
| | <u>COAL</u> 6 " | 2 | 6 | 1026 | 2 |
| | Clunch | 2 | 9 | 1028 | 11 |
| | Stone bind & rock | 8 | 10 | 1037 | 9 |
| | Bind, blue, w. ironst. | 5 | 4 | 1043 | 1 |
| | <u>COAL</u> 15 in. | 1 | 3 | 1044 | 4 |
| | Clunch, black | | 2 | 1044 | 6 |
| | " , grey | 3 | 7 | 1048 | 1 |
| | Stone clunch | 3 | 5 | 1051 | 6 |
| | <u>Dirt w. COAL streaks</u> 4 in. | | 4 | 1051 | 10 |
| | Stone clunch | 6 | 8 | 1057 | 10 |
| | Bind, clunchy blue, w. ironst. | 22 | 9 | 1080 | 7 |
| | Bind & dirt streaked w. <u>COAL</u> | 4 | 11 | 1085 | 6 |
| | Stone bind, clunchy | 7 | 1 | 1092 | 7 |
| | Bind, dark blue | 5 | 11 | 1098 | 6 |
| | <u>COAL</u> 11 in. | | | | |
| | { dirt 2 " | | | | |
| | <u>COAL</u> 8 " | 1 | 9 | 1100 | 3 |
| | Clunch | 4 | 10 | 1105 | 1 |
| | Bind, dark blue, w. ironst. | 14 | 2 | 1119 | 3 |
| | <u>Dirt w. COAL partings</u> 12 in. | 1 | 5 | 1120 | 8 |
| | Stone clunch | 4 | 10 | 1125 | 6 |
| | Bind, black | 1 | 1 | 1126 | 7 |
| | " , dark blue, w. ironst. | 6 | 4 | 1132 | 11 |
| | " , black | | 9 | 1133 | 8 |

Marine Sand at 956 ft. (tide 50. cliff).

| | | | | | | | |
|--|-----------------------|------|-------|---|---|------|----|
| British Geological Survey | Clunch | COAL | 8 in. | 3 | 5 | 1137 | 1 |
| | Clunch, dark, w. COAL | | | 3 | 8 | 1137 | 9 |
| | " , grey. | | | 4 | 2 | 1140 | 11 |
| | | | | | 1 | 1145 | |
| [11008B] Wt 10256/0175 2.500 5/32 H, J, R & L, Ld Op 410 | | | | | | | |

SK 66 NW / 36

SECTION OF

6-inch Map

B/H

| GEOLOGICAL CLASSIFICATION | NATURE OF STRATA | THICKNESS | | DEPTH | |
|---------------------------|---|-----------|-------|-------|-------|
| | | FEET | IN. | FEET | IN. |
| | Seat Earth, Siltstone, grey | 2 | 7 | 1484 | 11 |
| | Siltstone, grey, roots | 6 | 1 | 1491 | 0 |
| | Siltstone, grey coarse | 2 | 7 | 1493 | 7 |
| | Siltstone, grey, laminated | 7 | 11 | 1501 | 6 |
| | Mudstone grey, one coal streak | 2 | 8 | 1504 | 2 |
| | COAL & bat. Coal 1'11", bat 5", Coal 7" | 2 | 11 | 1507 | 1 |
| | Seat Earth Mudstone, black, Coal streaks | 2 | 4 | 1509 | 5 |
| | Seat Earth Siltstone, grey | 1 | 9 | 1511 | 2 |
| | Siltstone, grey, carbonaceous micaceous partings | 5 | 4 | 1516 | 6 |
| | Mudstone, grey | 3 | 5 | 1519 | 11 |
| | Siltstone, grey laminated | 12 | 4 | 1532 | 3 |
| | Canal | 9 | | 1533 | 0 |
| | Siltstone, grey massive | 8 | 5 | 1541 | 5 |
| | Mudstone, black, very lentic, coal streaks | 3 | | 1541 | 8 |
| | Mudstone, dark grey, canyly | 6 | | 1542 | 2 |
| | COAL | 11 | | 1543 | 1 |
| | Seat Earth Siltstone, grey | 5 | 7 | 1548 | 8 |
| | Siltstone, grey, plants | 12 | 7 | 1561 | 3 |
| | COAL | 2 | 1 | 1563 | 4 |
| | Seat Earth Siltstone | 6 | 6 | 1569 | 10 |
| | Coal, inferior | 10 | | 1570 | 8 |
| | Seat Earth Siltstone, light grey | 4 | 3 | 1574 | 11 |
| | Seat Earth Mudstone, grey | 7 | | 1575 | 6 |
| | Siltstone, grey, roots | 1 | 3 | 1576 | 9 |
| | Siltstone, grey, abundant plants, ferruginous | 5 | | 1577 | 2 |
| | Siltstone, light grey, coarse, laminated | 12 | 11 | 1590 | 1 |
| | Mudstone | 7 | 11 | 1598 | 0 |
| | Seat Earth, Siltstone, grey | 2 | 2 | 1600 | 2 |
| | Siltstone, dark grey, fine, plants | 4 | 1 | 1604 | 3 |
| | Siltstone, grey | 2 | 10 | 1607 | 1 |
| | COAL | 1 | 0 | 1608 | 1 |
| | Seat, Earth, Siltstone, grey | 6 | 2 | 1608 | 3 |
| | Seat Earth Mudstone, grey brown | 6 | 5 | 1614 | 9 |
| | Siltstone, grey, roots | 2 | 6 | 1617 | 3 |
| | COAL & dirt, Coal 2" dirt 4" Coal 1'0" | 1 | 6 | 1618 | 9 |
| | Seat Earth, Mudstone, grey | 7 | | 1619 | 4 |
| | Siltstone, grey, roots and ferns | 2 | 4 | 1621 | 8 |
| | Siltstone, grey | 15 | 8 | 1637 | 4 |
| | Bat | 1 | 7 | 1638 | 11 |
| | Seat Earth Siltstone | 2 | 7 | 1641 | 6 |
| | Siltstone, grey, roots | 2 | 9 | 1644 | 3 |
| | Sandstone | 1 | 4 | 1645 | 7 |
| | Siltstone, grey | 14 | 5 | 1660 | 0 |
| | COAL | 3 | | 1660 | 3 |
| | Seat Earth, Mudstone, black Coal Streaks | 4 | | 1660 | 7 |
| | Seat Earth Siltstone, dark grey | 2 | 6 | 1663 | 1 |
| | COAL | 2 | | 1663 | 3 |
| | Siltstone, grey, roots to 1664' | 24 | 5 | 1687 | 8 |
| | Coal, with sandstone lenses in top 5", inferior below | 1 | 3 | 1688 | 11 |
| | Seat Earth, Siltstone, grey | 9 | 11 | 1698 | 10 |
| | Sandstone | 3 | 3 | 1702 | 1 |
| | Siltstone, light grey, coarse | 6 | 2 | 1708 | 3 |
| | Siltstone, and Sandstone, interlaminated | 7 | 5 | 1715 | 8 |
| | Sandstone, light grey, laminated 1/7" at base | 2 | 7 | 1718 | 3 |
| | Siltstone, light grey, coarse | 1 | 0 | 1719 | 3 |
| | Siltstone, grey, ferruginous 9" @ 1821'5" | | | | |
| | fine 11 1/2" at base | 27 | 5 1/2 | 1745 | 5 1/2 |
| | Bat | 1 1/2 | | 1746 | 2 1/2 |
| | Coal & Dirt, Coal 4 1/2", dirt 1", Coal 4", dirt 1" | 6 1/2 | | 1747 | 5 1/2 |
| | Coal & Dirt, Coal 8", Dirt 1", Coal 3'9" | 4 | 6 1/2 | 1752 | 0 |
| | Seat Earth Siltstone, dark grey | 2 | 8 | 1754 | 8 |
| | Siltstone, grey | 6 | | 1755 | 2 |
| | Sandstone, light grey, laminated | 2 | 9 | 1757 | 11 |
| | Siltstone, light grey and grey, coarse | 2 | 4 | 1760 | 3 |
| | Siltstone, grey, ironstone band | 3 | 5 | 1763 | 8 |

SK 66 NW /36

SECTION OF

Thoresby Colliery, No. 2 Shaft

8-inch Map

B/H

| GEOLOGICAL CLASSIFICATION | NATURE OF STRATA | THICKNESS | | DEPTH | |
|---------------------------|---|-----------|-----|-------|-----|
| | | FEET | IN. | FEET | IN. |
| | Ironstone | | 1 | 1763 | 9 |
| | Siltstone, grey, poorly laminated | 9 | 9 | 1773 | 6 |
| | Siltstone, grey, laminated | 2 | 9 | 1776 | 3 |
| | COAL | 2 | 7 | 1776 | 10 |
| | Seat Earth, Siltstone, grey | 7 | 4 | 1784 | 2 |
| | Sandstone, light grey, roots disturb bedding | 1 | 4 | 1785 | 6 |
| | Seat Earth, Siltstone, grey | | 3 | 1785 | 9 |
| | Siltstone, grey, roots | 15 | 1 | 1800 | 10 |
| | COAL | 2 | 0 | 1802 | 10 |
| | Seat Earth | | 3 | 1803 | 1 |
| | Seat Earth, Siltstone | 2 | 3 | 1805 | 4 |
| | Seat Earth, Siltstone, Ironstone nodules | 2 | 6 | 1807 | 10 |
| | Sandstone, light grey, roots | | 8 | 1808 | 6 |
| | Siltstone, dark grey, carbonaceous with micaceous layers | 2 | 1 | 1810 | 7 |
| | Sandstone, near massive | 1 | 6 | 1812 | 1 |
| | Mudstone, grey | 2 | 0 | 1814 | 1 |
| | Sandstone, off white, massive | 1 | 8 | 1815 | 9 |
| | Mudstone, grey | 1 | 8 | 1817 | 5 |
| | COAL | | 8 | 1818 | 1 |
| | Seat Earth, Siltstone, grey | 2 | 4 | 1820 | 5 |
| | Siltstone, light grey, coarse, unlaminated | 3 | 0 | 1823 | 5 |
| | Siltstone, grey, massive, plant fragments | 2 | 6 | 1825 | 11 |
| | Mudstone, grey mussels | | 4 | 1826 | 3 |
| | COAL | | 4 | 1826 | 7 |
| | Seat Earth, Mudstone, black coal streaks | 1 | 5 | 1828 | 0 |
| | Seat Earth, Siltstone, grey | | 6 | 1828 | 6 |
| | Sandstone, light grey, roots | 1 | 10 | 1830 | 4 |
| | Siltstone, grey, coarse, laminated | 2 | 0 | 1832 | 4 |
| | Sandstone, silty wisps | | 6 | 1832 | 10 |
| | Mudstone | 7 | 6 | 1840 | 4 |
| | Carnel, few thin shelled mussels | | 4 | 1840 | 8 |
| | COAL | | 6 | 1841 | 2 |
| | Seat Earth Mudstone, dark grey, coaly streaks and layers | | 7 | 1841 | 9 |
| | Sandstone, light grey, roots | 3 | 11 | 1845 | 8 |
| | Siltstone, grey laminated | 1 | 1 | 1846 | 9 |
| | Mudstone, grey | 13 | 10 | 1860 | 7 |
| | Mudstone, dark grey, coal streaks | | 2 | 1860 | 9 |
| | Seat Earth, Siltstone, grey | 1 | 7 | 1862 | 4 |
| | Sandstone, light grey, roots | 4 | 6 | 1866 | 10 |
| | Sandstone, light grey, wispy bedding | | 2 | 1867 | 0 |
| | COAL | | 1 | 1867 | 1 |
| | Seat Earth, Siltstone, grey | 1 | 11 | 1869 | 0 |
| | Siltstone, light grey, coarse, roots | 1 | 8 | 1870 | 8 |
| | Sandstone, off white, massive | 3 | 1 | 1873 | 9 |
| | Siltstone, light grey, coarse, poorly laminated | 1 | 8 | 1875 | 5 |
| | Sandstone, off white, poorly laminated | 2 | 9 | 1878 | 2 |
| | Bind (no sample) | 2 | 2 | 1880 | 4 |
| | The depth was re-measured to:- | | | 1885 | 0 |
| | Shaft deepening continues | | | | |
| | Siltstone, grey, massive | | | | |
| | Siltstone, grey, massive | 6 | 7 | 1891 | 7 |
| | Mudstone, grey, light and dark layers | 2 | 4 | 1893 | 11 |
| | Sh, black, carbonaceous, fish, shale | | 3 | 1894 | 2 |
| | COAL | | 6 | 1894 | 8 |
| | Seat Earth Mudstone | | 3 | 1894 | 11 |
| | COAL | 1 | 1 | 1896 | 0 |
| | Siltstone, light grey, coarse, roots | 5 | 4 | 1901 | 4 |
| | Siltstone, grey, unlaminated | 1 | 6 | 1902 | 10 |
| | Siltstone, light grey, coarse, with papery fine silty layers ripple drift | 8 | 1 | 1910 | 11 |
| | Sandstone, light grey, massive | 1 | 5 | 1912 | 4 |
| | Siltstone, and Sandstone, papery laminare | 3 | 7 | 1915 | 11 |

P622A-08

| Thoresby Colliery | | 113/48A SK66(27A) | |
|--|--------------------------------------|-------------------|----|
| Brought forward | | 1145 | 0 |
| Dirt & bat | 6 | 1145 | 6 |
| Stone clunch | 1 | 1147 | 3 |
| Bind, blue & black, w. ironst. & rock band | 7 | 1155 | 0 |
| ? MANORFIELD MARINE BAND (fide S.G. Cliff) | Bind, dark blue, w. ironst. & shells | 39 | 1 |
| | Canal, blue | 2 | 2 |
| | Bind, dark blue | 3 | 0 |
| COAL 3 in. | | 3 | 3 |
| Clunch & stone clunch | 5 | 1204 | 10 |
| Bind, clunchy | 4 | 1208 | 10 |
| " , blue, w. ironst. | 20 | 1229 | 0 |
| " , dark blue | 1 | 1230 | 0 |
| Clunch, light grey | 4 | 1234 | 10 |
| Bind, blue, w. ironst. | 9 | 1244 | 7 |
| Clunch, dark | | 1244 | 11 |
| Bind, blue | 3 | 1248 | 10 |
| Bat | | 1249 | 1 |
| COAL 4 in. | | 4 | 5 |
| Clunch | 3 | 1253 | 4 |
| Bind, blue, merging into dark bind w. ironst. | 24 | 1277 | 7 |
| dirt | 1 | 1277 | 8 |
| COAL 4 in. | | 4 | 0 |
| Clunch & stone clunch | 6 | 1284 | 11 |
| COAL 23 in. | | 1 | 11 |
| Clunch & clunchy stone bind | 6 | 1293 | 3 |
| Bind, dark | 3 | 1296 | 4 |
| " , black | 5 | 1296 | 9 |
| Clunch | 3 | 1300 | 4 |
| Bind, strong grey | 12 | 1312 | 11 |
| " , blue, w. ironst. | 4 | 1317 | 6 |
| Rock, grey | 2 | 1320 | 0 |
| Bind, dark blue | 5 | 1325 | 5 |
| Dirt w. COAL partings 3 in. | | 3 | 8 |
| Clunch | 7 | 1333 | 1 |
| Bind, clunchy blue | 4 | 1337 | 3 |
| " , black | 11 | 1338 | 2 |
| CANAL 8 in. | | | |
| dirt 38 " | | | |
| COAL 25 " | | 6 | 1 |
| Clunch | 4 | 1348 | 11 |
| Bind, dark, w. rock bands | 3 | 1352 | 8 |
| " , dark. | 6 | 1358 | 9 |
| Dirt, soft | | 1359 | 1 |
| Stone bind & bind, dark | 2 | 1362 | 0 |
| COAL 4 in. | | 4 | 4 |
| Clunch & stone clunch | 7 | 1370 | 0 |
| Bind, strong grey, w. ironst. | 33 | 1403 | 9 |
| COAL, bright 23 in. | | | |
| COAL, with w. | | | |
| dirt partings 4 " | | | |
| COAL, bright, brownish 14 " | | 3 | 5 |
| Clunch & stone clunch | | 3 | 9 |
| Bind, clunchy blue | 9 | 1420 | 6 |
| " , black | 12 | 1433 | 4 |
| MARINE BAND (fide S.G. Cliff) | | | |

[o.d. - 1178 ft.]

SK 66 NW/36

SECTION OF Thoresby Colliery, No. 2 Shaft

2-inch Map

-B/H

| GEOLOGICAL CLASSIFICATION | NATURE OF STRATA | THICKNESS | | DEPTH | |
|---------------------------|---|-----------|--------|-------|-------|
| | | FEET | IN. | FEET | IN. |
| | Siltstone, grey | 2 | 7 | 1918 | 6 |
| | Siltstone, grey with ironstone bands | 1 | 1 1/2 | 1919 | 7 1/2 |
| | COAL | | 3 1/2 | 1919 | 11 |
| | Mudstone, grey, un laminated | 1 | 11 | 1921 | 10 |
| | Seat Earth, Siltstone, grey | 7 | 6 | 1929 | 4 |
| | Mudstone, dark grey | | 3 | 1929 | 7 |
| | Siltstone, black, carbonaceous | | 4 | 1929 | 11 |
| | Seat Earth Siltstone | 5 | 7 | 1935 | 6 |
| | Siltstone, grey, roots | 2 | 6 | 1938 | 0 |
| | Siltstone, grey, massive 1'7" @ 39'7" | 12 | 5 | 1950 | 5 |
| | Soft black bind. (no sample) | | 1 1/2 | 1950 | 6 1/2 |
| | COAL | 1 | 8 1/2 | 1952 | 3 |
| | Siltstone, grey, roots | 3 | 2 | 1955 | 5 |
| | Siltstone, coarse, papery sandy laminae | 2 | 10 | 1958 | 3 |
| | Sandstone, light grey, few carbonaceous micaceous partings | 5 | 11 | 1964 | 2 |
| | Siltstone, grey | 6 | 10 | 1971 | 0 |
| | Siltstone, grey, fine and coarse, papery laminae | 2 | 10 | 1974 | 10 |
| | Mudstone, dark grey | 2 | 2 | 1976 | 0 |
| | Siltstone, grey, few roots | 5 | 10 | 1982 | 10 |
| | Mudstone, grey, mussels | 1 | 8 | 1983 | 6 |
| | Siltstone, black carbonaceous | | 2 | 1983 | 8 |
| | Seat Earth, Siltstone, grey | 2 | 0 | 1985 | 8 |
| | Sandstone and Siltstone, lensing, few roots | 2 | 10 | 1988 | 6 |
| | Siltstone, light grey, coarse | 1 | 9 | 1990 | 3 |
| | Sandstone, light grey, few wispy siltstone layers | 1 | 3 | 1991 | 6 |
| | Siltstone, grey, with light grey coarse | | | | |
| | Siltstone papery laminae | 4 | 4 | 1996 | 10 |
| | Siltstone, coarse, dark grey, few sandy laminae | 1 | 9 | 1997 | 7 |
| | Siltstone, grey, few sandy laminae | 7 | 2 | 2004 | 9 |
| | Sandstone, off white, carbonaceous micaceous partings rib and furrow. | 1 | 0 | 2005 | 9 |
| | Siltstone, grey | 4 | 9 | 2010 | 6 |
| | Ironstone (no sample) | | 3 | 2010 | 9 |
| | Siltstone, grey | 7 | 3 | 2018 | 0 |
| | COAL | | 9 1/2 | 2018 | 9 1/2 |
| | Seat Earth, Siltstone | 1 | 11 1/2 | 2020 | 9 |
| | Siltstone, light grey, coarse, laminated roots | 6 | 5 | 2027 | 2 |
| | Siltstone, grey, roots 1 1/2" @ 32'10" | 5 | 8 | 2032 | 10 |
| | Siltstone, sandy laminae | 1 | 5 | 2034 | 3 |
| | Siltstone, grey, coarse, sandy laminae | 6 | 0 | 2040 | 3 |
| | Sandstone, off white, streaky laminae, fusain fragments 6" @ 40'9", laminated grey siltstone 7" @ 41'4", laminated 3'2" @ 44'6" | | | | |
| | massive at base | 8 | 0 | 2048 | 3 |
| | Sandstone, light grey, siltstone, laminae current bedded units | 12 | 9 | 2061 | 0 |
| | Siltstone, grey, few sandy laminae | 4 | 10 | 2065 | 10 |
| | Siltstone, grey | 4 | 10 | 2070 | 8 |
| | Mudstone, dark grey | 2 | 10 | 2073 | 6 |
| | COAL | 2 | 1 | 2075 | 7 |
| | Seat Earth Siltstone, light grey | 2 | 10 | 2078 | 5 |
| | Sandstone, off white, silty laminae | 0 | 8 | 2088 | 1 |
| | Siltstone, fine grey | 4 | 11 | 2093 | 0 |
| | Siltstone, grey, coarse | 1 | 8 | 2094 | 8 |
| | Siltstone, grey | 5 | 1 | 2099 | 9 |
| | Sandstone, light grey, very fine, papery silty laminae abundant | 3 | 2 | 2102 | 11 |
| | Sandstone, off white, massive | 2 | 11 | 2105 | 10 |
| | Mudstone, grey, silty | 3 | 1 | 2108 | 11 |

SK 66 NW / 36

SECTION OF Thoresby Colliery, No. 2 Shaft

| GEOLOGICAL CLASSIFICATION | NATURE OF STRATA | THICKNESS | | DEPTH | |
|---------------------------|--|-----------|-----|-------|-----|
| | | FEET | IN. | FEET | IN. |
| | Mudstone, grey | 9 | 9 | 2118 | 8 |
| | Mudstone, dark grey, mussels | 2 | 10 | 2121 | 6 |
| | Mudstone, grey, iron cemented, abundant mussels | 6 | | 2122 | 0 |
| | Siltstone, grey | 5 | | 2122 | 5 |
| | Mudstone, grey, silty, mussels | 3 | | 2122 | 8 |
| | Bind (no sample) | 6 | 0 | 2128 | 8 |
| | Mudstone, dark grey, goniatites, foraminifera, lingula, Dunbarella | 13 | 0½ | 2141 | 8½ |
| | Siltstone, grey | 1 | 4 | 2143 | 0½ |
| | COAL | 4½ | | 2143 | 5 |
| | Seat Earth, Siltstone, grey | 2 | 9 | 2146 | 2 |
| | Mudstone, grey roots | 3 | 8½ | 2149 | 10½ |
| | Ironstone | | 3½ | 2150 | 2 |
| | Siltstone, grey, massive | 4 | 6 | 2154 | 8 |
| | Mudstone, dark grey, listric | 2 | 6 | 2157 | 2 |
| | Siltstone, grey, roots 2'1" @ 59'3" | 8 | 5 | 2165 | 7 |
| | Mudstone, dark grey, silty | 11 | | 2166 | 6 |
| | Ironstone, shelly | 3 | | 2166 | 9 |
| | Mudstone, dark grey mussels | 1 | | 2166 | 10 |
| | Mudstone, grey | 2 | 2 | 2169 | 0 |
| | Mudstone, grey mussels | 1 | 10 | 2170 | 10 |
| | Siltstone, grey mussels | 3 | 2 | 2174 | 0 |
| | Siltstone, light grey, coarse | 5 | 4 | 2179 | 4 |
| | Ironstone | | 2 | 2179 | 6 |
| | Siltstone, grey, few mussels | 5 | 3 | 2184 | 9 |
| | Mudstone, dark grey, mussels, Ostracods | 1 | 8 | 2186 | 5 |
| | Siltstone, grey, fine, mussels | 4 | 8 | 2191 | 1 |
| | Soft Bind (no sample) | 2 | | 2191 | 3 |
| | Ironstone | 2 | | 2191 | 5 |
| | Black bind and shells | 3½ | | 2191 | 8½ |
| | Shale, carbonaceous | 8½ | | 2192 | 5 |
| | Mudstone, grey, mussels | 2 | 4 | 2194 | 9 |
| | Mudstone, dark grey, coal streaks | 2 | 0 | 2196 | 9 |
| | Sandstone, abundant papery silty laminae | 7 | 2 | 2203 | 11 |
| | COAL and dirt (no sample) | 1 | | 2204 | 0 |
| | Seat Earth Siltstone, fine, grey | 6 | | 2204 | 6 |
| | Coal and dirt, Coal 5", dirt 1", Coal 4" | 10 | | 2205 | 4 |
| | Seat Earth Siltstone | 1 | 11 | 2207 | 3 |
| | Siltstone, grey, coarse, plant debris, massive | 9 | 0 | 2216 | 3 |
| | Siltstone, grey, Ironstone | 6 | 0 | 2222 | 3 |
| | COAL and dirt, dirt 1", channel 3", Coal 2½ | 6½ | | 2222 | 9½ |
| | Seat Earth, Siltstone, grey, roots | 2 | 9 | 2224 | 6½ |
| | Siltstone, grey, mussels | 8 | | 2226 | 2½ |
| | Siltstone, grey roots | 3 | 10 | 2230 | 0½ |
| | Sandstone, light grey, papery silty laminae lensing | 6 | 6 | 2236 | 6½ |
| | Siltstone, grey, coarse, unlaminated | 11 | 1½ | 2247 | 8 |
| | Siltstone, grey unlaminated | 5 | 7 | 2253 | 3 |
| | Mudstone, dark grey, listric | 6 | | 2253 | 9 |
| | COAL | 3 | 3 | 2257 | 0 |
| | Seat Earth Siltstone, grey | 1 | 10 | 2258 | 10 |
| | Seat Earth Mudstone, black and coal streaks | 3 | | 2259 | 1 |

F8221-CN



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RECORD of WELL or BORING (continued)

Thoresby Colliery

County North.

113

SK66NW9/A
1" geol. map 113

GEOLOGICAL
CLASSIFICATION.

NATURE OF STRATA.

THICKNESS.

DEPTH

Feet.

Inches.

Feet.

Inches.

⑤

Brought forward

COAL 19 in.

Clunch & stone clunch

Stone bind

Rock

Bind, blue

" , black

COAL & bat 11 in.

dark clunch 15 "

dirt & COAL 4 "

Clunch & stone clunch

COAL 1 in.

Clunch

Bind, blue, w. ironst.

Dirt & COAL 18 in.

Clunch & stone clunch

Bind, strong grey

Stone bind w. rock bands

Bind, strong grey

Rock, grey

Bind, clunchy blue

COAL 4 in.

Dirt w. COAL partings

Stone clunch, grey

Bind, blue, w. ironst.

" , dark, w. COAL streaks

" , blue, w. ironst. nodules

" , dark, w. COAL streaks

" , blue

" , dark, w. COAL streaks

COAL, bright 4 in.

COAL, hard 2 "

COAL, soft smutty 1 "

COAL, bright, with

brown streaks 20 "

Dirt w. COAL streaks.

Stone clunch & clunchy stone bind

Rock bind

Bind, blue

" , dark

" , blue, w. ironst.

" , black

" , blue, w. ironst.

" , black

Dirt

COAL 14 in.

Clunch & stone clunch

1

7

1443

4

7

1

1447

11

5

6

1447

6

3

10

1451

4

3

3

1454

7

3

9

1455

4

2

6

1457

10

6

1

1463

11

1

1

1464

0

10

10

1464

10

2

7

1467

5

1

6

1468

11

5

0

1473

11

4

7

1478

6

6

6

1485

0

5

8

1490

8

3

3

1493

11

2

9

1496

8

4

4

1497

0

1

9

1498

9

2

3

1501

0

9

7

1510

7

3

2

1510

9

3

9

1514

6

1

3

1514

9

1

7

1516

4

2

2

1516

6

2

3

1518

9

1

10

1520

7

4

7

1525

2

5

5

1525

7

10

4

1535

11

2

8

1536

7

2

10

1539

5

2

9

1542

2

14

8

1556

10

5

5

1557

3

7

7

1557

10

1

2

1559

0

5

1

1564

1

| | | | | | |
|--|-------|------|----|------|---|
| Bind, strong, & stone bind | | 6 | 4 | 1570 | 5 |
| COAL, bright | 12 m. | | | | |
| COAL, hard | 3 " | | | | |
| COAL, bright | 2 " | | | | |
| dirt | 1 " | | | | |
| COAL, hard | 2 " | | | | |
| COAL, bright | 3 " | | | | |
| (11949B) Wt 10256/01" 2,500 8/92 H, J, R & L, Ltd Op 616 | | 1 | 11 | 1572 | 4 |
| | | over | | | |



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⑥

Thoresby Colliery

Brought forward

| | | | | |
|--------------------------------------|----|----|------|----|
| Clunch | 6 | 2 | 1572 | 4 |
| Stone clunch | 1 | 1 | 1578 | 6 |
| | | | 1579 | 7 |
| { Dirt w. COAL partings 14 in. | | | | |
| { clunch 11 " | | | | |
| { COAL 2 " | 2 | 3 | 1581 | 10 |
| Clunch | 2 | 6 | 1584 | 4 |
| Stone bind, bind & rock | 8 | 7 | 1592 | 11 |
| Cank, grey | 3 | 10 | 1596 | 9 |
| Bind, strong, w. ironst. | 15 | 3 | 1612 | 0 |
| " , dark, w. some COAL streaks | | 5 | 1612 | 5 |
| Clunch | 1 | 11 | 1614 | 4 |
| Bind, dark & black, w. ironst. band | 6 | 4 | 1620 | 8 |
| { COAL 10 in. | | | | |
| { dirt & COAL 5 " | 1 | 3 | 1621 | 11 |
| Clunch | 3 | 5 | 1625 | 4 |
| Stone bind, dark | 2 | 7 | 1627 | 11 |
| { dirt & COAL 4 in. | | | | |
| { COAL 11 " | 1 | 3 | 1629 | 2 |
| Stone clunch & clunch | 2 | 5 | 1631 | 7 |
| Rock & stone bind | 5 | 4 | 1636 | 11 |
| Bind & ironst. | 1 | 7 | 1638 | 6 |
| Rock | 5 | 4 | 1643 | 10 |
| Stone bind | 1 | 0 | 1644 | 10 |
| Bind, strong, w. ironst. | 10 | 0 | 1654 | 10 |
| { COAL 12 in. | | | | |
| { dirt & COAL 7 " | 1 | 7 | 1656 | 5 |
| Clunch, dark, w. COAL streaks | 1 | 0 | 1657 | 5 |
| Clunch | | 10 | 1658 | 3 |
| Stone bind & rock | 12 | 7 | 1670 | 10 |
| Bind, dark blue, w. ironst. | 6 | 8 | 1677 | 6 |
| { COAL 6 in. | | | | |
| { dark clunch 24 " | | | | |
| { COAL 2 " | 2 | 8 | 1680 | 2 |
| Clunch | 1 | 10 | 1682 | 0 |
| Stone bind | 1 | 4 | 1683 | 4 |
| Bind, blue, w. stone bands | 21 | 8 | 1705 | 0 |
| Basford rock | | 6 | 1705 | 6 |
| Bar & dirt | 10 | | 1706 | 4 |
| COAL, interior 5 in. | 5 | | 1706 | 2 |
| Clunch & stone clunch | 7 | 7 | 1714 | 1 |
| Bind, dark clunchy, w. ironst. | 4 | 11 | 1719 | 1 |
| COAL 2 in. | | 2 | 1719 | 5 |
| Stone clunch & clunch | 1 | 4 | 1720 | 9 |
| Bind, dark clunchy, w. ironst. | 2 | 2 | 1722 | 1 |
| Rock, canky, & stone bind | 8 | 6 | 1731 | 1 |
| Bind, strong grey & blue, w. ironst. | 29 | 1 | 1760 | 1 |
| Dirt & bar | | 3 | 1760 | 8 |



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| RECORD of WELL or BORING (continued) | | THICKNESS | | DEPTH | |
|---|--|--|---------|--|---------|
| GEOLOGICAL CLASSIFICATION. | | Feet. | Inches. | Feet. | Inches. |
| <p>⑦</p> <p><u>Coombe</u></p> <p><u>Top Hard</u></p> <p><u>Ritter</u></p> <p><u>Gees</u></p> <p>Bar</p> <p>Strong clunch</p> <p>Stone clunch</p> <p>Bind, clunchy, w. ironst.</p> <p>Rock, beddy</p> <p>Bind, strong</p> <p>stone bind, dark</p> <p>Bind, blue, w. ironst.</p> <p><u>COAL, interior.</u> 9 in.</p> <p>Dirt</p> <p>Clunch & stone clunch</p> <p>Bind, grey & blue, w. ironst. bands</p> <p><u>COAL</u> 26 in.</p> <p>Stone clunch & clunch</p> <p>Rock, clunchy</p> <p>Bind, dark blue w. ironst.</p> <p>Rock</p> <p>Bind, dark blue</p> <p>" , black</p> <p><u>COAL</u> 7 in.</p> <p>Stone clunch & clunch</p> <p>Stone bind & rock</p> <p><u>COAL</u> 5 in.</p> <p>dark clunch 16 "</p> <p>dirt & <u>COAL</u> 8 "</p> <p>Bind, blue clunchy, w. ironst.</p> <p>Rock & stone bind</p> | | <p>Brought forward</p> <p>6 in.</p> <p>1 "</p> <p>11 "</p> <p>0 1/4 "</p> <p>2 3/4 "</p> <p>0 1/2 "</p> <p>Bright COAL 9 1/2 "</p> <p>dirt 0 1/4 "</p> <p>Bright COAL 1 3/4 "</p> <p>dirt 0 1/4 "</p> <p>Bright COAL 3 3/4 "</p> <p>BEST HARDS 6 "</p> <p>Bright COAL 5 "</p> <p>Main HARDS 12 "</p> <p>Bright COAL 1 1/2 "</p> <p>dirt 0 1/4 "</p> <p>Bright COAL 0 1/4 "</p> <p>Streaky HARDS 3 "</p> <p>Bright COAL 4 "</p> | | <p>1766 6</p> <p>1766 7</p> <p>1769 0</p> <p>1771 10</p> <p>1775 10</p> <p>1777 5</p> <p>1785 0</p> <p>1787 2</p> <p>1789 11</p> <p>1790 8</p> <p>1790 11</p> <p>1795 5</p> <p>1815 9</p> <p>1817 11</p> <p>1827 1</p> <p>1828 7</p> <p>1831 6</p> <p>1833 7</p> <p>1835 1</p> <p>1835 3</p> <p>1835 10</p> <p>1838 7</p> <p>1844 4</p> <p>1846 9</p> <p>1847 8</p> <p>1859 10</p> | |
| <p>Thoresby Colliery</p> <p>County</p> <p>Notts.</p> | | <p>113</p> <p>SK 66/27A</p> <p>113</p> <p>48</p> <p>A</p> | | <p>113</p> <p>48</p> <p>A</p> | |

| | | | | | |
|--|--|---------------------------|--|---------------------------|-----------|
| British Geological Survey | | CANNEL 4 in. | | British Geological Survey | |
| | | COAL 4 " | | | |
| | | dirt 4 " | | | |
| | | COAL 5 " | | | |
| Clunch & clunchy rock | | | | 1 | 5 1861 3 |
| Bind, blue, w. ironst. | | | | 2 | 10 1864 1 |
| | | | | 10 | 1 1874 2 |
| (11969B) Wt: 10256/0175 2,500 9/32 H, J, R & L Ld Gp 616 | | | | Wet | |
| British Geological Survey | | British Geological Survey | | British Geological Survey | |



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171

Brought forward

Bind, grey clunchy

{ COAL 2 in
dirt + COAL 2 in.

clunch

stone bind a rock

Bind, dark blue

" , black

{ COAL, interior 6 in.
" , Hard 3 "
" , Bright 5 "
dirt 3 "
CANNEL 3 "
COAL 4 "

| | | | |
|----|---|------|----|
| 4 | 5 | 1874 | 2 |
| | | 1878 | 7 |
| | 4 | 1878 | 11 |
| 3 | 7 | 1882 | 6 |
| 11 | 5 | 1893 | 11 |
| 9 | 9 | 1903 | 8 |
| 2 | | 1903 | 10 |

| | | | |
|---|---|------|----|
| 2 | 0 | 1905 | 10 |
|---|---|------|----|

APPENDIX D

RISK ASSESSMENT METHODOLOGY

CLR11 outlines the framework to be followed for risk assessment in the UK. The framework is designed to be consistent with UK legislation and policies including planning. Under CLR11, three stages of risk assessment exist: preliminary, generic quantitative and detailed quantitative. An outline conceptual model should be formed at the preliminary risk assessment stage that collates all the existing information pertaining to a site in text, tabular or diagrammatic form. The outline conceptual model identifies potentially complete (termed possible) pollutant linkages (contaminant–pathway–receptor) and is used as the basis for the design of the site investigation. The outline conceptual model is updated as further information becomes available, for example as a result of the site investigation.

Production of a conceptual model requires an assessment of risk to be made. Risk is a combination of the likelihood of an event occurring and the magnitude of its consequences. Therefore, both the likelihood and the consequences of an event must be taken into account when assessing risk. RSK has adopted guidance provided in CIRIA C552 for use in the production of conceptual models.

The likelihood of an event can be classified on a four-point system using the following terms and definitions based on CIRIA C552:

-) highly likely: the event appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution
-) likely: it is probable that an event will occur or circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term
-) low likelihood: circumstances are possible under which an event could occur, but it is not certain even in the long term that an event would occur and it is less likely in the short term
-) unlikely: circumstances are such that it is improbable the event would occur even in the long term.

The severity can be classified using a similar system also based on CIRIA C552. The terms and definitions relating to severity are:

-) severe: short term (acute) risk to human health likely to result in ‘significant harm’ as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resources. Catastrophic damage to buildings or property. Short-term risk to an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in ‘Draft Circular on Contaminated Land’, DETR 2000)
-) medium: chronic damage to human health (‘significant harm’ as defined in ‘Draft Circular on Contaminated Land’, DETR 2000), pollution of sensitive water resources, significant change in an ecosystem or organism forming part of that ecosystem
-) mild: pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services (‘significant harm’ as defined in ‘Draft Circular on Contaminated Land’, DETR 2000). Damage to sensitive buildings, structures or the environment
-) minor: harm, not necessarily significant, but that could result in financial loss or expenditure to resolve. Non-permanent human health effects easily prevented by use of

personal protective clothing. Easily repairable damage to buildings, structures and services.

Once the probability of an event occurring and its consequences have been classified, a risk category can be assigned according to the table below.

| | | Consequences | | | |
|-------------|----------------|--------------|--------------|--------------|--------------|
| | | Severe | Medium | Mild | Minor |
| Probability | Highly likely | Very high | High | Moderate | Moderate/low |
| | Likely | High | Moderate | Moderate/low | Low |
| | Low likelihood | Moderate | Moderate/low | Low | Very low |
| | Unlikely | Moderate/low | Low | Very low | Very low |

Definitions of these risk categories are as follows together with an assessment of the further work that may be required:

-) Very high: there is a high probability that severe harm could occur or there is evidence that severe harm is currently happening. This risk, if realised, could result in substantial liability; urgent investigation and remediation are likely to be required.
-) High: harm is likely to occur. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required. Remedial works may be necessary in the short term and are likely over the long term.
-) Moderate: it is possible that harm could arise, but it is unlikely that the harm would be severe and it is more likely that the harm would be relatively mild. Investigation is normally required to clarify the risk and determine the liability. Some remedial works may be required in the longer term.
-) Low: it is possible that harm could occur, but it is likely that if realised this harm would at worst normally be mild.
-) Very low: there is a low possibility that harm could occur and if realised the harm is unlikely to be severe.



APPENDIX E

HUMAN HEALTH GENERIC ASSESSMENT CRITERIA (GAC) AND COMPARISON OF SOIL LABORATORY DATA

Generic assessment criteria for human health: residential scenario with home-grown produce

Background

RSK's generic assessment criteria (GAC) were initially prepared following the publication by the Environment Agency (EA) of soil guideline value (SGV) and toxicological (TOX) reports, and associated publications in 2009⁽¹⁾. RSK GAC were updated following the publication of GAC by LQM/CIEH in 2009⁽²⁾. RSK GAC are periodically revised when updated information on toxicological, land use or receptor parameters is published.

Updates to the RSK GAC

In 2014, the publication of Category 4 Screening Levels (C4SL)^(3,4), as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3)⁽⁵⁾ used in the generation of SGVs.

C4SL were published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern (LLTC; see Section 2.3 of research project report SP1010⁽³⁾). Where a C4SL has been published, the RSK GAC duplicates the C4SL published values using all input parameters within the SP1010 final project report⁽³⁾ and associated appendices⁽⁶⁾, and adopts them as GAC for these six substances.

For all other substances the C4SL exposure modifications, with the exception of the “top two” produce type approach taken in the C4SL, have been applied to the current RSK GAC. These include alterations to daily inhalation rates for residential and commercial scenarios, reducing soil adherence factors in children (age classes 1 to 12 only) for residential land use, reducing exposure frequency for dermal contact outdoors for residential land use, and updated produce type consumption rates (90th percentile) based on recent data from the National Diet and Nutrition Survey.

The RSK GAC have also been revised with updated toxicology published by LQM/CIEH in 2015⁽⁷⁾ or by the USEPA⁽¹⁴⁾, where a C4SL has not been published.

RSK GAC derivation for metals and organic compounds

Model selection

Soil assessment criteria (SAC) were calculated using the Contaminated Land Exposure Assessment (CLEA) tool v1.071, supporting EA guidance^(5,8,9) and revised exposure scenarios published for the C4SL⁽³⁾. The SAC are also termed GAC.

Conceptual model

In accordance with SR3⁽⁵⁾, the residential with home-grown produce scenario considers risks to a female child between the ages of 0 and 6 years old as the highest risk scenario. In accordance with Box 3.1 of SR3⁽⁵⁾, the pathways considered for production of the SAC in the residential with home-grown produce scenario are

- direct soil and dust ingestion

- consumption of home-grown produce
- consumption of soil attached to home-grown produce
- dermal contact with soil and indoor dust
- inhalation of indoor and outdoor dust and vapours.

Figure 1 is a conceptual model illustrating these linkages.

In line with guidance in the EA SGV report for cadmium⁽¹⁾, the RSK GAC for cadmium has been derived based on estimates representative of lifetime exposure. Although young children are generally more likely to have higher exposures to soil contaminants, the renal toxicity of cadmium, and the derivation of the TDI_{oral} and TDI_{inh} , are based on considerations of the kidney burden accumulated over 50 years or so. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period.

With respect to volatilisation, the CLEA model assumes a simple linear partitioning of a chemical in the soil between the sorbed, dissolved and vapour phase⁽⁹⁾. The upper boundaries of this partitioning are represented by the maximum aqueous solubility and pure saturated vapour concentration of the chemical. The CLEA model estimates saturated soil concentrations where these limits are reached⁽⁹⁾. The CLEA software uses a traffic light system to identify when individual and/or combined assessment criteria exceed the lower of either the aqueous- or vapour-based soil saturation limits. Model output cells are flagged red where the saturated soil concentration has been exceeded and the contribution of the indoor and outdoor vapour pathway to total exposure is greater than 10%. In this case, further consideration of the following is required⁽⁹⁾:

- Free phase contamination may be present.
- Exposure from the vapour pathways will be over-predicted by the model, as in reality the vapour phase concentration will not increase at concentrations above saturation limits
- Where the vapour pathway contribution is greater than 90%, it is unlikely the relevant health criteria value (HCV) will be exceeded at soil concentrations at least a factor of ten higher than the relevant HCV.

Where the vapour pathway is the predominant pathway (contributes greater than 90% of exposure) or the only exposure route considered and the cell is highlighted red (SAC exceeds saturation limit), the risk based on the assumed conceptual model is likely to be negligible as the vapour risk is assumed to be tolerable at maximum possible soil concentrations. In such circumstances, the vapour pathway exposure should be considered based on the presence of free phase or non-aqueous phase liquid sources and the measured concentrations of volatile organic compounds (VOC) in the vapour phase. Screening could be considered based on setting the SAC as the modelled soil saturation limits. However, as stated within the CLEA handbook⁽⁹⁾, this is likely to not be practical in many cases because of the very low saturation limits and, in any case, is highly conservative.

It should also be noted that for mixtures of compounds, free phase may be present where soil (or groundwater) concentrations are well below saturation limits for individual compounds.

Where the vapour pathway is only one of the exposure pathways considered, an additional approach can then be utilised as detailed within Section 4.12 of the CLEA model handbook⁽⁹⁾, which explains how to calculate an effective assessment criterion manually.

SR3⁽⁵⁾ states that, as a general rule of thumb, it is recognised that estimating vapour phase concentrations from dissolved and sorbed phase contamination by petroleum hydrocarbons are

at least a factor of ten higher than those likely to be measured on-site. RSK has therefore applied an empirical subsurface to indoor air correction factor of 10 into the CLEA model chemical database for all petroleum hydrocarbon fractions (including BTEX, trimethylbenzenes and the polycyclic aromatic hydrocarbons (PAH) naphthalene, acenaphthene and acenaphthylene) to reduce this conservatism.

Input selection

The most up-to-date published chemical and toxicological data was obtained from EA Report SC050021/SR7⁽¹⁰⁾, the EA TOX⁽¹⁾ reports, the C4SL SP1010 project report and associated appendices^(3,6), the 2015 LQM/CIEH report⁽⁷⁾ or the USEPA IRIS database⁽¹⁴⁾. Where a C4SL has been published, the RSK GAC have duplicated the C4SL published values using all input parameters within the SP1010 final project report⁽³⁾ and associated appendices⁽⁶⁾, and has adopted them as GAC for these six substances. Toxicological and specific chemical parameters for 1,2,4-trimethylbenzene and methyl tertiary-butyl ether (MTBE) were obtained from the CL:AIRE Soil Generic Assessment Criteria report⁽¹¹⁾.

For TPH, aromatic hydrocarbons C₅–C₈ were not modelled, as this range comprises benzene (>EC5-EC7) and toluene (>EC7-EC8), which are modelled separately.

Physical parameters

For the residential with home-grown produce scenario, the CLEA default building is a small, two-storey terrace house with a concrete ground-bearing slab. The house is assumed to have a 100m² private garden consisting of lawn and flowerbeds, incorporating a 20m² plot for growing fruit and vegetables consumed by the residents. SR3⁽⁵⁾ notes this residential building type to be the most conservative in terms of potential for vapour intrusion. The building parameters used in the production of the RSK GACs are the default CLEA v1.06 inputs presented in Table 3.3 of SR3⁽³⁾, with a dust loading factor detailed in Section 9.3 of SR3⁽⁵⁾. The parameters for a sandy loam soil type were used in line with Table 4.4 of SR3⁽⁵⁾. This includes a value of 6% for the percentage of soil organic matter (SOM) within the soil. In RSK's experience, this is rather high for many sites. To avoid undertaking site-specific risk assessments for SOM, RSK has produced an additional set of GAC for SOM of 1% and 2.5% for all substances using the CLEA tool.

Summary of modifications to the default CLEA SR3⁽⁵⁾ input parameters for residential with home-grown produce land-use scenario

In summary, the RSK GAC were produced using the default input parameters for soil properties, the air dispersion model, building properties and the vapour model detailed in SR3⁽⁵⁾. Modifications to the default SR3⁽⁵⁾ exposure scenarios based on the C4SL exposure scenarios⁽³⁾ are presented in Tables 2 and 3 below.

The final selected GAC are presented by pathway in Table 4 and the combined GAC in Table 5.

Figure 1: Conceptual model for residential scenario with home-grown produce

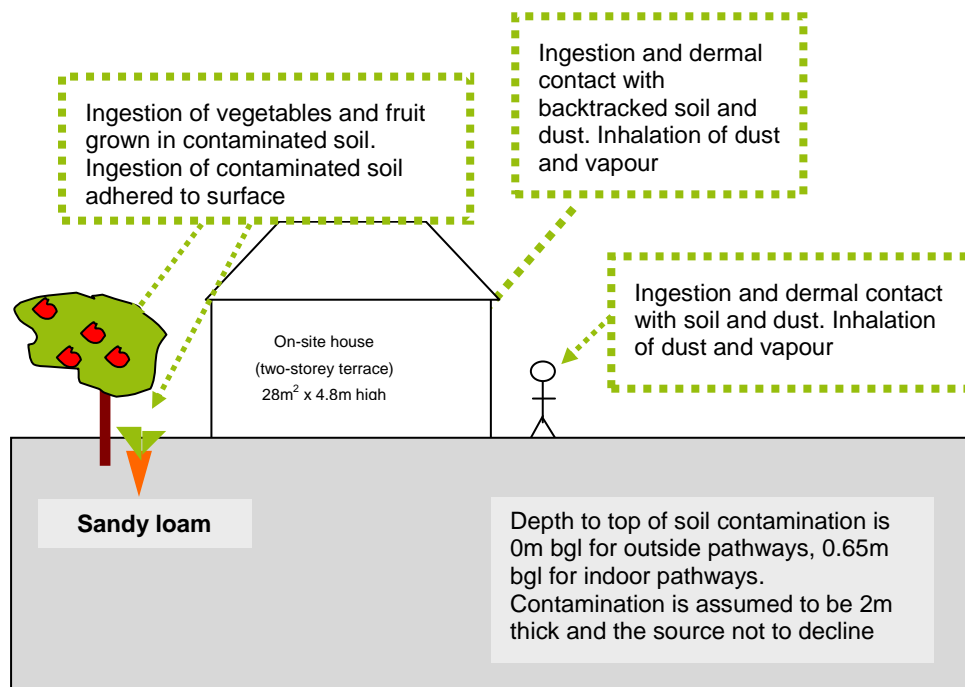


Table 1: Exposure assessment parameters for residential scenario with home-grown produce – inputs for CLEA model

| Parameter | Value | Justification |
|----------------------|------------------------------------|---|
| Land use | Residential with homegrown produce | Chosen land use |
| Receptor | Female child age 1 to 6 | Key generic assumption given in Box 3.1, SR3 ⁽⁵⁾ |
| Building | Small terraced house | Key generic assumption given in Box 3.1, SR3. Small, two-storey terraced house chosen, as it is the most conservative residential building type in terms of protection from vapor intrusion (Section 3.4.6, SR3) ⁽⁵⁾ |
| Soil type | Sandy Loam | Most common UK soil type (Section 4.3.1, from Table 3.1, SR3) ⁽⁵⁾ |
| Start AC (age class) | 1 | Range of age classes corresponding to key generic assumption that the critical receptor is a young female child aged 0–6. From Box 3.1, SR3 ⁽⁵⁾ |
| End AC (age class) | 6 | |
| SOM (%) | 6 | Representative of sandy loamy soil according to EA guidance note dated January 2009 entitled 'Changes We Have Made to the CLEA Framework Documents' ⁽¹³⁾ |
| | 1 | To provide SAC for sites where SOM <6% as often observed by RSK |
| | 2.5 | |
| pH | 7 | Model default |

Table 2: Residential with home-grown produce – modified home-grown produce data

| Name | Consumption rate 90 th percentile (g FW kg ⁻¹ BW day ⁻¹) by age class | | | | | | Dry weight conversion factor (g DW g ⁻¹ FW) | Home-grown fraction (average) | Home-grown fraction (high end) | Soil loading factor (g g ⁻¹ DW) | Preparation correction factor |
|------------------|---|------|------|------|------|------|--|--------------------------------|--------------------------------|--|-------------------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | | | | | |
| Green vegetables | 7.12 | 5.87 | 5.87 | 5.87 | 4.53 | 4.53 | 0.096 | 0.05 | 0.33 | 1.00E-03 | 2.00E-01 |
| Root vegetables | 10.7 | 2.83 | 2.83 | 2.83 | 2.14 | 2.14 | 0.103 | 0.06 | 0.4 | 1.00E-03 | 1.00E+00 |
| Tuber vegetables | 16 | 6.6 | 6.6 | 6.6 | 4.95 | 4.95 | 0.21 | 0.02 | 0.13 | 1.00E-03 | 1.00E+00 |
| Herbaceous fruit | 1.83 | 3.39 | 3.39 | 3.39 | 2.24 | 2.24 | 0.058 | 0.06 | 0.4 | 1.00E-03 | 6.00E-01 |
| Shrub fruit | 2.23 | 0.46 | 0.46 | 0.46 | 0.19 | 0.19 | 0.166 | 0.09 | 0.6 | 1.00E-03 | 6.00E-01 |
| Tree fruit | 3.82 | 10.3 | 10.3 | 10.3 | 5.16 | 5.16 | 0.157 | 0.04 | 0.27 | 1.00E-03 | 6.00E-01 |
| Justification | Table 3.4, SP1010 ⁽³⁾ | | | | | | Table 6.3, SR3 ⁽⁵⁾ | Table 4.19, SR3 ⁽⁵⁾ | | Table 6.3, SR3 ⁽⁵⁾ | |

Table 3: Residential with home-grown produce – modified and use and receptor data

| Parameter | Unit | Age class | | | | | |
|--|---------------------------------------|---|-----|-------|------|------|------|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| EF (soil and dust ingestion) | day yr ⁻¹ | 180 | 365 | 365 | 365 | 365 | 365 |
| EF (consumption of home-grown produce) | day yr ⁻¹ | 180 | 365 | 365 | 365 | 365 | 365 |
| EF (skin contact, indoor) | day yr ⁻¹ | 180 | 365 | 365 | 365 | 365 | 365 |
| EF (skin contact, outdoor) | day yr ⁻¹ | 170 | 170 | 170 | 170 | 170 | 170 |
| EF (inhalation of dust and vapour, indoor) | day yr ⁻¹ | 365 | 365 | 365 | 365 | 365 | 365 |
| EF (inhalation of dust and vapour, outdoor) | day yr ⁻¹ | 365 | 365 | 365 | 365 | 365 | 365 |
| Justification | | Table 3.5, SP1010 ⁽³⁾ ; Table 3.1, SR3 ⁽⁵⁾ | | | | | |
| Soil to skin adherence factor (outdoor) | mg cm ⁻² day ⁻¹ | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Justification | | Table 3.5, SP1010 ⁽³⁾ | | | | | |
| Inhalation rate | m ³ day ⁻¹ | 5.4 | 8.0 | 8.9/f | 10.1 | 10.1 | 10.1 |
| Justification | | Mean value USEPA, 2011 ⁽¹²⁾ ; Table 3.2, SP1010 ⁽³⁾ | | | | | |
| Notes: For cadmium , the exposure assessment for a residential land use is based on estimates representative of lifetime exposure AC1-18. This is because the TDI _{oral} and TDI _{inh} are based on considerations of the kidney burden accumulated over 50 years. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period. See the Environment Agency Science Report SC05002/ TOX 3 ⁽¹⁾ , Science Report SC050021/Cadmium SGV ⁽¹⁾ and the project report SP1010 ⁽³⁾ for more information. | | | | | | | |

References

1. Environment Agency (2009), 'Science Reports SC050021 - SGV and TOX reports for: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs'; 'Supplementary information for the derivation of SGV for: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs', and 'Contaminants in soil: updated collation of toxicological data and intake values for humans: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs'. Available at: <https://www.gov.uk/government/publications/contaminants-in-soil-updated-collation-of-toxicological-data-and-intake-values-for-humans> and <https://www.gov.uk/government/publications/land-contamination-soil-guideline-values-sgvs> (accessed 4 February 2015)
2. Nathanial, C. P., McCaffrey, C., Ashmore, M., Cheng, Y., Gillet, A. G., Ogden, R. C. and Scott, D. (2009), *LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment*, second edition (Nottingham: Land Quality Press).
3. Contaminated Land: Applications in Real Environment (CL:AIRE) (2014). 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination', Revision 2, DEFRA research project SP1010.
4. Department for Environment, Food and Rural Affairs (Defra) (2014), 'SP1010: Development of Category 4 Screening Levels for assessment of land affected by contamination – Policy Companion Document', Revision 2.
5. Environment Agency (2009), *Science Report – SC050021/SR3. Updated technical background to the CLEA model* (Bristol: Environment Agency).
6. Contaminated Land: Applications in Real Environment (CL:AIRE) (2014). 'Appendices C to H). DEFRA research project SP1010'.
7. Nathanial, C. P., McCaffrey, C., Gillet, A. G., Ogden, R. C. and Nathanial, J. F. (2015), *The LQM/CIEH S4ULs for Human Health Risk Assessment* (Nottingham: Land Quality Press).
8. Environment Agency (2009), *Human health toxicological assessment of contaminants in soil. Science Report – Final SC050021/SR2* (Bristol: Environment Agency).
9. Environment Agency (2009), *Science Report – SC050021/SR4 CLEA Software (version 1.05) Handbook* (Bristol: Environment Agency).
10. Environment Agency (2008), *Science Report SC050021/SR7. Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values* (Bristol: Environment Agency).
11. CL:AIRE (2009), *Soil Generic Assessment Criteria for Human Health Risk Assessment* (London: CL:AIRE).
12. USEPA (2011), *Exposure factors handbook*, EPA/600/R-090/052F (Washington, DC: Office of Research and Development).
13. Environment Agency (2009), 'Changes made to the CLEA framework documents after the three-month evaluation period in 2008', released January 2009.
14. USEPA (2010). Hydrogen cyanide and cyanide salts. Integrated Risk Information Systems (IRIS) Chemical Assessment Summary. September 2010. <https://www.epa.gov/iris> (accessed 9 December 2015)

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITH HOME-GROWN PRODUCE



Table 4

Human Health Generic Assessment Criteria by Pathway for Residential With Home-Grown Produce Scenario

| Compound | Notes | SAC Appropriate to Pathway SOM 1% (mg/kg) | | | Soil Saturation Limit (mg/kg) | SAC Appropriate to Pathway SOM 2.5% (mg/kg) | | | Soil Saturation Limit (mg/kg) | SAC Appropriate to Pathway SOM 6% (mg/kg) | | | Soil Saturation Limit (mg/kg) |
|--|-------|---|------------|----------|-------------------------------|---|------------|----------|-------------------------------|---|------------|----------|-------------------------------|
| | | Oral | Inhalation | Combined | | Oral | Inhalation | Combined | | Oral | Inhalation | Combined | |
| Metals | | | | | | | | | | | | | |
| Arsenic | (a,b) | 3.71E+01 | 5.26E+02 | NR | NR | 3.71E+01 | 5.26E+02 | NR | NR | 3.71E+01 | 5.26E+02 | NR | NR |
| Cadmium | (a) | 2.30E+01 | 4.88E+02 | 2.21E+01 | NR | 2.30E+01 | 4.88E+02 | 2.21E+01 | NR | 2.30E+01 | 4.88E+02 | 2.21E+01 | NR |
| Chromium (III) - trivalent | (c) | 1.84E+04 | 9.07E+02 | NR | NR | 1.84E+04 | 9.07E+02 | NR | NR | 1.84E+04 | 9.07E+02 | NR | NR |
| Chromium (VI) - hexavalent | (a,d) | 5.85E+01 | 2.06E+01 | NR | NR | 5.85E+01 | 2.06E+01 | NR | NR | 5.85E+01 | 2.06E+01 | NR | NR |
| Copper | | 2.72E+03 | 1.41E+04 | 2.47E+03 | NR | 2.72E+03 | 1.41E+04 | 2.47E+03 | NR | 2.72E+03 | 1.41E+04 | 2.47E+03 | NR |
| Lead | (a) | 2.01E+02 | NR | NR | NR | 2.01E+02 | NR | NR | NR | 2.01E+02 | NR | NR | NR |
| Elemental Mercury (Hg ⁰) | (d) | NR | 2.35E-01 | NR | 4.31E+00 | NR | 5.60E-01 | NR | 1.07E+01 | NR | 1.22E+00 | NR | 2.58E+01 |
| Inorganic Mercury (Hg ²⁺) | | 3.95E+01 | 3.63E+03 | 3.91E+01 | NR | 3.95E+01 | 3.63E+03 | 3.91E+01 | NR | 3.95E+01 | 3.63E+03 | 3.91E+01 | NR |
| Methyl Mercury (Hg ^{CH3}) | | 1.26E+01 | 1.87E+01 | 7.52E+00 | 7.33E+01 | 1.26E+01 | 3.62E+01 | 9.34E+00 | 1.42E+02 | 1.26E+01 | 7.68E+01 | 1.08E+01 | 3.04E+02 |
| Nickel | (d) | 1.27E+02 | 1.81E+02 | NR | NR | 1.27E+02 | 1.81E+02 | NR | NR | 1.27E+02 | 1.81E+02 | NR | NR |
| Selenium | (b) | 2.58E+02 | NR | NR | NR | 2.58E+02 | NR | NR | NR | 2.58E+02 | NR | NR | NR |
| Zinc | (b) | 3.86E+03 | 3.63E+07 | NR | NR | 3.86E+03 | 3.63E+07 | NR | NR | 3.86E+03 | 3.63E+07 | NR | NR |
| Cyanide (free) | | 1.37E+00 | 1.37E+04 | 1.37E+00 | NR | 1.37E+00 | 1.37E+04 | 1.37E+00 | NR | 1.37E+00 | 1.37E+04 | 1.37E+00 | NR |
| Volatile Organic Compounds | | | | | | | | | | | | | |
| Benzene | (a) | 2.62E-01 | 9.01E-01 | 2.03E-01 | 1.22E+03 | 5.39E-01 | 1.68E+00 | 4.08E-01 | 2.26E+03 | 1.16E+00 | 3.48E+00 | 8.72E-01 | 4.71E+03 |
| Toluene | | 1.53E+02 | 9.08E+02 | 1.31E+02 | 8.69E+02 | 3.49E+02 | 2.00E+03 | 2.97E+02 | 1.92E+03 | 7.95E+02 | 4.55E+03 | 6.77E+02 | 4.36E+03 |
| Ethylbenzene | | 1.10E+02 | 8.34E+01 | 4.74E+01 | 5.18E+02 | 2.61E+02 | 1.96E+02 | 1.12E+02 | 1.22E+03 | 6.00E+02 | 4.58E+02 | 2.60E+02 | 2.84E+03 |
| Xylene - m | | 2.10E+02 | 8.25E+01 | 5.92E+01 | 6.25E+02 | 5.01E+02 | 1.95E+02 | 1.40E+02 | 1.47E+03 | 1.15E+03 | 4.56E+02 | 3.27E+02 | 3.46E+03 |
| Xylene - o | | 1.92E+02 | 8.87E+01 | 6.07E+01 | 4.78E+02 | 4.56E+02 | 2.08E+02 | 1.43E+02 | 1.12E+03 | 1.05E+03 | 4.86E+02 | 3.32E+02 | 2.62E+03 |
| Xylene - p | | 1.98E+02 | 7.93E+01 | 5.66E+01 | 5.76E+02 | 4.70E+02 | 1.86E+02 | 1.33E+02 | 1.35E+03 | 1.08E+03 | 4.36E+02 | 3.10E+02 | 3.17E+03 |
| Total xylene | | 1.92E+02 | 7.93E+01 | 5.66E+01 | 6.25E+02 | 4.56E+02 | 1.86E+02 | 1.33E+02 | 1.47E+03 | 1.05E+03 | 4.36E+02 | 3.10E+02 | 3.46E+03 |
| Methyl tertiary-Butyl ether (MTBE) | | 1.54E+02 | 1.04E+02 | 6.22E+01 | 2.04E+04 | 2.97E+02 | 1.69E+02 | 1.08E+02 | 3.31E+04 | 6.03E+02 | 3.21E+02 | 2.10E+02 | 6.27E+04 |
| Trichloroethene | | 2.83E-01 | 1.72E-02 | 1.62E-02 | 1.54E+03 | 6.26E-01 | 3.59E-02 | 3.40E-02 | 3.22E+03 | 1.41E+00 | 7.98E-02 | 7.55E-02 | 7.14E+03 |
| Tetrachloroethene | | 4.49E+00 | 1.79E-01 | 1.76E-01 | 4.24E+02 | 1.04E+01 | 4.02E-01 | 3.94E-01 | 9.51E+02 | 2.38E+01 | 9.21E-01 | 9.04E-01 | 2.18E+03 |
| 1,1,1-Trichloroethane | | 3.33E+02 | 9.01E+00 | 8.77E+00 | 1.43E+03 | 7.26E+02 | 1.84E+01 | 1.80E+01 | 2.92E+03 | 1.62E+03 | 4.04E+01 | 3.94E+01 | 6.39E+03 |
| 1,1,1,2-Tetrachloroethane | | 5.39E+00 | 1.54E+00 | 1.20E+00 | 2.60E+03 | 1.27E+01 | 3.56E+00 | 2.78E+00 | 6.02E+03 | 2.92E+01 | 8.29E+00 | 6.46E+00 | 1.40E+04 |
| 1,1,2,2-Tetrachloroethane | | 2.81E+00 | 3.92E+00 | 1.64E+00 | 2.67E+03 | 6.10E+00 | 8.04E+00 | 3.47E+00 | 5.46E+03 | 1.36E+01 | 1.76E+01 | 7.67E+00 | 1.20E+04 |
| Carbon Tetrachloride | | 3.10E+00 | 2.58E-02 | 2.57E-02 | 1.52E+03 | 7.11E+00 | 5.65E-02 | 5.62E-02 | 3.32E+03 | 1.62E+01 | 1.28E-01 | 1.27E-01 | 7.54E+03 |
| 1,2-Dichloroethane | | 3.17E-02 | 9.20E-03 | 7.13E-03 | 3.41E+03 | 5.73E-02 | 1.33E-02 | 1.08E-02 | 4.91E+03 | 1.09E-01 | 2.28E-02 | 1.88E-02 | 8.43E+03 |
| Vinyl Chloride | | 3.82E-03 | 7.73E-04 | 6.43E-04 | 1.36E+03 | 6.87E-03 | 1.00E-03 | 8.73E-04 | 1.76E+03 | 1.25E-02 | 1.53E-03 | 1.36E-03 | 2.69E+03 |
| 1,2,4-Trimethylbenzene | | NR | 1.76E+00 | NR | 4.74E+02 | NR | 4.26E+00 | NR | 1.16E+03 | NR | 9.72E+00 | NR | 2.76E+03 |
| 1,3,5-Trimethylbenzene | (e) | NR | NR | NR | 2.30E+02 | NR | NR | NR | 5.52E+02 | NR | NR | NR | 1.30E+03 |
| Semi-Volatile Organic Compounds | | | | | | | | | | | | | |
| Acenaphthene | | 2.27E+02 | 4.86E+04 | 2.26E+02 | 5.70E+01 | 5.41E+02 | 1.18E+05 | 5.38E+02 | 1.41E+02 | 1.18E+03 | 2.68E+05 | 1.17E+03 | 3.36E+02 |
| Acenaphthylene | | 1.85E+02 | 4.59E+04 | 1.84E+02 | 8.61E+01 | 4.42E+02 | 1.11E+05 | 4.40E+02 | 2.12E+02 | 9.78E+02 | 2.53E+05 | 9.74E+02 | 5.06E+02 |
| Anthracene | | 2.43E+03 | 1.53E+05 | 2.39E+03 | 1.17E+00 | 5.53E+03 | 3.77E+05 | 5.45E+03 | 2.91E+00 | 1.10E+04 | 8.76E+05 | 1.09E+04 | 6.96E+00 |
| Benzo(a)anthracene | | 1.01E+01 | 2.47E+01 | 7.18E+00 | 1.71E+00 | 1.42E+01 | 4.37E+01 | 1.07E+01 | 4.28E+03 | 1.69E+01 | 6.26E+01 | 1.33E+01 | 1.03E+01 |
| Benzo(a)pyrene | (a) | 4.96E+00 | 3.51E+01 | NR | 9.11E-01 | 4.96E+00 | 3.77E+01 | NR | 2.28E+00 | 4.96E+00 | 3.89E+01 | NR | 5.46E+00 |
| Benzo(b)fluoranthene | | 2.96E+00 | 1.93E+01 | 2.56E+00 | 1.22E+00 | 3.89E+00 | 2.13E+01 | 3.29E+00 | 3.04E+00 | 4.43E+00 | 2.22E+01 | 3.69E+00 | 7.29E+00 |
| Benzo(g,h,i)perylene | | 3.77E+02 | 1.87E+03 | 3.14E+02 | 1.54E-02 | 4.09E+02 | 1.94E+03 | 3.38E+02 | 3.85E-02 | 4.23E+02 | 1.97E+03 | 3.48E+02 | 9.23E-02 |
| Benzo(k)fluoranthene | | 8.92E+01 | 5.41E+02 | 7.66E+01 | 6.87E-01 | 1.10E+02 | 5.76E+02 | 9.22E+01 | 1.72E+00 | 1.21E+02 | 5.91E+02 | 1.00E+02 | 4.12E+00 |
| Chrysene | | 1.66E+01 | 1.19E+02 | 1.46E+01 | 4.40E-01 | 2.54E+01 | 1.49E+02 | 2.17E+01 | 1.10E+00 | 3.19E+01 | 1.66E+02 | 2.67E+01 | 2.64E+00 |
| Dibenzo(a,h)anthracene | | 2.90E-01 | 1.45E+00 | 2.41E-01 | 3.93E-03 | 3.43E-01 | 1.64E+00 | 2.84E-01 | 9.82E-03 | 3.69E-01 | 1.74E+00 | 3.04E-01 | 2.36E-02 |
| Fluoranthene | | 2.87E+02 | 3.83E+04 | 2.85E+02 | 1.89E+01 | 5.63E+02 | 8.87E+04 | 5.60E+02 | 4.73E+01 | 9.00E+02 | 1.83E+05 | 8.96E+02 | 1.13E+02 |
| Fluorene | | 1.77E+02 | 6.20E+03 | 1.72E+02 | 3.09E+01 | 4.19E+02 | 1.53E+04 | 4.07E+02 | 7.65E+01 | 8.98E+02 | 3.62E+04 | 8.77E+02 | 1.83E+02 |
| Indeno(1,2,3-cd)pyrene | | 3.09E+01 | 2.12E+02 | 2.70E+01 | 6.13E-02 | 4.22E+01 | 2.38E+02 | 3.59E+01 | 1.53E-01 | 4.92E+01 | 2.50E+02 | 4.11E+01 | 3.68E-01 |
| Naphthalene | | 2.78E+01 | 2.33E+01 | 1.27E+01 | 7.64E+01 | 6.66E+01 | 5.58E+01 | 3.04E+01 | 1.83E+02 | 1.53E+02 | 1.31E+02 | 7.06E+01 | 4.32E+02 |
| Phenanthrene | | 9.85E+01 | 7.17E+03 | 9.72E+01 | 3.60E+01 | 2.24E+02 | 1.76E+04 | 2.22E+02 | 8.96E+01 | 4.48E+02 | 4.07E+04 | 4.43E+02 | 2.14E+02 |
| Pyrene | | 6.25E+02 | 8.79E+04 | 6.20E+02 | 2.20E+00 | 1.25E+03 | 2.04E+05 | 1.24E+03 | 5.49E+00 | 2.05E+03 | 4.23E+05 | 2.04E+03 | 1.32E+01 |
| Phenol | | 1.60E+02 | 4.58E+02 | 1.20E+02 | 2.42E+04 | 2.96E+02 | 6.95E+02 | 2.09E+02 | 3.81E+04 | 5.86E+02 | 1.19E+03 | 3.93E+02 | 7.03E+04 |
| Total Petroleum Hydrocarbons | | | | | | | | | | | | | |
| Aliphatic hydrocarbons EC ₉ -EC ₈ | | 4.99E+03 | 4.24E+01 | 4.23E+01 | 3.04E+02 | 1.13E+04 | 7.79E+01 | 7.78E+01 | 5.58E+02 | 2.50E+04 | 1.61E+02 | 1.60E+02 | 1.15E+03 |
| Aliphatic hydrocarbons >EC ₉ -EC ₈ | | 1.49E+04 | 1.04E+02 | 1.03E+02 | 1.44E+02 | 3.43E+04 | 2.31E+02 | 2.31E+02 | 3.22E+02 | 7.11E+04 | 5.29E+02 | 5.28E+02 | 7.36E+02 |
| Aliphatic hydrocarbons >EC ₉ -EC ₁₀ | | 1.61E+03 | 2.68E+01 | 2.67E+01 | 7.77E+01 | 2.91E+03 | 6.55E+01 | 6.51E+01 | 1.90E+02 | 4.26E+03 | 1.56E+02 | 1.54E+02 | 4.51E+02 |
| Aliphatic hydrocarbons >EC ₁₀ -EC ₁₂ | | 4.57E+03 | 1.33E+02 | 1.32E+02 | 4.75E+01 | 5.51E+03 | 3.31E+02 | 3.26E+02 | 1.18E+02 | 5.98E+03 | 7.93E+02 | 7.65E+02 | 2.83E+02 |
| Aliphatic hydrocarbons >EC ₁₀ -EC ₁₆ | | 6.27E+03 | 1.11E+03 | 1.06E+03 | 2.37E+01 | 6.34E+03 | 2.78E+03 | 2.41E+03 | 5.91E+01 | 6.36E+03 | 6.67E+03 | 4.34E+03 | 1.42E+02 |

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITH HOME-GROWN PRODUCE



Table 4

Human Health Generic Assessment Criteria by Pathway for Residential With Home-Grown Produce Scenario

| Compound | Notes | SAC Appropriate to Pathway SOM 1% (mg/kg) | | | Soil Saturation Limit (mg/kg) | SAC Appropriate to Pathway SOM 2.5% (mg/kg) | | | Soil Saturation Limit (mg/kg) | SAC Appropriate to Pathway SOM 6% (mg/kg) | | | Soil Saturation Limit (mg/kg) |
|--|-------|---|------------|----------|-------------------------------|---|------------|----------|-------------------------------|---|------------|----------|-------------------------------|
| | | Oral | Inhalation | Combined | | Oral | Inhalation | Combined | | Oral | Inhalation | Combined | |
| Aliphatic hydrocarbons >EC ₁₀ -EC ₂₀ | (b) | 6.46E+04 | NR | NR | 8.48E+00 | 9.17E+04 | NR | NR | 2.12E+01 | 1.10E+05 | NR | NR | 5.09E+01 |
| Aliphatic hydrocarbons >EC ₂₀ -EC ₂₄ | (b) | 6.46E+04 | NR | NR | 8.48E+00 | 9.17E+04 | NR | NR | 2.12E+01 | 1.10E+05 | NR | NR | 5.09E+01 |
| Aromatic hydrocarbons >EC8-EC ₁₀ | | 5.76E+01 | 4.74E+01 | 3.45E+01 | 6.13E+02 | 1.38E+02 | 1.16E+02 | 8.38E+01 | 1.50E+03 | 3.07E+02 | 2.77E+02 | 1.94E+02 | 3.58E+02 |
| Aromatic hydrocarbons >EC ₁₀ -EC ₁₂ | | 8.29E+01 | 2.58E+02 | 7.52E+01 | 3.64E+02 | 1.96E+02 | 6.39E+02 | 1.79E+02 | 8.99E+02 | 4.25E+02 | 1.52E+03 | 3.91E+02 | 2.15E+03 |
| Aromatic hydrocarbons >EC ₁₂ -EC ₁₆ | | 1.47E+02 | 2.85E+03 | 1.45E+02 | 1.69E+02 | 3.36E+02 | 7.07E+03 | 3.32E+02 | 4.19E+02 | 6.81E+02 | 1.68E+04 | 6.74E+02 | 1.00E+03 |
| Aromatic hydrocarbons >EC ₁₆ -EC ₂₁ | (b) | 2.63E+02 | NR | NR | 5.37E+01 | 5.45E+02 | NR | NR | 1.34E+02 | 9.34E+02 | NR | NR | 3.21E+02 |
| Aromatic hydrocarbons >EC ₂₁ -EC ₂₅ | (b) | 1.09E+03 | NR | NR | 4.83E+00 | 1.47E+03 | NR | NR | 1.21E+01 | 1.70E+03 | NR | NR | 2.90E+01 |
| Aromatic hydrocarbons >EC ₂₅ -EC ₃₄ | (b) | 1.09E+03 | NR | NR | 4.83E+00 | 1.47E+03 | NR | NR | 1.21E+01 | 1.70E+03 | NR | NR | 2.90E+01 |

Notes:

EC - equivalent carbon. SAC - soil assessment criteria.

The CLEA model output is colour coded depending upon whether the soil saturation limit has been exceeded.

| | |
|--|---|
| | Calculated SAC exceeds soil saturation limit and may significantly affect the interpretation of any exceedances as the contribution of the indoor and outdoor vapour pathway to total exposure is >10%. |
| | Calculated SAC exceeds soil saturation limit but the exceedance will not affect the SAC significantly as the contribution of the indoor and outdoor vapour pathway to total exposure is <10%. |
| | Calculated SAC does not exceed the soil saturation limit. |

The SAC for organic compounds are dependant upon soil organic matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs naphthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway (Section 10.1.1, SR3)

(a) SAC for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead are derived using the C4SL toxicology data.

(b) SAC for selenium should not include the inhalation pathway as no expert group HCV has been derived; aliphatic and aromatic hydrocarbons >EC16 should not include inhalation pathway due to their non-volatile nature and inhalation exposure being minimal (oral, dermal and inhalation exposure is compared to the oral HCV); arsenic should only be based on oral contribution (rather than combined) owing to the relative small contribution from inhalation in accordance with the SGV report. The Oral SAC should be adopted for zinc and benzo(a)pyrene.

(c) SAC for CrIII should be based on the lower of the oral and inhalation SAC (see LQM/CIEH 2015 Section 6.8)

(d) SAC for elemental mercury, chromium VI and nickel should be based on the inhalation pathway only.


(e) SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used.

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITH HOME-GROWN PRODUCE




Table 5
Human Health Generic Assessment Criteria for Residential with home-grown produce


| Compound | SAC for Soil SOM 1% (mg/kg) | SAC for Soil SOM 2.5% (mg/kg) | SAC for Soil SOM 6% (mg/kg) |
|--|---|----------------------------------|--------------------------------|
| Metals | | | |
| Arsenic | 37 | 37 | 37 |
| Cadmium | 22 | 22 | 22 |
| Chromium (III) - trivalent | 910 | 910 | 910 |
| Chromium (VI) - hexavalent | 21 | 21 | 21 |
| Copper | 2,500 | 2,500 | 2,500 |
| Lead | 200 | 200 | 200 |
| Elemental Mercury (Hg ⁰) | 0.2 | 0.6 | 1.2 |
| Inorganic Mercury (Hg ²⁺) | 39 | 39 | 39 |
| Methyl Mercury (Hg ⁴⁺) | 10 | 10 | 10 |
| Nickel | 130 | 130 | 130 |
| Selenium | 258 | 258 | 258 |
| Zinc | 3,900 | 3,900 | 3,900 |
| Cyanide (free) | 1.4 | 1.4 | 1.4 |
| Volatile Organic Compounds | | | |
| Benzene | 0.20 | 0.41 | 0.87 |
| Toluene | 130 | 300 | 680 |
| Ethylbenzene | 50 | 110 | 260 |
| Xylene - m | 59 | 140 | 327 |
| Xylene - o | 61 | 143 | 332 |
| Xylene - p | 57 | 133 | 310 |
| Total xylene | 57 | 133 | 310 |
| Methyl tertiary-Butyl ether (MTBE) | 60 | 110 | 210 |
| Trichloroethene | 0.02 | 0.03 | 0.08 |
| Tetrachloroethene | 0.2 | 0.4 | 0.9 |
| 1,1,1-Trichloroethane | 9 | 18 | 39 |
| 1,1,1,2-Tetrachloroethane | 1.2 | 2.8 | 6.5 |
| 1,1,2,2-Tetrachloroethane | 1.6 | 3.5 | 7.7 |
| Carbon Tetrachloride | 0.026 | 0.056 | 0.127 |
| 1,2-Dichloroethane | 0.007 | 0.011 | 0.019 |
| Vinyl Chloride | 0.0006 | 0.0009 | 0.0014 |
| 1,2,4-Trimethylbenzene | 1.8 | 4.3 | 9.7 |
| 1,3,5-Trimethylbenzene | NR | NR | NR |
| Semi-Volatile Organic Compounds | | | |
| Acenaphthene | 230 | 540 | 1,170 |
| Acenaphthylene | 180 | 440 | 970 |
| Anthracene | 2,400 | 5,500 | 10,900 |
| Benzo(a)anthracene | 7 | 11 | 13 |
| Benzo(a)pyrene | 5 | 5 | 5 |
| Benzo(b)fluoranthene | 2.6 | 3.3 | 3.7 |
| Benzo(g,h,i)perylene | 310 | 340 | 350 |
| Benzo(k)fluoranthene | 77 | 92 | 100 |
| Chrysene | 15 | 22 | 27 |
| Dibenzo(a,h)anthracene | 0.24 | 0.28 | 0.30 |
| Fluoranthene | 290 | 560 | 900 |
| Fluorene | 170 | 410 | 880 |
| Indeno(1,2,3-cd)pyrene | 27 | 36 | 41 |
| Naphthalene | 13 | 30 | 71 |
| Phenanthrene | 100 | 220 | 440 |
| Pyrene | 620 | 1,240 | 2,040 |
| Phenol | 120 | 210 | 390 |
| Total Petroleum Hydrocarbons | | | |
| Aliphatic hydrocarbons EC ₅ -EC ₆ | 42 | 78 | 160 |
| Aliphatic hydrocarbons >EC ₆ -EC ₈ | 100 | 230 | 530 |
| Aliphatic hydrocarbons >EC ₈ -EC ₁₀ | 27 | 65 | 154 |
| Aliphatic hydrocarbons >EC ₁₀ -EC ₁₂ | 130 (48) | 330 (118) | 760 (283) |
| Aliphatic hydrocarbons >EC ₁₂ -EC ₁₆ | 1,100 (24) | 2,400 (59) | 4,300 (142) |
| Aliphatic hydrocarbons >EC ₁₆ -EC ₃₅ | 65,000 (8) | 92,000 (21) | 110,000 |
| Aliphatic hydrocarbons >EC ₃₅ -EC ₄₄ | 65,000 (8) | 92,000 (21) | 110,000 |
| Aromatic hydrocarbons >EC ₈ -EC ₁₀ | 30 | 80 | 190 |
| Aromatic hydrocarbons >EC ₁₀ -EC ₁₂ | 80 | 180 | 390 |
| Aromatic hydrocarbons >EC ₁₂ -EC ₁₆ | 140 | 330 | 670 |
| Aromatic hydrocarbons >EC ₁₆ -EC ₂₁ | 260 | 540 | 930 |
| Aromatic hydrocarbons >EC ₂₁ -EC ₃₅ | 1,100 | 1,500 | 1,700 |
| Aromatic hydrocarbons >EC ₃₅ -EC ₄₄ | 1,100 | 1,500 | 1,700 |
| Minerals | | | |
| Asbestos | No asbestos detected with ID or <0.001% dry weight ¹ | | |
| Notes: | | | |
| ¹ - Generic assessment criteria not calculated owing to low volatility of substance and therefore no pathway, or an absence of toxicological data. | | | |
| NR - SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used | | | |
| EC - equivalent carbon. SAC - soil assessment criteria. | | | |
| ¹ LOD for weight of asbestos per unit weight of soil calculated on a dry weight basis using PLM, handpicking and gravimetry. | | | |
| The SAC for organic compounds are dependent on Soil Organic Matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. | | | |
| 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994. | | | |
| SAC for TPH fractions, PAHs naphthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway, section 10.1.1, SR3. | | | |
| (VALUE IN BRACKETS) | | | |
| RSK has adopted an approach for petroleum hydrocarbons in accordance with LQM/CIEH whereby the concentration modelled for each petroleum hydrocarbon fraction has been tabulated as the SAC with the corresponding solubility or vapour saturation limits given in brackets. | | | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|-------|--|-----|-------|------|--|-----------|---------------|-------|-------|-------|-------|-------|-------|-------|---|------------------|--|-------------|-------------|-------------|------------|------------|-------------|-------------|--|--|--|
| Project name | | Thoresby Area B | | Notes | | Topsoil - Southern agricultural fields | | | | | | | | | |  | | | | | | | | | | | | |
| Project code | | 301924 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Client name | | Harworth Estates Ltd | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Address | | Ollerton Road Edwinstowe Mansfield NG21 9QF | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NGR | | 463384, 367197 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Land use | | Residential with home-grown produce | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SOM | | 1% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| GAC version | | 2018_00 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | Lab sample ID | | 17/08636/20 | 17/08636/29 | 17/08636/33 | 17/08636/1 | 17/08636/3 | 17/08636/10 | 17/08636/18 | | | |
| | | | | | | | | | | | | | | | | | Client sample ID | | TP201 | TP205 | TP207 | TP210 | TP211 | TP215 | TP219 | | | |
| | | | | | | | | | | | | | | | | | Depth to top | | 0.2 | 0.1 | 0.2 | 0.3 | 0.3 | 0.3 | 0.2 | | | |
| | | | | | | | | | | | | | | | | | Depth to bottom | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | Date sampled | | 11/12/17 | 11/12/17 | 13/12/17 | 12/12/17 | 11/12/17 | 14/12/17 | 13/12/17 | | | |
| Analyte | Unit | GAC | T1 | Max | Min | Count | # Detects | # Non-detects | | | | | | | | | | | | | | | | | | | | |
| Metals and Inorganics | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Arsenic | mg/kg | 37 | | | | 7 | 0 | 7 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | | | | | | | | | | | | |
| Cadmium | mg/kg | 22 | | | | 7 | 0 | 7 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | | | | | | | | | | | | |
| Chromium | mg/kg | 910 | 21 | 11 | 7 | 7 | 7 | 0 | 7 | 7 | 7 | 10 | 10 | 8 | 11 | | | | | | | | | | | | | |
| Copper | mg/kg | 2500 | | 16 | 9 | 7 | 7 | 0 | 11 | 9 | 14 | 15 | 10 | 14 | 16 | | | | | | | | | | | | | |
| Lead | mg/kg | 200 | | 45 | 17 | 7 | 7 | 0 | 28 | 17 | 19 | 23 | 18 | 19 | 45 | | | | | | | | | | | | | |
| Mercury | mg/kg | 39 | 0.2 | | | 7 | 0 | 7 | <0.17 | <0.17 | <0.17 | <0.17 | <0.17 | <0.17 | <0.17 | | | | | | | | | | | | | |
| Nickel | mg/kg | 130 | | 8 | 5 | 7 | 7 | 0 | 6 | 5 | 7 | 8 | 7 | 8 | 8 | | | | | | | | | | | | | |
| Selenium | mg/kg | 258 | | | | 7 | 0 | 7 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | | | | | | | | | | | | | |
| Zinc | mg/kg | 3900 | | 43 | 24 | 7 | 7 | 0 | 29 | 24 | 29 | 34 | 29 | 28 | 43 | | | | | | | | | | | | | |
| Asbestos | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Asbestos in soil | | | | | | 7 | 0 | 7 | NAD | NAD | NAD | NAD | NAD | NAD | NAD | | | | | | | | | | | | | |
| Asbestos Matrix (microscope) | | | | | | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | |
| Asbestos in soil % composition (hand picking and weighing) | % w/w | | | | | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | |
| Petroleum Hydrocarbons | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ali >C5-C6 | mg/kg | 42 | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | | | | | | | | |
| Ali >C6-C8 | mg/kg | 100 | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | | | | | | | | |
| Ali >C8-C10 | mg/kg | 27 | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | | | | | | | | |
| Ali >C10-C12 | mg/kg | 130 | 48 | 0.4 | 0.4 | 7 | 1 | 6 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.4 | <0.1 | | | | | | | | | | | | | |
| Ali >C12-C16 | mg/kg | 1100 | 24 | 0.8 | 0.8 | 7 | 1 | 6 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.8 | <0.1 | | | | | | | | | | | | | |
| Ali >C16-C21 | mg/kg | | | 0.7 | 0.7 | 7 | 1 | 6 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.7 | <0.1 | | | | | | | | | | | | | |
| Ali >C21-C35 | mg/kg | | | 1.1 | 1.1 | 7 | 1 | 6 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 1.1 | <0.1 | | | | | | | | | | | | | |
| Ali >C16-C35 calculated | mg/kg | 65000 | 8 | 1.8 | 1.8 | 7 | 1 | 6 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 1.8 | <0.1 | | | | | | | | | | | | | |
| Total Aliphatics | mg/kg | | | 3.1 | 3.1 | 7 | 1 | 6 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 3.1 | <0.1 | | | | | | | | | | | | | |
| Aro >C5-C7 | mg/kg | | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | | | | | | | | |
| Aro >C7-C8 | mg/kg | | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | | | | | | | | |
| Aro >C8-C9 | mg/kg | 11 | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | | | | | | | | |
| Aro >C9-C10 | mg/kg | 30 | | 0.15 | 0.15 | 7 | 1 | 6 | <0.01 | <0.01 | 0.15 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | | | | | | | | |
| Aro >C10-C12 | mg/kg | 80 | | 1.1 | 0.3 | 7 | 2 | 5 | <0.1 | <0.1 | <0.1 | 0.3 | <0.1 | 1.1 | <0.1 | | | | | | | | | | | | | |
| Aro >C12-C16 | mg/kg | 140 | | 4.4 | 1.5 | 7 | 2 | 5 | <0.1 | <0.1 | <0.1 | 1.5 | <0.1 | 4.4 | <0.1 | | | | | | | | | | | | | |
| Aro >C16-C21 | mg/kg | 260 | | 5.4 | 3.8 | 7 | 2 | 5 | <0.1 | <0.1 | <0.1 | 3.8 | <0.1 | 5.4 | <0.1 | | | | | | | | | | | | | |
| Aro >C21-C35 | mg/kg | 1100 | | 0.7 | 0.2 | 7 | 2 | 5 | <0.1 | <0.1 | <0.1 | 0.7 | <0.1 | 0.2 | <0.1 | | | | | | | | | | | | | |
| Total Aromatics | mg/kg | | | 11 | 0.1 | 7 | 3 | 4 | <0.1 | <0.1 | 0.1 | 6.4 | <0.1 | 11 | <0.1 | | | | | | | | | | | | | |
| TPH (Ali & Aro) | mg/kg | | | 14.1 | 0.1 | 7 | 3 | 4 | <0.1 | <0.1 | 0.1 | 6.4 | <0.1 | 14.1 | <0.1 | | | | | | | | | | | | | |
| BTEX - Benzene | mg/kg | 0.2 | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | | | | | | | | |
| BTEX - Toluene | mg/kg | 130 | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | | | | | | | | |
| BTEX - Ethyl Benzene | mg/kg | 50 | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | | | | | | | | |
| BTEX - o Xylene | mg/kg | 61 | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | | | | | | | | |
| BTEX - m & p Xylene | mg/kg | 57 | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | | | | | | | | |
| MTBE | mg/kg | 60 | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | | | | | | | | |
| Polycyclic aromatic hydrocarbons | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | mg/kg | 230 | | 0.01 | 0.01 | 7 | 2 | 5 | <0.01 | <0.01 | <0.01 | 0.01 | <0.01 | 0.01 | <0.01 | | | | | | | | | | | | | |
| Acenaphthylene | mg/kg | 180 | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | | | | | | | | |
| Anthracene | mg/kg | 2400 | | | | 7 | 0 | 7 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | | | | | | | | | | | | | |

| | | | | | | | | | | Lab sample ID | 17/08636/20 | 17/08636/29 | 17/08636/33 | 17/08636/1 | 17/08636/3 | 17/08636/10 | 17/08636/18 | | | | |
|-------------------------------|-------|-----|------|-----|------|-------|-----------|---------------|---|------------------|-------------|-------------|-------------|------------|------------|-------------|-------------|------|--|--|--|
| | | | | | | | | | | Client sample ID | TP201 | TP205 | TP207 | TP210 | TP211 | TP215 | TP219 | | | | |
| | | | | | | | | | | Depth to top | 0.2 | 0.1 | 0.2 | 0.3 | 0.3 | 0.3 | 0.2 | | | | |
| | | | | | | | | | | Depth to bottom | | | | | | | | | | | |
| | | | | | | | | | | Date sampled | 11/12/17 | 11/12/17 | 13/12/17 | 12/12/17 | 11/12/17 | 14/12/17 | 13/12/17 | | | | |
| Analyte | Unit | GAC | T1 | Max | Min | Count | # Detects | # Non-detects | | | | | | | | | | | | | |
| Benzo(a)anthracene | mg/kg | | 7 | | 0.09 | 0.05 | 7 | 3 | 4 | <0.04 | <0.04 | | 0.06 | 0.09 | <0.04 | <0.04 | 0.05 | | | | |
| Benzo(a)pyrene | mg/kg | | 5 | | 0.12 | 0.05 | 7 | 6 | 1 | 0.05 | 0.05 | | 0.11 | 0.12 | 0.07 | <0.04 | 0.1 | | | | |
| Benzo(b)fluoranthene | mg/kg | | 2.6 | | 0.15 | 0.07 | 7 | 5 | 2 | <0.05 | <0.05 | | 0.11 | 0.15 | 0.07 | 0.08 | 0.12 | | | | |
| Benzo(ghi)perylene | mg/kg | | 310 | | | | 7 | 0 | 7 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | | | | |
| Benzo(k)fluoranthene | mg/kg | | 77 | | | | 7 | 0 | 7 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | | | | |
| Chrysene | mg/kg | | 15 | | 0.12 | 0.07 | 7 | 3 | 4 | <0.06 | <0.06 | | 0.07 | 0.12 | <0.06 | <0.06 | 0.07 | | | | |
| Dibenzo(ah)anthracene | mg/kg | | 0.24 | | | | 7 | 0 | 7 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | | | | |
| Fluoranthene | mg/kg | | 290 | | 0.12 | 0.12 | 7 | 1 | 6 | <0.08 | <0.08 | <0.08 | | 0.12 | <0.08 | <0.08 | <0.08 | | | | |
| Fluorene | mg/kg | | 170 | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | |
| Indeno(123-cd)pyrene | mg/kg | | 27 | | 0.07 | 0.03 | 7 | 4 | 3 | <0.03 | <0.03 | | 0.06 | 0.07 | 0.03 | <0.03 | 0.05 | | | | |
| Naphthalene | mg/kg | | 13 | | 0.44 | 0.03 | 7 | 5 | 2 | <0.03 | <0.03 | | 0.05 | 0.28 | 0.03 | 0.44 | 0.05 | | | | |
| Phenanthrene | mg/kg | | 100 | | 0.27 | 0.05 | 7 | 5 | 2 | <0.03 | <0.03 | | 0.06 | 0.21 | 0.05 | 0.27 | 0.07 | | | | |
| Pyrene | mg/kg | | 620 | | 0.09 | 0.09 | 7 | 1 | 6 | <0.07 | <0.07 | <0.07 | | 0.09 | <0.07 | <0.07 | <0.07 | | | | |
| PAH (total 16) | mg/kg | | | | 1.25 | 0.26 | 7 | 5 | 2 | <0.08 | <0.08 | | 0.51 | 1.25 | 0.26 | 0.8 | 0.52 | | | | |
| Phenols | | | | | | | | | | | | | | | | | | | | | |
| Phenols - Total by HPLC | mg/kg | | 120 | | | | 7 | 0 | 7 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | | | | |
| Phenols - Total by HPLC | mg/kg | | 120 | | | | 7 | 0 | 7 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | | | | |
| Other analytes | | | | | | | | | | | | | | | | | | | | | |
| % Stones >10mm | % w/w | | | | 14.2 | 3.7 | 7 | 2 | 5 | <0.1 | | 14.2 | <0.1 | <0.1 | | 3.7 | <0.1 | <0.1 | | | |
| Calorific Value (Gross/Total) | kJ/kg | | | | | | 0 | 0 | 0 | | | | | | | | | | | | |
| Loss on ignition (550degC) | % w/w | | | | | | 0 | 0 | 0 | | | | | | | | | | | | |
| pH | pH | | | | 8.11 | 7.47 | 7 | 7 | 0 | 8.02 | | 7.99 | 7.64 | 7.84 | 8.11 | | 7.47 | 7.61 | | | |
| pH BRE | pH | | | | | | 0 | 0 | 0 | | | | | | | | | | | | |
| Sulphate BRE (acid sol) | % w/w | | | | | | 0 | 0 | 0 | | | | | | | | | | | | |
| Sulphur BRE (total) | % w/w | | | | | | 0 | 0 | 0 | | | | | | | | | | | | |
| Total Organic Carbon | % w/w | | | | | | 0 | 0 | 0 | | | | | | | | | | | | |
| Converted to SOM (x / 0.58) | % w/w | | | | | | 0 | 0 | 0 | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | |
|--|-------|---|----|------|------|-------|-----------|---------------|-------|-------|-------|-------|-------|-------|-------|--|--|--|---|--|--|
| Project name | | Thoresby Area B | | | | | | | | | | | | | | | | | <div>Notes</div> <div></div> <div></div> | | |
| Project code | | 301924 | | | | | | | | | | | | | | | | | | | |
| Client name | | Harworth Estates Ltd | | | | | | | | | | | | | | | | | | | |
| Address | | Ollerton Road Edwinstowe Mansfield NG21 9QF | | | | | | | | | | | | | | | | | | | |
| NGR | | 463384, 367197 | | | | | | | | | | | | | | | | | | | |
| Land use | | Phytotoxic (pH >7.0) | | | | | | | | | | | | | | | | | | | |
| SOM | | 1% | | | | | | | | | | | | | | | | | | | |
| GAC version | | 2012_01 | | | | | | | | | | | | | | | | | | | |
| | | Lab sample ID 17/08636/2017/08636/2917/08636/3317/08636/117/08636/317/08636/1017/08636/18 | | | | | | | | | | | | | | | | | | | |
| | | Client sample ID TP201TP205TP207TP210TP211TP215TP219 | | | | | | | | | | | | | | | | | | | |
| | | Depth to top0.20.10.20.30.30.30.2 | | | | | | | | | | | | | | | | | | | |
| | | Depth to bottom | | | | | | | | | | | | | | | | | | | |
| | | Date sampled11/12/1711/12/1713/12/1712/12/1711/12/1714/12/1713/12/17 | | | | | | | | | | | | | | | | | | | |
| Analyte | Unit | GAC | T1 | Max | Min | Count | # Detects | # Non-detects | | | | | | | | | | | | | |
| Metals and Inorganics | | | | | | | | | | | | | | | | | | | | | |
| Arsenic | mg/kg | | | | | 7 | 0 | 7 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | | | | | | |
| Cadmium | mg/kg | 3 | | | | 7 | 0 | 7 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | | | | | | |
| Chromium | mg/kg | | | 11 | 7 | 7 | 7 | 0 | 7 | 7 | 7 | 10 | 10 | 8 | 11 | | | | | | |
| Copper | mg/kg | 200 | | 16 | 9 | 7 | 7 | 0 | 11 | 9 | 14 | 15 | 10 | 14 | 16 | | | | | | |
| Lead | mg/kg | 300 | | 45 | 17 | 7 | 7 | 0 | 28 | 17 | 19 | 23 | 18 | 19 | 45 | | | | | | |
| Mercury | mg/kg | 1 | | | | 7 | 0 | 7 | <0.17 | <0.17 | <0.17 | <0.17 | <0.17 | <0.17 | <0.17 | | | | | | |
| Nickel | mg/kg | 110 | | 8 | 5 | 7 | 7 | 0 | 6 | 5 | 7 | 8 | 7 | 8 | 8 | | | | | | |
| Selenium | mg/kg | | | | | 7 | 0 | 7 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | | | | | | |
| Zinc | mg/kg | 300 | | 43 | 24 | 7 | 7 | 0 | 29 | 24 | 29 | 34 | 29 | 28 | 43 | | | | | | |
| Asbestos | | | | | | | | | | | | | | | | | | | | | |
| Asbestos in soil | | | | | | 7 | 0 | 7 | NAD | NAD | NAD | NAD | NAD | NAD | NAD | | | | | | |
| Asbestos Matrix (microscope) | | | | | | 0 | 0 | 0 | | | | | | | | | | | | | |
| Asbestos in soil % composition (hand picking and weighing) | % w/w | | | | | 0 | 0 | 0 | | | | | | | | | | | | | |
| Petroleum Hydrocarbons | | | | | | | | | | | | | | | | | | | | | |
| Ali >C5-C6 | mg/kg | | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Ali >C6-C8 | mg/kg | | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Ali >C8-C10 | mg/kg | | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Ali >C10-C12 | mg/kg | | | 0.4 | 0.4 | 7 | 1 | 6 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.4 | <0.1 | | | | | | |
| Ali >C12-C16 | mg/kg | | | 0.8 | 0.8 | 7 | 1 | 6 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.8 | <0.1 | | | | | | |
| Ali >C16-C21 | mg/kg | | | 0.7 | 0.7 | 7 | 1 | 6 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.7 | <0.1 | | | | | | |
| Ali >C21-C35 | mg/kg | | | 1.1 | 1.1 | 7 | 1 | 6 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 1.1 | <0.1 | | | | | | |
| Ali >C16-C35 calculated | mg/kg | | | 1.8 | 1.8 | 7 | 1 | 6 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 1.8 | <0.1 | | | | | | |
| Total Aliphatics | mg/kg | | | 3.1 | 3.1 | 7 | 1 | 6 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 3.1 | <0.1 | | | | | | |
| Aro >C5-C7 | mg/kg | | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Aro >C7-C8 | mg/kg | | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Aro >C8-C9 | mg/kg | | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Aro >C9-C10 | mg/kg | | | 0.15 | 0.15 | 7 | 1 | 6 | <0.01 | <0.01 | 0.15 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Aro >C10-C12 | mg/kg | | | 1.1 | 0.3 | 7 | 2 | 5 | <0.1 | <0.1 | <0.1 | 0.3 | <0.1 | 1.1 | <0.1 | | | | | | |
| Aro >C12-C16 | mg/kg | | | 4.4 | 1.5 | 7 | 2 | 5 | <0.1 | <0.1 | <0.1 | 1.5 | <0.1 | 4.4 | <0.1 | | | | | | |
| Aro >C16-C21 | mg/kg | | | 5.4 | 3.8 | 7 | 2 | 5 | <0.1 | <0.1 | <0.1 | 3.8 | <0.1 | 5.4 | <0.1 | | | | | | |
| Aro >C21-C35 | mg/kg | | | 0.7 | 0.2 | 7 | 2 | 5 | <0.1 | <0.1 | <0.1 | 0.7 | <0.1 | 0.2 | <0.1 | | | | | | |
| Total Aromatics | mg/kg | | | 11 | 0.1 | 7 | 3 | 4 | <0.1 | <0.1 | 0.1 | 6.4 | <0.1 | 11 | <0.1 | | | | | | |
| TPH (Ali & Aro) | mg/kg | | | 14.1 | 0.1 | 7 | 3 | 4 | <0.1 | <0.1 | 0.1 | 6.4 | <0.1 | 14.1 | <0.1 | | | | | | |
| BTEX - Benzene | mg/kg | | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| BTEX - Toluene | mg/kg | | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| BTEX - Ethyl Benzene | mg/kg | | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| BTEX - o Xylene | mg/kg | | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| BTEX - m & p Xylene | mg/kg | | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| MTBE | mg/kg | | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Polycyclic aromatic hydrocarbons | | | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | mg/kg | | | 0.01 | 0.01 | 7 | 2 | 5 | <0.01 | <0.01 | <0.01 | 0.01 | <0.01 | 0.01 | <0.01 | | | | | | |
| Acenaphthylene | mg/kg | | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | | |
| Anthracene | mg/kg | | | | | 7 | 0 | 7 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | | | | | | |

| | | | | | | | | | | Lab sample ID | 17/08636/20 | 17/08636/29 | 17/08636/33 | 17/08636/1 | 17/08636/3 | 17/08636/10 | 17/08636/18 | | | |
|-------------------------------|-------|-----|----|------|------|-------|-----------|---------------|-------|------------------|-------------|-------------|-------------|------------|------------|-------------|-------------|--|--|--|
| | | | | | | | | | | Client sample ID | TP201 | TP205 | TP207 | TP210 | TP211 | TP215 | TP219 | | | |
| | | | | | | | | | | Depth to top | 0.2 | 0.1 | 0.2 | 0.3 | 0.3 | 0.3 | 0.2 | | | |
| | | | | | | | | | | Depth to bottom | | | | | | | | | | |
| | | | | | | | | | | Date sampled | 11/12/17 | 11/12/17 | 13/12/17 | 12/12/17 | 11/12/17 | 14/12/17 | 13/12/17 | | | |
| Analyte | Unit | GAC | T1 | Max | Min | Count | # Detects | # Non-detects | | | | | | | | | | | | |
| Benzo(a)anthracene | mg/kg | | | 0.09 | 0.05 | 7 | 3 | 4 | <0.04 | <0.04 | 0.06 | 0.09 | <0.04 | <0.04 | 0.05 | | | | | |
| Benzo(a)pyrene | mg/kg | | | 0.12 | 0.05 | 7 | 6 | 1 | 0.05 | 0.05 | 0.11 | 0.12 | 0.07 | <0.04 | 0.1 | | | | | |
| Benzo(b)fluoranthene | mg/kg | | | 0.15 | 0.07 | 7 | 5 | 2 | <0.05 | <0.05 | 0.11 | 0.15 | 0.07 | 0.08 | 0.12 | | | | | |
| Benzo(ghi)perylene | mg/kg | | | | | 7 | 0 | 7 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | | | | | |
| Benzo(k)fluoranthene | mg/kg | | | | | 7 | 0 | 7 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | | | | | |
| Chrysene | mg/kg | | | 0.12 | 0.07 | 7 | 3 | 4 | <0.06 | <0.06 | 0.07 | 0.12 | <0.06 | <0.06 | 0.07 | | | | | |
| Dibenzo(ah)anthracene | mg/kg | | | | | 7 | 0 | 7 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | | | | | |
| Fluoranthene | mg/kg | | | 0.12 | 0.12 | 7 | 1 | 6 | <0.08 | <0.08 | <0.08 | 0.12 | <0.08 | <0.08 | <0.08 | | | | | |
| Fluorene | mg/kg | | | | | 7 | 0 | 7 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | | |
| Indeno(123-cd)pyrene | mg/kg | | | 0.07 | 0.03 | 7 | 4 | 3 | <0.03 | <0.03 | 0.06 | 0.07 | 0.03 | <0.03 | 0.05 | | | | | |
| Naphthalene | mg/kg | | | 0.44 | 0.03 | 7 | 5 | 2 | <0.03 | <0.03 | 0.05 | 0.28 | 0.03 | 0.44 | 0.05 | | | | | |
| Phenanthrene | mg/kg | | | 0.27 | 0.05 | 7 | 5 | 2 | <0.03 | <0.03 | 0.06 | 0.21 | 0.05 | 0.27 | 0.07 | | | | | |
| Pyrene | mg/kg | | | 0.09 | 0.09 | 7 | 1 | 6 | <0.07 | <0.07 | <0.07 | 0.09 | <0.07 | <0.07 | <0.07 | | | | | |
| PAH (total 16) | mg/kg | | | 1.25 | 0.26 | 7 | 5 | 2 | <0.08 | <0.08 | 0.51 | 1.25 | 0.26 | 0.8 | 0.52 | | | | | |
| Phenols | | | | | | | | | | | | | | | | | | | | |
| Phenols - Total by HPLC | mg/kg | | | | | 7 | 0 | 7 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | | | | | |
| Other analytes | | | | | | | | | | | | | | | | | | | | |
| % Stones >10mm | % w/w | | | 14.2 | 3.7 | 7 | 2 | 5 | <0.1 | 14.2 | <0.1 | <0.1 | 3.7 | <0.1 | <0.1 | | | | | |
| Calorific Value (Gross/Total) | kJ/kg | | | | | 0 | 0 | 0 | | | | | | | | | | | | |
| Loss on ignition (550degC) | % w/w | | | | | 0 | 0 | 0 | | | | | | | | | | | | |
| pH | pH | | | 8.11 | 7.47 | 7 | 7 | 0 | 8.02 | 7.99 | 7.64 | 7.84 | 8.11 | 7.47 | 7.61 | | | | | |
| pH BRE | pH | | | | | 0 | 0 | 0 | | | | | | | | | | | | |
| Sulphate BRE (acid sol) | % w/w | | | | | 0 | 0 | 0 | | | | | | | | | | | | |
| Sulphur BRE (total) | % w/w | | | | | 0 | 0 | 0 | | | | | | | | | | | | |
| Total Organic Carbon | % w/w | | | | | 0 | 0 | 0 | | | | | | | | | | | | |
| Converted to SOM (x / 0.58) | % w/w | | | | | 0 | 0 | 0 | | | | | | | | | | | | |

| | | | | | |
|--------------|--|--|-------|-------------------|---|
| Project name | Thoresby Area B | | Notes | Chester Formation |  |
| Project code | 301924 | | | | |
| Client name | Harworth Estates Ltd | | | | |
| Address | Ollerton Road Edwinstowe Mansfield NG21 9QF | | | | |
| NGR | 463384, 367197 | | | | |
| Land use | Residential with home-grown produce | | | | |
| SOM | 1% | | | | |
| GAC version | 2018_00 | | | | |


| | | | | | | | | | | Lab sample ID | 17/08337/21 | 17/08337/51 | 17/08337/83 | 17/08337/88 | 17/08636/21 | 17/08636/23 | 17/08636/26 | 17/08636/30 | 17/08636/32 | 17/08636/34 | 17/08636/36 |
|--|-------|-------|-----|------|------|-------|-----------|---------------|-------|------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | | | | | | | | | | Client sample ID | TP113 | TP118 | TP132 | TP134 | TP201 | TP202 | TP203 | TP205 | TP206 | TP207 | TP208 |
| | | | | | | | | | | Depth to top | 0.3 | 0.4 | 1.9 | 3 | 0.6 | 0.6 | 0.8 | 0.7 | 0.7 | 0.7 | 0.8 |
| | | | | | | | | | | Depth to bottom | | | | | | | 1.1 | | | | |
| | | | | | | | | | | Date sampled | 21/11/17 | 27/11/17 | 28/11/17 | 28/11/17 | 11/12/17 | 14/12/17 | 11/12/17 | 11/12/17 | 14/12/17 | 13/12/17 | 11/12/17 |
| Analyte | Unit | GAC | T1 | Max | Min | Count | # Detects | # Non-detects | | | | | | | | | | | | | |
| Metals and Inorganics | | | | | | | | | | | | | | | | | | | | | |
| Arsenic | mg/kg | 37 | | 11 | 11 | 7 | 1 | 6 | 11 | | | | | | <1 | | <1 | | <1 | | |
| Cadmium | mg/kg | 22 | | | | 7 | 0 | 7 | <0.5 | | | | | | <0.5 | | <0.5 | | <0.5 | | |
| Chromium | mg/kg | 910 | 21 | 8 | 5 | 7 | 7 | 0 | 6 | | | | | | 8 | | 7 | | 6 | | |
| Copper | mg/kg | 2500 | | 20 | 3 | 7 | 7 | 0 | 20 | | | | | | 4 | | 3 | | 5 | | |
| Lead | mg/kg | 200 | | 11 | 2 | 7 | 7 | 0 | 9 | | | | | | 11 | | 5 | | 4 | | |
| Mercury | mg/kg | 39 | 0.2 | | | 7 | 0 | 7 | <0.17 | | | | | | <0.17 | | <0.17 | | <0.17 | | |
| Nickel | mg/kg | 130 | | 13 | 6 | 7 | 7 | 0 | 13 | | | | | | 6 | | 6 | | 7 | | |
| Selenium | mg/kg | 258 | | | | 7 | 0 | 7 | <1 | | | | | | <1 | | <1 | | <1 | | |
| Zinc | mg/kg | 3900 | | 20 | 11 | 7 | 7 | 0 | 13 | | | | | | 20 | | 17 | | 12 | | |
| Asbestos | | | | | | | | | | | | | | | | | | | | | |
| Asbestos in soil | | | | | | 7 | 0 | 7 | NAD | | | | | | NAD | | NAD | | NAD | | |
| Asbestos Matrix (microscope) | | | | | | 1 | 0 | 1 | - | | | | | | | | | | | | |
| Asbestos in soil % composition (hand picking and weighing) | % w/w | | | | | 0 | 0 | 0 | | | | | | | | | | | | | |
| Petroleum Hydrocarbons | | | | | | | | | | | | | | | | | | | | | |
| Ali >C5-C6 | mg/kg | 42 | | | | 7 | 0 | 7 | <0.01 | | | | | | <0.01 | | <0.01 | | <0.01 | | |
| Ali >C6-C8 | mg/kg | 100 | | | | 7 | 0 | 7 | <0.01 | | | | | | <0.01 | | <0.01 | | <0.01 | | |
| Ali >C8-C10 | mg/kg | 27 | | | | 7 | 0 | 7 | <0.01 | | | | | | <0.01 | | <0.01 | | <0.01 | | |
| Ali >C10-C12 | mg/kg | 130 | 48 | | | 7 | 0 | 7 | <0.1 | | | | | | <0.1 | | <0.1 | | <0.1 | | |
| Ali >C12-C16 | mg/kg | 1100 | 24 | | | 7 | 0 | 7 | <0.1 | | | | | | <0.1 | | <0.1 | | <0.1 | | |
| Ali >C16-C21 | mg/kg | | | | | 7 | 0 | 7 | <0.1 | | | | | | <0.1 | | <0.1 | | <0.1 | | |
| Ali >C21-C35 | mg/kg | | | | | 7 | 0 | 7 | <0.1 | | | | | | <0.1 | | <0.1 | | <0.1 | | |
| Ali >C16-C35 calculated | mg/kg | 65000 | 8 | | | 7 | 0 | 7 | <0.1 | | | | | | <0.1 | | <0.1 | | <0.1 | | |
| Total Aliphatics | mg/kg | | | | | 7 | 0 | 7 | <0.1 | | | | | | <0.1 | | <0.1 | | <0.1 | | |
| Aro >C5-C7 | mg/kg | | | | | 7 | 0 | 7 | <0.01 | | | | | | <0.01 | | <0.01 | | <0.01 | | |
| Aro >C7-C8 | mg/kg | | | | | 7 | 0 | 7 | <0.01 | | | | | | <0.01 | | <0.01 | | <0.01 | | |
| Aro >C8-C9 | mg/kg | 11 | | 0.02 | 0.02 | 7 | 1 | 6 | 0.02 | | | | | | <0.01 | | <0.01 | | <0.01 | | |
| Aro >C9-C10 | mg/kg | 30 | | | | 7 | 0 | 7 | <0.01 | | | | | | <0.01 | | <0.01 | | <0.01 | | |
| Aro >C10-C12 | mg/kg | 80 | | 0.4 | 0.4 | 7 | 1 | 6 | 0.4 | | | | | | <0.1 | | <0.1 | | <0.1 | | |
| Aro >C12-C16 | mg/kg | 140 | | 2.4 | 2.4 | 7 | 1 | 6 | 2.4 | | | | | | <0.1 | | <0.1 | | <0.1 | | |
| Aro >C16-C21 | mg/kg | 260 | | 0.3 | 0.3 | 7 | 1 | 6 | 0.3 | | | | | | <0.1 | | <0.1 | | <0.1 | | |
| Aro >C21-C35 | mg/kg | 1100 | | | | 7 | 0 | 7 | <0.1 | | | | | | <0.1 | | <0.1 | | <0.1 | | |
| Total Aromatics | mg/kg | | | 3.1 | 3.1 | 7 | 1 | 6 | 3.1 | | | | | | <0.1 | | <0.1 | | <0.1 | | |
| TPH (Ali & Aro) | mg/kg | | | 3.1 | 3.1 | 7 | 1 | 6 | 3.1 | | | | | | <0.1 | | <0.1 | | <0.1 | | |
| BTEX - Benzene | mg/kg | 0.2 | | | | 7 | 0 | 7 | <0.01 | | | | | | <0.01 | | <0.01 | | <0.01 | | |
| BTEX - Toluene | mg/kg | 130 | | | | 7 | 0 | 7 | <0.01 | | | | | | <0.01 | | <0.01 | | <0.01 | | |
| BTEX - Ethyl Benzene | mg/kg | 50 | | | | 7 | 0 | 7 | <0.01 | | | | | | <0.01 | | <0.01 | | <0.01 | | |
| BTEX - o Xylene | mg/kg | 61 | | | | 7 | 0 | 7 | <0.01 | | | | | | <0.01 | | <0.01 | | <0.01 | | |
| BTEX - m & p Xylene | mg/kg | 57 | | | | 7 | 0 | 7 | <0.01 | | | | | | <0.01 | | <0.01 | | <0.01 | | |
| MTBE | mg/kg | 60 | | | | 7 | 0 | 7 | <0.01 | | | | | | <0.01 | | <0.01 | | <0.01 | | |
| Polycyclic aromatic hydrocarbons | | | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | mg/kg | 230 | | | | 7 | 0 | 7 | <0.01 | | | | | | <0.01 | | <0.01 | | <0.01 | | |
| Acenaphthylene | mg/kg | 180 | | | | 7 | 0 | 7 | <0.01 | | | | | | <0.01 | | <0.01 | | <0.01 | | |
| Anthracene | mg/kg | 2400 | | | | 7 | 0 | 7 | <0.02 | | | | | | <0.02 | | <0.02 | | <0.02 | | |

| | | | | | | | | | | | | | | | | | |
|--------------|--|--|-------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Project name | Thoresby Area B | | Notes | | | | | | | | | | | | | | |
| Project code | 301924 | | | | | | | | | | | | | | | | |
| Client name | Harworth Estates Ltd | | | | | | | | | | | | | | | | |
| Address | Ollerton Road Edwinstowe Mansfield NG21 9QF | | | | | | | | | | | | | | | | |
| NGR | 463384, 367197 | | | | | | | | | | | | | | | | |
| Land use | Residential with home-grown produce | | | | | | | | | | | | | | | | |
| SOM | 1% | | | | | | | | | | | | | | | | |
| GAC version | 2018_00 | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | |
|--|-------|-------|-----|------|------|-------|-----------|---------------|------------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|--|
| | | | | | | | | | Lab sample ID | 17/08636/2 | 17/08636/5 | 17/08636/7 | 17/08636/11 | 17/08636/17 | 17/08636/19 | 17/08337/34 | 17/08337/36 | |
| | | | | | | | | | Client sample ID | TP210 | TP212 | TP213 | TP215 | TP218 | TP219 | WS108 | WS110 | |
| | | | | | | | | | Depth to top | 0.6 | 0.5 | 0.7 | 0.6 | 0.6 | 0.7 | 4 | 1.6 | |
| | | | | | | | | | Depth to bottom | | | | | | | 4.1 | 1.9 | |
| | | | | | | | | | Date sampled | 12/12/17 | 12/12/17 | 12/12/17 | 14/12/17 | 13/12/17 | 13/12/17 | 21/11/17 | 21/11/17 | |
| Analyte | Unit | GAC | T1 | Max | Min | Count | # Detects | # Non-detects | | | | | | | | | | |
| Metals and Inorganics | | | | | | | | | | | | | | | | | | |
| Arsenic | mg/kg | 37 | | 11 | 11 | 7 | 1 | 6 | | <1 | | | <1 | <1 | | | | |
| Cadmium | mg/kg | 22 | | | | 7 | 0 | 7 | | <0.5 | | | <0.5 | <0.5 | | | | |
| Chromium | mg/kg | 910 | 21 | 8 | 5 | 7 | 7 | 0 | | 8 | | | 5 | 8 | | | | |
| Copper | mg/kg | 2500 | | 20 | 3 | 7 | 7 | 0 | | 4 | | | 3 | 3 | | | | |
| Lead | mg/kg | 200 | | 11 | 2 | 7 | 7 | 0 | | 3 | | | 2 | 7 | | | | |
| Mercury | mg/kg | 39 | 0.2 | | | 7 | 0 | 7 | | <0.17 | | | <0.17 | <0.17 | | | | |
| Nickel | mg/kg | 130 | | 13 | 6 | 7 | 7 | 0 | | 8 | | | 6 | 7 | | | | |
| Selenium | mg/kg | 258 | | | | 7 | 0 | 7 | | <1 | | | <1 | <1 | | | | |
| Zinc | mg/kg | 3900 | | 20 | 11 | 7 | 7 | 0 | | 16 | | | 11 | 18 | | | | |
| Asbestos | | | | | | | | | | | | | | | | | | |
| Asbestos in soil | | | | | | 7 | 0 | 7 | | NAD | | | NAD | NAD | | | | |
| Asbestos Matrix (microscope) | | | | | | 1 | 0 | 1 | | | | | | | | | | |
| Asbestos in soil % composition (hand picking and weighing) | % w/w | | | | | 0 | 0 | 0 | | | | | | | | | | |
| Petroleum Hydrocarbons | | | | | | | | | | | | | | | | | | |
| Ali >C5-C6 | mg/kg | 42 | | | | 7 | 0 | 7 | | <0.01 | | | <0.01 | <0.01 | | | | |
| Ali >C6-C8 | mg/kg | 100 | | | | 7 | 0 | 7 | | <0.01 | | | <0.01 | <0.01 | | | | |
| Ali >C8-C10 | mg/kg | 27 | | | | 7 | 0 | 7 | | <0.01 | | | <0.01 | <0.01 | | | | |
| Ali >C10-C12 | mg/kg | 130 | 48 | | | 7 | 0 | 7 | | <0.1 | | | <0.1 | <0.1 | | | | |
| Ali >C12-C16 | mg/kg | 1100 | 24 | | | 7 | 0 | 7 | | <0.1 | | | <0.1 | <0.1 | | | | |
| Ali >C16-C21 | mg/kg | | | | | 7 | 0 | 7 | | <0.1 | | | <0.1 | <0.1 | | | | |
| Ali >C21-C35 | mg/kg | | | | | 7 | 0 | 7 | | <0.1 | | | <0.1 | <0.1 | | | | |
| Ali >C16-C35 calculated | mg/kg | 65000 | 8 | | | 7 | 0 | 7 | | <0.1 | | | <0.1 | <0.1 | | | | |
| Total Aliphatics | mg/kg | | | | | 7 | 0 | 7 | | <0.1 | | | <0.1 | <0.1 | | | | |
| Aro >C5-C7 | mg/kg | | | | | 7 | 0 | 7 | | <0.01 | | | <0.01 | <0.01 | | | | |
| Aro >C7-C8 | mg/kg | | | | | 7 | 0 | 7 | | <0.01 | | | <0.01 | <0.01 | | | | |
| Aro >C8-C9 | mg/kg | 11 | | 0.02 | 0.02 | 7 | 1 | 6 | | <0.01 | | | <0.01 | <0.01 | | | | |
| Aro >C9-C10 | mg/kg | 30 | | | | 7 | 0 | 7 | | <0.01 | | | <0.01 | <0.01 | | | | |
| Aro >C10-C12 | mg/kg | 80 | | 0.4 | 0.4 | 7 | 1 | 6 | | <0.1 | | | <0.1 | <0.1 | | | | |
| Aro >C12-C16 | mg/kg | 140 | | 2.4 | 2.4 | 7 | 1 | 6 | | <0.1 | | | <0.1 | <0.1 | | | | |
| Aro >C16-C21 | mg/kg | 260 | | 0.3 | 0.3 | 7 | 1 | 6 | | <0.1 | | | <0.1 | <0.1 | | | | |
| Aro >C21-C35 | mg/kg | 1100 | | | | 7 | 0 | 7 | | <0.1 | | | <0.1 | <0.1 | | | | |
| Total Aromatics | mg/kg | | | 3.1 | 3.1 | 7 | 1 | 6 | | <0.1 | | | <0.1 | <0.1 | | | | |
| TPH (Ali & Aro) | mg/kg | | | 3.1 | 3.1 | 7 | 1 | 6 | | <0.1 | | | <0.1 | <0.1 | | | | |
| BTEX - Benzene | mg/kg | 0.2 | | | | 7 | 0 | 7 | | <0.01 | | | <0.01 | <0.01 | | | | |
| BTEX - Toluene | mg/kg | 130 | | | | 7 | 0 | 7 | | <0.01 | | | <0.01 | <0.01 | | | | |
| BTEX - Ethyl Benzene | mg/kg | 50 | | | | 7 | 0 | 7 | | <0.01 | | | <0.01 | <0.01 | | | | |
| BTEX - o Xylene | mg/kg | 61 | | | | 7 | 0 | 7 | | <0.01 | | | <0.01 | <0.01 | | | | |
| BTEX - m & p Xylene | mg/kg | 57 | | | | 7 | 0 | 7 | | <0.01 | | | <0.01 | <0.01 | | | | |
| MTBE | mg/kg | 60 | | | | 7 | 0 | 7 | | <0.01 | | | <0.01 | <0.01 | | | | |
| Polycyclic aromatic hydrocarbons | | | | | | | | | | | | | | | | | | |
| Acenaphthene | mg/kg | 230 | | | | 7 | 0 | 7 | | <0.01 | | | <0.01 | <0.01 | | | | |
| Acenaphthylene | mg/kg | 180 | | | | 7 | 0 | 7 | | <0.01 | | | <0.01 | <0.01 | | | | |
| Anthracene | mg/kg | 2400 | | | | 7 | 0 | 7 | | <0.02 | | | <0.02 | <0.02 | | | | |

| | | | | | | | | | Lab sample ID | 17/08337/21 | 17/08337/51 | 17/08337/83 | 17/08337/88 | 17/08636/21 | 17/08636/23 | 17/08636/26 | 17/08636/30 | 17/08636/32 | 17/08636/34 | 17/08636/36 | |
|-------------------------------|-------|-----|------|-----|------|-------|-----------|---------------|------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------|
| | | | | | | | | | Client sample ID | TP113 | TP118 | TP132 | TP134 | TP201 | TP202 | TP203 | TP205 | TP206 | TP207 | TP208 | |
| | | | | | | | | | Depth to top | 0.3 | 0.4 | 1.9 | 3 | 0.6 | 0.6 | 0.8 | 0.7 | 0.7 | 0.7 | 0.8 | |
| | | | | | | | | | Depth to bottom | | | | | | | 1.1 | | | | | |
| | | | | | | | | | Date sampled | 21/11/17 | 27/11/17 | 28/11/17 | 28/11/17 | 11/12/17 | 14/12/17 | 11/12/17 | 11/12/17 | 14/12/17 | 13/12/17 | 11/12/17 | |
| Analyte | Unit | GAC | T1 | Max | Min | Count | # Detects | # Non-detects | | | | | | | | | | | | | |
| Benzo(a)anthracene | mg/kg | | 7 | | | | 7 | 0 | 7 | <0.04 | | | | | <0.04 | | | | <0.04 | | |
| Benzo(a)pyrene | mg/kg | | 5 | | | | 7 | 0 | 7 | <0.04 | | | | | <0.04 | | | | <0.04 | | |
| Benzo(b)fluoranthene | mg/kg | | 2.6 | | | | 7 | 0 | 7 | <0.05 | | | | | <0.05 | | | | <0.05 | | |
| Benzo(ghi)perylene | mg/kg | | 310 | | | | 7 | 0 | 7 | <0.05 | | | | | <0.05 | | | | <0.05 | | |
| Benzo(k)fluoranthene | mg/kg | | 77 | | | | 7 | 0 | 7 | <0.07 | | | | | <0.07 | | | | <0.07 | | |
| Chrysene | mg/kg | | 15 | | | | 7 | 0 | 7 | <0.06 | | | | | <0.06 | | | | <0.06 | | |
| Dibenzo(ah)anthracene | mg/kg | | 0.24 | | | | 7 | 0 | 7 | <0.04 | | | | | <0.04 | | | | <0.04 | | |
| Fluoranthene | mg/kg | | 290 | | | | 7 | 0 | 7 | <0.08 | | | | | <0.08 | | | | <0.08 | | |
| Fluorene | mg/kg | | 170 | | | | 7 | 0 | 7 | <0.01 | | | | | <0.01 | | | | <0.01 | | |
| Indeno(123-cd)pyrene | mg/kg | | 27 | | | | 7 | 0 | 7 | <0.03 | | | | | <0.03 | | | | <0.03 | | |
| Naphthalene | mg/kg | | 13 | | 0.11 | 0.11 | 7 | 1 | 6 | 0.11 | | | | | <0.03 | | | | <0.03 | | |
| Phenanthrene | mg/kg | | 100 | | | | 7 | 0 | 7 | <0.03 | | | | | <0.03 | | | | <0.03 | | |
| Pyrene | mg/kg | | 620 | | | | 7 | 0 | 7 | <0.07 | | | | | <0.07 | | | | <0.07 | | |
| PAH (total 16) | mg/kg | | | | 0.11 | 0.11 | 7 | 1 | 6 | 0.11 | | | | | <0.08 | | | | <0.08 | | |
| Phenols | | | | | | | | | | | | | | | | | | | | | |
| Phenols - Total by HPLC | mg/kg | | 120 | | | | 6 | 0 | 6 | | | | | | <0.2 | | | <0.2 | | <0.2 | |
| Phenols - Total by HPLC | mg/kg | | 120 | | | | 6 | 0 | 6 | | | | | | <0.2 | | | <0.2 | | <0.2 | |
| Other analytes | | | | | | | | | | | | | | | | | | | | | |
| % Stones >10mm | % w/w | | | | 14.1 | 2 | 19 | 10 | 9 | 2.2 | <0.1 | <0.1 | <0.1 | | 3.9 | 10.1 | 12.6 | 14.1 | 4.3 | <0.1 | <0.1 |
| Calorific Value (Gross/Total) | kJ/kg | | | | | | 0 | 0 | 0 | | | | | | | | | | | | |
| Loss on ignition (550degC) | % w/w | | | | | | 0 | 0 | 0 | | | | | | | | | | | | |
| pH | pH | | | | 8.6 | 5.55 | 7 | 7 | 0 | 5.55 | | | | | 8.24 | | | 8.6 | | 8.19 | |
| pH BRE | pH | | | | 8.59 | 6.54 | 12 | 12 | 0 | | 6.54 | 8.59 | 7.65 | 8.09 | | 8.24 | | 7.73 | | | 8.51 |
| Sulphate BRE (acid sol) | % w/w | | | | 0.42 | 0.06 | 12 | 2 | 10 | | <0.02 | <0.02 | 0.42 | <0.02 | | <0.02 | | <0.02 | | | <0.02 |
| Sulphur BRE (total) | % w/w | | | | 0.14 | 0.09 | 12 | 2 | 10 | | <0.01 | <0.01 | 0.14 | <0.01 | | <0.01 | | <0.01 | | | <0.01 |
| Total Organic Carbon | % w/w | | | | | | 0 | 0 | 0 | | | | | | | | | | | | |
| Converted to SOM (x / 0.58) | % w/w | | | | | | 0 | 0 | 0 | | | | | | | | | | | | |

| Lab sample ID | | | | | | | | | | 17/08636/2 | 17/08636/5 | 17/08636/7 | 17/08636/11 | 17/08636/17 | 17/08636/19 | 17/08337/34 | 17/08337/36 |
|-------------------------------|-------|------|----|------|------|-------|-----------|-------------|-------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|
| Client sample ID | | | | | | | | | | TP210 | TP212 | TP213 | TP215 | TP218 | TP219 | WS108 | WS110 |
| Depth to top | | | | | | | | | | 0.6 | 0.5 | 0.7 | 0.6 | 0.6 | 0.7 | 4 | 1.6 |
| Depth to bottom | | | | | | | | | | | | | | | | 4.1 | 1.9 |
| Date sampled | | | | | | | | | | 12/12/17 | 12/12/17 | 12/12/17 | 14/12/17 | 13/12/17 | 13/12/17 | 21/11/17 | 21/11/17 |
| Analyte | Unit | GAC | T1 | Max | Min | Count | # Detects | # Non-deter | | | | | | | | | |
| Benzo(a)anthracene | mg/kg | 7 | | | | 7 | 0 | 7 | | <0.04 | | <0.04 | <0.04 | | | | |
| Benzo(a)pyrene | mg/kg | 5 | | | | 7 | 0 | 7 | | <0.04 | | <0.04 | <0.04 | | | | |
| Benzo(b)fluoranthene | mg/kg | 2.6 | | | | 7 | 0 | 7 | | <0.05 | | <0.05 | <0.05 | | | | |
| Benzo(ghi)perylene | mg/kg | 310 | | | | 7 | 0 | 7 | | <0.05 | | <0.05 | <0.05 | | | | |
| Benzo(k)fluoranthene | mg/kg | 77 | | | | 7 | 0 | 7 | | <0.07 | | <0.07 | <0.07 | | | | |
| Chrysene | mg/kg | 15 | | | | 7 | 0 | 7 | | <0.06 | | <0.06 | <0.06 | | | | |
| Dibenzo(ah)anthracene | mg/kg | 0.24 | | | | 7 | 0 | 7 | | <0.04 | | <0.04 | <0.04 | | | | |
| Fluoranthene | mg/kg | 290 | | | | 7 | 0 | 7 | | <0.08 | | <0.08 | <0.08 | | | | |
| Fluorene | mg/kg | 170 | | | | 7 | 0 | 7 | | <0.01 | | <0.01 | <0.01 | | | | |
| Indeno(123-cd)pyrene | mg/kg | 27 | | | | 7 | 0 | 7 | | <0.03 | | <0.03 | <0.03 | | | | |
| Naphthalene | mg/kg | 13 | | 0.11 | 0.11 | 7 | 1 | 6 | | <0.03 | | <0.03 | <0.03 | | | | |
| Phenanthrene | mg/kg | 100 | | | | 7 | 0 | 7 | | <0.03 | | <0.03 | <0.03 | | | | |
| Pyrene | mg/kg | 620 | | | | 7 | 0 | 7 | | <0.07 | | <0.07 | <0.07 | | | | |
| PAH (total 16) | mg/kg | | | 0.11 | 0.11 | 7 | 1 | 6 | | <0.08 | | <0.08 | <0.08 | | | | |
| Phenols | | | | | | | | | | | | | | | | | |
| Phenols - Total by HPLC | mg/kg | 120 | | | | 6 | 0 | 6 | | <0.2 | | <0.2 | <0.2 | | | | |
| Phenols - Total by HPLC | mg/kg | 120 | | | | 6 | 0 | 6 | | <0.2 | | <0.2 | <0.2 | | | | |
| Other analytes | | | | | | | | | | | | | | | | | |
| % Stones >10mm | % w/w | | | 14.1 | 2 | 19 | 10 | 9 | <0.1 | <0.1 | <0.1 | <0.1 | | 5.2 | 9.4 | 2 | 9.2 |
| Calorific Value (Gross/Total) | kJ/kg | | | | | 0 | 0 | 0 | | | | | | | | | |
| Loss on ignition (550degC) | % w/w | | | | | 0 | 0 | 0 | | | | | | | | | |
| pH | pH | | | 8.6 | 5.55 | 7 | 7 | 0 | | 8.3 | | 8.07 | 8.34 | | | | |
| pH BRE | pH | | | 8.59 | 6.54 | 12 | 12 | 0 | 7.88 | | 7.76 | | | 8.14 | 7.12 | 7.4 | |
| Sulphate BRE (acid sol) | % w/w | | | 0.42 | 0.06 | 12 | 2 | 10 | <0.02 | | <0.02 | | | <0.02 | <0.02 | 0.06 | |
| Sulphur BRE (total) | % w/w | | | 0.14 | 0.09 | 12 | 2 | 10 | <0.01 | | <0.01 | | | <0.01 | <0.01 | 0.09 | |
| Total Organic Carbon | % w/w | | | | | 0 | 0 | 0 | | | | | | | | | |
| Converted to SOM (x / 0.58) | % w/w | | | | | 0 | 0 | 0 | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | |
|--------------|--|-------------------------------------|--|-------|--|---|--|--|--|--|--|--|--|--|--|--|--|---|--|--|--|
| Project name | | Thoresby Area B | | Notes | | Made ground – Coal Stocking Yard Colliery Spoil | | | | | | | | | | | |  | | | |
| Project code | | 301924 | | | | | | | | | | | | | | | | | | | |
| Client name | | Harworth Estates Ltd | | | | | | | | | | | | | | | | | | | |
| Address | | Ollerton Road | | | | | | | | | | | | | | | | | | | |
| | | Edwinstowe | | | | | | | | | | | | | | | | | | | |
| | | Mansfield | | | | | | | | | | | | | | | | | | | |
| | | NG21 9QF | | | | | | | | | | | | | | | | | | | |
| NGR | | 463384, 367197 | | | | | | | | | | | | | | | | | | | |
| Land use | | Residential with home-grown produce | | | | | | | | | | | | | | | | | | | |
| SOM | | 6% | | | | | | | | | | | | | | | | | | | |
| GAC version | | 2018_00 | | | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | |
|--|-------|--------|-----|------|------|-------|-----------|---------------|-------|------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | | | | | | | | | | Lab sample ID | 17/08337/61 | 17/08337/63 | 17/08337/64 | 17/08337/65 | 17/08337/66 | 17/08337/72 | 17/08337/73 | 17/08337/74 | 17/08337/77 | 17/08337/80 | 17/08337/81 |
| | | | | | | | | | | Client sample ID | TP123 | TP125 | TP126 | TP126 | TP127 | TP129 | TP129 | TP129 | TP130 | TP131 | TP131 |
| | | | | | | | | | | Depth to top | 0.6 | 0.5 | 0.6 | 0.9 | 0.5 | 0.7 | 1.3 | 2 | 0.3 | 0.5 | 1.3 |
| | | | | | | | | | | Depth to bottom | | | | | | | 1.5 | | | | |
| | | | | | | | | | | Date sampled | 23/11/17 | 23/11/17 | 23/11/17 | 23/11/17 | 24/11/17 | 24/11/17 | 24/11/17 | 24/11/17 | 24/11/17 | 24/11/17 | 24/11/17 |
| Analyte | Unit | GAC | T1 | Max | Min | Count | # Detects | # Non-detects | | | | | | | | | | | | | |
| Metals and Inorganics | | | | | | | | | | | | | | | | | | | | | |
| Arsenic | mg/kg | 37 | | 63 | 1 | 17 | 16 | 1 | 8 | | 9 | | 63 | 6 | 4 | | 9 | 9 | <1 | | |
| Cadmium | mg/kg | 22 | | 0.8 | 0.5 | 17 | 3 | 14 | <0.5 | | <0.5 | | 0.6 | <0.5 | <0.5 | | 0.8 | <0.5 | <0.5 | | |
| Chromium | mg/kg | 910 | 21 | 27 | 4 | 17 | 17 | 0 | 12 | | 21 | | 12 | 10 | 27 | | 19 | 9 | 16 | | |
| Copper | mg/kg | 2500 | | 35 | 7 | 17 | 17 | 0 | 24 | | 35 | | 35 | 33 | 29 | | 32 | 20 | 14 | | |
| Lead | mg/kg | 200 | | 37 | 7 | 17 | 16 | 1 | 15 | | 18 | | 37 | 19 | 23 | | 23 | 16 | <1 | | |
| Mercury | mg/kg | 39 | 1.2 | 0.68 | 0.21 | 17 | 2 | 15 | <0.17 | | <0.17 | | <0.17 | <0.17 | <0.17 | | <0.17 | <0.17 | 0.21 | | |
| Nickel | mg/kg | 130 | | 31 | 4 | 17 | 17 | 0 | 21 | | 29 | | 23 | 22 | 23 | | 27 | 18 | 11 | | |
| Selenium | mg/kg | 258 | | 2 | 1 | 17 | 5 | 12 | <1 | | 2 | | 2 | <1 | 2 | | <1 | <1 | <1 | | |
| Zinc | mg/kg | 3900 | | 81 | 8 | 17 | 17 | 0 | 21 | | 24 | | 24 | 27 | 26 | | 45 | 18 | 20 | | |
| Asbestos | | | | | | | | | | | | | | | | | | | | | |
| Asbestos in soil | | | | | | 17 | 0 | 17 | NAD | | NAD | | NAD | NAD | NAD | | NAD | NAD | NAD | | |
| Asbestos Matrix (microscope) | | | | | | 17 | 0 | 17 | - | | - | | - | - | - | | - | - | - | | |
| Asbestos in soil % composition (hand picking and weighing) | % w/w | | | | | 0 | 0 | 0 | | | | | | | | | | | | | |
| Petroleum Hydrocarbons | | | | | | | | | | | | | | | | | | | | | |
| Ali >C5-C6 | mg/kg | 160 | | | | 17 | 0 | 17 | <0.05 | | <0.05 | | <0.05 | <0.05 | <0.05 | | <0.05 | <0.05 | <0.01 | | |
| Ali >C6-C8 | mg/kg | 530 | | 0.15 | 0.07 | 17 | 4 | 13 | <0.05 | | 0.15 | | <0.05 | <0.05 | 0.14 | | <0.05 | 0.07 | <0.01 | | |
| Ali >C8-C10 | mg/kg | 154 | | 0.07 | 0.01 | 17 | 3 | 14 | <0.05 | | 0.06 | | <0.05 | <0.05 | 0.07 | | <0.05 | <0.05 | <0.01 | | |
| Ali >C10-C12 | mg/kg | 760 | 283 | 4.3 | 0.3 | 17 | 11 | 6 | 0.3 | | 0.6 | | <0.1 | 1.5 | 4.3 | | 0.9 | 0.5 | <0.1 | | |
| Ali >C12-C16 | mg/kg | 4300 | 142 | 8.1 | 0.8 | 17 | 14 | 3 | 2.3 | | 3.8 | | 1.3 | 2.7 | 8.1 | | 1.3 | 1.2 | <0.1 | | |
| Ali >C16-C21 | mg/kg | | | 26.7 | 0.7 | 17 | 13 | 4 | 1.1 | | 4.3 | | <0.1 | 1.5 | 12.1 | | 0.7 | 2 | <0.1 | | |
| Ali >C21-C35 | mg/kg | | | 46.2 | 0.8 | 17 | 8 | 9 | 1.1 | | 17.7 | | <0.1 | <0.1 | 21.1 | | 0.8 | 0.9 | <0.1 | | |
| Ali >C16-C35 calculated | mg/kg | 110000 | | 72.9 | 0.7 | 17 | 13 | 4 | 2.2 | | 22 | | <0.1 | 1.5 | 33.2 | | 1.5 | 2.9 | <0.1 | | |
| Total Aliphatics | mg/kg | | | 75.1 | 1.3 | 17 | 14 | 3 | 4.8 | | 26.4 | | 1.3 | 5.9 | 45.7 | | 3.6 | 4.5 | <0.1 | | |
| Aro >C5-C7 | mg/kg | | | 0.27 | 0.07 | 17 | 5 | 12 | <0.05 | | 0.17 | | <0.05 | <0.05 | 0.08 | | <0.05 | 0.27 | <0.01 | | |
| Aro >C7-C8 | mg/kg | | | 0.3 | 0.05 | 17 | 4 | 13 | <0.05 | | 0.3 | | <0.05 | <0.05 | <0.05 | | 0.06 | 0.14 | <0.01 | | |
| Aro >C8-C9 | mg/kg | 57 | | 0.43 | 0.02 | 17 | 8 | 9 | <0.05 | | 0.43 | | <0.05 | <0.05 | 0.08 | | 0.13 | 0.17 | <0.01 | | |
| Aro >C9-C10 | mg/kg | 190 | | 0.25 | 0.02 | 17 | 6 | 11 | <0.05 | | 0.25 | | <0.05 | <0.05 | 0.08 | | 0.1 | 0.09 | <0.01 | | |
| Aro >C10-C12 | mg/kg | 390 | | 5.2 | 0.4 | 17 | 13 | 4 | 0.5 | | 3.2 | | 0.9 | 2.1 | 5.2 | | 0.7 | 1 | <0.1 | | |
| Aro >C12-C16 | mg/kg | 670 | | 20 | 2.2 | 17 | 15 | 2 | 4.6 | | 8.4 | | 3.7 | 5.3 | 20 | | 4.5 | 5.4 | <0.1 | | |
| Aro >C16-C21 | mg/kg | 930 | | 16.5 | 1.3 | 17 | 15 | 2 | 4.2 | | 5.6 | | 1.9 | 3.3 | 16.5 | | 3.6 | 4.1 | <0.1 | | |
| Aro >C21-C35 | mg/kg | 1700 | | 7.8 | 0.4 | 17 | 12 | 5 | 1.2 | | 3.3 | | <0.1 | <0.1 | 7.8 | | 1 | 0.7 | <0.1 | | |
| Total Aromatics | mg/kg | | | 49.6 | 3.6 | 17 | 15 | 2 | 10.4 | | 20.5 | | 6.6 | 10.6 | 49.6 | | 9.6 | 11.3 | <0.1 | | |
| TPH (Ali & Aro) | mg/kg | | | 95.3 | 3.6 | 17 | 16 | 1 | 15.3 | | 47 | | 7.8 | 16.5 | 95.3 | | 13.2 | 15.7 | <0.1 | | |
| BTEX - Benzene | mg/kg | 0.87 | | 0.27 | 0.07 | 17 | 5 | 12 | <0.05 | | 0.17 | | <0.05 | <0.05 | 0.08 | | <0.05 | 0.27 | <0.01 | | |
| BTEX - Toluene | mg/kg | 680 | | 0.3 | 0.05 | 17 | 4 | 13 | <0.05 | | 0.3 | | <0.05 | <0.05 | <0.05 | | 0.06 | 0.14 | <0.01 | | |
| BTEX - Ethyl Benzene | mg/kg | 260 | | 0.07 | 0.07 | 17 | 1 | 16 | <0.05 | | 0.07 | | <0.05 | <0.05 | <0.05 | | <0.05 | <0.05 | <0.01 | | |
| BTEX - o Xylene | mg/kg | 332 | | 0.12 | 0.12 | 17 | 1 | 16 | <0.05 | | 0.12 | | <0.05 | <0.05 | <0.05 | | <0.05 | <0.05 | <0.01 | | |
| BTEX - m & p Xylene | mg/kg | 310 | | 0.21 | 0.06 | 17 | 3 | 14 | <0.05 | | 0.21 | | <0.05 | <0.05 | <0.05 | | 0.06 | 0.09 | <0.01 | | |
| MTBE | mg/kg | 210 | | | | 17 | 0 | 17 | <0.05 | | <0.05 | | <0.05 | <0.05 | <0.05 | | <0.05 | <0.05 | <0.01 | | |
| Polycyclic aromatic hydrocarbons | | | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | mg/kg | 1170 | | 0.12 | 0.02 | 17 | 4 | 13 | <0.01 | | 0.02 | | <0.01 | <0.01 | 0.12 | | <0.01 | 0.02 | <0.01 | | |
| Acenaphthylene | mg/kg | 970 | | 0.05 | 0.05 | 17 | 1 | 16 | <0.01 | | <0.01 | | <0.01 | <0.01 | 0.05 | | <0.01 | <0.01 | <0.01 | | |
| Anthracene | mg/kg | 10900 | | 0.22 | 0.02 | 17 | 12 | 5 | 0.03 | | 0.06 | | <0.02 | 0.02 | 0.22 | | 0.04 | 0.05 | <0.02 | | |

| | | | | | | | | | | | | | | | | | | | | | |
|--|--|--------|-------|------|------|-------|-----------|---------------|-------|------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Project name | Thoresby Area B | | Notes | | | | | | | | | | | | | | | | | | |
| Project code | 301924 | | | | | | | | | | | | | | | | | | | | |
| Client name | Harworth Estates Ltd | | | | | | | | | | | | | | | | | | | | |
| Address | Ollerton Road Edwinstowe Mansfield NG21 9QF | | | | | | | | | | | | | | | | | | | | |
| NGR | 463384, 367197 | | | | | | | | | | | | | | | | | | | | |
| Land use | Residential with home-grown produce | | | | | | | | | | | | | | | | | | | | |
| SOM | 6% | | | | | | | | | | | | | | | | | | | | |
| GAC version | 2018_00 | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | Lab sample ID | 17/08337/82 | 17/08337/84 | 17/08337/86 | 17/08337/87 | 17/08337/89 | 17/08337/91 | 17/08337/92 | 17/08337/98 | 17/08337/10 | 17/08337/10 | 17/08337/10 |
| | | | | | | | | | | Client sample ID | TP132 | TP133 | TP134 | TP134 | TP135 | TP136 | TP136 | TP139 | TP140 | TP141 | TP142 |
| | | | | | | | | | | Depth to top | 0.5 | 0.5 | 0.7 | 1.6 | 0.4 | 0.2 | 0.6 | 0.6 | 0.9 | 0.5 | 0.6 |
| | | | | | | | | | | Depth to bottom | | | | | | | | | | | |
| | | | | | | | | | | Date sampled | 28/11/17 | 28/11/17 | 28/11/17 | 28/11/17 | 28/11/17 | 28/11/17 | 28/11/17 | 29/11/17 | 29/11/17 | 29/11/17 | 28/11/17 |
| Analyte | Unit | GAC | T1 | Max | Min | Count | # Detects | # Non-detects | | | | | | | | | | | | | |
| Metals and Inorganics | | | | | | | | | | | | | | | | | | | | | |
| Arsenic | mg/kg | 37 | | 63 | 1 | 17 | 16 | 1 | 11 | 6 | 22 | 6 | 11 | | 6 | 1 | | 30 | | | |
| Cadmium | mg/kg | 22 | | 0.8 | 0.5 | 17 | 3 | 14 | <0.5 | 0.5 | <0.5 | <0.5 | <0.5 | | <0.5 | <0.5 | | <0.5 | | | |
| Chromium | mg/kg | 910 | 21 | 27 | 4 | 17 | 17 | 0 | 8 | 12 | 10 | 8 | 9 | | 7 | 7 | | 4 | | | |
| Copper | mg/kg | 2500 | | 35 | 7 | 17 | 17 | 0 | 20 | 26 | 34 | 15 | 21 | | 10 | 10 | | 7 | | | |
| Lead | mg/kg | 200 | | 37 | 7 | 17 | 16 | 1 | 15 | 16 | 21 | 13 | 17 | | 7 | 11 | | 18 | | | |
| Mercury | mg/kg | 39 | 1.2 | 0.68 | 0.21 | 17 | 2 | 15 | <0.17 | <0.17 | <0.17 | <0.17 | <0.17 | | <0.17 | <0.17 | | <0.17 | | | |
| Nickel | mg/kg | 130 | | 31 | 4 | 17 | 17 | 0 | 21 | 25 | 31 | 12 | 12 | | 10 | 7 | | 4 | | | |
| Selenium | mg/kg | 258 | | 2 | 1 | 17 | 5 | 12 | 1 | <1 | 2 | <1 | <1 | | <1 | <1 | | <1 | | | |
| Zinc | mg/kg | 3900 | | 81 | 8 | 17 | 17 | 0 | 20 | 81 | 26 | 20 | 21 | | 13 | 17 | | 8 | | | |
| Asbestos | | | | | | | | | | | | | | | | | | | | | |
| Asbestos in soil | | | | | | 17 | 0 | 17 | NAD | NAD | NAD | NAD | NAD | | NAD | NAD | | NAD | | | |
| Asbestos Matrix (microscope) | | | | | | 17 | 0 | 17 | - | - | - | - | - | | - | - | | - | | | |
| Asbestos in soil % composition (hand picking and weighing) | % w/w | | | | | 0 | 0 | 0 | | | | | | | | | | | | | |
| Petroleum Hydrocarbons | | | | | | | | | | | | | | | | | | | | | |
| Ali >C5-C6 | mg/kg | 160 | | | | 17 | 0 | 17 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | | <0.01 | <0.01 | | <0.01 | | | |
| Ali >C6-C8 | mg/kg | 530 | | 0.15 | 0.07 | 17 | 4 | 13 | <0.05 | <0.05 | 0.07 | <0.05 | <0.05 | | <0.01 | <0.01 | | <0.01 | | | |
| Ali >C8-C10 | mg/kg | 154 | | 0.07 | 0.01 | 17 | 3 | 14 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | | <0.01 | 0.01 | | <0.01 | | | |
| Ali >C10-C12 | mg/kg | 760 | 283 | 4.3 | 0.3 | 17 | 11 | 6 | 0.5 | <0.1 | 0.5 | 0.6 | <0.1 | | 1 | 1 | | <0.1 | | | |
| Ali >C12-C16 | mg/kg | 4300 | 142 | 8.1 | 0.8 | 17 | 14 | 3 | 1 | <0.1 | 0.8 | 1.9 | 1 | | 1.8 | 2.1 | | <0.1 | | | |
| Ali >C16-C21 | mg/kg | | | 26.7 | 0.7 | 17 | 13 | 4 | 0.7 | <0.1 | 0.8 | 2.2 | 1.2 | | 1.9 | 1.4 | | <0.1 | | | |
| Ali >C21-C35 | mg/kg | | | 46.2 | 0.8 | 17 | 8 | 9 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | | 2.2 | 2.4 | | <0.1 | | | |
| Ali >C16-C35 calculated | mg/kg | 110000 | | 72.9 | 0.7 | 17 | 13 | 4 | 0.7 | <0.1 | 0.8 | 2.2 | 1.2 | | 4.1 | 3.8 | | <0.1 | | | |
| Total Aliphatics | mg/kg | | | 75.1 | 1.3 | 17 | 14 | 3 | 2.2 | <0.1 | 2.1 | 4.6 | 2.3 | | 6.9 | 7 | | <0.1 | | | |
| Aro >C5-C7 | mg/kg | | | 0.27 | 0.07 | 17 | 5 | 12 | <0.05 | <0.05 | 0.08 | <0.05 | 0.07 | | <0.01 | <0.01 | | <0.01 | | | |
| Aro >C7-C8 | mg/kg | | | 0.3 | 0.05 | 17 | 4 | 13 | <0.05 | <0.05 | 0.05 | <0.05 | <0.05 | | <0.01 | <0.01 | | <0.01 | | | |
| Aro >C8-C9 | mg/kg | 57 | | 0.43 | 0.02 | 17 | 8 | 9 | <0.05 | <0.05 | 0.11 | 0.08 | 0.07 | | <0.01 | 0.02 | | <0.01 | | | |
| Aro >C9-C10 | mg/kg | 190 | | 0.25 | 0.02 | 17 | 6 | 11 | <0.05 | <0.05 | 0.05 | <0.05 | <0.05 | | <0.01 | 0.02 | | <0.01 | | | |
| Aro >C10-C12 | mg/kg | 390 | | 5.2 | 0.4 | 17 | 13 | 4 | 0.4 | <0.1 | 1.2 | 0.7 | 0.9 | | 0.5 | 0.6 | | <0.1 | | | |
| Aro >C12-C16 | mg/kg | 670 | | 20 | 2.2 | 17 | 15 | 2 | 3.5 | 2.4 | 7.4 | 6.5 | 4.3 | | 6.9 | 5.5 | | 2.2 | | | |
| Aro >C16-C21 | mg/kg | 930 | | 16.5 | 1.3 | 17 | 15 | 2 | 3.4 | 2.5 | 5.5 | 5.8 | 2.6 | | 7.9 | 4.4 | | 1.3 | | | |
| Aro >C21-C35 | mg/kg | 1700 | | 7.8 | 0.4 | 17 | 12 | 5 | 1.4 | 0.9 | 1.1 | 2.5 | 0.4 | | 1.2 | 1.1 | | <0.1 | | | |
| Total Aromatics | mg/kg | | | 49.6 | 3.6 | 17 | 15 | 2 | 8.7 | 5.8 | 15.2 | 15.6 | 8.2 | | 16.6 | 11.6 | | 3.6 | | | |
| TPH (Ali & Aro) | mg/kg | | | 95.3 | 3.6 | 17 | 16 | 1 | 10.9 | 5.8 | 17.4 | 20.2 | 10.6 | | 23.6 | 18.6 | | 3.6 | | | |
| BTEX - Benzene | mg/kg | 0.87 | | 0.27 | 0.07 | 17 | 5 | 12 | <0.05 | <0.05 | 0.08 | <0.05 | 0.07 | | <0.01 | <0.01 | | <0.01 | | | |
| BTEX - Toluene | mg/kg | 680 | | 0.3 | 0.05 | 17 | 4 | 13 | <0.05 | <0.05 | 0.05 | <0.05 | <0.05 | | <0.01 | <0.01 | | <0.01 | | | |
| BTEX - Ethyl Benzene | mg/kg | 260 | | 0.07 | 0.07 | 17 | 1 | 16 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | | <0.01 | <0.01 | | <0.01 | | | |
| BTEX - o Xylene | mg/kg | 332 | | 0.12 | 0.12 | 17 | 1 | 16 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | | <0.01 | <0.01 | | <0.01 | | | |
| BTEX - m & p Xylene | mg/kg | 310 | | 0.21 | 0.06 | 17 | 3 | 14 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | | <0.01 | <0.01 | | <0.01 | | | |
| MTBE | mg/kg | 210 | | | | 17 | 0 | 17 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | | <0.01 | <0.01 | | <0.01 | | | |
| Polycyclic aromatic hydrocarbons | | | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | mg/kg | 1170 | | 0.12 | 0.02 | 17 | 4 | 13 | <0.01 | <0.01 | 0.02 | <0.01 | <0.01 | | <0.01 | <0.01 | | <0.01 | | | |
| Acenaphthylene | mg/kg | 970 | | 0.05 | 0.05 | 17 | 1 | 16 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | <0.01 | <0.01 | | <0.01 | | | |
| Anthracene | mg/kg | 10900 | | 0.22 | 0.02 | 17 | 12 | 5 | <0.02 | <0.02 | 0.05 | 0.07 | 0.04 | | 0.04 | 0.03 | | <0.02 | | | |


| | | | | | | | | | | | | |
|--------------|--|-------------------------------------|--|--|--|--|--|-------|--|--|--|--|
| Project name | | Thoresby Area B | | | | | | Notes | | | | |
| Project code | | 301924 | | | | | | | | | | |
| Client name | | Harworth Estates Ltd | | | | | | | | | | |
| Address | | Ollerton Road | | | | | | | | | | |
| | | Edwinstowe | | | | | | | | | | |
| | | Mansfield | | | | | | | | | | |
| | | NG21 9QF | | | | | | | | | | |
| NGR | | 463384, 367197 | | | | | | | | | | |
| Land use | | Residential with home-grown produce | | | | | | | | | | |
| SOM | | 6% | | | | | | | | | | |
| GAC version | | 2018_00 | | | | | | | | | | |

| | | | | | | | | | | | | | | | |
|--|-------|--------|-----|------|------|-------|-----------|---------------|--|------------------|--|--|-------------|-------------|-------------|
| | | | | | | | | | | Lab sample ID | | | 17/08337/11 | 17/08337/11 | 17/08337/11 |
| | | | | | | | | | | Client sample ID | | | WS119 | WS120 | WS120 |
| | | | | | | | | | | Depth to top | | | 0.5 | 0.6 | 2.3 |
| | | | | | | | | | | Depth to bottom | | | 0.7 | 0.8 | 2.5 |
| | | | | | | | | | | Date sampled | | | 23/11/17 | 23/11/17 | 23/11/17 |
| Analyte | Unit | GAC | T1 | Max | Min | Count | # Detects | # Non-detects | | | | | | | |
| Metals and Inorganics | | | | | | | | | | | | | | | |
| Arsenic | mg/kg | 37 | | 63 | 1 | 17 | 16 | 1 | | | | | | | 13 |
| Cadmium | mg/kg | 22 | | 0.8 | 0.5 | 17 | 3 | 14 | | | | | | <0.5 | |
| Chromium | mg/kg | 910 | 21 | 27 | 4 | 17 | 17 | 0 | | | | | | | 20 |
| Copper | mg/kg | 2500 | | 35 | 7 | 17 | 17 | 0 | | | | | | | 20 |
| Lead | mg/kg | 200 | | 37 | 7 | 17 | 16 | 1 | | | | | | | 8 |
| Mercury | mg/kg | 39 | 1.2 | 0.68 | 0.21 | 17 | 2 | 15 | | | | | | | 0.68 |
| Nickel | mg/kg | 130 | | 31 | 4 | 17 | 17 | 0 | | | | | | | 12 |
| Selenium | mg/kg | 258 | | 2 | 1 | 17 | 5 | 12 | | | | | | <1 | |
| Zinc | mg/kg | 3900 | | 81 | 8 | 17 | 17 | 0 | | | | | | | 22 |
| Asbestos | | | | | | | | | | | | | | | |
| Asbestos in soil | | | | | | 17 | 0 | 17 | | | | | | NAD | |
| Asbestos Matrix (microscope) | | | | | | 17 | 0 | 17 | | | | | | - | |
| Asbestos in soil % composition (hand picking and weighing) | % w/w | | | | | 0 | 0 | 0 | | | | | | | |
| Petroleum Hydrocarbons | | | | | | | | | | | | | | | |
| Ali >C5-C6 | mg/kg | 160 | | | | 17 | 0 | 17 | | | | | | <0.01 | |
| Ali >C6-C8 | mg/kg | 530 | | 0.15 | 0.07 | 17 | 4 | 13 | | | | | | <0.01 | |
| Ali >C8-C10 | mg/kg | 154 | | 0.07 | 0.01 | 17 | 3 | 14 | | | | | | <0.01 | |
| Ali >C10-C12 | mg/kg | 760 | 283 | 4.3 | 0.3 | 17 | 11 | 6 | | | | | | <0.1 | |
| Ali >C12-C16 | mg/kg | 4300 | 142 | 8.1 | 0.8 | 17 | 14 | 3 | | | | | | | 2.7 |
| Ali >C16-C21 | mg/kg | | | 26.7 | 0.7 | 17 | 13 | 4 | | | | | | | 26.7 |
| Ali >C21-C35 | mg/kg | | | 46.2 | 0.8 | 17 | 8 | 9 | | | | | | | 46.2 |
| Ali >C16-C35 calculated | mg/kg | 110000 | | 72.9 | 0.7 | 17 | 13 | 4 | | | | | | | 72.9 |
| Total Aliphatics | mg/kg | | | 75.1 | 1.3 | 17 | 14 | 3 | | | | | | | 75.1 |
| Aro >C5-C7 | mg/kg | | | 0.27 | 0.07 | 17 | 5 | 12 | | | | | | <0.01 | |
| Aro >C7-C8 | mg/kg | | | 0.3 | 0.05 | 17 | 4 | 13 | | | | | | <0.01 | |
| Aro >C8-C9 | mg/kg | 57 | | 0.43 | 0.02 | 17 | 8 | 9 | | | | | | <0.01 | |
| Aro >C9-C10 | mg/kg | 190 | | 0.25 | 0.02 | 17 | 6 | 11 | | | | | | <0.01 | |
| Aro >C10-C12 | mg/kg | 390 | | 5.2 | 0.4 | 17 | 13 | 4 | | | | | | <0.1 | |
| Aro >C12-C16 | mg/kg | 670 | | 20 | 2.2 | 17 | 15 | 2 | | | | | | <0.1 | |
| Aro >C16-C21 | mg/kg | 930 | | 16.5 | 1.3 | 17 | 15 | 2 | | | | | | <0.1 | |
| Aro >C21-C35 | mg/kg | 1700 | | 7.8 | 0.4 | 17 | 12 | 5 | | | | | | <0.1 | |
| Total Aromatics | mg/kg | | | 49.6 | 3.6 | 17 | 15 | 2 | | | | | | <0.1 | |
| TPH (Ali & Aro) | mg/kg | | | 95.3 | 3.6 | 17 | 16 | 1 | | | | | | | 75.1 |
| BTEX - Benzene | mg/kg | 0.87 | | 0.27 | 0.07 | 17 | 5 | 12 | | | | | | <0.01 | |
| BTEX - Toluene | mg/kg | 680 | | 0.3 | 0.05 | 17 | 4 | 13 | | | | | | <0.01 | |
| BTEX - Ethyl Benzene | mg/kg | 260 | | 0.07 | 0.07 | 17 | 1 | 16 | | | | | | <0.01 | |
| BTEX - o Xylene | mg/kg | 332 | | 0.12 | 0.12 | 17 | 1 | 16 | | | | | | <0.01 | |
| BTEX - m & p Xylene | mg/kg | 310 | | 0.21 | 0.06 | 17 | 3 | 14 | | | | | | <0.01 | |
| MTBE | mg/kg | 210 | | | | 17 | 0 | 17 | | | | | | <0.01 | |
| Polycyclic aromatic hydrocarbons | | | | | | | | | | | | | | | |
| Acenaphthene | mg/kg | 1170 | | 0.12 | 0.02 | 17 | 4 | 13 | | | | | | <0.01 | |
| Acenaphthylene | mg/kg | 970 | | 0.05 | 0.05 | 17 | 1 | 16 | | | | | | <0.01 | |
| Anthracene | mg/kg | 10900 | | 0.22 | 0.02 | 17 | 12 | 5 | | | | | | | 0.09 |

| Lab sample ID | | | | | | | | | | | 17/08337/61 | 17/08337/63 | 17/08337/64 | 17/08337/65 | 17/08337/66 | 17/08337/72 | 17/08337/73 | 17/08337/74 | 17/08337/77 | 17/08337/80 | 17/08337/81 |
|-------------------------------|-------|-----|------|-----|----------|----------|-----------|---------------|----|-------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Client sample ID | | | | | | | | | | | TP123 | TP125 | TP126 | TP126 | TP127 | TP129 | TP129 | TP129 | TP130 | TP131 | TP131 |
| Depth to top | | | | | | | | | | | 0.6 | 0.5 | 0.6 | 0.9 | 0.5 | 0.7 | 1.3 | 2 | 0.3 | 0.5 | 1.3 |
| Depth to bottom | | | | | | | | | | | | | | | | | 1.5 | | | | |
| Date sampled | | | | | | | | | | | 23/11/17 | 23/11/17 | 23/11/17 | 23/11/17 | 24/11/17 | 24/11/17 | 24/11/17 | 24/11/17 | 24/11/17 | 24/11/17 | 24/11/17 |
| Analyte | Unit | GAC | T1 | Max | Min | Count | # Detects | # Non-detects | | | | | | | | | | | | | |
| Benzo(a)anthracene | mg/kg | | 13 | | 0.14 | 0.14 | 17 | 1 | 16 | <0.04 | | | <0.04 | | <0.04 | <0.04 | 0.14 | | <0.04 | <0.04 | <0.04 |
| Benzo(a)pyrene | mg/kg | | 5 | | 0.09 | 0.09 | 17 | 1 | 16 | <0.04 | | | <0.04 | | <0.04 | <0.04 | 0.09 | | <0.04 | <0.04 | <0.04 |
| Benzo(b)fluoranthene | mg/kg | | 3.7 | | 0.09 | 0.09 | 17 | 1 | 16 | <0.05 | | | <0.05 | | <0.05 | <0.05 | 0.09 | | <0.05 | <0.05 | <0.05 |
| Benzo(ghi)perylene | mg/kg | | 350 | | 0.09 | 0.09 | 17 | 1 | 16 | <0.05 | | | <0.05 | | <0.05 | <0.05 | 0.09 | | <0.05 | <0.05 | <0.05 |
| Benzo(k)fluoranthene | mg/kg | | 100 | | | | 17 | 0 | 17 | <0.07 | | | <0.07 | | <0.07 | <0.07 | <0.07 | | <0.07 | <0.07 | <0.07 |
| Chrysene | mg/kg | | 27 | | 0.13 | 0.07 | 17 | 2 | 15 | <0.06 | | | <0.06 | | <0.06 | <0.06 | 0.13 | | <0.06 | <0.06 | <0.06 |
| Dibenzo(ah)anthracene | mg/kg | | 0.3 | | | | 17 | 0 | 17 | <0.04 | | | <0.04 | | <0.04 | <0.04 | <0.04 | | <0.04 | <0.04 | <0.04 |
| Fluoranthene | mg/kg | | 900 | | 0.12 | 0.12 | 17 | 1 | 16 | <0.08 | | | <0.08 | | <0.08 | <0.08 | 0.12 | | <0.08 | <0.08 | <0.08 |
| Fluorene | mg/kg | | 880 | | 0.21 | 0.01 | 17 | 7 | 10 | <0.01 | | | 0.03 | | <0.01 | 0.01 | 0.21 | | 0.02 | 0.04 | <0.01 |
| Indeno(123-cd)pyrene | mg/kg | | 41 | | | | 17 | 0 | 17 | <0.03 | | | <0.03 | | <0.03 | <0.03 | <0.03 | | <0.03 | <0.03 | <0.03 |
| Naphthalene | mg/kg | | 71 | | 3.08 | 0.04 | 17 | 15 | 2 | 0.22 | | | 0.93 | | 0.29 | 0.35 | 3.08 | | 0.63 | 1.03 | <0.03 |
| Phenanthrene | mg/kg | | 440 | | 0.94 | 0.05 | 17 | 15 | 2 | 0.1 | | | 0.22 | | 0.13 | 0.09 | 0.94 | | 0.15 | 0.22 | <0.03 |
| Pyrene | mg/kg | | 2040 | | 0.15 | 0.08 | 17 | 2 | 15 | <0.07 | | | <0.07 | | <0.07 | <0.07 | 0.15 | | <0.07 | <0.07 | <0.07 |
| PAH (total 16) | mg/kg | | | | 5.42 | 0.21 | 17 | 15 | 2 | 0.36 | | | 1.26 | | 0.41 | 0.49 | 5.42 | | 0.85 | 1.36 | <0.08 |
| Phenols | | | | | | | | | | | | | | | | | | | | | |
| Phenols - Total by HPLC | mg/kg | | 390 | | | | 3 | 0 | 3 | | | | | | | | | | | | <0.2 |
| Phenols - Total by HPLC | mg/kg | | 390 | | | | 3 | 0 | 3 | | | | | | | | | | | | <0.2 |
| Other analytes | | | | | | | | | | | | | | | | | | | | | |
| % Stones >10mm | % w/w | | | | 44.1 | 1.1 | 25 | 17 | 8 | 39.1 | 18.1 | 23.8 | 14 | <0.1 | <0.1 | <0.1 | 1.1 | 11.6 | 39 | <0.1 | |
| Calorific Value (Gross/Total) | kJ/kg | | | | 6130 | 2420 | 5 | 5 | 0 | | 3800 | | 6130 | | | | 2420 | | | | |
| Loss on ignition (550degC) | % w/w | | | | 18.8 | 11.2 | 5 | 5 | 0 | | 18.8 | | 17.7 | | | | 13.7 | | | | |
| pH | pH | | | | 9.86 | 3.51 | 17 | 17 | 0 | 6.14 | | | 7.31 | | 3.51 | 7.93 | 7.54 | | 7.48 | 6.97 | 9.36 |
| pH BRE | pH | | | | 7.7 | 3.98 | 10 | 10 | 0 | | 7.7 | | 7.31 | | | | 3.98 | | | | |
| Sulphate BRE (acid sol) | % w/w | | | | 3.01 | 0.08 | 10 | 10 | 0 | | 0.15 | | 0.4 | | | | 3.01 | | | | |
| Sulphur BRE (total) | % w/w | | | | 3.36 | 0.04 | 10 | 10 | 0 | | 0.42 | | 0.96 | | | | 0.91 | | | | |
| Total Organic Carbon | % w/w | | | | 17.2 | 1.66 | 8 | 8 | 0 | | | | 17.2 | | | 10.9 | | | 7.41 | 11 | |
| Converted to SOM (x / 0.58) | % w/w | | | | 29.65517 | 2.862069 | 8 | 8 | 0 | | | | 29.6551724 | | | 18.7931034 | | | 12.7758621 | 18.9655172 | |

| | | | | | | | | | Lab sample ID | 17/08337/82 | 17/08337/84 | 17/08337/86 | 17/08337/87 | 17/08337/89 | 17/08337/91 | 17/08337/92 | 17/08337/98 | 17/08337/10 | 17/08337/10 | 17/08337/10 |
|-------------------------------|-------|------|----|----------|----------|-------|-----------|---------------|------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | | | | | | | | | Client sample ID | TP132 | TP133 | TP134 | TP134 | TP135 | TP136 | TP136 | TP139 | TP140 | TP141 | TP142 |
| | | | | | | | | | Depth to top | 0.5 | 0.5 | 0.7 | 1.6 | 0.4 | 0.2 | 0.6 | 0.6 | 0.9 | 0.5 | 0.6 |
| | | | | | | | | | Depth to bottom | | | | | | | | | | | |
| | | | | | | | | | Date sampled | 28/11/17 | 28/11/17 | 28/11/17 | 28/11/17 | 28/11/17 | 28/11/17 | 28/11/17 | 29/11/17 | 29/11/17 | 29/11/17 | 28/11/17 |
| Analyte | Unit | GAC | T1 | Max | Min | Count | # Detects | # Non-detects | | | | | | | | | | | | |
| Benzo(a)anthracene | mg/kg | 13 | | 0.14 | 0.14 | 17 | 1 | 16 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | | <0.04 | <0.04 | | <0.04 | | |
| Benzo(a)pyrene | mg/kg | 5 | | 0.09 | 0.09 | 17 | 1 | 16 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | | <0.04 | <0.04 | | <0.04 | | |
| Benzo(b)fluoranthene | mg/kg | 3.7 | | 0.09 | 0.09 | 17 | 1 | 16 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | | <0.05 | <0.05 | | <0.05 | | |
| Benzo(ghi)perylene | mg/kg | 350 | | 0.09 | 0.09 | 17 | 1 | 16 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | | <0.05 | <0.05 | | <0.05 | | |
| Benzo(k)fluoranthene | mg/kg | 100 | | | | 17 | 0 | 17 | <0.07 | <0.07 | <0.07 | <0.07 | <0.07 | | <0.07 | <0.07 | | <0.07 | | |
| Chrysene | mg/kg | 27 | | 0.13 | 0.07 | 17 | 2 | 15 | <0.06 | <0.06 | <0.06 | 0.07 | <0.06 | | <0.06 | <0.06 | | <0.06 | | |
| Dibenzo(ah)anthracene | mg/kg | 0.3 | | | | 17 | 0 | 17 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | | <0.04 | <0.04 | | <0.04 | | |
| Fluoranthene | mg/kg | 900 | | 0.12 | 0.12 | 17 | 1 | 16 | <0.08 | <0.08 | <0.08 | <0.08 | <0.08 | | <0.08 | <0.08 | | <0.08 | | |
| Fluorene | mg/kg | 880 | | 0.21 | 0.01 | 17 | 7 | 10 | <0.01 | <0.01 | 0.04 | 0.03 | <0.01 | | <0.01 | <0.01 | | <0.01 | | |
| Indeno(123-cd)pyrene | mg/kg | 41 | | | | 17 | 0 | 17 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | | <0.03 | <0.03 | | <0.03 | | |
| Naphthalene | mg/kg | 71 | | 3.08 | 0.04 | 17 | 15 | 2 | 0.14 | 0.16 | 0.56 | 0.62 | 0.51 | | 0.15 | 0.16 | | 0.04 | | |
| Phenanthrene | mg/kg | 440 | | 0.94 | 0.05 | 17 | 15 | 2 | 0.05 | 0.05 | 0.22 | 0.24 | 0.18 | | 0.13 | 0.12 | | <0.03 | | |
| Pyrene | mg/kg | 2040 | | 0.15 | 0.08 | 17 | 2 | 15 | <0.07 | <0.07 | <0.07 | 0.08 | <0.07 | | <0.07 | <0.07 | | <0.07 | | |
| PAH (total 16) | mg/kg | | | 5.42 | 0.21 | 17 | 15 | 2 | 0.22 | 0.21 | 0.89 | 1.16 | 0.73 | | 0.33 | 0.31 | | <0.08 | | |
| Phenols | | | | | | | | | | | | | | | | | | | | |
| Phenols - Total by HPLC | mg/kg | 390 | | | | 3 | 0 | 3 | | | <0.2 | | <0.2 | | | | | | | |
| Phenols - Total by HPLC | mg/kg | 390 | | | | 3 | 0 | 3 | | | <0.2 | | <0.2 | | | | | | | |
| Other analytes | | | | | | | | | | | | | | | | | | | | |
| % Stones >10mm | % w/w | | | 44.1 | 1.1 | 25 | 17 | 8 | 44.1 | 35.5 | 16.2 | 15.1 | 14.1 | 11.5 | 6.6 | <0.1 | 4.7 | 3 | 1.3 | |
| Calorific Value (Gross/Total) | kJ/kg | | | 6130 | 2420 | 5 | 5 | 0 | | | | | | 2920 | | | | | | |
| Loss on ignition (550degC) | % w/w | | | 18.8 | 11.2 | 5 | 5 | 0 | | | | | | 14 | | | | | | |
| pH | pH | | | 9.86 | 3.51 | 17 | 17 | 0 | 8.56 | 8.39 | 6.97 | 7.81 | 4.78 | | 6.34 | 7.4 | | 4.37 | | |
| pH BRE | pH | | | 7.7 | 3.98 | 10 | 10 | 0 | | | 6.97 | | | 7.15 | 6.34 | 7.4 | 7.69 | | 4.26 | |
| Sulphate BRE (acid sol) | % w/w | | | 3.01 | 0.08 | 10 | 10 | 0 | | | 0.28 | | | 0.23 | 0.24 | 0.08 | 0.11 | | 0.86 | |
| Sulphur BRE (total) | % w/w | | | 3.36 | 0.04 | 10 | 10 | 0 | | | 1.17 | | | 0.22 | 0.1 | 0.04 | 0.27 | | 0.49 | |
| Total Organic Carbon | % w/w | | | 17.2 | 1.66 | 8 | 8 | 0 | | | 9.03 | | | | 5.57 | 4.3 | | 1.66 | | |
| Converted to SOM (x / 0.58) | % w/w | | | 29.65517 | 2.862069 | 8 | 8 | 0 | | | 15.5689655 | | | | 9.60344828 | 7.4137931 | | 2.86206897 | | |

| | | | | | | | | | | | | | |
|-------------------------------|-------|------|----|----------|----------|-------|-----------|-------------|------|------------------|-------------|-------------|-------------|
| | | | | | | | | | | Lab sample ID | 17/08337/11 | 17/08337/11 | 17/08337/11 |
| | | | | | | | | | | Client sample ID | WS119 | WS120 | WS120 |
| | | | | | | | | | | Depth to top | 0.5 | 0.6 | 2.3 |
| | | | | | | | | | | Depth to bottom | 0.7 | 0.8 | 2.5 |
| | | | | | | | | | | Date sampled | 23/11/17 | 23/11/17 | 23/11/17 |
| Analyte | Unit | GAC | T1 | Max | Min | Count | # Detects | # Non-deter | | | | | |
| Benzo(a)anthracene | mg/kg | 13 | | 0.14 | 0.14 | 17 | 1 | 16 | | | | <0.04 | |
| Benzo(a)pyrene | mg/kg | 5 | | 0.09 | 0.09 | 17 | 1 | 16 | | | | <0.04 | |
| Benzo(b)fluoranthene | mg/kg | 3.7 | | 0.09 | 0.09 | 17 | 1 | 16 | | | | <0.05 | |
| Benzo(ghi)perylene | mg/kg | 350 | | 0.09 | 0.09 | 17 | 1 | 16 | | | | <0.05 | |
| Benzo(k)fluoranthene | mg/kg | 100 | | | | 17 | 0 | 17 | | | | <0.07 | |
| Chrysene | mg/kg | 27 | | 0.13 | 0.07 | 17 | 2 | 15 | | | | <0.06 | |
| Dibenzo(ah)anthracene | mg/kg | 0.3 | | | | 17 | 0 | 17 | | | | <0.04 | |
| Fluoranthene | mg/kg | 900 | | 0.12 | 0.12 | 17 | 1 | 16 | | | | <0.08 | |
| Fluorene | mg/kg | 880 | | 0.21 | 0.01 | 17 | 7 | 10 | | | | <0.01 | |
| Indeno(123-cd)pyrene | mg/kg | 41 | | | | 17 | 0 | 17 | | | | <0.03 | |
| Naphthalene | mg/kg | 71 | | 3.08 | 0.04 | 17 | 15 | 2 | | | | <0.03 | |
| Phenanthrene | mg/kg | 440 | | 0.94 | 0.05 | 17 | 15 | 2 | | | | 0.54 | |
| Pyrene | mg/kg | 2040 | | 0.15 | 0.08 | 17 | 2 | 15 | | | | <0.07 | |
| PAH (total 16) | mg/kg | | | 5.42 | 0.21 | 17 | 15 | 2 | | | | 0.63 | |
| Phenols | | | | | | | | | | | | | |
| Phenols - Total by HPLC | mg/kg | 390 | | | | 3 | 0 | 3 | | | | | |
| Phenols - Total by HPLC | mg/kg | 390 | | | | 3 | 0 | 3 | | | | | |
| Other analytes | | | | | | | | | | | | | |
| % Stones >10mm | % w/w | | | 44.1 | 1.1 | 25 | 17 | 8 | <0.1 | <0.1 | <0.1 | | |
| Calorific Value (Gross/Total) | kJ/kg | | | 6130 | 2420 | 5 | 5 | 0 | 5620 | | | | |
| Loss on ignition (550degC) | % w/w | | | 18.8 | 11.2 | 5 | 5 | 0 | 11.2 | | | | |
| pH | pH | | | 9.86 | 3.51 | 17 | 17 | 0 | | | | 9.86 | |
| pH BRE | pH | | | 7.7 | 3.98 | 10 | 10 | 0 | | 6.69 | | | |
| Sulphate BRE (acid sol) | % w/w | | | 3.01 | 0.08 | 10 | 10 | 0 | | 0.09 | | | |
| Sulphur BRE (total) | % w/w | | | 3.36 | 0.04 | 10 | 10 | 0 | | 3.36 | | | |
| Total Organic Carbon | % w/w | | | 17.2 | 1.66 | 8 | 8 | 0 | | | | | |
| Converted to SOM (x / 0.58) | % w/w | | | 29.65517 | 2.862069 | 8 | 8 | 0 | | | | | |

| | | | | |
|--------------|--|-------|--|---|
| Project name | Thoresby Area B | Notes | Made ground – Coal Stocking Yard Sand and Gravel |  |
| Project code | 301924 | | | |
| Client name | Harworth Estates Ltd | | | |
| Address | Ollerton Road Edwinstowe Mansfield NG21 9QF | | | |
| NGR | 463384, 367197 | | | |
| Land use | Residential with home-grown produce | | | |
| SOM | 6% | | | |
| GAC version | 2018_00 | | | |

| | | | | | | | | | Lab sample ID | 17/08337/59 | 17/08337/60 | 17/08337/62 | 17/08337/67 | 17/08337/68 | 17/08337/69 | 17/08337/71 | 17/08337/76 | 17/08337/78 | 17/08337/95 | 17/08337/96 |
|--|-------|--------|-----|------|------|-------|-----------|---------------|------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | | | | | | | | | Client sample ID | TP122 | TP122 | TP123 | TP127 | TP128 | TP128 | TP128 | TP130 | TP130 | TP136 | TP138 |
| | | | | | | | | | Depth to top | 0.5 | 1.9 | 1.4 | 0.9 | 0.6 | 1 | 1.5 | 0.7 | 1.3 | 3 | 0.7 |
| | | | | | | | | | Depth to bottom | | | | | | | 1.7 | | | | |
| | | | | | | | | | Date sampled | 24/11/17 | 24/11/17 | 23/11/17 | 24/11/17 | 23/11/17 | 23/11/17 | 23/11/17 | 24/11/17 | 24/11/17 | 28/11/17 | 29/11/17 |
| Analyte | Unit | GAC | T1 | Max | Min | Count | # Detects | # Non-detects | | | | | | | | | | | | |
| Metals and Inorganics | | | | | | | | | | | | | | | | | | | | |
| Arsenic | mg/kg | 37 | | 18 | 3 | 6 | 4 | 2 | <1 | | | 18 | | | 7 | | 6 | | <1 | |
| Cadmium | mg/kg | 22 | | 0.7 | 0.5 | 6 | 2 | 4 | <0.5 | | | <0.5 | | | <0.5 | | <0.5 | | 0.7 | |
| Chromium | mg/kg | 910 | 21 | 36 | 9 | 6 | 6 | 0 | 9 | | | 17 | | | 10 | | 12 | | 36 | |
| Copper | mg/kg | 2500 | | 52 | 7 | 6 | 6 | 0 | 7 | | | 42 | | | 52 | | 46 | | 22 | |
| Lead | mg/kg | 200 | | 32 | 6 | 6 | 6 | 0 | 6 | | | 21 | | | 32 | | 29 | | 17 | |
| Mercury | mg/kg | 39 | 1.2 | | | 6 | 0 | 6 | <0.17 | | | <0.17 | | | <0.17 | | <0.17 | | <0.17 | |
| Nickel | mg/kg | 130 | | 32 | 9 | 6 | 6 | 0 | 9 | | | 27 | | | 18 | | 18 | | 32 | |
| Selenium | mg/kg | 258 | | 3 | 1 | 6 | 4 | 2 | <1 | | | 2 | | | 3 | | 2 | | 1 | |
| Zinc | mg/kg | 3900 | | 60 | 13 | 6 | 6 | 0 | 19 | | | 20 | | | 13 | | 30 | | 60 | |
| Asbestos | | | | | | | | | | | | | | | | | | | | |
| Asbestos in soil | | | | | | 6 | 0 | 6 | NAD | | | NAD | | | NAD | | NAD | | NAD | |
| Asbestos Matrix (microscope) | | | | | | 6 | 0 | 6 | - | | | - | | | - | | - | | - | |
| Asbestos in soil % composition (hand picking and weighing) | % w/w | | | | | 0 | 0 | 0 | | | | | | | | | | | | |
| Petroleum Hydrocarbons | | | | | | | | | | | | | | | | | | | | |
| Ali >C5-C6 | mg/kg | 160 | | | | 6 | 0 | 6 | <0.05 | | | <0.05 | | | <0.05 | | <0.05 | | <0.01 | |
| Ali >C6-C8 | mg/kg | 530 | | 1.09 | 0.06 | 6 | 2 | 4 | <0.05 | | | 1.09 | | | <0.05 | | 0.06 | | <0.01 | |
| Ali >C8-C10 | mg/kg | 154 | | 3.62 | 3.62 | 6 | 1 | 5 | <0.05 | | | 3.62 | | | <0.05 | | <0.05 | | <0.01 | |
| Ali >C10-C12 | mg/kg | 760 | 283 | 51.7 | 0.6 | 6 | 3 | 3 | <0.1 | | | 51.7 | | | <0.1 | | 1.7 | | <0.1 | |
| Ali >C12-C16 | mg/kg | 4300 | 142 | 69.4 | 2 | 6 | 5 | 1 | 2.1 | | | 69.4 | | | 7.4 | | 11.5 | | <0.1 | |
| Ali >C16-C21 | mg/kg | | | 25.4 | 1.1 | 6 | 5 | 1 | 1.1 | | | 25.4 | | | 8.4 | | 11.4 | | <0.1 | |
| Ali >C21-C35 | mg/kg | | | 52.8 | 2 | 6 | 5 | 1 | 2 | | | 52.8 | | | 9.3 | | 9.8 | | <0.1 | |
| Ali >C16-C35 calculated | mg/kg | 110000 | | 78.2 | 3.1 | 6 | 5 | 1 | 3.1 | | | 78.2 | | | 17.7 | | 21.2 | | <0.1 | |
| Total Aliphatics | mg/kg | | | 199 | 5.1 | 6 | 5 | 1 | 5.1 | | | 199 | | | 25.2 | | 34.5 | | <0.1 | |
| Aro >C5-C7 | mg/kg | | | 3.03 | 0.08 | 6 | 2 | 4 | <0.05 | | | 3.03 | | | 0.08 | | <0.05 | | <0.01 | |
| Aro >C7-C8 | mg/kg | | | 0.61 | 0.61 | 6 | 1 | 5 | <0.05 | | | 0.61 | | | <0.05 | | <0.05 | | <0.01 | |
| Aro >C8-C9 | mg/kg | 57 | | 2.83 | 0.08 | 6 | 3 | 3 | <0.05 | | | 2.83 | | | 0.12 | | 0.08 | | <0.01 | |
| Aro >C9-C10 | mg/kg | 190 | | 3.55 | 0.12 | 6 | 2 | 4 | <0.05 | | | 3.55 | | | 0.12 | | <0.05 | | <0.01 | |
| Aro >C10-C12 | mg/kg | 390 | | 29.6 | 0.4 | 6 | 4 | 2 | <0.1 | | | 29.6 | | | 3.5 | | 1.3 | | <0.1 | |
| Aro >C12-C16 | mg/kg | 670 | | 72.9 | 2.7 | 6 | 5 | 1 | 2.7 | | | 72.9 | | | 16 | | 12.5 | | <0.1 | |
| Aro >C16-C21 | mg/kg | 930 | | 48.4 | 2.7 | 6 | 5 | 1 | 2.7 | | | 48.4 | | | 16.1 | | 15.5 | | <0.1 | |
| Aro >C21-C35 | mg/kg | 1700 | | 56.1 | 1.1 | 6 | 5 | 1 | 1.1 | | | 56.1 | | | 3.9 | | 7.3 | | <0.1 | |
| Total Aromatics | mg/kg | | | 207 | 6.5 | 6 | 5 | 1 | 6.5 | | | 207 | | | 39.4 | | 36.4 | | <0.1 | |
| TPH (Ali & Aro) | mg/kg | | | 406 | 11.6 | 6 | 5 | 1 | 11.6 | | | 406 | | | 64.5 | | 70.9 | | <0.1 | |
| BTEX - Benzene | mg/kg | 0.87 | | 3.03 | 0.08 | 6 | 2 | 4 | <0.05 | | | 3.03 | | | 0.08 | | <0.05 | | <0.01 | |
| BTEX - Toluene | mg/kg | 680 | | 0.61 | 0.61 | 6 | 1 | 5 | <0.05 | | | 0.61 | | | <0.05 | | <0.05 | | <0.01 | |
| BTEX - Ethyl Benzene | mg/kg | 260 | | 0.68 | 0.68 | 6 | 1 | 5 | <0.05 | | | 0.68 | | | <0.05 | | <0.05 | | <0.01 | |
| BTEX - o Xylene | mg/kg | 332 | | 0.41 | 0.41 | 6 | 1 | 5 | <0.05 | | | 0.41 | | | <0.05 | | <0.05 | | <0.01 | |
| BTEX - m & p Xylene | mg/kg | 310 | | 1.51 | 1.51 | 6 | 1 | 5 | <0.05 | | | 1.51 | | | <0.05 | | <0.05 | | <0.01 | |
| MTBE | mg/kg | 210 | | | | 6 | 0 | 6 | <0.05 | | | <0.05 | | | <0.05 | | <0.05 | | <0.01 | |
| Polycyclic aromatic hydrocarbons | | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | mg/kg | 1170 | | 0.2 | 0.05 | 6 | 3 | 3 | <0.01 | | | 0.2 | | | 0.09 | | 0.05 | | <0.01 | |
| Acenaphthylene | mg/kg | 970 | | 0.01 | 0.01 | 6 | 1 | 5 | <0.01 | | | <0.01 | | | 0.01 | | <0.01 | | <0.01 | |
| Anthracene | mg/kg | 10900 | | 0.35 | 0.04 | 6 | 5 | 1 | 0.04 | | | 0.35 | | | 0.3 | | 0.29 | | <0.02 | |

| | | | | | | | | | |
|--------------|--|--|-------|--|--|--|--|--|--|
| Project name | Thoresby Area B | | Notes | | | | | | |
| Project code | 301924 | | | | | | | | |
| Client name | Harworth Estates Ltd | | | | | | | | |
| Address | Ollerton Road Edwinstowe Mansfield NG21 9QF | | | | | | | | |
| NGR | 463384, 367197 | | | | | | | | |
| Land use | Residential with home-grown produce | | | | | | | | |
| SOM | 6% | | | | | | | | |
| GAC version | 2018_00 | | | | | | | | |

| | | | | | | | | | | |
|--|-------|--------|-----|------|------|-------|-----------|------------------|-------------|--|
| | | | | | | | | Lab sample ID | 17/08337/10 | |
| | | | | | | | | Client sample ID | TP140 | |
| | | | | | | | | Depth to top | 0.4 | |
| | | | | | | | | Depth to bottom | | |
| | | | | | | | | Date sampled | 29/11/17 | |
| Analyte | Unit | GAC | T1 | Max | Min | Count | # Detects | # Non-detects | | |
| Metals and Inorganics | | | | | | | | | | |
| Arsenic | mg/kg | 37 | | 18 | 3 | 6 | 4 | 2 | 3 | |
| Cadmium | mg/kg | 22 | | 0.7 | 0.5 | 6 | 2 | 4 | 0.5 | |
| Chromium | mg/kg | 910 | 21 | 36 | 9 | 6 | 6 | 0 | 16 | |
| Copper | mg/kg | 2500 | | 52 | 7 | 6 | 6 | 0 | 21 | |
| Lead | mg/kg | 200 | | 32 | 6 | 6 | 6 | 0 | 16 | |
| Mercury | mg/kg | 39 | 1.2 | | | 6 | 0 | 6 | <0.17 | |
| Nickel | mg/kg | 130 | | 32 | 9 | 6 | 6 | 0 | 26 | |
| Selenium | mg/kg | 258 | | 3 | 1 | 6 | 4 | 2 | <1 | |
| Zinc | mg/kg | 3900 | | 60 | 13 | 6 | 6 | 0 | 55 | |
| Asbestos | | | | | | | | | | |
| Asbestos in soil | | | | | | 6 | 0 | 6 | NAD | |
| Asbestos Matrix (microscope) | | | | | | 6 | 0 | 6 | - | |
| Asbestos in soil % composition (hand picking and weighing) | % w/w | | | | | 0 | 0 | 0 | | |
| Petroleum Hydrocarbons | | | | | | | | | | |
| Ali >C5-C6 | mg/kg | 160 | | | | 6 | 0 | 6 | <0.05 | |
| Ali >C6-C8 | mg/kg | 530 | | 1.09 | 0.06 | 6 | 2 | 4 | <0.05 | |
| Ali >C8-C10 | mg/kg | 154 | | 3.62 | 3.62 | 6 | 1 | 5 | <0.05 | |
| Ali >C10-C12 | mg/kg | 760 | 283 | 51.7 | 0.6 | 6 | 3 | 3 | 0.6 | |
| Ali >C12-C16 | mg/kg | 4300 | 142 | 69.4 | 2 | 6 | 5 | 1 | 2 | |
| Ali >C16-C21 | mg/kg | | | 25.4 | 1.1 | 6 | 5 | 1 | 2 | |
| Ali >C21-C35 | mg/kg | | | 52.8 | 2 | 6 | 5 | 1 | 3 | |
| Ali >C16-C35 calculated | mg/kg | 110000 | | 78.2 | 3.1 | 6 | 5 | 1 | 5 | |
| Total Aliphatics | mg/kg | | | 199 | 5.1 | 6 | 5 | 1 | 7.5 | |
| Aro >C5-C7 | mg/kg | | | 3.03 | 0.08 | 6 | 2 | 4 | <0.05 | |
| Aro >C7-C8 | mg/kg | | | 0.61 | 0.61 | 6 | 1 | 5 | <0.05 | |
| Aro >C8-C9 | mg/kg | 57 | | 2.83 | 0.08 | 6 | 3 | 3 | <0.05 | |
| Aro >C9-C10 | mg/kg | 190 | | 3.55 | 0.12 | 6 | 2 | 4 | <0.05 | |
| Aro >C10-C12 | mg/kg | 390 | | 29.6 | 0.4 | 6 | 4 | 2 | 0.4 | |
| Aro >C12-C16 | mg/kg | 670 | | 72.9 | 2.7 | 6 | 5 | 1 | 3.7 | |
| Aro >C16-C21 | mg/kg | 930 | | 48.4 | 2.7 | 6 | 5 | 1 | 3.6 | |
| Aro >C21-C35 | mg/kg | 1700 | | 56.1 | 1.1 | 6 | 5 | 1 | 1.5 | |
| Total Aromatics | mg/kg | | | 207 | 6.5 | 6 | 5 | 1 | 9.2 | |
| TPH (Ali & Aro) | mg/kg | | | 406 | 11.6 | 6 | 5 | 1 | 16.8 | |
| BTEX - Benzene | mg/kg | 0.87 | | 3.03 | 0.08 | 6 | 2 | 4 | <0.05 | |
| BTEX - Toluene | mg/kg | 680 | | 0.61 | 0.61 | 6 | 1 | 5 | <0.05 | |
| BTEX - Ethyl Benzene | mg/kg | 260 | | 0.68 | 0.68 | 6 | 1 | 5 | <0.05 | |
| BTEX - o Xylene | mg/kg | 332 | | 0.41 | 0.41 | 6 | 1 | 5 | <0.05 | |
| BTEX - m & p Xylene | mg/kg | 310 | | 1.51 | 1.51 | 6 | 1 | 5 | <0.05 | |
| MTBE | mg/kg | 210 | | | | 6 | 0 | 6 | <0.05 | |
| Polycyclic aromatic hydrocarbons | | | | | | | | | | |
| Acenaphthene | mg/kg | 1170 | | 0.2 | 0.05 | 6 | 3 | 3 | <0.01 | |
| Acenaphthylene | mg/kg | 970 | | 0.01 | 0.01 | 6 | 1 | 5 | <0.01 | |
| Anthracene | mg/kg | 10900 | | 0.35 | 0.04 | 6 | 5 | 1 | 0.06 | |

| Lab sample ID | | | | | | | | | | | 17/08337/59 | 17/08337/60 | 17/08337/62 | 17/08337/67 | 17/08337/68 | 17/08337/69 | 17/08337/71 | 17/08337/76 | 17/08337/78 | 17/08337/95 | 17/08337/96 |
|-------------------------------|-------|------|----|------|----------|-------|-----------|---------------|-----------|------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Client sample ID | | | | | | | | | | | TP122 | TP122 | TP123 | TP127 | TP128 | TP128 | TP128 | TP130 | TP130 | TP136 | TP138 |
| Depth to top | | | | | | | | | | | 0.5 | 1.9 | 1.4 | 0.9 | 0.6 | 1 | 1.5 | 0.7 | 1.3 | 3 | 0.7 |
| Depth to bottom | | | | | | | | | | | | | | | | | 1.7 | | | | |
| Date sampled | | | | | | | | | | | 24/11/17 | 24/11/17 | 23/11/17 | 24/11/17 | 23/11/17 | 23/11/17 | 23/11/17 | 24/11/17 | 24/11/17 | 28/11/17 | 29/11/17 |
| Analyte | Unit | GAC | T1 | Max | Min | Count | # Detects | # Non-detects | | | | | | | | | | | | | |
| Benzo(a)anthracene | mg/kg | 13 | | 0.28 | 0.15 | 6 | 3 | 3 | <0.04 | | | 0.28 | | | 0.17 | | 0.15 | | <0.04 | | |
| Benzo(a)pyrene | mg/kg | 5 | | 0.2 | 0.09 | 6 | 3 | 3 | <0.04 | | | 0.2 | | | 0.1 | | 0.09 | | <0.04 | | |
| Benzo(b)fluoranthene | mg/kg | 3.7 | | 0.24 | 0.2 | 6 | 3 | 3 | <0.05 | | | 0.2 | | | 0.22 | | 0.24 | | <0.05 | | |
| Benzo(ghi)perylene | mg/kg | 350 | | 0.18 | 0.1 | 6 | 3 | 3 | <0.05 | | | 0.18 | | | 0.14 | | 0.1 | | <0.05 | | |
| Benzo(k)fluoranthene | mg/kg | 100 | | | | 6 | 0 | 6 | <0.07 | | <0.07 | | | <0.07 | | <0.07 | | <0.07 | | | |
| Chrysene | mg/kg | 27 | | 0.32 | 0.07 | 6 | 4 | 2 | <0.06 | | | 0.32 | | | 0.22 | | 0.23 | | <0.06 | | |
| Dibenzo(ah)anthracene | mg/kg | 0.3 | | | | 6 | 0 | 6 | <0.04 | | <0.04 | | | <0.04 | | <0.04 | | <0.04 | | | |
| Fluoranthene | mg/kg | 900 | | 0.26 | 0.17 | 6 | 3 | 3 | <0.08 | | | 0.17 | | | 0.26 | | 0.23 | | <0.08 | | |
| Fluorene | mg/kg | 880 | | 0.47 | 0.01 | 6 | 4 | 2 | 0.01 | | | 0.47 | | | 0.22 | | 0.06 | | <0.01 | | |
| Indeno(123-cd)pyrene | mg/kg | 41 | | 0.05 | 0.04 | 6 | 3 | 3 | <0.03 | | | 0.04 | | | 0.05 | | 0.05 | | <0.03 | | |
| Naphthalene | mg/kg | 71 | | 9.45 | 0.16 | 6 | 5 | 1 | 0.2 | | | 9.45 | | | 2.84 | | 1.07 | | <0.03 | | |
| Phenanthrene | mg/kg | 440 | | 2.19 | 0.11 | 6 | 5 | 1 | 0.11 | | | 2.19 | | | 1.23 | | 0.99 | | <0.03 | | |
| Pyrene | mg/kg | 2040 | | 0.26 | 0.22 | 6 | 3 | 3 | <0.07 | | | 0.24 | | | 0.26 | | 0.22 | | <0.07 | | |
| PAH (total 16) | mg/kg | | | 14.3 | 0.35 | 6 | 5 | 1 | 0.35 | | | 14.3 | | | 6.12 | | 3.78 | | <0.08 | | |
| Phenols | | | | | | | | | | | | | | | | | | | | | |
| Phenols - Total by HPLC | mg/kg | 390 | | | | 3 | 0 | 3 | | | <0.2 | | | <0.2 | <0.2 | | | | | | |
| Phenols - Total by HPLC | mg/kg | 390 | | | | 3 | 0 | 3 | | | <0.2 | | | <0.2 | <0.2 | | | | | | |
| Other analytes | | | | | | | | | | | | | | | | | | | | | |
| % Stones >10mm | % w/w | | | 22.8 | 2.5 | 12 | 7 | 5 | 3.8 | 2.5 | <0.1 | | 22.8 | 16 | <0.1 | <0.1 | <0.1 | | 14.8 | <0.1 | 3.8 |
| Calorific Value (Gross/Total) | kJ/kg | | | 4860 | 1460 | 3 | 3 | 0 | 1460 | | | | | 3510 | | | | | 4860 | | |
| Loss on ignition (550degC) | % w/w | | | 25.6 | 1.9 | 3 | 3 | 0 | 1.9 | | | | | 12.9 | | | | | 25.6 | | |
| pH | pH | | | 7.75 | 6.7 | 6 | 6 | 0 | 7.5 | | | 7.25 | | | 7.16 | | 6.7 | | 6.82 | | |
| pH BRE | pH | | | 8.15 | 6.94 | 6 | 6 | 0 | | 7.62 | | | 7.06 | 7.56 | | 8.15 | | 6.94 | | 7.47 | |
| Sulphate BRE (acid sol) | % w/w | | | 0.77 | 0.05 | 6 | 6 | 0 | | 0.05 | | | 0.14 | 0.2 | | 0.77 | | 0.73 | | 0.05 | |
| Sulphur BRE (total) | % w/w | | | 1.99 | 0.03 | 6 | 6 | 0 | | 0.03 | | | 0.05 | 0.5 | | 0.26 | | 1.99 | | 0.03 | |
| Total Organic Carbon | % w/w | | | 5.51 | 1.5 | 2 | 2 | 0 | 1.5 | | | | | | | | | | | | |
| Converted to SOM (x / 0.58) | % w/w | | | 9.5 | 2.586207 | 2 | 2 | 0 | 2.5862069 | | | | | | | | | | | | |

| | | | | | | | | | | |
|-------------------------------|-------|------|----|------|----------|-------|-----------|---------------|------------------|-------------|
| | | | | | | | | | Lab sample ID | 17/08337/10 |
| | | | | | | | | | Client sample ID | TP140 |
| | | | | | | | | | Depth to top | 0.4 |
| | | | | | | | | | Depth to bottom | |
| | | | | | | | | | Date sampled | 29/11/17 |
| Analyte | Unit | GAC | T1 | Max | Min | Count | # Detects | # Non-detects | | |
| Benzo(a)anthracene | mg/kg | 13 | | 0.28 | 0.15 | 6 | 3 | 3 | <0.04 | |
| Benzo(a)pyrene | mg/kg | 5 | | 0.2 | 0.09 | 6 | 3 | 3 | <0.04 | |
| Benzo(b)fluoranthene | mg/kg | 3.7 | | 0.24 | 0.2 | 6 | 3 | 3 | <0.05 | |
| Benzo(ghi)perylene | mg/kg | 350 | | 0.18 | 0.1 | 6 | 3 | 3 | <0.05 | |
| Benzo(k)fluoranthene | mg/kg | 100 | | | | 6 | 0 | 6 | <0.07 | |
| Chrysene | mg/kg | 27 | | 0.32 | 0.07 | 6 | 4 | 2 | 0.07 | |
| Dibenzo(ah)anthracene | mg/kg | 0.3 | | | | 6 | 0 | 6 | <0.04 | |
| Fluoranthene | mg/kg | 900 | | 0.26 | 0.17 | 6 | 3 | 3 | <0.08 | |
| Fluorene | mg/kg | 880 | | 0.47 | 0.01 | 6 | 4 | 2 | <0.01 | |
| Indeno(123-cd)pyrene | mg/kg | 41 | | 0.05 | 0.04 | 6 | 3 | 3 | <0.03 | |
| Naphthalene | mg/kg | 71 | | 9.45 | 0.16 | 6 | 5 | 1 | 0.16 | |
| Phenanthrene | mg/kg | 440 | | 2.19 | 0.11 | 6 | 5 | 1 | 0.16 | |
| Pyrene | mg/kg | 2040 | | 0.26 | 0.22 | 6 | 3 | 3 | <0.07 | |
| PAH (total 16) | mg/kg | | | 14.3 | 0.35 | 6 | 5 | 1 | 0.49 | |
| Phenols | | | | | | | | | | |
| Phenols - Total by HPLC | mg/kg | 390 | | | | 3 | 0 | 3 | | |
| Phenols - Total by HPLC | mg/kg | 390 | | | | 3 | 0 | 3 | | |
| Other analytes | | | | | | | | | | |
| % Stones >10mm | % w/w | | | 22.8 | 2.5 | 12 | 7 | 5 | 14.9 | |
| Calorific Value (Gross/Total) | kJ/kg | | | 4860 | 1460 | 3 | 3 | 0 | | |
| Loss on ignition (550degC) | % w/w | | | 25.6 | 1.9 | 3 | 3 | 0 | | |
| pH | pH | | | 7.75 | 6.7 | 6 | 6 | 0 | 7.75 | |
| pH BRE | pH | | | 8.15 | 6.94 | 6 | 6 | 0 | | |
| Sulphate BRE (acid sol) | % w/w | | | 0.77 | 0.05 | 6 | 6 | 0 | | |
| Sulphur BRE (total) | % w/w | | | 1.99 | 0.03 | 6 | 6 | 0 | | |
| Total Organic Carbon | % w/w | | | 5.51 | 1.5 | 2 | 2 | 0 | 5.51 | |
| Converted to SOM (x / 0.58) | % w/w | | | 9.5 | 2.586207 | 2 | 2 | 0 | 9.5 | |

APPENDIX F

GENERIC ASSESSMENT CRITERIA FOR POTABLE WATER SUPPLY PIPES

A range of pipe materials is available and careful selection, design and installation is required to ensure that water supply pipes are satisfactorily installed and meet the requirements of the Water Supply (Water Fittings) Regulations 1999 in England and Wales, the Byelaws 2000 in Scotland and the Northern Ireland Water Regulations. The regulations include a requirement to use only suitable materials when laying water pipes and laying water pipes without protection is not permitted at contaminated sites. The water supply company has a statutory duty to enforce the regulations.

Contaminants in the ground can pose a risk to human health by permeating potable water supply pipes. To fulfil their statutory obligation, UK water supply companies require robust evidence from developers to demonstrate either that the ground in which new plastic supply pipes will be laid is free from specific contaminants, or that the proposed remedial strategy will mitigate any existing risk. If these requirements cannot be demonstrated to the satisfaction of the relevant water company, it becomes necessary to specify an alternative pipe material on the whole development or in specific zones.

In 2010, UK Water Industry Research (UKWIR) published *Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* (Report Ref. No. 10/WM/03/21). This report reviewed previously published industry guidelines and threshold concentrations adopted by individual water supply companies.

The focus of the UKWIR research project was to develop clear and concise procedures, which provide consistency in the pipe selection decision process. It was intended to provide guidance that can be used to ensure compliance with current regulations and to prevent water supply pipe failing prematurely due to the presence of contamination.

The report concluded that in most circumstances only organic contaminants pose a potential risk to plastic pipe materials and Table 3.1 of the report provides threshold concentrations for polyethylene (PE) and polyvinyl chloride (PVC) pipes for the organic contaminants of concern. The report also makes recommendations for the procedures to be adopted in the design of site investigations and sampling strategies, and the assessment of data, to ensure that the ground through which water supply pipes will be laid is adequately characterised.

Risks to water supply pipes have therefore been assessed against the threshold concentrations for PE and PVC pipe specified in Table 3.1 of Report 10/WM/03/21, which have been adopted as the GAC for this linkage and are reproduced in Table A3 below.

Since water supply pipes are typically laid at a minimum depth of 0.75 m below finished ground levels, sample results from depths between 0.5 m and 1.5 m below finished level are generally considered suitable for assessing risks to water supply. Samples outside these depths can be used, providing the stratum is the same as that in which water supply pipes are likely to be located. The report specifies that sampling should characterise the ground conditions to a minimum of 0.5 m below the proposed depth of the pipe.

It should be noted that the assessment provided in this report is a guide and the method of assessment and recommendations should be checked with the relevant water supply company.

Table A3: Generic assessment criteria for water supply pipes

| | | Pipe material | |
|---|---|---------------|----------|
| | | GAC (mg/kg) | |
| | Parameter group | PE | PVC |
| 1 | Extended VOC suite by purge and trap or head space and GC-MS with TIC (Not including compounds within group 1a) | 0.5 | 0.125 |
| 1a |) BTEX + MTBE | 0.1 | 0.03 |
| 2 | SVOCs TIC by purge and trap or head space and GC-MS with TIC (aliphatic and aromatic C ₅ –C ₁₀) (Not including compounds within group 2e and 2f) | 2 | 1.4 |
| 2e |) Phenols | 2 | 0.4 |
| 2f |) Cresols and chlorinated phenols | 2 | 0.04 |
| 3 | Mineral oil C ₁₁ –C ₂₀ | 10 | Suitable |
| 4 | Mineral oil C ₂₁ –C ₄₀ | 500 | Suitable |
| 5 | Corrosive (conductivity, redox and pH) | Suitable | Suitable |
| Specific suite identified as relevant following site investigation | | | |
| 2a | Ethers | 0.5 | 1 |
| 2b | Nitrobenzene | 0.5 | 0.4 |
| 2c | Ketones | 0.5 | 0.02 |
| 2d | Aldehydes | 0.5 | 0.02 |
| 6 | Amines | Not suitable | Suitable |
| Notes: where indicated as 'suitable', the material is considered resistant to permeation or degradation and no threshold concentration has been specified by UKWIR. | | | |



APPENDIX G

GROUND GAS ASSESSMENT GSV

CALCULATIONS

Generic NHBC Traffic Lights Ground Gas Risk Assessment

| |
|------------------------------|
| Job No.: 301924 |
| Client: Harworth Estates |
| Site: Thoresby Area B |
| Sub area: Coal Stocking Yard |

For low-rise residential developments with a clear ventilated sub-floor void ONLY

| Traffic Light | Methane | | Carbon Dioxide | |
|---------------|---------------|---------------|----------------|---------------|
| | TMV (%v/v) | GSV (l/hr) | TMV (%v/v) | GSV (l/hr) |
| Green | | | | |
| Amber 1 | 1 | 0.16 | 5 | 0.78 |
| Amber 2 | 5 | 0.63 | 10 | 1.56 |
| Red | 20 | 1.56 | 30 | 3.13 |

From NHBC (2007, Edition No.: 04) "Guidance On Evaluation Of Development Proposals On Sites Where Methane And Carbon Dioxide Are Present", Boyle & Witherington

| | |
|-------------|--|
| KEY: | |
| TMV | Typical Maximum Value |
| GSV | Gas Screening Value |
| | GSV can be calculated on a site-specific basis |
| | GSV within Green Traffic Light |
| | GSV within Amber 1 Traffic Light |
| | GSV within Amber 2 Traffic Light |
| | GSV within Red Traffic Light / TMV exceeded |
| | Oxygen concentration 10%v/v |
| | Total ground gas concentrations >100%v/v |

| BH NO. | DATE | Water Level BGL | CH4 P %v/v | CH4 SS %v/v | CO2 P %v/v | CO2 SS %v/v | O2 P %v/v | O2 SS %v/v | Flow l/hr | Baro mbar | BH Press mbar | I SUM %v/v | SS SUM %v/v | GSV | |
|--------|------------|-----------------|---------------|----------------|---------------|----------------|--------------|---------------|--------------|--------------|------------------|---------------|----------------|------|-------|
| WS114 | 05/01/2018 | NGW | <0.1 | <0.1 | 2.4 | 0.4 | 17.6 | 20.6 | 0 | 976 | 976 | 21.0 | 20.0 | 0.00 | 0.00 |
| | 11/01/2018 | NGW | <0.1 | <0.1 | <0.1 | <0.1 | 21.6 | 21.8 | 0 | 1011 | 1011 | 21.6 | 21.8 | 0.00 | 0.00 |
| | 17/01/2018 | NGW | <0.1 | <0.1 | 1.8 | 1.7 | 18.5 | 18.6 | -4.1 | 989 | 980 | 20.3 | 20.3 | 0.00 | -0.07 |
| | 23/01/2018 | NGW | <0.1 | <0.1 | 2.6 | 2.6 | 13.4 | 13.4 | 0 | 997 | 997 | 16.0 | 16.0 | 0.00 | 0.00 |
| | 26/01/2018 | NGW | <0.1 | <0.1 | 2.6 | 2.6 | 12.9 | 12.9 | 0 | 1008 | 1008 | 15.5 | 15.5 | 0.00 | 0.00 |
| | 29/01/2018 | NGW | <0.1 | <0.1 | 2.9 | 2.9 | 10.0 | 10.3 | -0.8 | 1013 | 1012 | 12.9 | 13.2 | 0.00 | -0.02 |

WORST-CASE VALUES PER BOREHOLE

| WORKS-CASE VALUES PER BOREROLEE | | Maximum CH4 | | Maximum CO2 | | Minimum O2 | | Max Flow | Not Applicable | | Maximum Total | | Maximum GSVs | |
|---------------------------------|--|-------------|------|-------------|-----|------------|------|----------|----------------|--|---------------|------|--------------|------|
| WS114 | | <0.1 | <0.1 | 2.9 | 2.9 | 10.0 | 10.3 | <0.1 | | | 12.9 | 13.2 | 0.00 | 0.00 |
| | | | | | | | | | | | | | | |

Generic NHBC Traffic Lights Ground Gas Risk Assessment

| |
|---------------------------|
| Job No.: 301924 |
| Client: Harworth Estates |
| Site: Thoresby Area B |
| Sub area: Southern Fields |

| For low-rise residential developments with a clear ventilated sub-floor void ONLY | | | | |
|---|---------------|---------------|----------------|---------------|
| Traffic Light | Methane | | Carbon Dioxide | |
| | TMV (%v/v) | GSV (l/hr) | TMV (%v/v) | GSV (l/hr) |
| Green | | | | |
| Amber 1 | 1 | 0.16 | 5 | 0.78 |
| Amber 2 | 5 | 0.63 | 10 | 1.56 |
| Red | 20 | 1.56 | 30 | 3.13 |

From NHBC (2007, Edition No. 04) 'Guidance On Evaluation Of Development Proposals On Sites Where Methane And Carbon Dioxide Are Present' Boyle & Witherington

KEY:
 TMV Typical Maximum Value
 GSV Gas Screening Value

GSV can be calculated on a site-specific basis

GSV within Green Traffic Light
 GSV within Amber 1 Traffic Light
 GSV within Amber 2 Traffic Light
 GSV within Red Traffic Light / TMV exceeded

Oxygen concentration 10%v/v
 Total ground gas concentrations >100%v/v

| BH NO | DATE | Water Level | CH4 P %v/v | CH4 SS %v/v | CO2 P %v/v | CO2 SS %v/v | O2 P %v/v | O2 SS %v/v | Flow l/hr | Baro mbar | BH Press mbar | I SUM %v/v | SS SUM %v/v | CH4 GSV | CO2 GSV |
|-------|------------|-------------|---------------|----------------|---------------|----------------|--------------|---------------|--------------|--------------|------------------|---------------|----------------|------------|------------|
| WS201 | 03/01/2018 | NGW | <0.1 | <0.1 | 0.3 | 0.1 | 20.3 | 20.4 | -0.41 | 983 | 983 | 20.6 | 20.7 | 0.00 | 0.00 |
| | 11/01/2018 | NGW | <0.1 | <0.1 | 1.0 | 0.9 | 19.0 | 19.4 | 0 | 1008 | 1008 | 20.0 | 20.3 | 0.00 | 0.00 |
| | 16/01/2018 | NGW | <0.1 | <0.1 | 1.5 | 1.3 | 18.1 | 18.9 | 0.3 | 979 | 980 | 19.6 | 20.2 | 0.00 | 0.00 |
| | 23/01/2018 | NGW | <0.1 | <0.1 | 1.4 | 1.4 | 17.9 | 18.1 | 1.7 | 996 | 999 | 19.3 | 19.5 | 0.00 | 0.00 |
| | 26/01/2018 | NGW | <0.1 | <0.1 | 0.5 | 0.5 | 20.7 | 20.7 | -1 | 1011 | 1009 | 21.2 | 21.2 | 0.00 | -0.01 |
| WS202 | 29/01/2018 | NGW | <0.1 | <0.1 | 1.5 | 1.5 | 18.4 | 18.5 | -1 | 1011 | 1009 | 19.9 | 20.0 | 0.00 | -0.02 |
| | 03/01/2018 | NGW | <0.1 | <0.1 | 0.3 | 0.3 | 20.7 | 20.8 | -1.7 | 984 | 980 | 21.0 | 21.1 | 0.00 | -0.01 |
| | 11/01/2018 | NGW | <0.1 | <0.1 | 0.6 | 0.6 | 20.4 | 20.4 | -0.5 | 1008 | 1008 | 21.0 | 21.0 | 0.00 | 0.00 |
| | 16/01/2018 | NGW | <0.1 | <0.1 | 1.0 | 1.0 | 19.8 | 19.8 | 3.5 | 980 | 989 | 20.8 | 20.8 | 0.00 | 0.04 |
| | 23/01/2018 | NGW | <0.1 | <0.1 | 1.0 | 1.0 | 19.8 | 19.8 | 2.8 | 996 | 1001 | 20.8 | 20.8 | 0.00 | 0.03 |
| WS203 | 26/01/2018 | NGW | <0.1 | <0.1 | 0.5 | 0.4 | 21.3 | 21.3 | | 1011 | 998 | 21.8 | 21.7 | 0.00 | -0.02 |
| | 29/01/2018 | NGW | <0.1 | <0.1 | 1.2 | 1.1 | 19.9 | 20.0 | -1 | 1011 | 1009 | 21.1 | 21.1 | 0.00 | -0.01 |
| | 03/01/2018 | NGW | <0.1 | <0.1 | 0.9 | 0.8 | 20.1 | 20.1 | -1.1 | 983 | 981 | 21.0 | 20.9 | 0.00 | -0.01 |
| | 11/01/2018 | NGW | <0.1 | <0.1 | 0.7 | 0.6 | 20.7 | 20.7 | -1 | 1008 | 1007.5 | 21.4 | 21.3 | 0.00 | -0.01 |
| | 16/01/2018 | NGW | <0.1 | <0.1 | 0.8 | 0.7 | 20.1 | 20.2 | 2.5 | 980 | 986 | 20.9 | 20.9 | 0.00 | 0.02 |
| WS204 | 23/01/2018 | NGW | <0.1 | <0.1 | 0.9 | 0.8 | 20.0 | 20.1 | 2.5 | 996 | 1001 | 20.9 | 20.9 | 0.00 | 0.02 |
| | 26/01/2018 | NGW | <0.1 | <0.1 | 0.3 | 0.3 | 21.5 | 21.5 | 0 | 1009 | 1009 | 21.8 | 21.8 | 0.00 | 0.00 |
| | 29/01/2018 | NGW | <0.1 | <0.1 | 1.1 | 1.1 | 19.0 | 19.8 | 0 | 1011 | 1011 | 20.1 | 20.9 | 0.00 | 0.00 |
| | 03/01/2018 | NGW | <0.1 | <0.1 | 1.2 | 1.2 | 19.5 | 19.5 | -1 | 985 | 983 | 20.7 | 20.7 | 0.00 | -0.01 |
| | 11/01/2018 | NGW | <0.1 | <0.1 | 1.1 | 1.1 | 19.3 | 19.7 | -1.4 | 1016 | 1013 | 20.4 | 20.8 | 0.00 | -0.02 |
| WS205 | 16/01/2018 | NGW | <0.1 | <0.1 | 1.2 | 1.2 | 19.4 | 19.4 | 0.5 | 981 | 981 | 20.6 | 20.6 | 0.00 | 0.01 |
| | 23/01/2018 | NGW | <0.1 | <0.1 | 1.2 | 1.2 | 19.3 | 19.3 | 0 | 996 | 996 | 20.5 | 20.5 | 0.00 | 0.00 |
| | 26/01/2018 | NGW | <0.1 | <0.1 | 0.9 | 0.9 | 20.2 | 20.2 | -3.1 | 1011 | 1003 | 21.1 | 20.2 | 0.00 | -0.03 |
| | 29/01/2018 | NGW | <0.1 | <0.1 | <0.1 | <0.1 | 20.9 | 21.1 | -3.1 | 1013 | 1006 | 18.4 | 21.1 | 0.00 | 0.00 |
| | 04/01/2018 | NGW | <0.1 | <0.1 | 1.5 | 1.5 | 19.4 | 19.4 | 0 | 973 | 973 | 20.9 | 20.9 | 0.00 | 0.00 |
| WS206 | 11/01/2018 | NGW | <0.1 | <0.1 | 0.4 | 0.3 | 21.4 | 21.4 | -2.3 | 1008 | 1003 | 21.8 | 21.7 | 0.00 | -0.01 |
| | 16/01/2018 | NGW | <0.1 | <0.1 | 1.8 | 1.7 | 19.3 | 19.4 | 4 | 973 | 989 | 21.1 | 21.1 | 0.00 | 0.07 |
| | 23/01/2018 | NGW | <0.1 | <0.1 | 2.1 | 2.0 | 18.9 | 18.9 | 0 | 984 | 984 | 21.0 | 20.9 | 0.00 | 0.00 |
| | 26/01/2018 | NGW | <0.1 | <0.1 | 1.8 | 1.7 | 19.4 | 19.5 | -0.5 | 1011 | 988 | 21.2 | 21.2 | 0.00 | -1.14 |
| | 29/01/2018 | NGW | <0.1 | <0.1 | 2.4 | 2.2 | 19.0 | 19.0 | -7 | 1011 | 983 | 21.4 | 21.2 | 0.00 | -0.15 |
| WS207 | 04/01/2018 | NGW | <0.1 | <0.1 | 2.4 | 2.4 | 17.8 | 17.9 | 0 | 974 | 974 | 20.2 | 20.3 | 0.00 | 0.00 |
| | 11/01/2018 | NGW | <0.1 | <0.1 | 2.3 | 2.3 | 18.1 | 18.1 | 0 | 1010 | 1010 | 20.4 | 20.4 | 0.00 | 0.00 |
| | 16/01/2018 | NGW | <0.1 | <0.1 | 2.4 | 2.4 | 16.7 | 17.9 | 2 | 979 | 983 | 19.1 | 20.3 | 0.00 | 0.05 |
| | 23/01/2018 | NGW | <0.1 | <0.1 | 2.4 | 2.3 | 18.0 | 18.0 | 0 | 996 | 998 | 20.4 | 20.3 | 0.00 | 0.00 |
| | 26/01/2018 | NGW | <0.1 | <0.1 | 1.5 | 1.5 | 19.2 | 19.4 | -1.7 | 1011 | 1007 | 20.7 | 20.9 | 0.00 | -0.03 |
| WS208 | 29/01/2018 | NGW | <0.1 | <0.1 | 2.7 | 2.6 | 17.6 | 17.7 | -1.6 | 1013 | 1010 | 20.3 | 20.3 | 0.00 | -0.04 |
| | 04/01/2018 | NGW | <0.1 | <0.1 | 1.1 | 1.1 | 19.2 | 19.3 | 0 | 974 | 974 | 20.3 | 20.4 | 0.00 | 0.00 |
| | 11/01/2018 | 1.965 | <0.1 | <0.1 | 1.1 | 1.0 | 19.5 | 19.7 | 0 | 1011 | 1011 | 20.6 | 20.7 | 0.00 | 0.00 |
| | 16/01/2018 | NGW | <0.1 | <0.1 | 1.2 | 1.2 | 19.1 | 19.1 | 1.6 | 980 | 984 | 20.3 | 20.3 | 0.00 | 0.02 |
| | 23/01/2018 | NGW | <0.1 | <0.1 | 1.0 | 1.0 | 19.6 | 19.7 | -1.1 | 996 | 994 | 20.6 | 20.7 | 0.00 | -0.01 |
| WS209 | 26/01/2018 | NGW | <0.1 | <0.1 | 1.0 | 0.9 | 20.2 | 20.3 | -0.3 | 1011 | 1011 | 21.2 | 21.2 | 0.00 | 0.00 |
| | 29/01/2018 | NGW | <0.1 | <0.1 | 1.4 | 1.3 | 19.2 | 19.3 | 0.4 | 1013 | 1014 | 20.6 | 20.6 | 0.00 | 0.01 |
| | 04/01/2018 | NGW | <0.1 | <0.1 | 3.4 | 3.3 | 21.6 | 17.4 | 0 | 974 | 974 | 25.0 | 20.7 | 0.00 | 0.00 |
| | 11/01/2018 | NGW | <0.1 | <0.1 | 3.1 | 3.1 | 16.7 | 17.2 | 0 | 1011 | 1011 | 19.8 | 20.3 | 0.00 | 0.00 |
| | 16/01/2018 | NGW | <0.1 | <0.1 | 3.1 | 3.1 | 17.2 | 17.4 | 0.2 | 980 | 984 | 20.3 | 20.5 | 0.00 | 0.01 |
| WS210 | 23/01/2018 | NGW | <0.1 | <0.1 | 3.1 | 3.1 | 17.0 | 17.2 | -1.6 | 997 | 994 | 20.1 | 20.3 | 0.00 | -0.05 |
| | 26/01/2018 | NGW | <0.1 | <0.1 | 2.9 | 2.9 | 17.0 | 17.3 | -1 | 1012 | 1010 | 19.9 | 20.2 | 0.00 | -0.03 |
| | 29/01/2018 | NGW | <0.1 | <0.1 | 3.5 | 3.4 | 16.5 | 16.9 | -2.2 | 1013 | 1007 | 20.0 | 20.3 | 0.00 | -0.07 |

WORST-CASE VALUES PER BOREHOLE

| | Maximum CH4 | Maximum CO2 | Minimum O2 | Max Flow | Not Applicable | Maximum Total | Maximum GSVs |
|-------|-------------|-------------|------------|----------|----------------|---------------|--------------|
| WS201 | <0.1 | <0.1 | 1.5 | 1.5 | 17.9 | 18.1 | 1.7 |
| WS202 | <0.1 | <0.1 | 1.2 | 1.1 | 19.8 | 19.8 | 3.5 |
| WS203 | <0.1 | <0.1 | 1.1 | 1.1 | 19.0 | 19.8 | 2.5 |
| WS204 | <0.1 | <0.1 | 1.2 | 1.2 | 19.3 | 19.3 | 0.5 |
| WS205 | <0.1 | <0.1 | 2.4 | 2.2 | 18.9 | 18.9 | 4.0 |
| WS206 | <0.1 | <0.1 | 2.4 | 2.6 | 16.7 | 17.7 | 2.0 |
| WS207 | <0.1 | <0.1 | 1.4 | 1.3 | 19.1 | 19.1 | 1.6 |
| WS208 | <0.1 | <0.1 | 3.5 | 3.4 | 16.5 | 16.9 | 0.2 |

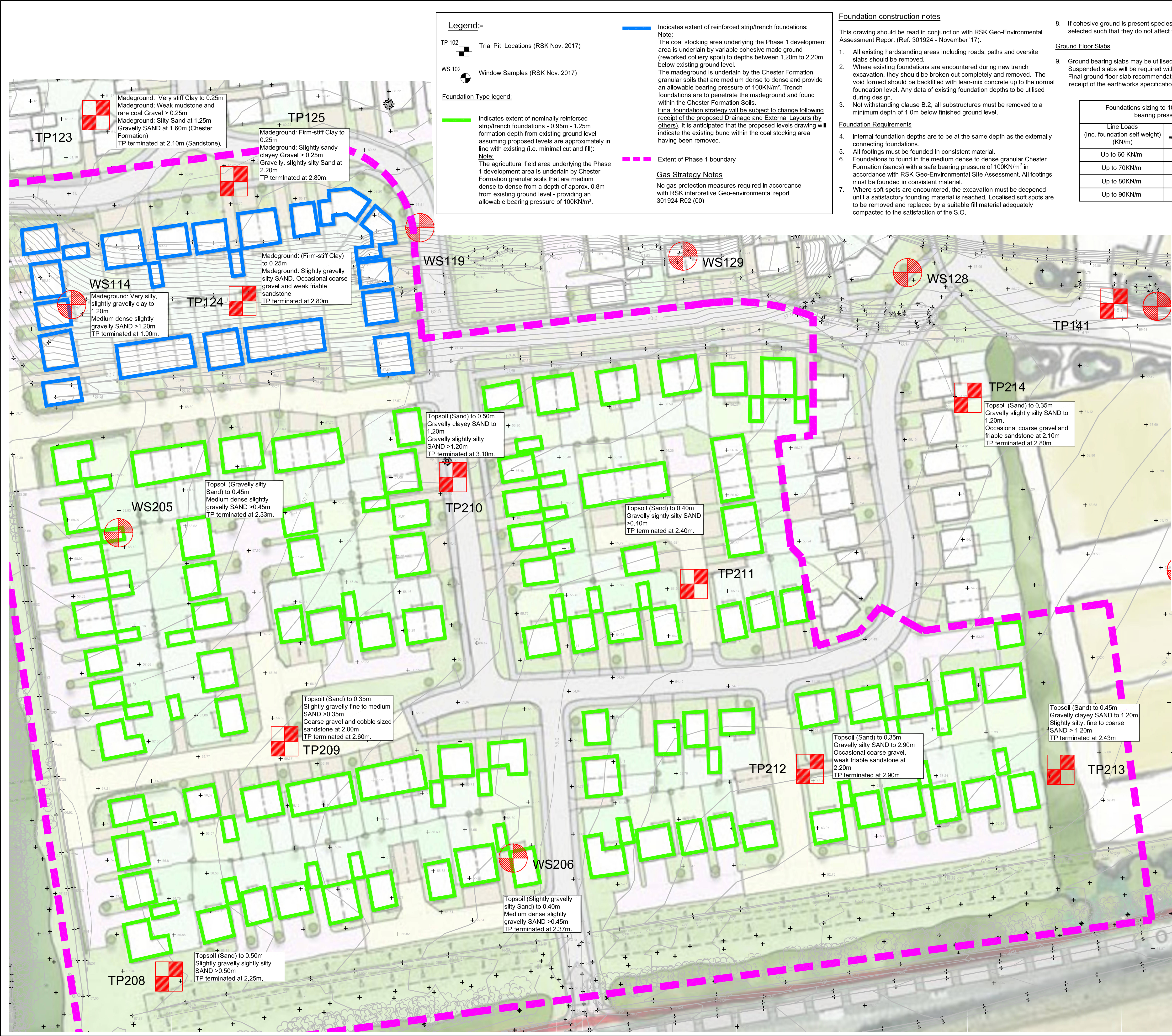


APPENDIX H

APPRAISAL AND DESIGN DRAWINGS

RSK Drawing ref. 881496 60-01 'Phase 1 Development Foundation Appraisal'

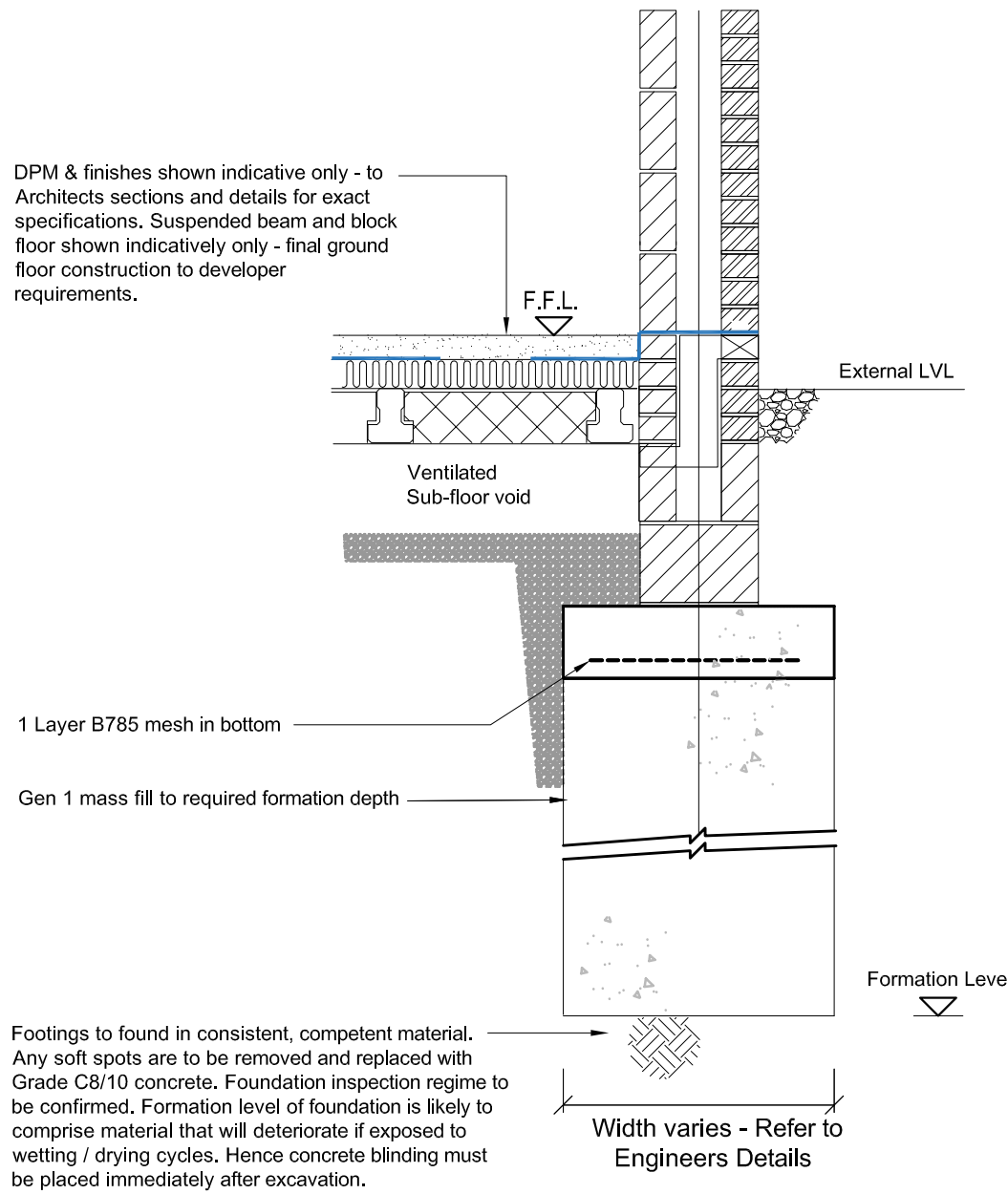
SCP drawing ref. 17109 - 0500 - 007 – 'Architects Masterplan - Phase 2'



CIVIL / STRUCTURAL DESIGN RISK MANAGEMENT

Abnormal or unusual residual risks associated with the design outcomes shown on this drawing are:-

RSK LDE LTD has followed it's Design Risk Management process for Hazard Elimination and Risk reduction in developing the designs shown on this drawing. Abnormal or unusual residual risks may be shown above where it is considered that such risk may not normally be expected by competent persons engaged on work of this nature or type.



| | | | | | |
|------|----------|------------------------|-------|-------|-------|
| P3 | 11.09.18 | Site boundary revised | DW | JG | JG |
| P2 | 05.09.18 | Gas strategy revised | JG | DW | JG |
| P1 | 13.06.18 | Issued for INFORMATION | JG | DW | JG |
| Rev. | Date | Amendment | Drawn | Chkd. | Appd. |

RSK

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Web: www.rsk.co.uk

Client
HARWORTH ESTATES

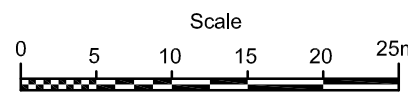
Project Title
**FORMER
THORESBY COLLIERY
AREA B**

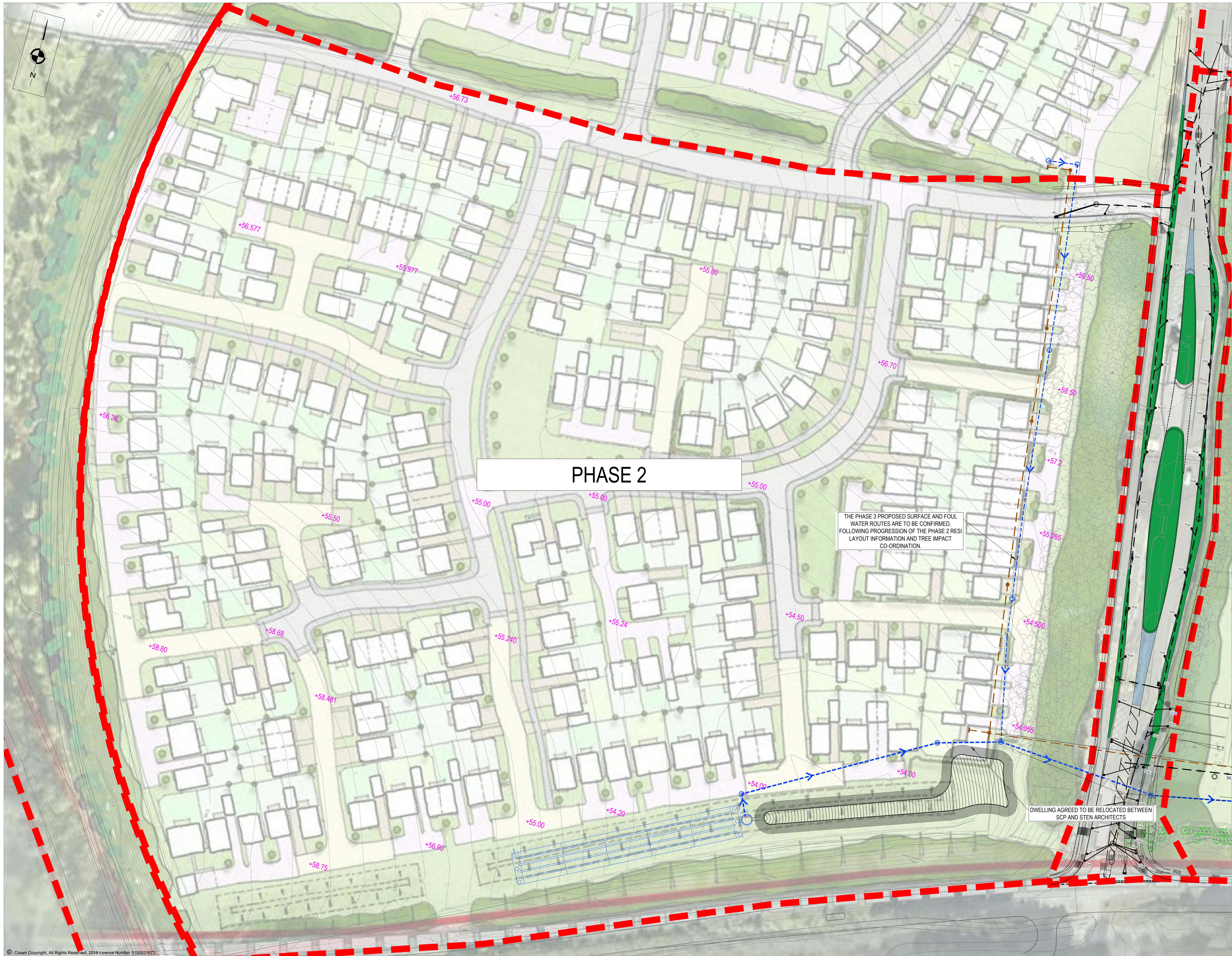
Drawing Title
**PHASE 1
DEVELOPMENT
FOUNDATION APPRAISAL**

| | | | | | |
|----------------|------------------|------------------|------------------|----------------|------------------|
| Drawn JG | Date JUNE '18 | Checked DW | Date JUNE '18 | Approved JG | Date JUNE '18 |
| Scale 1:500 | Orig Size A1 | Dimensions mm | | | |

| | |
|-----------------------|---------------------------|
| Project No. 881496 | Drawing File 60-01.dwg |
|-----------------------|---------------------------|

| | |
|----------------------|------------|
| Drawing No. 60-01 | Rev. P3 |
|----------------------|------------|





NOTES

1. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE.
2. ANY DISCREPANCIES WITHIN THIS DRAWING PACKAGE ARE TO BE BROUGHT TO THE ATTENTION OF SCP TRANSPORT.
3. ALL DRAWINGS TO BE CHECKED BEFORE COMMENCEMENT OF WORK ON SITE.
4. DRAWINGS ARE NUMBERED AS FOLLOWS:
PHASE 1 17109-0500-101
PHASE 2 17109-0500-201
S106/S102 SURFACE WATER 17109-0500-301
S106/S102 FOUL WATER 17109-0500-302
5. THIS DRAWING IS TO AID THE S104, S102, AND S106 APPLICATION TO SEVERN TRENT WATER.
6. THIS MASTERPLAN PDF HAS BEEN OVERLAID FOR INFORMATION PURPOSES ONLY AND SHOWN AS SCHEMATIC.

KEY

- PHASE BOUNDARY
- +55.50 OUTLINE PROPOSED SPOT LEVELS
- PROPOSED SURFACE WATER TO BE ADOPTED BY SEVERN TRENT WATER
- PROPOSED FOUL WATER TO BE ADOPTED BY SEVERN TRENT WATER

THE SCP DESIGN COVERS THE INFRASTRUCTURE SURFACE WATER AND FOUL WATER DRAINAGE DESIGNS, FOR PHASE 1 AND 2 ONLY. WITH STUB PROVISIONS FOR FUTURE PHASES

HOUSE BUILDERS WILL DESIGN AND SUBMIT THEIR OWN SEPARATE PHASING SECTION 104 SUBMISSIONS, FOR SURFACE WATER AND FOUL WATER DRAINAGE DESIGNS. WHICH WILL NOT INCLUDE ANY UPSTREAM STORAGE SYSTEMS AND DISCHARGE/CONNECT INTO THE PHASING INFRASTRUCTURE SECTION 104 STORAGE TANKS AND POND SYSTEMS.

MASTERPLAN NOT FIXED
PHASE 2 APPROXIMATELY 220 DWELLINGS

REVISIONS

| REV | DESCRIPTION | DATE | BY |
|-----|---------------------------------|----------|----|
| — | — | — | — |
| A | SECTION 104 DRAINAGE AMENDMENTS | 19.07.18 | WJ |

SCP

Transportation Planning : Infrastructure Design

Colwyn Chambers, 19 York Street, Manchester, M2 3BA, Tel 0161 832 4400, www.scptransport.co.uk, Email info@scptransport.co.uk

Client Name:

HARWORTH ESTATES LTD

Project Title:

THORESBY INFRASTRUCTURE
DETAILED DESIGN

Drawing Title:

ARCHITECTS MASTERPLAN
PHASE 2

| | | | |
|---------|------------|-----------|------------|
| Date: | 26.04.2018 | Drawn By: | CW |
| Scale: | NTS @ A1 | Checked: | WJ |
| Status: | DESIGN | Approved: | UNAPPROVED |

| | | | |
|-------------|----------------|------|---|
| Drawing No. | 17109-0500-007 | Rev. | A |
|-------------|----------------|------|---|