

TerraConsult

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DALE VIEW, BILLINGTON, CLITHEROE

PHASE 1 & 2 SITE INVESTIGATION REPORT

Carried out for:

Bloor Homes

TerraConsult

DALE VIEW, BILLINGTON, CLITHEROE

PHASE 1 & 2 SITE INVESTIGATION REPORT

Date: 30/11/2013

BLOOR HOMES

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FS 573193 EMS 573194

EXECUTIVE SUMMARY – BLOOR HOMES – DALE VIEW, BLLINGTON

Item	Description
Site Location and Name	The site is located off Dale View, Billington, Clitheroe, BB7 9LL. This report refers to a site previously undeveloped; the development will be an extension of Dale View.
Objective	The objective of the report is to provide information on ground conditions at the site such as geoenvironmental, geotechnical and ground gas as part of the planning process prior to developing the site for residential use. This will be accomplished using published information in association with an intrusive investigation.
Purpose of this Report	This report presents the findings of the ground investigation, the environmental risk assessment and any recommendations relating to the proposed development.
Land Use History	The site is largely undeveloped, primarily consisting of agricultural fields. The only developments at the site are allotment gardens along the eastern edge of the site, some of which in the southern area have been demolished and a small brick building in the south western part of the site associated with a pumping station. The adjacent land to the north and west of the site is undeveloped agricultural land. To the south and east of the site it is predominately residential buildings, however there are some commercial building along the main road (Whalley Road) and an industrial building to the north east of the site.
Geoenvironmental Setting	**Topography:** There is a gradual decrease in elevation northward on the site. There is a notable decrease in height of approximately 2.25 m at the southern corner of the site as well as 1.50 m between the northern third and the southern two thirds of the site. There is also a drainage ditch of roughly 0.25 m depth is located along the western boundary of the northern field. **Geology:** The ground conditions are complex at the site. In general terms the southern part is underlain by Glacial Till with alluvial deposits in the northern part. However, in the southern part of the site Alluvium is locally present. The only Made Ground encountered was relatively thin sandy gravel in allotment gardens. The solid geology is Bowland Shale but this was not encountered during the site investigation. **Hydrogeology:** The Bowland Shale Formation is classified as a Secondary Aquifer (Undifferentiated Layers), the Rad Brook Mudstone Member and the Alluvial deposits are categorized as Secondary (A) Aquifers and the Glacial Till is classified as Unproductive. The nearest groundwater abstraction point is located 1100 m to the southeast of the site. **Hydrology:** The site is located approximately 200 m south of the River Calder, which has an orientation of approximately northwest – southeast. **Mining & Quarrying:** There is no evidence of mineral abstraction or quarrying on or near the site and is not located within a Coal Authority Referral Area. The closest quarry recorded is a historic one 450 m to the east of the site.
Hazard Identification	Based on the former land uses at the site the potential for contamination to be present at the site is considered to be relatively low and the only likely source is the historic spreading of ash in the allotments. Based upon the results of the current ground investigation no significant contamination has been identified.
Hazard Assessment	Plausible contaminant linkages have been identified. The receptors of concern are human health, ecological receptors as well as surface water and groundwater.
Risk Estimation	The possible consequences on the plausible receptors are estimated to be NEGLIGIBLE to SEVERE and the probability of the identified risks occurring is considered to be from UNLIKELY to MEDIUM. The Risk Evaluation Given the adoption of suitable construction practices the overall risk is considered to be LOW.

Conclusions – Geoenvironmental	The ground investigation data has shown that the concentrations of potential contaminants are all lower than the appropriate screening criteria which are protective of humans for residential land use. There are exceedances of zinc, lead and copper with respect to phytotoxic risk (risk to plant growth) based on MAFF guidelines but this was found to be confined within the allotment gardens. Without substantial source of contamination the risk to controlled waters is assessed to be negligible. There will be an excess quantity of topsoil at the site. It is recommended that the topsoil within the allotment gardens is removed from site with suitable topsoil from the adjacent areas used to re-topsoil the gardens in the areas of the former allotments.
Conclusions – Ground Gas	Based on the ground gas assessment no ground gas protection measures are needed as the site is classified as Characteristic Situation 1 and radon protection measures are not required in this area.
Conclusions – Geotechnical	The ground conditions at the site are variable with locally very poor geotechnical conditions. In general terms the southern part of the site there is Glacial Till but alluvium is locally present with Alluvial deposits present in the northern part of the site. areas with o be completed
This summary forms part of a Tier 2 Risk Assessment (Ground Condition) report prepared by TerraConsult and contains an overview of the key findings and conclusions. The summary should not be treated as an independent document.	

DALE VIEW, BILLINGTON, CLITHEROE

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Appendix N	Summary of Guidance for Classification of Soil as a Waste Material

DALE VIEW, BILLINGTON, CLITHEROE

PHASE 1 & 2 SITE INVESTIGATION REPORT

1 INTRODUCTION

1.1 Background Information

1.1.1 TerraConsult Limited was commissioned by Bloor Homes to carry out a site investigation for an area of land off Dale View, Billington, BB7 9LL. The purpose of the report is to provide information on conditions at the site using published information in association with a limited intrusive investigation as part of the planning process prior to developing the site for residential use.

1.1.2 This report has been devised to generally comply with the relevant principles and requirements of a range of guidance including:

- Part IIA of the Environment Protection Act, 1990;
- Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, April 2012);
- National Planning Policy Framework (HCA, March 2012);
- BS5930:1999 +A2:2010: "Code of practice for site investigations";
- BS10175: 2011+A1:2013: "Investigation of Potentially Contaminated Sites - Code of Practice";
- DEFRA/Environment Agency (2004) Report CLR11 "Model Procedures for the Management of Land Contamination";
- Environment Agency (2011) Report GPLC1 "Guiding Principles for Land Contamination";
- Environment Agency (2012) Report GP3 "Groundwater protection: Principles and Practice".

1.1.3 TerraConsult's service constraints and report limitations are presented in Appendix A and a description of environmental risk assessment methodology and terminology is presented in Appendix B.

1.2. Previous Investigations

1.2.1 Two previous investigations from land adjacent to the site have been made available for review. Both of the investigations were undertaken in relation to redevelopment of the land for residential end use. Details of these investigations are in section 4.

1.3. Development Proposals and Planning Status

1.3.1 The proposed development of the site is understood to comprise:

- 53 detached and semidetached residential properties;
- Car parking and garages;
- Landscaping; and
- Roadways.

1.3.2 The proposed site layout is shown in figure 1 below:

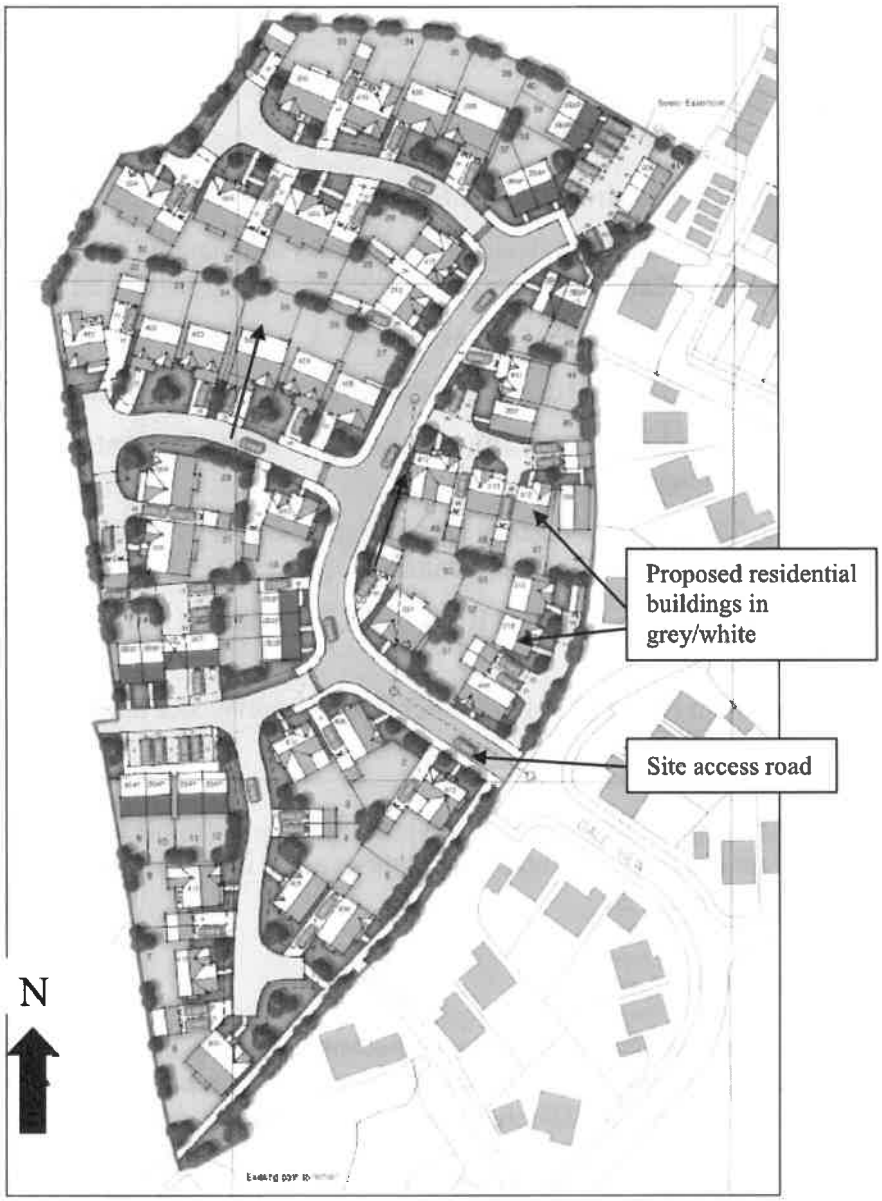


Figure 1: Proposed Site Layout

1.3.3 The National Planning Policy Framework (NPPF, 2012) has twelve core land-use planning principles, two of which directly relate to the potential for pollution and contaminated land:

- Requirement to *"contribute to conserving and enhancing the natural environment and reducing pollution"* and setting out of a preference for developments to be on land of "*lesser environmental value*"; and
- *"encourage the effective use of land by re-using land that has been previously developed (brownfield land), providing that it is not of high environmental value."*.

1.3.4 In accordance with the core principles of NPPF, Clause 109 clarifies that enhancing the natural environment includes:

- *"preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability; and*
- *remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."*.

1.3.5 Clause 121 of NPPF states that planning policies and decisions for developments 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."*.

1.3.6 This report has been prepared and authorised by staff that are competent as defined in the NPPF.

1.3.7 The findings and conclusions of the risk assessments have been set out and recommendations given for the proposed residential end use. If there is a subsequent change in the proposed land the risk assessments and conclusions should be reviewed to determine whether they are still applicable for the revised end use.

1.4 Objectives of the Investigation

1.4.1 The main objectives of the investigation were provide information to fulfil planning requirements prior to site re-development for residential use and to provide information for foundation design. The specific activities carried out are as follows:

- undertake a desk study of available information;
- carry out a site walk over;
- carry out an intrusive investigation by trial pitting and dynamic (window) sampling with associated sampling and testing for potential contaminants and *in-situ* and *ex-situ* geotechnical parameters;
- develop a preliminary conceptual site model and refine this according to the findings of the investigation;
- assess the general nature and extent of contamination at the site and carry out a contamination risk assessment to determine if the site poses a risk to potential receptors and to establish baseline environmental conditions;
- provide factual information on the ground conditions for use by architect/structural engineer;
- assess the ground gas conditions at the site and undertake a ground gas risk assessment;
- should the investigation indicate that remediation of contaminants be required, provide recommendations of feasible remedial measures to facilitate development of the site for residential end use;
- provide preliminary geotechnical information on the ground conditions for foundation and floor slab design.

2 SITE LOCATION AND DESCRIPTION

2.1 Site Location

2.1.1 The site is indicated in Figure 2 below and the site location is summarized in Table 1:

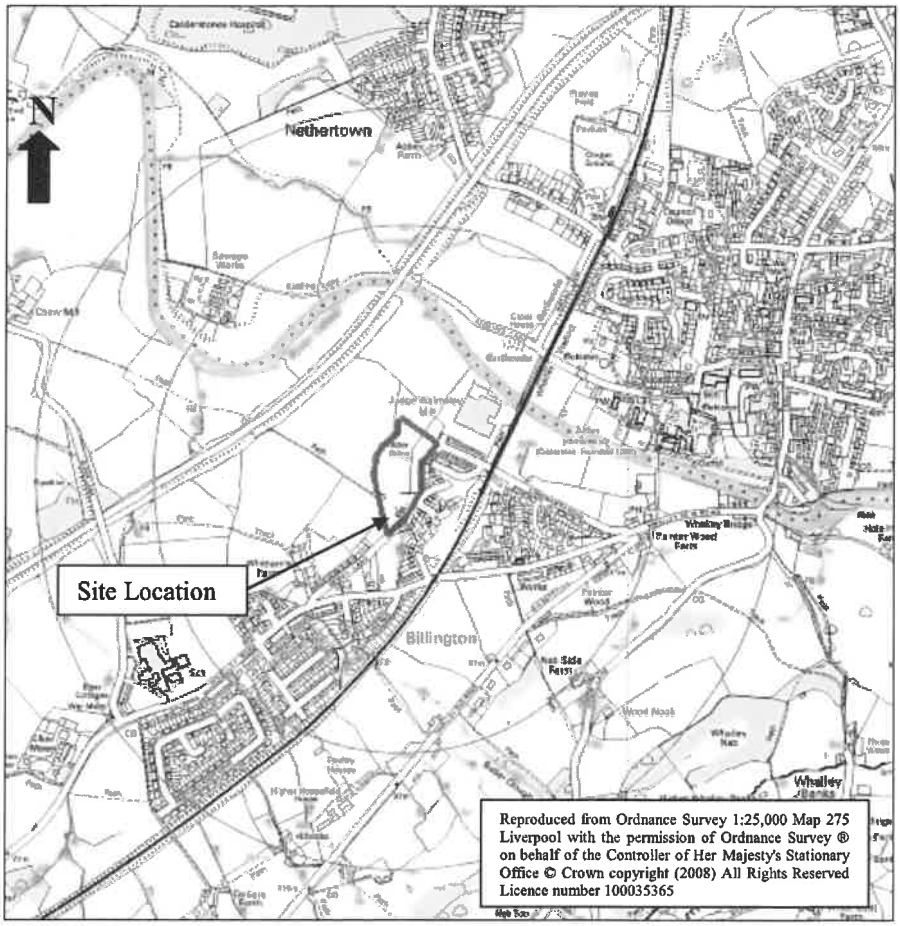


Figure 2: Site Location

Table 1: Summary of Description of the Site and its Environs	
Location	400m to the northeast of Billington village centre, off Dale View. The site is also 6.7 miles northeast of Blackburn town centre.
Grid Reference	372536 435919
Post Code	B77 9LL
Site Area	1 ha (approx.)
Site Shape	The site has maximum plan dimensions of approximately 200m long by 100m wide and is roughly triangular in shape.
Topography	The topography of the site shows a gradual slope, falling towards the north. Across the middle of the northern field there was a recognisable break of slope of ground level by approximately 1 m with a rough orientation of east to west. This break in slope was more clearly defined in the western side of the site.

2.2 Site Description

2.2.1 A site visit was undertaken on 23rd October 2013. The locations of various features are detailed on Drawing No. 1906/1/002. Photographs of the site are presented in Appendix C.

2.2.2 The investigation area is broadly triangular; covering a total area of approximately 1 hectare. The site consists of predominately agricultural fields with the north eastern region presently being used as allotments. Below in Table 2 there is a more detailed description of the site:

Table 2: Summary of Description of the Site and its Environs	
Current Use:	Predominately agricultural fields, there is a northern and southern field with the boundary orientation east to west. The north eastern edge of the site is presently being used as allotments. There are public pathways along the boundaries of the southern field.
Access	Access to the fields is via Neddy Lane entering at the southern corner of the southern field. The access to the allotments is via Longworth Road.
Existing Buildings & Structures	There are several buildings on site, all but one associated with the allotments. The other building is a pumping station in the southern field by the western boundary.
Site Surface & Vegetation	The sites surface is predominately long field grass. The allotments are a mixture of grown vegetation and compacted gravel. The boundaries of the fields and allotments have scattered mature and semi-mature trees as well as bushes.
Storage Tanks	Below Ground Tanks: No evidence/none suspected. Above Ground Tanks: None present.
Services	A number of services present on site due to observed access chambers. A water main is shown to run primarily within the northern field near the boundary with the allotments. The pumping station in the southern field has telecommunication and electricity services running to it within the southern field. There is also a rising sewer main running to the pumping station, within both fields and area of allotments.
Asbestos	No potential Asbestos Containing Materials (ACMs) noted in the buildings or on the ground surface
Waste Disposal/ Materials Storage	The only recorded waste storage was on within the southern allotment area from the demolishing of previous structures which existed on the site associated with the allotments.
Surrounding Area	Residential properties are located to the east and south. Agricultural fields are located to the north and west.
Ecology	There is no evidence of protected burrowing animals (e.g. badgers) or habitats suitable for protected amphibians (e.g. Great Crested Newts). No evidence of invasive plant species were noted. *These comments on the ecology are for initial preliminary assessment. They are based on the assessment of personnel who are* ***not*** *trained ecologists and does* ***not*** *constitute a Phase I Habitat Survey or similar.*
Local / Background Knowledge	None provided.

2.3 Site Ownership

2.3.1 The current owner of the site is Keith Geldard who is selling the land to Bloor Homes.

3. ENVIRONMENTAL SETTING

3.1 History

3.1.1 Details of relevant land use changes for the site and its surroundings are summarised below in Table 3. Information on the site history was obtained from Environmental Health Services Report No. CL9049 and from historic maps purchased from GroundSure. This information is presented in Appendix D.

Table 3: Summary of Examined Ordnance Survey Historical Mapping

OS Map Edition	On-site Features	Off-site Features
1846 1:10,560 County Series Map	The site is shown to be within a large agricultural field with no surface features.	The area can generally be considered as agricultural with a small number of buildings associated with industry as well as Whalley village to the east. The closest development is a large building approximately 60 m northeast. The River Calder is situated approximately 200 m northeast of the site with a rough orientation of northeast-southwest. There are other surface water features including reservoirs and tributaries, the closest being a reservoir approximately 100 m southwest. A 'brick and tile kiln' is located approximately 30 m south-southeast of the site as well as a 'colliers' located 1000 m southwest. 'Quarries' are located approximately 450 m east, 750 m southwest and 1000 m southeast. Two 'mills' are located approximately 700 m east and 900 m west. Numerous wells have been located within 1 km of the site; the closest is located approximately 400 m south east of the site. There are also a number of unidentified pipes located within 1 km of the site.
1892 County Series Plan 1:2,500 (part mapping) & 1892 1:10,560 map	The boundary of the field now matches the present boundaries (the site boundaries excluding the northern boundary).	Two 'Gasometers' are located approximately 100 m east and 400 m southwest, suggesting possible associated gas works. The building to northeast of the site has increased in size and is identified as a 'cotton mill'. There has been a construction of residential properties, the closest being adjacent to the eastern boundary. The 'quarry' located approximately 450 m east the site is now shown as a surface water feature.
1912 County Series Plan 1:2,500 & 1910 1:10,000 map	No significant changes.	Two 'sewage works' have been constructed approximately 200 m west and 400 m northwest. Continued construction of 'Whalley' residential area.
1932/1938 County Series Plan 1:2,500 (part mapping of 1938) & 1933/1950 1:10,000 map	Allotments have been developed on the very eastern side of the site.	The two 'Gasometers' are no longer present. Continued residential construction to the south ('Billington') and east ('Whalley'). A possible excavation is shown approximately 20 m from the southern part of the site.
1966/1967 County Series Plan 1:2,500 (part mapping of 1967) & 1969 1:10,560 map	The construction of two building enclosed within a rectangular structure in the southern half of the site on the western boundary.	Large 'sewage works' constructed approximately 1 km east of the site. Continued residential construction predominately north and southwest of site.

1977/1978/1992/ 1993 County Series Plan 1:2,500 (partial mapping of 1993) & 1973 1:10,000 map	No significant changes noted.	Construction of the A59 approximated 180 m northwest of the site with an approximate orientation of northeast to southwest. The 'sewage works' approximately 200 m west is no longer shown.
1995 Country Series Plan (partial mapping)	The rectangular boundary around the western buildings is no longer present.	The 'reservoir' approximately 20 m from the southern corner is no longer shown.
2012 Country Series Plan 1:2,500 and 2002/2012 1:10,000 map	Only one of the western buildings is now present on site.	The construction of 'Dale View' along the eastern boundary of the site.

3.2 Data Summary

3.2.1 A summary of the environmental background information (geology, hydrology, hydrogeology, database information etc.) and regulator consultation information has been tabulated and presented below. The source information for this table is presented in PDF format in Appendix D or is referred to in Table 4 below. The table below represents the base data used to formulate the conceptual ground model.

Table 4: Data Summary: Environmental Setting & Regulator Contact		
	Data Source	**Data Summary**
Regional Geology	GroundSure GeoInsight Report No. HMD-147-1148108 British Geological Survey Website, 31/10/2013	The site was shown to be underlain by drift deposits comprising Glacial Till (Diamicton) in the southern half of the site, possibly extending into northern half of the site which is shown to have alluvium deposits at the surface. On site the solid geology is shown to comprise of Bowland Shale Formation (Mudstone) at the surface of the site, this is Asbian in age and is part of the Craven group. The Rad Brook Mudstone Member is a notable unit within the Formation and outcrops approximately 15 m northwest of the site. A normal fault is shown approximately 470 m southwest.
Mining	GroundSure GeoInsight Report No. HMD-147-1148108	The site is not located in a Coal Authority Referral or Standing Advice Area.
Quarrying	GroundSure GeoInsight Report No. HMD-147-1148108 Historical mapping (1932/1938)	There is no evidence of mineral extraction or quarrying at the site (e.g. brick pits, sand and gravel extraction). There is a highly unlikely chance of localised and small scale mineral vein abstraction. Rare minor mining of mineral veins may have occurred 470 m southeast of the site. Possible excavation shown approximately 20 m from the southern site boundary.
Hydrogeology	GroundSure EnviroInsight Report No. HMD147-1148107 Environment Agency Website 06/11/2013	The site is not within a Source Protection Zone (SPZ). Solid Geology – The Bowland Shale Formation (Mudstone) is classified as a Secondary Aquifer (undifferentiated layers). The permeability of the formation ranges from low to negligible, varying within individual beds. The Rad Brook Mudstone Member to the northwest is classified as a Secondary (A) Aquifer, the permeability of this member ranges from high to low, the main mechanism being through fractures. Superficial Geology – The Glacial Till at the surface on the southern half of the site is classified as an unproductive unit, indicating little flow of water through it. The alluvium in the northern half of the site are classified as a Secondary (A) Aquifer with the permeability ranging from high to low. Groundwater Abstractions – No groundwater abstractions in the area of the site, the closest located over 1.1 km southeast of the site.
Hydrology	GroundSure EnviroInsight Report No. HMD147-1148107 Environment Agency Web Site, 07/11/2013	Nearest watercourse - the River Calder lies approximately 200 m to the northeast of the site. There are a number of associated tributaries (tertiary rivers) to the south and the southwest, the closest being approximately a 250 m south east.
	Drainage Plans	There are both a pumped foul main and surface water drainage systems that cross the site. At the time of the investigation the drainage ditch identified in the northern half of the western boundary was dry.

Hydrology4	GroundSure EnviroInsight Report No. HMD147-1148107	Buried Culverts - None currently identified on site, the closest is approximately 250 m southwest.
	GroundSure EnviroInsight Report No. HMD147-1148107 Groundsure FloodInsight Report no. HMD-147-1148105 Environment Agency Web Site, 07/11/2013	A small area in the northern part of the site (affecting three properies) site is in Flood Zone 2, therefore the annual risk of flooding from the River Calder is classified as greater than 0.1% but less than 1%. A Flood Zone 3 is shown to be approximately 30 m north of the site. The rest of the site is within a Flood Zone 1 and therefore the annual risk of flooding is less than 0.1% per annum. The site is greater than 1 ha with part of it within a Flood Zone 2 therefore a Flood Risk Assessment will be required. The site is within an area classified as having a very high susceptibility of groundwater flooding given the geological conditions present. Therefore groundwater is to be anticipated at shallow depth even when there is no flood conditions. An assessment of the risk of flooding caused by rainfall-generated overland flow indicates that there are regions with significant risk on site, signifying this area would be expected to be affected by surface water flooding in a 1 in 75 year rainfall event to a depth greater than 0.1 m. Development which increases the amount of impermeable surfaces can result in an increase in surface water run-off, which in turn can result in increased flood risk both on site and elsewhere within the catchment. The water quality of the River Calder is indicated to be B chemically and biologically, grading from A (very good) to F (bad). Pollution Incidents – There has been a recorded incident regarding hydraulic oils approximately 145 m southeast of the site on the 21st November 2001, it is categorised as having no impact. Abstractions – No groundwater abstractions in the area of the site, the closest located over 1.1 km southeast of the site. Discharge Consents – On site there have been two records of licenced discharged into the River Calder. The first being an emergency miscellaneous discharge in 01st January 1995 and the second being an historic sewage discharge issued 31/08/1989. Registered 162 m east of the site there was also a sewage discharge consents issued in in both 13th July 1967 and 31st April 1991.
Radon Potential and Other Radiation	GroundSure GeoInsight Report No. HMD-147-1148108 Building Research Establishment, 2007, BR211 'Radon: Guidance on protective measures for new buildings'	Site is not in a Radon affected area.
	GroundSure GeoInsight Report HMD-147-1148108 GroundSure EnviroInsight Report No. HMD147-1148107	No reasonable grounds for believing land to be radioactively contaminated (in accordance with 2005 extension of Part IIA of The Environment Protection Act 1990).

Ordnance	Zetica Bomb Risk Map (Lancashire)	Low risk for unexploded ordnance.
Industries	GroundSure EnviroInsight Report No. HMD147-1148107	There are four potentially contaminating industries within 250 m of the site. There have been two electricity sub stations identified 130 m east and 240 m southwest of the site. There are also structural engineers with potential contaminating substances and a concrete industrial premise 170 m northeast and 200 m southwest respectively.
Environmental Permits/Authorisations	GroundSure EnviroInsight Report No. HMD147-1148107	There are no registered Integrated Pollution Control (IPC) Sites, Registered Radioactive Substances sites, Control of Major Accident sites (COMAH), Explosives Sites or Notification of Installations Handling Hazardous Substances (NIHHS) within 500m of the site.
Waste Transfer Sites	GroundSure EnviroInsight Report No. HMD147-1148107	There are no Waste Transfer Stations within 500 m of the site.
Landfill Search	Environmental Agency Website 07/11/2013 GroundSure EnviroInsight Report No. HMD147-1148107	There are no recorded operational landfills within 500 m of the site. There is one recorded historical landfill 350 m northwest of the site, last receiving waste 31st December 1973.
Fuel Station	GroundSure EnviroInsight Report No. HMD147-1148107	There are no recorded fuel stations within 500 m of the site.
Ecology	MAGIC Website 07/11/2013 http://magic.defra.gov.uk/MagicMaps.aspx/	There are no sites of Special Scientific Interest (SSSI), Special Protection Areas, Conservation Areas, National Nature Reserves, National Parks, Areas of Outstanding Natural Beauty or RAMSAR (wetlands) within 1km of the site.
Archaeological & Building Heritage	MAGIC Website 07/11/2013 English Heritage Website 07/11/2013 http://list.english-heritage.org.uk/mapsearch.aspx	There are a number of listed buildings within 500 m northeast and east of the site. The closest being approximately 340 m northeast of the site.

Archaeological & Building Heritage	English Heritage Website 07/11/2013 MAGIC Website 07/11/2013	There are no sites of archaeological interest in site.
	MAGIC Website 07/11/2013	The site is not within areas of outstanding natural beauty or a national park
	English Heritage Website 07/11/2013 MAGIC Website 07/11/2013	There are a three scheduled ancient monuments within 500 m northeast and east of the site. The closest being approximately 350 m northeast of the site.
Regulator Contact	Ribble Valley Borough Council	Contact with the council was not made at this stage but they will require a copy of this Phase I and II Site Investigation in order to discharge Planning Conditions.
	Environmental Agency	Contact with the Environmental Agency was not made at this stage.

3.3 Geology

3.2.2 GroundSure GeoInsight Report No. HMD-147-1148108 shows two types of drift geology present on site. The southern half of the site is shown to have Glacial Till at ground surface whist the northern half of the site is shown to have Alluvium deposits at ground surface. It is thought that the Glacial Till may underlie the alluvium in the north however this is unknown as the base of the Alluvium was not encountered.

3.2.3 The bedrock geology is shown as the Bowland Shale Formation (Mudstone) which extends across the whole of the site. This formation is part of the Craven Group of Carboniferous age. The Rad Brook Mudstone Member is a notable unit within the formation outcropping approximately 15 m northwest of the site.

3.2.4 An inferred normal fault is shown approximately 470 m southwest with a north-south orientation.

3.4 Mining and Quarrying

3.4.1 The site is not within a Coal Authority Referral Area, stated by the GroundSure EnviroInsight Report No. HMD-147-1148107.

3.4.2 The GroundSure EnviroInsight Report No. HMD-147-1148107 indicates that the there is no evident of mineral extraction or quarrying at the site (e.g. brick pits, sand and gravel extraction etc.) however there is a highly unlikely chance of localised and small scale mineral vein abstraction. Rare minor mining of mineral veins may have also occurred 470 m southeast of the site.

3.4.3 The closest quarry identified on the a number of the historic Country Series Plans (1:2,500) was located approximately 450 m east of the site. On the basis of the geology of

the area, the EnviroInsight Report and the historic mapping it is considered that the site is not likely to be at risk from ground movements due to previous mines and quarrying.

3.4 Hydrogeology

3.4.1 The Environment Agency has defined Source Protection Zones (SPZs) for 2000 groundwater sources such as wells and boreholes used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The site lies further than 1 km from the nearest SPZ and therefore will not need to be considered when developing pollution control measures.

3.4.2 The Environment Agency have classified different types of aquifer from which groundwater can be extracted (see Appendix K for definitions). The bedrock (Bowland Shale Formation) is classified as a Secondary (Undifferentiated Layers) Aquifer which has beds of both minor and non-aquifer characteristics, however the Rad Brook Mudstone Member is classified as a Secondary (A) Aquifer. Drift deposits of Glacial Till and Alluvium at are classified as Unproductive strata and a Secondary (A) Aquifer respectively.

4. PREVIOUS INVESTIGATIONS

4.1 Report Ref: E7336 – Geo-Environmental Review

4.1.1 In September 2005 White Young Green Environmental Limited conducted a review of land adjacent to the west of the current site under investigation by TerraConsult. This consisted of a visual inspection of the current conditions and a review of the Geo-Environmental Appraisal prepared by AIG Consultants Limited.

4.1.2 Noteworthy conclusions are as follows:

- *"The site was previously undeveloped, although the tipping of ash material has taken place in areas of the site."* and *"there are two areas of made ground across the site that comprise of black ash with some brick and glass fragments.*
- *"natural ground was proved to be firm to stiff sandy clay, although medium dense sands were determined at one exploratory location."*
- *"Natural clay samples tested by AIG were determined not to be contaminated when compared to current guidance."* and *"Ash fills were determined to be contaminated with arsenic, copper, nickel, lead, zinc and polyaromatic hydrocarbons. Elevated sulphate and boron were also determined "*

4.2 Report Ref: Billington Area B – Geo-Environmental Investigation

4.2.1 In January 2008 White Young Green Environmental Limited conducted an intrusive investigation on land adjacent to the site.

4.2.2 Noteworthy conclusions were as follows:

- *"The subsurface conditions encountered generally comprised a variable depth of CLAY made ground overlying superficial CLAY (Boulder Clay) with minor components comprising of sand, silt and gravel."*
- *"Slight contamination of PAHs in made ground was identified."*
- *"Ground gas monitoring indicates that protection of buildings from the ingress of gases consistent with "Characteristic Situation 2" will be required."*
- *It was recommended that all of the proposed buildings are founded on piles or vibro-stone columns."*

5. HAZARD ASSESSMENT & PRELIMINARY (TIER 1) CONCEPTUAL SITE MODEL

5.1 Hazards Identified with the Proposed Development

5.1.1 The hazard identification is based on the assumptions presented below:

- the site will be a residential development;
- the residential development will include some domestic gardens, and residents may choose to grow their own vegetables.
- drinking water will be from mains supply.

5.2 Potential Sources of Contamination

5.2.1 Several potential sources of contamination have been identified based upon current and previous land uses within the environs of the site.

5.2.2 The current land use having been identified as being allotments and agricultural land for grazing animals and therefore the following contaminants are potentially considered to be present on site:

- Nitrates and ammonia;
- Pesticides and herbicides.

5.2.3 With the farm land being grass land it is unlikely that there would have been significant use of pesticides and herbicides in this area and that as part of the allotments land use they will not have been used in high concentrations. Therefore it is assessed that there is no need to carry out further assessment for pesticides and herbicides.

5.2.4 In allotments ash has often been spread as a soil conditioner. This can include the following contaminants:

- Metals and metaloids;
- Organic compounds particularly PAHs;

- Sulphates.

5.2.5 Several historical potentially contaminative land uses surrounding the site have been identified through the historical mapping and environmental data sheets. These include sewage works, electrical sub-stations, structural engineers and concrete industries, cotton and other unidentified mills as well as possible gas works. Further contaminants relating these industries which need to be considered are:

- Metals and metaloids;
- Asbestos;
- Organic compounds including solvents;
- Inorganic compounds;
- Fuels and oils; and
- Acids and Alkalis.

5.2.6 Other contaminants that may need consideration include soil gas or vapours from potential organic matter within Alluvium deposits and Made Ground. However, given the anticipated ground conditions it is assessed that the most likely ground gas conditions will be Characteristic Situation 1 unless a significant thickness of peat is encountered within the northern part of the site. In the central and southern part of the site it is extremely unlikely that the ground gas conditions will be anything other than Characteristic Situation 1.

5.3 Potential Receptors of Contamination

5.3.1 The main receptors to any contaminants present will be future residents. Other potential receptors include:

- Construction workers;
- Visitors;
- Surrounding land users;
- Controlled waters (including groundwater and surface waters of River Calder and its tributaries);
- Building foundations and services;
- Present and future flora and fauna.

5.3.2 Based on the data previously discussed, the following potential receptors to contamination have been identified:

Table 5: Identified Potential Receptors	
	Sensitive Receptors
A	Humans – Pre development completion, i.e. working on site during demolition and construction.
B	Humans living on the site post construction.
C	Controlled waters – Surface Waters (River Calder).
D	Controlled waters – Aquifers - (Secondary (A) Aquifer).
E	Local flora and fauna during and post demolition and construction.
F	Building structure and services.

5.3.3 The possible contaminant linkages are discussed below. It should be noted not all may be formed between all sources and receptors.

5.3.4 The preliminary assessment of risks undertaken for the development considers potential risks to receptors A to F in Table 5 above. The receptors A to F incorporate each of the receptors normally required by the Local Authority to be considered in their planning conditions relating to land contamination;

- Human Health (A & B)
- Property (including buildings, crops, livestock, pets, woodland, service lines) (E & F)
- Adjoining land (D & F)
- Groundwater and surface water (C & D)
- Ecological systems (E)
- Buildings and structures (F)

5.3.5 It should be noted that there are no archaeological sites or ancient monuments considered to be within the zone of influence of the site. They are therefore not considered in the risk assessment.

5.3.6 The closest of each of the above receptor categories to the site are considered to be;

Onsite

- Site occupants;
- Proposed residential developments;
- Flora and fauna; and
- Secondary (A) Aquifer (Alluvium drift deposits and Rad Brook Mudstone Member)

Offsite

- River network including the River Calder and its tributaries (200 m northeast);
- Flora and fauna;
- Residential, industrial and commercial:

- Residential units (<10m south and east)
- Industrial unit (60 m northeast)

5.3.7 The possible contaminant linkages are discussed below. It should be noted not all may be formed between all sources and receptors.

5.4 Identification of Pathways

Pathways to Human Health

5.4.1 There are various routes by which a potential contaminant may reach a receptor. For example, in areas where contaminated material is exposed, dermal contact with the material, inhalation or ingestion of dust may occur.

5.4.2 Inhalation or ingestion of dust and water could occur during the construction and development phase at the site. Pathways from dermal contact with soil and groundwater may also arise. It is considered that the risk of short term exposure for ground workers and other construction workers is low.

5.4.3 Post construction, the surface of the development area will comprise residential buildings with associated garden areas and roadways. The soft standing areas allows for a significant number of potential pathways such as long term direct contact, ingestion of home grown produce and dust inhalation/ingestion to be present.

5.4.4 Gas and vapour entry into buildings is considered to be a possible pathway for the proposed development due to present of organic matter within the natural drift geology being a potential source. The gas and vapour entry into building is a possibility due to advection and diffusion, which may occur regardless of the presence of hard standing across the site.

Pathways to Controlled Waters

5.4.5 Groundwater levels at the site are anticipated to be relatively shallow at a depth of less than 3 m due to low permeability of the underlying Glacial Till and relatively low permeability Alluvium. Lateral migration of potentially contaminated groundwater offsite (via permeable layers) within the Alluvial deposits must be considered.

5.4.6 The vertical leaching of contaminants into the groundwater is a potential pathway for contaminants to impact upon groundwater. The presence of Glacial Till drift deposits means it is unlikely contaminated materials will become in contact with the Secondary (A) Aquifer (Rad Brook Mudstone Member). The unsaturated bedrock will also act as an attenuator to potential contaminants leaching into the groundwater which is assumed to be at depth.

5.4.7 Surface run off from contaminated areas into surface watercourses must also be considered. Due to a lack of a hard standing at the site surface, this will be uncontrolled prior to and during the groundworks phase when this must be carefully managed as the River Calder is situated approximately 200 m to the northeast. Post construction the majority of the site and surface run-off will be limited and controlled through drains.

5.4.8 Other potential pathways that are possibly less significant to the site but still require consideration are; potential phytotoxic effects on sensitive landscaping plants; chemical attack on foundations and services and permeation of contaminants through domestic water pipes.

5.5 Contaminant Linkages

5.5.1 For each contamination source there are potential contaminant linkages with all receptors. However, in the context of this site, not all of the contaminant linkages are plausible. The likelihood of the various pathways linking the contaminants to the receptors is presented in Table 6 below:

Table 6: Matrix of Contaminant Linkages

Source/ Contaminated Medium	Pathway	Receptor					
		A - Humans using the site pre-development completion	B - Humans occupying the site post construction	C – Surface Water	D - Groundwater	E - Flora & fauna	F - Building & Services
Soil/Made Ground/Bund Material	Ingestion	S	S	-	-	P	-
	Dermal Contact/Direct Contact	S	S	-	-	P	P
	Inhalation	P	P	-	-	P	-
	Infrastructure/Drainage	P	P	P	P	U	P
	Groundwater	P	U	P	-	U	P
	Surface water	U	U	-	P	P	P
Groundwater	Ingestion	P	U	-	-	U	-
	Inhalation	U	U	-	-	U	-
	Dermal Contact	P	U	-	-	U	P
	Groundwater	U	U	P	P	U	P
	Surface Water	U	U	P	-	P	U
Gas (CH_4 CO_2)	Migration	U	U	-	-	U	U

Key to significance of contaminant linkages
S = Significant Pathway P = Possible Pathway U = Unlikely Pathway - =Not Applicable
Only Significant and possible linkages are taken forwards to the next part of the risk assessment.

5.6 Conceptual Site Model

5.6.1 In accordance with BS 10175, a schematic section has been developed for the site based on the previously presented data and contaminant linkage assessment:

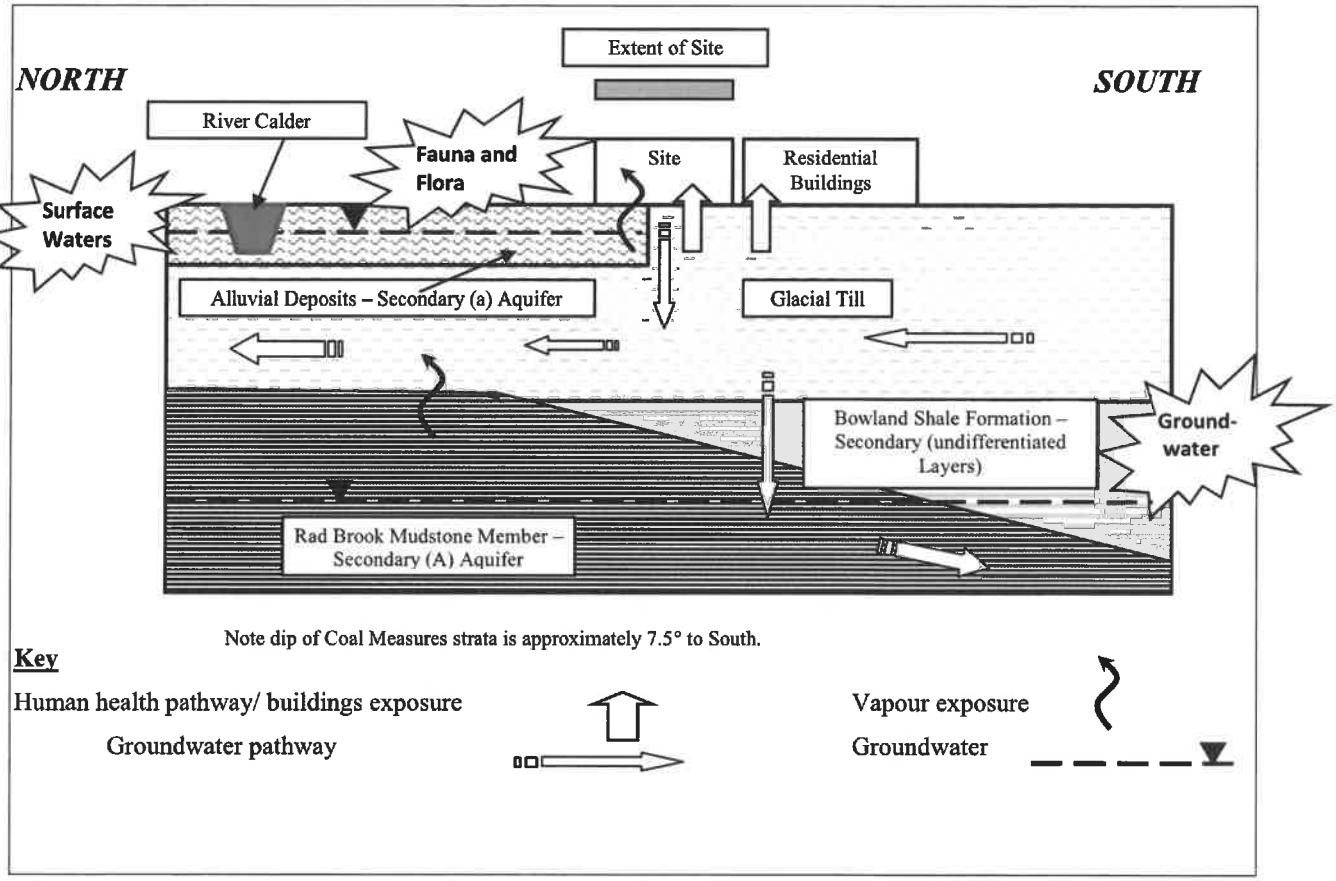


Figure 1: Preliminary Conceptual Ground Model - Schematic Section (not to scale)

5.6.2 The model shows the predicted geology and topography, the major on site potential contamination sources and vulnerable receptors. The drawing may not be considered to scale.

5.6.3 The information presented above represents the preliminary conceptual ground model that may need to be revised based on information obtained as part of any future intrusive investigation. A number of sensitive receptors and potential pathways and sources (in association with a list of likely contaminants) have been identified.

5.6.4 The ground model and proposed end use described above should be considered broadly representative of the standard housing (with vegetable uptake) as defined in SR3 "Updated Technical Model to the CLEA Model" (SC050021/SR3, 2011) for the purpose of this report.

5.6.5 There are uncertainties within the model that require consideration when undertaking assessment.

5.7 Preliminary Contamination Hazard Assessment

5.7.1 The preliminary hazard assessment is based on current available guidance published by a number of sources and is summarised in Appendix B. A preliminary conceptual site model for this site has been established using the desk study information and has been used as a basis for the preliminary hazard assessment. The significant and possible potential pathways are only considered for the hazard assessment.

5.7.2 The preliminary hazard assessment is a qualitative assessment of the risks posed by each viable pollution link identified. The hazard assessment leads to a recommended subsequent activity that could be:

- Action Required (AR) in the short term to break existing contaminant-pathway-receptor (CPR) link;
- Site Investigation Required (SIR) with objectives for risk estimation, or
- No Action Required (NAR) at this stage.

5.7.3 The hazard assessment is summarised in Table 7 below.

Table 7: Preliminary Hazard Assessment

Hazard Identification				Hazard Assessment			
Link	**Contaminant**	**Pathway**	**Receptor**	**Probability**	**Consequence**	**Risk**	**Hazard Assessment**
1	Contaminated soil/ groundwater	Ingestion (via soil dust) and inhalation (via soil dust and vapours), ingestion through dirty hands, dermal contact with soil/water.	A- Humans using the site during construction.	Medium/ Reasonably Foreseeable	Medium	**Medium**	SIR - Total soil concentration of relevant contaminants and ground gas vapours for contractors and designer's risk assessments.
2	Contaminated soil/ groundwater	Ingestion (via soil dust) and inhalation (via soil dust and vapours), ingestion through dirty hands, dermal contact with soil/water.	B- Humans using the site after development completion.	Medium/ Reasonably Foreseeable	Medium	**Medium**	SIR- Total soil concentration of relevant contaminants for designer's risk assessments.
3	Contaminated soil/ groundwater	Via service pipes	B- Humans using the site after construction. F- Building structures	Low/Unlikely	Medium	**Medium/ Low**	SIR - Total soil concentration of relevant contaminants for designer's risk assessments.
4	Contaminated soil/ groundwater	Downward & lateral migration	D- Perched groundwater C- Surface Water	Low/Unlikely	Medium	**Medium/ Low**	SIR- Total soil concentration of relevant contaminants for designer's risk assessments.
5	Gas – methane & carbon dioxide (radon already ruled out)	Inhalation, explosion	A & B- Humans using the site during construction and after development completion.	Low/Unlikely	Severe	**High/ Medium**	SIR – High organic content possible within the alluvium may be a likely source of ground gas – see below for further comment.
6	Contaminated soil/ groundwater	Ingestion, inhalation, dermal/direct contact	E- Ecology (Flora/Fauna)	Low/Unlikely	Negligible	**Near Zero**	NAR – however there will be data collected within site investigation
7	Contaminated groundwater	Secondary (A) Aquifer/ Surface water	E- Ecology (Flora/Fauna)	Low/Unlikely	Negligible	**Near Zero**	NAR – however there will be data collected within site investigation
8	Contaminated soil/ groundwater	Direct contact.	F- Building structures.	Medium/ Reasonably Foreseeable	Medium	**Medium/ Low**	SIR – Total soil concentration of relevant contaminants for designer's risk assessment.

5.7.4 With regard to the risk from ground gas the risk is almost wholly from the Alluvium in the north of the site being a source if there is a significant peat content in the stratum. If there is limited peat present or it is absent then there will be a negligible risk from ground gas. Ground gas wells and monitoring is only required in the northern part of the site if peat is encountered within the Alluvium. If peat is not encountered then no ground gas monitoring is required.

5.7.5 From Table 7 a range of risk ranking from near zero to high/medium was established. Potentially moderate and high risks require quantification and consideration prior to development. The site investigation objectives described above should represent part of a detailed main stage investigation that should include overall characterisation of the ground in association with obtaining and analysing the information described above.

5.8 Geotechnical Hazards Associated with the Development

5.8.1 In addition to the environmental hazards, there are also potential geotechnical hazards associated with the stability of the ground (including load bearing capacity, slope stability etc.). Local Authorities follow NPPF (2012) which requires that "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." A summary of the geotechnical considerations is provided below:

Table 8: Summary of Geotechnical Hazards

Geohazards:	
Highly Compressible Ground	Northern part of the site – soft Alluvium of thickness more than 2.0m Southern part of the site – low strength soils are not anticipated (other than within about 0.6 m of the ground surface).
Collapsible Soils	Yes
Swelling Clay	Yes – Anticipate medium volume change potential clay present
Running Sand	Low
Ground Dissolution	No
Landslip	No
Mining & Quarrying	There is no evidence of mining or mineral extraction or quarrying at the site (see Section 3.3).
Geotechnical Design Considerations	
Site Clearance	Limited site clearance required at the site from the allotments. All green waste and deleterious material to be removed from site
Trees	Trees present on site. Check whether there are any Tree Preservation Orders. Foundation design to take into account trees and hedgerow.
Existing Obstructions	No below ground obstructions expected but note presence of services.
Foundations	Northern part of site - anticipate deep foundations will be appropriate (vibro (stone) columns or piles. Southern part of site - anticipate that shallow spread foundations will be suitable at this site designed following NHBC guidance to take into account of the presence of the trees and hedges.
Floor Slabs	Suspended floor slabs envisaged. Raft to proposed conservatory.
Groundwater	Groundwater not encountered in previous ground investigation (max depth 5m)
Earthworks	Possible bulk earthworks will be required to raise part of the northern area of the site above flood plain.
Slopes	Slope stability considered to be a negligible risk
Retaining Walls	Not considered to be relevant to the proposed development
Chemically aggressive ground conditions	Possibility for low pH and high sulphate concentrations which could be detrimental to below ground concrete.

6. INVESTIGATION METHODOLOGY

6.1 Investigation Strategy

6.1.1 The ground investigation strategy required exploratory holes to be carried out a across the site to allow appropriate site characterisation and to obtain environmental and geotechnical samples for analysis. The investigation comprised:

- Twenty trial pits (TP1 to TP20), 18 machine dug, 2 hand dug, including shear vane tests undertaken over various depths in selected locations.
- Four dynamic (window) sample boreholes were carried out in the northern half of the site (WS1 to WS4) including Standard Penetration Tests (SPTs), as well as environmental and geotechnical sampling. All boreholes were completed with monitoring wells.
- Two Dynamic Probing Tests (DPTs) took place next to WS1 and WS4 to a depth of 5 m.

6.1.2 The locations of the site investigation holes are presented in Drawing 1906/1/001.

6.1.3 The trial pits were carried out with the overall aims indicated below:

- To achieve appropriate ground characterisation across the site through excavation logs;
- To provide general ground conditions through geo-chemical and geotechnical laboratory testing of various deposits; and
- Delineate the extent of the Alluvial deposits within the north of the site.

6.1.4 The dynamic (window) sample holes were carried out with the overall aims indicated below:

- To install four groundwater monitoring wells to enable monitoring of groundwater levels and for taking groundwater samples, the secondary purpose of these wells is to enable confirmation of the ground gas conditions with the anticipated low ability of the ground in the north of the site to produce ground gas;
- In-situ monitoring of permanent ground gases at the site in order to conduct a Generic Quantitative Risk Assessment (GQRA) in accordance with CIRIA C665 and BS8576;
- To provide in-site geotechnical information on the propertied of the natural (drift) deposits to enable an assessment of the load bearing capacity of the ground for the proposed development;
- To provide general ground conditions through geo-chemical and geotechnical laboratory testing of various deposits; and

- To achieve appropriate ground characterisation across the site through exploratory hole logs.

6.1.5 The dynamic probing tests were undertaken to determine the geotechnical properties of the soils and delineate soil stratigraphy.

6.2 Chemical and Geotechnical Testing Strategy

6.2.1 The chemical testing strategy for soils was designed to be sufficiently broad to enable the identification of potentially elevated contaminants. Site specific analytical suites were chosen for soil analysis based upon identified potential contaminant sources.

6.2.2 Groundwater samples were collected after allowing groundwater monitoring wells to equilibrate for approximately one week wells to allow characterisation of groundwater and quantification of contaminants.

6.2.3 Geotechnical sampling and testing was designed to enable the classification of each of the units load bearing capacity.

6.3 Monitoring Strategy

6.3.1 Monitoring of permanent ground gases and groundwater levels within monitoring wells (WS1 to WS4) will occur over four separate visits over three weeks following the installation of the wells due to the presence of peat found during the intrusive investigation. This strategy is in accordance with BS8576:2013 as the potential source for ground gas is low.

6.3.2 Gas monitoring is involves the measurement of the five ground gas concentrations (CO_2, CH_4, O_2, CO and H_2S) as well as the flow, relative pressure and ambient barometric pressure.

7. FIELDWORK

7.1 General Observations

7.1.1 The fieldwork was carried out between 4th November 2013 (trial pits) and 5th November 2013 (trial pits and window sampling). TerraConsult personnel were present to supervise all work, describe the ground encountered, carry out *in-situ* testing, collect samples for environmental and geo-technical laboratory analysis and decide on the depths and response zones of monitoring wells. A services search was carried out prior to the site work and a CAT scan performed at the location of each exploratory hole location. Fieldwork procedures were undertaken in accordance with the relevant sections of:

- British Drilling Association "Guidance for Safe Intrusive Activities on contaminated or Potentially Contaminated Land" (2008);
- BS EN 1997-2:2007 [Eurocode 7 Part 2];
- BS5930:1999 +A2 (2010) "Code of Practice for Site Investigations;"
- BS10175:2011 "Investigation of potentially contaminated sites – Code of practice".

7.1.2 The investigation comprised the following fieldwork scope:

- twenty trial pits, 18 using a JCB 3CX hydraulic excavator, 2 by hand;
- four dynamic (window) sample holes with plastic liners;
- installation of four combined ground gas and groundwater monitoring wells (all 52 mm internal diameter HDPE with slotted sections having a 250 µm geotextile filter wrap);
- two dynamic probe profiles;
- sampling and laboratory analysis of soils and groundwaters for environmental and geotechnical parameters;
- description of the ground encountered in accordance with BS5930:1999+A2 (2010) "Code of Practice for Site Investigations;"
- gas and groundwater monitoring.

7.2 Trial Pits

7.2.1 Fourteen trial pits were excavated using a tracked JCB 3CX excavator, where access permitted, across the site to depths of between 1.90 m (TP9) and 3.80 m bgl (TP4). Six trial pits were hand excavated to 0.10 to 1.00 m bgl (TP13 to TP16 plus TP18 and TP19), in the allotments area in the north east of the site where access was limited. Hand shear vane tests were carried out in cohesive strata in each trial pit.

7.2.2 None of the excavation reached bedrock. There was an influx of water which occurred in granular strata within the base of a number of trial pits and this made the trial pits unstable and they were abandoned at the depths recorded within the logs.

7.2.3 For more detail the trial pits logs are included as Appendix E and photographs are included within Appendix C.

7.3 Dynamic (Window) Sample Boreholes

7.3.1 Four dynamic sampling boreholes (WS1 to WS4) were carried out using a tracked 'Terrier' rig. These boreholes were progressed in the northern area of the site to depths of between 3.05 m bgl (WS4) to 4.45 m bgl (WS2-3) in the majority of holes.

7.3.2 Dynamic sample boreholes WS1 and WS4 were abandoned at 3.43 m bgl and 3.05 m bgl respectively, due to very dense granular strata being encountered preventing further penetration.

7.3.3 Dynamic sample borehole WS2 encountered significant collapse due to sand deposits collapsing into the borehole. This caused difficulty in determining exact geology below 3.00 m. The monitoring well installation only has a response zone of 1.00 m bgl to a depth of 1.80 m due to collapse during installation.

7.3.4 Standard Penetration Tests (SPTs) were carried out in all four of the dynamic sample holes at 1 m centres in general accordance with BS EN ISO 22476-3:2005.

7.3.5 The monitoring wells were installed with 52 mm internal diameter HDPE pipe, the first metre below ground level being plain and completing the remaining length of the borehole with slotted pipe. They were completed with gas tap and a flush cover fixed with ready mixed concrete.

7.3.6 Groundwater was immediately encountered in all of the monitoring wells to the following depths:

- WS1 – 1.5 m bgl
- WS2 – 1.2 m bgl
- WS3 – 2.7 m bgl
- WS4 – 1.4 m bgl

7.3.7 The dynamic sample logs are presented in Appendix E.

7.4 Dynamic Probing

7.4.1 Two dynamic probes were completed adjacent to dynamic (window) sample holes WS1 and WS4 where they were abandoned due to obstructions. Both tests were completed to a depth of 5.00 m bgl with no refusals.

7.4.2 The probes were undertaken with a super heavy probe designation in accordance with BS EN ISO 22476-2: 2005. The logs are recorded in Appendix E.

7.5 Samples and Sample Containers

Soil Samples

7.5.1 Each soil sample for geochemical laboratory testing comprised of a plastic tubs for inorganic analysis including asbestos and an amber glass jar for organic analysis.

7.5.2 Each soil sample for geotechnical laboratory testing comprised of either a single plastic tub or a bulk bag dependent on the type of analysis being undertaken.

7.5.3 Soil samples intended for geo-chemical analysis were stored in a cool box containing ice packs to keep as cool as reasonably practicable and bubble wrap to avoid breakages. Samples were couriered directly to the testing laboratory.

Groundwater Samples

7.5.4 Groundwater samples were taken for geochemical testing; each set comprised of a 1 litre plastic bottle for inorganic analysis, 1 litre amber glass bottle for organic analysis and two 60 millilitre glass veils for volatile organic compound (VOC) analysis.

7.5.5 Groundwater samples were stored in a cool box containing ice packs to keep as cool as reasonably practicable and bubble wrap to avoid breakages, the glass vials were stored in a tub as an additional precaution. Samples were couriered directly to the testing laboratory.

7.5.6 Prior to taking any water samples, the wells were developed and approximately three well volumes of water were purged using dedicated disposable bailers. If recharge was relatively slow and not sufficient to allow a purged sample from being taken then a sample was taken of the water during the purging and the volume of purged water was noted.

7.6 Monitoring

7.6.1 After completion of the fieldwork four visits were made to the site over three weeks to carry out monitoring of groundwater levels. As part of the monitoring visits the ground gas concentrations were also measured in order to confirm (or disprove) the conceptual ground gas model which has assessed the site as being ground gas Characteristic Situation 1. Ground gas monitoring was carried out in accordance with BS8576:2013. A GasData GFM435 was used to measure gas flow rate, methane, carbon dioxide, oxygen, carbon monoxide and hydrogen sulphide.

7.6.2 The results of this monitoring are presented in Appendix F. It should be noted that no free phase hydrocarbons were encountered in any of the monitoring wells.

7.7 Topographical Survey

7.7.1 A topographic survey was complete prior to TerraConsult's investigation and was supplied by the client. TerraConsult levelled the hole locations.

8. LABORATORY TESTING

8.1 Chemical Laboratory Testing

8.1.1 The samples were submitted to QTS Environmental of Lenham in Kent for soil samples and Scientific Analytical Laboratories Ltd (SAL) in Manchester for water analysis. Both laboratories are UKAS accredited in accordance with ISO17025 and are also MCERTS accredited for soil and water analysis respectively in accordance with the Environment Agency's scheme. The laboratories carry out Quality Assurance and Quality Control in accordance with BS ISO 17025 and participate in external laboratory comparison and quality control schemes. Details of the accreditation and the methods of analysis are provided on the relevant test reports in Appendix G.

8.1.2 The selection of samples for laboratory testing and analytes to be determined were made based on the Phase 1 assessment, the excavation records and other observations during the investigations. The sample selection rational was as follows:

- to gain a good coverage across the site and of the various material types and strata encountered;
- to characterise samples which had visual or olfactory evidence of contamination;
- targeting specific areas which have been identified as being a potential source of contaminated based upon historical land end use;
- to characterise the groundwater.

8.1.3 The selected soil and groundwater samples were tested for a range of typical contamination indicators including specific tests for contaminants suspected as being present from the desk study and from observations made on site. Tests were also performed which were used to support the modelling of contaminant transport and impacts (e.g. TOC).

8.1.4 Each of the soil samples were analysed for the 'total' concentration of a suite of potential contaminants. No leachate tests were undertaken as there were not significant 'total' concentrations found in the soil samples to suggest a substantial source of leachable contaminants.

8.1.5 The various suites of analysis for the soil, leachate and water were as follows:

Table 9: Suites of Analysis for Soil and Water Samples			
Determinand	**Soil Suite 1**	**Soil Suite 2**	**Water Suite**
Anticipated Number of Samples (including topsoil)	7	3	4
Index Tests			
Asbestos Screen		**	
pH	✓	✓	✓
Electrical Conductivity	-	-	
Metals			
As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn	✓	✓	✓
Inorganics			
Ammonium	-	✓	✓
Cyanide - Total	✓	✓	✓
Chloride (2:1 extract on soil samples)	✓	✓	✓
Sulphate (2:1 extract on soil samples)	✓	✓	✓
Organics			
Phenols - Total (monohydric)	✓	✓	✓
Total Organic Carbon (TOC)	-	✓	✓
PAH (Speciated USEPA 16)	✓	✓	✓
TPH (C_8 to C_{36})	✓	✓	✓
TPH (C_8 to C_{36}) TPH CWG (RBCA) Speciation	-	✓	✓
Mineral Oil (C_{10} to C_{40})	-	✓	✓
Benzene, Toluene, Ethyl Benzene, Xylenes (BTEX);	-	✓	✓
NOTE ✓ = Test carried out on all samples **= Test required on selected samples only 2. All soil samples to be tested and reported in accordance with EA MCERTS for Soils Scheme 3. In addition to the above, one sample was also tested for the presence of Asbestos fibres.			

8.2 Geotechnical Laboratory Testing

8.2.1 Samples were submitted to Professional Soils Laboratories Limited in Doncaster who are UKAS accredited in accordance with ISO17025. The following geotechnical testing was undertaken:

- 6 No. Moisture Content Determinations in accordance with BS1377: Part 2: 1990
- 6 No. Liquid and Plastic Limit Determinations in accordance with BS1377: Part 2: 1990

8.2.2 The results of the geotechnical testing are included in Appendix H.

9. GROUND CONDITIONS

9.1 General

9.1.1 The site investigations have allowed the site specific ground conditions to be described and this information was used to provide an improved conceptual ground model.

9.1.2 The geology encountered during the site investigations was generally consistent with that anticipated from the desk study other than alluvium was also encountered in one trial pit in the southern part of the site. The ground conditions are summarised below.

9.2 Ground Surface

9.2.1 The ground surface of the site was predominately long field grass with immature and mature trees and shrubs at the extremities of the fields.

9.2.2 The allotments are a mixture of grown vegetation and loosely compacted mudstone and sandstone gravel. There were a number of built structures associated with the lands use. In the southern section of the allotments there was demolition rubble from the destruction of earlier allotment structures.

9.2.3 The topsoil was generally about 0.20 m thick across the site but varied from 0.06 to 0.40 m thick.

9.3 Made Ground

9.3.1 Made Ground was only encountered within dynamic (window) sample WS3 located within the allotments to a depth of 0.20 m. The Made Ground was a thin layer sandy Gravel. The gravel is angular to sub-angular, fine to medium of predominately mudstone and sandstone.

9.4 Drift Deposits

9.4.1 In general the near surface ground conditions were in the north Alluvium and in the south Glacial Till but two southerly holes (TP2 & TP4) encountered Alluvium. It should also be noted that TP2 could represent an infilled channel and Alluvial features could cross the southern part of the site. Within the former allotments the majority of the exploratory holes were hand dug trial pits with limited depth of penetration. Additional deeper trial pits are required in this area to confirm ground conditions.

Alluvial Deposits

9.4.2 Alluvium was present in the northern end of site and within TP2 and TP4 in the southern part of the site. This is summarised below.

9.4.3 In the north of the site the Alluvium was more than 4.45 m thick (WS3) with the rest of the exploratory holes in the northern part of the site having 0.90 to 2.90 m of Alluvium.

9.4.4 In TP2 the alluvium was 2.90 m thick with the adjacent TP4 only having 0.40 m of Alluvium indicating that this hole is on the edge of the southern area with Alluvium.

9.4.5 The character of the Alluvium is highly variable, though the unit is predominately a soft or very soft clay. Within the unit there are clays with negligible organic content as well as thin peaty bands and discontinuous lenses of fine to coarse sand and clayey sandy gravels.

9.4.6 One of the dynamic probe tests (WS4) show a gradual increase in strength starting at a depth of approximately 4.60 m bgl, this notably different to the sharp signature of the alluvium which may indicate a change in lithology to the underlying Glacial Deposits.

Glacial Till

9.4.7 The Glacial Till was present in the exploratory holes TP1, TP3, TP4, TP10, TP12-TP14 and TP20. In places it was encountered below the Alluvium and elsewhere it was encountered below the topsoil. Where the Alluvium was relatively thick the Glacial Till was not encountered. The Glacial Till varies in thickness from 0.55 m thick (TP5) to 2.10 m thick (TP10).

9.4.8 The Glacial Till was typically described as firm (locally soft or up to stiff in consistancy) orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse and subangular to subrounded of various lithologies.

Granular Glacial Deposits

9.4.9 The Granular Glacial Deposits appear to have a combination of types, some may be fluvio-glacial in origin (i.e. water lain deposits associated with former glaciers), but most are likely to be Deformation Till. Deformation Till is bedrock that has been broken up and usually not moved a significant distance but often there is also an element of mixing with other glacial deposits. Deformation Till often contains cobbles and boulders. The majority of the Granular Glacial Deposits encountered was the Deformation Till.

9.4.10 Typical descriptions of the Granular Glacial Deposits are:

- Orangish brown very silty fine to medium SAND – Possible Fluvio-glacial Deposits.
- Very clayey fine to coarse SAND and fine to coarse subangular subrounded GRAVEL of various lithologies with a low cobble content – Possible Deformation Till.
- Brown slightly silty sandy fine to coarse (predominantly medium to coarse) subrounded to rounded GRAVEL of various lithologies with a high subrounded cobble and low boulder content. – Possible Deformation Till

9.4.11 The Granular Glacial Deposits were encountered below the Alluvium and the Glacial Till where these overlying strata were fully penetrated. The maximum thickness of Granular Glacial Deposits penetrated was in TP5 with a 2.50 m thickness. At this location the sandy possible fluvio-glacial deposits were present overlying the Deformation Till.

9.5 Solid Geology

9.5.1 Solid geology was not encountered.

9.6 Groundwater

9.6.1 Whilst groundwater was encountered within the base of many trial pits this should not be taken as being representative of the long term groundwater conditions.

9.6.2 The depth to groundwater in the four wells varied from 0.30 to 2.05 m with corresponding reduced levels of 42.08 and 42.83 mOD. Prior to and during the monitoring period there was a period of relatively wet weather. It is anticipated that the

groundwater level will be close to ground level in the wettest periods of the year in the northern part of the site but the groundwater will be at a slightly greater depth in the southern part of the site.

9.6.3 There was no visual or olfactory evidence of contamination of groundwater.

9.7 Surface Water

9.7.1 Surface water was present on the site in the form of a single shallow temporary pond on the north western boundary of the site, assumed to be the result of the slow drainage of recent rain into the underlying ground of low permeability.

10. TIER 2 RISK ASSESSMENT

10.1 Introduction

10.1.1 The assessment of contamination has been carried out in accordance with the overall guidance presented in CLR11 Model Procedures for the Management of Land Contamination using the procedures as indicated in the following sections in accordance with current relevant guidance and legislation.

10.1.2 The aim of this site investigation was to provide geo-chemical and geotechnical information to fulfil planning requirements prior to site redevelopment for residential use.

10.1.3 Where contamination has been observed, potential contaminant linkages have been postulated and require a definitive assessment to confirm an actual contaminant linkage and hence, a requirement for remedial action.

- **Human Health**
  The overall methodology for assessing the risk to human health from potential contaminants in soil is presented in Appendix I in accordance with the guidelines as set out in the Environment Agency's guidance "Using Soil Guideline Values" SC050021/SGV Introduction, March 2009 and using the CLEA 1.06 model software. These have been used for a Tier 2 assessment of soil contamination for the protection of human health. The limited number of SGVs that have been published are for a soil organic matter of 6%. For this site the CLEA 1.06 software has been used to derive generic assessment criteria are for a soil organic matter of 2.5% in accordance with the following:

  - Science Report SC050021/SR2: Human health toxicological assessment of contaminants in soil;
  - Science Report SC050021/SR3: Updated technical background to the CLEA model;
  - Science Report SC050021/SR4: CLEA Software (Version) Handbook;
  - Toxicological reports and SGV technical notes;
  - Toxicological data published by LQM/CIEH (2009) and CL:AIRE/EIC/AGS (2009).

- **Controlled Waters**
  The risk posed to controlled waters from total soil concentrations cannot be directly assessed. The risk is assessed either by comparison of results of leachate tests carried out on soil samples, or from the direct testing of samples of groundwater to screening criteria. Leachate testing generally forms a conservative assessment and is not appropriate for organic contaminants. Further details of the Tier 1 methodology is presented in Appendix L. There is a hierarchy of screening criteria which is as follows:

  - Updated Recommendations on Environmental Technical Standards, River Basin Management (2015-21), April 2012 by the UK Technical Advisory Group on the Water Framework Directive;
  - Environmental Quality Standards (EQS) for freshwaters;
  - Surface Waters (Abstraction for Drinking Water)(Classification) Regulations (1996)
  - Surface Waters (Fishlife) (Classification) Regulations (1997)
  - UK Drinking Water Standards (DWS) (Water Supply (Water Quality) Regulations 2000);
  - World Health Organisation Guidelines for Drinking Water (2004)

- **Phytotoxic Risks**
  Generic assessment of phytotoxicity is by comparison with guideline values presented in the MAFF document "Code of Good agricultural practice for the protection of soil", October 1998. This is in accordance with CLR's reference to DEFRA notice CLAN 4/04.

- **Chemical attack on buildings**
  Generic assessment of the chemical attack on building materials has been assessed using guidance presented in the BRE Special Digest 1: "Concrete in aggressive ground" 2005.

- **Tier 2 Ground Gas Assessment**
  Concentrations and flow rates of ground gases (and vapours) have been assessed in accordance with the guidance given in CIRIA C665 "Assessing risks posed by hazardous gases to buildings" and BS:8485:2007 "Code of practice for the characterization and remediation from ground gas in affected developments". The assessment follows the BS8485:2007 gas characterisation system and the NHBC traffic light system in CIRIA C665.Other gases may need to be assessed on a site specific basis (e.g. hydrogen sulphide, carbon monoxide). The risk due to radon has already been assessed (see Section 3.2) and this assessment indicates that no special precautions are required due to the potential risk from radon.

10.2 Assessment for the Protection of Human Health

10.2.1 The Generic Qualitative Risk Assessment (GQRA) based on a soil with a Soil Organic Matter of 1 % was carried in accordance with the methodology for assessing soil samples

set out in Appendix I based on a residential end use. A full summary of the chemical test results is presented in Appendix J. Exceedence of applicable Generic Assessment Criteria (GAC) threshold concentrations are indicated in yellow (note that the results highlighted in orange do not pose a risk to health bur relate to concrete design). Discussions on the various exceedences are presented below.

Metals

10.2.2 All samples tested were below the GAC for residential use with vegetable uptake.

PAHs

10.2.3 All samples tested were below the GAC for residential use with vegetable uptake.

Hydrocarbons

10.2.4 All samples tested were below the GAC for residential use with vegetable uptake.

Asbestos

10.2.5 Asbestos can be present in soil as fragments of bulk Asbestos Containing Materials (ACMs) (e.g. asbestos cement sheeting) and also as discrete asbestos fibres within the soil matrix. This investigation has carried out assessments to determine whether both bulk fragments of asbestos and discrete fibres are present in the soil at the site. The asbestos assessment commenced on site with inspection of the Made Ground by our site staff for the presence of bulk ACMs. During the fieldwork no suspected ACMs were identified.

10.2.6 Two different types of laboratory assessments were carried out in order to confirm the site assessment that ACMs were absent:

- 1 sample underwent laboratory assessment to confirm that bulk ACMs are absent.
- 1 soil sample was sent for full asbestos quantification and composition analysis. This assessment confirms whether fibres of asbestos are present and identifies the type of asbestos (by polarised light microscopy). No asbestos fibres were found in any of the samples (note that the laboratory detection limit for these samples is 0.001%).

10.2.7 Both types of laboratory analysis confirmed that asbestos was not present in the tested soil sample.

Risks to Human Health (Construction Phase)

10.2.8 During the construction works there will be a risk from dust to on site workers and people occupying adjacent properties although the contaminant concentrations are below the GACs as well as causing a statutory nuisance. Appropriate risk assessments should be carried out by the contractor to allow appropriate controls for the mitigation of risk to health of construction workers to be put in place. This risk can be controlled to within acceptable limits by:

- control of dust generation (see below);

- workers wear suitable Personal Protective Equipment (PPE);
- having adequate site hygiene facilities allowing staff to keep a good level of personal hygiene;
- only permitting smoking or eating on site in appropriate pre-designated areas.

10.2.9 Given the proximity of the River Calder to the northeast of the site, commercial, residential and industrial receptors both to the south and west as well as the construction workers on site, control of fugitive dust will be a priority. As a minimum it is anticipated the works will be undertaken in accordance with BRE best practise guidance and that the following measures will be introduced to assist with control of dust generation:

- access roads and stockpiles should be regularly damped down with water;
- vehicles used to transport materials and aggregates should be enclosed or tarpaulined;
- local roads should be regularly cleaned;
- vehicle movements and speed should be kept to a minimum within the site ;
- minimising drop heights of all loading and unloading activities that involve the transfer of soils and demolition materials.

10.2.10 Based on the recorded ground gas conditions there should not be a significant risk during the re-development works for personnel entering excavations. Notwithstanding this, entry into all below ground excavations should be carried out in accordance with The Confined Spaces Regulations (1997) and The Management of Health and Safety Regulations (1999).

10.3 Assessment for the Protection of Controlled Waters

10.3.1 The preliminary investigation concluded that the controlled surface waters (River Calder and associated tributaries) approximately 200 m northeast and the groundwater within both Secondary (A) Aquifers (Alluivium drift deposits and the Rad Brook Mudstone Member) are potential receptors. The risk posed by contamination to the underlying Red Brook Mudstone Member is low as it is protected by the overlying low permeable Glacial Till and the depth to the water table within the underlying bedrock is believed to be relatively deep and any unsaturated bedrock will also act as an attenuator to potential contaminants. The fieldwork confirmed that the depth of the perched groundwater within the alluvial deposits was shallow at a depth of less than 1.00 m within three of the monitoring wells and at a depth of 1.75 to 2.00 m in the other well located at a higher elevation.

10.3.2 There was significant influx of groundwater through sand and gravel layers into both the trial pits and dynamic (window) sample boreholes.

10.3.3 The risks to controlled waters have been assessed by carrying out a Tier 1 assessment in accordance with the EA Remedial Targets Methodology.

10.3.4 The only contaminants which exceeded the screening criteria were the PAHs benzo(a)pyrene and benzo(ghi)perylene. Benzo(a)pyrene was detected at a maximum concentration of 0.03 µg/l with two samples having concentrations below the limit of detection (0.01 µg/l). The screening value for benzo(ghi)perylene is 0.002 µg/l, which is less than the limit of detection 0.01 µg/l. Two samples had concentrations above the limit of detection with a maximum concentration of 0.02 µg/l.

10.3.5 The concentration of PAH compounds which exceed the screening value are only marginally over the limit of detection. These concentrations of benzo(a)pyrene and benzo(ghi)perylene are assessed as being of no concern to environmental receptors.

10.3.6 Analysis of TPH has shown all samples shows speciated TPH concentrations below the limit of detection. There is therefore no wider petroleum hydrocarbon risks, and the PAH concentrations are representative of background concentrations.

10.3.7 Concentrations of amminiacal nitrogen are above the screening value whereas concentrations of unionised ammonia are below the screening value. Therefore the ammonia concentrations are slightly elevated which is common in agricultural areas but is not high enough to be of concern to environmental receptors.

10.4 Phytotoxic Risks

10.4.1 Concentrations of the phytotoxic metals zinc, lead and copper in excess of the guideline values for the protection of plants as presented in the MAFF document "Code of Good agricultural practice for the protection of soil" (1998) have been recorded in two samples (TP15 and WS3) taken from the allotments. None of the test results from samples within the main field area exceeded the phytotoxic screening criteria. The results of the phytotoxic screening are presented in the tables below.

Table 10: Phytotoxic Risk of Soils

Determinand	Number of samples	Trigger Value* (mg/kg)	95% Confidence Limit of Concentration (mg/kg)	Exceeds Tier 1 Screening (Y/N)
Copper	10	135	105	N
Chromium	10	400	24.4	N
Nickel	10	110	23.4	N
Zinc	10	300	352.6	Y – 2 No samples
Trigger value from MAFF "Code of Good agricultural practice for the protection of soil" October 1998 for a pH of 7. (note actual results varied from 6.3 to 7.8 with an average of)				

10.4.2 The 95% confident limit of the concentrations indicates that zinc represented on the site as a whole exceeds the guideline values for phytotoxic risk, therefore the topsoil from within the allotments is not suitable for topsoil end use, and will require either removed or replacement with appropriate clean inert materials or provision of a suitable capping system to protect the ecological receptors. The possibility of hazards to local flora and fauna arising from some of the levels of contamination cannot be precluded. Appropriate advice should be sought from the Local Authority Ecological Consultant.

10.5 Chemical Attack on Structures and Materials

10.5.1 Below ground concrete structures are potentially at risk in areas of elevated sulphates and where there is low pH. An assessment of the soil and groundwater data (following the protocol established in BRE Special Digest 1, 2005) indicates that the Design Sulphate (DS) and Aggressive Chemical Environmental for Concrete (AC) class for the entire site is DS-1 AC-1. Therefore no special precautions are required at the site for the design of concrete in terms of the durability and structural performance.

10.5.2 Gross hydrocarbon contamination can also have an adverse impact on the setting of concrete, which may affect foundation construction and piling. Based on the measured concentrations of hydrocarbons at the site there is no risk of these affecting the setting of concrete.

10.5.3 Plastic pipe materials are also potentially vulnerable to attack from elevated levels of hydrocarbons, which can potentially lead to contamination of potable water supplies and water supply companies also require the risk to their workers from other contaminants in the ground to be assessed. The water supply companies have their own screening criteria and these criteria are generally lower than the SGVs and GACs used in this report to assess the risk to residents/end users of the site. However, based on the chemical test results, it is anticipated that no special precautions are required for the design and installation of water supply pipes due to hydrocarbons and other potential contaminants.

10.6 Ground Gases

Measured Gas Concentrations

10.6.1 The Conceptual Site Model indicated that Characteristic Situation 1 ground gas conditions were to be anticipated so no ground gas investigation was required. There were thin bands of peat present locally in the Alluvium but this only presented a relatively small proportion of the stratum so it is unlikely to be a significant source of permanent ground gases. However, four wells were installed in order to assess the groundwater levels and quality at the northern (down-gradient) end of the site. These wells were monitored on four occasions for groundwater levels with ground gas monitoring carried out at the same time to confirm that the alluvium was not producing significant quantities of ground gas. Note that where the preliminary risk assessment indicates that Characteristic Situation 1 ground gas conditions are expected, there is no requirement for ground gas monitoring. This ground gas monitoring was only carried out to confirm that Characteristic Situation 1 ground gas conditions were present at the site and it was assessed that four rounds of gas monitoring in one month was sufficient.

10.6.2 Monitoring was carried out with atmospheric conditions varying from 996 to 1028 mbar during November 2013. One of the monitoring visits were carried out with atmospheric pressures less than 1000 mbar (pressure 996 mbar) with the other three sets of readings were all taken with air pressured greater than 1000 mbar. The highest flow rates, methane and carbon dioxide concentrations, together with the lowest oxygen levels (i.e. a combination of the worst case temporal conditions recorded) from the monitoring visits are summarised in the table below:

Table 11 : Summary of Ground Gas Monitoring											
Borehole	Response Zone mbgl	Contamination evidence	No. of monitoring occasions	Methane (%v/v)	Carbon Dioxide (%v/v)	Oxygen (% v/v)	Carbon Monoxide (ppm)	Hydrogen sulphide (ppm)	Flow (l/hr)	Water Level (mOD)	Atmospheric pressure readings mb
WS1	1.00-2.95m	No	4	<0.1	1.9-3.1	18.0-19.5	<1-2	<1	<0.1	42.45-42.13	996-1028
WS2	1.00-1.80m	No	4	-2.5'	0.9-2.3	16.4-19.8	<1-1	<1	<0.1--4.5	42.59-42.26	996-1027
WS3	1.00-3.50m	No	4	<0.1	2.9-4.1	14.5-17.0	<1-1	<1	<0.1	42..38 -42.08	996-1028
WS4	1.00-3.00m	No	4	<0.1	0.7-4.2	17.1-20.0	<1-1	<1	<0.1	42.83-42.57	996-1028

Ground Gas Assessment

10.6.3 Background information relating to the origin and production of landfill and ground gases are presented in Appendix M, together with current guidance on the assessment of ground gases. In accordance with this approach and the above measured ground gas levels, it is considered that the worst case temporal conditions may not have been measured during the monitoring period. However, as gas concentrations were measured at atmospheric pressures of 996 mbar, it is anticipated that the worst case temporal conditions will not be significantly worse than those presented in Table 11 above. The gas flow rates measured across the whole of the site at all of the monitoring visits were less than the instrument detection limit of 0.1 l/hr other than an initial release of pressure typically by the draw down in of air. From Table 8.5 of CIRIA C665 the worst case Characteristic Situation for the northern area of the site are as follows:

Table 12: Characteristic Gas Situations							
Borehole Number	Flow	CH_4			CO_2		
	l/h	% v/v	GSV (l/hr)	Characteristic Situation	% v/v	GSV (l/hr)	Characteristic Situation
WS1	<0.1	<0.1	0.0001	1	3.1	0.0031	1
WS2	-2.5	<0.1	0.0025	1	2.3	0.0575	1
WS3	<0.1	<0.1	0.0001	1	4.1	0.0041	1
WS4	<0.1	<0.1	0.0001	1	4.2	0.0042	1

10.6.4 Based on the Ground Gas Assessment it can be seen that the carbon dioxide conditions at the site are the main risk driver regarding the gas conditions. The gas screening values (GSV) calculated suggests a Characteristic Situation of 1 and therefore no gas measures are needed for the site.

Radon Assessment

10.6.5 Note that it as been determined that no protective measures are required, based on Maps in Annex A of Buildings Research Establishment, 2007, BR211 'Radon: Guidance on protective measures for New Buildings'.

10.7 Summary of Contaminant Linkage Assessment

10.7.1 The results of the risk assessments indicate that there is no significant source of contaminants present at the site so there is a negligible risk to humans, ecology or archaeological receptors. No asbestos containing materials or discrete asbestos fibres were identified during the investigation. No specific precautions are required with respect to landfill type ground gases and hydrocarbons for the development. Protection measures will be required due to the potential risk from radon. All below ground concrete should be designed to meet the requirements of ACEC Class AC-1. There is no significant risk to controlled waters at the site. However, elevated levels of PAHs were encountered in groundwater but the concentrations are marginally elevated and are not considered to be a risk to controlled waters receptors.

11. WASTE ASSESSMENT

11.1 The results of the total concentrations form the chemical testing on soil samples have been assessed to determine their potential waste classifications in accordance with the methodology outlined in Appendix N. The samples were first assessed to determine whether they are non-hazardous or are hazardous in terms of waste classification. The results of this assessment indicate all of the materials encountered during the investigation can be classified as non-hazardous. If there is any excess natural soil at the site which is to be sent for disposal at a landfill then this will all be classified as Inert Waste.

11.2 In order to determine whether the Made Ground at the site can be sent to a licensed landfill for disposal, further testing is required comprising landfill Waste Acceptance Criteria (WAC) analysis for both total concentrations for certain chemicals and for leachate analysis. No WAC testing was carried out as part of this investigation. Should it be proposed to dispose any excess soil at a landfill site then WAC testing will have to be carried out to confirm the landfill waste classification and if any pre-treatment is required.

11.3 There are also set requirements for the required sampling and testing frequencies for materials being sent for disposal at landfills. The required testing frequencies for each different waste type are summarised in Table 13 below.

Table 13: Laboratory Sampling Testing Frequencies for a Single Waste Type			
Testing Level	**Quantity of Waste**	**Number of Samples**	
		Homogeneous	**Heterogeneous & New Wastes**
Level 1 Characterisation (Description, Total Concentrations & Leaching)	<100T	2	5
	<500T	3	8
	<1000T	5	14
	10,000 T	11	22
	Per additional 10,000T	+5 pro rata	+10 pro rata
Level 2 Compliance For Regularly Generated Wastes (Total Concentrations & Leaching)		1 per defined waste sub-population per year	3 per defined waste sub-population per year
Level 3 Verification		Visual – Each Load	Visual – Each Load
Delivery document & visual check Chemical testing as per Level 2 suite		1 per year per waste stream	3 per year per waste stream

12. GEOTECHNICAL ASSESSMENT & RECOMMENDATIONS

12.1 Fieldwork and Laboratory Data Review

12.1.1 Made Ground was only encountered in the allotment area in WS3 and was only 0.30 m thick. A number of other areas within the Allotments were observed to have thin Made Ground of similar nature to that encountered in WS3. Due to the Made Ground only locally being present and that it is relatively thin it will not be considered further as it is not a suitable formation for foundations.

12.1.2 In general the near surface ground conditions were in the north Alluvium and in the south Glacial Till but two southerly holes (TP2 & TP4) also encountered Alluvium. It should also be noted that TP2 could represent an infilled channel and Alluvial features could cross the southern part of the site. Within the former allotments the majority of the exploratory holes were hand dug trial pits with limited depth of penetration. Additional deeper trial pits are required in this area to confirm ground conditions and to define the area with Alluvium around TP2.

12.1.3 The Granular Glacial Deposits below the Alluvium and the Glacial Till will be suitable for the end bearing of deep foundations.

12.1.4 Due to the presence of clays and a range of trees present, the depth of desiccation and the volume change potential of the clays will have to be considered in the design. The classification test results on the clay strata are summarised below:

Table 14: Summary of Geotechnical Laboratory Classification Testing										
Hole	**Depth (m)**	**Moisture Content (%)**	**% passing 425um sieve**	**Liquid Limit (%)**	**Plastic Limit (%)**	**Plasticity Index**	**Modified Plasticity Index**	**Plasticity**	**Volume Change Potential**	**Liquidity Index**
Alluvium										
TP2	2.00	26	100	47	20	27	27	Inter-mediate	Medium	0.22
TP7	1.20	45	100	62	27	35	35	High	Medium	0.51
TP17	1.50	28	95	61	29	32	30.4	High	Medium	-0.03
Minimum		**26**	**95**	**47**	**20**	**27**	**27**	**Inter-mediate**	**Medium**	**-0.03**
Average		**33**	**98.3**	**56.7**	**25.3**	**31.3**	**30.8**	**High**	**Medium**	**0.23**
Maximum		**45**	**100**	**62**	**29**	**35**	**35**	**High**	**Medium**	**0.45**
Glacial Till										
TP3	1.20	21	90	33	18	15	13.5	Low	Low	0.09
TP4	1.40	19	88	32	17	15	13.2	Low	Low	0.06
TP10	0.80	12	100	29	14	15	15	Low	Low	-0.07
Minimum		**12**	**88**	**29**	**14**	**15**	**13.2**	**Low**	**Low**	**-0.07**
Average		**17.3**	**92.7**	**28.3**	**16.3**	**15**	**13.9**	**Low**	**Low**	**0.07**
Maximum		**21**	**100**	**33**	**18**	**15**	**15**	**Low**	**Low**	**0.09**

12.1.5 Overall the Alluvium is a high plasticity clay with a medium volume change potential and the Glacial Till is a low plasticity clay with a low volume change potential. The Glacial Till has a much lower moisture content than the alluvium so it will have a higher strength and a lower compressibility.

12.1.6 The Alluvium will be relatively compressible and the relatively low shear strengths would result in low net allowable bearing pressures being applicable to this stratum.

12.1.7 Table 15 over page summarises the results of in situ hand vane tests in both the Alluvium and the Glacial Till. The mean shear strength of the Alluvium is 65 kPa and for the Glacial Till it is 101 kPa.

Table 15: Summary of Hand Shear Vane Strength Tests				
Trial Pit	Depth (m)	Stratum	Hand Shear Vane Strength (kPa)	
			Alluvium	Glacial Till
TP1	0.50	Glacial Till		75
TP1	0.75	Glacial Till		105
TP1	1.50	Glacial Till		70
TP2	0.40	Alluvium	70	
TP2	1.00	Alluvium	62	
TP2	2.00	Alluvium	50	
TP3	0.60	Glacial Till		105
TP3	1.20	Glacial Till		120
TP4	0.40	Alluvium	75	
TP4	0.80	Glacial Till		128
TP6	0.40	Alluvium	82	
TP7	0.50	Alluvium	82	
TP7	1.20	Alluvium	50	
TP7	2.20	Alluvium	38	
TP8	0.50	Alluvium	72	
TP8	0.90	Alluvium	85	
TP8	1.50	Alluvium	53	
TP9	0.50	Alluvium	88	
TP9	1.00	Alluvium	82	
TP9	1.50	Alluvium	35	
TP10	0.50	Glacial Till		125
TP10	2.00	Glacial Till		145
TP12	0.50	Glacial Till		105
TP12	1.50	Glacial Till		82
TP13	0.50	Glacial Till		80
TP13	0.90	Glacial Till		88
TP14	0.45	Glacial Till		88
TP15	0.80	Alluvium	58	
		Number of tests	**15**	**13**
		Minimum	**35**	**70**
		Average	**65**	**101**
		Maximum	**88**	**145**

12.1.8 SPT N-values were recorded throughout each borehole and are summarised below. All four boreholes were located in the northern part of the site and none of the boreholes encountered Glacial Till. The SPT N-values were very low in the Alluvium varying from 1 to 6 with a mean of 2.4. The SPT N-values indicate a lower undrained strength for the Alluvium than measured in the hand vane tests indicating undrained shear strengths between 5 and 35 kPa.

Table 16: Summary of SPT Test Results					
Hole No	Depth (m)	Stratum	SPT N-Value		Remarks
			Alluvium	Glacial Deposits	
WS1	1.30	Alluvium	1		
WS1	2.30	Glacial Deposits		16	
WS1	3.30	Glacial Deposits		>50	
WS2	1.30	Alluvium	1		
WS2	2.30	Glacial Deposits		27	
WS2	3.30	Glacial Deposits		~~(2)~~	Possibly affected by piping, ignore
WS2	4.30	Glacial Deposits		20	
WS3	1.30	Alluvium	3		
WS3	2.30	Alluvium	1		
WS3	3.30	Alluvium	2		
WS3	4.30	Alluvium	6		
WS4	1.30	Alluvium	1		
WS4	2.30	Alluvium	4		
WS4	3.30	Glacial Deposits		>50	

12.2 Foundation and Ground Floor Slab Recommendations – Area with Alluvium

12.2.1 The units which his section applies to are indicated on Drawing 1906/1/003 and are units 4, 5, 7, 8, 22 to 26 and 28 to 44.

12.2.2 In theory spread footings could be adopted for the foundations within the area where the alluvium is present but due to the thickness, localised very low to low strength and compressibility it is assessed that spread footings are not suitable in this area

12.2.3 As an alternative to the spread footings, deep foundations including vibro stone columns or piles could be considered. The design of deep foundations would still have to take into account the potential for negative skin friction (down-drag) which occurs when soil consolidates or settles around a piles. It is assessed that precast concrete driven piles are likely to be the most cost effective type of pile for this area. These piles would end bear within the Granular Glacial Deposits. Further site investigation comprising additional deeper boreholes or electric CPT profiles are required in order to complete the design of deep foundations at the site.

12.2.4 It is recommended that suspended floors are adopted for the buildings in this area in order to prevent settlement of the ground below the buildings being an issue.

12.2.5 If the ground surface is to be raised in the northern part of the site a suitable amount of time should be allowed before construction of any houses or roads or pavements in this area. This is because the Alluvium is relatively compressible and there will be significant

settlement even if the ground is raised by relatively small amounts. Sufficient time should be allowed for this settlement to take place prior to construction and at this stage it is recommended that a settlement period of six months should be allowed in any construction programme.

12.3 Foundation and Ground Floor Slab Recommendations – Area with Glacial Till

12.3.1 The units which his section applies to are indicated on Drawing 1906/1/003 and are units 1 to 3, 6, 9 to 21, 27 and 44 to 53.

12.3.2 It is anticipated that spread footings could be adopted for the foundations in this area of the site but the following factors should be taken into account for the design:

- the type and height of trees present at the site and proposals for any new planting, adopt NHBC guidance (2013) based on low volume change potential clay;
- potential for shrinkage of heave on the sides of any footings.

12.3.3 It should be noted that the majority of the properties are located outside the area of influence of any trees which are only located locally around the perimeter of the site and in the area of the allotments. It is recommended that a tree survey is carried out to determine the type and height of trees currently present at the site to enable appropriate design of the foundations in accordance with NHBC guidance (2013). Discussions should also be held with the council's tree preservation officer to determine whether there are any tree preservation orders on the site. Any proposed felling or removal of trees or hedgerows should be agreed with the Local Authority as part of the pre-planning discussions for development and should be carried out outside the bird nesting season (it may be possible that tree felling can be carried out during the bird nesting season under the direction of an ecologist). Care must be taken to ensure that any existing trees scheduled for retention beyond the site boundary are not adversely affected by construction operations. Further guidance on this aspect of site works is given in the British Standards "Guidance for Trees in Relation to Constructions", BS5837.

12.3.4 For low volume change potential soils the minimum foundations depth allowing for restricted new planting is 0.85 m. At a number of locations the ground is relatively low strength at this depth and the depth of footings will more likely to be at a depth of about 1.0 m below current ground level where the footings are located away from the influence of the existing trees.

12.3.5 In order to limit the potential for differential settlement it is recommended that for preliminary design purposes that a net allowable bearing capacity of a deep trench fill type strip footing 900 mm wide at a depth of about 1.0 m (actual depth will vary depending on location/type/height of trees plus any soft strata near the ground surface) in the glacial deposits should be limited to 115 kPa per metre run. This should be sufficient for founding the houses.

12.3.6 Due to the near surface soils locally being of relatively low strength it is recommended that suspended floors are adopted for the houses within this area to prevent settlement of the ground floor. Notwithstanding this heave protection measures may be required for ground floors in a few of the units where they are located close to existing trees which are to be felled. The tree survey is required before this assessment can be made.

12.4 Groundwater and Excavations

12.4.1 The groundwater will be close to the ground surface in the northern part of the site. It is anticipated that any groundwater in excavations can be controlled by sump pumping in the Alluvium and the Glacial Till. Excavations in the Granular Glacial Deposits may require full face sheeting to exclude water in addition to sump pumping.

12.4.2 If inflows into the Alluvium and the Glacial Till are relatively localised, this may cause softening of the ground and require localised excavation support in order to prevent instability of the sides of excavations. Inflows from the Granular Glacial Deposits could lead to loss of fines from the surrounding ground and this will loosen the ground and markedly reduce stability.

12.4.3 Excavations through the soils to a depth of about 2.0m should be stable in the short term (up to 3 to 4 hours). However, it is anticipated that where the granular soils are encountered at depth these will gradually collapse into excavations undercutting the overlying clays, leading to instability of the sides of excavations. All excavations should be carried out in accordance with CIRIA Report 97 "Trenching Practice".

12.4.4 Excavation depths should generally be readily achieved using conventional hydraulic plant (e.g. wheeled JCB or similar) although larger plant (tracked 360° or similar) will have higher excavation rates as these machines will be better suited to handling any boulders that are to be expected in the Granular Glacial Deposits. Due to the presence of boulders and cobbles there will be some over break in excavations in the Granular Glacial Deposits.

12.5 Buried Concrete and Pipework

12.5.1 The results of laboratory pH and sulphate analysis (ten soil samples for contaminant suites, four soil samples for just pH and sulphate and four groundwater samples) all indicate that ACEC Class AC-1s conditions prevail in accordance with BRE Special Digest 1, 2005 (the Design Concrete Class). Therefore no special precautions are required at the site for the design of concrete in terms of the durability and structural performance.

12.5.2 The sub-structure ready mix design designations are as follows:

Table 17: Sub-structure ready mix concrete designations by end use over the whole site:	
Use as substructure and ground floors	**Ready-mixed concrete (designated mix)**
General Use	
Rough blinding (non-structural)	GEN1
Infill	GEN1
Unreinforced oversite concrete below timber floors	GEN1
Structural blinding and overbreak	GEN1
In situ external concrete for drives and paths	PAV1
In situ external concrete foundations for precast concrete paving slabs	GEN1
Fill to wall cavity	GEN1
Solid filling under steps	GEN1
Foundations:	
Strip foundations	GEN1
Trench fill	GEN1
Other mass concrete foundations	GEN1
Reinforced concrete footing	GEN1
Floor Slabs:	
House or garage with reinforced concrete floor slab, either suspended or precast. -	RC35
House with non-reinforced slab (ground bearing) with either: a) Permanent finish to be added, e.g. screed or floating floor. b) No permanent finish to be added, e.g. carpet.	 GEN1 GEN2
Garage with non-reinforced slab (ground bearing)	GEN3
Notes: *1) Sulphate conditions for the majority of the site are ACEC Class DS-1/AC-1s, and Design Chemical Class DC-1.* *2) Classification and designation in accordance with NHBC guidance, Section 2.1 – Table 1, and BS8500-1, 2006.* *3) The above conditions represent the worst case conditions identified within the testing of soils on the site.* *4) Any fill material to be imported onto the site should be tested and should not exceed the classifications given above.*	

12.5.3 Any fill material to be imported onto the site should be tested and should not exceed the classifications given above

12.6 Drainage

12.6.1 The design of drainage and in particular manholes and the connections between them and the drains should take into account settlement within the Alluvium. Where services traverse from the Glacial Till onto the more compressible Alluvium, measures should be adopted to limit settlement problems. Within the Alluvium it is recommended that invert levels for sewers and drains will require increased depths of sub-base materials possibly laid on geotextile type reinforcement (geogrids). The advice contained in Section 5.3 of the NHBC Standards should be followed in this regard. In particular, all pipes should be flexible with flexible and watertight joints. In order to make allowance for future settlement, the design gradients should be steeper than the minimum allowed for the flow rate and pipe size.

Soakways

12.6.2 Due to the nature of the strata at the site and the high groundwater table, soakaways are not considered suitable for the disposal of surface water/storm water.

12.7 Road Design

12.7.1 The consistency of formation materials for the roads will be variable ranging from soft to stiff but will mainly be relatively low. Based upon the nature of the ground conditions encountered during the site investigations undertaken, it is recommended that a lower bound CBR value of less than 2% is adopted for design purposes. If improvement measures such as lime or cement stabilisation were adopted then considerably higher CBR values would be appropriate and this sub-grade improvement may prove to be more economic than using thicker sub-base materials as there will be less excavated material and a thinner sub-base. Consideration should also be made regarding use of geogrids to strengthen the sub-base reducing the thickness of capping required and help reduce differential settlement. All exposed formations should be proof rolled and any soft spots revealed should be excavated and replaced with suitable compacted granular fill. .

12.8 Proposals for Further Geotechnical Investigation

12.8.1 A tree survey is required prior to finalising the foundation and floor slab design. Further trial pitting is recommended in order to better delineate the area where the Alluvium is present. Within the former allotments the majority of the exploratory holes were hand dug trial pits with limited depth of penetration. Additional deeper trial pits are required in this area to confirm ground conditions. Additional deep boreholes or CPTs are required so that the design of piles can be completed.

13. CONCLUSION

13.1 Environmental Risk Assessment

13.1.1 A preliminary risk assessment has been carried out based on the contaminant-pathway-receptor model as defined in Statutory Guidance to Part IIA of the Environment Protection Act, 1990, and in accordance with BS 10175: 2011 "Investigation of Potentially Contaminated Sites – Code of Practice". In order to make a more detailed assessment of the potential hazards, a Phase 2 intrusive investigation was carried out to develop a more comprehensive conceptual ground model of the site. This detailed the characteristic ground conditions and elements of the surrounding environment and has assisted with identifying the potential contaminants of contamination, the potential receptors of the contamination and the potential pathways between them.

13.1.2 The results of the risk assessments indicate that there is no significant source of contaminants present at the site so there is a negligible risk to receptors including humans and controlled waters. There are potential phytotoxic risks in the area of the current allotments and localised replacement of topsoil may be required if this area is utilised for soft landscaping purposes.

13.1.3 The topsoil on the agricultural land is suitable to be used as topsoil across the entire site, however if there is a need for imported topsoil the concentration of contaminants within it should be checked in order to ensure that it is suitable for use on a residential development.

13.1.4 Controlled waters are not at risk as there was no significant source of contamination to pose a risk and therefore no mitigation measures are required on site.

13.1.5 Based on the Ground Gas Assessment it is recommended that no protection measures are needed as the site is classified as Characteristic Situation 1 and the site is within an area where radon protection measures are not required.

13.1.6 Any unexpected visual or olfactory ground contamination should be tested appropriately in accordance assessed risks. Material should be stockpiled if necessary and subsequently disposed or re-used on site as required. Such areas should be marked on a plan and testing results incorporated into the validation report. Material should only be re-used in areas where compliance of the remediation targets is achieved.

13.1.7 No buried underground fuel storage tanks have been encountered during the site investigation works, however, their remains a low risk that tanks are present on site. Should an underground tank be encountered, operations should cease in the area and TerraConsult informed. Degassing and removal of the tank by a suitably qualified contractor will be required, and a Naked Flame Certificate should be provided. Validation testing of remaining soil and water will be supervised by TerraConsult to confirm whether risks to human health remain.

13.2 Geotechnical Design

13.2.1 The geotechnical hazards associated coal mining at the site are negligible and no special precautions are required to be made in relation to the proposed development.

13.2.2 In general the near surface ground conditions were in the north Alluvium and in the south Glacial Till but two southerly holes (TP2 & TP4) also encountered Alluvium. It should also be noted that TP2 could represent an infilled channel and Alluvial features could cross the southern part of the site.

13.2.3 Where there is Alluvium present it is recommended that the housed are founded on piles. The Granular Glacial Deposits below the Alluvium and the Glacial Till will be suitable for the end bearing of deep foundations.

13.2.4 In the area where Alluvium is absent (or thin, less than 1 m thick) then conventional strip footings can be used with the formation being mainly in the Glacial Till (locally in the Granular Glacial Deposits). There are locally trees around the perimeter of the site and in the allotment area. The depth of desiccation and the volume change potential of the clays will have to be considered in the final design of foundations. The classification test results on the Glacial Till indicates that this is a low volume change potential clay.

13.2.5 It is recommended that suspended floors are adopted for the houses.

13.2.6 The design of drainage and in particular manholes and the connections between them and the drains should take into account settlement within the Alluvium. Where services traverse from the Glacial Till onto the more compressible Alluvium, measures should be adopted to limit settlement problems. Within the Alluvium it is recommended that invert levels for sewers and drains will require increased depths of sub-base materials possibly laid on geotextile type reinforcement (geogrids).

13.2.7 The consistency of formation materials for the roads will be variable ranging from soft to stiff but will mainly be relatively low. Based upon the nature of the ground conditions encountered during the site investigations undertaken, it is recommended that a lower bound CBR value of less than 2% is adopted for design purposes. If improvement measures such as lime or cement stabilisation were adopted then considerably higher CBR values would be appropriate and this sub-grade improvement may prove to be more economic than using thicker sub-base materials as there will be less excavated material and a thinner sub-base. Consideration should also be made regarding use of geogrids to strengthen the sub-base reducing the thickness of capping required and help reduce differential settlement

13.2.8 The pH and sulphate content of the soils requires checking with respect to its potential attack of concrete and take appropriate action in terms of specifying a suitable mix in line with Building Research Establishment Special Digest 1 Concrete in Aggressive Ground (2005).

13.3 Recommendations for Further Works

13.3.1 A tree survey is required prior to finalising the foundation and floor slab design. Further trial pitting is recommended in order to better delineate the area where the Alluvium is present. Within the former allotments the majority of the exploratory holes were hand dug trial pits with limited depth of penetration. Additional deeper trial pits are required in this area to confirm ground conditions. Additional deep boreholes or CPTs are required so that the design of piles can be completed.

14.3.2 Any proposals to remediate or develop the site should be agreed with the relevant authorities (e.g. local authority environmental health officer, Environment Agency etc) to obtain Planning Permission prior to commencement of the works and should be agreed with the NHBC or similar, or with the local authority building control officer prior to commencement of the works. Where remediation works are required, a verification report should be submitted to the relevant authorities for approval in accordance with relevant Planning Conditions.

13.4 Health and Safety

13.4.1 As outlined within the HSE publication "Successful Health and Safety Management – HSG65" this report should inform your development of safe systems of work and information as an input into the safety management system. The contents of this report may be used to supplement the contents of the Health and Safety File as required under the Construction Design and Management (CDM) Regulations 2007

13.4.2 When developing risk control systems we suggest making reference to the CIRIA report 132 "A guide for safe working on contaminated sites" and the HSE document "Protection of workers and the general public during the development of contaminated land – HSG66". All risk control measures should be in accordance with the guidelines laid down within the Management of Health and Safety at Work Regulations 1999.

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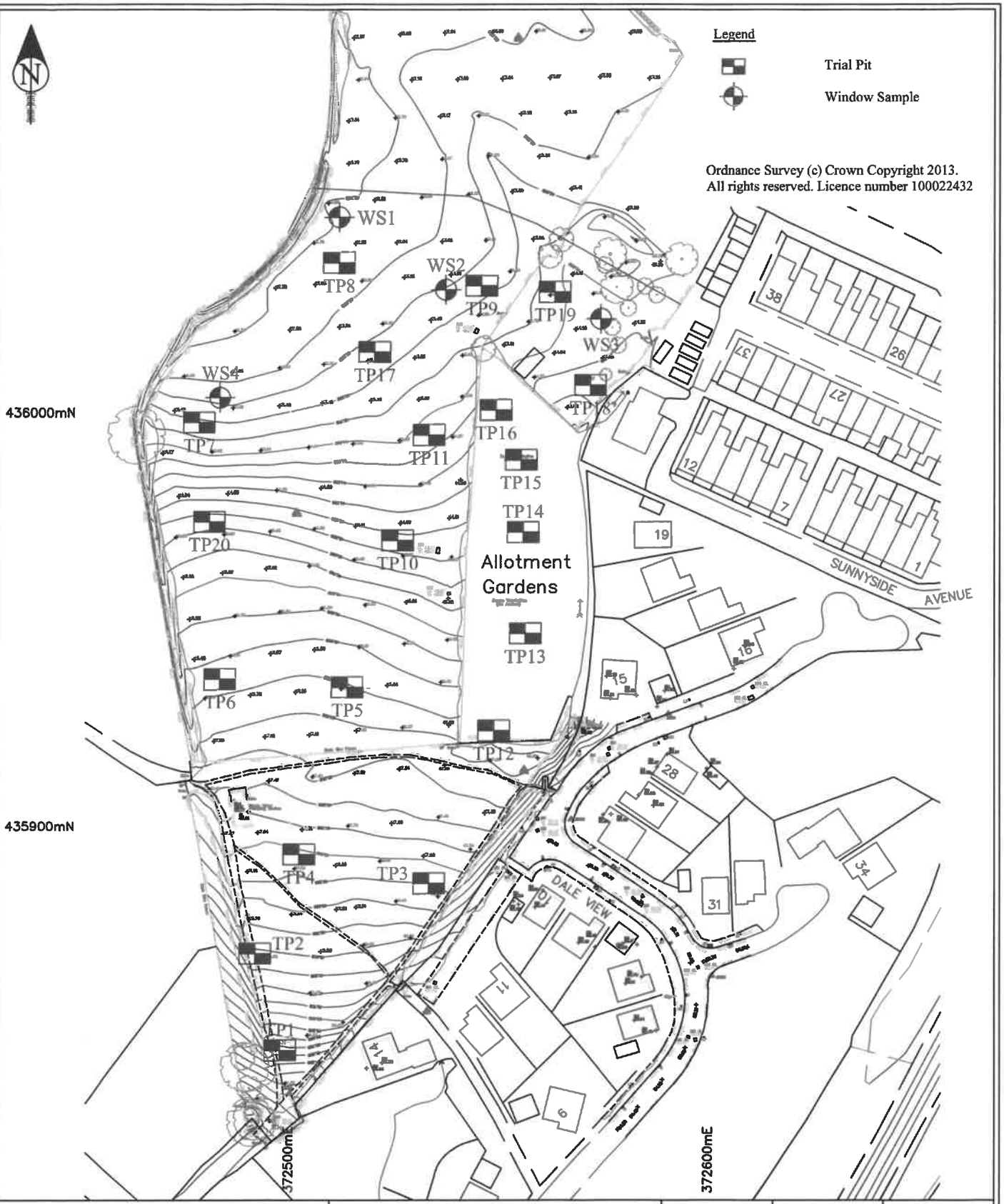
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DRAWINGS

1906/1/001	**Trial Pit and Sample Location Plan**
1906/1/002	**Proposed Development**
1906/1/003	**Preliminary Foundation Types**



TerraConsult

Bold Business Centre, Bold Lane, Sutton, St Helens WA9 4TX

Client

BLOOR HOMES

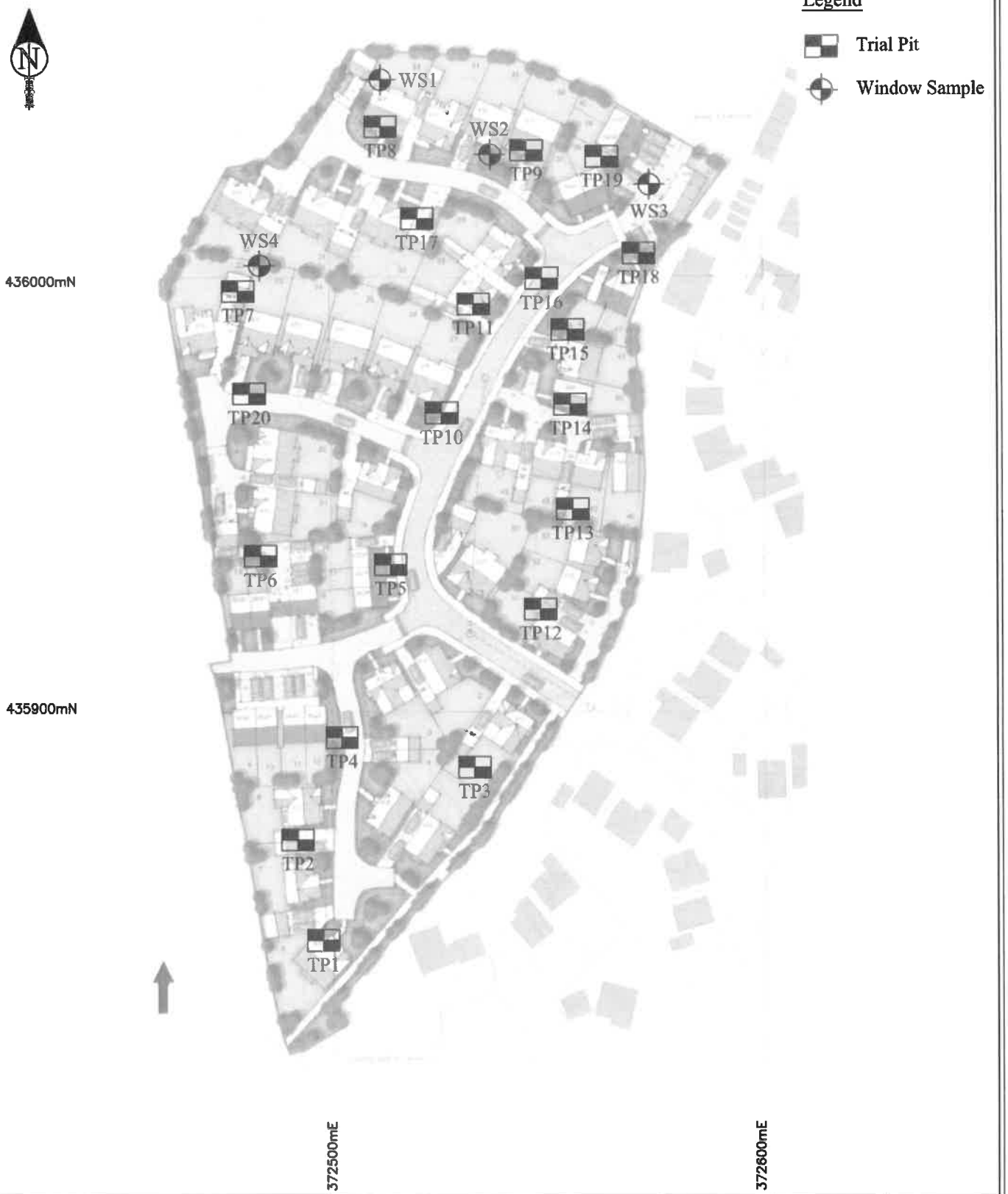
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Dale View, Billington

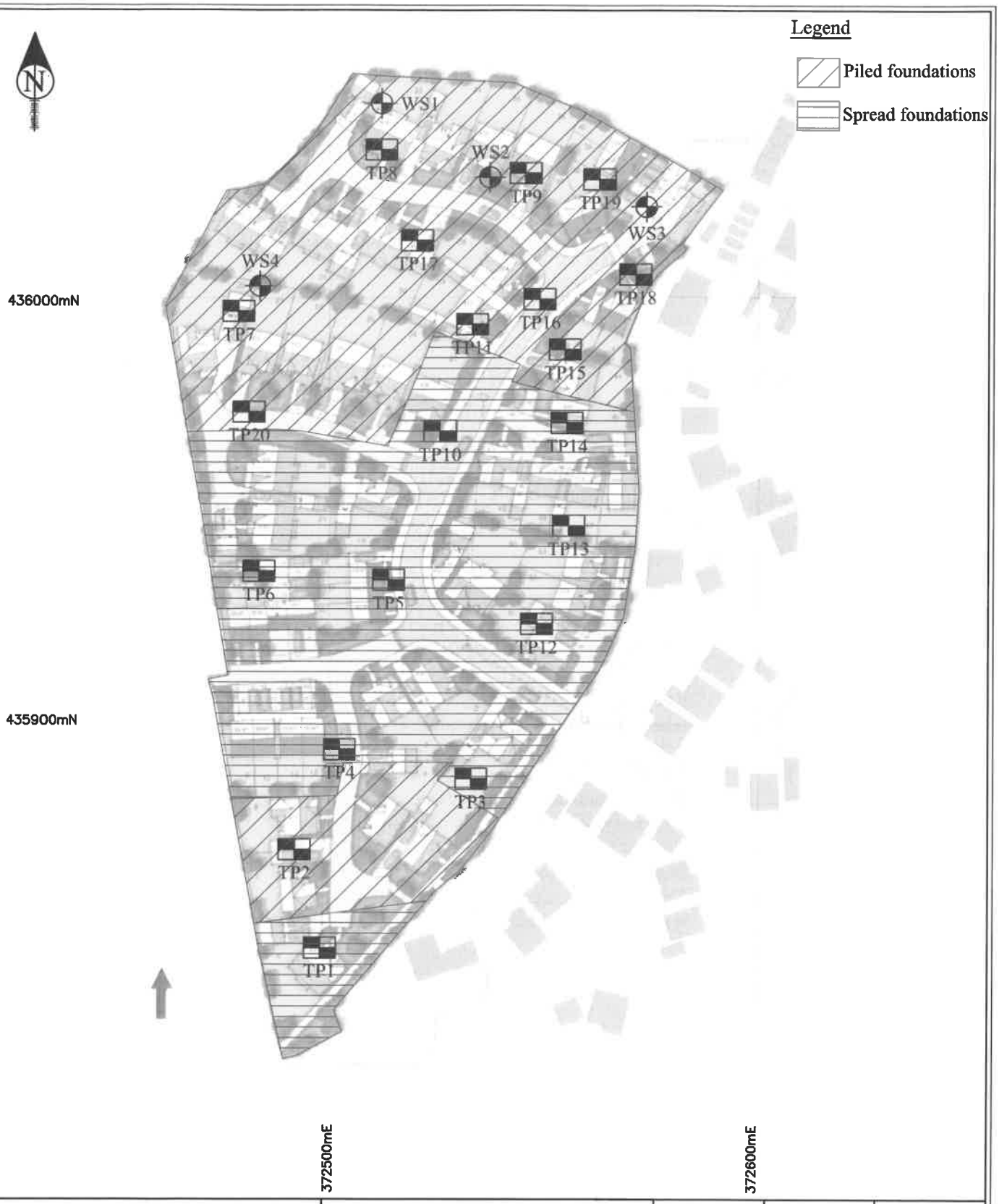
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Trial Pit & Sample Location Plan

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Drawing No.	1906 /1/001		
Rev	Date	Description	
File	19061001tplocs.dwg		
Date	11/13	Engineer	CE
Drawn	LG	Checked	MH



TerraConsult	Site: **Dale View, Billington**	Scale	1:1250 @ A4
Bold Business Centre, Bold Lane, Sutton, St Helens WA9 4TX		Drawing No.	1906/1/002
		Rev / Date / Description	
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		Date 11/13	Engineer CE
		Drawn LG	Checked MH



TerraConsult	Site: **Dale View, Billington**	Scale: 1:1250	@ A4
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Client: BLOOR HOMES	Title: **Preliminary Foundation Types**	Rev / Date / Description:	
		File: 19061003foundtypes.dwg	
		Date: 11/13	Engineer: CE
		Drawn: SK	Checked: MH

APPENDICES

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APPENDIX A

Service Constraints and Report Limitations

Service Constraints and Report Limitations

This report and the site investigation (together comprise the "Services") were compiled and carried out by TerraConsult Limited (TCL) for YY (the "client") in accordance with the terms of a contract between TCL and the "client." The Services were performed by TCL 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 TCL 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 TCL and the client.

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It is TCL'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 TCL 's review and advice shall be at the client's sole and own risk.

The information contained in this report is protected by disclosure under Part 3 of the Environmental Information Regulations 2004 pursuant to the provisions of Regulation 12(5) without the consent in writing of a Director of TerraConsult Limited.

The report was written in November 2013 and should be read in light of any subsequent changes in legislation, statutory requirements and industry practices. Ground conditions can also change over time and further investigations or assessment should be made if there is any significant delay in acting on the findings of this report. 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 TCL. In the absence of such written advice of TCL, reliance on the report in the future shall be at the client's own and sole risk. Should TCL be requested to review the report in the future, TCL shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between TCL and the client.

The observations and conclusions described in this report are based solely upon the Services that were provided pursuant to the agreement between the client and TCL. TCL has not performed any observations, investigations, studies or testing not specifically set out or mentioned within this report. TCL 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, TCL did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, radon gas or other radioactive or hazardous materials.

The Services are based upon TCL's observations of existing physical conditions at the site gained from a walkover survey of the site together with TCL's interpretation of information including

documentation, obtained from third parties and from the client on the history and usage of the site. The findings and recommendations contained in this report are based in part upon information provided by third parties, and whilst TerraConsult Ltd have no reason to doubt the accuracy and that it has been provided in full from those it was requested from, the items relied on have not been verified. No responsibility can be accepted for errors within third party items presented in this report. Further TCL 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. TCL 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 TCL and including the doing of any independent investigation of the information provided to TCL save as otherwise provided in the terms of the contract between the client and TCL.

Where field investigations have been carried out these have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions can also be variable and as investigation excavations only allow examination of the ground at discrete locations. The potential exists for ground conditions to be encountered which are different to those considered in this report. 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 TCL] based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

The groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The normal speed of investigation usually does not permit the recording of an equilibrium water level for any one water strike. Moreover, groundwater levels are subject to seasonal variation or changes in local drainage conditions and higher groundwater levels may occur at other times of the year than were recorded during this investigation.

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.

APPENDIX B

Environmental Risk Assessment Methodology & Terminology

ENVIRONMENTAL RISK ASSESSMENT METHODOLOGY & TERMINOLOGY

Legislation Overview

This report includes hazard identification and environmental risk assessment in line with the risk-based methods referred to in relevant UK legislation and guidance. Government environmental policy is based upon a "suitable for use approach," which is relevant to both the current use of land and also to any proposed future use The contaminated land regime is the statutory regime for remediation of contaminated land that causes an unacceptable level of risk and is set out in Part 2A of the Environmental Protection Act 1990 ("EPA 1990"). The main objective of introducing the Part IIA regime is to provide an improved system for the identification and remediation of land where contamination is causing unacceptable risks to human health or the wider environment given the current use and circumstances of the land. Part IIA provides a statutory definition of contaminated land under Section 78A(2) 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:*
>
> *(a) Significant harm is being caused or there is a significant possibility of such harm being caused;*
>
> *or*
>
> *(b) Pollution of controlled waters is being, or is likely to be, caused."*

In order to assist in establishing if there is a "*significant possibility of significant harm*" there must be a "*contaminant linkage*" for potential harm to exist. That means there must be a source(s) of contamination, sensitive receptors present and a connection or pathway between the two. This combination of contaminant-pathway-receptor is termed a "contaminant linkage or CPR linkage."

Part IIA of The Environmental Protection Act 1990 is supported by a substantial quantity of guidance and other Regulations. Key implementing legislation of the Part 2A regime includes the Contaminated Land (England) Regulations 2006 (SI 2006/1380) as recently amended by the overarching legislation for the contaminated land regime, which implements the provisions of Part IIA of the Environmental Protection Act 1990 (as inserted by section 57 of the Environment Act 1995), came into force on 14th July 2000 together with recent amended regulations: Contaminated Land (England) (Amendment) Regulations 2012 (SI 2012/263). Revised and Contaminated Land Statutory Guidance was published by DEFRA in (DEFRA, April 2012). Part IIA defines the duties of Local Authorities in dealing with it. Part IIA places contaminated land responsibility as a part of planning and redevelopment process rather than Local Authority direct action except in situations of very high pollution risk. In the planning process guidance is provided by National Planning Policy Framework (NPPF) of March 2012 which requires that a site which has been developed shall not be capable of being determined "contaminated land" under Part IIA. In practice, Planning Authorities require sites being developed to have a lower level of risk post development than the higher level of risk that is required in order to determine a site as being contaminated in accordance with Part IIA. This is to ensure that there is a suitable zone of safety below the level for Part IIA determination and prevent recently developed sites becoming reclassified as contaminated land if there are future legislative or technical changes (e.g. a substance is subsequently found to be more toxic than previously assessed this increases its hazard)..

The criteria for assessing levels of contaminants and hence determining whether a site represents a hazard are based on a range of techniques, models and guidance. Within this context it is relevant to note that Government objectives are:

(a) to identify and remove unacceptable risks to human health and the environment;
(b) to seek to bring damaged land back into beneficial use;
(c) to seek to ensure that the cost burdens faced by individuals, companies and society as a whole are proportionate, manageable and economically sustainable.

These three objectives underlie the "suitable for use" approach to remediation of contaminated land. The "suitable for use" approach focuses on the risks caused by land contamination. The approach recognises that the risks presented by any given level of contamination will vary greatly according to the use of the land and a wide range of other factors, such as the underlying geology of the site. Risks therefore should be assessed on a site-by-site basis.

The "suitable for use" approach then consists of three elements:

(a) *ensuring that land is suitable for its current use* - in other words, identifying any land where contamination is causing unacceptable risks to human health and the environment, assessed on the basis of the current use and circumstances of the land, and returning such land to a condition where such risks no longer arise ("remediating" the land); the contaminated land regime provides the regulatory mechanisms to achieve this;

(b) *ensuring that land is made suitable for any new use, as planning permission is given for that new use* - in other words, assessing the potential risks from contamination, on the basis of the proposed future use and circumstances, before official permission is given for the development and, where necessary to avoid unacceptable risks to human health and the environment, remediating the land before the new use commences; this is the role of the town and country planning and building control regimes; and

(c) *limiting requirements for remediation to the work necessary to prevent unacceptable risks to human health or the environment in relation to the current use or future use of the land for which planning permission is being sought* - in other words, recognising that the risks from contaminated land can be satisfactory assessed only in the context of specific uses of the land (whether current or proposed), and that any attempt to guess what might be needed at some time in the future for other uses is likely to result either in premature work (thereby running the risk of distorting social, economic and environmental priorities) or in unnecessary work (thereby wasting resources).

The mere presence of contaminants does not therefore necessarily warrant action, and consideration must be given to the scale of risk involved for the use that the site has, and will have in the future.

Risk Assessment

Current practice recommends that the determination of potential liabilities that could arise from land contamination be carried out using the process of risk assessment, whereby "risk" is defined as:

"(a) The probability, or frequency, or occurrence of a defined hazard; and

(b) The magnitude (including the seriousness) of the consequences."

The UK's approach to the assessment of environmental risk is set out in by the Department of the Environment Transport and the Regions (2000) publication "A Guide to Risk Assessment and Risk Management for Environmental Protection" (also called Greenleaves II). This established an iterative, systematic staged process which comprises:

(a) Hazard identification;
(b) Hazard assessment;
(c) Risk estimation;
(d) Risk evaluation;
(e) Risk assessment;

At each stage during the development process the above steps are repeated as more detailed information becomes available for the site.

For an environmental risk to be present, all three of the following elements must be present:

- Source/Contaminant: hazardous substance that has the potential to cause adverse impacts;
- Receptor: target that may be affected by contamination: examples include human occupants/users of site, water resources (rivers or groundwater), or structures;
- Pathway: a viable route whereby a hazardous substance may come into contact with the receptor.

The absence of one or more of each component (contaminant, pathway, receptor) would prevent a contaminant linkage being established and there would be no significant environmental risk.

The identification of potential contaminant linkages is based on a Conceptual Model of the site, which is subject to continual refinement as additional data becomes available. As part of a Phase I Investigation (Desk Study and site walk over) a Preliminary Conceptual Site Model (PCSM) is formed. Based on the PCSM, potential contaminant linkages can be assessed. If the PCSM and hazard assessment indicate that a pollution linkage is not of significance then no further assessment or action is required due to this linkage. For each significant and possible linkage a risk assessment is carried out. The linkages which potentially pose significant risks may require a variety of responses ranging from immediate remedial action or risk management or, more commonly, further investigation and risk assessment. This next stage is termed a Phase II Main Site Investigation and should provide additional data to allow refinement of the Conceptual Site Model and assess the level of risk from each contaminant linkage.

Definition of Risk Assessment Terminology

The criteria used for risk assessment are broadly based on those presented in DETR's "A Guide to Risk Assessment and Risk Management for Environmental Protection" (2000). The Severity of the risk is classified according to the criteria in Table B.1 below:

Table B.1 Severity/Consequence of Risk	
Severe	Acute risks to human health. Catastrophic damage to buildings/property (e.g. by explosion). Direct pollution of sensitive water receptors or serious pollution of other controlled water (watercourses or groundwater) bodies.
Medium	Harm to human health from long-term exposure. Slight pollution of sensitive controlled waters (surface waters or aquifers) or pollution of other water bodies. Significant effects on sensitive ecosystems or species.
Mild	No significant harm to human health in either short or long term. No pollution of sensitive controlled waters, no more than slight pollution of non-sensitive waters. Significant damage to buildings or structures. Requirement for protective equipment during site works to mitigate health effects.
Negligible	Damage to non-sensitive ecosystems or species. Minor damage to buildings or structures. No harm or pollution of water.

The probability of the risk occurring is classified according to criteria given in Table B.2 below:

Table B.2: Probability of Risk Occurring	
High likelihood	Contaminant linkage may be present, and risk is almost certain to occur in the long term, or there is evidence of harm to the receptor.
Medium/Reasonably Foreseeable	Contaminant linkage may be present, and it is probable that the risk will occur over the long term.
Low/Unlikely	Contaminant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
Negligible/ Not credible	Contaminant linkage may be present but the circumstances under which harm would occur are improbable.

An overall evaluation of the level of risk is gained from a comparison of the severity and probability, as shown in Table B.3 below:

Table B.3: Comparison of Severity and Probability					
		Severity			
		Severe	**Medium**	**Mild**	**Negligible**
Probability	**High likelihood**	Very High Risk	High Risk	Medium/Low Risk	Low Risk
	Medium/Reasonably Foreseeable	High Risk	Medium Risk	Low Risk	Near Zero
	Low/Unlikely	High/Medium Risk	Medium/Low Risk	Low Risk	Near Zero
	Negligible/ Not credible	Medium/Low Risk	Low Risk	Low Risk	Near Zero

The various risk rankings provide guidance for recommended actions, whether this is:

AR - Action Required, Remediation or mitigation or site investigation works required
SIR - Site Investigation Required, further assessment is required.
NAR - No Action Required.

A description of the evaluated risk is as follows:

Table B.4 – Description of the Classified Risks and Likely Action Required	
Evaluated Risk	**Recommended Actions**
Very High Risk	AR: There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High Risk	AR: Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the long term.
Moderate Risk	SI: It is possible that harm could arise to a designated receptor from an identified hazard. However, it is relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Low Risk	NAR: It is possible that harm could arise to a designated receptor from an identified hazard, but there is a low likelihood of this hazard occurring and if realised, harm would at worst normally be mild.
Near Zero	NAR: There is a negligible possibility that harm could arise to a receptor. In the event of such harm being realised, it is not likely to be severe.

Management of Contaminated Land

When risk assessment of the site has been completed and this indicates that remedial works are required, the main guidance in managing this process is set out in the DEFRA/EA publication CLR11 (2004) "Model Procedures for the Management of Land Contamination." The stages of managing remediation are as follows:

(a) Options Appraisal and develop Remediation Strategy;
(b) Develop Implementation Plan and Verification Plan;
(c) Remediation, Verification and Monitoring.

The Remediation Strategy sets out the remediation targets, identifies technically feasible remedial solutions and presents an evaluation of the options so that these can be assessed enabling that the most suitable solution is adopted. An outline of the proposed remedial method should be presented. Agreement should be sought of the appropriate statutory bodies for the Remediation Strategy before proceeding to the next stage.

The Implementation Plan is a detailed method statement setting out how the remediation is to be carried out including stating how the site will be managed, welfare procedures, health and safety considerations together with practical measures such as details of temporary works, programme of works, waste management licences and regulatory consents required. Agreement should again be sought of the appropriate statutory bodies for this Plan.

The Verification Plan sets out the requirements for gathering data to demonstrate that the remediation has met the required remediation objectives and criteria. The Verification Plan presents the requirements for a wide range of issues including the level of supervision, sampling and testing regimes for treated materials, waste and imported materials, required monitoring works during and post remediation, how compliance with all licenses and consents will be checked etc. Agreement should again be sought of the appropriate statutory bodies for the Verification Plan. On completion of the remediation a Verification Report should be produced to provide a complete record of all remediation activities on site and the data collected as required in the Verification Plan. The Verification Report should demonstrate that the remediation has met the remedial targets to show that the site is suitable for the proposed use.

APPENDIX C

Site Photographs



Photograph 1: Looking east at Entrance Gate into Dale View (proposed road entrance)



Photograph 2: Looking southwest towards Neddy Lane access



Photograph 3: Looking west along the dividing field boundary towards the water pumping station



Photograph 4: Looking southwest from outside the eastern boundary of the site



Photograph 5: Pumping station located near the western boundary of the site



Photograph 6: Pumping station located near the western boundary of the site



Photograph 7: Looking north-northwest from dividing field boundary into the north field



Photograph 8: Looking out along the western boundary of the site



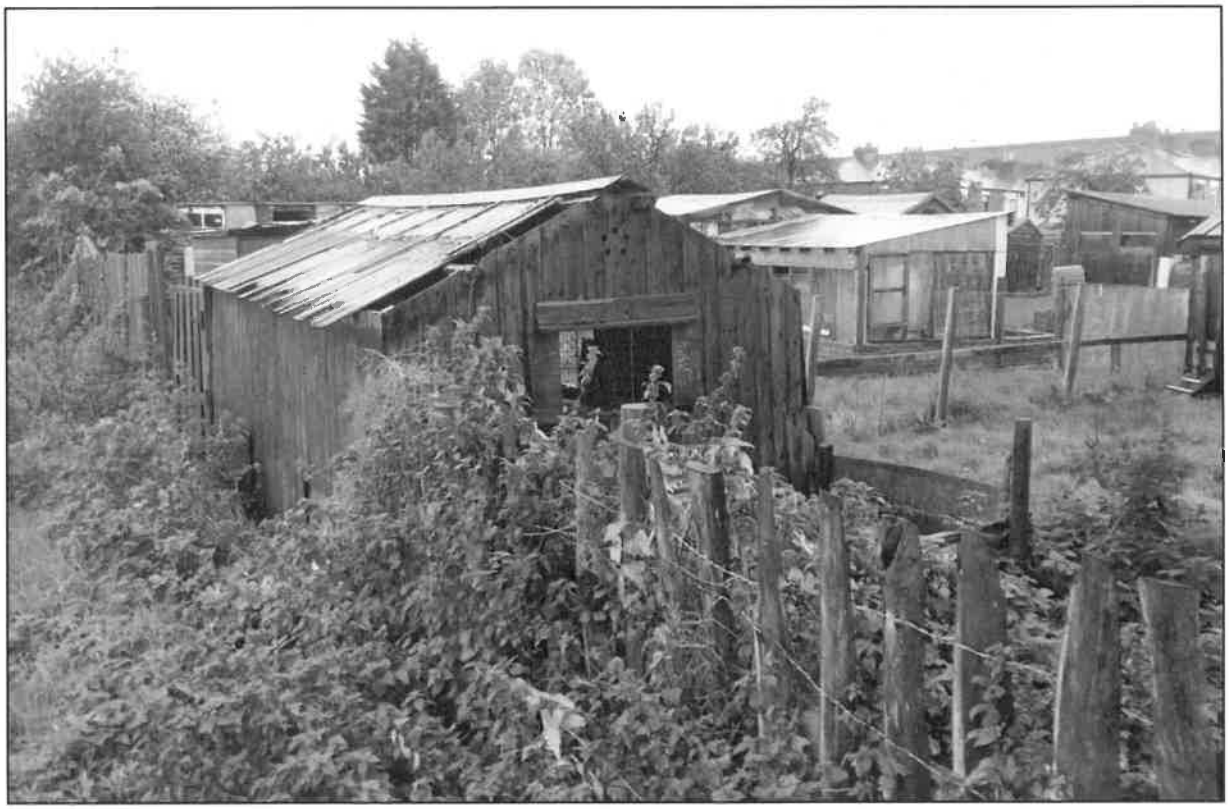
Photograph 9: Looking north at a ditch running along the northern half of the western boundary of the site



Photograph 10: Looking north along the eastern boundary of the northern field into the allotment gardens



Photograph 11: Service cover located near the eastern boundary of the field



Photograph 12: Allotment gardens on the eastern boundary of the site



Photograph 11: TP1

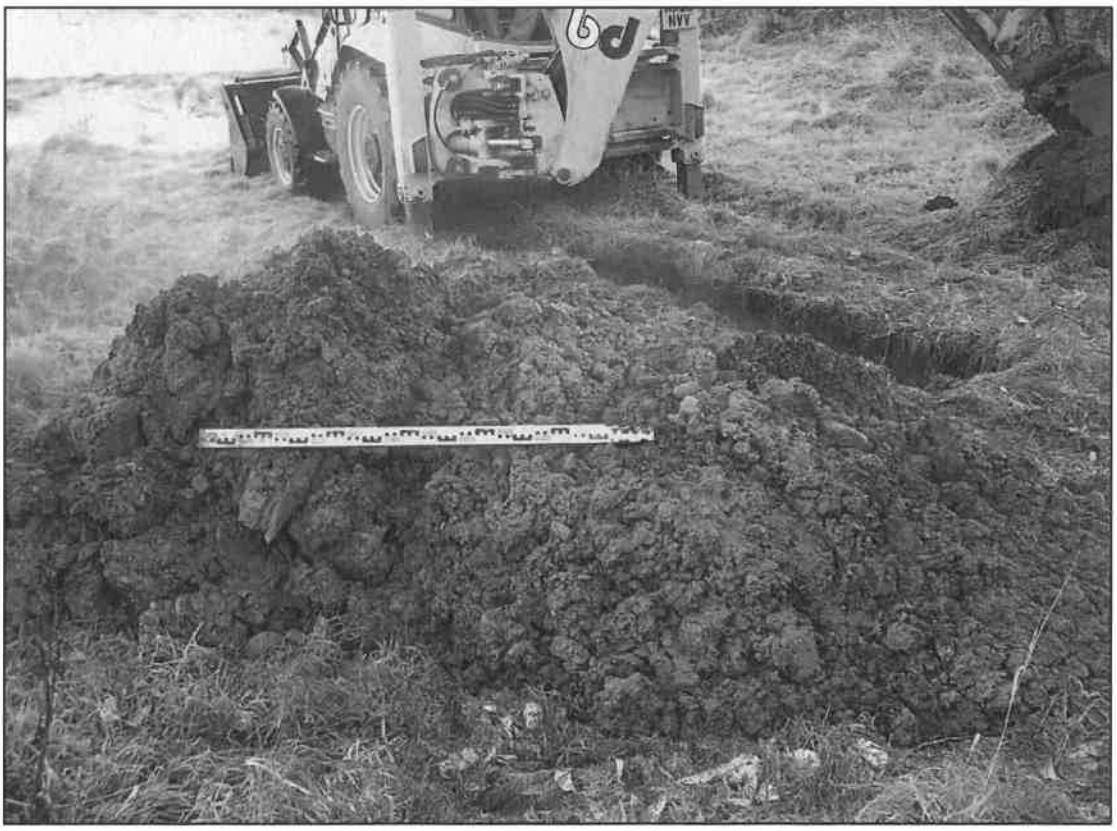
Photograph 13: Monitoring Well WS1305



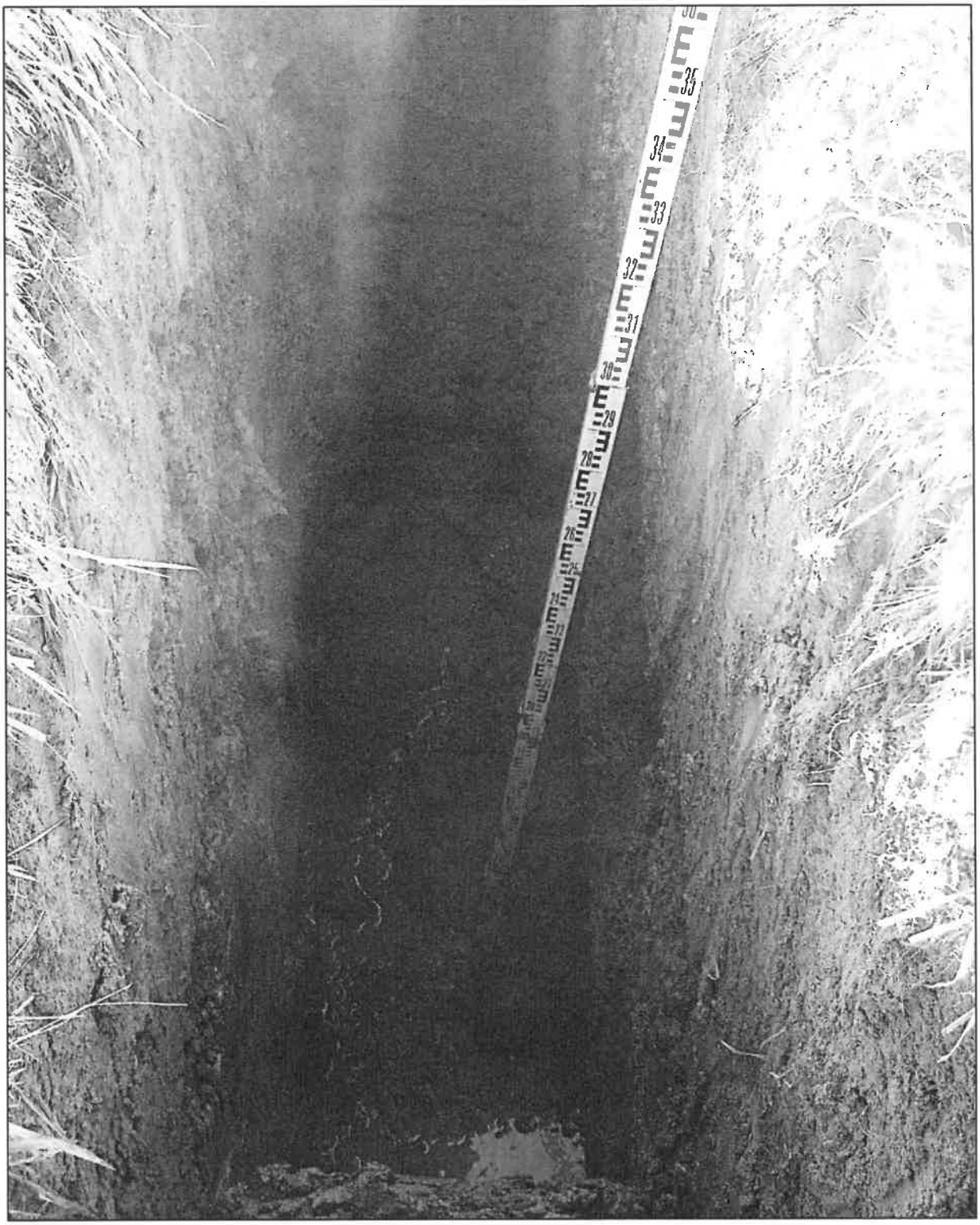
TRIAL PIT 1 - Portrait



TRIAL PIT 1 - Landscape



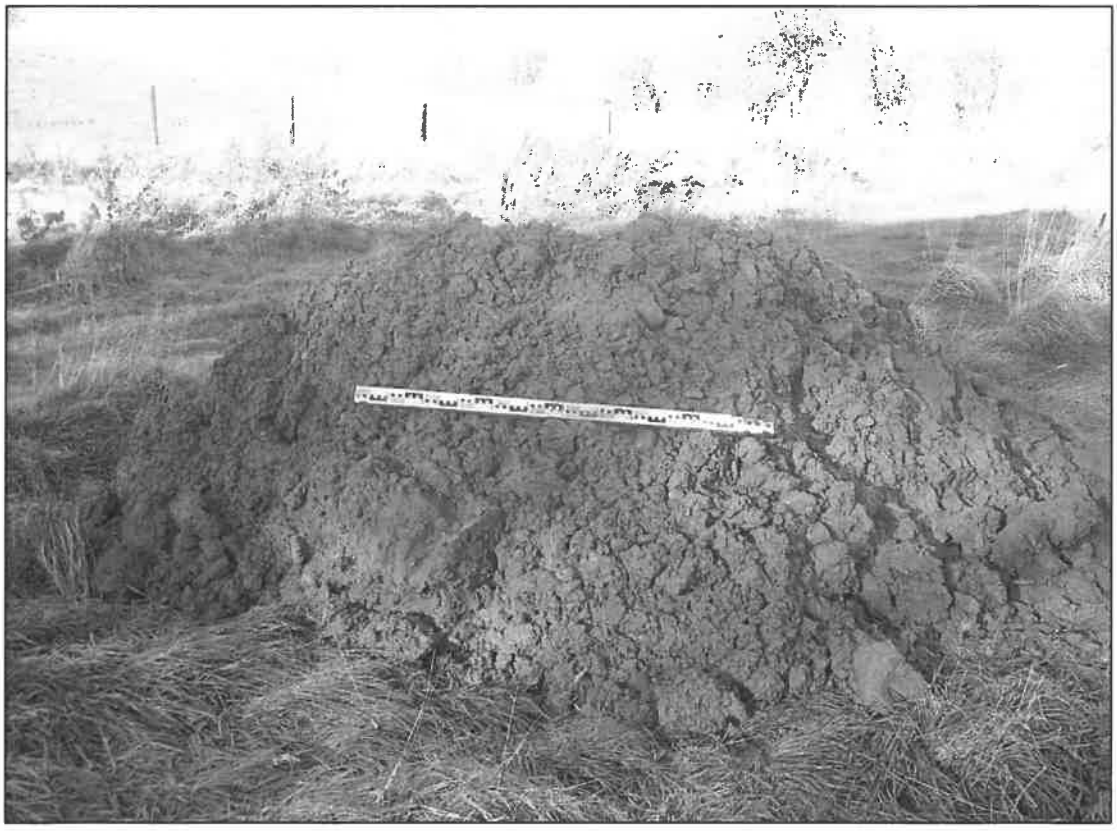
TRIAL PIT 1 – Spoil



TRIAL PIT 2 - Portrait



TRIAL PIT 2 – Landscape



TRIAL PIT 2 – Spoil



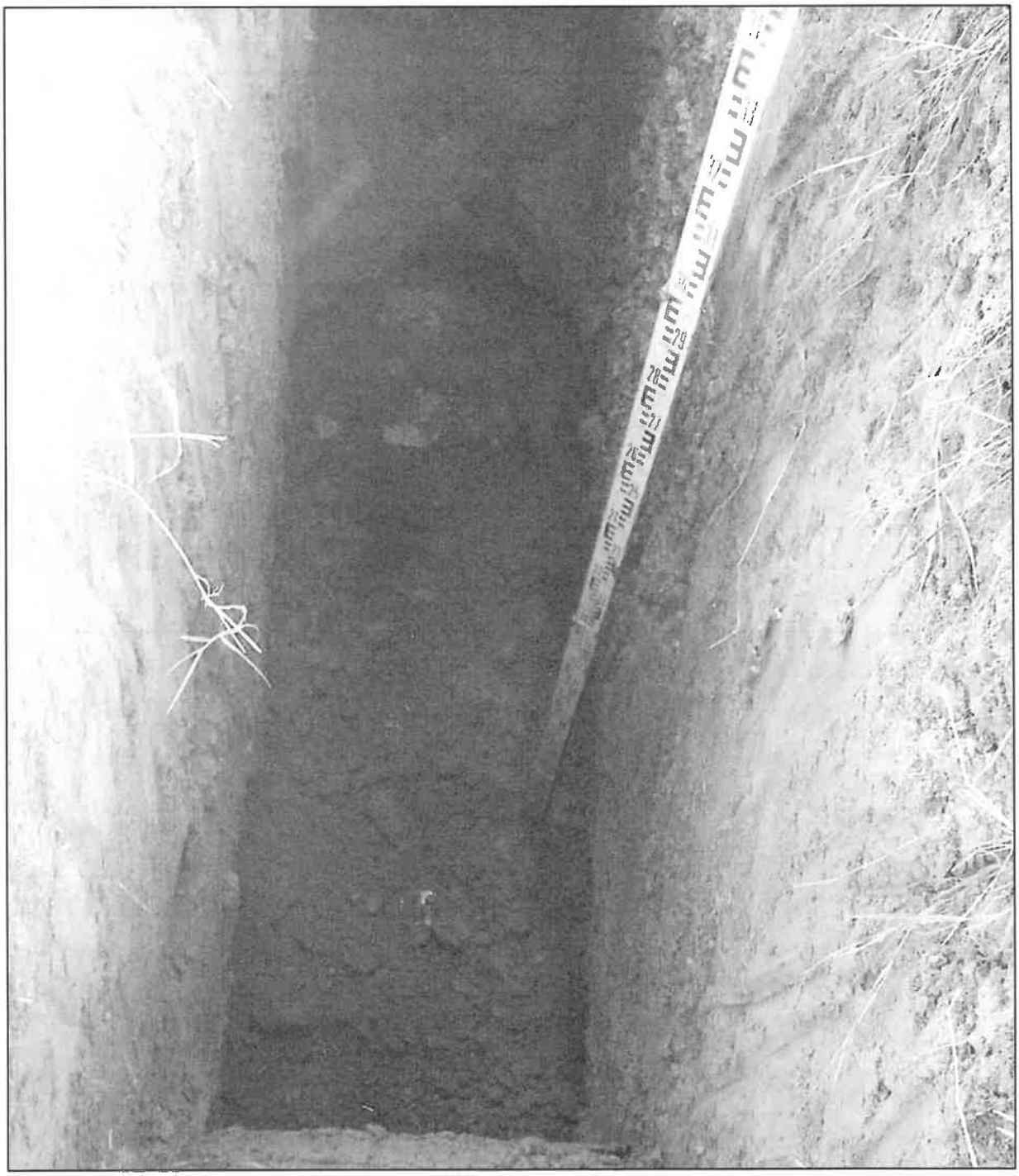
TRIAL PIT 3 - Portrait



TRIAL PIT 3 – Landscape



TRIAL PIT 3 – Spoil



TRIAL PIT 4 – Portrait



TRIAL PIT 4 – Landscape



TRIAL PIT 4 – Spoil



TRIAL PIT 5 – Portrait



TRIAL PIT 5 – Landscape



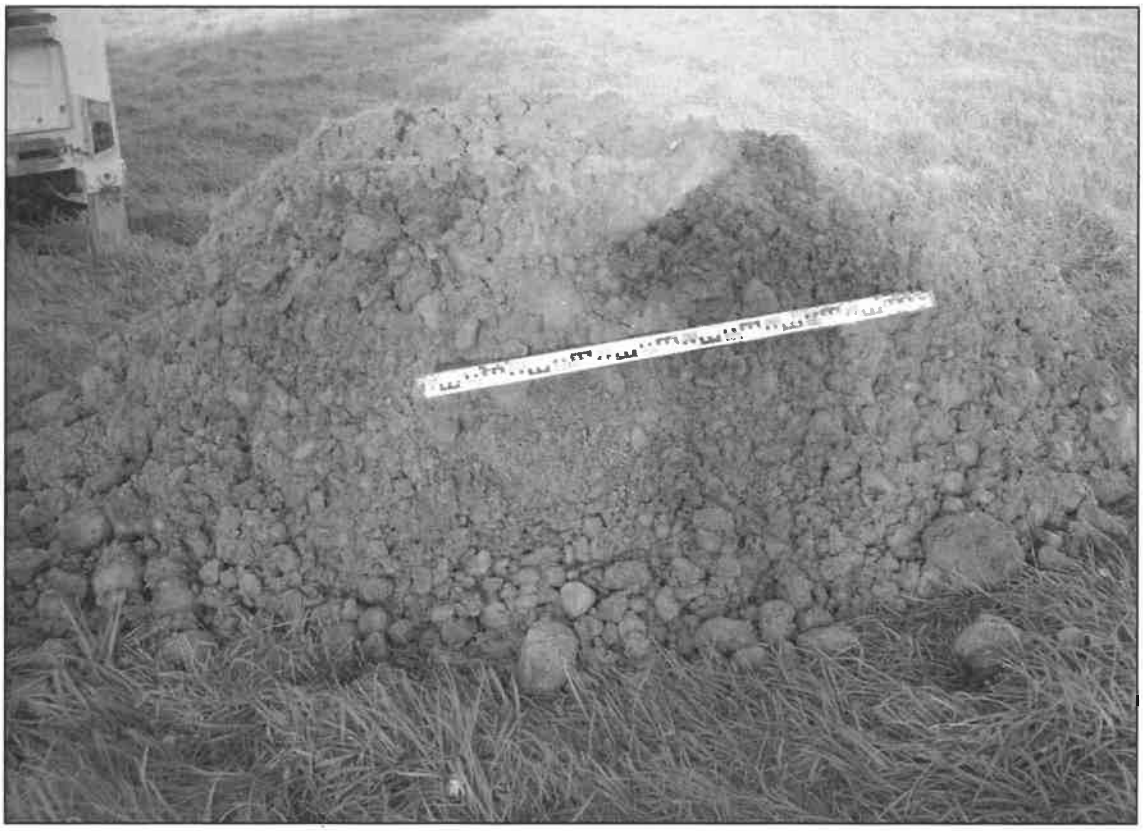
TRIAL PIT 5 – Spoil



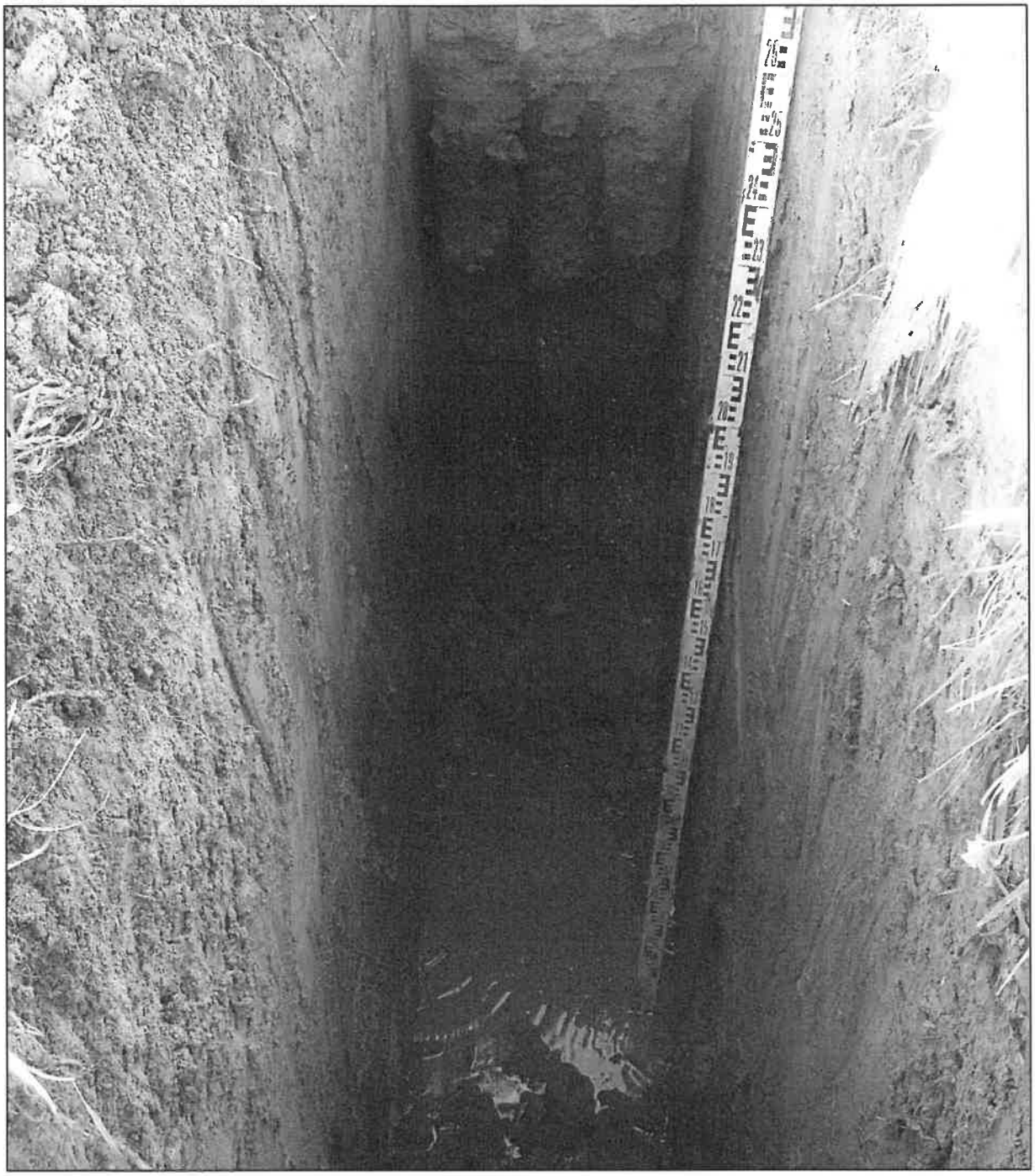
TRIAL PIT 6 – Portrait



TRIAL PIT 6 – Landscape



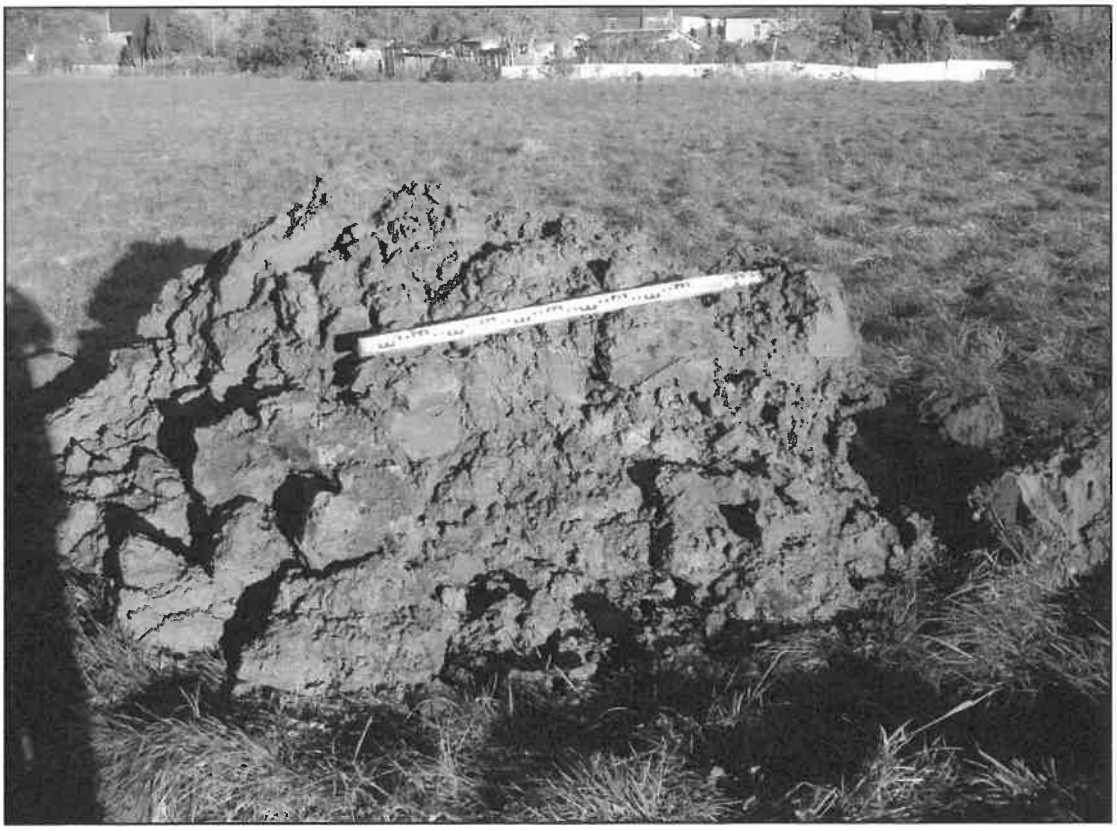
TRIAL PIT 6 – Spoil



TRIAL PIT 7 – Portrait



TRIAL PIT 7 – Landscape



TRIAL PIT 7 – Spoil



TRIAL PIT 8 – Portrait



TRIAL PIT 8 – Landscape



TRIAL PIT 8 – Spoil



TRIAL PIT 9 – Portrait



TRIAL PIT 9 – Landscape



TRIAL PIT 9 – Spoil



TRIAL PIT 10 – Portrait



TRIAL PIT 10 – Landscape



TRIAL PIT 10 – Spoil



TRIAL PIT 11 – Portrait



TRIAL PIT 11 – Landscape



TRIAL PIT 11 – Spoil



TRIAL PIT 12 – Portrait



TRIAL PIT 12 – Landscape



TRIAL PIT 13 – Portrait



TRIAL PIT 13 – Landscape



TRIAL PIT 14 – Portrait



TRIAL PIT 14 – Landscape



TRIAL PIT 15 – Portrait



TRIAL PIT 15 – Landscape



TRIAL PIT 16



TRIAL PIT 16 – Spoil



TRIAL PIT 17 – Portrait



TRIAL PIT 17 – Landscape



TRIAL PIT 17 – Spoil



TRIAL PIT 18



TRIAL PIT 19



TRIAL PIT 20 – Portrait



TRIAL PIT 20 – Landscape



TRIAL PIT 20 – Spoil

APPENDIX D

GroundSure Report

(Historical Maps & Datasheets on Surrounding Land Use)

NOTE - AREA OF SITE IS INCORRECT SITE EXTENDS FURTHER TO NORTH AND WEST THAN INDICATED ON MAPS

Terra Consult
Bold Business Centre, Bold Lane,
Bold Lane,
Sutton, WA9 4TX

GroundSure Reference:	HMD-147-1148107
Your Reference:	PO12232
Report Date:	31 Oct 2013
Report Delivery Method:	**xml**
Client Email:	mailbox@terraconsult.co.uk

GroundSure EnviroInsight

Address: 1,DALE VIEW,BILLINGTON,CLITHEROE, BB7 9LL

Dear Sir/Madam,

Thank you for placing your order with GroundSure. Please find enclosed the GroundSure EnviroInsight as requested

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above GroundSure reference number.

Yours faithfully,

Managing Director
Groundsure Limited

Enc.
GroundSure EnviroInsight

GroundSure EnviroInsight

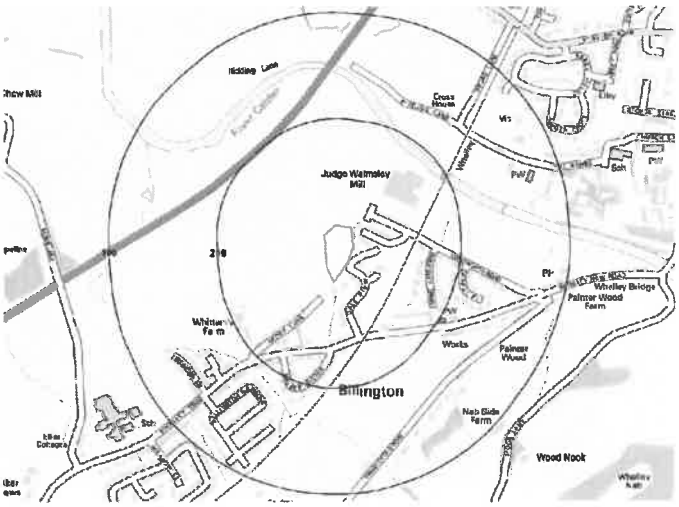
Address: 1,DALE VIEW,BILLINGTON,CLITHEROE, BB7 9LL

Date: 31 Oct 2013

GroundSure Reference: HMD-147-1148107

Your Reference: PO12232

Client: Terra Consult



Brought to you by GroundSure

Aerial Photograph of Study Site



Aerial photography supplied by Getmapping PLC.
© Copyright Getmapping PLC 2003. All Rights Reserved.

Site Name: 1,DALE VIEW,BILLINGTON,CLITHEROE, BB7 9LL
Grid Reference: 372536,435919
Size of Site: 0.58 ha

Overview of Findings

For further details on each dataset, please refer to each individual section in the main report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Report Section	Number of records found within (X) m of the study site boundary					
1. Environmental Permits, Incidents and Registers	on-site	0-50	51-250	251-500	501-1000	1000-1500
1.1 Industrial Sites Holding Environmental Permits and/or Authorisations						
Records of historic IPC Authorisations	0	0	0	0	-	-
Records of Part A(1) and IPPC Authorised Activities	0	0	0	0	-	-
Records of Water Industry Referrals (potentially harmful discharges to the public sewer)	0	0	0	0	-	-
Records of Red List Discharge Consents (potentially harmful discharges to controlled waters)	0	0	0	0	-	-
Records of List 1 Dangerous Substances Inventory sites	0	0	0	0	-	-
Records of List 2 Dangerous Substances Inventory sites	0	0	0	1	-	-
Records of Part A(2) and Part B Activities and Enforcements	0	0	0	0	-	-
Records of Category 3 or 4 Radioactive Substances Authorisations	0	0	0	0	-	-
Records of Licensed Discharge Consents	2	0	2	5	-	-
Records of Planning Hazardous Substance Consents and Enforcements	0	0	0	0	-	-
1.2 Records of COMAH and NIHHS sites	0	0	0	0	-	-
1.3 Environment Agency Recorded Pollution Incidents						
National Incidents Recording System, List 2	0	0	1	-	-	-
National Incidents Recording System, List 1	0	0	0	-	-	-
1.4 Sites Determined as Contaminated Land under Part 2A EPA 1990	0	0	0	0	-	-
2. Landfill and Other Waste Sites	on-site	0-50	51-250	251-500	501-1000	1000-1500
2.1 Landfill Sites						
Environment Agency Registered Landfill Sites	0	0	0	0	0	-
Environment Agency Historic Landfill Sites	0	0	0	1	0	1
BGS/DoE Landfill Site Survey	0	0	0	0	0	0
GroundSure Local Authority Landfill Sites Data	0	0	0	2	0	0
2.2 Landfill and Other Waste Sites Findings						
Operational and Non-Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	-	-
Environment Agency Licensed Waste Sites	0	0	0	0	0	0

3. Current Land Uses	on-site	0-50	51-250	251-500	501-1000	1000-1500
3.1 Current Industrial Sites Data	0	0	4	-	-	-
3.2 Records of Petrol and Fuel Sites	0	0	0	0	-	-
3.3 Underground High Pressure Oil and Gas Pipelines	0	0	0	0	-	-

4. Geology	Description
4.1 Are there any records of Artificial Ground and Made Ground present beneath the study site? *	No
4.2 Are there any records of Superficial Ground and Drift Geology present beneath the study site? *	Yes
4.3 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
Source: Scale: 1:50,000 BGS Sheet 068	

* This includes an automatically generated 50m buffer zone around the site.

5. Hydrogeology and Hydrology	on-site	0-50	51-250	251-500	501-1000	1001-2000
5.1 Are there any records of Productive Strata in the Superficial Geology within 500m of the study site?				Yes		
5.2 Are there any records of Productive Strata in the Bedrock Geology within 500m of the study site?				Yes		
5.3 Groundwater Abstraction Licences (within 2000m of the study site).	0	0	0	0	0	3
5.4 Surface Water Abstraction Licences (within 2000m of the study site).	0	0	0	0	0	0
5.5 Potable Water Abstraction Licences (within 2000m of the study site).	0	0	0	0	0	3
5.6 Are there any Source Protection Zones within 500m of the study site?				No		

5.7 River Quality	on-site	0-50	51-250	251-500	501-1000	1001-1500
Is there any Environment Agency information on river quality within 1500m of the study site?	No	No	No	Yes	No	No
5.8 Detailed River Network entries within 500m of the site	0	0	1	20	-	-
5.9 Surface water features within 250m of the study site	No	Yes	Yes	-	-	-

6. Flooding	
6.1 Are there any Environment Agency indicative Zone 2 floodplains within 250m of the study site?	Yes
6.2 Are there any Environment Agency indicative Zone 3 floodplains within 250m of the study site?	Yes
6.3 Are there any Flood Defences within 250m of the study site?	No
6.4 Are there any areas benefiting from Flood Defences within 250m of the study site?	No
6.5 Are there any areas used for Flood Storage within 250m of the study site?	No
6.6 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	Very High
6.7 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	Moderate

7. Designated Environmentally Sensitive Sites	on-site	0-50	51-250	251-500	501-1000	1001-2000
7.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	0	0
7.2 Records of National Nature Reserves (NNR)	0	0	0	0	0	0

7.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	0	0
7.3 Records of Local Nature Reserves (LNR)	0	0	0	0	0	0
7.4 Records of Special Areas of Conservation (SAC)	0	0	0	0	0	0
7.5 Records of Special Protection Areas (SPA)	0	0	0	0	0	0
7.6 Records of Ramsar sites	0	0	0	0	0	0
7.7 Records of World Heritage Sites	0	0	0	0	0	0
7.8 Records of Environmentally Sensitive Areas	0	0	0	0	0	0
7.9 Records of Areas of Outstanding Natural Beauty (AONB)	0	0	0	0	0	0
7.10 Records of National Parks	0	0	0	0	0	0
7.11 Records of Nitrate Sensitive Areas	0	0	0	0	0	0
7.12 Records of Nitrate Vulnerable Zones	0	0	0	0	0	0
7.13 Records of Ancient Woodlands	0	0	0	0	0	13

8. Natural Hazards

8.1 What is the maximum risk of natural ground subsidence?	Moderate

9. Mining

9.1 Are there any coal mining areas within 75m of the study site?	No
9.2 What is the risk of subsidence relating to shallow mining within 150m of the study site?	Negligible
9.3 Are there any brine affected areas within 75m of the study site?	No

Using this Report

The following report is designed by Environmental Consultants for Environmental Professionals bringing together the most up-to-date market leading environmental data. This report is provided under and subject to the Terms & Conditions agreed between GroundSure and the Client. The document contains the following sections:

1. Environmental Permits, Incidents and Registers

Provides information on Regulated Industrial Activities and Pollution Incidents as recorded by Regulatory Authorities, and sites determined as Contaminated Land. This search is conducted using radii up to 500m.

2. Landfills and Other Waste Sites

Provides information on landfills and other waste sites that may pose a risk to the study site. This search is conducted using radii up to 1500m.

3. Current Land Uses

Provides information on current land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. These searches are conducted using radii of up to 500m. This includes information on potentially contaminative industrial sites, petrol stations and fuel sites as well as high pressure underground oil and gas pipelines.

4. Geology

Provides information on artificial and superficial deposits and bedrock beneath the study site.

5. Hydrogeology and Hydrology

Provides information on productive strata within the bedrock and superficial geological layers, abstraction licenses, Source Protection Zones (SPZs) and river quality. These searches are conducted using radii of up to 2000m.

6. Flooding

Provides information on surface water flooding, flood defences, flood storage areas and groundwater flood areas. This search is conducted using radii of up to 250m.

7. Designated Environmentally Sensitive Sites

Provides information on the Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar sites, Local Nature Reserves (LNR), Areas of Outstanding Natural Beauty (AONB), National Parks (NP), Environmentally Sensitive Areas, Nitrate Sensitive Areas, Nitrate Vulnerable Zones and World Heritage Sites and Scheduled Ancient Woodland. These searches are conducted using radii of up to 2000m.

8. Natural Hazards

Provides information on a range of natural hazards that may pose a risk to the study site. These factors include natural ground subsidence.

9. Mining

Provides information on areas of coal and shallow mining.

10. Contacts

This section of the report provides contact points for statutory bodies and data providers that may be able to provide further information on issues raised within this report. Alternatively, GroundSure provide a free Technical Helpline (08444 159000) for further information and guidance.

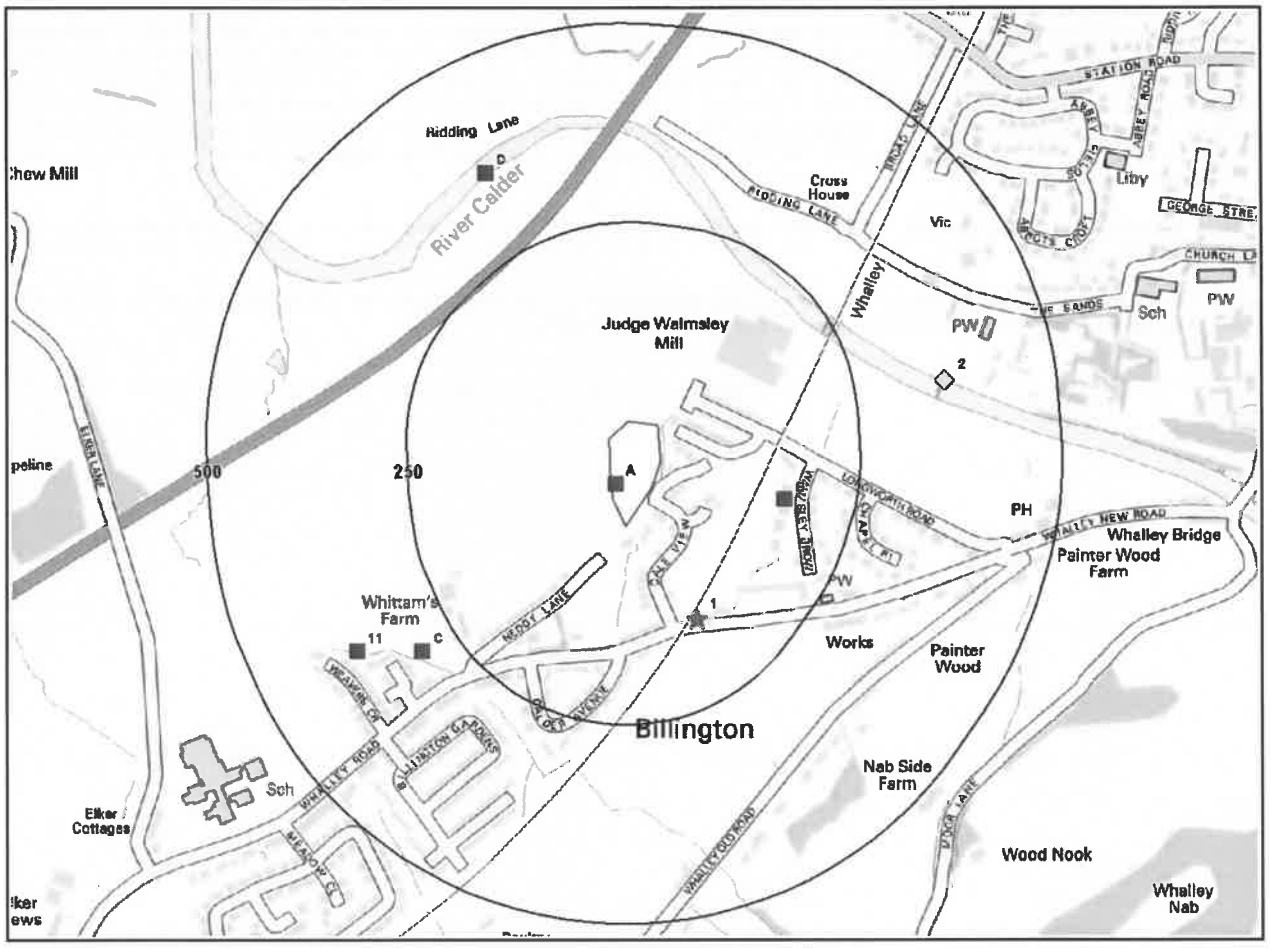
Note: Maps

Only certain features are placed on the maps within the report. All features represented on maps found within this search are given an identification number. This number identifies the feature on the mapping and correlates it to the additional information provided below. This identification number precedes all other information and takes the following format -Id: 1, Id: 2, etc. Where numerous features on the same map are in such close proximity that the numbers would obscure each other a letter identifier is used instead to represent the features. (e.g. Three features which overlap may be given the identifier "A" on the map and would be identified separately as features 1A, 3A, 10A on the data tables provided).

Where a feature is reported in the data tables to a distance greater than the map area, it is noted in the data table as "Not Shown".

All distances given in this report are in Metres (m). Directions are given as compass headings such as N: North, E: East, NE: North East from the nearest point of the study site boundary.

1. Environmental Permits, Incidents and Registers Map



Authorisations,Incidents and Registers Legend

Mapping sourced from Ordnance Survey

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- Site Outline
- Search Buffers (m) — 250 / 500
- Recorded Pollution Incident
- Dangerous Substances (List 1)
- Dangerous Substances (List 2)
- Water Industry Referrals
- Licenced Discharge Consents
- Red List Discharge Consents
- RAS 3 & 4 Authorisations
- Part A(1) Authorised Processes and Historic IPC Authorisations
- Part A(2) and Part B Authorised Processes
- COMAH / NIHHS Sites
- Sites Determined as Contaminated Land
- Hazardous Substance Consents and Enforcements

1.Environmental Permits, Incidents and Registers

1.1 Industrial Sites Holding Licences and/or Authorisations

Searches of information provided by the Environment Agency and Local Authorities reveal the following information:

Records of historic IPC Authorisations within 500m of the study site: **0**

Database searched and no data found.

Records of Part A(1) and IPPC Authorised Activities within 500m of the study site: **0**

Database searched and no data found.

Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site: **0**

Database searched and no data found.

Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site: **0**

Database searched and no data found.

Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site: **0**

Database searched and no data found.

Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site: **1**

The following List 2 Dangerous Substance Inventory Site records are represented as points on the Authorisations, Incidents and Registers map:

ID	Distance	Direction	NGR	Details	
2	362.0	E	372920, 436050	Name: River Calder At Whalley (hms) Status: Not Active Receiving Water: -	Authorised Substances: Dichlorvos, Atrazine & Simazine, Azinphos-methyl, Endosulphan, Fenitrothion, Malathion, Trifluralin, 4-Chloro-3-methyl-phenol, 2-Chlorophenol, 2,4-Dichlorophenol, 2,4-D(ester), 2,4-D (non-ester), 1,1,1-Trichloroethane, 1,1,2-Trichloroethane, Bentazone

---

Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site: **0**

Database searched and no data found.

Records of Category 3 or 4 Radioactive Substance Licences within 500m of the study site: **0**

Database searched and no data found.

Records of Licensed Discharge Consents within 500m of the study site: **9**

The following Licensed Discharge Consents records are represented as points on the Authorisations, Incidents and Registers map:

ID	Distance	Direction	NGR	Details	
3A	0.0	On Site	372510, 435920	Address: Neddy Lane Ps, Billington, Lancashire Effluent Type: Miscellaneous Discharges - Emergency Discharges Permit Number: 01RIB0046 Permit Version: 1	Receiving Water: Trib River Calder Status: Consent Revoked Or Revised - New Consent Issued (37(1)) Issue date: - Effective Date: 1/1/1995 Revocation Date: 1/1/1995
4A	0.0	On Site	372510, 435920	Address: Neddy Lane Ps, Billington, Lancashire Effluent Type: Sewage Discharges - Pumping Station - Water Company Permit Number: 017180502 Permit Version: 1	Receiving Water: Trib River Calder Status: Post Nra Legislation Where Issue Date > 31-aug-89 (historic Only) Issue date: - Effective Date: - Revocation Date: -
5B	162.0	E	372720, 435900	Address: Billington, Ribble Valley, Lancashire Effluent Type: Sewage Discharges - Sewer Storm Overflow - Water Company Permit Number: 01LA1549 Permit Version: 1	Receiving Water: River Calder Status: Revoked - Unspecified Issue date: - Effective Date: 13/7/1967 Revocation Date: 13/7/1967
6B	162.0	E	372720, 435900	Address: Longworth Rd/r'way Viaduct, Billington, Ribble Valley, Lancashire Effluent Type: Sewage Discharges - Sewer Storm Overflow - Water Company Permit Number: 01RIB0021 Permit Version: 1	Receiving Water: Stream Of River Calder Status: Post Nra Legislation Where Issue Date > 31-aug-89 (historic Only) Issue date: - Effective Date: 1/4/1991 Revocation Date: -
7C	297.0	SW	372270, 435710	Address: Billington, Ribble Valley, Lancashire Effluent Type: Sewage Discharges - Sewer Storm Overflow - Water Company Permit Number: 01LA1548 Permit Version: 1	Receiving Water: Trib River Calder Status: Revoked - Unspecified Issue date: - Effective Date: 13/7/1967 Revocation Date: 13/7/1967
8C	297.0	SW	372270, 435710	Address: Whittams Farm-abbey Mill, Billington, Lancashire Effluent Type: Sewage Discharges - Sewer Storm Overflow - Water Company Permit Number: 01RIB0020 Permit Version: 1	Receiving Water: Stream Trib River Calder Status: Post Nra Legislation Where Issue Date > 31-aug-89 (historic Only) Issue date: - Effective Date: 1/4/1991 Revocation Date: 13/4/2009
9D	358.0	NW	372350, 436310	Address: Whalley Relief Sewer Sso, Whalley, Lancashire Effluent Type: Sewage Discharges - Stw Storm Overflow/storm Tank - Water Company Permit Number: 017160332 Permit Version: 1	Receiving Water: River Calder Status: Post Nra Legislation Where Issue Date > 31-aug-89 (historic Only) Issue date: 1/5/1990 Effective Date: 1/5/1990 Revocation Date: -
10D	358.0	NW	372350, 436310	Address: Whalley Relief Sewer Sso, Whalley, Lancashire Effluent Type: Sewage Discharges - Sewer Storm Overflow - Water Company Permit Number: 01RIB0043 Permit Version: 1	Receiving Water: - Status: Revoked - Unspecified Issue date: - Effective Date: 1/7/1991 Revocation Date: 1/1/1995
11	367.0	SW	372190, 435710	Address: Whittams Farm-abbey Mill, Billington, Lancashire Effluent Type: Sewage Discharges - Sewer Storm Overflow - Water Company Permit Number: 01RIB0020 Permit Version: 2	Receiving Water: Stream Trib River Calder Status: Varied Under Epr 2010 Issue date: 14/4/2009 Effective Date: 14/4/2009 Revocation Date: -

Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site: **0**

Database searched and no data found.

1.2 Dangerous or Hazardous Sites

Records of COMAH & NIHHS sites within 500m of the study site: **0**

Database searched and no data found.

1.3 Environment Agency Recorded Pollution Incidents

Records of National Incidents Recording System, List 2 within 250m of the study site: **1**

The following NIRS List 2 records are represented as points on the Authorisations, Incidents and Registers Map:

ID	Distance	Direction	NGR	Details	
1	146.0	SE	372610, 435750	Incident Date: 21/11/2001 Incident Identification: 44230 Pollutant: Oils and Fuel Pollutant Description: Hydraulic Oils	Water Impact: Category 4 (No Impact) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)

Records of National Incidents Recording System, List 1 within 250m of the study site: **0**

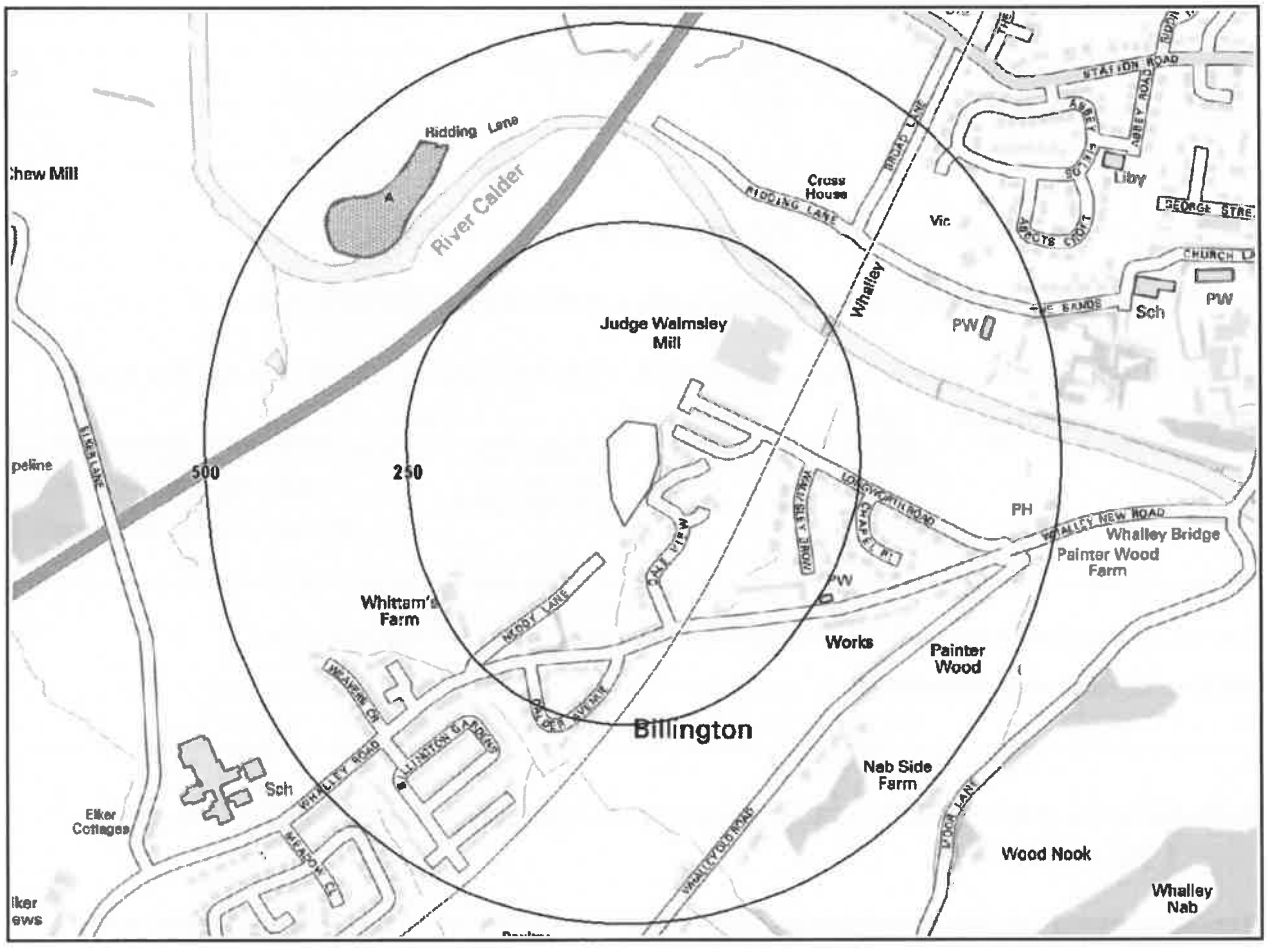
Database searched and no data found.

1.4 Sites Determined as Contaminated Land under Part 2A EPA 1990

How many records of sites determined as contaminated land under Section 78R of the Environmental Protection Act 1990 are there within 500m of the study site? **0**

Database searched and no data found.

2. Landfill and Other Waste Sites Map



Landfill & Other Waste Sites Legend

Mapping sourced from Ordnance Survey

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- Site Outline
- Search Buffers (m): 250, 500
- E.A. Active Landfill
- E.A. Historic Landfill
- Local Authority Landfill
- Historic and Planned Waste Sites
- E.A. Licensed Waste Site
- BGS / DoE Survey Landfill

2. Landfill and Other Waste Sites

2.1 Landfill Sites

Records from Environment Agency landfill data within 1000m of the study site: **0**

Database searched and no data found.

Records of Environment Agency historic landfill sites within 1500m of the study site: **2**

The following landfill records are represented as either points or polygons on the Landfill and Other Waste Sites map:

ID	Distance	Direction	NGR	Details	
1A	360.0	NW	372200, 436200	Site Address: Whalley Sewage Works, Riding Lane, Whalley, Blackburn, Lancashire Waste Licence: - Site Reference: K1/03/022 Waste Type: Commercial, Household Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Hold Address: - Operator: -
Not shown	1494.0	N	372300, 437500	Site Address: Calderstones Hospital A, Off Mitton Road, Whalley Moor, Blackburn, Lancashire Waste Licence: - Site Reference: K1/01/021 Waste Type: Inert, Commercial, Household Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Hold Address: - Operator: -

---

Records of BGS/DoE non-operational landfill sites within 1500m of the study site: **0**

Database searched and no data found.

Records of Local Authority landfill sites within 1500m of the study site: **2**

The following landfill records are represented as points or polygons on the Landfill and Other Waste Sites map:

ID	Distance	Direction	Site Address	Source	Data Type
3A	360.0	NW	Refuse Tip	1974 mapping	Polygon
4A	360.0	NW	Refuse Tip	1966 mapping	Polygon

2.2 Other Waste Sites

Records of waste treatment, transfer or disposal sites within 500m of the study site: **0**

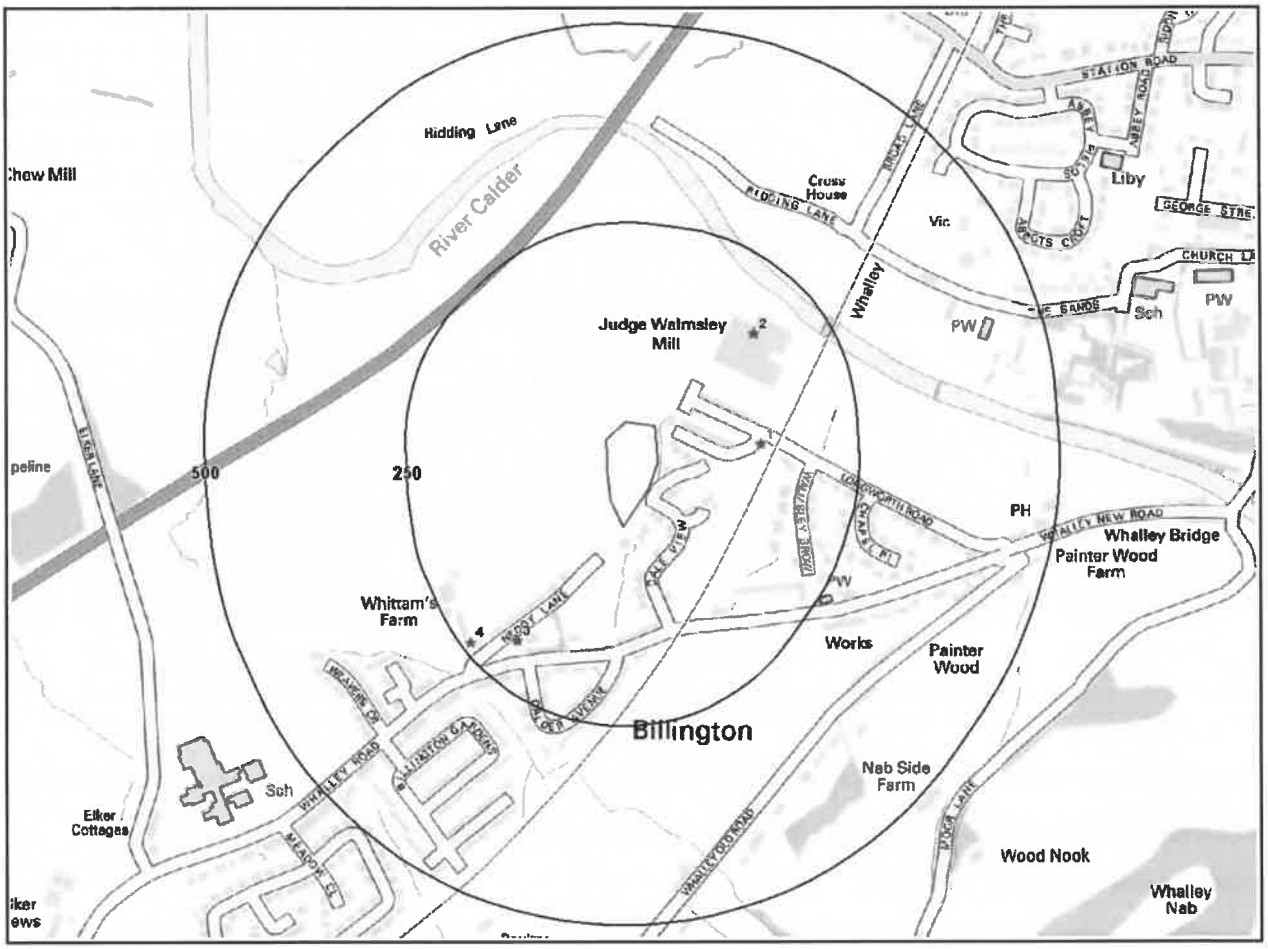
Database searched and no data found.

Records of Environment Agency licensed waste sites within 1500m of the study site: **0**

Database searched and no data found.

---

3. Current Land Use Map



Current Land Use Legend

Mapping sourced from Ordnance Survey

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Site Outline

Search Buffers (m)

Current Industrial Sites

Petrol & Fuel Sites

Underground High Pressure Oil & Fuel Pipelines

3. Current Land Uses

3.1 Current Industrial Data

Records of potentially contaminative industrial sites within 250m of the study site: **4**

The following records are represented as points on the Current Land Uses map.

ID	Distance	Direction	Company	Address	Activity	Category
1	128.0	E	Electricity Sub Station	BB7	Electrical Features	Infrastructure and Facilities
2	167.0	NE	Harrisons Engineering Ltd	Judge Walmsley Mill, Longworth Road, Billington, Clitheroe, BB7 9TP	Structural Engineers	Engineering Services
3	195.0	SW	Ribble Valley Concrete	Old Coach House, Whalley Road, Billington, Clitheroe, BB7 9NA	Concrete Products	Industrial Products
4	239.0	SW	Electricity Sub Station	BB7	Electrical Features	Infrastructure and Facilities

3.2 Petrol and Fuel Sites

Records of petrol or fuel sites within 500m of the study site: **0**

Database searched and no data found.

3.3 Underground High Pressure Oil and Gas Pipelines

Records of high pressure underground pipelines within 500m of the study site: **0**

Database searched and no data found.

4. Geology

4.1 Artificial Ground and Made Ground

Database searched and no data found.

The database has been searched on site, including a 50m buffer.

4.2 Superficial Ground and Drift Geology

The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
TILLD-DMTN	TILL, DEVENSIAN	DIAMICTON
ALV-CSSG	ALLUVIUM	CLAY, SILT, SAND AND GRAVEL

(Derived from the BGS 1:50,000 Digital Geological Map of Great Britain)

4.3 Bedrock and Solid Geology

The database has been searched on site, including a 50m buffer.

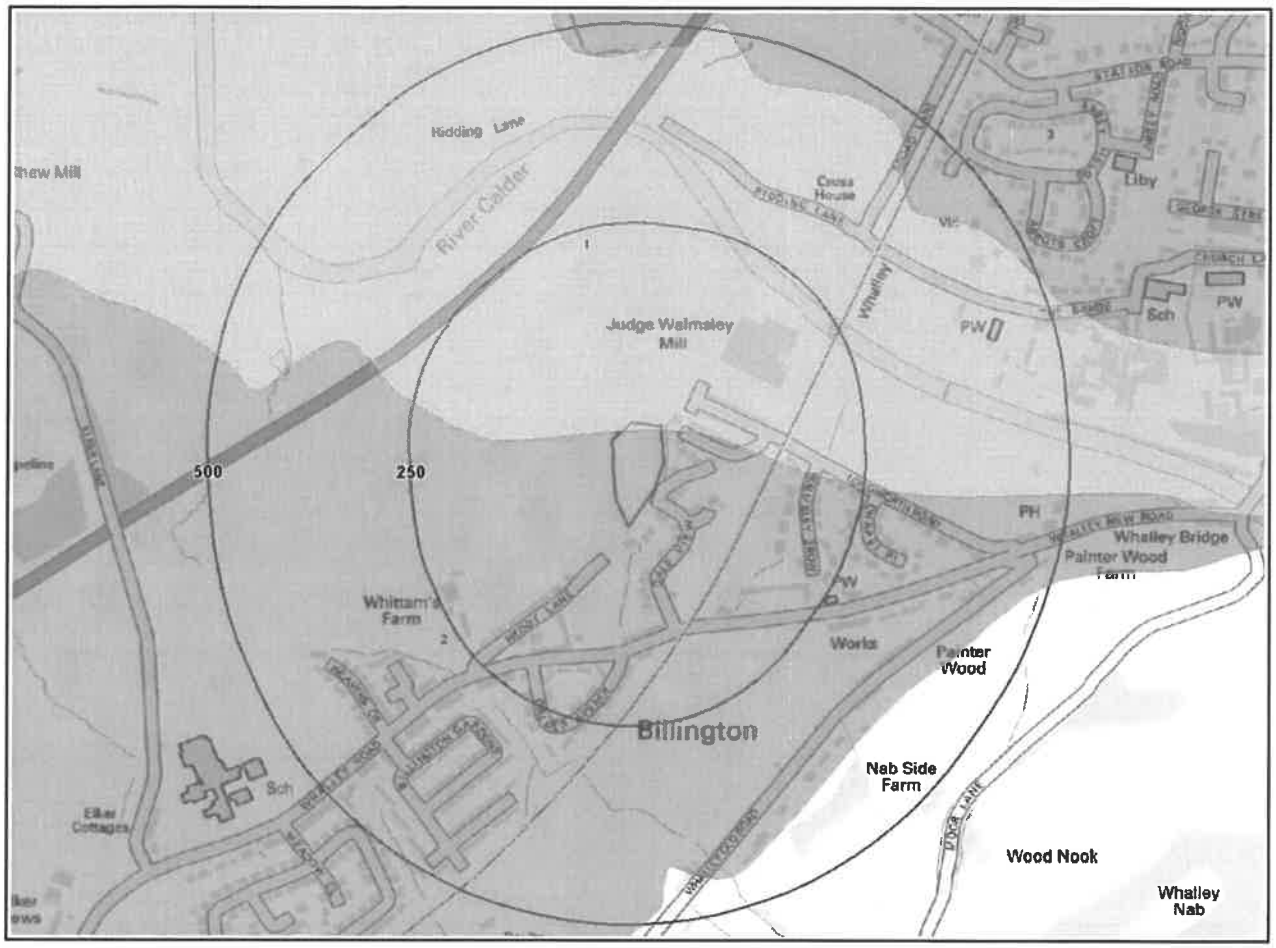
LEX Code	Description	Rock Type
BSG-MDST	BOWLAND SHALE FORMATION	MUDSTONE

(Derived from the BGS 1:50,000 Digital Geological Map of Great Britain)

For more detailed geological and ground stability data please refer to the "GroundSure GeoInsight". Available from our website.

5a. Hydrogeology - Aquifer Within Superficial Geology

NW N NE



W E

SW S SE

Aquifer Within Superficial Geology Legend

Mapping sourced from Ordnance Survey

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Site Outline

250 500 Search Buffers (m)

Principal Aquifer

Secondary (A) Aquifer - Permeable Layers

Secondary (B) Aquifer - Lower Permeability Layers

Secondary Aquifer - Undifferentiated Layers

Unproductive

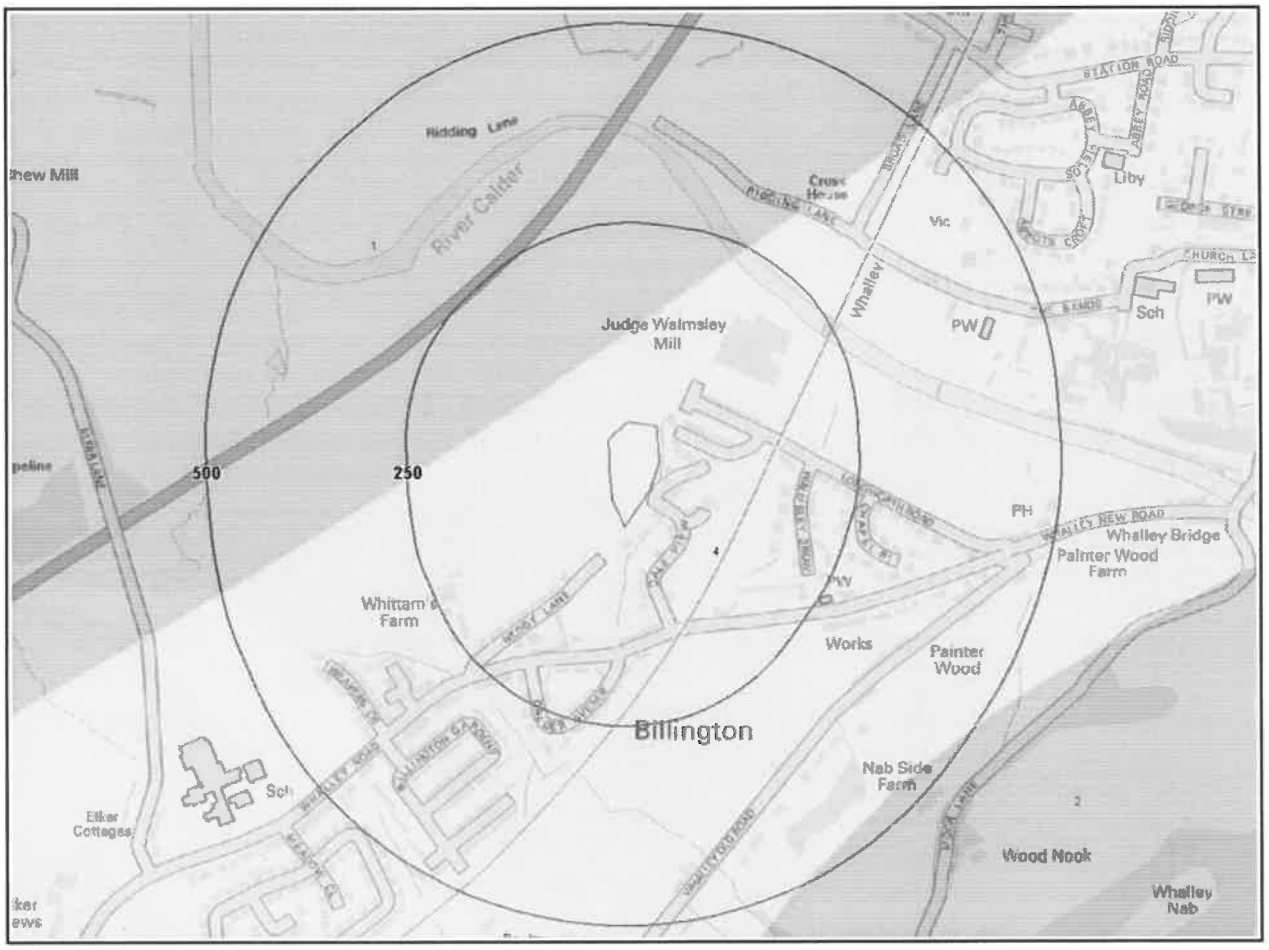
Unknown (lakes and landslip)

5b. Hydrogeology - Aquifer Within Bedrock Geology and Abstraction Licenses

NW N NE

W E

SW S SE



Aquifer Within Bedrock Geology Legend

Mapping sourced from Ordnance Survey

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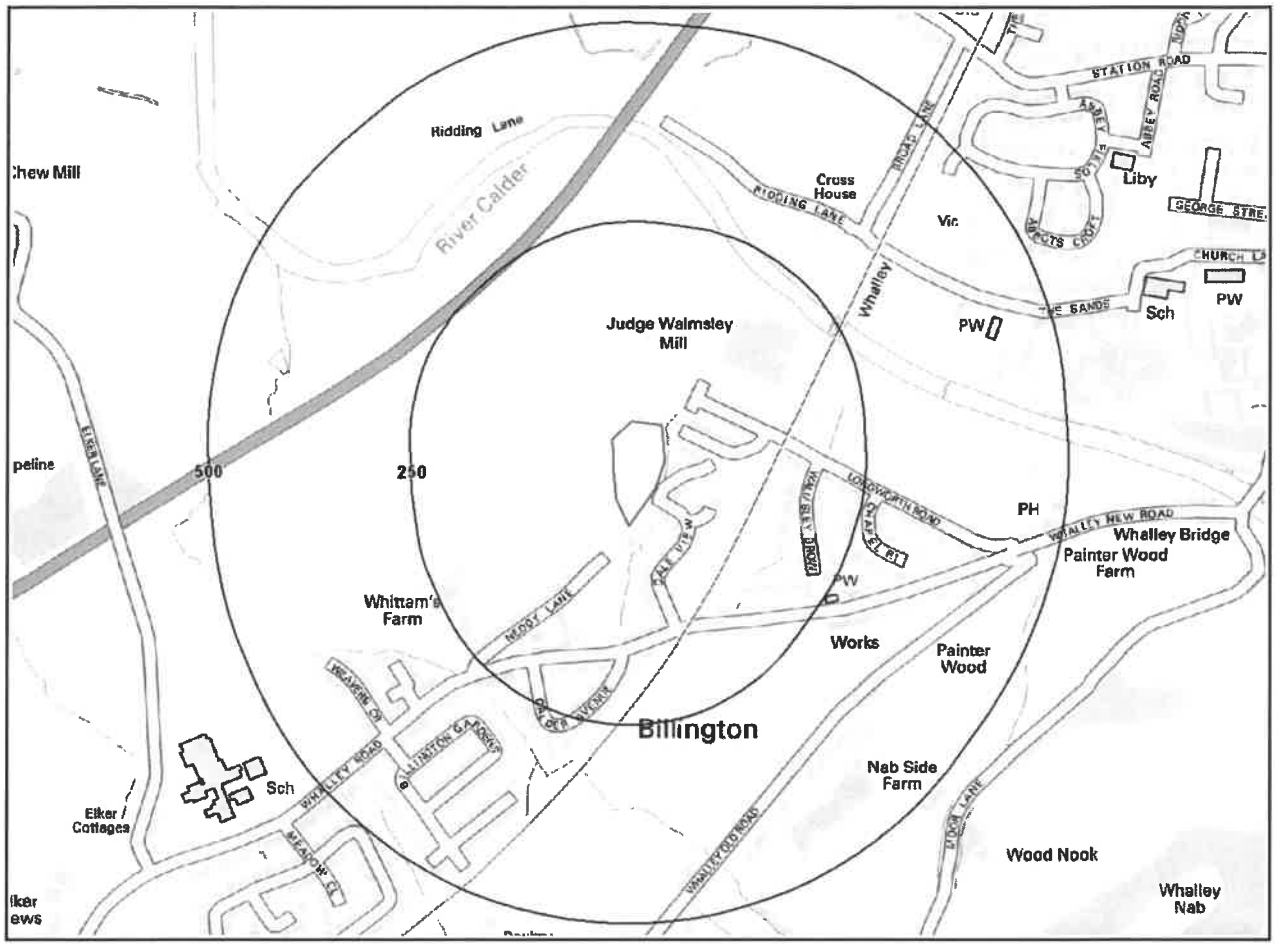
- Site Outline
- Search Buffers (m): 250, 500
- Principal Aquifer
- Secondary (A) Aquifer - Permeable Layers
- Secondary (B) Aquifer - Lower Permeability Layers
- Groundwater Abstraction Licence
- Secondary Aquifer - Undifferentiated Layers
- Unproductive
- Unknown (lakes and landslip)
- Surface Water Abstraction Licence

5c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses

NW N NE

W E

SW S SE



SPZ and Potable Water Abstraction Licenses Legend

Mapping sourced from Ordnance Survey

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Site Outline

250 / 500 Search Buffers (m)

Source Protection Zone 1 - Inner Catchment

Source Protection Zone 2 - Outer Catchment

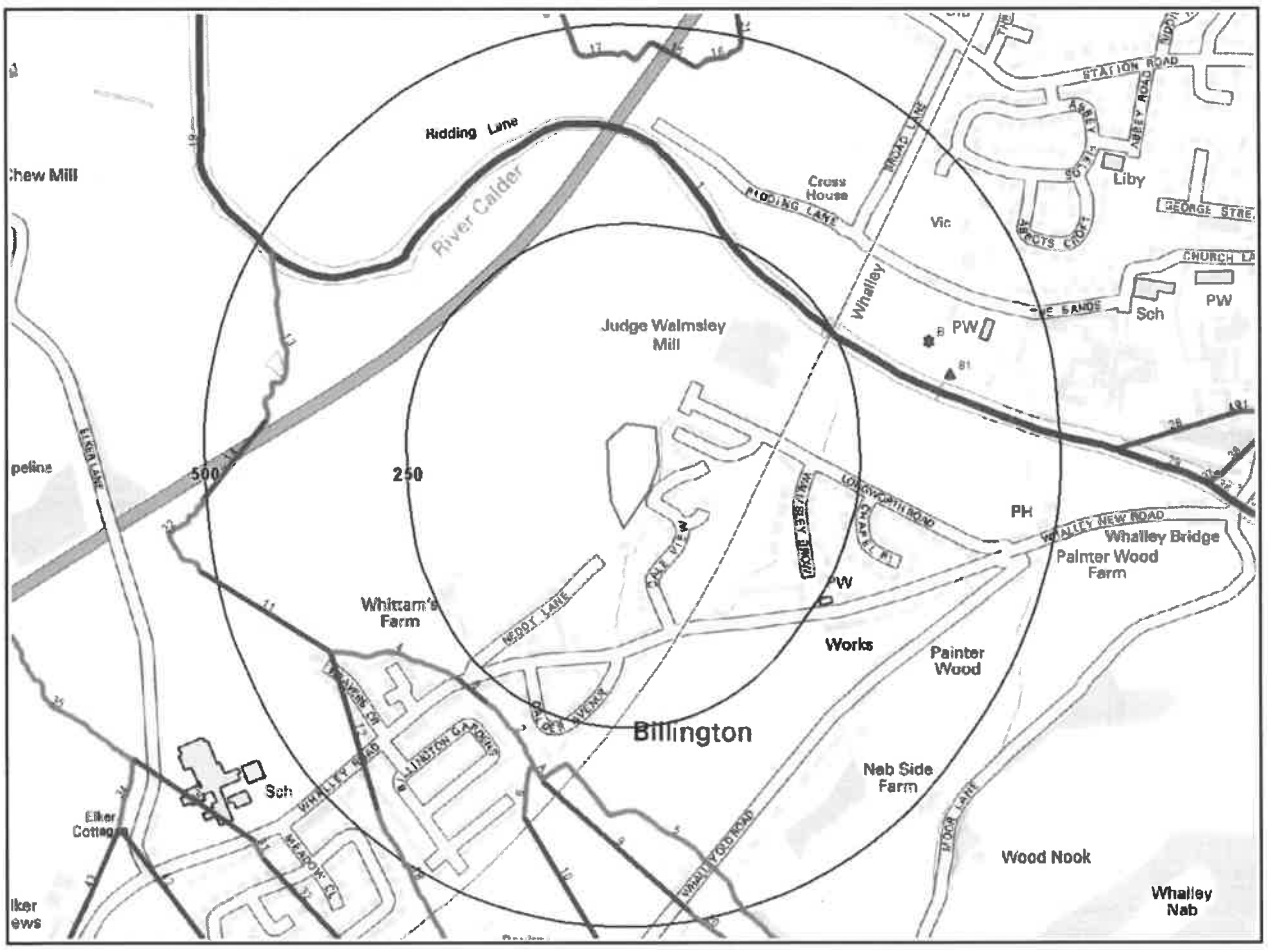
Source Protection Zone 3 - Total Catchment

Source Protection Zone 4 - Zone of Special Interest

Potable Water Abstraction Licence

5d. Hydrology – Detailed River Network and River Quality

NW N NE



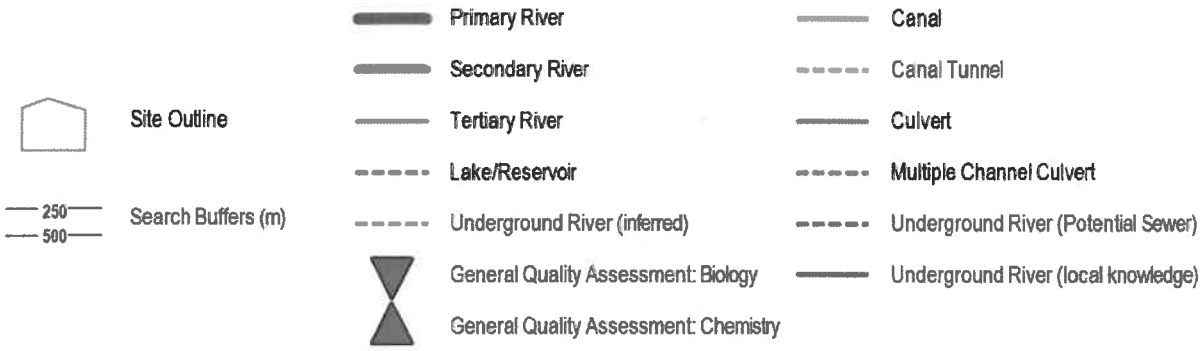
W E

SW S SE

Hydrology Legend

Mapping sourced from Ordnance Survey

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Site Outline
250
500
Search Buffers (m)
Primary River
Secondary River
Tertiary River
Lake/Reservoir
Underground River (inferred)
General Quality Assessment: Biology
General Quality Assessment: Chemistry
Canal
Canal Tunnel
Culvert
Multiple Channel Culvert
Underground River (Potential Sewer)
Underground River (local knowledge)

5.Hydrogeology and Hydrology

5.1 Aquifer within Superficial Deposits

Are there records of productive strata within the superficial geology at or in proximity to the property? Yes

From 1 April 2010, the Environment Agency's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the GroundSure Enviroinsight User Guide.

The following aquifer records are shown on the Aquifer within Superficial Geology Map (5a):

ID	Distance [m]	Direction	Designation	Description
1	0.0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
2	0.0	On Site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
3	410.0	NE	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow

5.2 Aquifer within Bedrock Deposits

Are there records of productive strata within the bedrock geology at or in proximity to the property? Yes

From 1 April 2010, the Environment Agency's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the GroundSure Enviroinsight User Guide.

The following aquifer records are shown on the Aquifer within Bedrock Geology Map (5b):

ID	Distance [m]	Direction	Designation	Description
4	0.0	On Site	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type
1	93.0	NW	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
2	470.0	SE	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers

5.3 Groundwater Abstraction Licences

Are there any Groundwater Abstraction Licences within 2000m of the study site? Yes

The following Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (5b):

ID	Distance	Direction	NGR	Details	
Not shown	1166.0	SE		Licence No: 2671336007 Details: "Drinking, Cooking, Sanitary, Washing, (Small Garden) - Household" Direct Source: Ground Water - North West Region Point: "borehole At Dean Nab , Whalley" Data Type: Point	Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: - Original Start Date: 19/7/1993 Expiry Date: - Issue No: 101 Version Start Date: 29/6/1998 Version End Date:
Not shown	1166.0	SE		Licence No: 2671336007 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Household Direct Source: Ground Water - North West Region Point: Borehole At Dean Nab, Whalley Data Type: Point	Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: 7203 Original Start Date: 19/7/1993 Expiry Date: - Issue No: 102 Version Start Date: 1/7/2003 Version End Date:
Not shown	1166.0	SE		Licence No: 2671336007 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Household Direct Source: Ground Water - North West Region Point: Borehole At Dean Nab , Whalley Data Type: Point	Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: 7203 Original Start Date: 19/7/1993 Expiry Date: - Issue No: 102 Version Start Date: 1/7/2003 Version End Date:

5.4 Surface Water Abstraction Licences

Are there any Surface Water Abstraction Licences within 2000m of the study site? **No**

Database searched and no data found.

5.5 Potable Water Abstraction Licences

Are there any Potable Water Abstraction Licences within 2000m of the study site? **Yes**

The following Potable Water Abstraction Licences records are represented as points, lines and regions on the SPZ and Potable Water Abstraction Licences Map (5c):

ID	Distance	Direction	NGR	Details	
Not shown	1166.0	SE	373400, 435100	Licence No: 2671336007 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Household Direct Source: Ground Water - North West Region Point: Borehole At Dean Nab, Whalley Data Type: Point	Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: 7203 Original Start Date: 19/7/1993 Expiry Date: - Issue No: 102 Version Start Date: Version End Date:
Not shown	1166.0	SE	373400, 435100	Licence No: 2671336007 Details: "Drinking, Cooking, Sanitary, Washing, (Small Garden) - Household" Direct Source: Ground Water - North West Region Point: "borehole At Dean Nab , Whalley" Data Type: Point	Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: - Original Start Date: 19/7/1993 Expiry Date: - Issue No: 101 Version Start Date: Version End Date:
Not shown	1166.0	SE	373400, 435100	Licence No: 2671336007 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Household Direct Source: Ground Water - North West Region Point: Borehole At Dean Nab , Whalley Data Type: Point	Annual Volume (m³): - Max Daily Volume (m³): - Original Application No: 7203 Original Start Date: 19/7/1993 Expiry Date: - Issue No: 102 Version Start Date: Version End Date:

5.6 Source Protection Zones

Are there any Source Protection Zones within 500m of the study site? **No**

Database searched and no data found.

5.7 River Quality

Is there any Environment Agency information on river quality within 1500m of the study site? **Yes**

Biological Quality:

Biological Quality data describes water quality in terms of 83 groups of macroinvertebrates, some of which are pollution sensitive. The results are graded from A ('Very Good') to F ('Bad').

The following Biological Quality records are shown on the Hydrology Map (5d):

ID	Distance [m]	Direction	NGR	River Details	Biological Quality Grade				
					2005	2006	2007	2008	2009
79B	354.0	E	372900, 436100	River Name: Calder (calder) Reach: Hyndburn Bk To Whalley Weir End/Start of Stretch: End of Stretch NGR	D	D	D	B	B

Chemical Quality:

Chemical quality data is based on the General Quality Assessment Headline Indicators scheme (GQAHI). In England, each chemical sample is measured for ammonia and dissolved oxygen. In Wales, the samples are measured for biological oxygen demand (BOD), ammonia and dissolved oxygen. The results are graded from A ('Very Good') to F ('Bad').

The following Chemical Quality records are shown on the Hydrology Map (5d):

ID	Distance [m]	Direction	NGR	River Details	Chemical Quality Grade (Headline Indicator)				
					2005	2006	2007	2008	2009
80B	354.0	E	372900, 436100	River Name: Calder Reach: Whalley Weir To Ribble End/Start of Stretch: Start of Stretch NGR	C	B	B	B	B
81	371.0	E	372927, 436058	River Name: Calder Reach: Whalley Weir To Ribble End/Start of Stretch: Sample Point NGR	C	B	B	B	B

5.8 Detailed River Network

Are there any Detailed River Network entries within 500m of the study site? **Yes**

The following Detailed River Network records are represented on the Hydrology Map (5d):

ID	Distance	Direction		Details
1	231.0	NE	River Name: River Calder Welsh River Name: - Alternative Name: -	River Type: Primary River Main River Status: Currently Undefined

2	277.0	SW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
3	277.0	SW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
4	281.0	SW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
5	303.0	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
6	317.0	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
7A	317.0	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
8A	330.0	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
9	332.0	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
10	382.0	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
11	395.0	SW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
12	395.0	SW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
13	408.0	W	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
14	424.0	W	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
15	454.0	N	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
16	454.0	N	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
17	457.0	N	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
18	468.0	SW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
19	480.0	NW	River Name: River Calder Welsh River Name: - Alternative Name: -	River Type: Primary River Main River Status: Currently Undefined
20	488.0	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
21	493.0	N	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined

5.9 Surface Water Features

Are there any surface water features within 250m of the study site? **Yes**

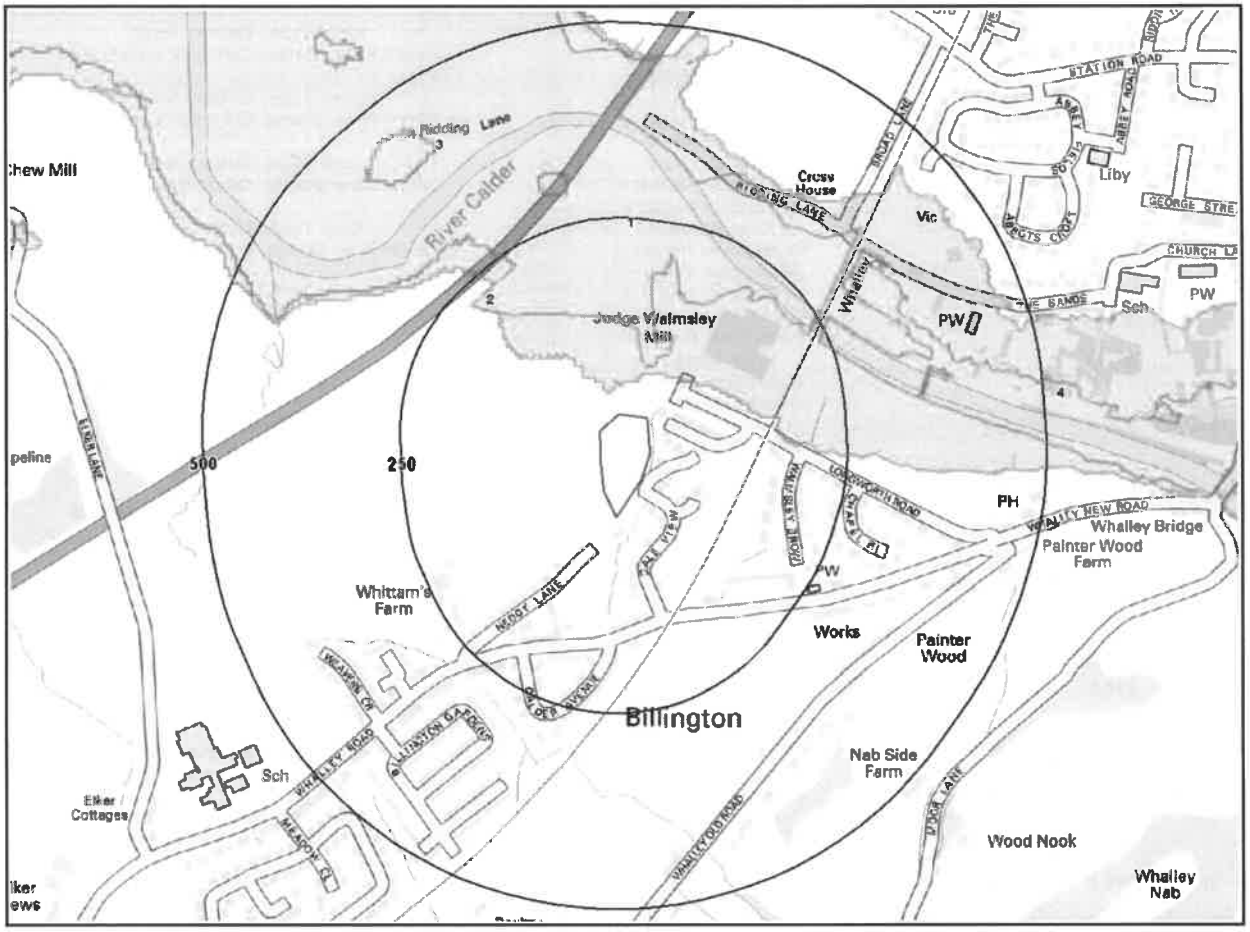
The following surface water records are not represented on mapping:

Distance to Surface Water (m)	on-site	0-50	51-250
Surface water features within 250m of the study site	No	Yes	Yes

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6. Environment Agency Flood Map

NW ▲ N NE



◄W E►

SW ▼ S SE

Environment Agency Flood Legend

Mapping sourced from Ordnance Survey

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Site Outline

250 / 500 Search Buffers (m)

Zone 2 Floodplain

Zone 3 Floodplain

Flood Storage Area

Area Benefiting from Flood Defences

Flood Defences

6. Flooding

6.1 Zone 2 Flooding

Zone 2 floodplain estimates the annual probability of flooding as one in one thousand (0.1%) or greater from rivers and the sea but less than 1% from rivers or 0.5% from the sea. Alternatively, where information is available they may show the highest known flood level.

Is the site within 250m of an Environment Agency indicative Zone 2 floodplain? **Yes**

The following floodplain records are represented as green shading on the Flood Map:

ID	Distance	Direction	Update	Type
1	29.0	N	09-Sep-2013	Zone 2 - (Fluvial Models)
2	197.0	NW	09-Sep-2013	Zone 2 - (Fluvial Models)

6.2 Zone 3 Flooding

Zone 3 estimates the annual probability of flooding as one in one hundred (1%) or greater from rivers and a one in two hundred (0.5%) or greater from the sea. Alternatively, where information is available they may show the highest known flood level.

Is the site within 250m of an Environment Agency indicative Zone 3 floodplain? **Yes**

The following floodplain records are represented as blue shading on the Flood Map:

ID	Distance	Direction	Update	Type
3	65.0	N	09-Sep-2013	Zone 3 - (Fluvial Models)
4	238.0	NE	09-Sep-2013	Zone 3 - (Fluvial Models)

6.3 Flood Defences

Are there any Flood Defences within 250m of the study site? **No**

6.4 Areas benefiting from Flood Defences

Are there any areas benefiting from Flood Defences within 250m of the study site? **No**

6.5 Areas used for Flood Storage

Are there any areas used for Flood Storage within 250m of the study site? **No**

6.6 Groundwater Flooding Susceptibility Areas

Are there any British Geological Survey groundwater flooding susceptibility flood areas within 50m of the boundary of the study site?	**Yes**
What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?	**Very High**

6.7 Groundwater Flooding Confidence Areas

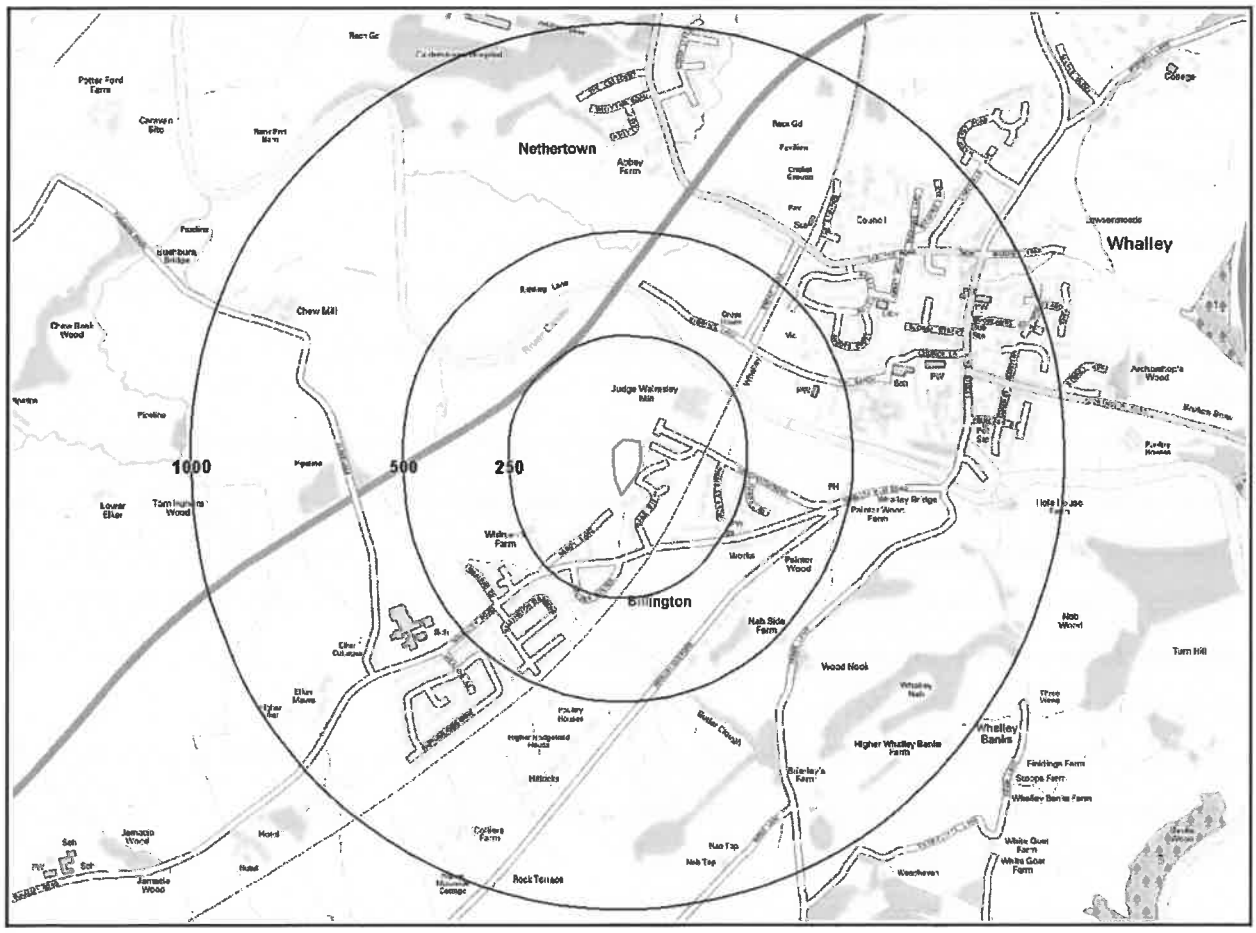
What is the British Geological Survey confidence rating in this result?	**Moderate**

Notes:

Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

The **confidence rating** is on a threefold scale - Low, Moderate and High. This provides a relative indication of the BGS confidence in the accuracy of the susceptibility result for groundwater flooding. This is based on the amount and precision of the information used in the assessment. In areas with a relatively lower level of confidence the susceptibility result should be treated with more caution. In other areas with higher levels of confidence the susceptibility result can be used with more confidence.

7.Designated Environmentally Sensitive Sites Map



Designated Environmentally Sensitive Sites Legend

Mapping sourced from Ordnance Survey

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- Site Outline
- Areas of Outstanding Natural Beauty
- SAC
- SPA
- Nitrate Vulnerable Zones
- SSSI
- Ramsar
- Nitrate Sensitive Areas
- NNR
- LNR
- National Parks
- World Heritage Sites
- Environmentally Sensitive Areas
- Ancient Woodlands

7.Designated Environmentally Sensitive Sites

Presence of Designated Environmentally Sensitive Sites within 2000m of the study site? **No**

Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site: **0**

Database searched and no data found.

Records of National Nature Reserves (NNR) within 2000m of the study site: **0**

Database searched and no data found.

Records of Special Areas of Conservation (SAC) within 2000m of the study site: **0**

Database searched and no data found.

Records of Special Protection Areas (SPA) within 2000m of the study site: **0**

Database searched and no data found.

Records of Ramsar sites within 2000m of the study site: **0**

Database searched and no data found.

Records of Local Nature Reserves (LNR) within 2000m of the study site: **0**

Database searched and no data found.

Records of World Heritage Sites within 2000m of the study site: **0**

Database searched and no data found.

Records of Environmentally Sensitive Areas within 2000m of the study site: **0**

Database searched and no data found.

Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site: **0**

Database searched and no data found.

Records of National Parks (NP) within 2000m of the study site: **0**

Database searched and no data found.

Records of Nitrate Sensitive Areas within 2000m of the study site: **0**

Database searched and no data found.

Records of Nitrate Vulnerable Zones within 2000m of the study site: **0**

Database searched and no data found.

Records of Ancient Woodland within 2000m of the study site: **13**

The following Ancient Woodland records are supplied by English Nature/Scottish Natural Heritage/Countryside Council for Wales and are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance	Direction	Ancient Woodland Name	Type
1	1310.0	E	SPRING WOOD	Ancient and Semi-Natural Woodland
2	1393.0	E	PLANES WOOD	Ancient and Semi-Natural Woodland
Not shown	1408.0	NW	MITTON WOOD	Ancient and Semi-Natural Woodland
Not shown	1473.0	E	SPRING WOOD	Ancient and Semi-Natural Woodland
5	1476.0	SE	BANKS WOOD	Ancient and Semi-Natural Woodland
Not shown	1637.0	S	DEAN WOOD	Ancient and Semi-Natural Woodland
Not shown	1666.0	E	SPRING WOOD	Ancient Replanted Woodland
Not shown	1746.0	E	PLANES WOOD	Ancient and Semi-Natural Woodland
Not shown	1800.0	SE	DEAN WOOD	Ancient and Semi-Natural Woodland
Not shown	1857.0	SE	DEAN WOOD	Ancient Replanted Woodland
Not shown	1867.0	SE	DEAN WOOD	Ancient Replanted Woodland
Not shown	1873.0	NW	UNKNOWN	Ancient and Semi-Natural Woodland
Not shown	1989.0	NW	UNKNOWN	Ancient and Semi-Natural Woodland

8. Natural Hazards Findings

8.1 Detailed BGS GeoSure Data

BGS GeoSure Data has been searched to 50m. The data is included in tabular format. If you require further information on geology and ground stability, please obtain a GroundSure GeoInsight, available from our website. The following information has been found:

8.1.1 Shrink Swell

What is the maximum Shrink-Swell* hazard rating identified on the study site? **Very Low**

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Ground conditions predominantly low plasticity. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with shrink-swell clays.

8.1.2 Landslides

What is the maximum Landslide* hazard rating identified on the study site? **Very Low**

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

8.1.3 Soluble Rocks

What is the maximum Soluble Rocks* hazard rating identified on the study site? **Null - Negligible**

Soluble rocks are not present in the search area. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

8.1.4 Compressible Ground

What is the maximum Compressible Ground* hazard rating identified on the study site? **Moderate**

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Significant potential for compressibility problems. Avoid large differential loadings of ground. Do not drain or de-water ground near the property without technical advice. For new build consider possibility of compressible ground in ground investigation, construction and building design. Consider effects of groundwater changes. Extra construction costs are likely. For existing property possible increase in insurance risk from compressibility, especially if water conditions or loading of the ground change significantly.

8.1.5 Collapsible Rocks

What is the maximum Collapsible Rocks* hazard rating identified on the study site? **Very Low**

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

8.1.6Running Sand

What is the maximum Running Sand* hazard rating identified on the study site? **Low**

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property no significant increase in insurance risk due to running sand problems is likely.

* This indicates an automatically generated 50m buffer and site.

9.Mining

9.1 Coal Mining

Are there any coal mining areas within 75m of the study site? **No**

Database searched and no data found.

9.2 Shallow Mining

What is the subsidence hazard relating to shallow mining on-site*? **Negligible**

*Please note this data is searched with a 150m buffer.

9.3 Brine Affected Areas

Are there any brine affected areas within 75m of the study site? **No**

Guidance: No Guidance Required.

10.Contacts

GroundSure Helpline
Telephone: 08444 159 000
info@groundsure.com

British Geological Survey (England & Wales)
Kingsley Dunham Centre
Keyworth, Nottingham NG12 5GG
Tel: 0115 936 3143. Fax: 0115 936 3276. Email: enquiries@bgs.ac.uk
Web: www.bgs.ac.uk
BGS Geological Hazards Reports and general geological enquiries

Environment Agency
National Customer Contact Centre
PO Box 544
Rotherham
S60 1BY
Tel: 08708 506 506
Web: www.environment-agency.gov.uk
Email: enquiries@environment-agency.gov.uk

Public Health England
Public information access office, Public Health England
Wellington House, 133-155 Waterloo Road, London, SE1 8UG
https://www.gov.uk/government/organisations/public-health-england
Email: enquiries@phe.gov.uk
Main switchboard: 020 7654 8000

The Coal Authority
200 Lichfield Lane, Mansfield, Notts NG18 4RG
Tel: 0845 762 6848
DX 716176 Mansfield 5
Web: www.groundstability.com

Ordnance Survey
Romsey Road
Southampton SO16 4GU
Tel: 08456 050505

Local Authority
Authority: Ribble Valley Borough Council
Phone: 01200 425111
Web: www.ribblevalley.gov.uk
Address: Council Offices, Church Walk, Clitheroe, Lancashire, BB7 2RA

Get Mapping PLC
Virginia Villas, High Street, Hartley Witney, Hampshire RG27 8NW
Tel: 01252 845444

Acknowledgements

Site of Special Scientific Interest, National Nature Reserve, Ramsar Site, Special Protection Area, Special Area of Conservation data is provided by, and used with the permission of, English Nature who retain the Copyright and Intellectual Property Rights for the data.

PointX © Database Right/Copyright, Thomson Directories Limited © Copyright Link Interchange Network Limited © Database Right/Copyright and Ordnance Survey © Crown Copyright and/or Database Right. All Rights Reserved. Licence Number [03421028]. This report has been prepared in accordance with the GroundSure Ltd standard Terms and Conditions of business for work of this nature.

Standard Terms and Conditions

1 Definitions

In these terms and conditions unless the context otherwise requires:

"Beneficiary" means the person or entity for whose benefit the Client has obtained the Services.

"Client" means the party or parties entering into a Contract with GroundSure.

"Commercial" means any building or property which is not Residential.

"Confidential Information" means the contents of this Contract and all information received from the Client as a result of, or in connection with, this Contract other than

(i) information which the Client can prove was rightfully in its possession prior to disclosure by GroundSure and

(ii) any information which is in the public domain (other than by virtue of a breach of this Contract).

"Support Services" means Support Services provided by GroundSure including, without limitation, interpreting third party and in-house environmental data, providing environmental support advice, undertaking environmental audits and assessments, Site investigation, Site monitoring and related items.

"Contract" means the contract between GroundSure and the Client for the provision of the Services, and which shall incorporate these terms and conditions, the Order, and the relevant User Guide.

"Third Party Data Provider" means any third party providing Third Party Content to GroundSure.

"Data Reports" means reports comprising factual data with no accompanying interpretation.

"Fees" has the meaning set out in clause 5.1.

"GroundSure" means GroundSure Limited, a company registered in England and Wales under number 03421028.

"GroundSure Materials" means all materials prepared by GroundSure and provided as part of the Services, including but not limited to Third Party Content, Data Reports, Mapping, and Risk Screening Reports.

"Intellectual Property" means any patent, copyright, design rights, trade or service mark, moral rights, data protection rights, know-how or trade mark in each case whether registered or not and including applications for the same or any other rights of a similar nature anywhere in the world.

"Mapping" means a map, map data or a combination of historical maps of various ages, time periods and scales.

"Order" means an electronic, written or other order form submitted by the Client requesting Services from GroundSure in respect of a specified Site.

"Ordnance Survey" means the Secretary of State for Business, Innovation and Skills, acting through Ordnance Survey, Adanac Drive, Southampton, SO16 0AS, UK.

"Order Website" means the online platform through which Orders may be placed by the Client and accepted by GroundSure.

"Report" means a Risk Screening Report or Data Report for Commercial or Residential property.

"Residential" means any building or property used as or intended to be used as a single dwelling.

"Risk Screening Report" means a risk screening report comprising factual data with an accompanying interpretation by GroundSure.

"Services" means any Report, Mapping and/or Support Services which GroundSure has agreed to provide by accepting an Order pursuant to clause 2.6.

"Site" means the area of land in respect of which the Client has requested GroundSure to provide the Services.

"Third Party Content" means data, database information or other information which is provided to GroundSure by a Third Party Data Provider.

"User Guide" means the user guide, as amended from time to time, available upon request from GroundSure and on the website (www.groundsure.com) and forming part of this Contract.

2 Scope of Services, terms and conditions, requests for insurance and quotations

2.1 GroundSure agrees to provide the Services in accordance with the Contract.

2.2 GroundSure shall exercise reasonable skill and care in the provision of the Services.

2.3 Subject to clause 7.3 the Client acknowledges that it has not relied on any statement or representation made by or on behalf of GroundSure which is not set out and expressly agreed in writing in the Contract and all such statements and representations are hereby excluded to the fullest extent permitted by law.

2.4 The Client acknowledges that terms and conditions appearing on a Client's order form, printed stationery or other communication, or any terms or conditions implied by custom, practice or course of dealing shall be of no effect, and that this Contract shall prevail over all others in relation to the Order.

2.5 If the Client or Beneficiary requests insurance in conjunction with or as a result of the Services, GroundSure shall use reasonable endeavours to recommend such insurance, but makes no warranty that such insurance shall be available from insurers or that it will be offered on reasonable terms. Any insurance purchased by the Client or Beneficiary shall be subject solely to the terms of the policy issued by insurers and GroundSure will have no liability therefor. In addition you acknowledge and agree that GroundSure does not act as an agent or broker for any insurance providers. The Client should take (and ensure that the Beneficiary takes) independent advice to ensure that the insurance policy requested or offered is suitable for its requirements.

2.6 GroundSure's quotations or proposals are valid for a period of 30 days only unless an alternative period of time is explicitly stipulated by Groundsure. GroundSure reserves the right to withdraw any quotation or proposal at any time before an Order is accepted by GroundSure. GroundSure's acceptance of an Order shall be binding only when made in writing and signed by GroundSure's authorised representative or when accepted through the Order Website.

3 The Client's obligations

3.1 The Client shall comply with the terms of this Contract and

(i) procure that the Beneficiary or any third party relying on the Services complies with and acts as if it is bound by the Contract and

(ii) be liable to GroundSure for the acts and omissions of the Beneficiary or any third party relying on the Services as if such acts and omissions were those of the Client.

3.2 The Client shall be solely responsible for ensuring that the Services are appropriate and suitable for its and/or the Beneficiary's needs.

3.3 The Client shall supply to GroundSure as soon as practicable and without charge all requisite information (and the Client warrants that such information is accurate, complete and appropriate), including without limitation any environmental information relating to the Site and shall give such assistance as GroundSure shall reasonably require in the provision of the Services including, without limitation, access to the Site, facilities and equipment.

3.4 Where the Client's approval or decision is required to enable GroundSure to carry out work in order to provide the Services, such approval or decision shall be given or procured in reasonable time and so as not to delay or disrupt the performance of the Services.

3.5 Save as expressly permitted by this Contract the Client shall not, and shall procure that the Beneficiary shall not, re-sell, alter, add to, or amend the GroundSure Materials, or use the GroundSure Materials in a manner for which they were not intended. The Client may make the GroundSure Materials available to a third party who is considering acquiring some or all of, or providing funding in relation to, the Site, but such third party cannot rely on the same unless expressly permitted under clause 4.

3.6 The Client is responsible for maintaining the confidentiality of its user name and password if using the Order Website and the Client acknowledges that GroundSure accepts no liability of any kind for any loss or damage suffered by the Client as a consequence of using the Order Website.

4 Reliance

4.1The Client acknowledges that the Services provided by GroundSure consist of the presentation and analysis of Third Party Content and other content and that information obtained from a Third Party Data Provider cannot be guaranteed or warranted by GroundSure to be reliable.
4.2 In respect of Data Reports, Mapping and Risk Screening Reports, the following classes of person and no other are entitled to rely on their contents;
(i) the Beneficiary,
(ii) the Beneficiary's professional advisers, (iii) any person providing funding to the Beneficiary in relation to the Site (whether directly or as part of a lending syndicate),
(iv) the first purchaser or first tenant of the Site, and
(v) the professional advisers and lenders of the first purchaser or tenant of the Site.
4.3 In respect of Support Services, only the Client, Beneficiary and parties expressly named in a Report and no other parties are entitled to rely on its contents.
4.4 Save as set out in clauses 4.2 and 4.3 and unless otherwise expressly agreed in writing, no other person or entity of any kind is entitled to rely on any Services or Report issued or provided by GroundSure. Any party considering such Reports and Services does so at their own risk.

5 Fees and Disbursements

5.1GroundSure shall charge and the Client shall pay fees at the rate and frequency specified in the written proposal, Order Website or Order acknowledgement form, plus (in the case of Support Services) all proper disbursements incurred by GroundSure. The Client shall in addition pay all value added tax or other tax payable on such fees and disbursements in relation to the provision of the Services (together "Fees").
5.2 The Client shall pay all outstanding Fees to GroundSure in full without deduction, counterclaim or set off within 30 days of the date of GroundSure's invoice or such other period as may be agreed in writing between GroundSure and the Client ("Payment Date"). Interest on late payments will accrue on a daily basis from the Payment Date until the date of payment (whether before or after judgment) at the rate of 8% per annum.
5.3 The Client shall be deemed to have agreed the amount of any invoice unless an objection is made in writing within 28 days of the date of the invoice. As soon as reasonably practicable after being notified of an objection, without prejudice to clause 5.2 a member of GroundSure's management team will contact the Client and the parties shall then use all reasonable endeavours to resolve the dispute within 15 days.

6 Intellectual Property and Confidentiality

6.1 Subject to
(i) full payment of all relevant Fees and
(ii) compliance with this Contract, the Client is granted (and is permitted to sub-licence to the Beneficiary) a royalty-free, worldwide, non-assignable and (save to the extent set out in this Contract) non-transferable licence to make use of the GroundSure Materials.
6.2 All Intellectual Property in the GroundSure Materials are and shall remain owned by GroundSure or GroundSure's licensors (including without limitation the Third Party Data Providers) the Client acknowledges, and shall procure acknowledgement by the Beneficiary of, such ownership. Nothing in this Contract purports to transfer or assign any rights to the Client or the Beneficiary in respect of such Intellectual Property.
6.3 Third Party Data Providers may enforce any breach of clauses 6.1 and 6.2 against the Client or Beneficiary.
6.4 The Client shall, and shall procure that any recipients of the GroundSure Materials shall:
(i) not remove, suppress or modify any trade mark, copyright or other proprietary marking belonging to GroundSure or any third party from the Services;
(ii) use the information obtained as part of the Services in respect of the subject Site only, and shall not store or reuse any information obtained as part of the Services provided in respect of adjacent or nearby sites;
(iii) not create any product or report which is derived directly or indirectly from the Services (save that those acting in a professional capacity to the Beneficiary may provide advice based upon the Services);
(iv) not combine the Services with or incorporate such Services into any other information data or service;
(v) not reformat or otherwise change (whether by modification, addition or enhancement), the Services (save that those acting for the Beneficiary in a professional capacity shall not be in breach of this clause 6.4(v) where such reformatting is in the normal course of providing advice based upon the Services);
(vi) where a Report and/or Mapping contains material belonging to Ordnance Survey, acknowledge and agree that such content is protected by Crown Copyright and shall not use such content for any purpose outside of receiving the Services; and
(vii) not copy in whole or in part by any means any map prints or run-on copies containing content belonging to Ordnance Survey (other than that contained within Ordnance Survey's OS Street Map) without first being in possession of a valid Paper Map Copying Licence from Ordnance Survey,
6.5 Notwithstanding clause 6.4, the Client may make reasonable use of the GroundSure Materials in order to advise the Beneficiary in a professional capacity. However, GroundSure shall have no liability in respect of any advice, opinion or report given or provided to Beneficiaries by the Client.
6.6 The Client shall procure that any person to whom the Services are made available shall notify GroundSure of any request or requirement to disclose, publish or disseminate any information contained in the Services in accordance with the Freedom of Information Act 2000, the Environmental Information Regulations 2004 or any associated legislation or regulations in force from time to time.

7.Liability: Particular Attention Should Be Paid To This Clause

7.1 This Clause 7 sets out the entire liability of GroundSure, including any liability for the acts or omissions of its employees, agents, consultants, subcontractors and Third Party Content, in respect of:
(i) any breach of contract, including any deliberate breach of the Contract by GroundSure or its employees, agents or subcontractors;
(ii) any use made of the Reports, Services, Materials or any part of them; and
(iii) any representation, statement or tortious act or omission (including negligence) arising under or in connection with the Contract.
7.2 All warranties, conditions and other terms implied by statute or common law are, to the fullest extent permitted by law, excluded from the Contract.
7.3 Nothing in the Contract limits or excludes the liability of the Supplier for death or personal injury resulting from negligence, or for any damage or liability incurred by the Client or Beneficiary as a result of fraud or fraudulent misrepresentation.
7.4 GroundSure shall not be liable for
(i) loss of profits;
(ii) loss of business;
(iii) depletion of goodwill and/or similar losses;
(iv) loss of anticipated savings;
(v) loss of goods;
(vi) loss of contract;
(vii) loss of use;
(viii) loss or corruption of data or information;
(ix) business interruption;
(x) any kind of special, indirect, consequential or pure economic loss, costs, damages, charges or expenses;
(xi) loss or damage that arise as a result of the use of all or part of the GroundSure Materials in breach of the Contract;
(xii) loss or damage arising as a result of any error, omission or inaccuracy in any part of the GroundSure Materials where such error, omission or inaccuracy is caused by any Third Party Content or any reasonable interpretation of Third Party Content;
(xiii) loss or damage to a computer, software, modem, telephone or other property; and
(xiv) loss or damage caused by a delay or loss of use of GroundSure's internet ordering service.
7.5 GroundSure's total liability in relation to or under the Contract shall be limited to £10 million for any claim or claims.
7.6 GroundSure shall procure that the Beneficiary shall be bound by limitations and exclusions of liability in favour of GroundSure which accord with those detailed in clauses 7.4 and 7.5 (subject to clause 7.3) in respect of all claims which the Beneficiary may bring against GroundSure in relation to the Services or other matters arising pursuant to the Contract.

8 GroundSure's right to suspend or terminate

8.1 If GroundSure reasonably believes that the Client or Beneficiary has not provided the information or assistance required to enable the proper provision of the Services, GroundSure shall be entitled to suspend all further performance of the Services until such time as any such deficiency has been made good.
8.2 GroundSure shall be entitled to terminate the Contract immediately on written notice in the event that:
(i) the Client fails to pay any sum due to GroundSure within 30 days of the Payment Date; or
(ii) the Client (being an individual) has a bankruptcy order made against him or (being a company) shall enter into liquidation whether compulsory or voluntary or have an administration order made against it or if a receiver shall be appointed over the whole or any part of its property assets or undertaking or if the Client is struck off the Register of Companies or dissolved; or
(iii) the Client being a company is unable to pay its debts within the meaning of Section 123 of the Insolvency Act 1986 or being an individual appears unable to pay his debts within the meaning of Section 268 of the Insolvency Act 1986 or if the Client shall enter into a composition or arrangement with the Client's creditors or shall suffer distress or execution to be levied on his goods; or
(iv) the Client or the Beneficiary breaches any term of the Contract (including, but not limited to, the obligations in clause 4) which is incapable of remedy or if remediable, is not remedied within five days of notice of the breach.

9. Client's Right to Terminate and Suspend

9.1 Subject to clause 10.1, the Client may at any time upon written notice terminate or suspend the provision of all or any of the Services.
9.2 In any event, where the Client is a consumer (and not a business) he/she hereby expressly acknowledges and agrees that:
(i) the supply of Services under this Contract (and therefore the performance of this Contract) commences immediately upon GroundSure's acceptance of the Order; and
(ii) the Reports and/or Mapping provided under this Contract are
(a) supplied to the Client's specification(s) and in any event
(b) by their nature cannot be returned.

10 Consequences of Withdrawal, Termination or Suspension

10.1 Upon termination of the Contract:
(i) GroundSure shall take steps to bring to an end the Services in an orderly manner, vacate any Site with all reasonable speed and shall deliver to the Client and/or Beneficiary any property of the Client and/or Beneficiary in GroundSure's possession or control; and
(ii) the Client shall pay to GroundSure all and any Fees payable in respect of the performance of the Services up to the date of termination or suspension. In respect of any Support Services provided, the Client shall also pay GroundSure any additional costs incurred in relation to the termination or suspension of the Contract. 11 Anti-Bribery
11.1 The Client warrants that it shall:
(i) comply with all applicable laws, statutes and regulations relating to anti-bribery and anti-corruption including but not limited to the Bribery Act 2010;
(ii) comply with such of GroundSure's anti-bribery and anti-corruption policies as are notified to the Client from time to time; and
(iii) promptly report to GroundSure any request or demand for any undue financial or other advantage of any kind received by or on behalf of the Client in connection with the performance of this Contract.
11.2 Breach of this Clause 11 shall be deemed a material breach of this Contract.

12 General

12.1 The Mapping contained in the Services is protected by Crown copyright and must not be used for any purpose other than as part of the Services or as specifically provided in the Contract.
12.2 The Client shall be permitted to make one copy only of each Report or Mapping Order. Thereafter the Client shall be entitled to make unlimited copies of the Report or Mapping Order only in accordance with an Ordnance Survey paper map copy license available through GroundSure.
12.3 GroundSure reserves the right to amend or vary this Contract. No amendment or variation to this Contract shall be valid unless signed by an authorised representative of GroundSure.
12.4 No failure on the part of GroundSure to exercise, and no delay in exercising, any right, power or provision under this Contract shall operate as a waiver thereof.
12.5 Save as expressly provided in this Contract, no person other than the persons set out therein shall have any right under the Contract (Rights of Third Parties) Act 1999 to enforce any terms of the Contract.
12.6 The Secretary of State for Business, Innovation and Skills ("BIS") or BIS' successor body, as the case may be, acting through Ordnance Survey may enforce a breach of clause 6.4(vi) and clause 6.4(vii) of these terms and conditions against the Client in accordance with the provisions of the Contracts (Rights of Third Parties) Act 1999.
12.7 GroundSure shall not be liable to the Client if the provision of the Services is delayed or prevented by one or more of the following circumstances:
(i) the Client or Beneficiary's failure to provide facilities, access or information;
(ii) fire, storm, flood, tempest or epidemic;
(iii) Acts of God or the public enemy;
(iv) riot, civil commotion or war;
(v) strikes, labour disputes or industrial action;
(vi) acts or regulations of any governmental or other agency;
(vii) suspension or delay of services at public registries by Third Party Data Providers;
(viii) changes in law; or
(ix) any other reason beyond GroundSure's reasonable control.
In the event that GroundSure is prevented from performing the Services (or any part thereof) in accordance with this clause 12.6 for a period of not less than 30 days then GroundSure shall be entitled to terminate this Contract immediately on written notice to the Client.
12.8 Any notice provided shall be in writing and shall be deemed to be properly given if delivered by hand or sent by first class post, facsimile or by email to the address, facsimile number or email address of the relevant party as may have been notified by each party to the other for such purpose or in the absence of such notification the last known address.
12.9 Such notice shall be deemed to have been received on the day of delivery if delivered by hand, facsimile or email (save to the extent such day is not a working day where it shall be deemed to have been delivered on the next working day) and on the second working day after the day of posting if sent by first class post.
12.10 The Contract constitutes the entire agreement between the parties and shall supersede all previous arrangements between the parties relating to the subject matter hereof.
12.11 Each of the provisions of the Contract is severable and distinct from the others and if one or more provisions is or should become invalid, illegal or unenforceable, the validity and enforceability of the remaining provisions shall not in any way be tainted or impaired.
12.12 This Contract shall be governed by and construed in accordance with English law and any proceedings arising out of or connected with this Contract shall be subject to the exclusive jurisdiction of the English courts.
12.13 GroundSure is an executive member of the Council of Property Search Organisation (CoPSO) and has signed up to the Search Code administered by the Property Codes Compliance Board (PCCB). All Risk Screening Reports shall be supplied in accordance with the provisions of the Search Code.
12.14 If the Client or Beneficiary has a complaint about the Services, written notice should be given to the Compliance Officer at GroundSure who will respond in a timely manner.
12.15 The Client agrees that it shall, and shall procure that each Beneficiary shall, treat in confidence all Confidential Information and shall not, and shall procure that each Beneficiary shall not (i) disclose any Confidential Information to any third party other than in accordance with the terms of this Contract; and (ii) use Confidential Information for a purpose other than the exercise of its rights and obligations under this Contract. Subject to clause 6.6, nothing shall prevent the Client or any Beneficiary from disclosing Confidential Information to the extent required by law.

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Terra Consult
Bold Business Centre, Bold Lane,
Bold Lane,
Sutton, WA9 4TX

GroundSure Reference:	HMD-147-1148105
Client Reference:	PO12232
Report Date:	31 Oct 2013
Report Delivery Method:	**xml**
Client Email:	mailbox@terraconsult.co.uk

GroundSure FloodInsight

Address: 1,DALE VIEW,BILLINGTON,CLITHEROE, BB7 9LL

Dear Sir/Madam,

Thank you for placing your order with GroundSure. Please find enclosed the GroundSure FloodInsight report as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above GroundSure reference number.

Yours faithfully,



Managing Director
Groundsure Limited

Enc.
GroundSure FloodInsight

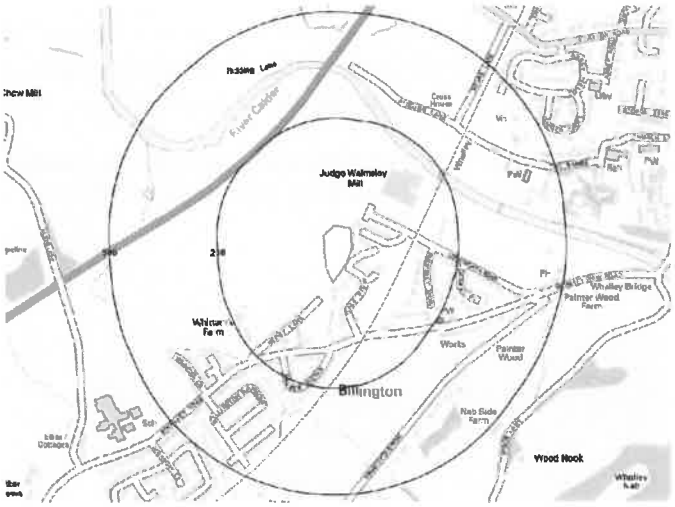
GroundSure FloodInsight

Address: 1,DALE VIEW,BILLINGTON,CLITHEROE, BB7 9LL

Date: 31 Oct 2013

Client Reference: PO12232

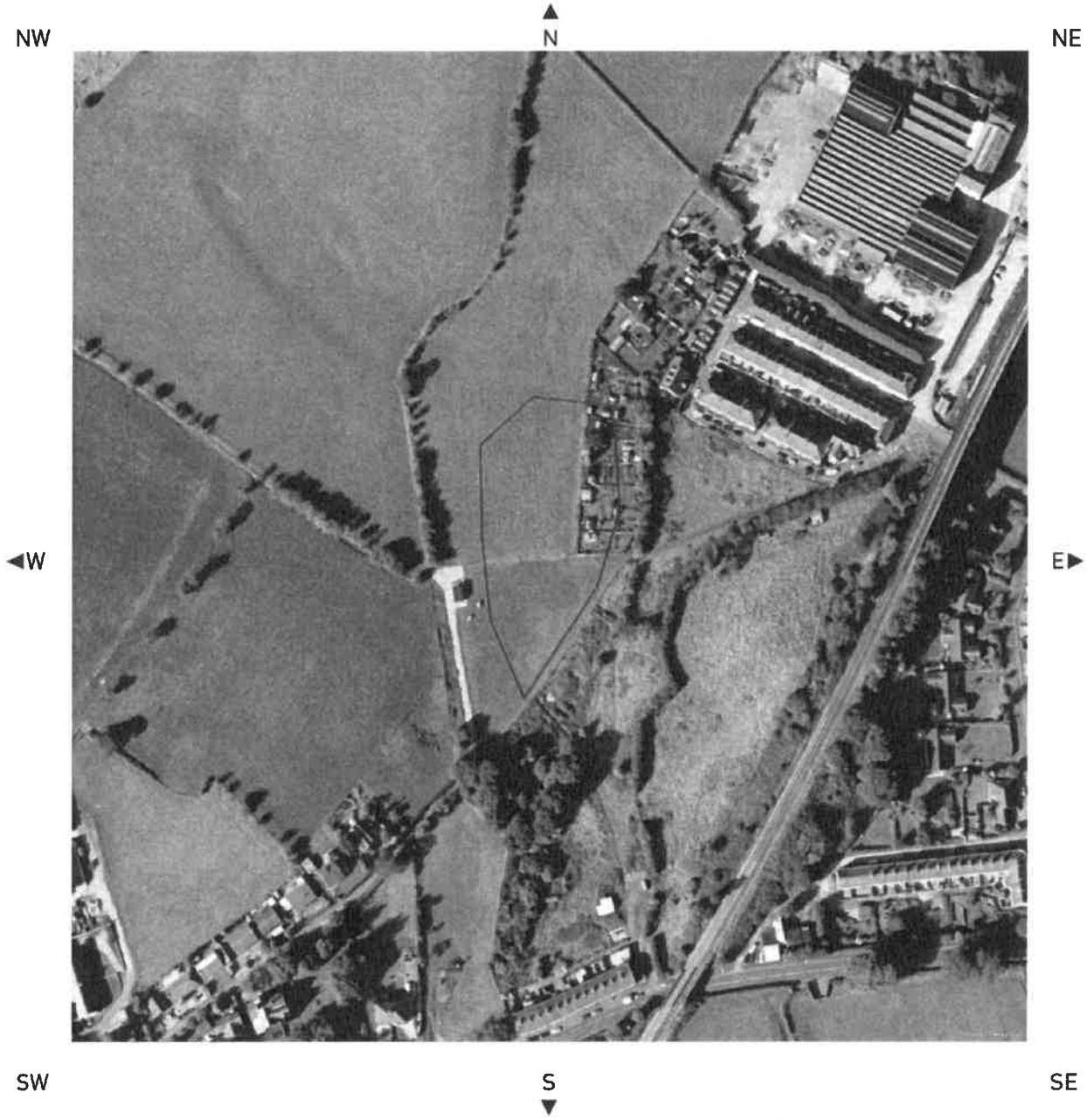
Client: Terra Consult



Brought to you by GroundSure

If you would like any further assistance regarding this report then please contact GroundSure on (T) 08444 159 000, email: info@groundsure.com

Aerial Photograph of Study Site



Aerial photography supplied by Getmapping PLC.
© Copyright Getmapping PLC 2003. All Rights Reserved.

Site Name: 1,DALE VIEW,BILLINGTON,CLITHEROE, BB7 9LL

Grid Reference: 372536,435919

Size of Site: 0.58 ha

Overview of Findings

For further details on each dataset, please refer to each individual section in the main report as listed.

Report Section	
1. Environment Agency Flood Zones	
1.1 Are there any Environment Agency indicative Zone 2 floodplains within 250m of the study site?	Yes
1.2 Are there any Environment Agency indicative Zone 3 floodplains within 250m of the study site?	Yes
1.3 Are there any Flood Defences within 250m of the study site?	No
1.4 Are there any areas benefiting from Flood Defences within 250m of the study site?	No
1.5 Are there any areas used for Flood Storage within 250m of the study site?	No
2. National Flood Risk Assessment (NaFRA)	
2.1 What is the National Flood Risk Assessment (NaFRA) Flood Rating for the study site?	Negligible
3. Historic Flood Events	
3.1 Has the site been subject to past flooding as recorded by the Environment Agency?	No
4. Surface Water Floods	
4.1 Is the site or any area within 50m at risk of Surface Water (Pluvial) Flooding?	Yes
5. Groundwater Flooding	
5.1 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	Very High
5.2 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	Moderate
6. BGS Geological Indicators of historic flooding	
6.1 Are there any geological indicators of historic flooding within 250m of the study site?	Yes
7. JBA Reservoir failure	
7. Is the property located in an area identified as being at potential risk in the event of a reservoir failure?	Yes

Additional Matters

Riparian ownership	If your land abuts a river, stream or ditch, you may have responsibility to maintain this watercourse, even if Title Deeds show the property boundary to be adjacent to the watercourse. This includes the responsibility for clearing debris and obstructions which may impede the free passage of water and fish, and also includes the responsibilities to accept flood flows through your land, even if these are caused by inadequate capacity downstream. There is no duty in common law for a landowner to improve the drainage capacity of a watercourse. Please contact GroundSure if you need further advice on riparian ownership issues relating to this property.
Sewerage Flooding	Extreme rainfall events may overwhelm sewerage systems and cause local flooding. The water and sewerage companies within the UK are required to maintain 'DG5 – At Risk Registers' which record properties that have flooded from sewers and/or are considered to be at risk of flooding from sewers in the future. If your property is on the 'At Risk' Register, this may be recorded within a standard CON29 Drainage and Water search.

Using this Report

The following report is designed by Environmental Consultants for Environmental Professionals bringing together the most up-to-date market leading environmental data. This report is provided under and subject to the Terms & Conditions agreed between GroundSure and the Client.

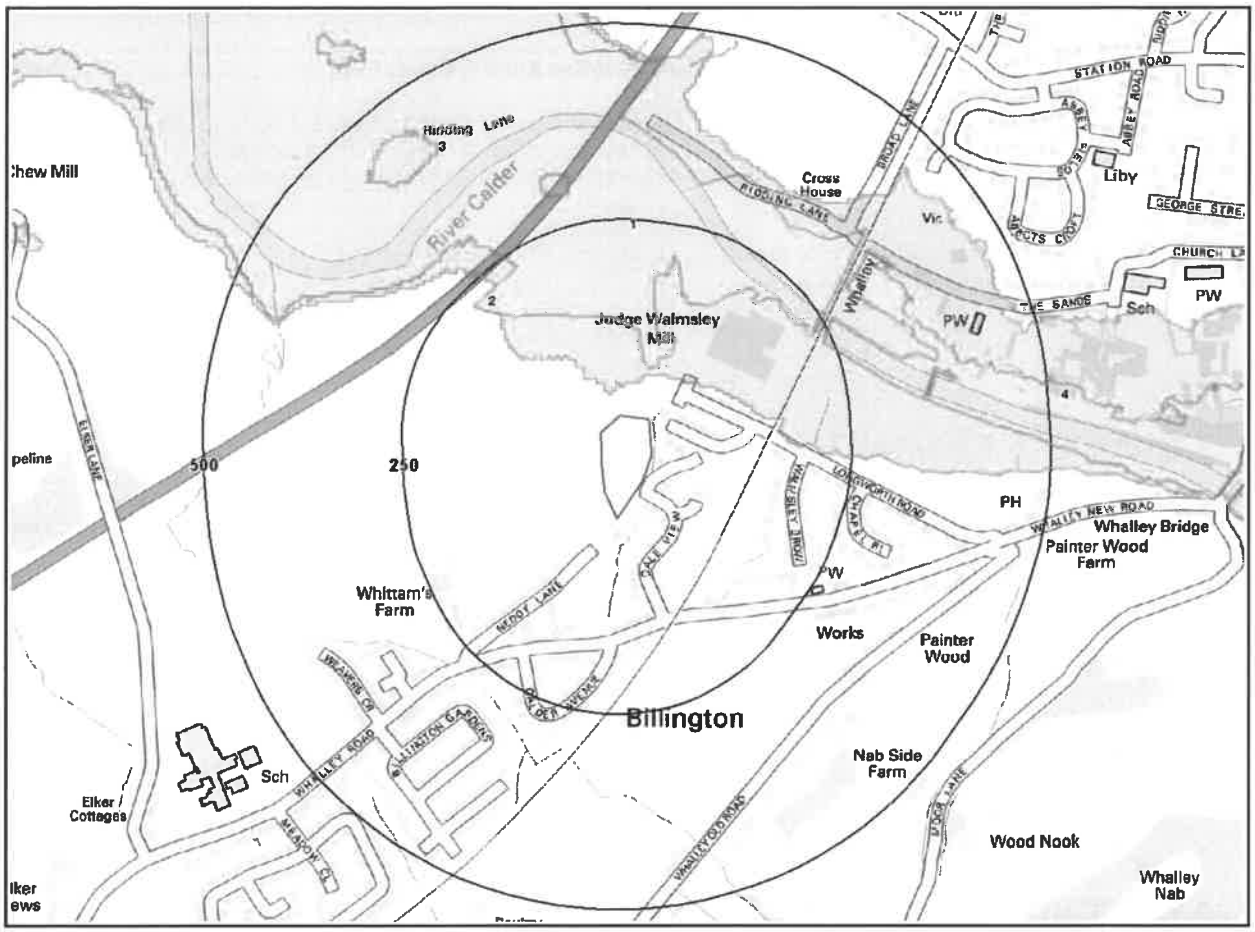
Note: Maps

Only certain features are placed on the maps within the report. All features represented on maps found within this search are given an identification number. This number identifies the feature on the mapping and correlates it to the additional information provided below. This identification number precedes all other information and takes the following format -Id: 1, Id: 2, etc. Where numerous features on the same map are in such close proximity that the numbers would obscure each other a letter identifier is used instead to represent the features. (e.g. Three features which overlap may be given the identifier "A" on the map and would be identified separately as features 1A, 3A, 10A on the data tables provided).

Where a feature is reported in the data tables to a distance greater than the map area, it is noted in the data table as "Not Shown".

All distances given in this report are in Metres (m). Directions are given as compass headings such as N: North, E: East, NE: North East from the nearest point of the study site boundary.

1. River and Coastal Flood Map



River and Coastal Flood Legend

Mapping sourced from Ordnance Survey

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Site Outline

250 / 500 Search Buffers (m)

Zone 2 Floodplain

Zone 3 Floodplain

Flood Storage Area

Area Benefiting from Flood Defences

Flood Defences

1. Environment Agency Flood Zones

1.1 River and Coastal Zone 2 Flooding

Is the site within 250m of an Environment Agency indicative Zone 2 floodplain? **Yes**

Zone 2 floodplain estimates the annual probability of flooding as one in one thousand (0.1%) or greater from rivers and the sea but less than 1% from rivers or 0.5% from the sea. Alternatively, where information is available they may show the highest known flood level. Any relevant data is represented on Map 1 - River and Coastal Flooding:

The following floodplain records are represented as green shading on the Flood Map (1):

ID	Distance [m]	Direction	Update	Type
1	29.0	N	09-Sep-2013	Zone 2 - (Fluvial Models)
2	197.0	NW	09-Sep-2013	Zone 2 - (Fluvial Models)

1.2 River and Coastal Zone 3 Flooding

Is the site within 250m of an Environment Agency indicative Zone 3 floodplain? **Yes**

Zone 3 estimates the annual probability of flooding as one in one hundred (1%) or greater from rivers and a one in two hundred (0.5%) or greater from the sea. Alternatively, where information is available they may show the highest known flood level. Any relevant data is represented on Map 1 - River and Coastal Flooding.

The following floodplain records are represented as green shading on the Flood Map (1):

ID	Distance [m]	Direction	Update	Type
3	65.0	N	09-Sep-2013	Zone 3 - (Fluvial Models)
4	238.0	NE	09-Sep-2013	Zone 3 - (Fluvial Models)

1.3 River and Coastal Flood Defences

Are there any Flood Defences within 250m of the study site ? **No**

Only flood defences constructed within the last five years to Environment Agency standards are likely to be shown within this dataset. Any relevant data is represented on Map 1 - River and Coastal Flooding.

1.4 Areas benefiting from Flood Defences

Are there any areas benefiting from Flood Defences within 250m of the study site? **No**

Any relevant data is represented on Map 1 - River and Coastal Flooding.

1.5 Areas used for Flood Storage

Are there any areas used for Flood Storage within 250m of the study site? **No**

Flood Storage Areas are considered part of the functional floodplain, and are areas where water has to flow or be stored in times of flood. *Planning Policy Statement (PPS) 25: Development and Flood Risk* states that only water-compatible development and essential infrastructure should be permitted within flood storage areas, and existing

development within this area should be relocated to an area with a lower risk of flooding. Any relevant data is represented on Map 1 – River and Coastal Flooding.

Notes on Flood Zone Data:

This data relates solely to flooding from rivers or the sea. The Environment Agency estimate that over 2.5 million properties are at risk of flooding within England and Wales. **River flooding** occurs when a watercourse cannot cope with the water draining into it from the surrounding land. This can happen, for example, when heavy rain falls on an already waterlogged catchment. **Coastal flooding** results from a combination of high tides and stormy conditions. If low atmospheric pressure coincides with a high tide, a tidal surge may happen which can cause serious flooding.

The GroundSure FloodInsight Report comments upon whether a property lies in proximity to Environment Agency Zone 2 and Zone 3 floodplains. The Government's National Planning Policy Framework (NPPF) explains how flood risk should be considered at all stages of the planning and development process in order to reduce future damage to property and potential loss of life. The Government looks to planning authorities to ensure that flood risk is properly taken into account in the planning of developments to reduce the risk of flooding and the damage which floods cause.

The Environment Agency Flood Mapping Strategy covers a five-year period from 2003 to 2008 and sets out to improve the quality and coverage of data and information on actual and potential flood risk. One of the key outputs of the strategy is the production of the flood zones, to enable planning authorities to apply the sequential test (see NPPF) for development proposals and prevent inappropriate development.

NPPF defines the flood zones as: -

- Zone 1 – little or no risk with an annual probability of flooding from rivers and the sea of less than 0.1%
- Zone 2 – low to medium risk with an annual probability of flooding of 0.1-1.0% from rivers and 0.1-0.5% from the sea.
- Zone 3 – high risk with an annual probability of flooding of 1.0% or greater from rivers, and 0.5% or greater from the sea.
- Flood Zone 3b/Flood Storage Areas - very high risk with the site being used as part of the functional flood plain or as a Flood Storage Area.

The flood zones provide more accurate and consistent information on flood risk using the definitions detailed in the NPPF than the previous Indicative Floodplain Map (IFM). The flood zones are the main constraint map underpinning decisions on development and flood risk.

Flood Defences

Flood defences seek to reduce the risk of flooding and to safeguard life, protect property, sustain economic activity and the natural environment. Flood defences are designed to protect against flood events of a particular magnitude, expressed as risk in any one year. For example, defences in urban areas may be built to provide protection against flood events of a size which might occur on average once in one hundred years or less.

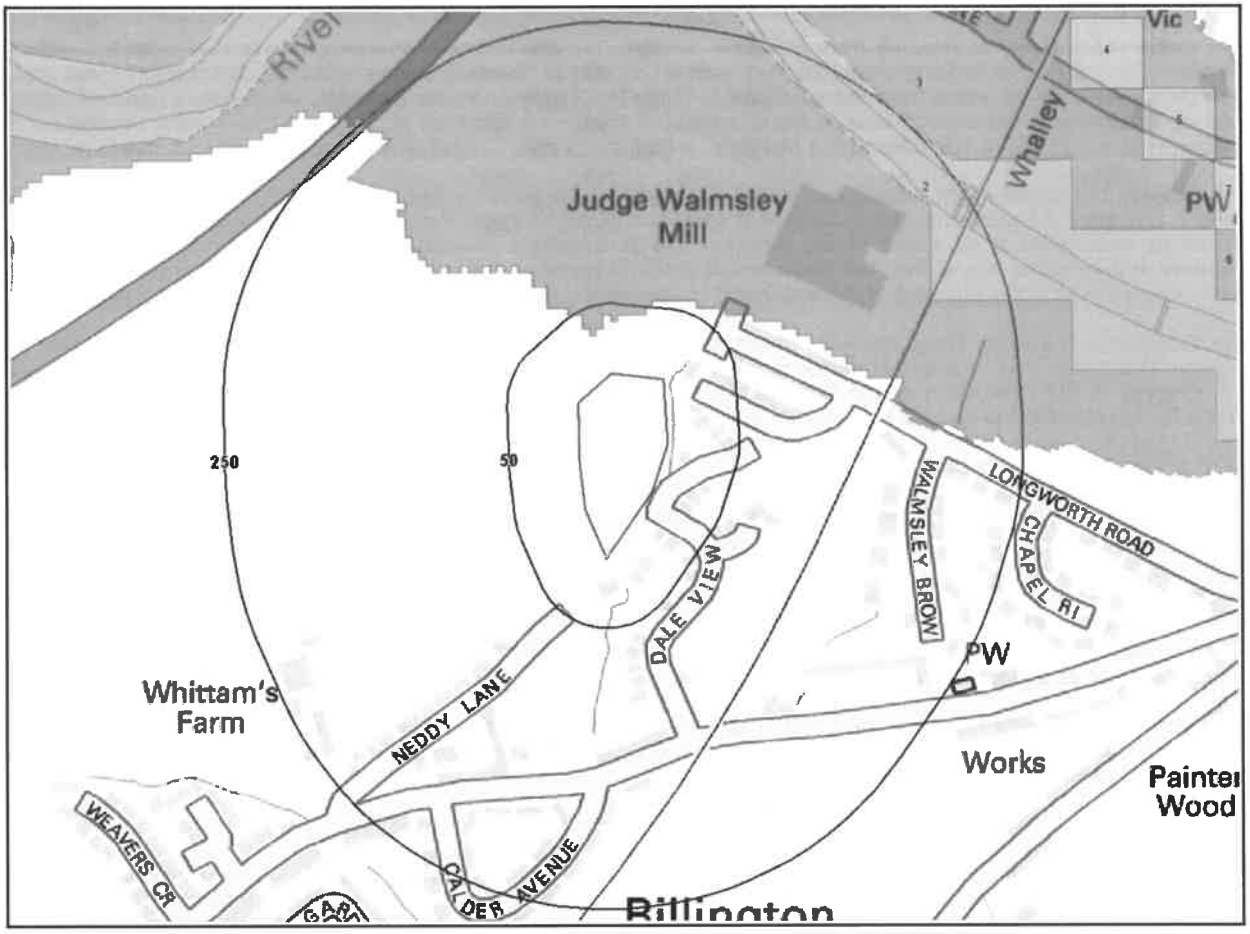
All flood defences constructed during the last five years have a standard of protection equal to or better than 1% for rivers and 0.5% from the sea. Some additional defences, which may be older or may have been designed to provide a lower standard of protection, are also shown within the data GroundSure provides.

Flood Storage Areas

Flood Storage Areas may also act as flood defences. A flood storage area may also be referred to as a balancing reservoir, storage basin or balancing pond. Its purpose is to attenuate an incoming flood peak to a flow level that can be accepted by the downstream channel. It may also delay the timing of a flood peak so that its volume is discharged over a longer time interval.

A flood storage area may take the form of a wet or dry reservoir. A wet reservoir is a water storage facility in which storage can be effected by allowing water levels to rise during flood times. A dry reservoir is typically adjacent to a river and comprises an enclosed area that accepts water only at peak times. These areas are also referred to as Zone 3b or 'the functional floodplain' and has a 5% or greater chance of flooding in any given year, or is designed to flood in the event of an extreme (0.1%) flood or another probability which may be agreed between the Local Planning Authority and the Environment Agency, including water conveyance routes. Development within Flood Storage Areas is severely restricted.

2. NaFRA Flooding Map



NaFRA Flood Legend

Mapping sourced from Ordnance Survey

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Site Outline

125
250
Search Buffers (m)

No Result

Low

Moderate

Significant

If you would like any further assistance regarding this report then please contact GroundSure on (T) 08444 159 000, email: info@groundsure.com

2.1 National Flood Risk Assessment (NaFRA) Flood Rating (River and Coastal)

What is the highest risk of flooding onsite? **Negligible**

The Environment Agency NaFRA database provides an indication of flood river and coastal risk at a national level on a 50m grid with the flood rating at the centre of the grid calculated and given above. The data considers the probability that the flood defences will overtop or breach, and the distance from the river or the sea.

Most insurance companies providing cover for flood risk use this data as the basis of their risk model, although they may also utilise additional information such as claims histories, which may further influence their decision. Where a significant risk of flooding is identified flood risk insurance may be difficult to obtain without further work being undertaken. Property owners of sites within Low and Moderate risk areas are still considered to be at risk of flooding and insurance premiums may be increased as a result. Owners of properties within Low, Moderate and Significant risk areas, as well as areas yet to receive a full assessment are advised to sign up to the Environment Agency's Floodline Warning scheme.

NaFRA data for the study site indicates the property has a negligible (less than 1 in 1000) chance of flooding in any given year.

Any relevant data within 250m is represented on the NaFRA Flood map. Data to 50m is reported in the table below.

ID	Distance [m]	Direction	NaFRA flood Risk
1	29.0	N	Moderate

Notes on NaFRA data:

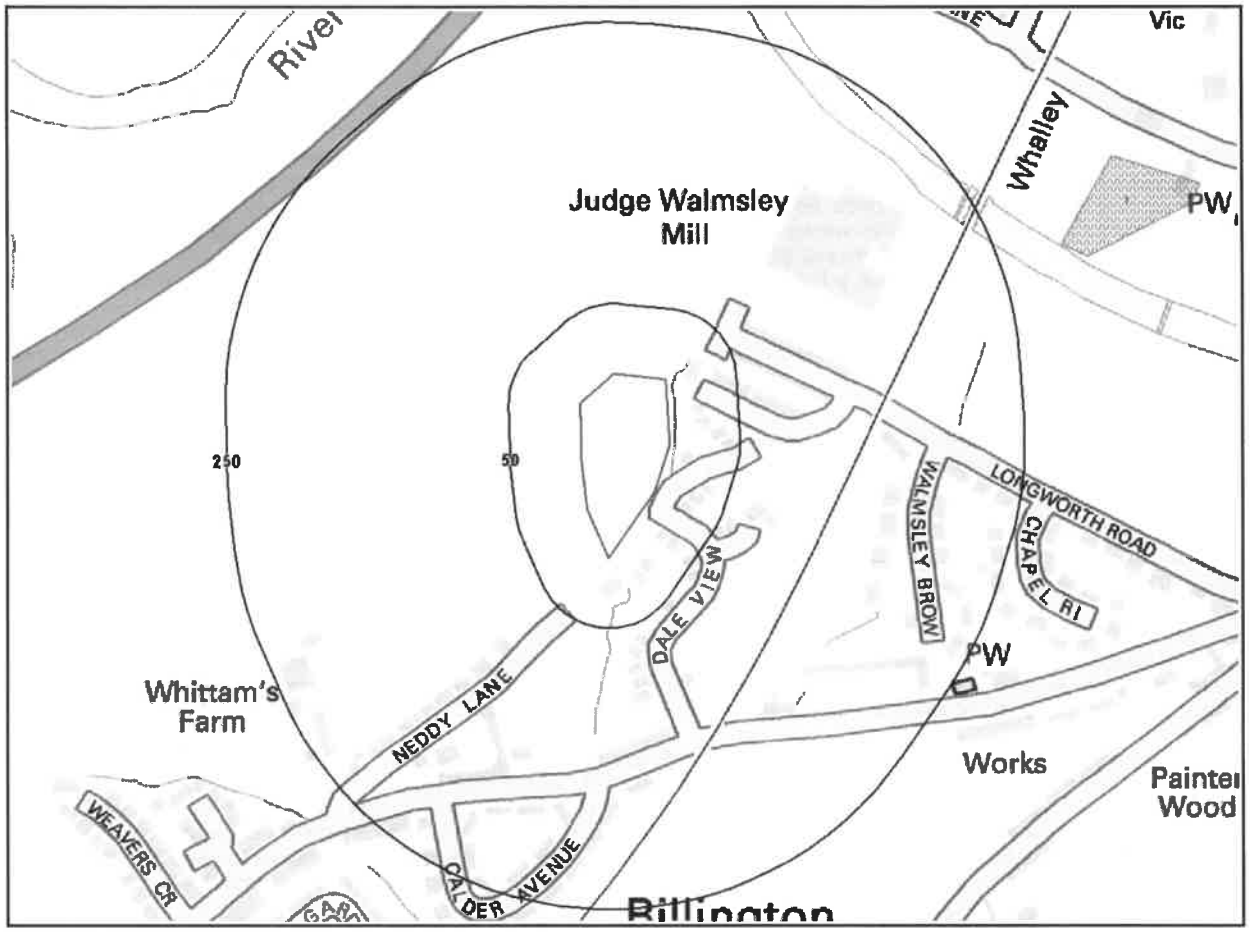
This information is based on the very latest Environment Agency National Flood Risk Assessment (NaFRA) data. This data has been created by dividing the flood plain into 50m squares, or smaller areas where a square if intersected by a river or coastline. These are called impact cells. The method then calculates the likelihood that the centre of each impact cell will start to flood using a number of different flood scenarios.

Most insurance companies providing cover for flood risk use this data as the basis of their risk model, although they may also utilise additional information such as claims histories, which may further influence their decision. Where a significant risk of flooding is identified flood risk insurance may be difficult to obtain without further work being undertaken. Property owners of sites within Low and Moderate risk areas are still considered to be at risk of flooding and insurance premiums may be increased as a result. Owners of properties within Low, Moderate and Significant risk areas are advised to sign up to the Environment Agency's Floodline Warning scheme. The probability estimates for NaFRA risk bands are as follows:

- Negligible – the chance of flooding from rivers or the sea is considered to be less than 0.1% (1 in 1000)
- Low – the chance of flooding from rivers or the sea is greater than 0.1% (1 in 1000) but less than 0.5% (1 in 200)
- Moderate - the chance of flooding from rivers or the sea is greater than 0.5% (1 in 200) but less than 1.3% (1 in 75)
- Significant – the chance of flooding from rivers or the sea is greater than 1.3% (1 in 75)

Additionally, a site may fall within an area not yet fully assessed within NaFRA – noted as 'No data available' or 'No Result'. These areas tend to fall within existing floodplains, and hence a cautionary approach is taken and these areas are treated as though they have the potential to lie within areas considered to be at Significant risk of flooding.

3. Historic Flooding Events



Historic Flooding Legend

Mapping sourced from Ordnance Survey

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Site Outline

Historic Flood Events

125
250
Search Buffers (m)

3.1 Historic Flood Outlines

Has the site or any area within 250m been subject to historic flooding as recorded by the Environment Agency? **No**

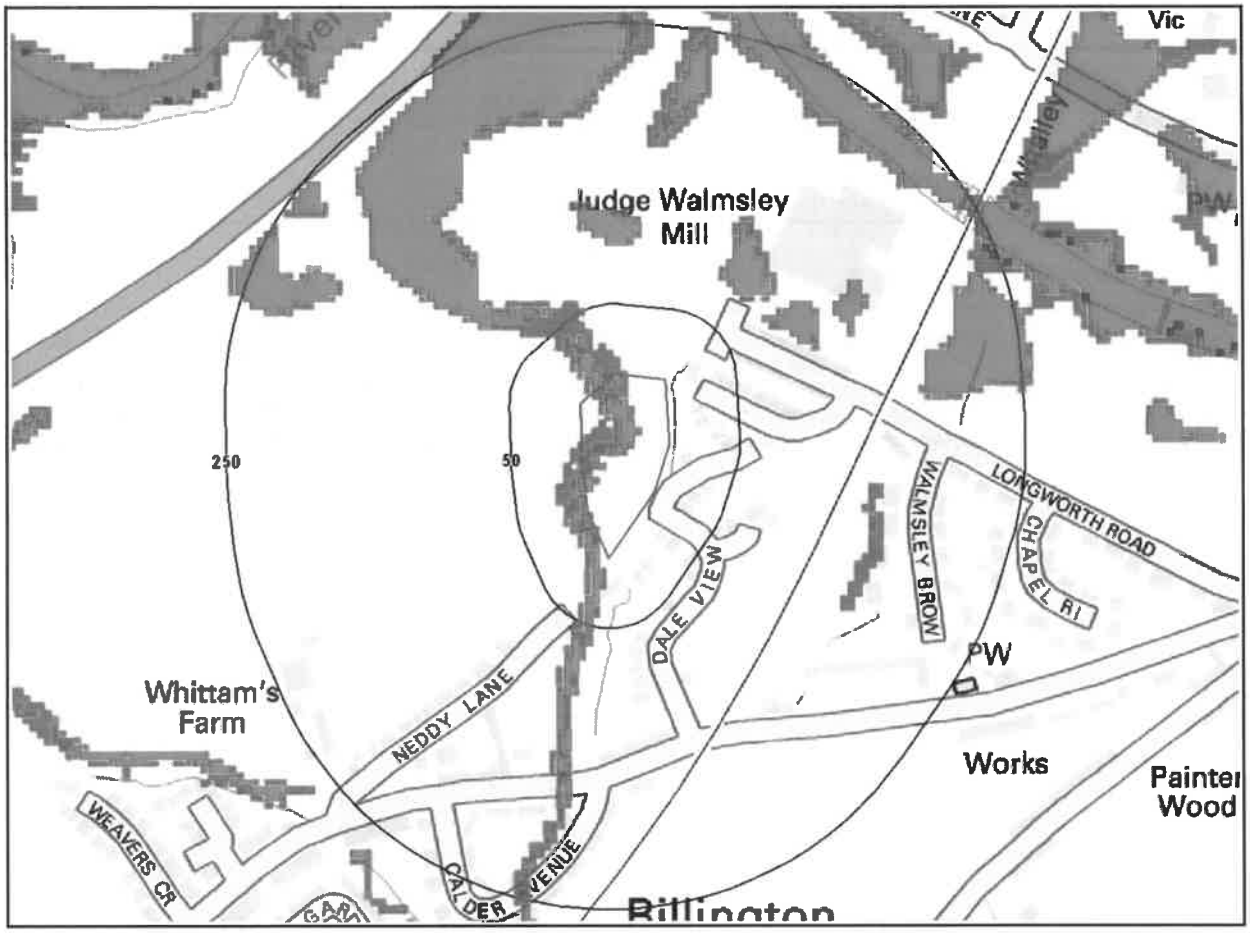
This database shows the individual footprint of every flood event recorded by the Environment Agency and previous bodies.

Any records found within the search radius are displayed on Map 3 – Historic Flooding Events.

Notes on Historic Flooding data:

Over 21,000 separate events are recorded within this database, dating back to 1947. This data is used to understand where flooding has occurred in the past and provides details as available. Absence of a historic flood event for an area does not mean that the area has never flooded, but only that the Environment Agency do not currently have records of flooding within the area. Equally, a record of a flood footprint in previous years does not mean that an area will flood again, and this information does not take account of flood management schemes and improved flood defences.

4. JBA Surface Water (Pluvial) Flood Map



Surface Water (Pluvial) Flood Legend

Mapping sourced from Ordnance Survey

© Crown copyright and database rights 2013. Ordnance Survey license 100035207.

The data is provided by JBA Risk Management Limited, © Jeremy Benn Associates Limited and JBA Risk Management Limited 2008, 2009, 2010, 2011.

Site Outline

125
250
Search Buffers (m)

Significant
High
Moderate
Low to Moderate
Low

4.1 JBA Surface (Pluvial) Water Flooding

Surface Water (pluvial) flooding is defined as flooding caused by rainfall-generated overland flow before the runoff enters a watercourse or sewer. In such events, sewerage and drainage systems and surface watercourses may be entirely overwhelmed.

Surface Water (pluvial) flooding will usually be a result of extreme rainfall events, though may also occur when lesser amounts of rain falls on land which has low permeability and/or is already saturated, frozen or developed. In such cases overland flow and 'ponding' in topographical depressions may occur.

What is the risk of pluvial flooding at the study site? **Significant**

Guidance: The site or an area in close proximity has been assessed to be at Significant Risk of surface water (pluvial) flooding. This indicates that this area would be expected to be affected by surface water flooding in a 1 in 75 year rainfall event to a depth of greater than 0.1m.

This data is provided by JBA Consulting, © Jeremy Benn Associates Limited 2008/2009

The following pluvial (surface water) flood risk records within 50m of the study site are shown on the JBA Surface Water Flooding Map:

Distance	Direction	Risk
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	W	Low to Moderate
0.0	On Site	Significant
0.0	On Site	Significant
0.0	On Site	Significant
0.0	On Site	Significant
0.0	On Site	Significant
0.0	On Site	Significant
1.0	NW	Low
2.0	SW	Low to Moderate
3.0	SW	Significant
4.0	W	Low
4.0	W	Low to Moderate
5.0	NW	Low to Moderate
6.0	W	Low to Moderate
7.0	S	Low
7.0	W	Significant
8.0	SW	Low
9.0	NW	Low to Moderate
10.0	SW	Low to Moderate
11.0	SW	Low
12.0	NW	Low
13.0	SW	Low
14.0	SW	Low
19.0	NW	Low
22.0	NW	Low to Moderate
23.0	NW	Low to Moderate
26.0	NW	Significant
30.0	NW	Significant
33.0	S	Low

36.0	SW	Low

Notes on Surface water (Pluvial) Flooding data:

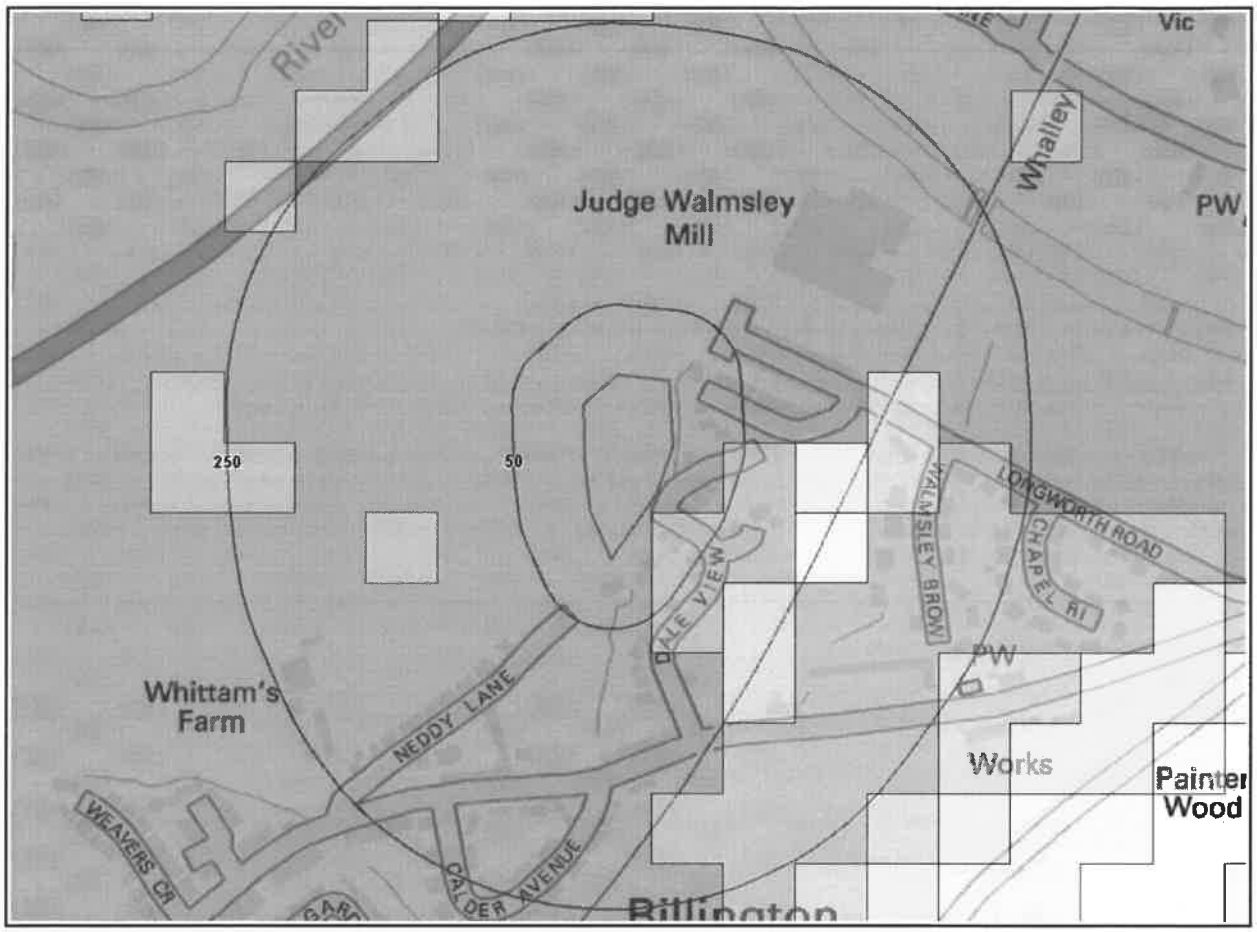
JBA Consulting surface water flood map identifies areas likely to flood following extreme rainfall events, i.e. land naturally vulnerable to surface water or "pluvial" flooding. This data set was produced by simulating 1 in 75 year, 1 in 200 year and 1 in 1000 year rainfall events. Modern urban drainage systems are typically built to cope with rainfall events between 1 in 20 and 1 in 30 years, though older ones may even flood in a 1 in 5 year rainstorm event.

The model provides the maximum depth of flooding in each 5m "cell" of topographical mapping coverage. The maps include 5 bands indicating areas of increasing natural vulnerability to surface water flooding. These are:-

- 0.1m or greater in a 1 in 1,000 year rainfall event - Low
- Between 0.1m and 0.3m in a 1 in 200 year rainfall event – Low to Moderate
- Between 0.3m and 1.0m in a 1 in 200 year rainfall event - Moderate
- Greater than 1.0m in a 1 in 200 year rainfall event – High
- Greater than 0.1m in a 1 in 75 year rainfall event – Significant

5.Groundwater Flooding Map

NW N NE



W E

SW S SE

BGS Groundwater Flood Legend

Mapping sourced from Ordnance Survey

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50 / 250 Search Buffers (m)

Site Outline

Very Low Susceptibility

Low Susceptibility

Moderate Susceptibility

High Susceptibility

Very High Susceptibility

5.1 Groundwater Flooding Susceptibility Areas

Are there any British Geological Survey groundwater flooding susceptibility flood areas within 50m of the boundary of the study site? **Yes**

What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions? **Very High**

Where very high susceptibility is indicated, this means that given the geological conditions in the area groundwater flooding hazard should be considered in all land-use planning decisions. It is recommended that other relevant information e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information be investigated in order to establish relative, but not absolute, risk of groundwater flooding.

5.2 Groundwater Flooding Confidence Areas

What is the British Geological Survey confidence rating in this result? **Moderate**

Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

The **confidence rating** is on a threefold scale - Low, Moderate and High. This provides a relative indication of the BGS confidence in the accuracy of the susceptibility result for groundwater flooding. This is based on the amount and precision of the information used in the assessment. In areas with a relatively lower level of confidence the susceptibility result should be treated with more caution. In other areas with higher levels of confidence the susceptibility result can be used with more confidence.

Notes on Groundwater Flooding data:

The British Geological Survey (BGS) Susceptibility to Groundwater Flooding hazard dataset identifies areas where geological conditions could potentially enable groundwater flooding to occur and where groundwater may come close to the ground surface. The dataset is supplied with confidence information which provides an indication of the resolution and quality of the data behind the susceptibility assessment.

The susceptibility data is suitable for use for regional or national planning purposes where the groundwater flooding information will be used along with a range of other relevant information to inform land-use planning decisions. It might also be used in conjunction with a large number of other factors, e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information, to establish relative, but not absolute, risk of groundwater flooding at a resolution of greater than a few hundred metres. It should be noted that the susceptibility data is based entirely upon geological data, and does not take into account topography, actual depths of water tables etc.

In all cases it is strongly recommended that the confidence data is used in conjunction with the groundwater flooding susceptibility data. The susceptibility data should not be used on its own to make planning decisions at any scale, and, in particular, should not be used to inform planning decisions at the site scale. The susceptibility data cannot be used on its own to indicate risk of groundwater flooding and is merely an indication of the susceptibility of certain geological deposits to groundwater flooding, not an indication of likelihood of such flooding occurring.

The susceptibility to groundwater flooding is calibrated on a fivefold scale by the BGS:-

- Where susceptibility is ***not applicable***, this means that you need take no further action in relation to groundwater hazard in this area.
- Where ***low*** susceptibility is indicated, this means that, given the geological conditions, there may be a groundwater flooding hazard. Unless other relevant information, e.g., records of previous flooding suggests groundwater flooding has occurred before in this area, you need take no further action in relation to groundwater flooding hazard. If there are records of previous incidences of groundwater flooding, then is recommended that other information e.g. rainfall history, property type, and land drainage information in addition to previous records of flooding be investigated in order to establish relative, but not absolute, risk of groundwater flooding.
- Where ***moderate*** susceptibility is indicated, this means that, given the geological conditions, there may be a groundwater flooding hazard. Unless other relevant information, e.g., records of previous flooding suggests groundwater flooding has occurred before in this area, you need take no further action in relation to groundwater flooding hazard. If there are records of previous incidences of groundwater flooding, then is recommended that other information e.g. rainfall history, property type, and land drainage information in addition to previous records of flooding be investigated in order to establish relative, but not absolute, risk of groundwater flooding.
- Where ***moderately high*** susceptibility is indicated, this means that given the geological conditions in the area groundwater flooding hazard should be considered in all land-use planning decisions. It is recommended that other

relevant information e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information be investigated in order to establish relative, but not absolute, risk of groundwater flooding.

- Where ***high*** susceptibility is indicated, this means that given the geological conditions in the area groundwater flooding hazard should be considered in all land-use planning decisions. It is recommended that other relevant information e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information be investigated in order to establish relative, but not absolute, risk of groundwater flooding.

The **confidence rating** is also measured on a fivefold scale - Low, Moderately Low, Moderate, Moderately High and High. This provides a relative indication of the BGS confidence in the accuracy of the susceptibility result for groundwater flooding. This is based on the amount and precision of the information used in the assessment. In areas with a relatively lower level of confidence the susceptibility result should be treated with more caution. In other areas with higher levels of confidence the susceptibility result can be used with more confidence.

6. BGS Geological Indicators of Flooding

Are there any geological indicators of flooding within 250m of the study site? **Yes**

This dataset identifies the presence of superficial geological deposits which indicate that the site may be, or have been in the past, vulnerable to inland and/or coastal flooding. This assessment does not take account of any man-made factors such as flood protection schemes, and the data behind the report are purely geological.

Distance [m]	Direction	Description
0.0	On Site	Higher flood potential from rivers: the first areas to experience the effects of inland flooding in a river catchment.

Notes on BGS Geological Indicators of Flooding data:

The BGS Geological Indicators of Flooding (GIF) data set is a digital map based on the BGS Digital Geological Map of Great Britain at the 1:50,000 scale (DiGMapGB-50). It was produced by characterising Superficial (Drift) Deposits on DiGMapGB-50 in terms of their likely vulnerability to flooding, either from coastal or inland water flow. These Superficial Deposits are considered 'recent' in geological terms, most having been formed in the later parts of the Quaternary geological period (i.e. within the last few tens of thousands of years). Observations made during recent major inland and coastal flooding events have demonstrated that the erosion and deposition of these recent geological sediments have produced subtle topographical variations, resulting in landforms such as fluvial and coastal floodplains. The mapping of these landforms, in conjunction with the fluvial and/or coastal deposits that underlie them, has in turn determined the extent of previous coastal and inland flooding.

On this basis, the floodplains which are at greatest risk from flooding can be both visualised and defined by Superficial Deposits as depicted on geological maps. These include deposits such as river alluvium and lacustrine (lake) alluvium, as well as the First River Terrace or 'Floodplain terrace' (raised flat areas adjacent to or within floodplains, which represent the level of the floodplain prior to the most recent episode of down-cutting). Older and higher river terraces have been excluded as they lie outside the geologically defined floodplain. Areas at risk from coastal inundation are similarly characterised by a range of estuarine or marine deposits that include, for example, tidal flats.

7. JBA Reservoir Failure Impact Modelling

Is the property located in an area identified as being at potential risk in the event of a reservoir failure? **Yes**

JBA consulting have modelled the flooding impact from 1,700 reservoirs in England and Wales, should there be a catastrophic failure of a reservoir wall or embankment.

Guidance: The property is in an area at risk should a reservoir fail. Such events are extremely rare with the last event being 1925, however if the property is operational the potential for reservoir failure should be included in any business continuity plan.

Notes on Reservoir Failure Impact data:

This dataset identified area that are most likely to flood following the sudden catastrophic failure of a reservoir and is provided by JBA Consulting. JBA has identified over 1,700 reservoirs that pose a risk to people and property. These maps identify properties that would flood in the unlikely event of the failure of the reservoir's dam or embankment. Empirical methods were used to predict the flow that would result from the failure which was then modelled onto high resolution Digital Terrain Models (DTM) using JBA's advanced 2D hydraulic modelling techniques. The model provides the maximum depth of flooding in each cell of the DTM.

8. Contacts

GroundSure Helpline
Telephone: 08444 159 000
info@groundsure.com

British Geological Survey (England & Wales)
Kingsley Dunham Centre
Keyworth, Nottingham NG12 5GG
Tel: 0115 936 3143.Fax: 0115 936 3276. Email: enquiries@bgs.ac.uk
Web: www.bgs.ac.uk
BGS Geological Hazards Reports and general geological enquiries

Environment Agency
Floodline tel: 0845 988 1188
General enquiry tel: 08708 506 506
Web: www.environment-agency.gov.uk
Email: enquiries@environment-agency.gov.uk

JBA Consulting
South Barn,
Broughton Hall,
Skipton
BD23 3AE
01756 799919

Ordnance Survey
Romsey Road
Southampton SO16 4GU
Tel: 08456 050505

Local Authority
Authority: Ribble Valley Borough Council
Phone: 01200 425111
Web: www.ribblevalley.gov.uk
Address: Council Offices, Church Walk, Clitheroe, Lancashire, BB7 2RA

Get Mapping PLC
Virginia Villas, High Street, Hartley Witney, Hampshire RG27 8NW
Tel: 01252 845444

Acknowledgements

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This report has been prepared in accordance with the GroundSure Ltd standard Terms and Conditions of business for work of this nature.

Standard Terms and Conditions

1 Definitions

In these terms and conditions unless the context otherwise requires:

"Beneficiary" means the person or entity for whose benefit the Client has obtained the Services.

"Client" means the party or parties entering into a Contract with GroundSure.

"Commercial" means any building or property which is not Residential.

"Confidential Information" means the contents of this Contract and all information received from the Client as a result of, or in connection with, this Contract other than

(i) information which the Client can prove was rightfully in its possession prior to disclosure by GroundSure and

(ii) any information which is in the public domain (other than by virtue of a breach of this Contract).

"Support Services" means Support Services provided by GroundSure including, without limitation, interpreting third party and in-house environmental data, providing environmental support advice, undertaking environmental audits and assessments, Site investigation, Site monitoring and related items.

"Contract" means the contract between GroundSure and the Client for the provision of the Services, and which shall incorporate these terms and conditions, the Order, and the relevant User Guide.

"Third Party Data Provider" means any third party providing Third Party Content to GroundSure.

"Data Reports" means reports comprising factual data with no accompanying interpretation.

"Fees" has the meaning set out in clause 5.1.

"GroundSure" means GroundSure Limited, a company registered in England and Wales under number 03421028.

"GroundSure Materials" means all materials prepared by GroundSure and provided as part of the Services, including but not limited to Third Party Content, Data Reports, Mapping, and Risk Screening Reports.

"Intellectual Property" means any patent, copyright, design rights, trade or service mark, moral rights, data protection rights, know-how or trade mark in each case whether registered or not and including applications for the same or any other rights of a similar nature anywhere in the world.

"Mapping" means a map, map data or a combination of historical maps of various ages, time periods and scales.

"Order" means an electronic, written or other order form submitted by the Client requesting Services from GroundSure in respect of a specified Site.

"Ordnance Survey" means the Secretary of State for Business, Innovation and Skills, acting through Ordnance Survey, Adanac Drive, Southampton, SO16 0AS, UK.

"Order Website" means the online platform through which Orders may be placed by the Client and accepted by GroundSure.

"Report" means a Risk Screening Report or Data Report for Commercial or Residential property.

"Residential" means any building or property used as or intended to be used as a single dwelling.

"Risk Screening Report" means a risk screening report comprising factual data with an accompanying interpretation by GroundSure.

"Services" means any Report, Mapping and/or Support Services which GroundSure has agreed to provide by accepting an Order pursuant to clause 2.6.

"Site" means the area of land in respect of which the Client has requested GroundSure to provide the Services.

"Third Party Content" means data, database information or other information which is provided to GroundSure by a Third Party Data Provider.

"User Guide" means the user guide, as amended from time to time, available upon request from GroundSure and on the website (www.groundsure.com) and forming part of this Contract.

2 Scope of Services, terms and conditions, requests for insurance and quotations

2.1 GroundSure agrees to provide the Services in accordance with the Contract.

2.2 GroundSure shall exercise reasonable skill and care in the provision of the Services.

2.3 Subject to clause 7.3 the Client acknowledges that it has not relied on any statement or representation made by or on behalf of GroundSure which is not set out and expressly agreed in writing in the Contract and all such statements and representations are hereby excluded to the fullest extent permitted by law.

2.4 The Client acknowledges that terms and conditions appearing on a Client's order form, printed stationery or other communication, or any terms or conditions implied by custom, practice or course of dealing shall be of no effect, and that this Contract shall prevail over all others in relation to the Order.

2.5 If the Client or Beneficiary requests insurance in conjunction with or as a result of the Services, GroundSure shall use reasonable endeavours to recommend such insurance, but makes no warranty that such insurance shall be available from insurers or that it will be offered on reasonable terms. Any insurance purchased by the Client or Beneficiary shall be subject solely to the terms of the policy issued by insurers and GroundSure will have no liability therefor. In addition you acknowledge and agree that GroundSure does not act as an agent or broker for any insurance providers. The Client should take (and ensure that the Beneficiary takes) independent advice to ensure that the insurance policy requested or offered is suitable for its requirements.

2.6 GroundSure's quotations or proposals are valid for a period of 30 days only unless an alternative period of time is explicitly stipulated by Groundsure. GroundSure reserves the right to withdraw any quotation or proposal at any time before an Order is accepted by GroundSure. GroundSure's acceptance of an Order shall be binding only when made in writing and signed by GroundSure's authorised representative or when accepted through the Order Website.

3 The Client's obligations

3.1 The Client shall comply with the terms of this Contract and

(i) procure that the Beneficiary or any third party relying on the Services complies with and acts as if it is bound by the Contract and

(ii) be liable to GroundSure for the acts and omissions of the Beneficiary or any third party relying on the Services as if such acts and omissions were those of the Client.

3.2 The Client shall be solely responsible for ensuring that the Services are appropriate and suitable for its and/or the Beneficiary's needs.

3.3 The Client shall supply to GroundSure as soon as practicable and without charge all requisite information (and the Client warrants that such information is accurate, complete and appropriate), including without limitation any environmental information relating to the Site and shall give such assistance as GroundSure shall reasonably require in the provision of the Services including, without limitation, access to the Site, facilities and equipment.

3.4 Where the Client's approval or decision is required to enable GroundSure to carry out work in order to provide the Services, such approval or decision shall be given or procured in reasonable time and so as not to delay or disrupt the performance of the Services.

3.5 Save as expressly permitted by this Contract the Client shall not, and shall procure that the Beneficiary shall not, re-sell, alter, add to, or amend the GroundSure Materials, or use the GroundSure Materials in a manner for which they were not intended. The Client may make the GroundSure Materials available to a third party who is considering acquiring some or all of, or providing funding in relation to, the Site, but such third party cannot rely on the same unless expressly permitted under clause 4.

3.6 The Client is responsible for maintaining the confidentiality of its user name and password if using the Order Website and the Client acknowledges that GroundSure accepts no liability of any kind for any loss or damage suffered by the Client as a consequence of using the Order Website.

4 Reliance

4.1The Client acknowledges that the Services provided by GroundSure consist of the presentation and analysis of Third Party Content and other content and that information obtained from a Third Party Data Provider cannot be guaranteed or warranted by GroundSure to be reliable.
4.2 In respect of Data Reports, Mapping and Risk Screening Reports, the following classes of person and no other are entitled to rely on their contents;
(i) the Beneficiary,
(ii) the Beneficiary's professional advisers, (iii) any person providing funding to the Beneficiary in relation to the Site (whether directly or as part of a lending syndicate),
(iv) the first purchaser or first tenant of the Site, and
(v) the professional advisers and lenders of the first purchaser or tenant of the Site.
4.3 In respect of Support Services, only the Client, Beneficiary and parties expressly named in a Report and no other parties are entitled to rely on its contents.
4.4 Save as set out in clauses 4.2 and 4.3 and unless otherwise expressly agreed in writing, no other person or entity of any kind is entitled to rely on any Services or Report issued or provided by GroundSure. Any party considering such Reports and Services does so at their own risk.

5 Fees and Disbursements

5.1GroundSure shall charge and the Client shall pay fees at the rate and frequency specified in the written proposal, Order Website or Order acknowledgement form, plus (in the case of Support Services) all proper disbursements incurred by GroundSure. The Client shall in addition pay all value added tax or other tax payable on such fees and disbursements in relation to the provision of the Services (together "Fees").
5.2 The Client shall pay all outstanding Fees to GroundSure in full without deduction, counterclaim or set off within 30 days of the date of GroundSure's invoice or such other period as may be agreed in writing between GroundSure and the Client ("Payment Date"). Interest on late payments will accrue on a daily basis from the Payment Date until the date of payment (whether before or after judgment) at the rate of 8% per annum.
5.3 The Client shall be deemed to have agreed the amount of any invoice unless an objection is made in writing within 28 days of the date of the invoice. As soon as reasonably practicable after being notified of an objection, without prejudice to clause 5.2 a member of GroundSure's management team will contact the Client and the parties shall then use all reasonable endeavours to resolve the dispute within 15 days.

6 Intellectual Property and Confidentiality

6.1 Subject to
(i) full payment of all relevant Fees and
(ii) compliance with this Contract, the Client is granted (and is permitted to sub-licence to the Beneficiary) a royalty-free, worldwide, non-assignable and (save to the extent set out in this Contract) non-transferable licence to make use of the GroundSure Materials.
6.2 All Intellectual Property in the GroundSure Materials are and shall remain owned by GroundSure or GroundSure's licensors (including without limitation the Third Party Data Providers) the Client acknowledges, and shall procure acknowledgement by the Beneficiary of, such ownership. Nothing in this Contract purports to transfer or assign any rights to the Client or the Beneficiary in respect of such Intellectual Property.
6.3 Third Party Data Providers may enforce any breach of clauses 6.1 and 6.2 against the Client or Beneficiary.
6.4 The Client shall, and shall procure that any recipients of the GroundSure Materials shall:
(i) not remove, suppress or modify any trade mark, copyright or other proprietary marking belonging to GroundSure or any third party from the Services;
(ii) use the information obtained as part of the Services in respect of the subject Site only, and shall not store or reuse any information obtained as part of the Services provided in respect of adjacent or nearby sites;
(iii) not create any product or report which is derived directly or indirectly from the Services (save that those acting in a professional capacity to the Beneficiary may provide advice based upon the Services);
(iv) not combine the Services with or incorporate such Services into any other information data or service;
(v) not reformat or otherwise change (whether by modification, addition or enhancement), the Services (save that those acting for the Beneficiary in a professional capacity shall not be in breach of this clause 6.4(v) where such reformatting is in the normal course of providing advice based upon the Services);
(vi) where a Report and/or Mapping contains material belonging to Ordnance Survey, acknowledge and agree that such content is protected by Crown Copyright and shall not use such content for any purpose outside of receiving the Services; and
(vii) not copy in whole or in part by any means any map prints or run-on copies containing content belonging to Ordnance Survey (other than that contained within Ordnance Survey's OS Street Map) without first being in possession of a valid Paper Map Copying Licence from Ordnance Survey,
6.5 Notwithstanding clause 6.4, the Client may make reasonable use of the GroundSure Materials in order to advise the Beneficiary in a professional capacity. However, GroundSure shall have no liability in respect of any advice, opinion or report given or provided to Beneficiaries by the Client.
6.6 The Client shall procure that any person to whom the Services are made available shall notify GroundSure of any request or requirement to disclose, publish or disseminate any information contained in the Services in accordance with the Freedom of Information Act 2000, the Environmental Information Regulations 2004 or any associated legislation or regulations in force from time to time.

7.Liability: Particular Attention Should Be Paid To This Clause

7.1 This Clause 7 sets out the entire liability of GroundSure, including any liability for the acts or omissions of its employees, agents, consultants, subcontractors and Third Party Content, in respect of:
(i) any breach of contract, including any deliberate breach of the Contract by GroundSure or its employees, agents or subcontractors;
(ii) any use made of the Reports, Services, Materials or any part of them; and
(iii) any representation, statement or tortious act or omission (including negligence) arising under or in connection with the Contract.
7.2 All warranties, conditions and other terms implied by statute or common law are, to the fullest extent permitted by law, excluded from the Contract.
7.3 Nothing in the Contract limits or excludes the liability of the Supplier for death or personal injury resulting from negligence, or for any damage or liability incurred by the Client or Beneficiary as a result of fraud or fraudulent misrepresentation.
7.4 GroundSure shall not be liable for
(i) loss of profits;
(ii) loss of business;
(iii) depletion of goodwill and/or similar losses;
(iv) loss of anticipated savings;
(v) loss of goods;
(vi) loss of contract;
(vii) loss of use;
(viii) loss or corruption of data or information;
(ix) business interruption;
(x) any kind of special, indirect, consequential or pure economic loss, costs, damages, charges or expenses;
(xi) loss or damage that arise as a result of the use of all or part of the GroundSure Materials in breach of the Contract;
(xii) loss or damage arising as a result of any error, omission or inaccuracy in any part of the GroundSure Materials where such error, omission or inaccuracy is caused by any Third Party Content or any reasonable interpretation of Third Party Content;
(xiii) loss or damage to a computer, software, modem, telephone or other property; and
(xiv) loss or damage caused by a delay or loss of use of GroundSure's internet ordering service.
7.5 GroundSure's total liability in relation to or under the Contract shall be limited to £10 million for any claim or claims.
7.6 GroundSure shall procure that the Beneficiary shall be bound by limitations and exclusions of liability in favour of GroundSure which accord with those detailed in clauses 7.4 and 7.5 (subject to clause 7.3) in respect of all claims which the Beneficiary may bring against GroundSure in relation to the Services or other matters arising pursuant to the Contract.

8 GroundSure's right to suspend or terminate

8.1 If GroundSure reasonably believes that the Client or Beneficiary has not provided the information or assistance required to enable the proper provision of the Services, GroundSure shall be entitled to suspend all further performance of the Services until such time as any such deficiency has been made good.
8.2 GroundSure shall be entitled to terminate the Contract immediately on written notice in the event that:
(i) the Client fails to pay any sum due to GroundSure within 30 days of the Payment Date; or
(ii) the Client (being an individual) has a bankruptcy order made against him or (being a company) shall enter into liquidation whether compulsory or voluntary or have an administration order made against it or if a receiver shall be appointed over the whole or any part of its property assets or undertaking or if the Client is struck off the Register of Companies or dissolved; or
(iii) the Client being a company is unable to pay its debts within the meaning of Section 123 of the Insolvency Act 1986 or being an individual appears unable to pay his debts within the meaning of Section 268 of the Insolvency Act 1986 or if the Client shall enter into a composition or arrangement with the Client's creditors or shall suffer distress or execution to be levied on his goods; or
(iv) the Client or the Beneficiary breaches any term of the Contract (including, but not limited to, the obligations in clause 4) which is incapable of remedy or if remediable, is not remedied within five days of notice of the breach.

9. Client's Right to Terminate and Suspend

9.1 Subject to clause 10.1, the Client may at any time upon written notice terminate or suspend the provision of all or any of the Services.
9.2 In any event, where the Client is a consumer (and not a business) he/she hereby expressly acknowledges and agrees that:
(i) the supply of Services under this Contract (and therefore the performance of this Contract) commences immediately upon GroundSure's acceptance of the Order; and
(ii) the Reports and/or Mapping provided under this Contract are (a) supplied to the Client's specification(s) and in any event (b) by their nature cannot be returned.

10 Consequences of Withdrawal, Termination or Suspension

10.1 Upon termination of the Contract:
(i) GroundSure shall take steps to bring to an end the Services in an orderly manner, vacate any Site with all reasonable speed and shall deliver to the Client and/or Beneficiary any property of the Client and/or Beneficiary in GroundSure's possession or control; and
(ii) the Client shall pay to GroundSure all and any Fees payable in respect of the performance of the Services up to the date of termination or suspension. In respect of any Support Services provided, the Client shall also pay GroundSure any additional costs incurred in relation to the termination or suspension of the Contract. 11 Anti-Bribery
11.1 The Client warrants that it shall:
(i) comply with all applicable laws, statutes and regulations relating to anti-bribery and anti-corruption including but not limited to the Bribery Act 2010;
(ii) comply with such of GroundSure's anti-bribery and anti-corruption policies as are notified to the Client from time to time; and
(iii) promptly report to GroundSure any request or demand for any undue financial or other advantage of any kind received by or on behalf of the Client in connection with the performance of this Contract.
11.2 Breach of this Clause 11 shall be deemed a material breach of this Contract.

12 General

12.1 The Mapping contained in the Services is protected by Crown copyright and must not be used for any purpose other than as part of the Services or as specifically provided in the Contract.
12.2 The Client shall be permitted to make one copy only of each Report or Mapping Order. Thereafter the Client shall be entitled to make unlimited copies of the Report or Mapping Order only in accordance with an Ordnance Survey paper map copy license available through GroundSure.
12.3 GroundSure reserves the right to amend or vary this Contract. No amendment or variation to this Contract shall be valid unless signed by an authorised representative of GroundSure.
12.4 No failure on the part of GroundSure to exercise, and no delay in exercising, any right, power or provision under this Contract shall operate as a waiver thereof.
12.5 Save as expressly provided in this Contract, no person other than the persons set out therein shall have any right under the Contract (Rights of Third Parties) Act 1999 to enforce any terms of the Contract.
12.6 The Secretary of State for Business, Innovation and Skills ("BIS") or BIS' successor body, as the case may be, acting through Ordnance Survey may enforce a breach of clause 6.4(vi) and clause 6.4(vii) of these terms and conditions against the Client in accordance with the provisions of the Contracts (Rights of Third Parties) Act 1999.
12.7 GroundSure shall not be liable to the Client if the provision of the Services is delayed or prevented by one or more of the following circumstances:
(i) the Client or Beneficiary's failure to provide facilities, access or information;
(ii) fire, storm, flood, tempest or epidemic;
(iii) Acts of God or the public enemy;
(iv) riot, civil commotion or war;
(v) strikes, labour disputes or industrial action;
(vi) acts or regulations of any governmental or other agency;
(vii) suspension or delay of services at public registries by Third Party Data Providers;
(viii) changes in law; or
(ix) any other reason beyond GroundSure's reasonable control.
In the event that GroundSure is prevented from performing the Services (or any part thereof) in accordance with this clause 12.6 for a period of not less than 30 days then GroundSure shall be entitled to terminate this Contract immediately on written notice to the Client.
12.8 Any notice provided shall be in writing and shall be deemed to be properly given if delivered by hand or sent by first class post, facsimile or by email to the address, facsimile number or email address of the relevant party as may have been notified by each party to the other for such purpose or in the absence of such notification the last known address.
12.9 Such notice shall be deemed to have been received on the day of delivery if delivered by hand, facsimile or email (save to the extent such day is not a working day where it shall be deemed to have been delivered on the next working day) and on the second working day after the day of posting if sent by first class post.
12.10 The Contract constitutes the entire agreement between the parties and shall supersede all previous arrangements between the parties relating to the subject matter hereof.
12.11 Each of the provisions of the Contract is severable and distinct from the others and if one or more provisions is or should become invalid, illegal or unenforceable, the validity and enforceability of the remaining provisions shall not in any way be tainted or impaired.
12.12 This Contract shall be governed by and construed in accordance with English law and any proceedings arising out of or connected with this Contract shall be subject to the exclusive jurisdiction of the English courts.
12.13 GroundSure is an executive member of the Council of Property Search Organisation (CoPSO) and has signed up to the Search Code administered by the Property Codes Compliance Board (PCCB). All Risk Screening Reports shall be supplied in accordance with the provisions of the Search Code.
12.14 If the Client or Beneficiary has a complaint about the Services, written notice should be given to the Compliance Officer at GroundSure who will respond in a timely manner.
12.15 The Client agrees that it shall, and shall procure that each Beneficiary shall, treat in confidence all Confidential Information and shall not, and shall procure that each Beneficiary shall not (i) disclose any Confidential Information to any third party other than in accordance with the terms of this Contract; and (ii) use Confidential Information for a purpose other than the exercise of its rights and obligations under this Contract. Subject to clause 6.6, nothing shall prevent the Client or any Beneficiary from disclosing Confidential Information to the extent required by law.

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Terra Consult
Bold Business Centre, Bold Lane,
Bold Lane,
Sutton, WA9 4TX

GroundSure Reference:	HMD-147-1148108
Your Reference:	PO12232
Report Date	31 Oct 2013
Report Delivery Method:	Email - pdf

GroundSure GeoInsight

Address: 1,DALE VIEW,BILLINGTON,CLITHEROE, BB7 9LL

Dear Sir/Madam,

Thank you for placing your order with GroundSure. Please find enclosed the **GroundSure GeoInsight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above GroundSure reference number.

Managing Director
Groundsure Limited

Enc.
GroundSure GeoInsight

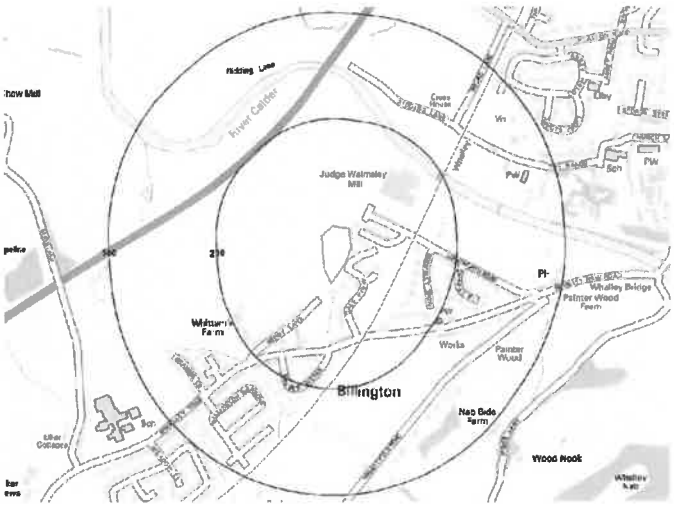
GroundSure GeoInsight

Address: 1,DALE VIEW,BILLINGTON,CLITHEROE, BB7 9LL

Date: 31 Oct 2013

GroundSure Reference: HMD-147-1148108

Your Reference: PO12232



Brought to you by GroundSure

Aerial Photograph of Study Site



Aerial photography supplied by Getmapping PLC.
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Site Name: 1,DALE VIEW,BILLINGTON,CLITHEROE, BB7 9LL
Grid Reference: 372536,435919
Size of Site: 0.58 ha

Overview of Findings

The GroundSure GeoInsight provides high quality geo-environmental information that allows geo-environmental professionals and their clients to make informed decisions and be forewarned of potential ground instability problems that may affect the ground investigation, foundation design and possibly remediation options that could lead to possible additional costs.

The report is based on the BGS 1:50,000 Digital Geological Map of Great Britain, BGS Geosure data; BRITPITS database; Shallow Mining data and Borehole Records, Coal Authority data including brine extraction areas, PBA non-coal mining and natural cavities database, Johnson Poole and Bloomer mining data and GroundSure's unique database including historical surface ground and underground workings.

For further details on each dataset, please refer to each individual section in the report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Report Section	Number of records found within (X) m of the study site boundary
1. Geology	**Description**
1.1 Artificial Ground,	
1.1.1 Is there any Artificial Ground /Made Ground present beneath the study site?*	No
1.1.2 Are there any records relating to permeability of artificial ground within the study site* boundary?	No
1.2 Superficial Geology & Landslips	
1.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site?*	Yes
1.2.2 Are there any records relating to permeability of superficial geology within the study site* boundary?	Yes
1.2.3 Are there any records of landslip within 500m of the study site boundary?	No
1.2.4 Are there any records relating to permeability of landslips within the study site* boundary?	No
1.3 Bedrock, Solid Geology & Faults	
1.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
1.3.2 Are there any records relating to permeability of bedrock within the study site* boundary?	Yes
1.3.3 Are there any records of faults within 500m of the study site boundary?	Yes
1.3.4 Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?	The property is in a Radon Affected Area, as between 1 and 3% of properties are above the Action Level
1.3.5 Is the property in an area where Radon Protection Measures are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?	No radon protective measures are necessary

* This includes an automatically generated 50m buffer zone around the site

Source:Scale 1:50,000 BGS Sheet No:068

2. Ground Workings	on-site	0-50	51-250	251-500	501-1000
2.1 Historical Surface Ground Working Features from Small Scale Mapping	0	0	9	-	-
2.2 Historical Underground Workings Features from Small Scale Mapping	0	0	0	0	0
2.3 Current Ground Workings	0	0	0	0	1

3. Mining, Extraction & Natural Cavities	on-site	0-50	51-250	251-500	501-1000
3.1 Historical Mining	0	0	0	0	0
3.2 Coal Mining	0	0	0	0	1
3.3 Johnson Poole and Bloomer Mining Area	0	0	0	0	0
3.4 Non-Coal Mining*	1	0	0	1	2
3.5 Non-Coal Mining Cavities	0	0	0	0	0
3.6 Natural Cavities	0	0	0	0	0
3.7 Brine Extraction	0	0	0	0	0
3.8 Gypsum Extraction	0	0	0	0	0
3.9 Tin Mining	0	0	0	0	0
3.10 Clay Mining	0	0	0	0	0

*This includes an automatically generated 50m buffer zone around the site

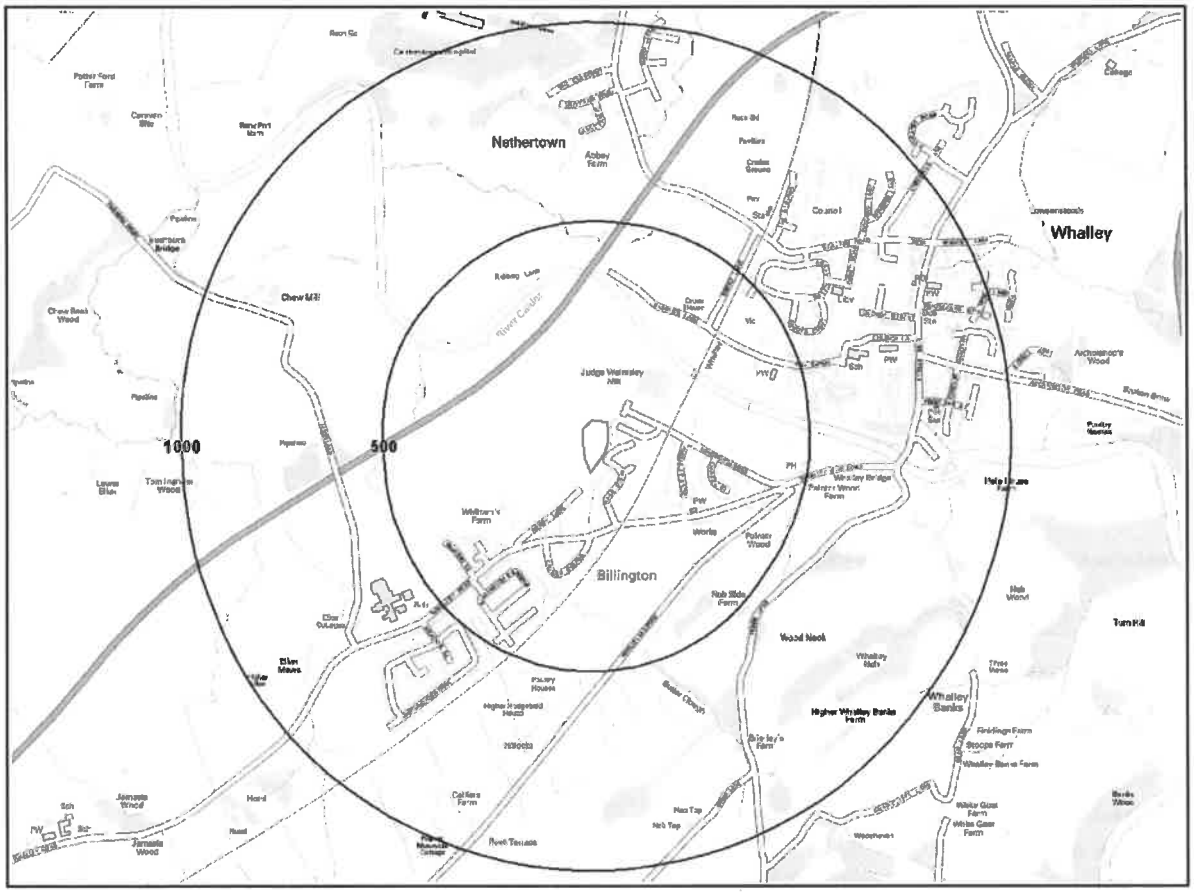
4. Natural Ground Subsidence	on-site*	0-50	51-250	251-500	501-1000
4.1 Shrink-Swell Clay	Very Low	-	-	-	-
4.2 Landslides	Very Low	-	-	-	-
4.3 Ground Dissolution of Soluble Rocks	Null	-	-	-	-
4.4 Compressible Deposits	Moderate	-	-	-	-
4.5 Collapsible Deposits	Very Low	-	-	-	-
4.6 Running Sand	Low	-	-	-	-

* This includes an automatically generated 50m buffer zone around the site

5. Borehole Records	on-site	0-50	51-250	251-500	501-1000
5.1 BGS Recorded Boreholes	0	0	1	-	-

6. Estimated Background Soil Chemistry	on-site	0-50	51-250	251-500	501-1000
6.1 Records of Background Soil Chemistry	2	1	0	-	-

1.1 Artificial Ground Map



Artificial Ground Legend

Mapping sourced from Ordnance Survey

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Site Outline

500
1000
Search Buffers (m)

Made Ground (undivided)

Disturbed Ground (undivided)

Worked Ground (undivided)

Landscaped Ground (undivided)

Infilled Ground

Reclaimed Ground

Geological information represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

1.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No:068

1.1.1 Artificial/Made Ground

Are there any records of Artificial/Made Ground within 500m of the study site boundary? **No**

Database searched and no data found.

1.1.2 Permeability of Artificial Ground

Are there any records relating to permeability of artificial ground within the study site* boundary? **No**

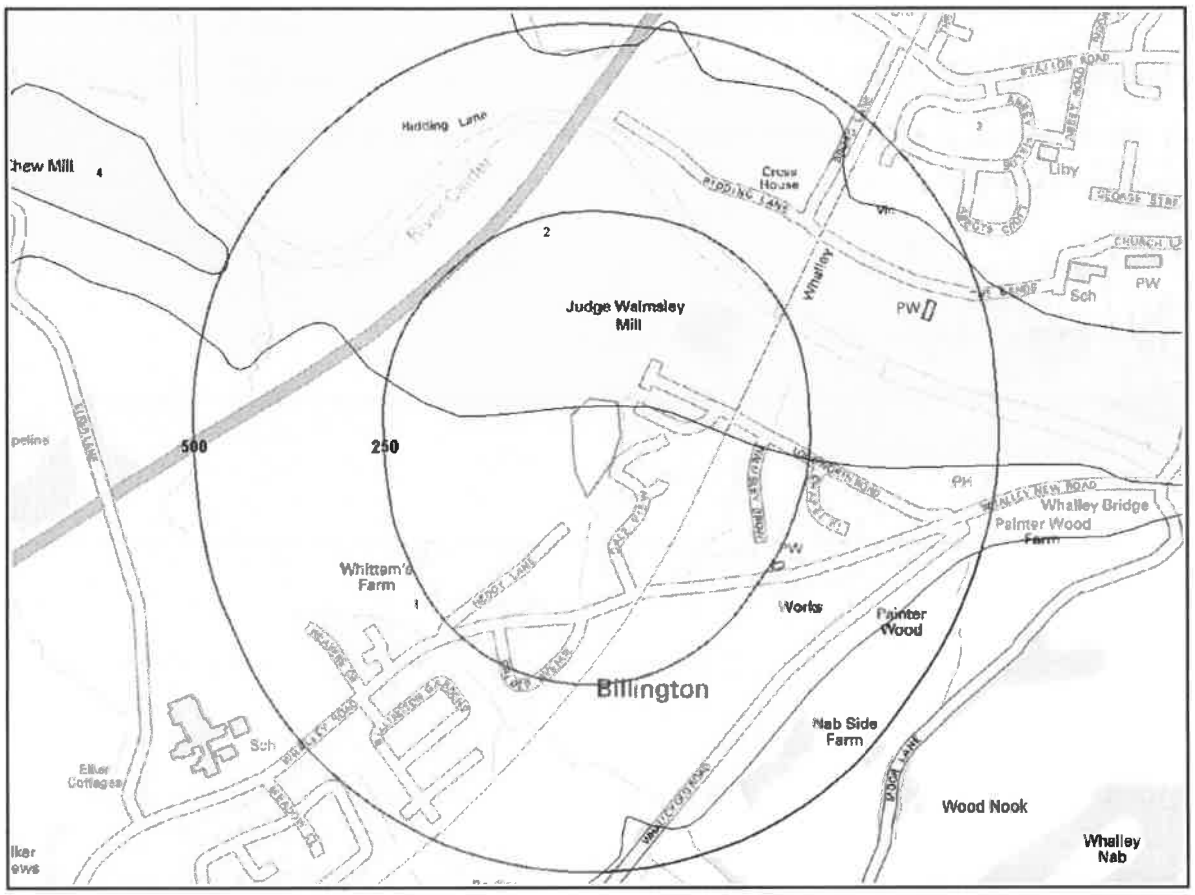
Database searched and no data found.

---

* This includes an automatically generated 50m buffer zone around the site.

1.2 Superficial Deposits and Landslips Map

NW N NE



W E

SW S SE

Superficial and Landslips Legend

Mapping sourced from Ordnance Survey

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Site Outline

500
1000
Search Buffers (m)

Geological information represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

1.2 Superficial Deposits and Landslips

1.2.1 Superficial Deposits/Drift Geology

Are there any records of Superficial Deposits/Drift Geology within 500m of the study site boundary? Yes

ID	Distance (m)	Direction	Lex Code	Description	Rock Description
1	0.0	On Site	TILLD-DMTN	TILL, DEVENSIAN	DIAMICTON
2	0.0	On Site	ALV-CSSG	ALLUVIUM	CLAY, SILT, SAND AND GRAVEL
3	410.0	NE	TILLD-DMTN	TILL, DEVENSIAN	DIAMICTON
4	497.0	NW	RTD1-SAGR	RIVER TERRACE DEPOSITS, 1	SAND AND GRAVEL

1.2.2 Permeability of Superficial Ground

Are there any records relating to permeability of superficial ground within the study site* boundary? Yes

Distance (m)	Direction	Flow type	Maximum Permeability	Minimum Permeability
0.0	On Site	Intergranular	High	Very Low
0.0	On Site	Mixed	High	Low

1.2.3 Landslip

Are there any records of Landslip within 500m of the study site boundary? No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, these are: Artificial / Made Ground, Superficial / Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

1.2.4 Landslip Permeability

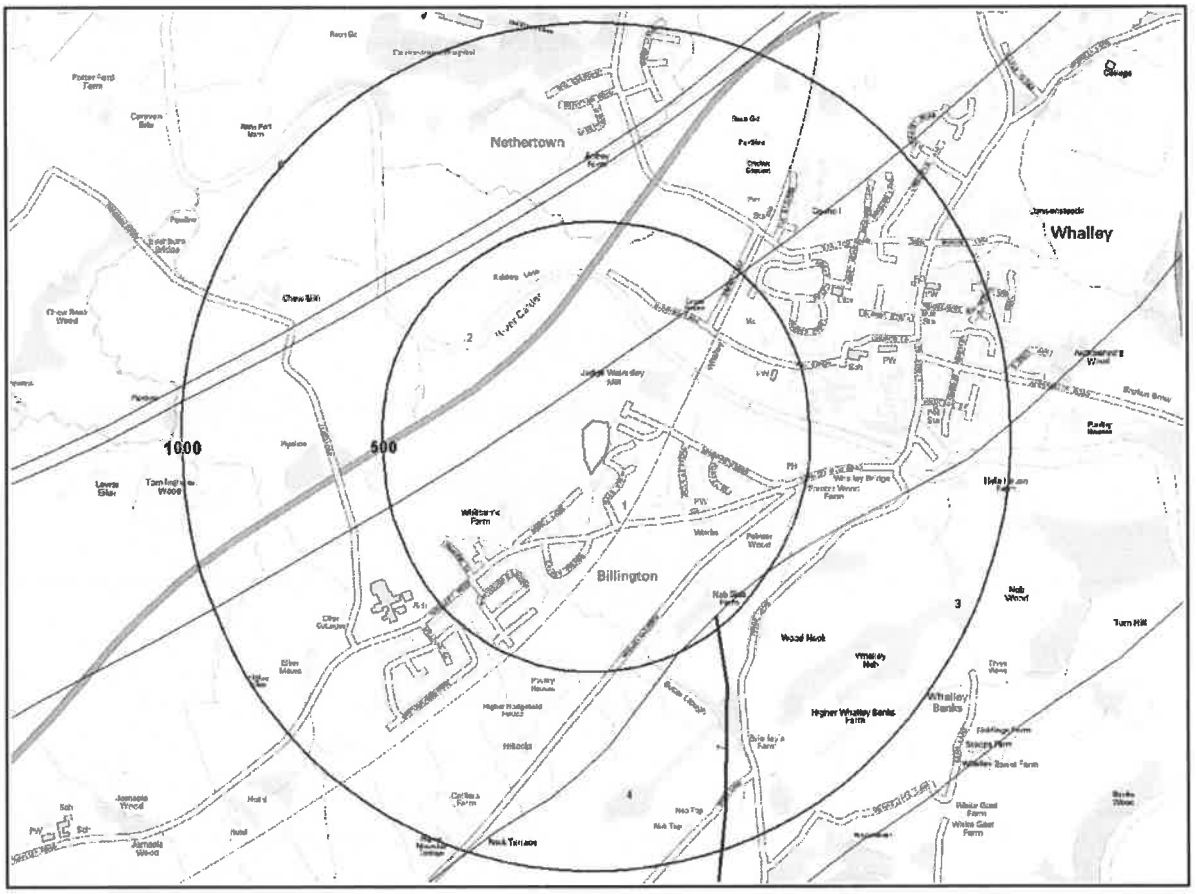
Are there any records relating to permeability of landslips within the study site* boundary? No

Database searched and no data found.

*This includes an automatically generated 50m buffer zone around the site.

1.3 Bedrock and Faults Map

NW N NE



W E

SW S SE

Bedrock & Faults Deposits Legend

Mapping sourced from Ordnance Survey
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Site Outline

500
1000
Search Buffers (m)

Geological information represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

1.3 Bedrock, Solid Geology & Faults

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No:068

1.3.1 Bedrock/Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary:

ID	Distance (m)	Direction	LEX Code	Rock Description	Rock Age
1	0.0	On Site	BSG-MDST	Bowland Shale Formation - Mudstone	Yeadonian / Asbian
2	93.0	NW	RKM-MDST	Rad Brook Mudstone Member - Mudstone	Holkerian
3	470.0	SE	PG-SDST	Pendle Grit Member - Sandstone	Pendleian
4	471.0	SE	PG-SDST	Pendle Grit Member - Sandstone	Pendleian

1.3.2 Permeability of Bedrock Ground

Are there any records relating to permeability of bedrock ground within the study site* boundary? Yes

Distance (m)	Direction	Flow type	Maximum Permeability	Minimum Permeability
0.0	On Site	Fracture	Low	Low

1.3.3 Faults

Are there any records of Faults within 500m of the study site boundary? Yes

ID	Distance (m)	Direction	Category Description	Feature Description
7	471.0	SE	FAULT	Normal fault, Inferred

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/ Solid Geology and linear features such as Faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

1.3.4 Radon Affected Areas

Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?

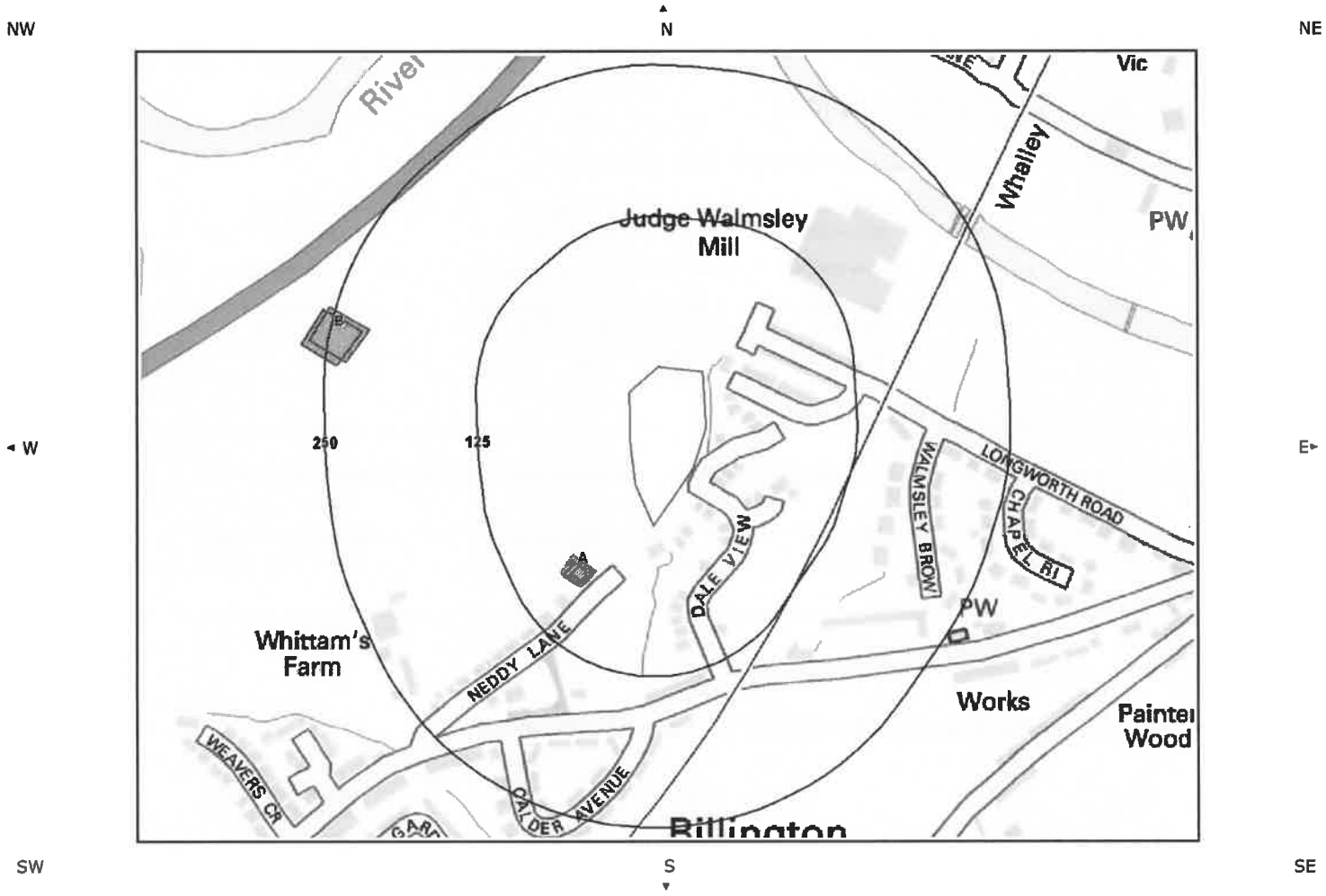
The property is in a Radon Affected Area, as between 1 and 3% of properties are above the Action Level

1.3.5 Radon Protection

Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?

* This includes an automatically generated 50m buffer zone around the site.

2. Ground Workings Map



2. Ground Workings

2.1 Historical Surface Ground Working Features derived from Historical Mapping

This dataset is based on GroundSure's unique Historical Land Use Database derived from 1:10,560 and 1:10,000 scale historical mapping.

Are there any Historical Surface Ground Working Features within 250m of the study site boundary? Yes

The following Historical Surface Ground Working Features are provided by GroundSure:

ID	Distance (m)	Direction	NGR	Use	Date
1A	61.0	SW	372464,435829	Reservoir	1973
2A	61.0	SW	372464,435829	Reservoir	1969
3A	61.0	SW	372464,435829	Reservoir	1950
4A	61.0	SW	372459,435830	Reservoir	1892
5A	67.0	SW	372458,435828	Reservoir	1910
6A	67.0	SW	372458,435828	Reservoir	1933
7B	218.0	W	372265,436025	Sewage Works	1950
8B	224.0	W	372259,436023	Sewage Works	1933
9B	224.0	W	372259,436023	Sewage Works	1910

2.2 Historical Underground Workings Features derived from Historical Mapping

This data is derived from the GroundSure unique Historical Land Use Database. It contains data derived from 1:10,000 and 1:10,560 historical Ordnance Survey Mapping and includes some natural topographical features (Shake Holes for example) as well as manmade features that may have implications for ground stability. Underground and mining features have been identified from surface features such as shafts. The distance that these extend underground is not shown.

Are there any Historical Underground Working Features within 1000m of the study site boundary? No

Database searched and no data found.

2.3 Current Ground Workings

This dataset is derived from the BGS BRITPITS database covering active; inactive mines; quarries; oil wells; gas wells and mineral wharves; and rail deposits throughout the British Isles.

Are there any BGS Current Ground Workings within 1000m of the study site boundary? Yes

The following Current Ground Workings information is provided by British Geological Society:

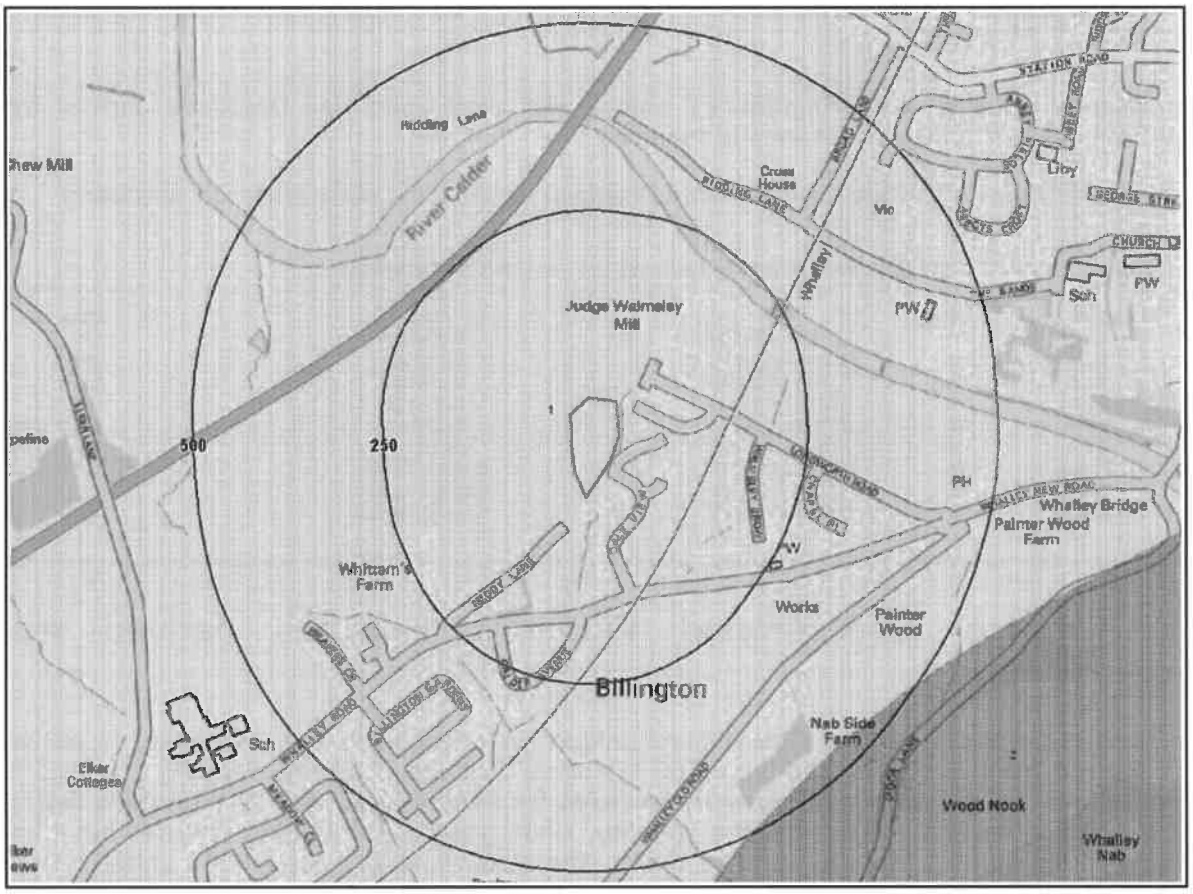
ID	Distance (m)	Direction	NGR	Commodity Produced	Pit Name	Type of working	Status
Not shown	772.0	SW	3718 82,43 5435	Clay & Shale	Buckfoot	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased

3. Mining, Extraction & Natural Cavities Map

NW N NE

W E

SW S SE



Mining, Extraction & Natural Cavities Legend

Mapping sourced from Ordnance Survey

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Site Outline

250
500
Search Buffers (m)

Historical Mining

Non-Coal Mining Cavities

Natural Cavities

Non-Coal Mining

Highly likely

Likely

Unlikely

Highly unlikely

Rare

3.Mining, Extraction & Natural Cavities

3.1 Historical Mining

This dataset is derived from GroundSure unique Historical Land-use Database that are indicative of mining or extraction activities.

Are there any Historical Mining areas within 1000m of the study site boundary? **No**

Database searched and no data found.

3.2 Coal Mining

This dataset provides information as to whether the study site lies within a known coal mining affected area as defined by the coal authority.

Are there any Coal Mining areas within 1000m of the study site boundary? **Yes**

The following Coal Mining information provided by the Coal Authority is not represented on Mapping:

Distance (m)	Direction	Details
867.0	S	The study site is located within the specified search distance of an identified mining area. Further details concerning this can be obtained from the Coal Authority Helpline on 0845 762 6848.

3.3 Johnson Poole and Bloomer

This dataset provides information as to whether the study site lies within an area where JPB hold information relating to mining.

Are there any JPB Mining areas within 1000m of the study site boundary? **No**

The following information provided by JPB is not represented on Mapping:

Database searched. No results found.

3.4 Non – Coal Mining

This dataset provides information as to whether the study site lies within an area which may have been subject to non-coal historic mining.

Are there any Non-Coal Mining areas within 1000m of the study site boundary? **Yes**

The following non-coal mining information is provided by the BGS:

ID	Distance (m)	Direction	Name	Commodity	Assessment of likelihood
1	0.0	On Site	Not available	Vein Mineral	Highly Unlikely - Localised small scale mining may have occurred but restricted in extent.
2	470.0	SE	Not available	Vein Mineral	Rare - Infrequent minor mining may have occurred but restricted in extent.
Not shown	867.0	S	Not available	Vein Mineral	Rare - Infrequent minor mining may have occurred but restricted in extent.

Not shown	887.0	S	Not available	Vein Mineral	Highly Unlikely - Localised small scale mining may have occurred but restricted in extent.

3.5 Non – Coal Mining Cavities

This dataset provides information from the Peter Brett Associates (PBA) mining cavities database (compiled for the national study entitled "Review of mining instability in Great Britain, 1990" PBA has also continued adding to this database) on mineral extraction by mining.

Are there any Non-Coal Mining cavities within 1000m of the study site boundary? **No**

Database searched and no data found.

3.6 Natural Cavities

This dataset provides information based on Peter Brett Associates natural cavities database.

Are there any Natural Cavities within 1000m of the study site boundary? **No**

Database searched and no data found.

3.7 Brine Extraction

This dataset provides information from the Brine Compensation Board which has been discontinued and is now covered by the Coal Authority.

Are there any Brine Extraction areas within 1000m of the study site boundary? **No**

Database searched and no data found.

3.8 Gypsum Extraction

This dataset provides information on Gypsum extraction from British Gypsum records.

Are there any Gypsum Extraction areas within 1000m of the study site boundary? **No**

Database searched and no data found.

3.9 Tin Mining

This dataset provides information on tin mining areas and is derived from tin mining records. This search is based upon postcode information to a sector level. More detailed information on potential Tin Mining may be found in Section 3.4 – Non-Coal Mining Hazards.

Are there any Tin Mining areas within 1000m of the study site boundary? **No**

Database searched and no data found.

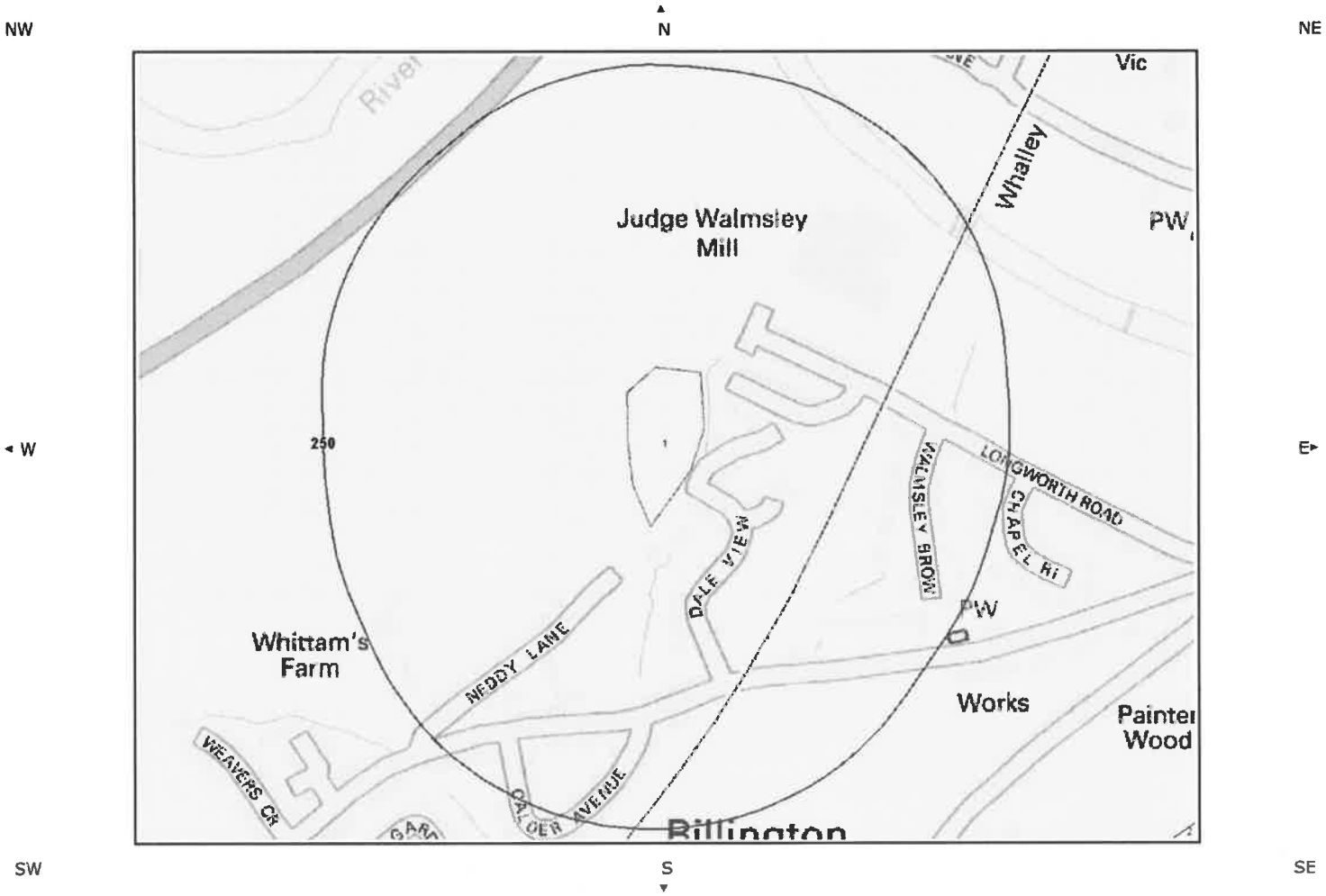
3.10 Clay Mining

This dataset provides information on Kaolin and Ball Clay mining from relevant mining records.

Are there any Clay Mining areas within 1000m of the study site boundary? **No**

Database searched and no data found.

4. Natural Ground Subsidence
4.1 Shrink-Swell Clay Map



Shrink-Swell Clay Legend

Mapping sourced from Ordnance Survey

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Site Outline

125
250
Search Buffers (m)

No Data / Null

Negligible

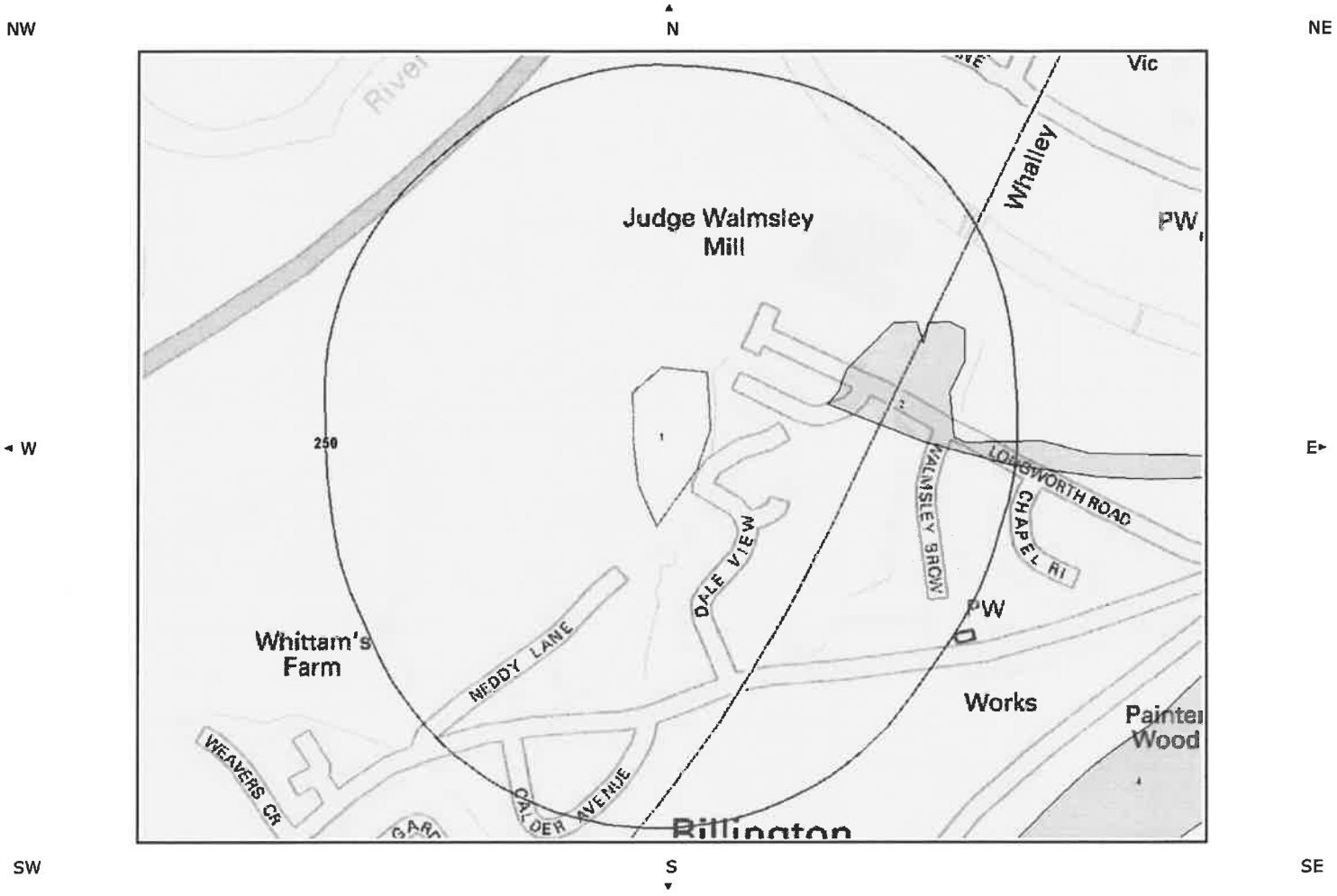
Very Low

Low

Moderate

High

4.2 Landslides Map



Landslides Legend

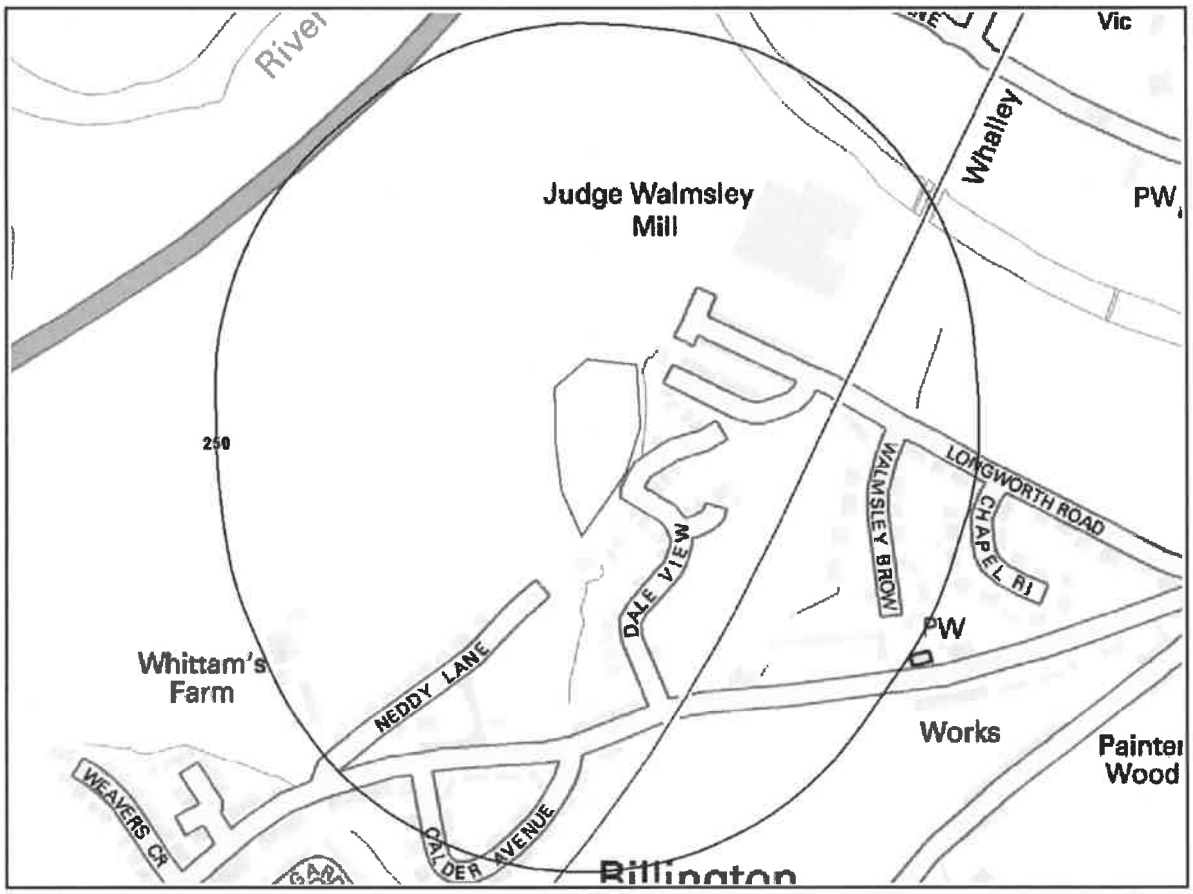
Mapping sourced from Ordnance Survey
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Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low
Low
Moderate
High

4.3 Ground Dissolution Soluble Rocks Map



Ground Dissolution Soluble Rocks Legend

Mapping sourced from Ordnance Survey

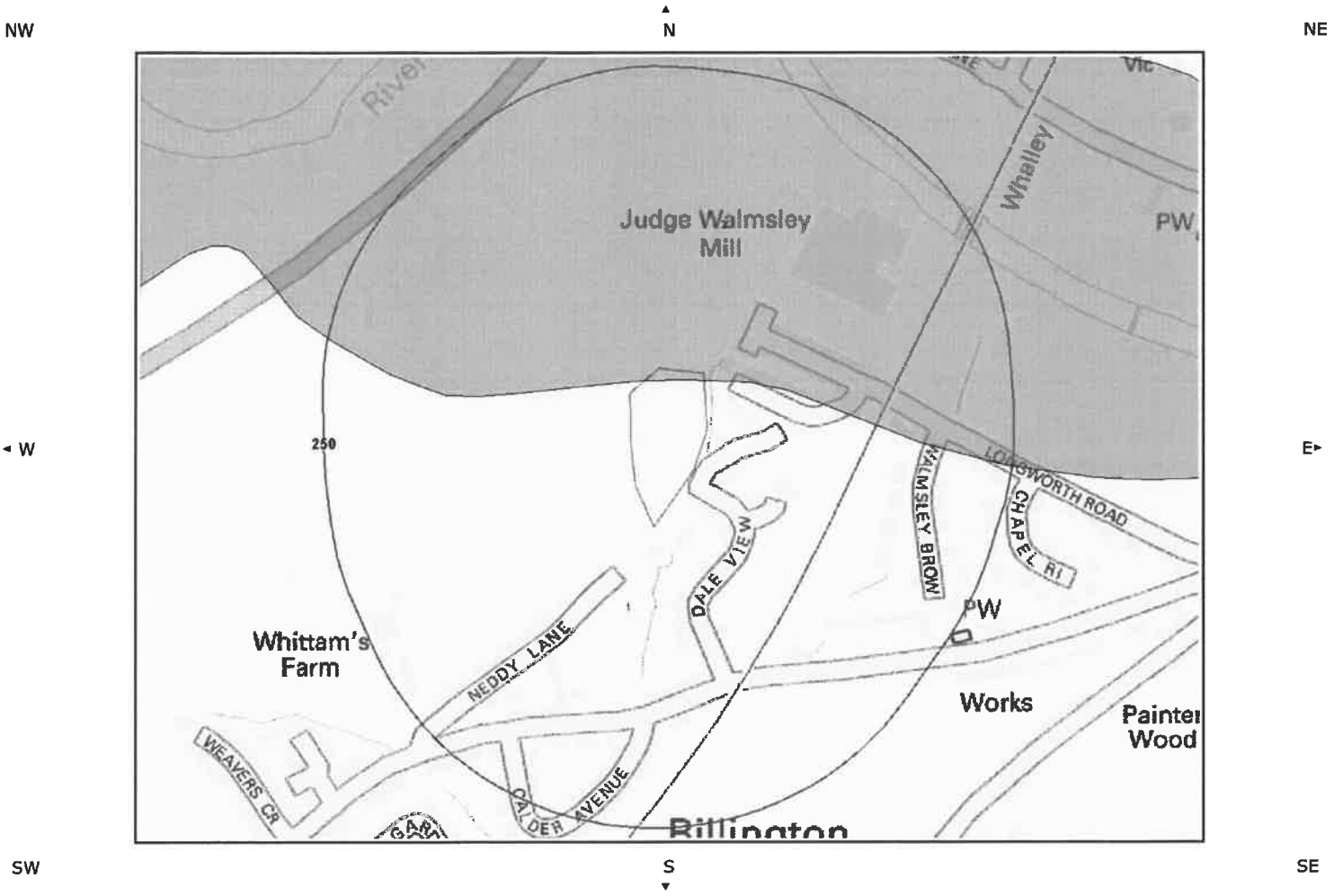
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Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low
Low
Moderate
High

4.4 Compressible Deposits Map



Compressible Deposits Legend

Mapping sourced from Ordnance Survey

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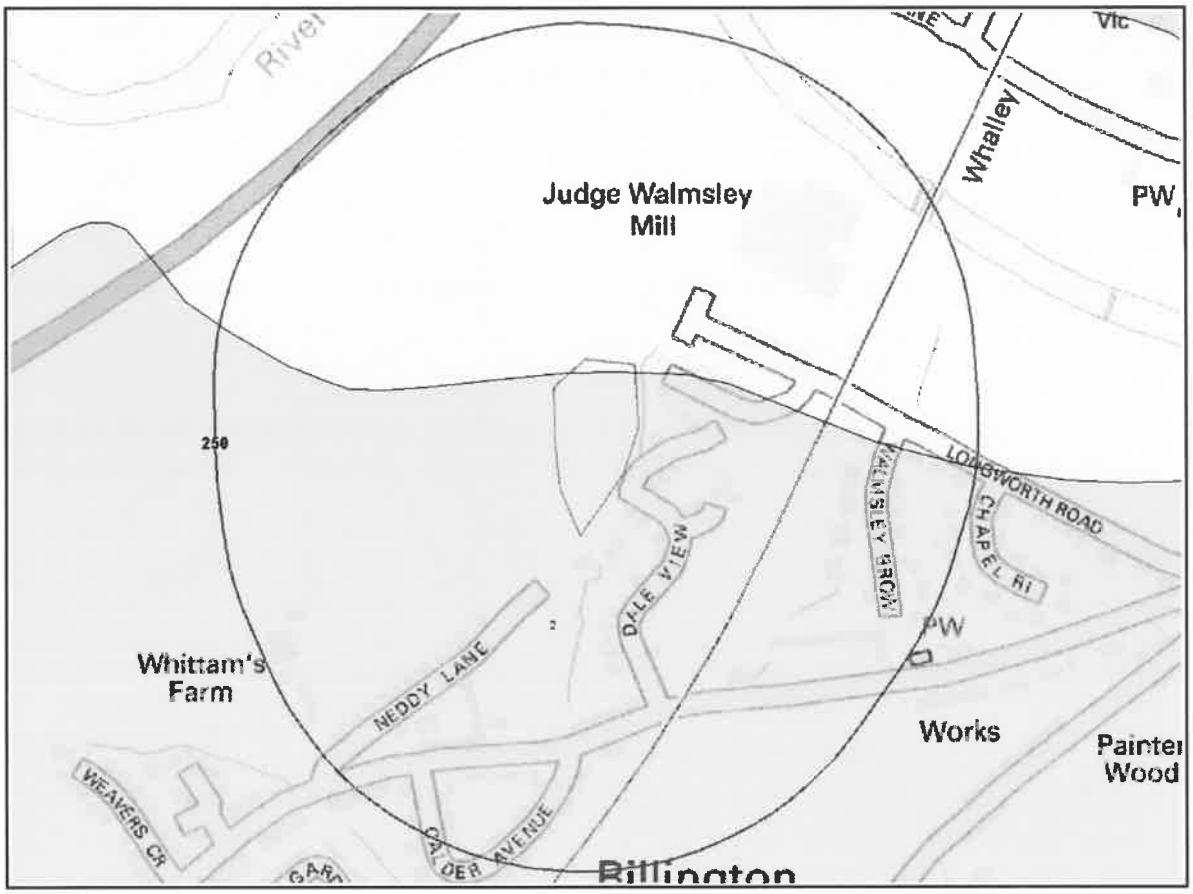
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

4.5 Collapsible Deposits Map



Collapsible Deposits Legend

Mapping sourced from Ordnance Survey

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Site Outline

125
250
Search Buffers (m)

No Data / Null

Negligible

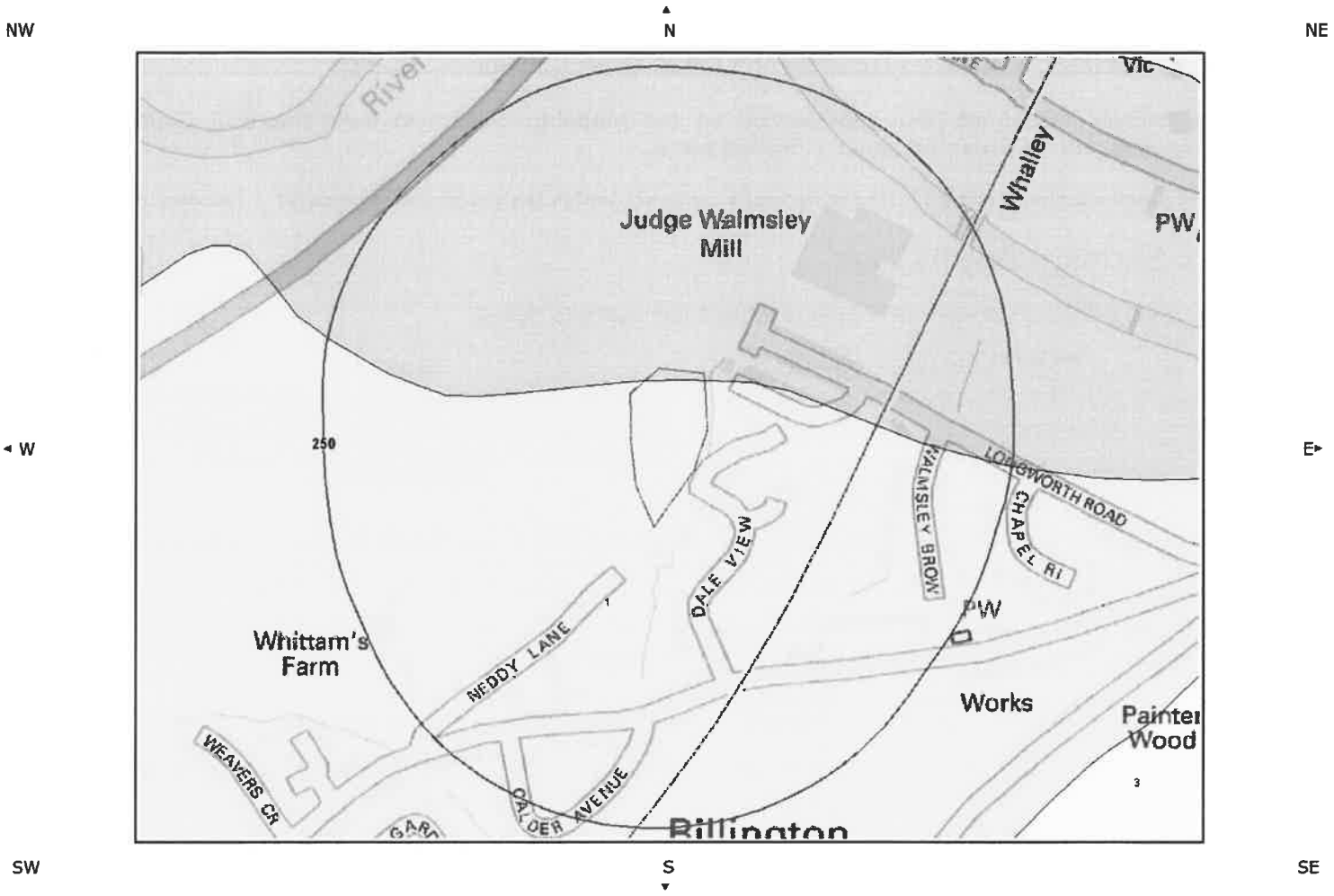
Very Low

Low

Moderate

High

4.6 Running Sand Map



Running Sand Legend

Mapping sourced from Ordnance Survey

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Site Outline

125
250
Search Buffers (m)

No Data / Null

Negligible

Very Low

Low

Moderate

High

4.Natural Ground Subsidence

The National Ground Subsidence rating is obtained through the 6 natural ground stability hazard datasets, which are supplied by the British Geological Survey (BGS).

The following GeoSure data represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

What is the maximum hazard rating of natural subsidence within the study site* boundary? **Moderate**

4.1 Shrink – Swell Clays

The following Shrink Swell information provided by the British Geological Survey:

ID	Distance (m) *	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Ground conditions predominantly low plasticity. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with shrink-swell clays.

4.2 Landslides

The following Landslides information provided by the British Geological Survey:

ID	Distance (m)*	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

4.3 Ground Dissolution of Soluble Rocks

The following Soluble Rocks information provided by the British Geological Survey:

Distance (m)*	Direction	Hazard Rating	Details
0.0	On site	Null-Negligible	Soluble rocks are not present in the search area. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

4.4 Compressible Deposits

The following Compressible Ground information provided by the British Geological Survey:

ID	Distance (m)*	Direction	Hazard Rating	Details

*This includes an automatically generated 50m buffer zone around the study site boundary.

1	0.0	On Site	Negligible	No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.
2	0.0	On Site	Moderate	Significant potential for compressibility problems. Avoid large differential loadings of ground. Do not drain or de-water ground near the property without technical advice. For new build - consider possibility of compressible ground in ground investigation, construction and building design. Consider effects of groundwater changes. Extra construction costs are likely. For existing property - possible increase in insurance risk from compressibility, especially if water conditions or loading of the ground change significantly.

4.5 Collapsible Deposits

The following Collapsible Rocks information is provided by the British Geological Survey:

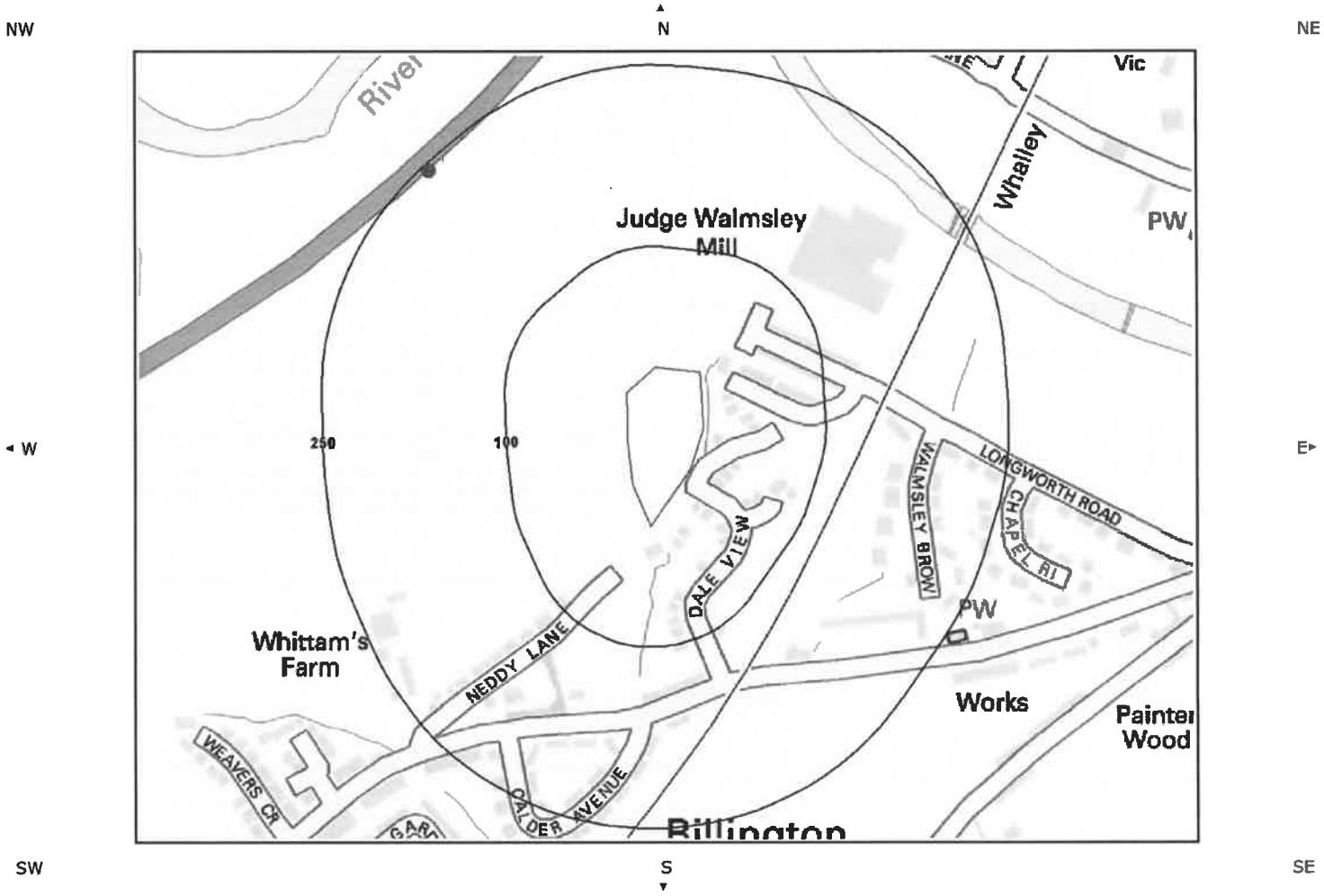
ID	Distance (m)*	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	No indicators for collapsible deposits identified. No actions required to avoid problems due to collapsible deposits. No special ground investigation required, or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
2	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

4.6 Running Sands

The following Running Sands information is provided by the British Geological Survey:

ID	Distance (m)*	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
2	0.0	On Site	Low	Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property no significant increase in insurance risk due to running sand problems is likely.

5. Borehole Records Map



Borehole Records Legend

Mapping sourced from Ordnance Survey

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Site Outline

Borehole Locations

125
250
Search Buffers (m)

5.Borehole Records

The systematic analysis of data extracted from the BGS Borehole Records database provides the following information.

Records of boreholes within 250m of the study site boundary: **1**

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length (m)	Borehole Name
1	244.0	NW	372340,436160	SD73NW28	4.57	A59 WALLEY-CLITHEROE BY-PASS 6

Additional online information is available for the following boreholes listed above:

#1: http://scans.bgs.ac.uk/sobi_scans/boreholes/25525

6.Estimated Background Soil Chemistry

Records of background estimated soil chemistry within 250m of the study site boundary: 3

For further information on how this data is calculated and limitations upon its use, please see the GroundSure GeoInsight User Guide, available on request.

			Estimated Geometric Mean Soil Concentrations (mg/kg)				
Distance (m)*	Direction	Sample Type	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Lead (Pb)
0.0	On Site	Sediment	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	15 - 30 mg/kg	<150 mg/kg
0.0	On Site	Sediment	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<150 mg/kg
2.0	N	Sediment	<15 mg/kg	<1.8 mg/kg	40 - 60 mg/kg	15 - 30 mg/kg	<150 mg/kg

*As this data is based upon underlying 1:50,000 scale geological information, a 50m buffer has been added to the search radius.

7. Contacts

GroundSure Helpline
Telephone: 08444 159 000
info@groundsure.com

British Geological Survey Enquiries
Kingsley Dunham Centre
Keyworth, Nottingham NG12 5GG
Tel: 0115 936 3143. Fax: 0115 936 3276.
Email: enquiries@bgs.ac.uk
Web: www.bgs.ac.uk
BGS Geological Hazards Reports and general geological enquiries

British Gypsum
British Gypsum Ltd, East Leake, Loughborough, Leicestershire, LE12 6HX
Tel: www.british-gypsum.com

The Coal Authority
200 Lichfield Lane, Mansfield, Notts NG18 4RG
Tel: 0845 762 6848
DX 716176 Mansfield 5 www.coal.gov.uk

Johnson Poole & Bloomer Limited
Harris and Pearson Building, Brettel Lane, Brierley Hill, West Midlands DY5 3LH
Tel: +44 (0) 1384 262 000
Email: enquiries.gs@jpb.co.uk
Website: www.jpb.co.uk

Ordnance Survey
Romsey Road, Southampton SO16 4GU
Tel: 08456 050505

Getmapping PLC
Virginia Villas, High Street, Hartley Witney,
Hampshire RG27 8NW
Tel: 01252 845444

Peter Brett Associates
Caversham Bridge House, Waterman Place, Reading
Berkshire RG1 8DN
Tel: +44 (0)118 950 0761 E-mail: reading@pba.co.uk

Acknowledgements

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This report has been prepared in accordance with the GroundSure Ltd standard Terms and Conditions of business for work of this nature.

Standard Terms and Conditions

1 Definitions

In these terms and conditions unless the context otherwise requires:
"Beneficiary" means the person or entity for whose benefit the Client has obtained the Services.
"Client" means the party or parties entering into a Contract with GroundSure.
"Commercial" means any building or property which is not Residential.
"Confidential Information" means the contents of this Contract and all information received from the Client as a result of, or in connection with, this Contract other than
(i) information which the Client can prove was rightfully in its possession prior to disclosure by GroundSure and
(ii) any information which is in the public domain (other than by virtue of a breach of this Contract).
"Support Services" means Support Services provided by GroundSure including, without limitation, interpreting third party and in-house environmental data, providing environmental support advice, undertaking environmental audits and assessments, Site investigation, Site monitoring and related items.
"Contract" means the contract between GroundSure and the Client for the provision of the Services, and which shall incorporate these terms and conditions, the Order, and the relevant User Guide.
"Third Party Data Provider" means any third party providing Third Party Content to GroundSure.
"Data Reports" means reports comprising factual data with no accompanying interpretation.
"Fees" has the meaning set out in clause 5.1.
"GroundSure" means GroundSure Limited, a company registered in England and Wales under number 03421028.
"GroundSure Materials" means all materials prepared by GroundSure and provided as part of the Services, including but not limited to Third Party Content, Data Reports, Mapping, and Risk Screening Reports.
"Intellectual Property" means any patent, copyright, design rights, trade or service mark, moral rights, data protection rights, know-how or trade mark in each case whether registered or not and including applications for the same or any other rights of a similar nature anywhere in the world.
"Mapping" means a map, map data or a combination of historical maps of various ages, time periods and scales.
"Order" means an electronic, written or other order form submitted by the Client requesting Services from GroundSure in respect of a specified Site.
"Ordnance Survey" means the Secretary of State for Business, Innovation and Skills, acting through Ordnance Survey, Adanac Drive, Southampton, SO16 0AS, UK.
"Order Website" means the online platform through which Orders may be placed by the Client and accepted by GroundSure.
"Report" means a Risk Screening Report or Data Report for Commercial or Residential property.
"Residential" means any building or property used as or intended to be used as a single dwelling.
"Risk Screening Report" means a risk screening report comprising factual data with an accompanying interpretation by GroundSure.
"Services" means any Report, Mapping and/or Support Services which GroundSure has agreed to provide by accepting an Order pursuant to clause 2.6.
"Site" means the area of land in respect of which the Client has requested GroundSure to provide the Services.
"Third Party Content" means data, database information or other information which is provided to GroundSure by a Third Party Data Provider.
"User Guide" means the user guide, as amended from time to time, available upon request from GroundSure and on the website (www.groundsure.com) and forming part of this Contract.

2 Scope of Services, terms and conditions, requests for insurance and quotations

2.1 GroundSure agrees to provide the Services in accordance with the Contract.
2.2 GroundSure shall exercise reasonable skill and care in the provision of the Services.
2.3 Subject to clause 7.3 the Client acknowledges that it has not relied on any statement or representation made by or on behalf of GroundSure which is not set out and expressly agreed in writing in the Contract and all such statements and representations are hereby excluded to the fullest extent permitted by law.
2.4 The Client acknowledges that terms and conditions appearing on a Client's order form, printed stationery or other communication, or any terms or conditions implied by custom, practice or course of dealing shall be of no effect, and that this Contract shall prevail over all others in relation to the Order.
2.5 If the Client or Beneficiary requests insurance in conjunction with or as a result of the Services, GroundSure shall use reasonable endeavours to recommend such insurance, but makes no warranty that such insurance shall be available from insurers or that it will be offered on reasonable terms. Any insurance purchased by the Client or Beneficiary shall be subject solely to the terms of the policy issued by insurers and GroundSure will have no liability therefor. In addition you acknowledge and agree that GroundSure does not act as an agent or broker for any insurance providers. The Client should take (and ensure that the Beneficiary takes) independent advice to ensure that the insurance policy requested or offered is suitable for its requirements.
2.6 GroundSure's quotations or proposals are valid for a period of 30 days only unless an alternative period of time is explicitly stipulated by Groundsure. GroundSure reserves the right to withdraw any quotation or proposal at any time before an Order is accepted by GroundSure. GroundSure's acceptance of an Order shall be binding only when made in writing and signed by GroundSure's authorised representative or when accepted through the Order Website.

3 The Client's obligations

3.1The Client shall comply with the terms of this Contract and
(i) procure that the Beneficiary or any third party relying on the Services complies with and acts as if it is bound by the Contract and
(ii) be liable to GroundSure for the acts and omissions of the Beneficiary or any third party relying on the Services as if such acts and omissions were those of the Client.
3.2 The Client shall be solely responsible for ensuring that the Services are appropriate and suitable for its and/or the Beneficiary's needs.
3.3 The Client shall supply to GroundSure as soon as practicable and without charge all requisite information (and the Client warrants that such information is accurate, complete and appropriate), including without limitation any environmental information relating to the Site and shall give such assistance as GroundSure shall reasonably require in the provision of the Services including, without limitation, access to the Site, facilities and equipment.
3.4 Where the Client's approval or decision is required to enable GroundSure to carry out work in order to provide the Services, such approval or decision shall be given or procured in reasonable time and so as not to delay or disrupt the performance of the Services.
3.5 Save as expressly permitted by this Contract the Client shall not, and shall procure that the Beneficiary shall not, re-sell, alter, add to, or amend the GroundSure Materials, or use the GroundSure Materials in a manner for which they were not intended. The Client may make the GroundSure Materials available to a third party who is considering acquiring some or all of, or providing funding in relation to, the Site, but such third party cannot rely on the same unless expressly permitted under clause 4.
3.6 The Client is responsible for maintaining the confidentiality of its user name and password if using the Order Website and the Client acknowledges that GroundSure accepts no liability of any kind for any loss or damage suffered by the Client as a consequence of using the Order Website.

4 Reliance

4.1The Client acknowledges that the Services provided by GroundSure consist of the presentation and analysis of Third Party Content and other content and that information obtained from a Third Party Data Provider cannot be guaranteed or warranted by GroundSure to be reliable.
4.2 In respect of Data Reports, Mapping and Risk Screening Reports, the following classes of person and no other are entitled to rely on their contents;
(i) the Beneficiary,
(ii) the Beneficiary's professional advisers, (iii) any person providing funding to the Beneficiary in relation to the Site (whether directly or as part of a lending syndicate),
(iv) the first purchaser or first tenant of the Site, and
(v) the professional advisers and lenders of the first purchaser or tenant of the Site.
4.3 In respect of Support Services, only the Client, Beneficiary and parties expressly named in a Report and no other parties are entitled to rely on its contents.
4.4 Save as set out in clauses 4.2 and 4.3 and unless otherwise expressly agreed in writing, no other person or entity of any kind is entitled to rely on any Services or Report issued or provided by GroundSure. Any party considering such Reports and Services does so at their own risk.

5 Fees and Disbursements

5.1GroundSure shall charge and the Client shall pay fees at the rate and frequency specified in the written proposal, Order Website or Order acknowledgement form, plus (in the case of Support Services) all proper disbursements incurred by GroundSure. The Client shall in addition pay all value added tax or other tax payable on such fees and disbursements in relation to the provision of the Services (together "Fees").
5.2 The Client shall pay all outstanding Fees to GroundSure in full without deduction, counterclaim or set off within 30 days of the date of GroundSure's invoice or such other period as may be agreed in writing between GroundSure and the Client ("Payment Date"). Interest on late payments will accrue on a daily basis from the Payment Date until the date of payment (whether before or after judgment) at the rate of 8% per annum.
5.3 The Client shall be deemed to have agreed the amount of any invoice unless an objection is made in writing within 28 days of the date of the invoice. As soon as reasonably practicable after being notified of an objection, without prejudice to clause 5.2 a member of GroundSure's management team will contact the Client and the parties shall then use all reasonable endeavours to resolve the dispute within 15 days.

6 Intellectual Property and Confidentiality

6.1 Subject to
(i) full payment of all relevant Fees and
(ii) compliance with this Contract, the Client is granted (and is permitted to sub-licence to the Beneficiary) a royalty-free, worldwide, non-assignable and (save to the extent set out in this Contract) non-transferable licence to make use of the GroundSure Materials.
6.2 All Intellectual Property in the GroundSure Materials are and shall remain owned by GroundSure or GroundSure's licensors (including without limitation the Third Party Data Providers) the Client acknowledges, and shall procure acknowledgement by the Beneficiary of, such ownership. Nothing in this Contract purports to transfer or assign any rights to the Client or the Beneficiary in respect of such Intellectual Property.
6.3 Third Party Data Providers may enforce any breach of clauses 6.1 and 6.2 against the Client or Beneficiary.
6.4 The Client shall, and shall procure that any recipients of the GroundSure Materials shall:
(i) not remove, suppress or modify any trade mark, copyright or other proprietary marking belonging to GroundSure or any third party from the Services;
(ii) use the information obtained as part of the Services in respect of the subject Site only, and shall not store or reuse any information obtained as part of the Services provided in respect of adjacent or nearby sites;
(iii) not create any product or report which is derived directly or indirectly from the Services (save that those acting in a professional capacity to the Beneficiary may provide advice based upon the Services);
(iv) not combine the Services with or incorporate such Services into any other information data or service;
(v) not reformat or otherwise change (whether by modification, addition or enhancement), the Services (save that those acting for the Beneficiary in a professional capacity shall not be in breach of this clause 6.4(v) where such reformatting is in the normal course of providing advice based upon the Services);
(vi) where a Report and/or Mapping contains material belonging to Ordnance Survey, acknowledge and agree that such content is protected by Crown Copyright and shall not use such content for any purpose outside of receiving the Services; and
(vii) not copy in whole or in part by any means any map prints or run-on copies containing content belonging to Ordnance Survey (other than that contained within Ordnance Survey's OS Street Map) without first being in possession of a valid Paper Map Copying Licence from Ordnance Survey,
6.5 Notwithstanding clause 6.4, the Client may make reasonable use of the GroundSure Materials in order to advise the Beneficiary in a professional capacity. However, GroundSure shall have no liability in respect of any advice, opinion or report given or provided to Beneficiaries by the Client.
6.6 The Client shall procure that any person to whom the Services are made available shall notify GroundSure of any request or requirement to disclose, publish or disseminate any information contained in the Services in accordance with the Freedom of Information Act 2000, the Environmental Information Regulations 2004 or any associated legislation or regulations in force from time to time.

7.Liability: Particular Attention Should Be Paid To This Clause

7.1 This Clause 7 sets out the entire liability of GroundSure, including any liability for the acts or omissions of its employees, agents, consultants, subcontractors and Third Party Content, in respect of:
(i) any breach of contract, including any deliberate breach of the Contract by GroundSure or its employees, agents or subcontractors;
(ii) any use made of the Reports, Services, Materials or any part of them; and
(iii) any representation, statement or tortious act or omission (including negligence) arising under or in connection with the Contract.
7.2 All warranties, conditions and other terms implied by statute or common law are, to the fullest extent permitted by law, excluded from the Contract.
7.3 Nothing in the Contract limits or excludes the liability of the Supplier for death or personal injury resulting from negligence, or for any damage or liability incurred by the Client or Beneficiary as a result of fraud or fraudulent misrepresentation.
7.4 GroundSure shall not be liable for
(i) loss of profits;
(ii) loss of business;
(iii) depletion of goodwill and/or similar losses;
(iv) loss of anticipated savings;
(v) loss of goods;
(vi) loss of contract;
(vii) loss of use;
(viii) loss or corruption of data or information;
(ix) business interruption;
(x) any kind of special, indirect, consequential or pure economic loss, costs, damages, charges or expenses;
(xi) loss or damage that arise as a result of the use of all or part of the GroundSure Materials in breach of the Contract;
(xii) loss or damage arising as a result of any error, omission or inaccuracy in any part of the GroundSure Materials where such error, omission or inaccuracy is caused by any Third Party Content or any reasonable interpretation of Third Party Content;
(xiii) loss or damage to a computer, software, modem, telephone or other property; and
(xiv) loss or damage caused by a delay or loss of use of GroundSure's internet ordering service.
7.5 GroundSure's total liability in relation to or under the Contract shall be limited to £10 million for any claim or claims.
7.6 GroundSure shall procure that the Beneficiary shall be bound by limitations and exclusions of liability in favour of GroundSure which accord with those detailed in clauses 7.4 and 7.5 (subject to clause 7.3) in respect of all claims which the Beneficiary may bring against GroundSure in relation to the Services or other matters arising pursuant to the Contract.

8 GroundSure's right to suspend or terminate

8.1 If GroundSure reasonably believes that the Client or Beneficiary has not provided the information or assistance required to enable the proper provision of the Services, GroundSure shall be entitled to suspend all further performance of the Services until such time as any such deficiency has been made good.
8.2 GroundSure shall be entitled to terminate the Contract immediately on written notice in the event that:
(i) the Client fails to pay any sum due to GroundSure within 30 days of the Payment Date; or
(ii) the Client (being an individual) has a bankruptcy order made against him or (being a company) shall enter into liquidation whether compulsory or voluntary or have an administration order made against it or if a receiver shall be appointed over the whole or any part of its property assets or undertaking or if the Client is struck off the Register of Companies or dissolved; or
(iii) the Client being a company is unable to pay its debts within the meaning of Section 123 of the Insolvency Act 1986 or being an individual appears unable to pay his debts within the meaning of Section 268 of the Insolvency Act 1986 or if the Client shall enter into a composition or arrangement with the Client's creditors or shall suffer distress or execution to be levied on his goods; or

(iv) the Client or the Beneficiary breaches any term of the Contract (including, but not limited to, the obligations in clause 4) which is incapable of remedy or if remediable, is not remedied within five days of notice of the breach.

9. Client's Right to Terminate and Suspend

9.1 Subject to clause 10.1, the Client may at any time upon written notice terminate or suspend the provision of all or any of the Services.
9.2 In any event, where the Client is a consumer (and not a business) he/she hereby expressly acknowledges and agrees that:
(i) the supply of Services under this Contract (and therefore the performance of this Contract) commences immediately upon GroundSure's acceptance of the Order; and
(ii) the Reports and/or Mapping provided under this Contract are
(a) supplied to the Client's specification(s) and in any event
(b) by their nature cannot be returned.

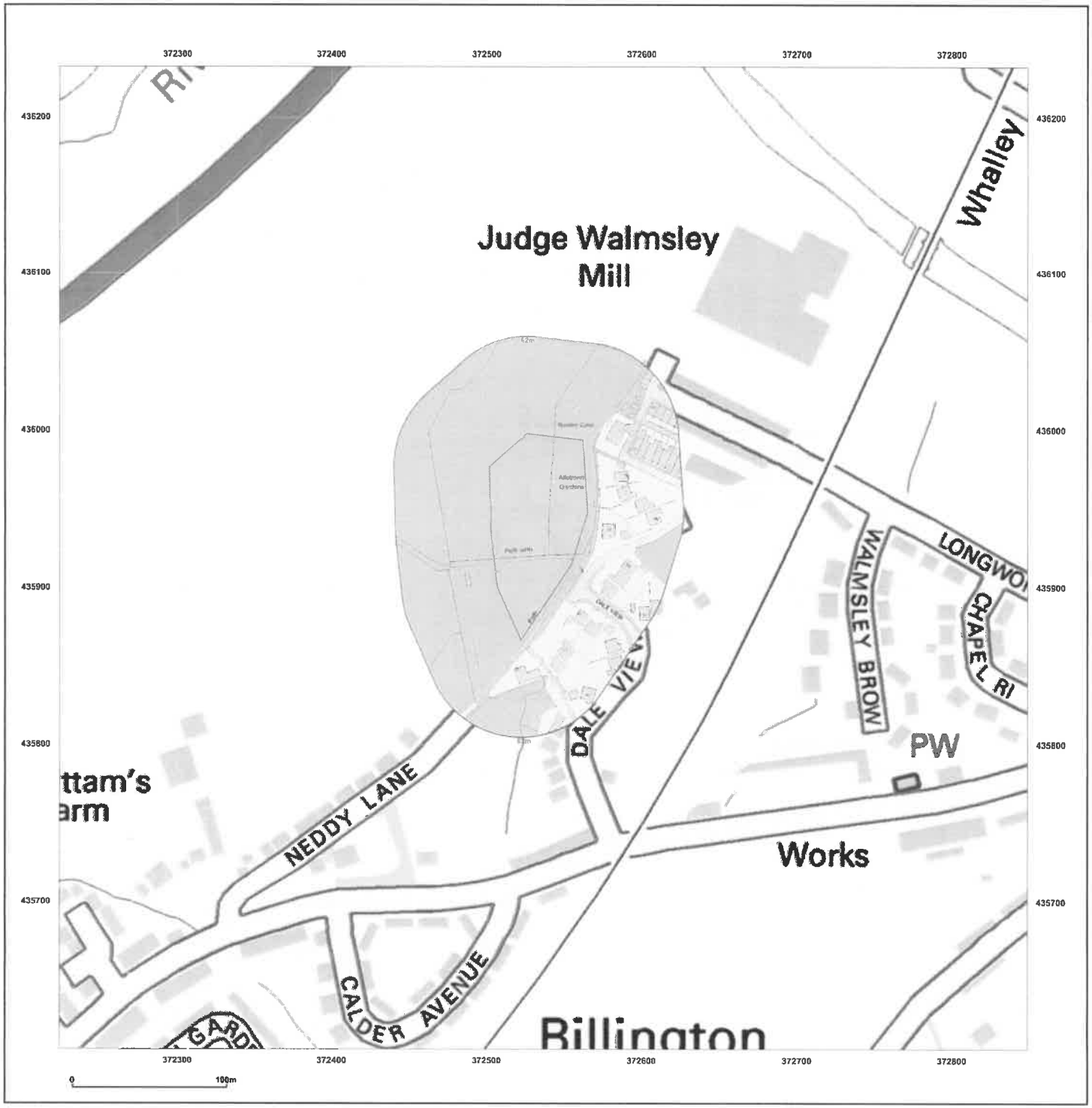
10 Consequences of Withdrawal, Termination or Suspension

10.1 Upon termination of the Contract:
(i) GroundSure shall take steps to bring to an end the Services in an orderly manner, vacate any Site with all reasonable speed and shall deliver to the Client and/or Beneficiary any property of the Client and/or Beneficiary in GroundSure's possession or control; and
(ii) the Client shall pay to GroundSure all and any Fees payable in respect of the performance of the Services up to the date of termination or suspension. In respect of any Support Services provided, the Client shall also pay GroundSure any additional costs incurred in relation to the termination or suspension of the Contract. 11 Anti-Bribery
11.1 The Client warrants that it shall:
(i) comply with all applicable laws, statutes and regulations relating to anti-bribery and anti-corruption including but not limited to the Bribery Act 2010;
(ii) comply with such of GroundSure's anti-bribery and anti-corruption policies as are notified to the Client from time to time; and
(iii) promptly report to GroundSure any request or demand for any undue financial or other advantage of any kind received by or on behalf of the Client in connection with the performance of this Contract.
11.2 Breach of this Clause 11 shall be deemed a material breach of this Contract.

12 General

12.1 The Mapping contained in the Services is protected by Crown copyright and must not be used for any purpose other than as part of the Services or as specifically provided in the Contract.
12.2 The Client shall be permitted to make one copy only of each Report or Mapping Order. Thereafter the Client shall be entitled to make unlimited copies of the Report or Mapping Order only in accordance with an Ordnance Survey paper map copy license available through GroundSure.
12.3 GroundSure reserves the right to amend or vary this Contract. No amendment or variation to this Contract shall be valid unless signed by an authorised representative of GroundSure.
12.4 No failure on the part of GroundSure to exercise, and no delay in exercising, any right, power or provision under this Contract shall operate as a waiver thereof.
12.5 Save as expressly provided in this Contract, no person other than the persons set out therein shall have any right under the Contract (Rights of Third Parties) Act 1999 to enforce any terms of the Contract.
12.6 The Secretary of State for Business, Innovation and Skills ("BIS") or BIS' successor body, as the case may be, acting through Ordnance Survey may enforce a breach of clause 6.4(vi) and clause 6.4(vii) of these terms and conditions against the Client in accordance with the provisions of the Contracts (Rights of Third Parties) Act 1999.
12.7 GroundSure shall not be liable to the Client if the provision of the Services is delayed or prevented by one or more of the following circumstances:
(i) the Client or Beneficiary's failure to provide facilities, access or information;
(ii) fire, storm, flood, tempest or epidemic;
(iii) Acts of God or the public enemy;
(iv) riot, civil commotion or war;
(v) strikes, labour disputes or industrial action;
(vi) acts or regulations of any governmental or other agency;
(vii) suspension or delay of services at public registries by Third Party Data Providers;
(viii) changes in law; or
(ix) any other reason beyond GroundSure's reasonable control.
In the event that GroundSure is prevented from performing the Services (or any part thereof) in accordance with this clause 12.6 for a period of not less than 30 days then GroundSure shall be entitled to terminate this Contract immediately on written notice to the Client.
12.8 Any notice provided shall be in writing and shall be deemed to be properly given if delivered by hand or sent by first class post, facsimile or by email to the address, facsimile number or email address of the relevant party as may have been notified by each party to the other for such purpose or in the absence of such notification the last known address.
12.9 Such notice shall be deemed to have been received on the day of delivery if delivered by hand, facsimile or email (save to the extent such day is not a working day where it shall be deemed to have been delivered on the next working day) and on the second working day after the day of posting if sent by first class post.
12.10 The Contract constitutes the entire agreement between the parties and shall supersede all previous arrangements between the parties relating to the subject matter hereof.
12.11 Each of the provisions of the Contract is severable and distinct from the others and if one or more provisions is or should become invalid, illegal or unenforceable, the validity and enforceability of the remaining provisions shall not in any way be tainted or impaired.
12.12 This Contract shall be governed by and construed in accordance with English law and any proceedings arising out of or connected with this Contract shall be subject to the exclusive jurisdiction of the English courts.
12.13 GroundSure is an executive member of the Council of Property Search Organisation (CoPSO) and has signed up to the Search Code administered by the Property Codes Compliance Board (PCCB). All Risk Screening Reports shall be supplied in accordance with the provisions of the Search Code.
12.14 If the Client or Beneficiary has a complaint about the Services, written notice should be given to the Compliance Officer at GroundSure who will respond in a timely manner.
12.15 The Client agrees that it shall, and shall procure that each Beneficiary shall, treat in confidence all Confidential Information and shall not, and shall procure that each Beneficiary shall not (i) disclose any Confidential Information to any third party other than in accordance with the terms of this Contract; and (ii) use Confidential Information for a purpose other than the exercise of its rights and obligations under this Contract. Subject to clause 6.6, nothing shall prevent the Client or any Beneficiary from disclosing Confidential Information to the extent required by law.

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GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

1,DALE VIEW,BILLINGTON,CLITHEROE , BB7 9LL

Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: MasterMap
Map date: 2012
Scale: 1:1,250
Printed at: 1:2,500

N
W E
S

2012

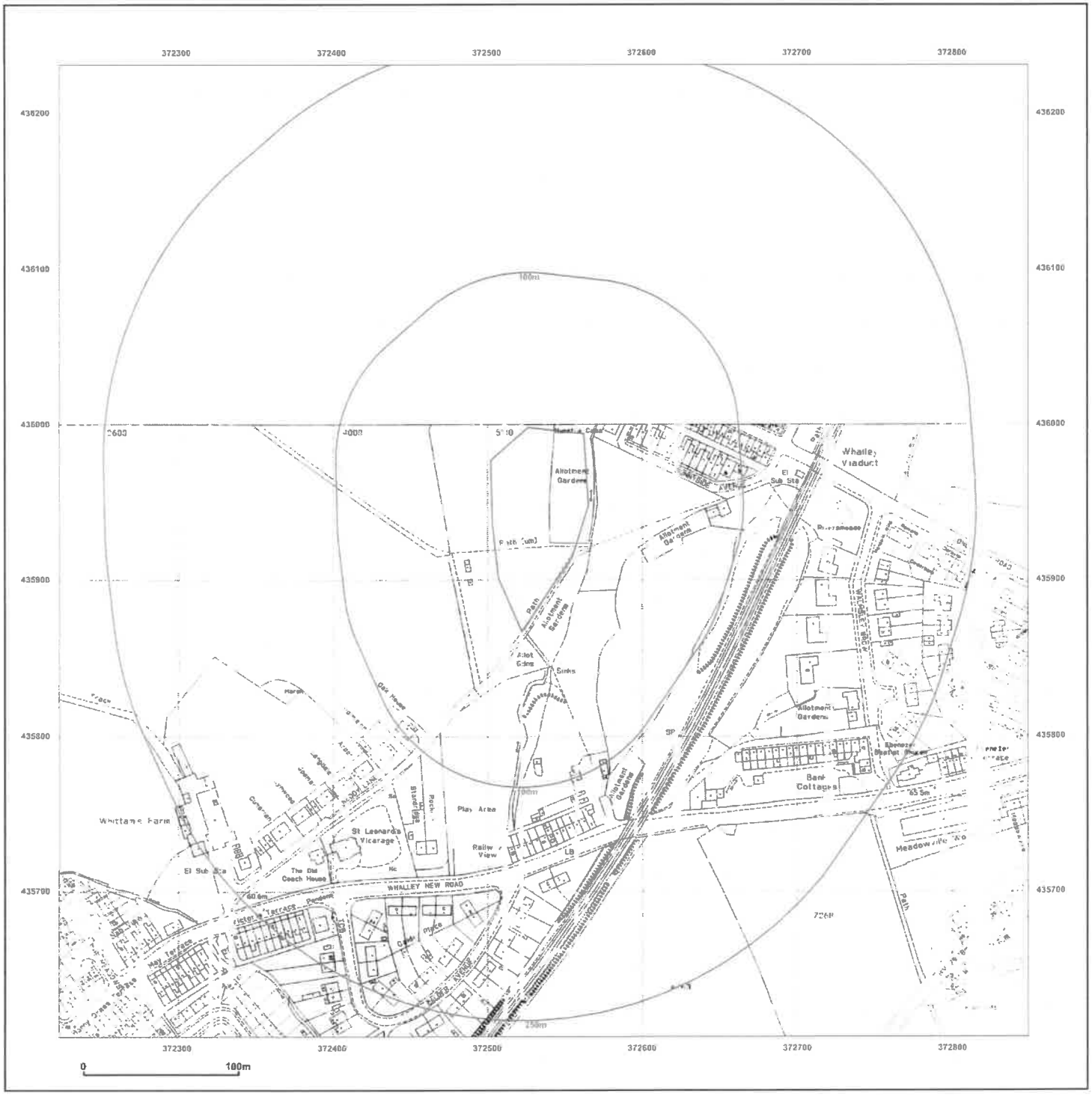
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GroundSure Environmental Insight
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E: info@groundsure.com
W: www.groundsure.com

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Production date: 31 October 2013

To view map legend click here *Legend*



GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

1,DALE VIEW,BILLINGTON,CLITHEROE , BB7 9LL

Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: National Grid
Map date: 1995
Scale: 1:2,500
Printed at: 1:2,500

N
W E
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Surveyed N/A
Revised N/A
Edition N/A
Copyright 1995
Levelled N/A

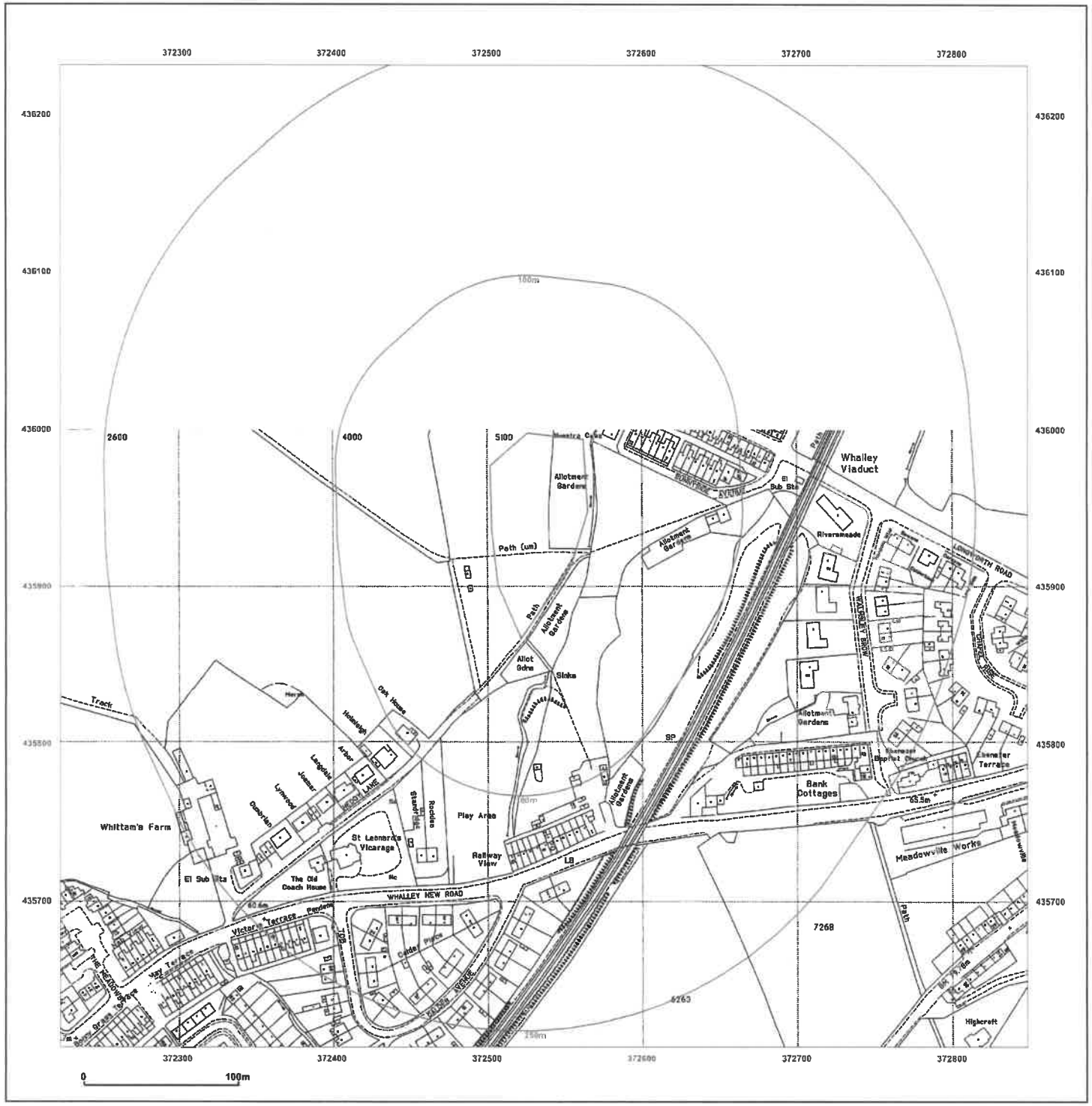
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ENVIRONMENTAL INSIGHT

Site Details:

1,DALE VIEW,BILLINGTON,CLITHEROE , BB7 9LL

Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: National Grid
Map date: 1995
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1995
Revised N/A
Edition N/A
Copyright N/A
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GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

1,DALE VIEW,BILLINGTON,CLITHEROE , BB7 9LL

Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: National Grid
Map date: 1993
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: National Grid
Map date: 1993
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
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Levelled N/A

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Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: National Grid
Map date: 1992
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A



Surveyed N/A
Revised N/A
Edition N/A
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Production date: 31 October 2013

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ENVIRONMENTAL INSIGHT

Site Details:

1,DALE VIEW,BILLINGTON,CLITHEROE , BB7 9LL

Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: National Grid
Map date: 1975-1978
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A



Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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ENVIRONMENTAL INSIGHT

Site Details:

1,DALE VIEW,BILLINGTON,CLITHEROE , BB7 9LL

Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: National Grid
Map date: 1974-1977
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1974
Revised 1974
Edition N/A
Copyright 1975
Levelled 1962

Surveyed 1977
Revised 1977
Edition N/A
Copyright 1978
Levelled 1981

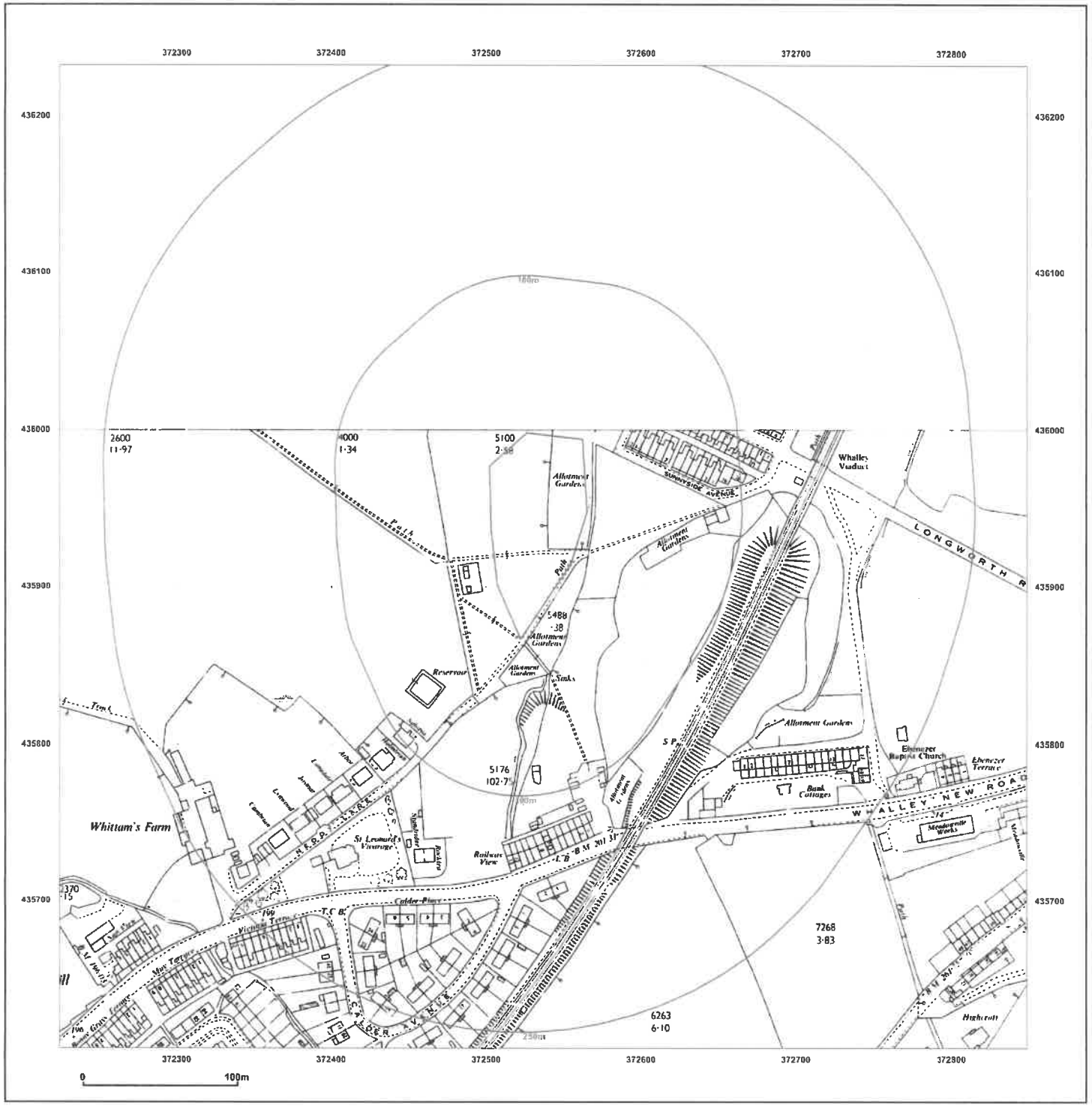
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Site Details:

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Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: National Grid
Map date: 1967
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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Site Details:

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Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: National Grid
Map date: 1966
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed N/A
Revised 1966
Edition N/A
Copyright 1968
Levelled 1962

Surveyed 1966
Revised 1966
Edition N/A
Copyright 1967
Levelled 1961

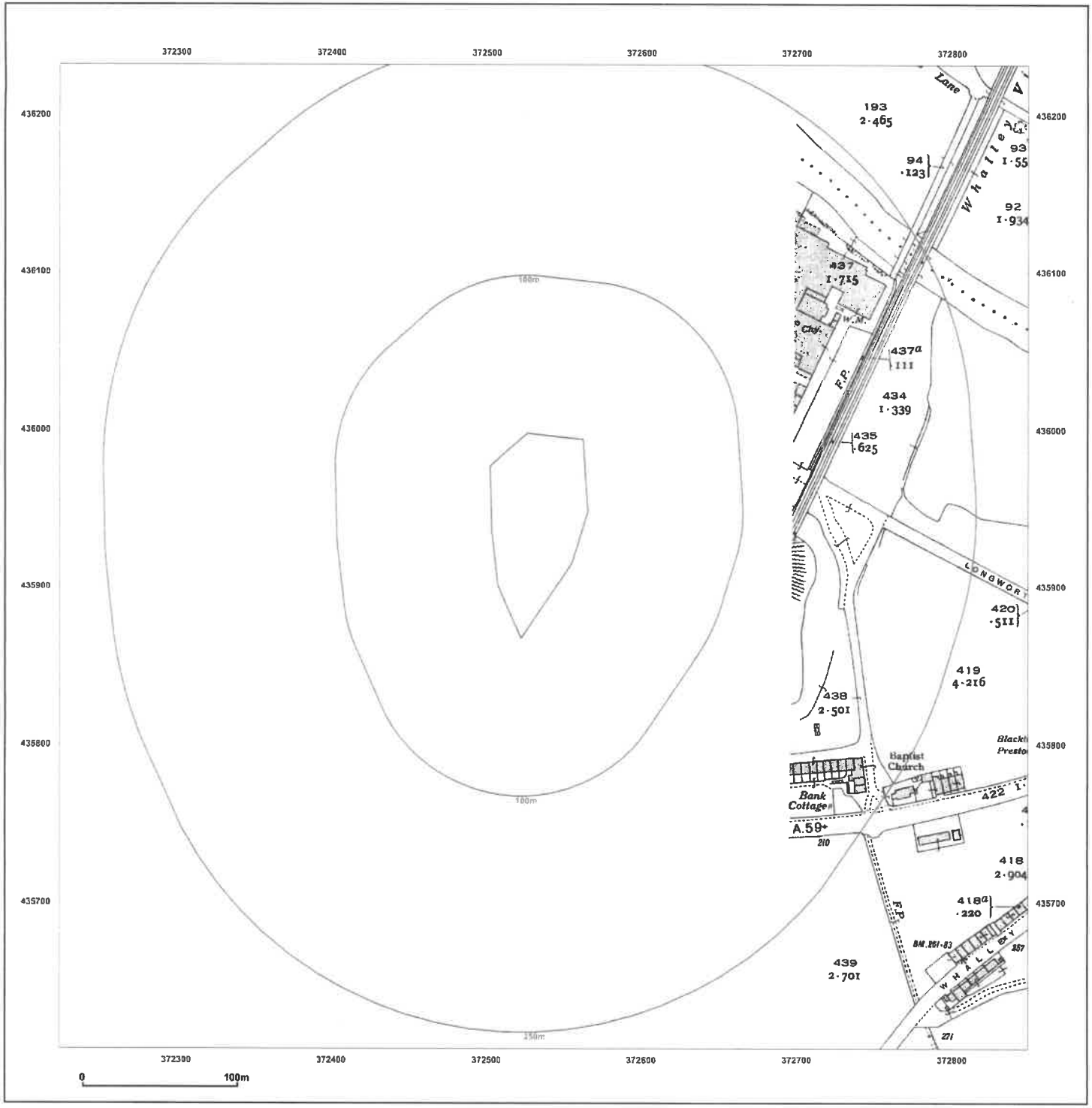
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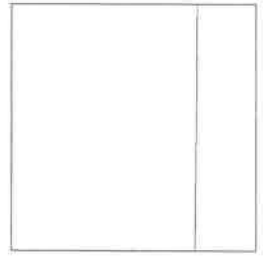
Site Details:

1,DALE VIEW,BILLINGTON,CLITHEROE , BB7 9LL

Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: County Series
Map date: 1938
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S



Surveyed 1938
Revised 1938
Edition N/A
Copyright N/A
Levelled N/A

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ENVIRONMENTAL INSIGHT

Site Details:

1,DALE VIEW,BILLINGTON,CLITHEROE , BB7 9LL

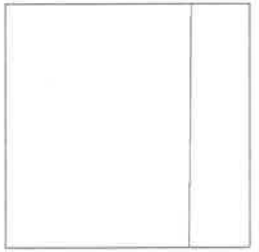
Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: County Series
Map date: 1932
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1932
Revised 1932
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1932
Revised 1932
Edition N/A
Copyright N/A
Levelled N/A



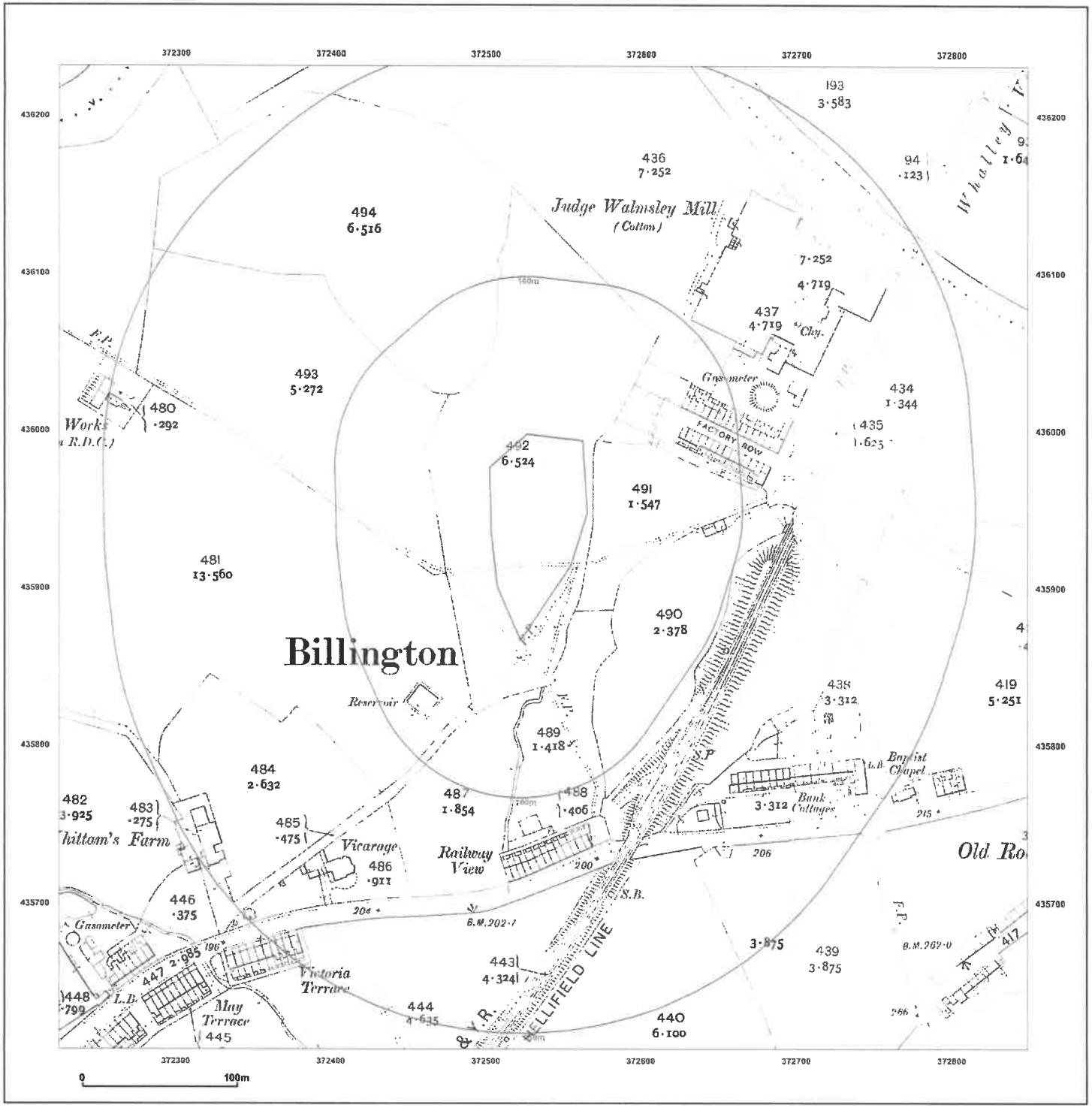
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Site Details:

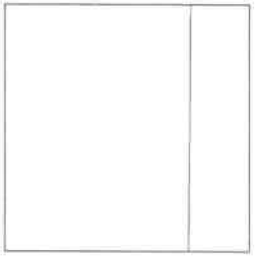
1,DALE VIEW,BILLINGTON,CLITHEROE , BB7 9LL

Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: County Series
Map date: 1912
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1912
Revised 1912
Edition N/A
Copyright N/A
Levelled N/A



Surveyed 1912
Revised 1912
Edition N/A
Copyright N/A
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Site Details:

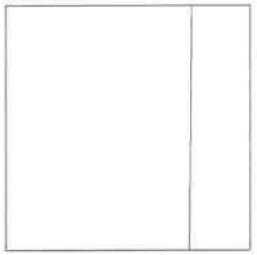
1,DALE
VIEW,BILLINGTON,CLITHEROE
, BB7 9LL

Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: County Series
Map date: 1892
Scale: 1:2,500
Printed at: 1:2,500

N
W E
S

Surveyed 1892
Revised 1892
Edition N/A
Copyright N/A
Levelled N/A



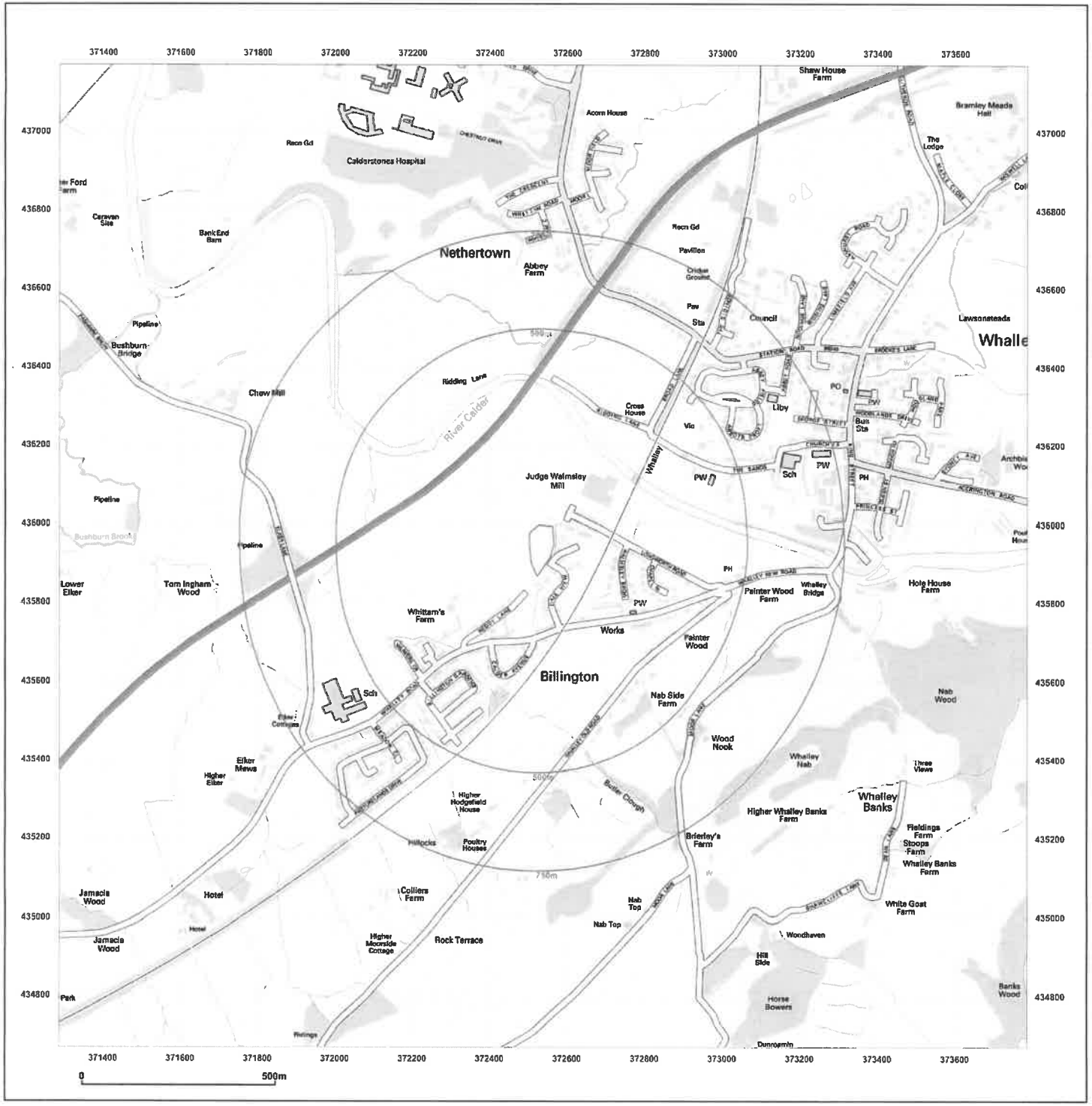
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Site Details:

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Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: National Grid
Map date: 2012
Scale: 1:10,000
Printed at: 1:10,000

N
W E
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2012

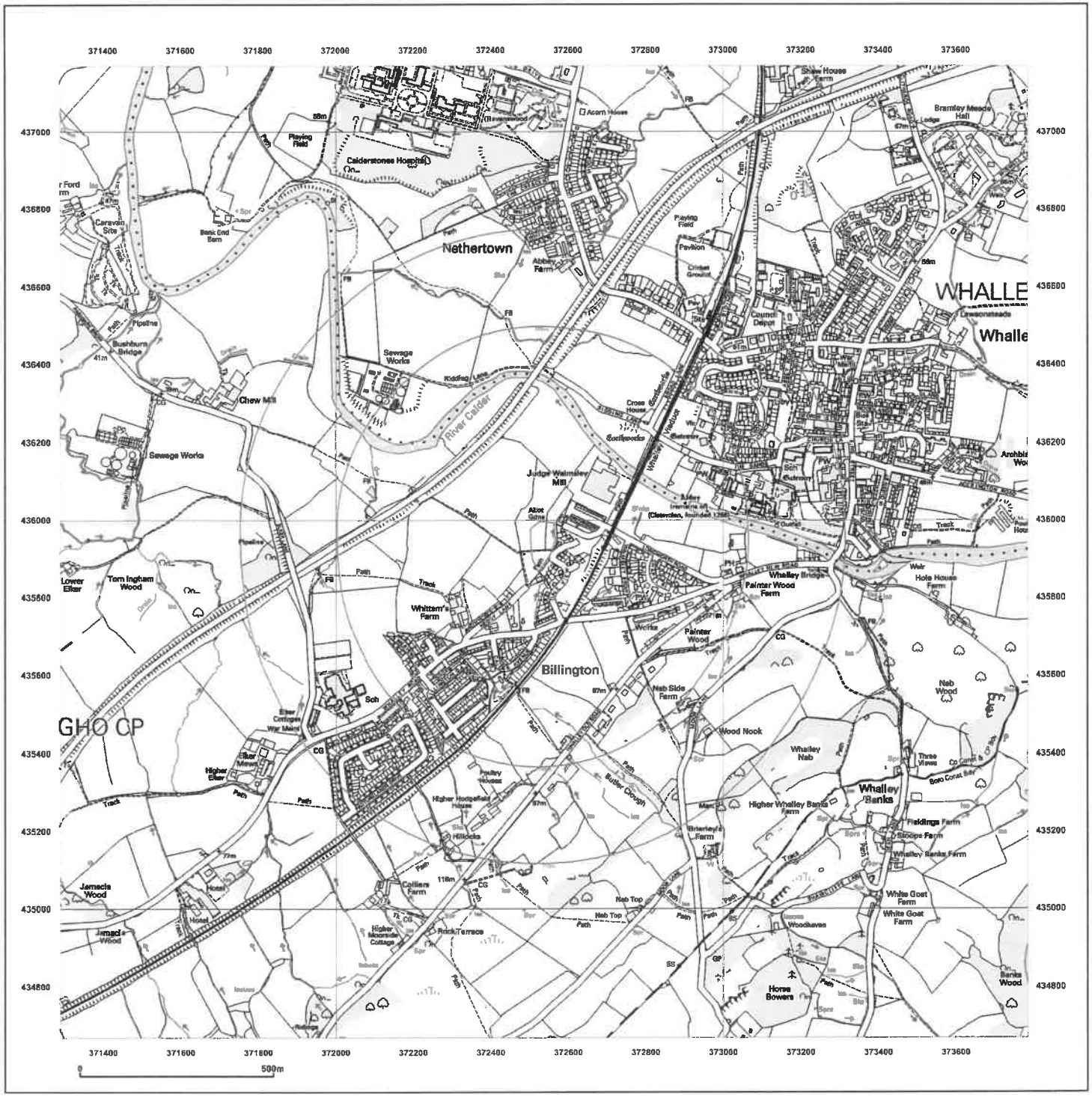
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Site Details:

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, BB7 9LL

Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: 1:10,000 Raster
Map date: 2002
Scale: 1:10,000
Printed at: 1:10,000

N
W E
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2002

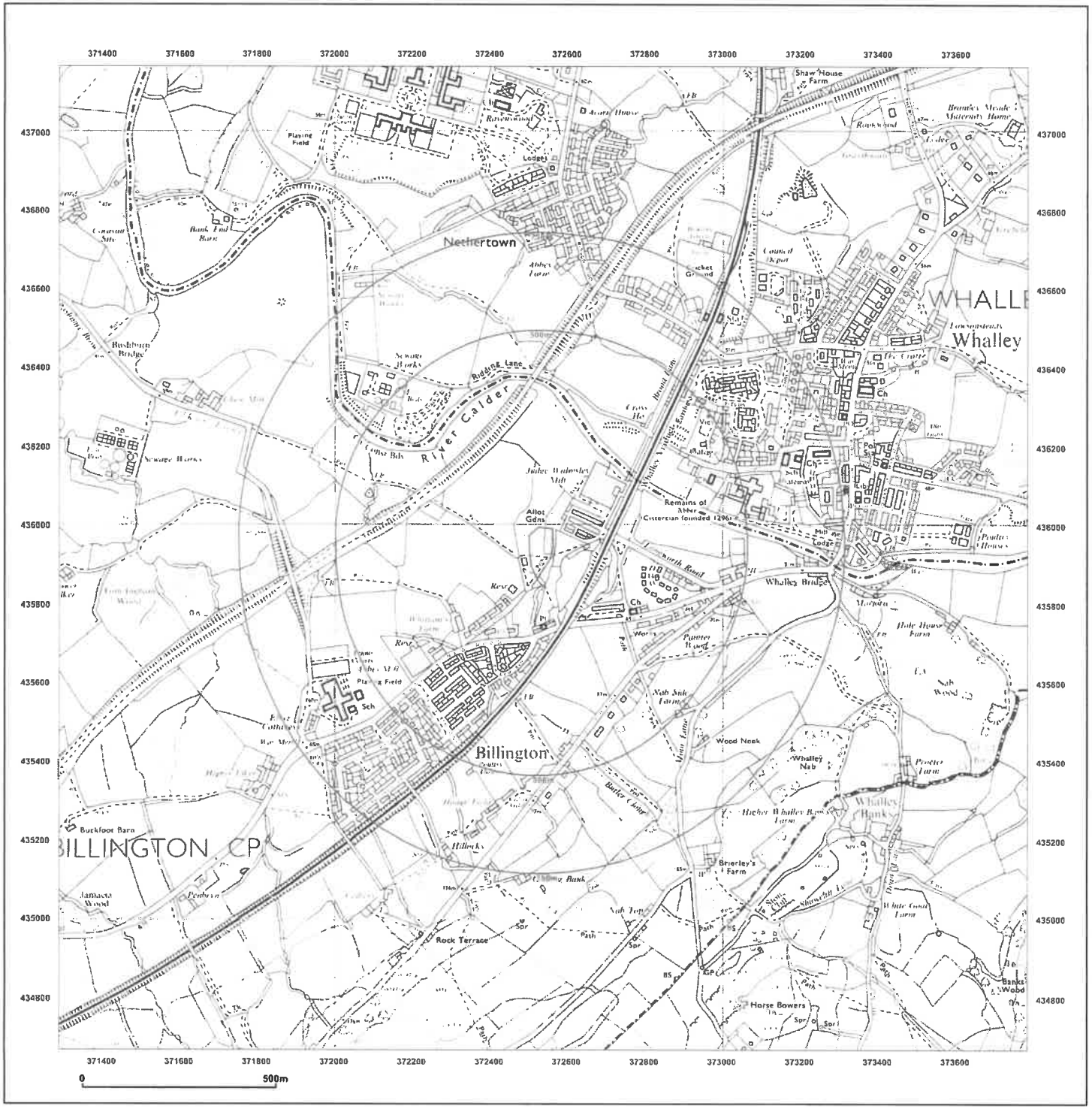
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Site Details:

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Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: National Grid
Map date: 1973
Scale: 1:10,000
Printed at: 1:10,000

N
W E
S

Surveyed 1972
Revised 1973
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1973
Revised 1973
Edition N/A
Copyright N/A
Levelled N/A

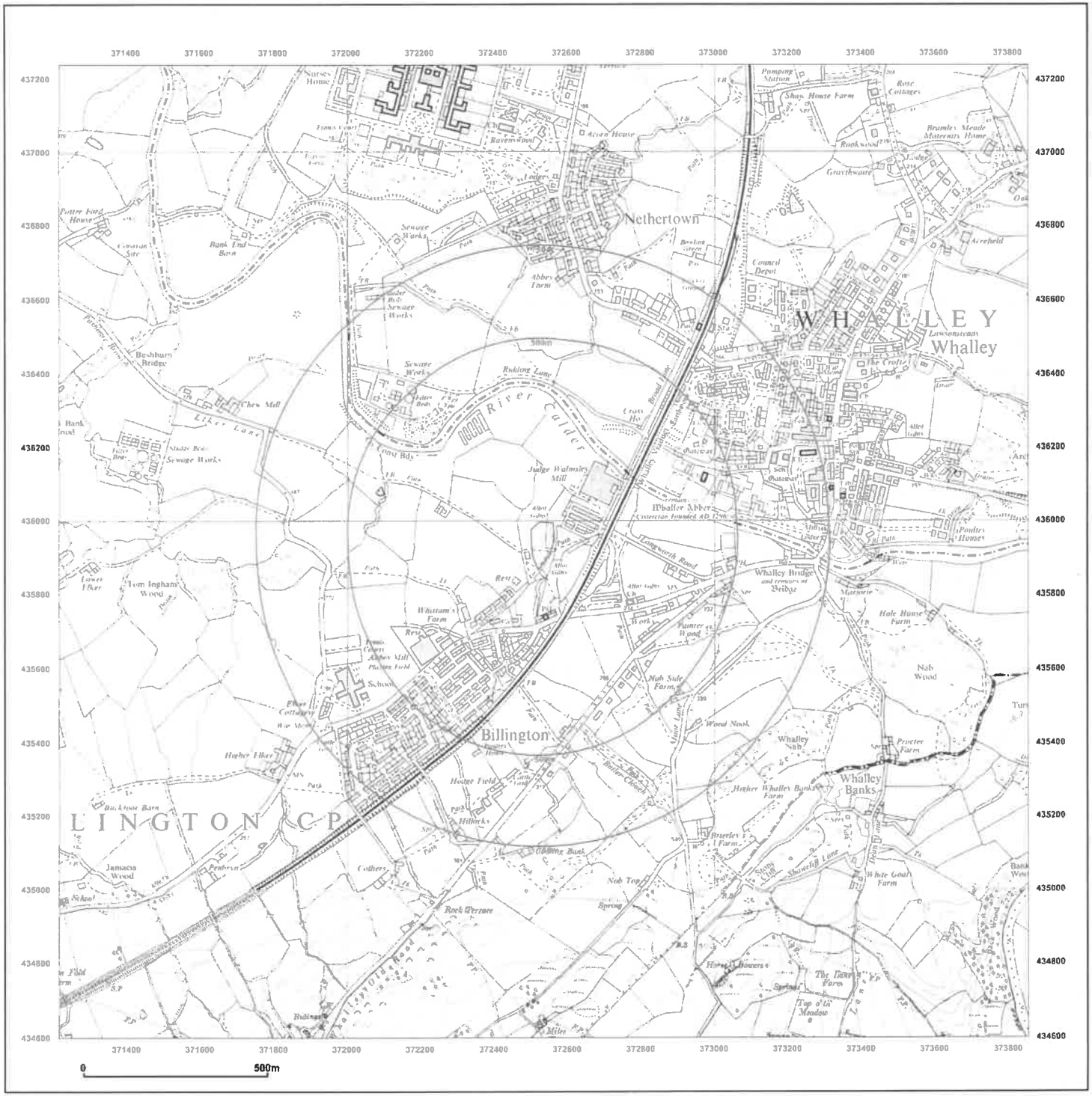
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Site Details:

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Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: Provisional
Map date: 1966-1969
Scale: 1:10,560
Printed at: 1:10,560

N
W E
S

Surveyed 1969
Revised 1969
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1950
Revised 1950
Edition N/A
Copyright N/A
Levelled N/A

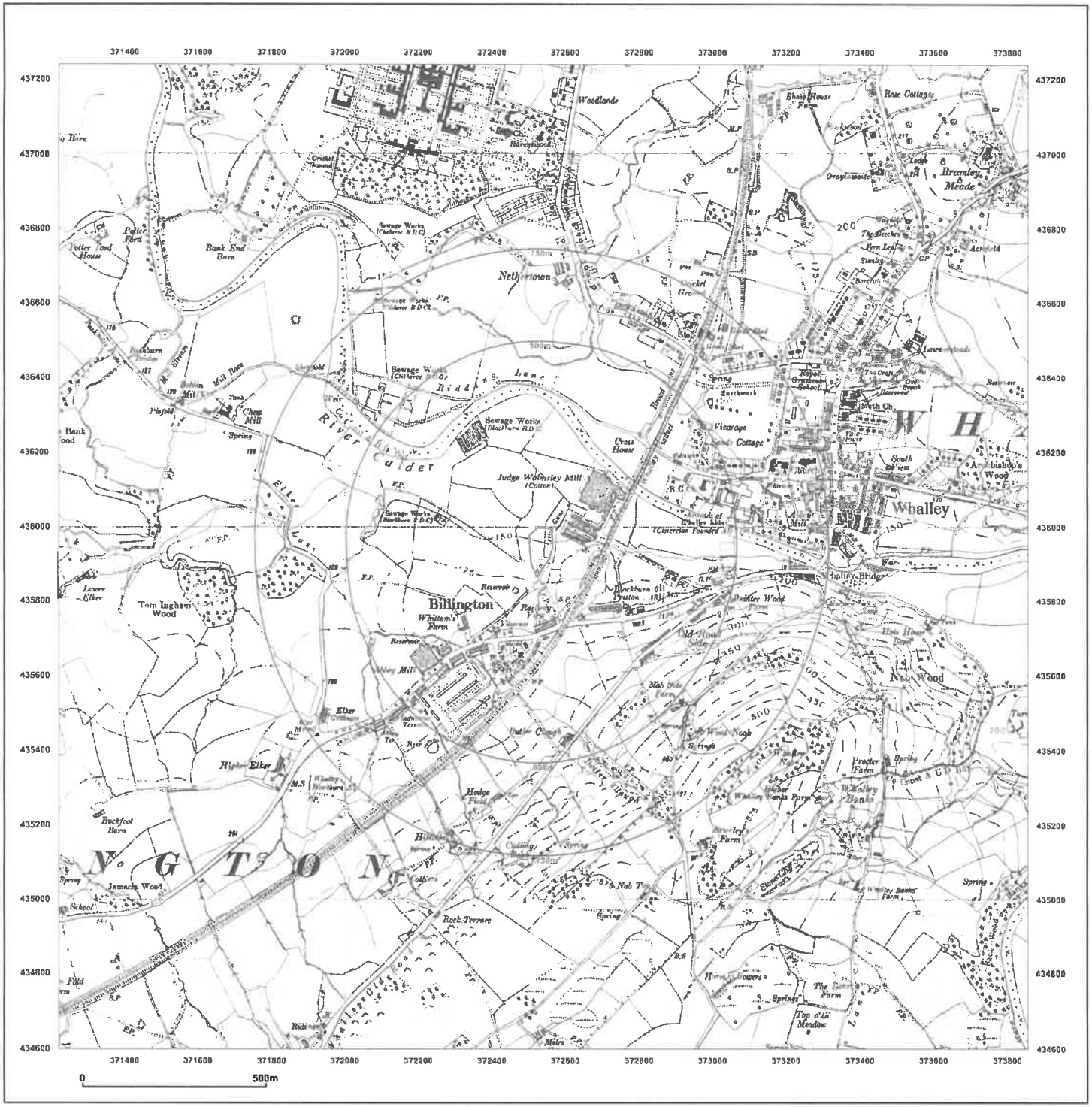
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Site Details:

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Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: Provisional
Map date: 1950
Scale: 1:10,560
Printed at: 1:10,560

N
W E
S

Surveyed 1950
Revised 1950
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1950
Revised 1950
Edition N/A
Copyright N/A
Levelled N/A

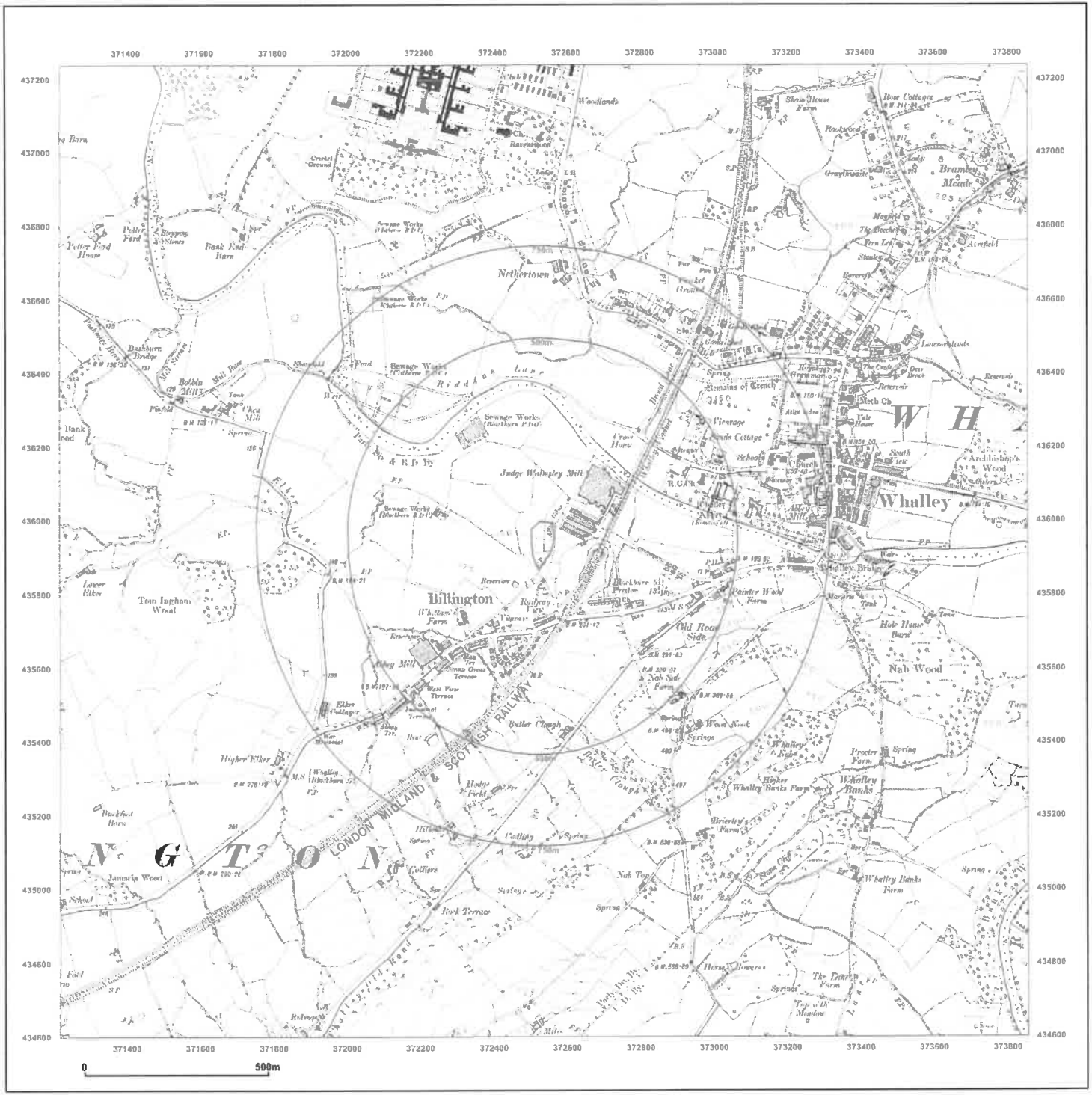
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Site Details:

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Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: County Series
Map date: 1932-1933
Scale: 1:10,560
Printed at: 1:10,560

N
W E
S

Surveyed 1844
Revised 1932
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1844
Revised 1933
Edition N/A
Copyright N/A
Levelled N/A

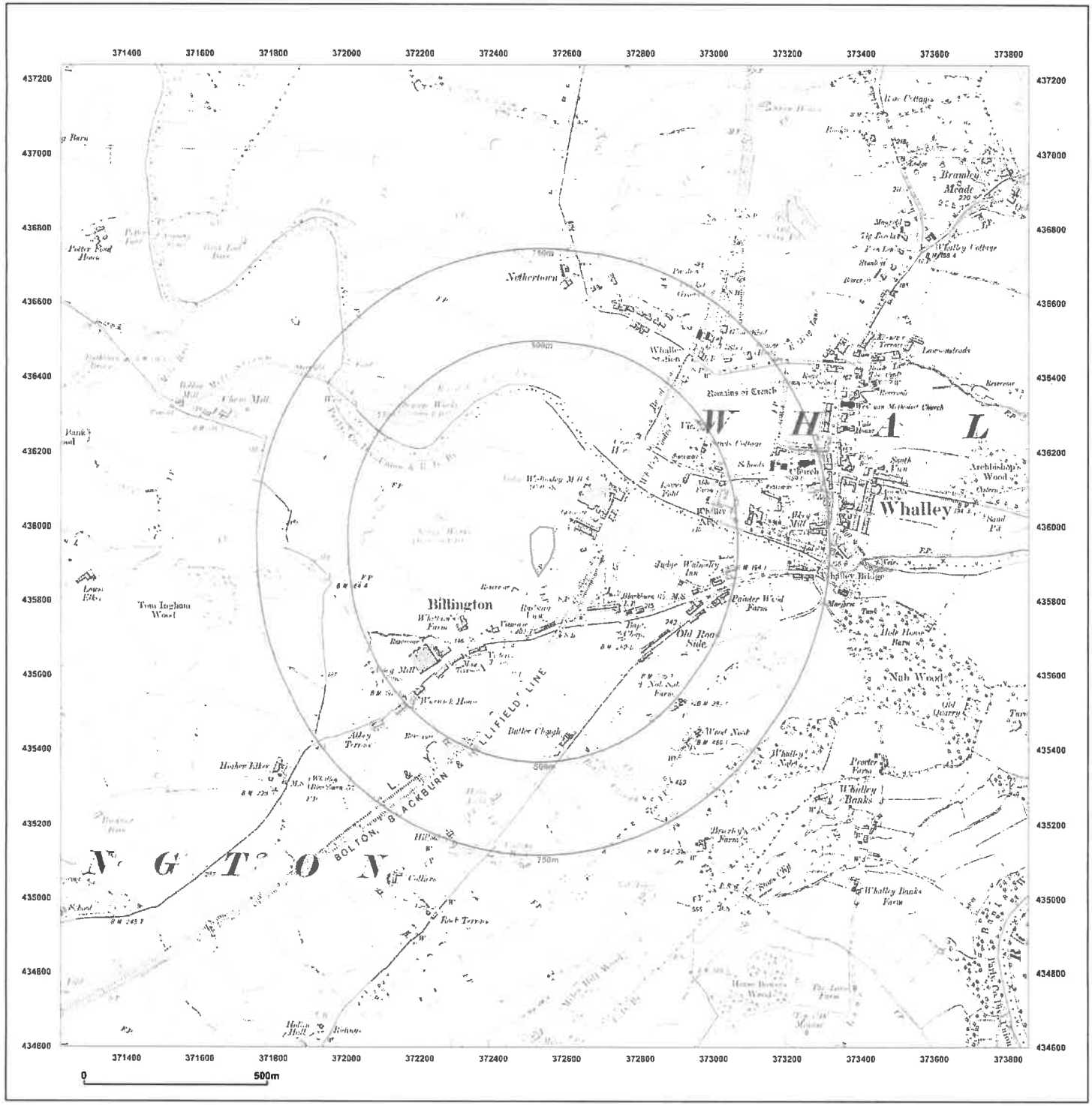
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Site Details:

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Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: County Series
Map date: 1910
Scale: 1:10,560
Printed at: 1:10,560

N
W E
S

Surveyed 1844
Revised 1910
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1844
Revised 1910
Edition N/A
Copyright N/A
Levelled N/A

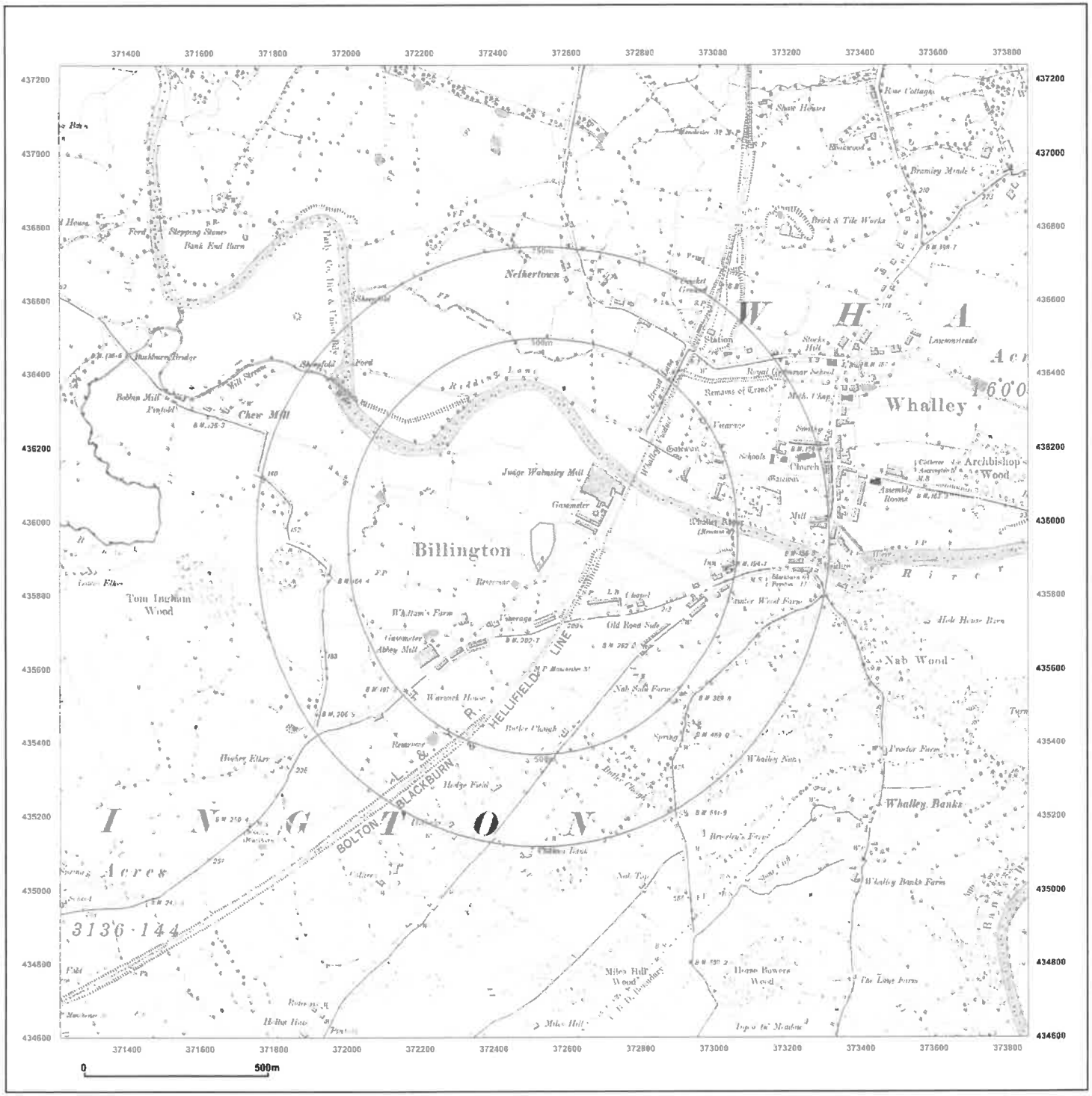
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Site Details:

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Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: County Series
Map date: 1892
Scale: 1:10,560
Printed at: 1:10,560

N
W E
S

Surveyed 1892
Revised 1892
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1892
Revised 1892
Edition N/A
Copyright N/A
Levelled N/A

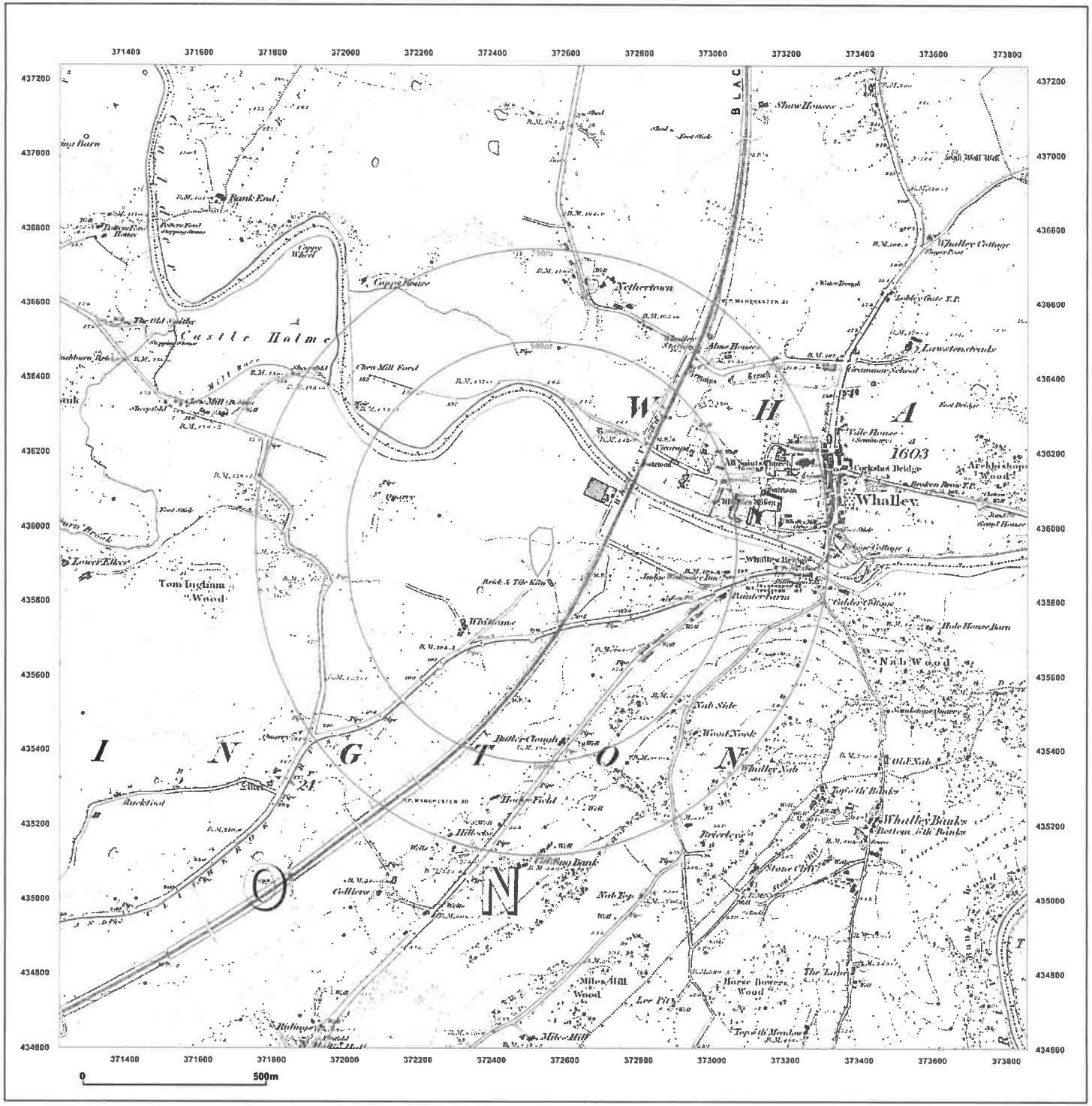
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ENVIRONMENTAL INSIGHT

Site Details:

1,DALE VIEW,BILLINGTON,CLITHEROE , BB7 9LL

Client Ref: PO12232
Report Ref: HMD-147-1148106
Grid Ref: 372536, 435919

Map Name: County Series
Map date: 1846
Scale: 1:10,560
Printed at: 1:10,560

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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APPENDIX E

Exploratory Hole Records

TerraConsult

Terraconsult
Tel: 01925 291111
Fax: 01925 291191
email: mailbox@terraconsult.co.uk

Trialpit No
TP1
Sheet 1 of 1

Project Name	Project No.	Co-ords:	Date
Dale View	1906	372498E - 435847N Level: 50.88 m AOD	04/11/2013

Location:	Dimensions:	Scale	
Billington	Depth 2.80m; 0.70m; 3.00m	1:20	
Client: Bloor Homes		Log'd: MOH	Chk'd: CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.15	50.73		Grass over TOPSOIL: Dark brown slightly gravelly sandy SILT with occasional rootlets. Gravel is fine to medium subrounded of various lithologies.
0.50	IVN 1	75 kPa				Soft light brown slightly gravelly sandy CLAY. Gravel is fine to coarse and subrounded of various lithologies. (GLACIAL TILL)
0.50	D					
0.50	ES					
			0.70	50.18		
0.75	IVN 2	105 kPa				Firm brown mottled grey and orange slightly gravelly slightly sandy CLAY. Gravel is fine to coarse and and subangular to subrounded of sandstone and various lithologies. (GLACIAL TILL)
1.00	D					
1.50	IVN 3	70 kPa				
			1.90	48.98		Brown very clayey fine to coarse SAND and fine to coarse subangular to rounded GRAVEL of various lithologies, with occasional thick bands of silty fine to coarse sand. Medium cobble content. (GLACIAL DEPOSITS)
						2.50m - 2.70m: Band of silty sand.
			2.80	48.08		Trialpit Complete at 2.80 m

Remarks: Instability and side collapse due to granular deposits and water ingress.

Groundwater: Groundwater encountered at 2.80m.

AGS

HoleBASE III (Bld 4.26.72) Standard Trialpit Log v1 dated 25th Mar 03

TerraConsult

Terraconsult
Tel: 01925 291111
Fax: 01925 291191
email: mailbox@terraconsult.co.uk

Trialpit No
TP2
Sheet 1 of 1

Project Name	Project No.	Co-ords:	Date
Dale View	1906	Level: 49.05 m AOD	04/11/2013

Location:	Dimensions:	Scale	
Billington	Depth 2.70m, 0.70m, 3.00m	1:20	
Client: Bloor Homes		Log'd: MOH	Chk'd: CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Grass over TOPSOIL: Dark brown slightly gravelly sandy SILT with occasional rootlets. Gravel is fine to medium subrounded of various lithologies.
			0.20	48.85		
						Firm light brown sandy CLAY. (ALLUVIUM)
0.40	IVN 1	70 kPa				
			0.60	48.45		
						Soft grey slightly gravelly slightly sandy CLAY. Gravel is fine to medium and subangular of various lithologies. (ALLUVIUM)
0.80	D					
1.00	IVN 2	62 kPa				1
			1.30	47.75		
						Soft grey mottled brown and orange slightly sandy slightly gravelly CLAY with occasional bands of sand. Gravel is fine to coarse and angular to subangular of siltstone and sandstone. (ALLUVIUM)
2.00	IVN 3	50 kPa				2
2.00	D					
			2.70	46.35		
						Brown very clayey fine to coarse SAND and fine to coarse subrounded to rounded GRAVEL with a medium cobble and low boulder content. (GLACIAL DEPOSITS)
3.00	B		3.00	46.05		3
						Trialpit Complete at 2.70 m

Remarks: Instability and side collapse due to granular deposits and water ingress.

Groundwater: Groundwater encountered at 3.00m.

AGS

Holds BSE (BH-426.72) Standard Trialpit Log v1 dated 25th Mar 03

TerraConsult

Terraconsult
Tel: 01925 291111
Fax: 01925 291191
email: mailbox@terraconsult.co.uk

Trialpit No
TP3
Sheet 1 of 1

Project Name	Project No.	Co-ords: 372533E - 435887N	Date
Dale View	1906	Level: 48.25 m AOD	04/11/2013

Location: Billington

Dimensions: 3.00m
Depth 2.70m
0.70m

Scale 1:20

Client: Bloor Homes

Log'd	Chk'd
MOH	CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Grass over TOPSOIL: Dark brown slightly gravelly sandy SILT with occasional rootlets. Gravel is fine to medium subrounded of various lithologies.
			0.40	47.85		
						Firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. (GLACIAL TILL)
0.60	IVN 1	105 kPa				
			0.90	47.35		
						Firm grey mottled orange and brown slightly gravelly sandy CLAY. (GLACIAL TILL)
1.20	IVN 2	120 kPa				
1.20	D					1.20m - 2.20m: Grading to sand and gravel with depth.
			2.10	46.15		
						Brown very clayey fine to coarse SAND and fine to coarse subrounded to rounded GRAVEL with a medium cobble and low boulder content. (GLACIAL DEPOSITS)
			2.70	45.55		
						Trialpit Complete at 2.70 m

Remarks: Instability and side collapse due to granular deposits.

Groundwater: No groundwater encountered.

AGS

HeadMASE Rigid 426.72) Standard Trialpit Log v1 dated 26th Mar 03

TerraConsult

Terraconsult
Tel: 01925 291111
Fax: 01925 291191
email: mailbox@terraconsult.co.uk

Trialpit No
TP4
Sheet 1 of 1

Project Name	Project No.	Co-ords:	Date
Dale View	1906	372502E - 435894N	04/11/2013
		Level: 48.05 m AOD	

Location: Billington

Client: Bloor Homes

Dimensions: 3.00m
Depth 3.80m
0.70m

Scale 1:20

Log'd	Chk'd
MOH	CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	ES					Grass over TOPSOIL: Dark brown slightly gravelly sandy SILT with occasional rootlets. Gravel is of coarse angular siltstone.
			0.20	47.85		
0.40	IVN 1	75 kPa				Soft brownish grey silty sandy CLAY. (ALLUVIUM)
			0.60	47.45		
0.80	IVN 2	128 kPa				Firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse and subangular to subrounded of various lithologies. (GLACIAL TILL)
0.80	D					
1.40	D					
			2.20	45.85		Brown very clayey fine to coarse SAND and fine to coarse subrounded to rounded GRAVEL with a medium cobble and low boulder content. (GLACIAL DEPOSITS)
			3.80	44.25		Trialpit Complete at 3.80 m

Remarks: Instability and side collapse due to granular deposits and water ingress.

Groundwater: Groundwater encountered at 2.20m, very slow ingress.

AGS

HoleBASE III (Bld 4.05.72) Standard Trialpit Log v1 dated 25th Mar 03

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Trialpit No
TP5
Sheet 1 of 1

Project Name	Project No.	Co-ords:	Date
Dale View	1906	372514E - 435935N Level: 46.80 m AOD	04/11/2013

Location: Billington

Client: Bloor Homes

Dimensions: 3.00m
Depth 3.30m
0.70m

Scale 1:20

Log'd	Chk'd
MOH	CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Grass over TOPSOIL: Dark brown slightly gravelly sandy SILT with occasional rootlets. Gravel is fine to medium subrounded of various lithologies.
			0.25	46.55		Soft light orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of various lithologies. (GLACIAL TILL)
			0.80	46.00		Very clayey fine to coarse SAND and fine to coarse subangular subrounded GRAVEL of various lithologies with a low cobble content. (GLACIAL DEPOSITS)
1.20	B					
			3.00	43.80		Orangish brown very silty fine to medium SAND. (GLACIAL DEPOSITS)
			3.30	43.50		Trialpit Complete at 3.30 m

1
2
3

Remarks: Instability and side collapse due to granular deposits and water ingress.

Groundwater: Groundwater encountered at 2.80m.

AGS

HMBASE III (Bid 426.72) Standard Trialpit Log v1 dated 25th Mar 03

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Trialpit No
TP6
Sheet 1 of 1

Project Name	Project No.	Co-ords:	Date
Dale View	1906	372483E - 435937N Level: 46.63 m AOD	04/11/2013

Location:	Dimensions:	Scale	
Billington	Depth 2.80m, 0.70m, 3.00m	1:20	
Client: Bloor Homes		Log'd: MOH	Chk'd: CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	ES					Grass over TOPSOIL: Dark brown slightly gravelly sandy SILT with occasional rootlets. Gravel is fine to medium subrounded of various lithologies.
			0.20	46.43		
0.40	IVN 1	82 kPa				Soft light orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of various lithologies. (ALLUVIUM)
0.40	D		0.50	46.13		
0.70	D					Soft dark grey slightly gravelly slightly sandy CLAY. Gravel is fine to medium and subangular of siltstone. (ALLUVIUM)
			0.85	45.78		Orangish brown very clayey fine to coarse SAND and fine to coarse subangular to rounded GRAVEL of various lithologies. Medium cobble content. (GLACIAL DEPOSITS)
			2.80	43.83		Trialpit Complete at 2.80 m

Remarks: Instability and side collapse due to granular deposits.

Groundwater: No groundwater encountered.

AGS

HoleBASE III (Bit 425.72) Standard Trialpit Log v1 dated 26th Mar 03

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Trialpit No
TP7
Sheet 1 of 1

Project Name	Project No.	Co-ords: 372483E - 435937N	Date
Dale View	1906	Level: 46.63 m AOD	04/11/2013

Location: Billington

Client: Bloor Homes

Dimensions: 3.00m
Depth 3.10m
0.70m

Scale 1:20

Log'd	Chk'd
MOH	CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Grass over TOPSOIL: Dark brown slightly gravelly sandy SILT with occasional rootlets. Gravel is fine to medium subrounded of various lithologies.
			0.20	46.43		Soft orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of various lithologies. (ALLUVIUM)
0.50	IVN 1	82 kPa				
			1.00	45.63		Very soft dark grey slightly sandy CLAY with frequent bands of peat and peaty organic clay. (ALLUVIUM)
1.20 1.20	IVN 2 D	50 kPa				
2.20 2.20	IVN 3 D	38 kPa				
			2.80	43.83		Brown slightly silty sandy fine to coarse (predominantly medium to coarse) subrounded to rounded GRAVEL of various lithologies with a high subrounded cobble and low boulder content. (GLACIAL DEPOSITS)
			3.00	43.63		Trialpit Complete at 3.10 m

1 2 3

Remarks: Instability and side collapse due to granular deposits and water ingress.

Groundwater: Groundwater encountered at 1.20m and 2.80m.

AGS

HubBASE III (Build 426.72) Standard Trialpit Log v1 dated 25th Mar 03

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Trialpit No
TP8
Sheet 1 of 1

Project Name	Project No.	Co-ords:	Date
Dale View	1906	372512E - 436037N	04/11/2013
		Level: 42.88 m AOD	

Location:	Dimensions:	Scale	
Billington	Depth 2.50m, 0.70m, 3.00m	1:20	
Client: Bloor Homes		Log'd: MOH	Chk'd: CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.20	42.68		Grass over TOPSOIL: Dark brown slightly gravelly sandy SILT with occasional rootlets. Gravel is fine to medium subrounded of various lithologies.
0.50 0.50	IVN 1 ES	72 kPa				Firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of various lithologies. (ALLUVIUM)
			0.80	42.08		
0.90	IVN 2	85 kPa				Soft dark grey slightly sandy CLAY with occasional bands of peat and peaty organic clay. (ALLUVIUM)
1.50	IVN 3	53 kPa				
			2.30	40.58		Brown slightly silty sandy fine to coarse (predominantly medium to coarse) subrounded to rounded GRAVEL of various lithologies with a high subrounded cobble and low boulder content. (GLACIAL DEPOSITS)
			2.50	40.38		Trialpit Complete at 2.50 m

1
2
3

Remarks: Instability and side collapse due to granular deposits and water ingress.

Groundwater: Groundwater encountered at 2.30m and rose to 1.50m in 10 mins

AGS

HoleBASE III (Bld 425.72) Standard Trialpit Log v1 dated 26th Mar 03

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Trialpit No
TP9
Sheet 1 of 1

Project Name	Project No.	Co-ords:	Date
Dale View	1906	Level: 43.38 m AOD	04/11/2013

Location: Billington

Client: Bloor Homes

Dimensions: 3.00m
Depth 1.90m
0.70m

Scale 1:20

Log'd	Chk'd
MOH	CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Grass over TOPSOIL: Dark brown slightly gravelly sandy SILT with occasional rootlets. Gravel is fine to medium subrounded of various lithologies.
			0.20	43.18		Firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of various lithologies. (ALLUVIUM)
0.40	ES					
0.50	IVN 1	88 kPa				
						0.60m: Becoming greyish brown mottled orange.
0.80	D					
1.00	IVN 2	82 kPa				
			1.25	42.13		Soft grey slightly gravelly silty sandy CLAY. Gravel is fine to medium and subangular of siltstone. (ALLUVIUM)
1.50	IVN 3	35 kPa				
			1.80	41.58		Brown slightly silty sandy fine to coarse (predominantly medium to coarse) subrounded to rounded GRAVEL of various lithologies with a high subrounded cobble and low boulder content. (GLACIAL DEPOSITS)
			1.90	41.48		Trialpit Complete at 1.90 m

Remarks: Instability and side collapse due to granular deposits and water ingress.

Groundwater: Groundwater encountered at 1.80m and rose to 1.70m in 5 mins

AGS

RocksBASE III (RW 426.72) Standard Trialpit Log v1 dated 25th Mar 03

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Trialpit No
TP10
Sheet 1 of 1

Project Name	Project No.	Co-ords:	Date
Dale View	1906	372526E - 435970N Level: 45.10 m AOD	05/11/2013

Location:	Dimensions:	Scale
Billington	Depth 2.60m; 0.70m; 3.00m	1:20

Client:	Log'd	Chk'd
Bloor Homes	MOH	CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.20	44.90		Grass over TOPSOIL: Dark brown slightly gravelly sandy SILT with occasional rootlets. Gravel is fine to medium subrounded of various lithologies.
0.50	IVN 1	125 kPa				Stiff orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of various lithologies. (GLACIAL TILL)
			0.95	44.15		Firm orangish brown slightly sandy gravelly CLAY with a medium cobble content. Gravel is fine to coarse and subangular to subrounded of various lithologies. (GLACIAL TILL)
			1.20	43.90		Stiff brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded of various lithologies. (GLACIAL TILL)
1.50	D					
			1.85	43.25		Stiff grey slightly sandy CLAY with rare medium to coarse rounded gravel of various lithologies. (GLACIAL TILL)
2.00	IVN 2	145 kPa				
			2.30	42.80		Orangish brown slightly gravelly silty fine to medium SAND. Gravel is fine to coarse subangular to subrounded of various lithologies. (GLACIAL DEPOSITS)
			2.60	42.50		Trialpit Complete at 2.60 m

Remarks: Stable throughout excavation.

Groundwater: Groundwater encountered at 2.30m.

AGS

HoleBASE III (SM 426.72) Standard Trialpit Log v1 dated 26th Mar 03

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Trialpit No
TP11
Sheet 1 of 1

Project Name	Project No.	Co-ords:	Date
Dale View	1906	Level: 44.13 m AOD	05/11/2013

Location: Billington

Client: Bloor Homes

Dimensions: 3.00m
Depth 2.20m
0.70m

Scale 1:20

Log'd	Chk'd
MOH	CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Grass over TOPSOIL: Dark brown slightly gravelly sandy SILT with occasional rootlets. Gravel is fine to medium subrounded of various lithologies.
			0.20	43.93		Firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of various lithologies. (ALLUVIUM)
			0.90	43.23		Orangish brown very clayey fine to coarse SAND and fine to coarse subangular to rounded GRAVEL of various lithologies. Medium cobble content. (ALLUVIUM)
			1.50	42.63		Soft grey slightly sandy CLAY. (ALLUVIUM)
			2.20	41.93		Trialpit Complete at 2.20 m

1
2
3

Remarks: Stable throughout excavation.

Groundwater: No groundwater encountered.

AGS

HoleBASE W (Bld 426.72) Standard Trialpit Log v1 dated 26th Mar 03

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Trialpit No
TP12
Sheet 1 of 1

Project Name	Project No.	Co-ords:	Date
Dale View	1906	372549E - 435924N Level: 46.88 m AOD	05/11/2013

Location: Billington

Client: Bloor Homes

Dimensions: 3.00m
Depth 1.90m
0.70m

Scale 1:20

Log'd	Chk'd
MOH	CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20	ES		0.25	46.63		Rough vegetation over TOPSOIL: Dark brown slightly sandy gravelly SILT with frequent rootlets. Gravel is fine to coarse and angular to subangular of limestone and wood.
0.50	IVN 1	105 kPa				Firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of various lithologies. (GLACIAL TILL)
			1.25	45.63		
1.50	IVN 2	82 kPa				Firm orangish brown slightly sandy gravelly CLAY with a medium cobble content. Gravel is fine to coarse and subangular to subrounded of various lithologies. (GLACIAL TILL)
			1.90	44.98		Trialpit Complete at 1.90 m

Remarks: Stable throughout excavation.

Groundwater: No groundwater encountered.

AGS

HoleBASE III (Bit 426.72) Standard Trialpit Log v1 dated 28th Mar 03

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Trialpit No
TP13
Sheet 1 of 1

Project Name	Project No.	Co-ords: 372556E - 435948N	Date
Dale View	1906	Level: 45.85 m AOD	05/11/2013

Location: Billington

Client: Bloor Homes

Dimensions: 3.00m
Depth 1.00m
0.70m

Scale 1:20

Log'd MOH | Chk'd CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Rough vegetation over TOPSOIL: Dark brown slightly sandy gravelly SILT with frequent rootlets. Gravel is fine to medium and subangular to subrounded of various lithologies and glass.
			0.25	45.60		
0.40	ES					Firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of various lithologies. (GLACIAL TILL)
0.40	D					
0.50	IVN 1	80 kPa				0.55m - 0.85m: Band of soft grey sandy CLAY with frequent cobble-sized pockets of sand.
0.90	IVN 2	88 kPa				
			1.00	44.85		Trialpit Complete at 1.00 m

Remarks: Stable throughout excavation.

Groundwater: No groundwater encountered.

AGS

HoleBASE III (Bld 426.72) Standard Trialpit Log v1 dated 29th Mar 03

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Trialpit No
TP14
Sheet 1 of 1

Project Name	Project No.	Co-ords:	Date
Dale View	1906	372549E - 436002N Level: 44.35 m AOD	05/11/2013

Location:	Dimensions:	Scale	
Billington	Depth 0.45m, 0.70m, 3.00m	1:20	
Client: Bloor Homes		Log'd: MOH	Chk'd: CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20	ES		0.25	44.10		Rough vegetation over TOPSOIL: Dark brown slightly gravelly sandy SILT with frequent rootlets. Gravel is fine to medium and subrounded of various lithologies.
0.45	IVN 1	88 kPa	0.45	43.90		Firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of various lithologies. (GLACIAL TILL)
						Trialpit Complete at 0.45 m

1
2
3

Remarks: Stable throughout excavation.

Groundwater: No groundwater encountered.

AGS

HoleBASE III (Bit 426.72) Standard Trialpit Log v1 dated 26th Mar 03

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Trialpit No
TP15
Sheet 1 of 1

Project Name	Project No.	Co-ords: 372555E - 435990N	Date
Dale View	1906	Level: 44.75 m AOD	05/11/2013

Location: Billington

Dimensions: 3.00m
Depth 0.90m
0.70m

Scale 1:20

Client: Bloor Homes

Log'd MOH | Chk'd CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20	ES					Rough vegetation over TOPSOIL: Dark brown slightly gravelly sandy SILT with frequent rootlets. Gravel is fine to medium and angular to subrounded of glass, clinker, ash, sandstone and various lithologies.
			0.30	44.45		Soft orangish brown mottled grey slightly sandy slightly gravelly CLAY, sandy in places. Gravel is subangular to subrounded fine to coarse of various lithologies. (ALLUVIUM)
0.80	IVN 1	58 kPa				
			0.90	43.85		Trialpit Complete at 0.90 m

Remarks: Stable throughout excavation.

Groundwater: No groundwater encountered.

AGS

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Trialpit No
TP16
Sheet 1 of 1

Project Name	Project No.	Co-ords:	Date
Dale View	1906	372549E - 436010N Level: 44.10 m AOD	05/11/2013

Location:	Dimensions:	Scale	
Billington	3.00m Depth 0.10m 0.70m	1:20	
Client: Bloor Homes		Log'd: MOH	Chk'd: CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	ES		0.10	44.00		Rough vegetation over TOPSOIL: Dark brown slightly gravelly sandy SILT with frequent rootlets. Gravel is fine to medium and subrounded of various lithologies.
						Trialpit Complete at 0.10 m

Remarks: Stable throughout excavation.

Groundwater: No groundwater encountered.

AGS

HoleBASE III (BH 426.72) Standard Trialpit Log v1 dated 26th Mar 03

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Trialpit No
TP17
Sheet 1 of 1

Project Name	Project No.	Co-ords: 372520E - 436016N	Date
Dale View	1906	Level: 43.38 m AOD	05/11/2013

Location: Billington

Client: Bloor Homes

Dimensions: 3.00m
Depth 2.30m
0.70m

Scale 1:20

Log'd	Chk'd
MOH	CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.20	43.18		Rough vegetation over TOPSOIL: Dark brown slightly gravelly sandy SILT with frequent rootlets. Gravel is fine to medium and subrounded of various lithologies.
0.70	D					Firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of various lithologies. (ALLUVIUM)
			0.95	42.43		Grey silty fine to coarse SAND. (ALLUVIUM)
			1.15	42.23		Very soft dark grey slightly sandy CLAY with occasional bands of peat and peaty organic clay. (ALLUVIUM)
1.50	D					
			2.20	41.18		Brown slightly silty sandy fine to coarse (predominantly medium to coarse) subrounded to rounded GRAVEL of various lithologies with a high subrounded cobble and low boulder content. (GLACIAL DEPOSITS)
			2.30	41.08		Trialpit Complete at 2.30 m

Remarks: Stable throughout excavation.

Groundwater: Groundwater encountered at 2.30m.

AGS

Holis/ASE III (Bld 125.72) Standard Trialpit Log v1 dated 29th Mar 03

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Trialpit No
TP18
Sheet 1 of 1

Project Name	Project No.	Co-ords: 372572E - 436008N	Date
Dale View	1906	Level: 44.38 m AOD	05/11/2013

Location: Billington

Client: Bloor Homes

Dimensions: 0.40m
Depth 0.30m
0.40m

Scale 1:20

Log'd MOH | Chk'd CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	ES					Sparse vegetation over TOPSOIL: Dark brown slightly gravelly sandy SILT with frequent rootlets. Gravel is fine to medium and subrounded of various lithologies.
			0.30	44.08		Trialpit Complete at 0.30 m

Remarks: Stable throughout excavation.

Groundwater: No groundwater encountered.

AGS

HoleBASE III (Bld 425.72) Standard Trialpit Log v1 dated 26th Mar 03

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Trialpit No
TP19
Sheet 1 of 1

Project Name	Project No.	Co-ords: 372563E - 436030N	Date
Dale View	1906	Level: 43.76 m AOD	05/11/2013

Location: Billington

Client: Bloor Homes

Dimensions: 0.40m
Depth 0.30m
0.40m

Scale 1:20

Log'd MOH | Chk'd CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	ES					Sparse vegetation over TOPSOIL: Dark brown slightly gravelly sandy SILT with frequent rootlets. Gravel is fine to medium and subrounded of various lithologies.
			0.30	43.46		Trialpit Complete at 0.30 m

Remarks: Stable throughout excavation.

Groundwater: No groundwater encountered.

AGS

RockBASE (Bd 426.72) Standard Trialpit Log v1 dated 25th Mar 03

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Trialpit No
TP20
Sheet 1 of 1

Project Name	Project No.	Co-ords:	Date
Dale View	1906	Level: 45.38 m AOD	05/11/2013

Location: Billington

Client: Bloor Homes

Dimensions: 3.00m
Depth 3.30m
0.70m

Scale 1:20

Log'd	Chk'd
MOH	CSE

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Grass over TOPSOIL: Dark brown slightly gravelly sandy SILT with occasional rootlets. Gravel is fine to medium subrounded of various lithologies.
			0.20	45.18		Firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of various lithologies. (GLACIAL TILL)
			0.70	44.68		Firm orangish brown slightly sandy gravelly CLAY with a medium cobble content. Gravel is fine to coarse and subangular to subrounded of various lithologies. (GLACIAL TILL)
			1.25	44.13		Stiff grey slightly sandy CLAY with rare medium to coarse rounded gravel of various lithologies. (GLACIAL TILL)
			2.20	43.18		Brown slightly silty sandy fine to coarse (predominantly medium to coarse) subrounded to rounded GRAVEL of various lithologies with a high subrounded cobble and low boulder content. (GLACIAL DEPOSITS)
			3.30	42.08		Trialpit Complete at 3.30 m

1
2
3

Remarks: Stable throughout excavation.

Groundwater: Groundwater encountered at 2.20m.

AGS

HoleBASE BI (Bd 426.72) Standard Trialpit Log v1 dated 25th Mar 03

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Client: **Bloor Homes**

Start: **05/11/2013** End: **05/11/2013**

Borehole No. **WS1** Sheet 1 of 1

Project Name: **Dale View**

Project No. **1906**

Co-ords: **372512E - 436048N**

Ground Level: **42.75 m OD**

Hole Type **WLS**

Location: **Billington**

Final depth (m) **3.43**

Logged: **CLB** Checked: **CSE** Drilled: **SP**

Scale **1:25**

Samples & In Situ Testing			Depth (m)	Level (m AOD) <Thickness>	Legend	Stratum Description	Water Strikes	Well
Depth (m)	Type,No	Results						
				<0.15>		Grass over TOPSOIL: Dark brown slightly gravelly sandy SILT with occasional rootlets. Gravel is fine to medium subrounded of various lithologies.		
			0.15	42.60				
				<0.40>		Soft greyish brown slightly gravelly sandy silty CLAY. Gravel is fine angular to subangular coal. (ALLUVIUM)		
			0.55	42.20				
				<0.45>		Soft greyish brown mottled orange slightly sandy CLAY with occasional rootlets. (ALLUVIUM)		
1.00-1.45	SPT	N=1 (0,0/1,0,0,0)	1.00	41.75		0.90m: Mottling absent.	1	
				<0.60>		Very soft dark brown peaty CLAY with frequent plant fragments. (ALLUVIUM)		
			1.60	41.15				
2.00-2.45	SPT	N=16 (4,5/5,5,3,3)		<0.90>		Medium dense greyish brown slightly gravelly silty fine to coarse SAND. Gravel is fine to coarse subangular to rounded of various lithologies. (GLACIAL DEPOSITS)	2	
			2.50	40.25				
3.00-3.43	SPT	50 (10,12/14,14,13,9 for 50mm)		<0.93>		Very dense greyish brown clayey fine to coarse SAND and GRAVEL Gravel is fine to coarse subangular to rounded of sandstone and various lithologies. (GLACIAL DEPOSITS)	3	
			3.43	39.32		End of Borehole at 3.43 m		
							4	
	Type	Results						

Remarks:

Standard TerraConsult Borehole Log 04/09/08

TerraConsult	TerraConsult Ltd Tel: 01925 291111 Fax 01925 291191 www.terraconsult.co.uk mailbox@terraconsult.co.uk	Client: **Bloor Homes**	Borehole No. **WS2** **Sheet 1 of 1**
		Start: **05/11/2013** End: **05/11/2013**	

Project Name: **Dale View**	Project No. **1906**	Co-ords: **372537E - 436031N**	Hole Type **WLS**
		Ground Level: **43.26 m OD**	
Location: **Billington**	Final depth (m) **4.45**	Logged: **CLB** Checked: **CSE** Drilled: **SP**	Scale **1:25**

Samples & In Situ Testing			Depth (m)	Level (m AOD) <Thickness>	Legend	Stratum Description	Water Strikes	Well
Depth (m)	Type,No	Results						
			0.06	<0.06> 43.20		Grass over TOPSOIL: Dark brown slightly gravelly sandy SILT with occasional rootlets. Gravel is fine to medium subrounded of various lithologies.		
				<1.04>		Soft grey mottled orange slightly sandy slightly gravelly CLAY. Gravel is fine subangular to subrounded sandstone and various lithologies. (ALLUVIUM)		
1.00-1.45	SPT	N=1 (0,1/0,0,1,0)		1				1
			1.10	42.16		Very soft grey slightly gravelly silty sandy CLAY. Gravel is fine subrounded sandstone. (ALLUVIUM)		
				<0.30>				
			1.40	41.86		Greyish brown slightly gravelly clayey fine to coarse SAND. Gravel is fine to medium subrounded to rounded of various lithologies. (ALLUVIUM)		
				<0.55>				
			1.95	41.31			▽	
2.00-2.45	SPT	N=27 (3,4/6,8,6,7)		2		Medium dense greyish brown clayey fine to coarse SAND and fine to coarse subangular to subrounded GRAVEL of various lithologies. (GLACIAL DEPOSITS)	1.95	2
3.00-3.45	SPT	N=2 (3,1/0,1,0,1)		3				3
				<2.50>				
4.00-4.45	SPT	N=20 (2,5/9,7,2,2)		4				4
			4.45	38.81		End of Borehole at 4.45 m		
	Type	Results						

Remarks:

Standard TerraConsult Borehole Log 04/09/08

TerraConsult	TerraConsult Ltd Tel: 01925 291111 Fax 01925 291191 www.terraconsult.co.uk mailbox@terraconsult.co.uk	Client: **Bloor Homes**	Borehole No. **WS3** **Sheet 1 of 1**
		Start: **05/11/2013** End: **05/11/2013**	

Project Name: **Dale View**	Project No. **1906**	Co-ords: **372574E - 436024N** Ground Level: **44.13 m OD**	Hole Type **WLS**
Location: **Billington**	Final depth (m) **4.45**	Logged: **CLB** Checked: **CSE** Drilled: **SP**	Scale **1:25**

Samples & In Situ Testing			Depth (m)	Level (m AOD) <Thickness>	Legend	Stratum Description	Water Strikes	Well
Depth (m)	Type, No	Results						
0.05	ES1			<0.20>		Grass over MADE GROUND: Blackish grey slightly silty sandy fine to medium angular to subangular GRAVEL of mudstone, sandstone and painted tile fragments.		
			0.20	43.93		Soft dark brown slightly gravelly sandy CLAY. Gravel is fine to coarse rounded to subrounded of coal, sandstone and various lithologies. (ALLUVIUM)		
0.50	ES2					0.30m: Becomes greyish brown.		
0.60	D3			<1.10>				
1.00-1.45	SPT	N=3 (1,1/1,1,1,0)		1		0.95m: Becomes greyish brown.		1
1.25	D4							
			1.30	42.83		Very soft dark greyish brown slightly sandy gravelly CLAY. Gravel is subangular to rounded fine to coarse of sandstone and various lithologies. (ALLUVIUM)		
				<0.80>				
2.00-2.45	SPT	N=1 (0,0/0,0,0,1)		2				2
			2.10	42.03		Very soft greyish brown slightly sandy slightly gravelly CLAY with occasional plant fragments. Gravel is fine to coarse subangular to rounded of sandstone and various lithologies. (ALLUVIUM)	▽ 2.10	
2.30	D5							
3.00-3.45	SPT	N=2 (4,2/1,0,0,1)		3				3
				<2.35>		3.40m: Becomes dark brown.		
3.80	D6							
4.00-4.45	SPT	N=6 (1,1/1,1,2,2)		4		4.00m: Becomes soft.		4
			4.45	39.68		End of Borehole at 4.45 m		
	Type	Results						

Remarks:

Standard TerraConsult Borehole Log 04/10/06

TerraConsult	TerraConsult Ltd Tel: 01925 291111 Fax: 01925 291191 www.terraconsult.co.uk mailbox@terraconsult.co.uk	Client: **Bloor Homes**	Borehole No. **WS4** **Sheet 1 of 1**
		Start: **05/11/2013** End: **05/11/2013**	

Project Name: **Dale View**	Project No. **1906**	Co-ords: **372483E - 436005N**	Hole Type **WLS**
Location: **Billington**	Final depth (m) **3.05**	Ground Level: **43.14 m OD**	Scale **1:25**
		Logged: **CLB** Checked: **CSE** Drilled: **SP**	

Samples & In Situ Testing			Depth (m)	Level (m AOD) <Thickness>	Legend	Stratum Description	Water Strikes	Well
Depth (m)	Type,No	Results						
				<0.12>		Grass over TOPSOIL: Dark brown slightly gravelly sandy SILT with occasional rootlets. Gravel is fine to medium subrounded of various lithologies.		
			0.12	43.02				
						Soft greyish brown mottled orange slightly sandy slightly gravelly CLAY with occassional plant fragments. Gravel is subangular to rounded of sandstone, coal and various lithologies. (ALLUVIUM)		
				<1.18>				
1.00-1.45	SPT	N=1 (0,0/0,0,1,0)		1				1
			1.30	41.84		Very soft greyish brown peaty CLAY with coarse gravel sized lenses of sandy CLAY. (ALLUVIUM)		
				<0.45>				
			1.75	41.39		Soft dark greyish brown peaty sandy CLAY with frequent plant fragments. (ALLUVIUM)		
				<0.25>				
2.00-2.45	SPT	N=4 (0,0/1,1,1,1)	2.00	2 41.14		Very soft greyish brown sandy CLAY with occasional plant fragments. (ALLUVIUM)	▽ 2.00	2
				<0.90>				
			2.90	40.24		Firm greyish brown slightly sandy gravelly CLAY with occassional plant fragments. Gravel is rounded fine to coarse of sandstone and various lithologies. (POSSIBLE GLACIAL DEPOSITS) 3.00m - 3.05m: Suspected cobble or obstruction.		
3.00-3.05	SPT	50 (25 for 40mm/50 for 10mm)		<0.15>				
			3.05	3 40.09		End of Borehole at 3.05 m		3
				4				4
	Type	Results						

Remarks:

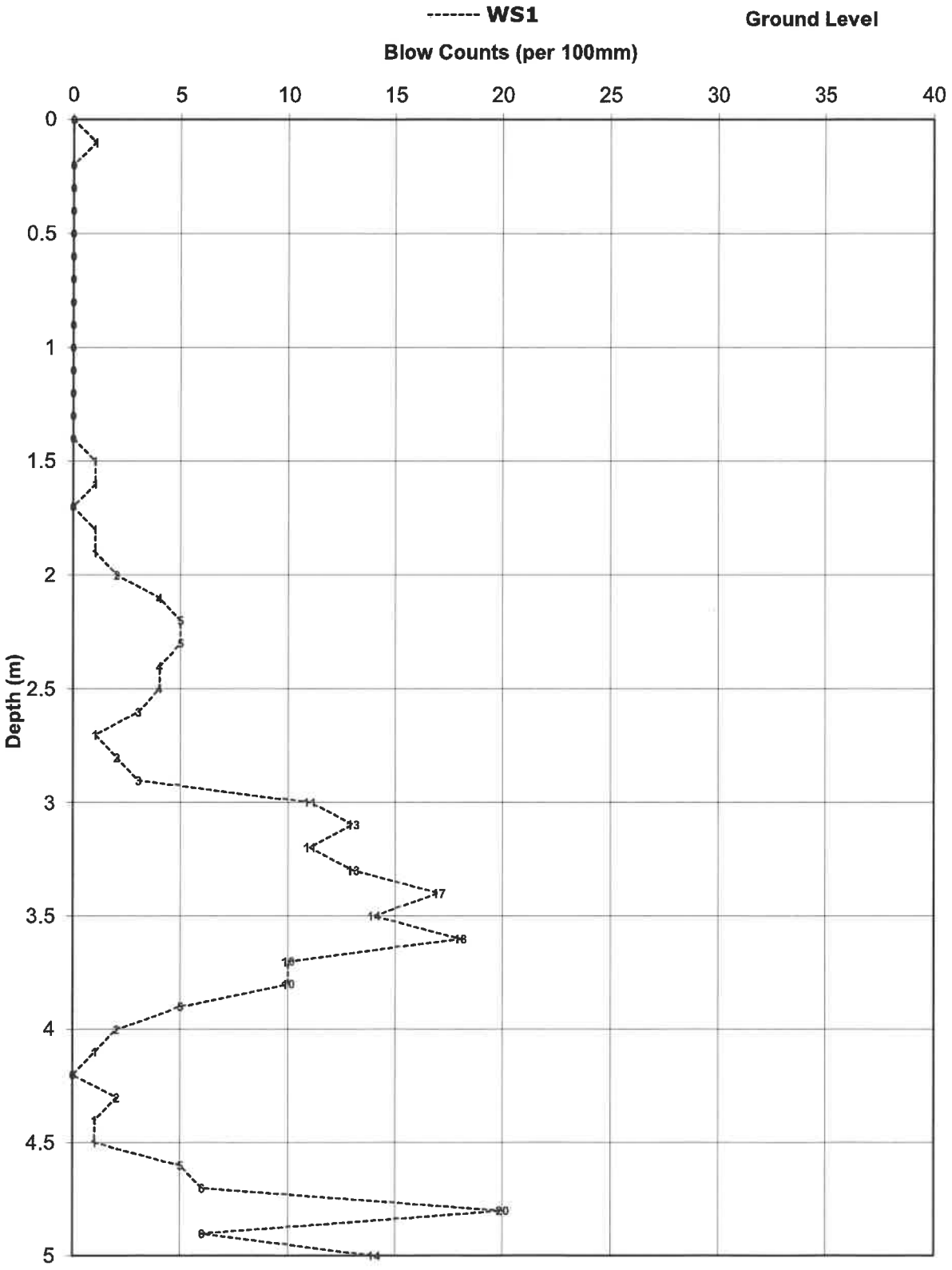
Standard TerraConsult Borehole Log 04/06/06

BS EN ISO 22476-2:2005 DPSH
63.5kg hammer
750mm drop
50mm cone
38mm rods

TerraConsult

Job No.: 1609
Dale View, Billington

Dynamic Penetration Test Record



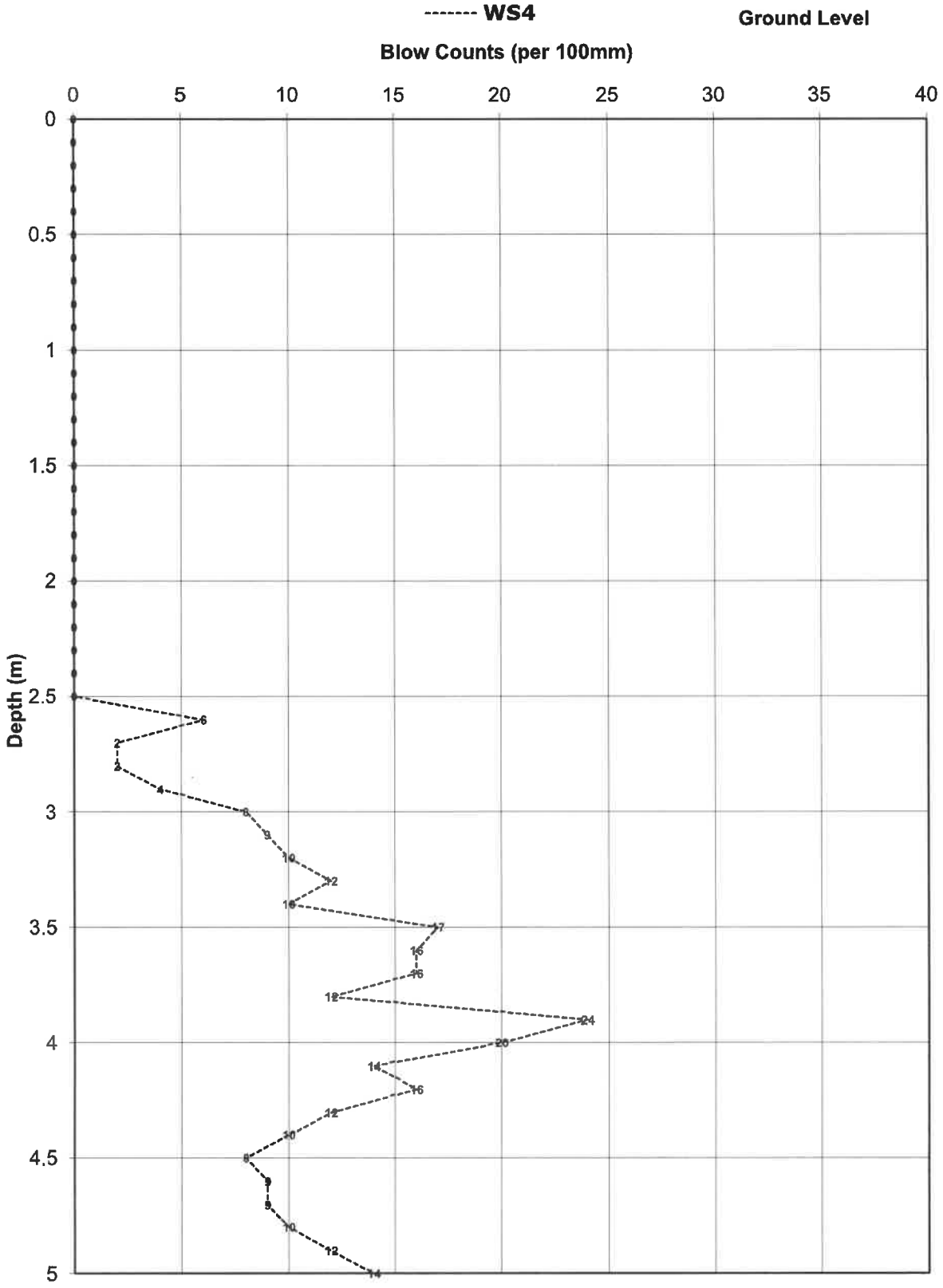
Client: Bloor Homes

BS EN ISO 22476-2:2005 DPSH
63.5kg hammer
750mm drop
50mm cone
38mm rods

TerraConsult

Job No.: 1906
Dale View, Billington

Dynamic Penetration Test Record



Client: Bloor Homes

Key To Exploratory Hole Records

SAMPLES

Undisturbed

U	Driven tube sample
TW	Pushed thin wall tube sample } nominally 100 mm diameter and full recovery unless otherwise stated
P	Pushed piston sample
L	Liner sample (from windowless or similar sampler), full recovery unless otherwise stated
CBR	CBR mould sample
BLK	Block sample
CS	Core sample (from rotary core) taken for laboratory testing
AMAL	Amalgamated sample

Disturbed

D	Small sample
B	Bulk sample

Other

W	Water sample
G	Gas sample
	Environmental chemistry samples (in more than one container where appropriate)
ES	Soil sample
EW	Water sample

Comments Sample reference numbers are assigned to every sample taken. A sample reference of 'NR' indicates that attempt was made to take a tube sample; however, there was no recovery.

Monitoring samples taken after completion of hole construction are not shown on the exploratory hole logs.

TESTS

SPT S or SPT C Standard Penetration Test, open shoe (S) or solid cone (C)

The Standard Penetration Test is defined in BS EN ISO 22476-3 (2005). The incremental blow counts are given in the Field Records column; each increment is 75 mm unless stated otherwise and any penetration under self weight in mm (SW) is noted. Where the full 300 mm test drive is achieved the total number of blows for the test drive is presented as N = ** in the Test column. Where the test drive blows reach 50 (either in total or for a single increment) the total blow count beyond the seating drive is given (without the N = prefix).

IV	*in situ* Vane shear strength, peak (p) and remoulded (r), kPa
HV	Hand vane shear strength, peak (p) and remoulded (r), kPa
PP	Pocket penetrometer test, converted to shear strength, kPa
KFH, KRH, KPI	Variable head permeability tests (KFH = falling head test, KRH = rising head test, KPI = packer test), permeability value
	Test results provided in Field Records column

DRILLING RECORDS

The mechanical indices (TCR/SCR/RQD & If) are defined in BS 5930 (1999) and BS EN ISO 22575-1 (2006)

TCR	Total Core Recovery, %
SCR	Solid Core Recovery, %
RQD	Rock Quality Designation, %
If	Fracture spacing, mm. Minimum, typical and maximum spacings are presented.
NI	Non-intact is used where the core is fragmented.

Flush returns, estimated percentage with colour where relevant, are given in the Records column

CRF	Core recovered (length in m) in the following run
AZCL	Assessed zone of core loss
NR	Not recovered

GROUNDWATER

▼	Groundwater strike
▽	Groundwater level after standing period

INSTALLATION

Standpipe/ piezometer

Details of standpipe/piezometer installations are given on the Record. Legend column shows installed instrument depths including slotted pipe section or tip depth, response zone filter material type and layers of backfill.



The type of instrument installed is indicated by a code in the Legend column at the depth of the response zone:

SP Standpipe
SPIE Standpipe piezometer
PPIE Pneumatic piezometer
EPIE Electronic piezometer

Inclinometer or Slip Indicator

The installation of vertical profiling instruments is indicated on the Record. The base of tubing is shown in the Legend column.



The type of instrument installed is indicated by a code in the Legend column at the base of the tubing:

ICE Biaxial inclinometer
ICM Inclinometer tubing for use with probe
SLIP Slip indicator

Settlement Points or Pressure Cells

The installation of single point instruments is indicated on the Record. The location of the measuring device is shown in the Legend column.



The type of instrument installed is indicated by a code in the Legend column:

ESET Electronic settlement cell/gauge
ETM Magnetic extensometer settlement point
EPCE Electronic embedment pressure cell
PPCE Electronic push in pressure cell

INSTALLATION LEGENDS

A legend describing the installation is shown in the rightmost column. Legends additional to BS5930 are used to describe the backfill materials as indicated below.



NOTES

1. Soils and rocks are described in accordance with BS EN ISO 14688-1 (2002), 14688-2 (2004), 14689-1 (2003) and BS 5930 (1999) as clarified by Baldwin et al (2007).

2. Strata legends are in accordance with BS 5930 (1999).

3. Water level observations of discernible entries during the advancing of the exploratory hole are given at the foot of the log and in the Legend column. The term "none observed" is used where no discrete entries are identified although this does not necessarily indicate that the hole has not been advanced below groundwater level. Under certain conditions groundwater cannot be observed, for instance, drilling with water flush or overwater, or boring at a rate much faster than water can make its way into the borehole (ref BS5930: 1999, Clause 47.2.7). In addition, where appropriate, water levels in the hole at the time of recovering individual samples or carrying out in situ tests and at shift changes are given in the Records column.

4. Evidence of the occurrence of very coarse particles (cobbles and boulders) is presented on the logs, however, because of their size in relation to the exploratory hole these records may not be fully representative of their size and frequency in the ground mass.

5. The borehole logs present the results of Standard Penetration Tests recorded in the field without correction or interpretation. However, in certain ground conditions (eg high hydraulic head or where very coarse particles are present) some judgement may be necessary in considering whether the results are representative of in situ mass conditions.

6. The declination of bedding and joints is given with respect to the normal to the core axis. Thus in a vertical borehole this will be the dip.

7. The assessment of SCR, RQD and Fracture Spacing excludes artificial (non in situ) fractures.

NOTE

Where "tarmac" is referred to in descriptions, this refers to bound bituminous paving materials which could be blacktop, asphalt, mastic asphalt, tarmac or other type of materials. The word "tarmac" is not intended to covey that tar has been used in the material.

REFERENCES

Baldwin M, Gosling R C and Brownlie N: 2007: Soil and rock descriptions - a practical guide to the implementation of BS EN ISO 14688 and 14689. Ground Engineering, July 2007.

BS EN ISO 14688-1: 2002: Geotechnical investigation and testing - Identification and classification of soil - Part 1 Identification and description. British Standards Institution.

BS EN ISO 14688-2: 2004: Geotechnical investigation and testing - Identification and classification of soil - Part 2 Principles for a classification. British Standards Institution.

BS EN ISO 14689-1: 2003: Geotechnical investigation and testing - Identification and classification of rock - Part 1 Identification and description. British Standards Institution.

BS EN ISO 22476-3: 2005: Geotechnical investigation and testing - Field testing - Part 3: Standard penetration test. British Standards Institution.

BS EN ISO 22475-1: 2007: Geotechnical investigation and testing – Sampling methods and groundwater measurements - Part 1: Technical principles for execution (reproduced 2007). British Standards Institution.

BS 5930: 1999: Code of Practice for site investigations (amendment number 2, 2010). British Standards Institution

APPENDIX F

Gas and Groundwater Monitoring

No: 1906

GROUNDWATER AND GROUND GAS MONITORING

TerraConsult

Site: Bloor Homes, Dale View, Billington

Location	Date	Monitored by	Well Details		Groundwater				Gas												Weather	
			Standpipe diameter (mm)	Depth to Base (m bgl)	Water Depth (m bgl)	Reduced Level (mOD)	Purged (Y/N - litres)	Water Sample Taken?	Atmospheric Pressure (mbar)	Atmospheric Pressure Comment	Relative Pressure	Steady Flow (l/h)	Peak Flow (l/h)	CH_4 (% v/v)	GSV CH_4 (l/hr)	CO_2 (% v/v)	GSV CO_2 (l/hr)	O_2 (% v/v)	CO (ppm)	H2S (ppm)	Conditions	Ambient Temp °C
WS1	12/11/13	CB	50	2.78	0.30	42.45	3.00	Y	1023	Steady	0.01	0.1	0.1	0.1	0.0001	1.9	0.0019	19.2	1	1	Sunny	12
	19/11/13	CB	50	2.78	0.52	42.23	N	N	1015	Steady	0.01	0.1	0.1	0.1	0.0001	2.9	0.0029	18.4	1	1	Sunny	2
	20/11/13	CSE	50	2.78	0.48	42.27	N	N	996	Slow fall	0.01	0.1	0.1	0.1	0.0001	3.1	0.0031	18.0	1	1	Cloudy/rain	4
	28/11/13	CB	50	2.78	0.62	42.13	N	N	1028	Steady	0.01	0.1	0.1	0.1	0.0001	2.1	0.0021	19.5	2	1	Overcast	8
WS2	12/11/13	CB	50	1.78	0.67	42.59	3.00	Y	1022	Falling	-24.00	-2.5	-13.2	0.1	-0.0025	0.9	-0.0225	19.2	1	1	Sunny	12
	19/11/13	CB	50	1.74	0.89	42.37	N	N	1015	Steady	0.01	0.1	0.1	0.1	0.0001	1.9	0.0019	18.8	1	1	Sunny	2
	20/11/13	CSE	50	1.74	0.81	42.45	N	N	996	Slow fall	0.01	0.1	0.1	0.1	0.0001	2.3	0.0023	16.4	1	1	Cloudy/rain	4
	28/11/13	CB	50	1.74	1.00	42.26	N	N	1027	Slow fall	0.01	0.1	-62.1	0.1	0.0001	1.0	0.0010	19.8	1	1	Overcast	8
WS3	12/11/13	CB	50	2.84	1.75	42.38	3.00	Y	1022	Steady	0.01	0.1	0.1	0.1	0.0001	3.9	0.0039	15.0	1	1	Sunny	12
	19/11/13	CB	50	2.84	1.95	42.18	N	N	1015	Steady	0.01	0.1	0.1	0.1	0.0001	4.0	0.0040	14.5	1	1	Sunny	2
	20/11/13	CSE	50	2.84	1.90	42.23	N	N	996	Slow fall	0.01	0.1	0.1	0.1	0.0001	4.1	0.0041	14.6	1	1	Cloudy	4
	28/11/13	CB	50	2.84	2.05	42.08	N	N	1028	Steady	0.01	0.1	0.1	0.1	0.0001	2.9	0.0029	17.0	1	1	Overcast	8
WS4	12/11/13	CB	50	2.99	0.31	42.83	3.00	Y	1022	Steady	0.01	0.1	3.0	0.1	0.0001	4.2	0.0042	17.1	1	1	Sunny	12
	19/11/13	CB	50	2.99	0.40	42.74	N	N	1014	Steady	0.01	0.1	0.1	0.1	0.0001	2.9	0.0029	18.3	1	1	Sunny	2
	20/11/13	CSE	50	2.99	0.39	42.75	N	N	996	Slow fall	0.01	0.1	0.1	0.1	0.0001	3.5	0.0035	17.4	1	1	Cloudy	4
	28/11/13	CB	50	2.99	0.57	42.57	N	N	1028	Slow fall	0.01	0.1	-6.1	0.1	0.0001	0.7	0.0007	20.0	1	1	Overcast	8

NOTES:
NM = Not Measured.
(x) = Peak value recorded.
[grey] = Below detection limit.

$$GSV\ (l/HR) = \frac{[gas\ concentration\ (\%v/v)] \times [gas\ well\ flow\ rate\ (l/hr)}{100}$$

APPENDIX G

Laboratory Chemical Test Results

Chris Eccles
TerraConsult Ltd
Bold Business Centre
Bold Lane
Sutton
St Helens
Merseyside
WA9 4TX

QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410
russell.jarvis@qtsenvironmental.com

QTS Environmental Report No: 13-17678

Site Reference:	Dale View
Project / Job Ref:	1906
Order No:	PO12253
Sample Receipt Date:	08/11/2013
Sample Scheduled Date:	08/11/2013
Report Issue Number:	1
Reporting Date:	14/11/2013

Authorised by

Russell Jarvis
Director
On behalf of QTS Environmental Ltd

On behalf of QTS Environmental Ltd

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate							
QTS Environmental Report No: 13-17678	Date Sampled	04/11/13	04/11/13	04/11/13	04/11/13	05/11/13
TerraConsult Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Dale View	TP / BH No	TP1	TP4	TP6	TP8	TP12
Project / Job Ref: 1906	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: PO12253	Depth (m)	0.50	0.10	0.10	0.50	0.20
Reporting Date: 14/11/2013	QTSE Sample No	85237	85238	85239	85240	85241

Determinand	Unit	MDL	Accreditation					
Asbestos Screen (S)	N/a	N/a	ISO17025					None Detected
pH	pH Units	N / a	MCERTS	7.2	7.6	6.3	6.4	7.2
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Total Sulphate as SO_4	mg/kg	< 200	NONE					559
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	NONE	0.01	0.01	0.02	< 0.01	0.01
Organic Matter	%	< 0.1	NONE					4.5
Total Organic Carbon (TOC)	%	< 0.1	NONE					2.6
W/S Chloride (2:1)	mg/kg	< 1	NONE					10
Arsenic (As)	mg/kg	< 2	MCERTS	5	8	7	10	11
Cadmium (Cd)	mg/kg	< 0.5	MCERTS	0.9	1.5	1.4	2.1	1.5
Chromium (Cr)	mg/kg	< 2	MCERTS	12	12	13	15	14
Copper (Cu)	mg/kg	< 4	MCERTS	17	21	19	23	48
Lead (Pb)	mg/kg	< 3	MCERTS	42	86	58	96	288
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	14	17	16	20	18
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	75	106	104	126	249
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
DRO (C10 - C24)	mg/kg	< 6	MCERTS					10
Oil (C25 - C40)	mg/kg	< 6	MCERTS					12
Mineral Oil (C10 - C40)	mg/kg	< 6	NONE					< 6

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content
Subcontracted analysis (S)

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate						
QTS Environmental Report No: 13-17678	**Date Sampled**	05/11/13	05/11/13	05/11/13	05/11/13	05/11/13
TerraConsult Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Dale View	**TP / BH No**	TP13	TP15	TP18	TP19	WS3
Project / Job Ref: 1906	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: PO12253	**Depth (m)**	0.40	0.20	0.10	0.10	0.05
Reporting Date: 14/11/2013	**QTSE Sample No**	85242	85243	85244	85245	85246

Determinand	Unit	MDL	Accreditation					
Asbestos Screen [S]	N/a	N/a	ISO17025					
pH	pH Units	N / a	MCERTS	6.9	7.5	7.1	7.1	7.8
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Total Sulphate as SO_4	mg/kg	< 200	NONE		707			622
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	NONE	0.03	0.02	0.01	0.01	0.03
Organic Matter	%	< 0.1	NONE		4.9			10.1
Total Organic Carbon (TOC)	%	< 0.1	NONE		2.9			5.9
W/S Chloride (2:1)	mg/kg	< 1	NONE		11			17
Arsenic (As)	mg/kg	< 2	MCERTS	9	9	4	< 2	7
Cadmium (Cd)	mg/kg	< 0.5	MCERTS	1.9	2.1	< 0.5	< 0.5	1.2
Chromium (Cr)	mg/kg	< 2	MCERTS	11	13	11	25	47
Copper (Cu)	mg/kg	< 4	MCERTS	19	39	11	24	295
Lead (Pb)	mg/kg	< 3	MCERTS	80	335	39	14	251
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	18	26	11	22	33
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	122	351	76	75	814
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
DRO (C10 - C24)	mg/kg	< 6	MCERTS		8			91
Oil (C25 - C40)	mg/kg	< 6	MCERTS		12			1560
Mineral Oil (C10 - C40)	mg/kg	< 6	NONE		< 6			667

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content
Subcontracted analysis [S]

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Soil Analysis Certificate - Speciated PAHs						
QTS Environmental Report No: 13-17678	Date Sampled	04/11/13	04/11/13	04/11/13	04/11/13	05/11/13
TerraConsult Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Dale View	TP / BH No	TP1	TP4	TP6	TP8	TP12
Project / Job Ref: 1906	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: PO12253	Depth (m)	0.50	0.10	0.10	0.50	0.20
Reporting Date: 14/11/2013	QTSE Sample No	85237	85238	85239	85240	85241

Determinand	Unit	MDL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.61
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.15
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	1.88
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	1.55
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.75
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.84
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.86
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.32
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.55
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.33
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.28
Coronene	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total Oily Waste PAHs	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	3.6
Total Dutch 10 PAHs	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	5.7
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6	< 1.6	8.1
Total WAC-17 PAHs	mg/kg	< 1.7	NONE	< 1.7	< 1.7	< 1.7	< 1.7	8.1

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C

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Soil Analysis Certificate - Speciated PAHs						
QTS Environmental Report No: 13-17678	**Date Sampled**	05/11/13	05/11/13	05/11/13	05/11/13	05/11/13
TerraConsult Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Dale View	**TP / BH No**	TP13	TP15	TP18	TP19	WS3
Project / Job Ref: 1906	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: PO12253	**Depth (m)**	0.40	0.20	0.10	0.10	0.05
Reporting Date: 14/11/2013	**QTSE Sample No**	85242	85243	85244	85245	85246

Determinand	Unit	MDL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.19	0.13
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	0.27	0.19	0.19	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	0.29	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	2.28	1.48	1.45	0.35
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.62	0.28	0.29	0.11
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	2.50	2.63	2.42	0.59
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	1.92	2.10	1.93	0.64
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.87	0.84	0.85	0.24
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	0.92	0.97	1.08	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.85	0.94	1.13	0.37
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.29	0.34	0.42	0.55
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.64	0.67	0.76	0.59
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.30	0.31	0.52	0.47
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	0.27	0.25	0.42	0.64
Coronene	mg/kg	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total Oily Waste PAHs	mg/kg	< 1	MCERTS	< 1	3.9	4.1	4.8	2.2
Total Dutch 10 PAHs	mg/kg	< 1	MCERTS	< 1	8.7	7.8	8.4	3.7
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	12	11	11.6	4.7
Total WAC-17 PAHs	mg/kg	< 1.7	NONE	< 1.7	12	11	11.6	4.7

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C

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Soil Analysis Certificate - TPH CWG Banded						
QTS Environmental Report No: 13-17678	Date Sampled	05/11/13	05/11/13	05/11/13		
TerraConsult Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Dale View	TP / BH No	TP12	TP15	WS3		
Project / Job Ref: 1906	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: PO12253	Depth (m)	0.20	0.20	0.05		
Reporting Date: 14/11/2013	QTSE Sample No	85241	85243	85246		

Determinand	Unit	MDL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05		
Aliphatic >C8 - C10	mg/kg	< 1	NONE	< 1	< 1	< 1		
Aliphatic >C10 - C12	mg/kg	< 1	NONE	< 1	< 1	< 1		
Aliphatic >C12 - C16	mg/kg	< 1	NONE	< 1	< 1	< 1		
Aliphatic >C16 - C21	mg/kg	< 1	NONE	< 1	< 1	10		
Aliphatic >C21 - C34	mg/kg	< 6	NONE	< 6	< 6	562		
Aliphatic (C5 - C34)	mg/kg	< 12	NONE	< 12	< 12	571		
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05		
Aromatic >C8 - C10	mg/kg	< 1	NONE	< 1	< 1	< 1		
Aromatic >C10 - C12	mg/kg	< 1	NONE	< 1	< 1	< 1		
Aromatic >C12 - C16	mg/kg	< 1	NONE	< 1	< 1	< 1		
Aromatic >C16 - C21	mg/kg	< 1	NONE	< 1	< 1	7		
Aromatic >C21 - C35	mg/kg	< 6	NONE	12	20	421		
Aromatic (C5 - C35)	mg/kg	< 12	NONE	12	20	428		
Total >C5 - C35	mg/kg	< 24	NONE	< 24	< 24	1000		

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C

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Soil Analysis Certificate - BTEX / MTBE							
QTS Environmental Report No: 13-17678	Date Sampled	05/11/13	05/11/13	05/11/13		
TerraConsult Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Dale View	TP / BH No	TP12	TP15	WS3		
Project / Job Ref: 1906	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: PO12253	Depth (m)	0.20	0.20	0.05		
Reporting Date: 14/11/2013	QTSE Sample No	85241	85243	85246		

Determinand	Unit	MDL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2		
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5		
Ethylbenzene	ug/kg	< 10	MCERTS	< 10	< 10	15		
p & m-xylene	ug/kg	< 10	MCERTS	< 10	< 10	< 10		
o-xylene	ug/kg	< 10	MCERTS	< 10	< 10	< 10		

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C

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Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 13-17678	
TerraConsult Ltd	
Site Reference: Dale View	
Project / Job Ref: 1906	
Order No: PO12253	
Reporting Date: 14/11/2013	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
85237	TP1	None Supplied	0.50	15.8	Brown clayey loam with vegetation
85238	TP4	None Supplied	0.10	19.2	Brown clayey loam
85239	TP6	None Supplied	0.10	18.2	Brown clayey loam with vegetation
85240	TP8	None Supplied	0.50	23.3	Brown loamy clay with vegetation
85241	TP12	None Supplied	0.20	21.4	Brown clayey loam with vegetation
85242	TP13	None Supplied	0.40	19	Brown clayey loam with vegetation
85243	TP15	None Supplied	0.20	24.8	Grey clayey loam with vegetation
85244	TP18	None Supplied	0.10	29.4	Grey clayey loam with vegetation
85245	TP19	None Supplied	0.10	26.8	Grey clayey loam with vegetation
85246	WS3	None Supplied	0.05	6	Grey sandy gravel with rubble

Insufficient sample I/S
Unsuitable Sample U/S

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Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 13-17678
TerraConsult Ltd
Site Reference: Dale View
Project / Job Ref: 1906
Order No: PO12253
Reporting Date: 14/11/2013

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E021
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by turbidimeter	E020
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E023
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E011
Soil	D	Loss on Ignition @ 450°C	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	D	Phosphorus	Determination of phosphorus by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	AR	Sulphide	Determination of sulphide by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia, potassium iodide/iodate followed by ICP-OES	E002
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E011
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E009
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E009
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E010
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E009
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	VPH (C6 - C10)	Determination of hydrocarbons C6-C10 by headspace GC-MS	E001
Soil	AR	EPH TEXAS	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	TPH CWG	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	TPH LQM	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	EPH (with florisil cleanup)	Determination of acetone/hexane extractable hydrocarbons with florisil cleanup step by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001

Key

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AR As Received

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Scientific Analysis Laboratories Ltd

Certificate of Analysis

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Report Number: 361006-1

Date of Report: 21-Nov-2013

Customer: TerraConsult Limited
Unit 34
Bold Business Centre
Bold Lane
Sutton
St Helens
WA9 4TX

Customer Contact: Mr Nick Frost

Customer Job Reference: 1906
Customer Purchase Order: PO12268
Customer Site Reference: Dale View
Date Job Received at SAL: 13-Nov-2013
Date Analysis Started: 18-Nov-2013
Date Analysis Completed: 21-Nov-2013

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
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Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with QP22

UKAS TESTING
1549

Report checked
and authorised by :
Mr Ross Walker
Customer Services Manager
(Land)

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SAL Reference: 361006
Project Site: Dale View
Customer Reference: 1906

Water Analysed as Water
TerraConsult 3

					SAL Reference	361006 001	361006 002	361006 003	361006 004
					Customer Sample Reference	WS1	WS2	WS3	WS4
					Date Sampled	12-NOV-2013	12-NOV-2013	12-NOV-2013	12-NOV-2013
Determinand	Method	Test Sample	LOD	Units					
As (Dissolved)	T281	AR	0.2	µg/l		5.5	9.5	9.9	5.4
Boron	T6	AR	10	µg/l		13	36	<10	13
Cd (Dissolved)	T281	AR	0.02	µg/l		0.26	0.67	0.69	0.09
Cr (Dissolved)	T281	AR	1	µg/l		12	16	19	22
Cu (Dissolved)	T281	AR	0.5	µg/l		5.8	4.8	1.8	1.0
Pb (Dissolved)	T281	AR	0.3	µg/l		0.4	<0.3	<0.3	<0.3
Hg (Dissolved)	T281	AR	0.05	µg/l		<0.05	<0.05	<0.05	<0.05
Ni (Dissolved)	T281	AR	1	µg/l		13	9	10	9
Se (Dissolved)	T281	AR	0.5	µg/l		1.0	4.1	4.8	1.3
Zn (Dissolved)	T281	AR	2	µg/l		9	8	9	6
Alkalinity expressed as CaCO3	T22	AR	10	mg/l		270	260	280	360
Ammoniacal nitrogen	T686	AR	0.05	mg/l		0.12	0.07	0.07	<0.05
Chloride	T686	AR	1	mg/l		13	47	44	6
Cyanide(Total)	T4	AR	0.05	mg/l		<0.05	<0.05	<0.05	<0.05
Electrical Conductivity	T7	AR	10	µS/cm		780	570	670	2700
Hardness expressed as CaCO3	T6	AR	10	mg/l		210	280	290	320
Nitrate	T686	AR	0.5	mg/l		<0.5	<0.5	<0.5	<0.5
pH	T7	AR				8.3	8.3	8.3	8.3
Sulphate	T686	AR	0.5	mg/l		28	61	56	23
Total Phenols	T16	AR	0.5	µg/l		<0.5	<0.5	<0.5	<0.5
Naphthalene	T149	AR	0.01	µg/l		0.04	0.02	0.03	0.02
Acenaphthylene	T149	AR	0.01	µg/l		<0.01	<0.01	0.02	<0.01
Acenaphthene	T149	AR	0.01	µg/l		<0.01	<0.01	<0.01	<0.01
Fluorene	T149	AR	0.01	µg/l		<0.01	<0.01	<0.01	<0.01
Phenanthrene	T149	AR	0.01	µg/l		0.03	<0.01	<0.01	<0.01
Anthracene	T149	AR	0.01	µg/l		<0.01	<0.01	<0.01	<0.01
Fluoranthene	T149	AR	0.01	µg/l		0.02	<0.01	<0.01	<0.01
Pyrene	T149	AR	0.01	µg/l		0.03	<0.01	<0.01	0.01
Benzo(a)Anthracene	T149	AR	0.01	µg/l		0.02	<0.01	<0.01	0.01
Chrysene	T149	AR	0.01	µg/l		0.02	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	T149	AR	0.01	µg/l		0.02	<0.01	0.01	0.02
Benzo(k)fluoranthene	T149	AR	0.01	µg/l		<0.01	<0.01	<0.01	0.02
Benzo(a)Pyrene	T149	AR	0.01	µg/l		0.01	<0.01	<0.01	0.03
Indeno(123-cd)Pyrene	T149	AR	0.01	µg/l		0.01	<0.01	<0.01	0.02
Dibenzo(ah)Anthracene	T149	AR	0.01	µg/l		0.02	<0.01	<0.01	<0.01
Benzo(ghi)Perylene	T149	AR	0.01	µg/l		0.01	<0.01	<0.01	0.02
PAH(total)	T149	AR	0.01	µg/l		0.23	0.02	0.06	0.15
Benzene	T54	AR	1	µg/l		<1	<1	<1	<1
EthylBenzene	T54	AR	1	µg/l		<1	<1	<1	<1
M/P Xylene	T54	AR	1	µg/l		<1	<1	<1	<1
Methyl tert-Butyl Ether	T54	AR	1	µg/l		<1	<1	<1	<1
O Xylene	T54	AR	1	µg/l		<1	<1	<1	<1
Toluene	T54	AR	1	µg/l		<1	<1	<1	<1
TPH (C5-C6 aliphatic)	T215	AR	0.010	mg/l		<0.010	<0.010	<0.010	<0.010
TPH (C6-C8 aliphatic)	T215	AR	0.010	mg/l		<0.010	<0.010	<0.010	<0.010
TPH (C8-C10 aliphatic)	T215	AR	0.010	mg/l		<0.010	<0.010	<0.010	<0.010
TPH DW(C10-C12 aliphatic)	T81	AR	0.01	mg/l		<0.01	<0.01	<0.01	<0.01
TPH DW(C12-C16 aliphatic)	T81	AR	0.01	mg/l		<0.01	<0.01	<0.01	<0.01
TPH DW(C16-C21 aliphatic)	T81	AR	0.01	mg/l		<0.01	<0.01	<0.01	<0.01
TPH DW(C21-C35 aliphatic)	T81	AR	0.01	mg/l		<0.01	<0.01	<0.01	<0.01
TPH (C35-C40 aliphatic)	T81	AR	0.01	mg/l		<0.01	<0.01	<0.01	<0.01
TPH (C6-C7 aromatic)	T215	AR	0.010	mg/l		<0.010	<0.010	<0.010	<0.010
TPH (C7-C8 aromatic)	T215	AR	0.010	mg/l		<0.010	<0.010	<0.010	<0.010
TPH (C8-C10 aromatic)	T215	AR	0.010	mg/l		<0.010	<0.010	<0.010	<0.010
TPH DW(C10-C12 aromatic)	T81	AR	0.01	mg/l		<0.01	<0.01	<0.01	<0.01
TPH DW(C12-C16 aromatic)	T81	AR	0.01	mg/l		<0.01	<0.01	<0.01	<0.01
TPH DW(C16-C21 aromatic)	T81	AR	0.01	mg/l		<0.01	<0.01	<0.01	<0.01
TPH DW(C21-C35 aromatic)	T81	AR	0.01	mg/l		<0.01	<0.01	<0.01	<0.01

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SAL Reference: 361006
Project Site: Dale View
Customer Reference: 1906

Water Analysed as Water
TerraConsult 3

				SAL Reference	361006 001	361006 002	361006 003	361006 004
				Customer Sample Reference	WS1	WS2	WS3	WS4
				Date Sampled	12-NOV-2013	12-NOV-2013	12-NOV-2013	12-NOV-2013
Determinand	Method	Test Sample	LOD	Units				
TPH (C35-C40 aromatic)	T81	AR	0.01	mg/l	<0.01	<0.01	<0.01	<0.01
TPH (Aliphatic+Aromatic) C10-C40 (Sum)	T85	AR	0.01	mg/l	<0.01	<0.01	<0.01	<0.01

Index to symbols used in 361006-1

Value	Description
AR	As Received
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Method Index

Value	Description
T16	GC/MS
T54	GC/MS (Headspace)
T281	ICP/MS (Filtered)
T215	GC/MS (Headspace)(LV)
T686	Discrete Analyser
T4	Colorimetry
T7	Probe
T81	GC/FID (LV)
T149	GC/MS (SIR)
T85	Calc
T6	ICP/OES
T22	Titration

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
As (Dissolved)	T281	AR	0.2	µg/l	U	001-004
Boron	T6	AR	10	µg/l	N	001-004
Cd (Dissolved)	T281	AR	0.02	µg/l	U	001-004
Cr (Dissolved)	T281	AR	1	µg/l	U	001-004
Cu (Dissolved)	T281	AR	0.5	µg/l	U	001-004
Pb (Dissolved)	T281	AR	0.3	µg/l	U	001-004
Hg (Dissolved)	T281	AR	0.05	µg/l	U	001-004
Ni (Dissolved)	T281	AR	1	µg/l	U	001-004
Se (Dissolved)	T281	AR	0.5	µg/l	U	001-004
Zn (Dissolved)	T281	AR	2	µg/l	U	001-004
Alkalinity expressed as CaCO3	T22	AR	10	mg/l	N	001-004
Ammoniacal nitrogen	T686	AR	0.05	mg/l	U	001-004
Chloride	T686	AR	1	mg/l	U	001-004
Cyanide(Total)	T4	AR	0.05	mg/l	U	001-004
Electrical Conductivity	T7	AR	10	µS/cm	N	001-004
Hardness expressed as CaCO3	T6	AR	10	mg/l	N	001-004
Nitrate	T686	AR	0.5	mg/l	U	001-004
pH	T7	AR			U	001-004
Sulphate	T686	AR	0.5	mg/l	U	001-004
Total Phenols	T16	AR	0.5	µg/l	U	001-004
Naphthalene	T149	AR	0.01	µg/l	U	001-004
Acenaphthylene	T149	AR	0.01	µg/l	U	001-004
Acenaphthene	T149	AR	0.01	µg/l	U	001-004
Fluorene	T149	AR	0.01	µg/l	U	001-004
Phenanthrene	T149	AR	0.01	µg/l	U	001-004
Anthracene	T149	AR	0.01	µg/l	U	001-004
Fluoranthene	T149	AR	0.01	µg/l	U	001-004

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Pyrene	T149	AR	0.01	µg/l	U	001-004
Benzo(a)Anthracene	T149	AR	0.01	µg/l	U	001-004
Chrysene	T149	AR	0.01	µg/l	U	001-004
Benzo(b)fluoranthene	T149	AR	0.01	µg/l	U	001-004
Benzo(k)fluoranthene	T149	AR	0.01	µg/l	U	001-004
Benzo(a)Pyrene	T149	AR	0.01	µg/l	U	001-004
Indeno(123-cd)Pyrene	T149	AR	0.01	µg/l	U	001-004
Dibenzo(ah)Anthracene	T149	AR	0.01	µg/l	U	001-004
Benzo(ghi)Perylene	T149	AR	0.01	µg/l	U	001-004
PAH(total)	T149	AR	0.01	µg/l	U	001-004
Benzene	T54	AR	1	µg/l	U	001-004
EthylBenzene	T54	AR	1	µg/l	U	001-004
M/P Xylene	T54	AR	1	µg/l	U	001-004
Methyl tert-Butyl Ether	T54	AR	1	µg/l	U	001-004
O Xylene	T54	AR	1	µg/l	U	001-004
Toluene	T54	AR	1	µg/l	U	001-004
TPH (C5-C6 aliphatic)	T215	AR	0.010	mg/l	N	001-004
TPH (C6-C8 aliphatic)	T215	AR	0.010	mg/l	N	001-004
TPH (C8-C10 aliphatic)	T215	AR	0.010	mg/l	N	001-004
TPH DW(C10-C12 aliphatic)	T81	AR	0.01	mg/l	N	001-004
TPH DW(C12-C16 aliphatic)	T81	AR	0.01	mg/l	N	001-004
TPH DW(C16-C21 aliphatic)	T81	AR	0.01	mg/l	N	001-004
TPH DW(C21-C35 aliphatic)	T81	AR	0.01	mg/l	N	001-004
TPH (C35-C40 aliphatic)	T81	AR	0.01	mg/l	N	001-004
TPH (C6-C7 aromatic)	T215	AR	0.010	mg/l	N	001-004
TPH (C7-C8 aromatic)	T215	AR	0.010	mg/l	N	001-004
TPH (C8-C10 aromatic)	T215	AR	0.010	mg/l	N	001-004
TPH DW(C10-C12 aromatic)	T81	AR	0.01	mg/l	N	001-004
TPH DW(C12-C16 aromatic)	T81	AR	0.01	mg/l	N	001-004
TPH DW(C16-C21 aromatic)	T81	AR	0.01	mg/l	N	001-004
TPH DW(C21-C35 aromatic)	T81	AR	0.01	mg/l	N	001-004
TPH (C35-C40 aromatic)	T81	AR	0.01	mg/l	N	001-004
TPH (Aliphatic+Aromatic) C10-C40 (Sum)	T85	AR	0.01	mg/l	N	001-004

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APPENDIX H

Laboratory Geotechnical Test Results

Summary of Chemical Analysis
Soil Samples

Our Ref: 13-92853
Client Ref: PSL13/4382
Contract Title: Dale View, Billington

			Lab No.	578462	578463	578464	578465
			Sample ID	TP2	TP4	TP6	TP17
			Depth	0.80	0.80	0.70	1.50
			Sample Ref				
			Sample Type	D	D	D	D
			Sampling Date	04/11/2013	04/11/2013	04/11/2013	05/11/2013
			Sampling Time				
Test	**Units**	**DETSxx**	**LOD**				
Sulphate Aqueous Extract as SO4	mg/l	DETSC 2076#	10	< 10	12	< 10	< 10
pH		DETSC 2008#		7.0	7.8	7.1	7.0

Sample Comments

DETS cannot be held responsible for the integrity of sample(s) received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating.
Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note "Guidance on Deviating Samples".

All samples received are listed below. However, those samples that have additional comments in relation to hold time and/or inappropriate contain due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations.

If no sampled date (soils) or date/time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (a this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Lab No.	Sample ID	Date Sampled	Containers Received	Deviating due to holding time being exceeded for test(s)	Deviating due to inappro test(s)
578462	TP2 0.80 SOIL	04/11/2013	Plastic Tub 1 litre (1kg)		
578463	TP4 0.80 SOIL	04/11/2013	Plastic Tub 1 litre (1kg)		
578464	TP6 0.70 SOIL	04/11/2013	Plastic Tub 1 litre (1kg)		
578465	TP17 1.50 SOIL	05/11/2013	Plastic Tub 1 litre (1kg)		

),

Deviating due to headspace presence in container for test(s)

DETS can supply containers appropriate for the samples and the testing required

APPENDIX I

Current Guidance on Interpretation of Chemical Analysis of Soils for Human Health Assessment

contaminant linkages, referred to as the contaminant pathway - receptor model, based upon the current or proposed use of the site.

Before undertaking a risk assessment a conceptual site model is devised in order to identify the potential contaminants, pathways and receptors. The individual contaminants, pathways and receptors then need to be further investigated in order to refine the initial assessment and risk assessment undertaken.

In March 2002, the Department for Environment, Food and Rural Affairs (DEFRA) and the EA published the Contaminated Land Exposure Assessment (CLEA) Model and a series of related reports. These were designed to provide a scientifically based framework for the assessment of chronic risks to human health from contaminated land. These reports (CLR7-10) together with associated "SGV" documents were withdrawn and the following documents have been published as revised guidance to the CLEA assessment:

- Environment Agency : 2008: Using Soil Guideline Values SC050021/SGV Introduction, March 2008.
- Environment Agency : 2008: Science Report SC050021/SR2: Human health toxicological assessment of contaminants in soil.
- Environment Agency : 2008: Science Report SC050021/SR3: Updated technical background to the CLEA model.
- Environment Agency : 2008 :Compilation of Data for Priority Organic Contaminants for Derivation of Soil Guideline Values Science report SC050021/SR7
- Science Report SC050021/SR4: CLEA Software (Version) Handbook.

Additional guidance on statistical assessment replacing CLR 7 is partly provided in:

- CL:AIRE :2009: Guidance on Comparing Data With a Critical Concentration

A different approach to the statistical appraisal of data is required depending on whether the assessment of risk is to assess whether land is Contaminated Land in accordance with regulations, or whether the assessment is to assess whether the site is suitable for new development in according with Planning guidance. This is discussed further in CL:AIRE :2009 "Guidance on Comparing Data With a Critical Concentration".

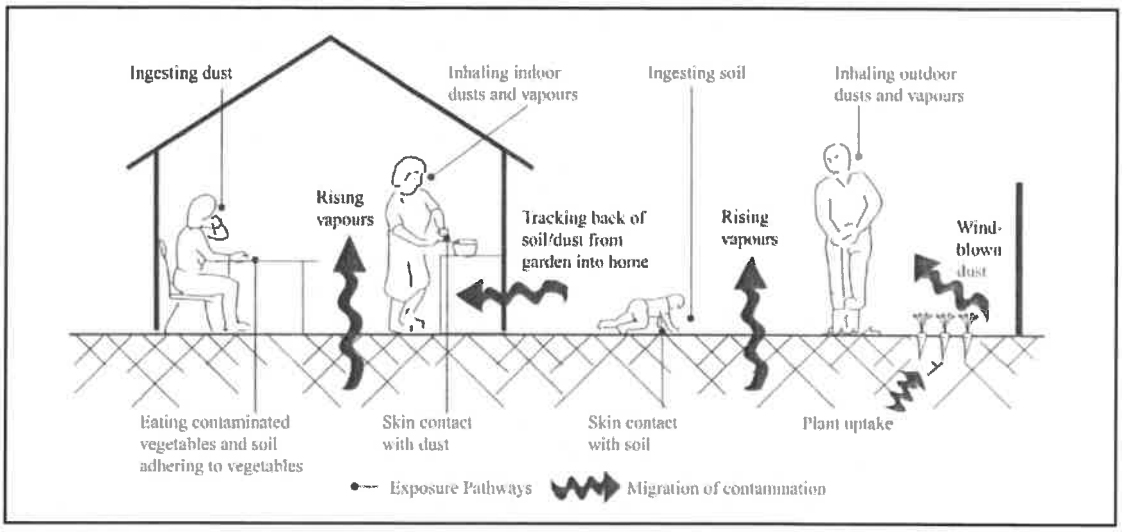
Soil Guideline Values

A program for the derivation of SGVs based on the above guidance is provided by the Environment Agency and is entitled "CLEA Software Version 1.06". These reports, together with supporting toxicology reviews ("Tox" or Supplementary Information Reports) for individual substances (which will be gradually updated), Soil Guideline Value Reports and other guidance referred to in the above documents, provide guidance and the scientific basis for assessing the risk to human health from potential contaminants. Soil Guideline Value Reports (SGV Reports) have been published for a number of contaminants and these are published on the Environment Agency website. Eventually the reports will include SGVs for:

- heavy metals and other inorganic compounds: arsenic, cadmium, chromium, cyanide, lead, mercury nickel, and selenium;
- benzene, ethylbenzene, toluene and xylenes;
- phenol;
- dioxins and dioxin-like polychlorinated biphenyls (PCBs);
- polycyclic aromatic hydrocarbons (PAHs) – 11 substances.

In addition CIEH through LQM and the EIC have published generic assessment criteria (GACs) for a wide variety of other parameters including metals, hydrocarbons, solvents, PAHs and explosive substances for three standard land uses. These have been produced to supplement the Environment Agency guidance. These GACs will be replaced by SGVs when or if the EA publishes any more SGVs.

The CLEA model has been developed to calculate an estimated tolerable daily soil intake (TDSI) for site users given a set 'default' exposure pathways. Ten human exposure pathways are covered in the CLEA model as presented below:



- **Ingestion**
  - ingestion of outdoor soil;
  - ingestion of indoor dust;
  - ingestion of home grown vegetables;
  - ingestion of soil attached to home grown vegetables.

- **Dermal Contact**
  - dermal contact with outdoor soil;
  - dermal contact with indoor dust.

- **Inhalation**
  - inhalation of outdoor dust;
  - inhalation of indoor dust;
  - inhalation of outdoor soil vapour;
  - inhalation of indoor soil vapour.

It should be noted that there are other potential exposure pathways on some sites not included in the CLEA model e.g. certain organic compounds can pass through plastic water pipes into drinking water supply.

The presence and/or significance of each of the above exposure pathways are dependent on the type of land use being considered and the nature of the contaminant under scrutiny. Accordingly, the CLEA model considers for principle 'default' land use types and makes a series of 'default' assumptions with regard to human exposure frequency, duration and critical human target groups for each land use considered:

- residential land use;
- allotments;
- commercial and industrial land use.

CLEA model assumes that regardless of the style of housing the residents will have access to either a private garden or community open space nearby, and that soil tracked into the home will form indoor dust. It allows for the ingestion pathways from home grown vegetables.

Allotments: The CLEA model incorporates an assessment of land provided by local authorities specifically for people to grow fruit and vegetables for their own consumption. Consumption of such fruit and vegetables present several exposure pathways; plants absorb contaminants mainly via water uptake through roots, the contaminants move to edible portions of plants via translocation and contaminated soil particles become trapped in the skin and between leaves. At present the model fails to account for exposure through the consumption of animals, and their products (e.g. eggs), which have been reared on contaminated land.

Commercial/Industrial: Although there are a wide variety of workplaces and work-related activities, the CLEA assessment of this land-use assumes that work occurs in a permanent, three-storey structure, where employees spend most time indoors, conducting office-based or light physical work. The model assumes employees sit outside during breaks for most of the year. Limitations in applying this land-use to different industries is detailed in EA publication "Updated technical background to the CLEA model" (2011). The generic model assumes that the site would not be covered by hard standing. Risk of exposure to contaminants would be clearly less where commercial land is essentially all buildings and hard standing.

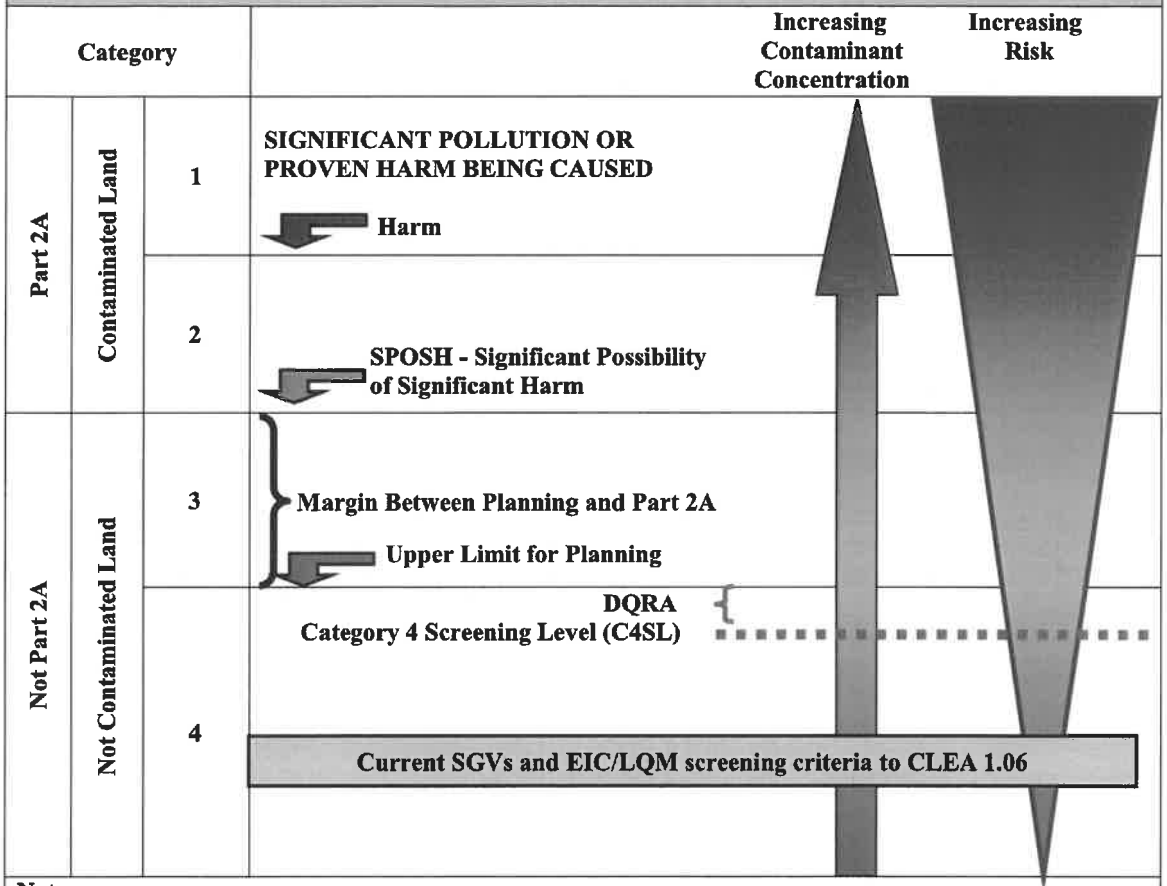
Based on the assumptions of each land use and the associated applicable exposure pathways, a 'Soil Guideline Value' (SGV) may be calculated for each contaminant under consideration for a particular land use in order to determine whether certain contaminant soil concentrations pose a significant risk to human health. The primary purpose of the CLEA SGVs are as 'trigger values' – indicators to a risk assessor that soil concentrations below this level require no further assessment as it can be assumed that the soil is suitable for the proposed use. Where soil concentrations occur above the SGV then further assessment of the results is required. The Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, 2012) which came into force in early April 2012 provides new clarity on the assessment of risk where soil concentrations exceed the SGV. The guidance introduces a four stage classification system relating to concentration of contaminants and the assessed risk which indicates appropriate actions. Category 1 and 2 sites are classified as "Contaminated Land" as defined in Part IIA of The Environmental Protection Act (1990). Category 3 and 4 sites are not considered as "Contaminated Land" in accordance with the Act. This can be explained using the figure on the following page.

For new developments progressing through the planning regime, it is desirable that the soil concentrations are within Category 4 where there is a valid contaminant linkage. The upper boundary between Category 4 and 3 is not defined in the guidance. From communication with senior personnel in the Homes and Communities Agency this boundary will be at about three to five times higher than the SGV calculated in accordance with CLEA 1.06 but this is contaminant and site specific. This boundary can also be better defined by carrying out a Detailed Quantified Risk Assessment (DQRA) and this is discussed later in this appendix. DEFRA have let a research project to CL:AIRE to generate new Category 4 Screening Levels (C4SL) which will define this boundary and provide a simple test for deciding whether land is suitable for use without any remediation. The proposed C4SLs will represent a new set of screening levels that are more pragmatic (but strongly precautionary) compared to the existing soil guideline values (SGVs and the other GACs calculate in accordance with the existing CLEA methodology). The C4SLs will provide cautious estimates of contaminant concentrations in soil that are still considered to present an acceptable level of risk, within the context of Part 2A, by combining information on toxicology, exposure assessment and normal levels of exposure to these contaminants.

There are also difficulties in establishing soil concentrations of contaminants beyond which risks from exposure to these contaminants would be 'unacceptable' and that they would lead to "significant possibility of significant harm" as defined in Part IIA of The Environmental Protection Act (1990) and determine that the land is "contaminated." This

ultimately requires detailed 'toxicological' information of the health effects of individual contaminants and also a scientific judgement on what constitutes an 'unacceptable' risk. It is for local authorities or the Environment Agency to determine whether a particular site is contaminated land and it is for local Planning Authorities to determine whether land affected by contamination can be redeveloped.

Relationship Between Contaminant Concentration, Risk and Screening Values



Note:
The vertical scale should not be considered as being linear and will be site and contaminant specific.

- The upper limit for planning could be 3 to 5 times the SGV/EIC/LQM screening concentration.
- SPOSH concentrations could be 10 to 100 times the SGV/EIC/LQM screening concentration.

Given the SGVs have been derived only for a limited number of contaminants and there was little prospect of further SGVs being published, two professional groupings have produced Generic Assessment Criteria (GACs) in accordance with the CLEA model for a large number of additional contaminants. These GACs were recognised in the new Contaminated Land Statutory Guidance (DEFRA, 2012) and have been produced as follows:

LQM/CIEH : 2009 Nathaniel CP, McCaffrey C, Ashmore MH, Cheng YY, Gillett A, Ogden R & Scott D : 2009 . The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (2nd edition). Land Quality Press, Nottingham.

CL:AIRE/EIC/AGS: 2009 : Soil Generic Assessment Criteria (GAC) for Human Health Risk Assessment. Contaminated Land: Applications in Real Environments, Environment Industries Commission & Association of Geotechnical and Environmental Specialists. December 2009.

routes selected for the generic land use, building type, soil type and soil organic matter content within the CLEA software.

- **Detailed adjustment.** It may be relevant to make greater modifications to the model due to the specific use of the land in question. This can include modification to any parameter value, including exposure assumptions, building parameters, and the choice and application of fate and transport models. This is equally relevant to site-specific modifications of existing generic land uses, the development of new land uses, and the inclusion of additional exposure pathways. Much of this can be undertaken using the CLEA software. Depending on the complexity of the detailed adjustments required, it may be necessary to use other tools either alone or in conjunction with the CLEA software. Both options should follow established protocols for DQRA and require sufficient justification and supporting information for the adjustments made. Detailed adjustments are likely to require substantially greater technical justification and supporting documentation, especially if modifications are based on information not contained within the SGV framework documents.

The two choices present the risk assessor with three options/decisions:

(1) Use a published SGV/GAC if it can be demonstrated that the assumptions inherent in the value are appropriate to the site in question. If they are not, proceed to either option 2 or 3 below.

(2) Make simple site-specific adjustments to the generic exposure model used to derive the SGV/GAC. Three examples of when this could be appropriate are:

a. High density residential development with no exposed contaminated soil at surface. It is appropriate in this case to consider the relevance of direct contact pathways and consumption of homegrown produce.

b. Soil type is significantly different (specifically when soil type is likely to be less protective e.g. made ground) to that assumed in the SGV/GAC.

c. Soil organic matter content is significantly different to that assumed in the derivation of the SGV/GAC.

(3) If simple adjustments are not sufficient to reflect site conditions, undertake a DQRA. This may be undertaken using the CLEA software or by using an alternative risk assessment methodology that is relevant, appropriate, authoritative and scientifically based. In the context of this guidance, simple adjustments of a generic land use scenario for soil type or SOM content for example are not considered sufficient to be classed as a DQRA. The resultant screening values from such simple adjustment remain generic in terms of the balance of the assumptions being made.

DQRAs should be conducted with the agreement of the local authority (or the Environment Agency) since it is the authority that determines whether land is Contaminated Land or whether Planning Permission for a new development may be granted.

Lead

For comparative purposes only, the withdrawn SGV for lead has been used in this report. If this initial screening value for lead is exceeded then a different model to the CLEA 1.06 model will be used to derive site specific assessment

criteria for lead as the CLEA model does not access the intake factors and levels of lead in the blood appropriately. This assessment will be in accordance with the latest guidance using information from the HPA etc.

Representative Data

The type, quantity and quality of the available soil data influence the method chosen to obtain a site representative soil concentration that is compared with a SGV in the screening process. The soil data should be representative of the exposure scenario being considered. This can include factors such as:

- averaging area over which exposure occurs;
- sample depth;
- heterogeneity of soil

where the 'averaging area' is defined as:

> *That area (together with a consideration of depth) of soil to which a receptor is exposed or which otherwise contributes to the creation of hazardous conditions'.*

Site investigations take discrete samples from a given area (and to a certain depth). It has to be assumed that these samples are to some degree representative of the contaminant concentration throughout that volume of soil. The critical soil volume (taking into account area and depth) which might be usefully compared with a SGV is a site-specific decision, but a starting point is the generic land use scenarios used in the derivation of the SGV. The critical soil volume depends on two factors:

- Contaminant distribution and vertical profile (bands of highly contaminated material or lateral hot spots should not necessarily be averaged out with more extensive cleaner areas of soil without justification)
- Contribution to average exposure underpinning the SGV. Direct contact exposure pathways depend on the adult or child coming into contact with near-surface soils and the area over which that exposure occurs is usually important (i.e. the averaging area). Vapour pathways are less dependent on surface area, for example vapour intrusion may result from a highly concentrated hot spot beneath a building leading to elevated average indoor air concentrations. For the three standard land uses for which SGVs are derived, relevant considerations are:
- For the standard **residential or allotment land use**, the critical soil volume is the area of an individual garden, communal play area or working plot from the surface to a depth of between 0.5m and 1.0m. This is the ground over which children are most likely to come into contact with soil or from which vegetable and fruit produce will be harvested. In the case of volatile contaminants, it may also be appropriate to consider the volume of soil underneath the footprint of the building although vapour intrusion may be driven by a soil volume much smaller than this if the contaminant source is highly concentrated.
- For the standard **commercial land use**, the critical soil volume has to be decided on a case-by- case basis due to the wide range of possible site layouts. However, for non-volatile contaminants, landscaped and recreational areas around the perimeter of office buildings are likely to be most important. For volatile contaminants, the footprint occupied by the building itself should also be considered.
- For **most exposure pathways**, the contamination is assumed to be at or within one metre of the surface.

The use of averaging areas must be justified on the basis of relevance to the exposure scenario. SGVs are relevant only when the exposure assumptions inherent in them are appropriate for the identified exposure averaging area. Further guidance on critical soil volumes and the consideration of averaging exposure areas can be found in:

- *Secondary model procedure for the development of appropriate soil sampling strategies for land contamination* (Environment Agency, 2000);
- *Guidance on comparing soil contamination data with a critical concentration* (CIEH/CL:AIRE, 2009).

approach is most appropriate. If statistical methods such as those presented in CIEH/CL:AIRE (2011) are to be used, sufficient data need to be available or obtained. No one single statistical approach is applicable to all sites and circumstances. The wider range of robust statistical techniques developed by organisations including the US Environmental Protection Agency (USEPA) are also important tools. Risk assessors should choose an appropriate statistical approach on the basis of the specific site and the decision that is being made. For further guidance on the appropriate use of statistical approaches, refer to USEPA 2006 or good environmental monitoring statistics textbooks.

When statistical approaches are inappropriate (this will depend on the objectives of the site investigation), individual or composite samples should be compared directly to the SGV. Guidance on use of alternative data handling approaches such as the use of composite sampling can be found in documents such as:

- *Verification of remediation of land contamination* (Environment Agency, 2010);
- *Sampling and testing of wastes to meet landfill Waste Acceptance Criteria* (Environment Agency, 2005);
- *Guidance on choosing a sampling design for environmental data collection* (USEPA, 2002);
- *Soil Quality – Sampling, ISO 10381 series* (ISO, 2002–2007).

The statistical tests should not be used as arbiters for decisions under Part 2A. They are an additional, useful line of evidence to assist in decision-making. The implications of the basis for the derivation of the site representative soil concentration must be taken into account in any decision-making process and clearly documented.

Where the statistical tests are conducted in accordance with the method described in CL:AIRE 2009:

- For the Planning situation, the regulator needs to check whether the concentration of contaminants is low compared to the SGV/SSTL. This decision is based on whether there is at least a 95% confidence level that the true mean of the dataset is lower than the SGV/SSTL.
- For the Part 2A scenario the regulator needs to determine whether the concentration of contaminants is greater than the SGV/SSTL. This decision is based on whether there is at least a 95% confidence level that the true mean of the dataset is higher than the SGV/SSTL. However, the regulator may proceed with determination if there is just a 51% probability, "on the balance of probabilities".

If the screening levels are exceeded then more sophisticated quantitative risk assessment can be undertaken or remedial action may be taken to break the contaminant linkages. The benefits of undertaking a quantitative risk assessment must be weighed against the likelihood that it will bring about cost savings in the proposed remediation. Further information about the use of soil guideline values is provided in Environment Agency : 2008: Using Soil Guideline Values SC050021/SGV Introduction, March 2008.

APPENDIX J

Summary of Chemical Test Results of Soil Samples

Bulk ACMs	Field ID	-	-	-	-	-	-	-	-	-	-	10							N/A			
Asbestos Fibres	<0.001%	-	-	-	-	Negative	-	-	-	-	-	10							N/A			
Asbestos Type		-	-	-	-	-	-	-	-	-	-	10							N/A			
Metals																						
Arsenic (total)	<2 mg/kg	8	8	7	10	11	9	9	4	8	7	10	2.82	7.3	5.8	2.0	11.0	32	Pass	SC060021*	SC060021	
Cadmium (total)	<0.8 mg/kg	0.9	1.0	1.4	2.1	1.0	1.0	2.1	0.8	0.8	1.0	10	0.59	1.4	1.7	0.6	2.1	10	Pass	SC060021*	SC060021	
Chromium (total)	<2 mg/kg	12	12	13	15	14	11	13	11	25	47	10	11.01	17.3	15.2	11.0	47.0	3010	Pass	CLEA v1.06	LQM 2009	
Copper (total)	<4 mg/kg	17	21	19	23	45	19	39	11	24	205	10	80.22	61.6	105.0	11.0	295.0	2330	Pass	CLEA v1.06	LQM 2009	
Lead (total)	<2 mg/kg	42	86	58	96	288	80	335	39	14	251	10	116.37	128.9	201.0	14.0	335.0	450	Pass	Former SGV	Former SGV	
Mercury (total inorganic)	<1 mg/kg	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	10	0.00	1.0	1.0	1.0	1.0	170	Pass	SC050021*	SC050021	
Nickel (total)	<3 mg/kg	14	17	16	20	19	16	26	11	22	33	10	6.20	10.5	23.4	11.0	33.0	130	Pass	SC050021*	SC050021	
Selenium (total)	<2 mg/kg	3	3	3	3	3	3	3	2	3	3	10	0.00	3.0	3.6	3.0	3.0	350	Pass	SC050021*	SC050021	
Zinc (total)	<3 mg/kg	75	106	104	126	249	122	291	76	75	514	10	230.33	269.6	352.8	75.0	874.0	3749	Pass	CLEA v1.06	LQM 2009	
Inorganic																						
pH Value	<0.1 %	7.2	7.8	8.3	8.4	7.2	8.0	7.1	7.1	7.1	7.8	10	0.48	7.1		6.3	7.8		N/A			
Chloride (2:1)	pH Units	-	-	-	-	10.0	-	11.0	-	-	17.0	10	3.79	12.7		10.0	17.0		N/A			
Cyanide (total)	<3 mg/kg	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	10	0.00	2.0		2.0	2.0		N/A			
Sulphate (total)	<1 mg/kg	-	-	-	-	600.0	-	707.0	-	-	622.0	10	74.27	629.3		509.0	707.0		N/A			
Sulphate (2:1)	<200 mg/kg	0.01	0.01	0.02	0.01	0.01	0.03	0.02	0.01	0.01	0.03	10	0.01	0.0		0.01	0.03		N/A			
Organic	<0.01 g/l																					
Soil Organic Matter	<0.1 %	-	-	-	-	4.8	-	4.8	-	-	10.1	10	3.12	6.5		4.5	10.1		N/A			
TOC	<0.1 %	-	-	-	-	2.4	-	2.8	-	-	5.9	10	1.82	3.8		2.5	5.9		N/A			
Phenols (Total Monohydric)	<1 mg/kg	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	10	0.00	2.0		2.0	2.0	210	Pass	CLEA v1.06	SC050021	
PAH																						
Naphthalene	<0.1 mg/kg	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.13	10	0.03	0.1		0.1	0.2	1.54	Pass	CLEA v1.06	LQM 2009	
Acenaphthylene	<0.1 mg/kg	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	10	0.00	0.1		0.1	0.1	168	Pass	CLEA v1.06	LQM 2009	
Acenaphthene	<0.1 mg/kg	0.10	0.10	0.10	0.10	0.10	0.10	0.27	0.19	0.18	0.10	10	0.06	0.1		0.1	0.3	205	Pass	CLEA v1.06	LQM 2009	
Fluorene	<0.1 mg/kg	0.10	0.10	0.10	0.10	0.10	0.10	0.29	0.20	0.16	0.10	10	0.06	0.1		0.1	0.3	168	Pass	CLEA v1.06	LQM 2009	
Phenanthrene	<0.1 mg/kg	0.10	0.10	0.10	0.10	0.61	0.10	2.29	1.48	1.45	0.35	10	0.79	0.7		0.1	2.3	92	Pass	CLEA v1.06	LQM 2009	
Anthracene	<0.1 mg/kg	0.10	0.10	0.10	0.10	0.15	0.10	0.62	0.28	0.29	0.11	10	0.17	0.2		0.1	0.6	2360	Pass	CLEA v1.06	LQM 2009	
Fluoranthene	<0.1 mg/kg	0.10	0.10	0.10	0.10	1.68	0.10	2.60	2.80	2.42	0.59	10	1.35	1.1		0.1	2.6	257	Pass	CLEA v1.06	LQM 2009	
Pyrene	<0.1 mg/kg	0.10	0.10	0.10	0.10	1.55	0.10	1.92	2.10	1.93	0.64	10	0.90	0.9		0.1	2.1	563	Pass	CLEA v1.06	LQM 2009	
Benz[a]anthracene	<0.1 mg/kg	0.10	0.10	0.10	0.10	0.75	0.10	0.97	0.84	0.95	0.24	10	0.37	0.4		0.1	0.9	3.1	Pass	CLEA v1.06	LQM 2009	
Chrysene	<0.1 mg/kg	0.10	0.10	0.10	0.10	0.84	0.10	0.92	0.97	1.08	0.10	10	0.44	0.4		0.1	1.1	6	Pass	CLEA v1.06	LQM 2009	
Benzo(b)fluoranthene	<0.1 mg/kg	0.10	0.10	0.10	0.10	0.86	0.10	0.85	0.84	1.13	0.37	10	0.43	0.5		0.1	1.1	5.8	Pass	CLEA v1.06	LQM 2009	
Benzo(k)fluoranthene	<0.1 mg/kg	0.10	0.10	0.10	0.10	0.32	0.10	0.29	0.34	0.42	0.68	10	0.17	0.2		0.1	0.6	8.5	Pass	CLEA v1.06	LQM 2009	
Benzo(a)pyrene	<0.1 mg/kg	0.10	0.10	0.10	0.10	0.66	0.10	0.64	0.67	0.76	0.59	10	0.29	0.4		0.1	0.8	0.83	Pass	CLEA v1.06	LQM 2009	
Indeno(1,2,3-c,d)pyrene	<0.1 mg/kg	0.10	0.10	0.10	0.10	0.33	0.10	0.30	0.31	0.52	0.47	10	0.17	0.2		0.1	0.5	3.2	Pass	CLEA v1.06	LQM 2009	
Dibenz(a,h)anthracene	<0.1 mg/kg	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	10	0.00	0.1		0.1	0.1	0.76	Pass	CLEA v1.06	LQM 2009	
Benzo(ghi)perylene	<0.1 mg/kg	0.10	0.10	0.10	0.10	0.26	0.10	0.27	0.25	0.43	0.64	10	0.16	0.2		0.1	0.6	44	Pass	CLEA v1.06	LQM 2009	
Coronene	<0.1 mg/kg	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	10	0.00	0.1		0.1	0.1	88.1	Pass	CLEA v1.06	LQM 2009	
Total City Waste PAHs	<1 mg/kg	1.0	1.0	1.0	1.0	3.8	1.0	3.9	4.1	4.8	2.2	10	1.57	2.4		1.0	4.8		N/A			
Total Dutch -10 PAHs	<10 mg/kg	1.0	1.0	1.0	1.0	5.7	1.0	8.7	7.8	8.4	3.7	10	3.40	3.8		1.0	8.7		N/A			
Total EPA-16 PAHs	<16 mg/kg	1.6	1.6	1.6	1.6	6.1	1.6	12.0	11.0	11.8	4.7	10	4.63	5.5		1.6	12.0		N/A			
Total WAC-17 PAHs	<17 mg/kg	1.7	1.7	1.7	1.7	6.1	1.7	12.0	11.0	11.8	4.7	10	4.59	5.4		1.7	12.0		N/A			
BTEX																						
Benzene	<0.882 mg/kg	-	-	-	-	0.002	-	0.002	-	-	0.002	10	0	0.00		0.00	0.00	0.078	Pass	CLEA v1.06	SC050021	
Toluene	<6.865 mg/kg	-	-	-	-	0.005	-	0.005	-	-	0.005	10	0	0.01		0.01	0.01	110	Pass	CLEA v1.06	SC050021	
Ethyl Benzene	<0.01 mg/kg	-	-	-	-	0.01	-	0.01	-	-	0.01	10	0	0.01		0.01	0.01	65.2	Pass	CLEA v1.06	SC050021	
Xylene (m & p)	<0.01 mg/kg	-	-	-	-	0.01	-	0.01	-	-	0.01	10	0	0.01		0.01	0.01	41.7	Pass	CLEA v1.06	SC050021	
Xylene (o)	<0.01 mg/kg	-	-	-	-	0.01	-	0.01	-	-	0.01	10	0	0.01		0.01	0.01	45.2	Pass	CLEA v1.06	SC050021	
TPH																						
DRO (C$_{10}$ - C$_{28}$)	<8 mg/kg	-	-	-	-	10.0	-	8.0	-	-	91.0	10	47.35	36.3		8.0	91.0		N/A			
Oil (C$_{28}$ - C$_{40}$)	<8 mg/kg	-	-	-	-	12.0	-	12.0	-	-	1660.0	10	693.74	529.0		12.0	1660.0		N/A			
Mineral Oil (C$_{10}$ - C$_{40}$)	<8 mg/kg	-	-	-	-	8.0	-	8.0	-	-	567.0	10	281.63	226.3		8.0	567.0		N/A			
Aliphatic+Aromatic C$_5$-C$_{35}$	<24 mg/kg	-	-	-	-	24.0	-	24.0	-	-	1000.0	10	561.49	348.3		24.0	1000.0		N/A			
Aliphatic >C$_5$ - C$_6$	<0.01 mg/kg	-	-	-	-	0.01	-	0.01	-	-	0.01	10	0.00	0.0		0.0	0.0	30	Pass	CLEA v1.06	LQM 2009	
Aliphatic >C$_6$ - C$_8$	<0.05 mg/kg	-	-	-	-	0.05	-	0.05	-	-	0.05	10	0.00	0.1		0.1	0.1	73	Pass	CLEA v1.06	LQM 2009	
Aliphatic >C$_8$ - C$_{10}$	<1 mg/kg	-	-	-	-	1.0	-	1.0	-	-	1.0	10	0.00	1.0		1.0	1.0	19	Pass	CLEA v1.06	LQM 2009	
Aliphatic >C$_{10}$ - C$_{12}$	<1 mg/kg	-	-	-	-	1.0	-	1.0	-	-	1.0	10	0.00	1.0		1.0	1.0	93	Pass	CLEA v1.06	LQM 2009	
Aliphatic >C$_{12}$ - C$_{16}$	<1 mg/kg	-	-	-	-	1.0	-	1.0	-	-	1.0	10	0.00	1.0		1.0	1.0	740	Pass	CLEA v1.06	LQM 2009	
Aliphatic >C$_{16}$ - C$_{21}$	<1 mg/kg	-	-	-	-	1.0	-	1.0	-	-	10.0	10	5.20	4.0		1.0	10.8	45000	Pass	CLEA v1.06	LQM 2009	
Aliphatic >C$_{21}$ - C$_{35}$	<8 mg/kg	-	-	-	-	8.0	-	8.0	-	-	562.0	10	321.01	191.9		8.0	562.0	46000	Pass	CLEA v1.06	LQM 2009	
Total Aliphatic >C$_5$ - C$_{35}$	<12 mg/kg	-	-	-	-	12.0	-	12.0	-	-	671.0	10	332.74	198.3		12.0	671.0		N/A			
Aromatic C$_5$ - C$_7$	<0.01 mg/kg	-	-	-	-	0.01	-	0.01	-	-	0.01	10	0.00	0.0		0.0	0.0	65	Pass	CLEA v1.06	LQM 2009	
Aromatic >C$_7$ - C$_8$	<0.05 mg/kg	-	-	-	-	0.05	-	0.05	-	-	0.05	10	0.00	0.1		0.1	0.1	120	Pass	CLEA v1.06	LQM 2009	
Aromatic >C$_8$ - C$_{10}$	<1 mg/kg	-	-	-	-	1.0	-	1.0	-	-	1.0	10	0.00	1.0		1.0	1.0	27	Pass	CLEA v1.06	LQM 2009	
Aromatic >C$_{10}$ - C$_{12}$	<1 mg/kg	-	-	-	-	1.0	-	1.0	-	-	1.0	10	0.00	1.0		1.0	1.0	69	Pass	CLEA v1.06	LQM 2009	
Aromatic >C$_{12}$ - C$_{16}$	<1 mg/kg	-	-	-	-	1.0	-	1.0	-	-	1.0	10	0.00	1.0		1.0	1.0	140	Pass	CLEA v1.06	LQM 2009	
Aromatic >C$_{16}$ - C$_{21}$	<1 mg/kg	-	-	-	-	1.0	-	1.0	-	-	7.0	10	3.46	3.0		1.0	7.0	250	Pass	CLEA v1.06	LQM 2009	
Aromatic >C$_{21}$ - C$_{35}$	<8 mg/kg	-	-	-	-	12.0	-	12.0	-	-	421.0	10	236.14	148.5		12.0	421.0	890	Pass	CLEA v1.06	LQM 2009	
Total Aromatic >C$_5$ - C$_{35}$	<12 mg/kg	-	-	-	-	12.0	-	12.0	-	-	429.0	10	240.18	150.7		12.0	429.0		N/A			

ND	Below Detection Limits.
	No suspected bulk asbestos containing materials detected on site through visual assessment
	Exceeded Threshold Criteria
	Exceeded Threshold Criteria for Phytotoxicity

Notes

1. Generic Qualitative Assessment Criteria have been used where appropriate based on the current CLEA 1.06 Model (default values, sandy loam 1%SOM). Where no CLEA generic guideline value has been calculated no assessment has been made. The maximum and mean concentrations shown is to provide a reasonable prediction of the range of data rather than to provide any detailed statistical appraisal.
2. When the test result is recorded as being less than the detection limit, the result used for the analysis is the detection limit.
3. Cyanide (total)*, in the absence of a GQAC based on current CLEA 1.06 Model, the Atrisk Soil Value for Cyanide (free) has been used.
4. For metals, where an SGV has been published, this value has been used. Note that the published SGVs do not include the residential without plant uptake scenario. CLEA v1.06 has therefore been used to derive GACs for this scenario. For organics, CLEA v1.06 has been used as the SGV assumes 6% SOM)

APPENDIX K

Current Guidance for Controlled Waters Risk Assessment

CURRENT GUIDANCE FOR CONTROLLED WATERS RISK ASSESSMENT

1995 [1], which came into force in England on 1 April 2000. The main objective of introducing the Part IIA regime is to provide an improved system for the identification and remediation of land where contamination is causing unacceptable risks to human health, controlled waters or the wider environment given the current use and circumstances of the land. Part IIA provides a statutory definition of contaminated land under Section 78A(2) 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:*
>
> *(a) Significant harm is being caused or there is a significant possibility of such harm being caused; or*
>
> *(b) Pollution of controlled waters is being, or is likely to be, caused."*

Part IIA provides a statutory definition of the pollution of controlled waters under Section 78A(9) as:

> *"the entry into controlled waters of **any** poisonous, noxious or polluting matter or **any** solid waste matter"*

Part IIA is supported by a substantial quantity of guidance and other Regulations, especially for England, The Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, 2012) which came into force in early April 2012. The document re-confirms the duties of Enforcing Authorities in dealing with contamination including the role of the Environment Agency which has powers under Part 7 of The Water Resources Act (1991) to take action to prevent or remedy the pollution of controlled waters, including circumstances where the pollution arises from contamination in the land.

Part IIA introduces the concept of a contaminant linkage; where for potential harm to exist there must be a connection between the source of the hazard and the receptor via a pathway. Risk assessment in contaminated land is therefore directed towards identifying the contaminants, pathways and receptors that can provide contaminant linkages. This is known as the contaminant-pathway-receptor link (CPR or contaminant linkage).

Part IIA places contaminated land responsibility as a part of the planning and redevelopment process rather than Local Authority or Environment Agency taking direct action except in situations of very high pollution risk or where harm is occurring. In the planning process guidance is provided by National Planning Policy Framework (NPPF) of March 2012. This requires that a site which has been developed shall not be capable of being determined "contaminated land" under Part IIA. Therefore, appropriate risk-based investigation is required to identify the contaminant linkages that can then be assessed, and then mitigated using methods that can be readily agreed with the planners.

Environment Agency Guidance

Legislation and guidance surrounding the protection of controlled waters in the UK is numerous and can be complex. The Environment Agency's overall position on groundwater is *"To protect and manage groundwater resources for present and future generation in ways that are appropriate for the risks that we identify"* (Groundwater Protection : Policy and Practice GP3, 2012). In brief, the core objectives of the existing legislation serve to enforce this position.

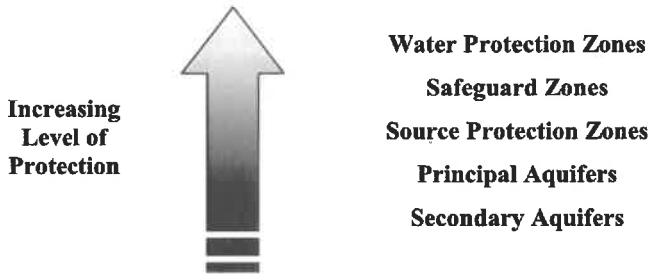
In 1992, the National Rivers Authority published their Policy and Practice for the Protection of Groundwater (PPPG), this document was influential as it provided a focus for key developments such as Source Protection Zones (SPZs) and Groundwater Vulnerability Maps. The Policy was then revised in 1998, since which there have been substantial changes in legislation, driven by Europe. Key European Directives relating to groundwater include the Groundwater Directive (80/68/EEC) and the Water Framework Directive (2000/60/EC). Aspects of these directives are controlled

by primary UK legislation such as the Water Resources Act 1991 as amended by the Water Act 2003. Further to legislative changes, gaps identified in the 1998 PPPG required addressing. These changes are reflected in the Environment Agency Policy document *Groundwater Protection: Policy and Practice (GP3), Version 1* of November 2012. The following diagram indicates the three main parts of GP3:



Structure of GP3

The Environment Agency follows a tiered, risk based approach to drinking water protection and this should be taken into account when carrying out controlled waters risk assessment:



Tools available for Risk Assessment of Controlled Waters

In order for a developer of a potentially contaminated site to fulfil their obligations under the legislation, a site assessment would be required to be undertaken in order to identify any potential risks to controlled waters and to derive suitable clean-up criteria if necessary to ensure the protection of controlled waters. A number of tools are available for this purpose and the general approach is detailed further in Part 3 of GP3.

Three main stages apply to any risk assessment of controlled waters, these are:

i) Risk Screening (devise Conceptual Site Model, making reference to groundwater vulnerability maps, site setting etc)
ii) Generic Risk Assessment (EA Remedial Targets Methodology Tier 1 / Comparison of groundwater data with relevant standards)
iii) Detailed Quantitative Risk Assessment (Consideration of aquifer properties and site specific parameters, EA Remedial Targets Methodology Tiers 2 & 3)

The process is summarised below (Taken from the Environment Agency GP3 draft consultation document, 2006):

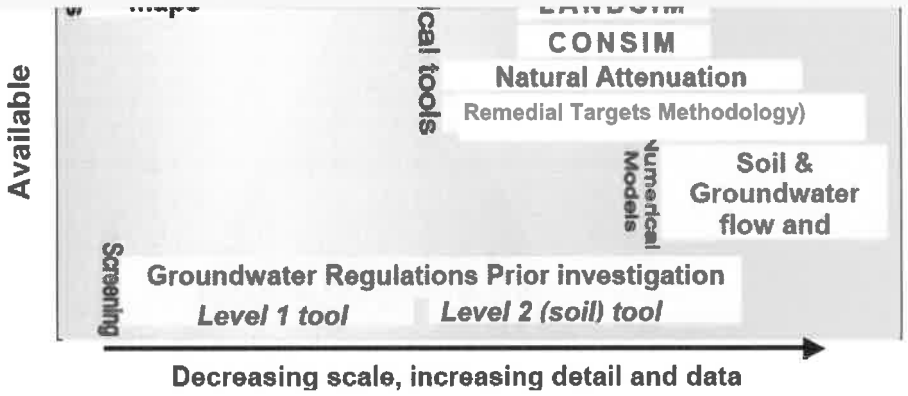


Figure 1-1 Environment Agency groundwater assessment tools, mapped against the different levels of risk assessment.

When assessing groundwater impact the Environment Agency advocate the application of their framework methodology "Remedial Targets Methodology – Hydrogeological Risk Assessment for Land Contamination" Environment Agency (2006). The methodology has four tiers of assessment:

> **Tier 1** utilises either a soil concentration (calculation of pore water concentrations based on partitioning calculations), leaching test or pore-water concentration of perched water as a source concentration input and these are contrasted directly to water quality standards. No dilution or attenuation is considered at Level 1.
>
> **Tier 2 (groundwater)** considers dilution of the contaminant within the underlying receiving groundwater or surface water body. To determine a dilution factor the infiltration rate of pore water and the discharge of groundwater beneath the source must be determined. Level 2 Assessment is comprises a comparison between measured groundwater concentrations with to water quality standards.
>
> **Tier 3** considers natural attenuation in the form of dispersion, retardation and degradation of the contaminant. As the levels are progressed, the assessment becomes increasingly more detailed and less conservative as the data requirements are increased with each successive tier. The Environment Agency has released Excel Worksheets to carry out basic calculations using a conservative approach up to Tier 3. However, in this case the conceptual model is a simple one and assumes there is a simple migration of contaminants from the source zone into the aquifer receptor. Using these worksheets requires a sensitivity analysis showing how by varying each parameter, what effect it might have on the outcome of the assessment. Groundwater conceptual models are not always this simple.
>
> **Tier 4** is for more complex conceptual models where multiple sources, multiple pathways, multiple receptors and complex water balances can be assessed. The Tier 4 assessment is not supported by the RTM software.

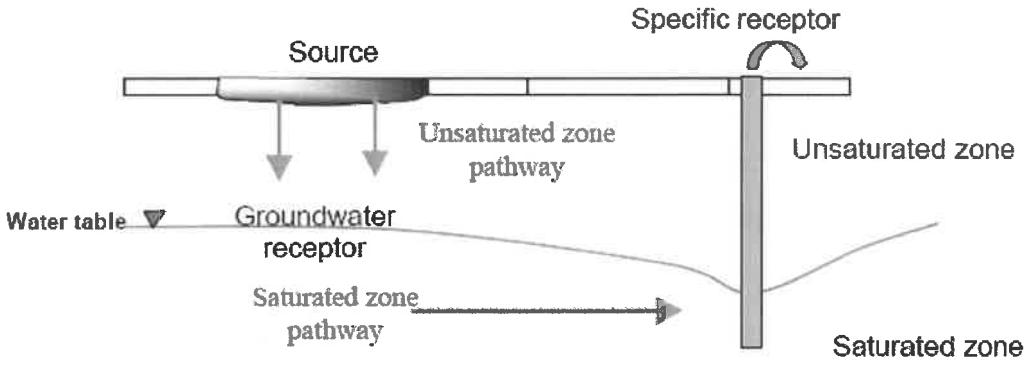
A slightly more advanced program, ConSim 2, developed on behalf of the Environment Agency, allows for the introduction of additional geological horizons and is used mainly to determine whether soil contaminants will reach their target within a specified timeframe. This model as inbuilt sensitivity, however, due to its greater complexity

requires more time to run. The overall approach and basic calculations required within the Remedial Targets Methodology framework are incorporated within ConSim 2. These models assess only the dissolved phase contaminants. There are many further models commercially available for use in controlled waters risk assessment, particularly for more complex situations, however, these should be used with caution and only once agreement has been obtained from the Environment Agency. All have the overall aim of the protection of controlled waters.

General notes on each stage of the controlled waters risk assessment process

Risk Screening

The understanding of the Conceptual Site Model (CSM) is the key to assessing any site. Using a robust CSM, potential pathways or receptors may be screened out from any further assessment at an early stage. For example if the pathway through the unsaturated zone is blocked by the presence of a significant thickness of low permeability clay. A greater understanding of the CSM is achieved with each tier of risk assessment. An example of a basic Source-Pathway-Receptor concept is given below (taken from the Environment Agency GP3, 2012):



Generic Risk Assessment

When undertaking the Generic Hydrogeological Risk Assessment (EA Remedial Targets Methodology Tier 1), comparison of chemical analytical results is made with screening criteria. Published values of screening criteria with which chemical test results can be compared are published in the following guidance:

- Updated Recommendations on Environmental Technical Standards, River Basin Management (2015-21), April 2012 by the UK Technical Advisory Group on the Water Framework Directive;
- Environmental Quality Standards (EQS) for freshwaters based on The EC Dangerous Substances Directive (76/464/EEC and Daughter Directives);
- Surface Waters (Abstraction for Drinking Water)(Classification) Regulations (1996)
- Surface Waters (Fishlife) (Classification) Regulations (1997)
- UK Drinking Water Standards (DWS) (Water Supply (Water Quality) Regulations 2000);
- Dutch Ministry of Housing, Spatial Planning and Environment (2001) Intervention Values and Target Values – soil quality standards;
- World Health Organisation Guidelines for Drinking Water (2004)

Should the Level 1 or 2 assessments indicate threshold levels to be exceeded, then there are three alternative ways in which to proceed:

- To devise suitable remedial solutions;

- To carry out more investigation, sampling and analysis;

The decision to carry out a DQRA will be dependant on the extent and implications of the initial qualitative and generic assessment. The scope of any such assessment will be accurately defined by the outcomes of the former two stages. The CSM will be sufficiently refined by this stage that only certain contaminants of concern, certain pathways and certain receptors will require further assessment, the remainder having been screened out.

Additional site specific data is normally required for this stage of assessment, as explained above, more processes that are capable of affecting contaminant concentrations are considered (such as dilution and attenuation).

Remediation criteria derived will therefore be specific to each site and will be based on a detailed assessment of the potential impact at the identified receptor or *compliance point*. A greater level of confidence can be placed on the predicted impact on the compliance point following a DQRA.

Definition of Controlled Waters

The term 'controlled waters' is defined in Section 104 of the Water Resources Act 1991 as:

> *"Territorial Waters...which extend seawards for three miles..., coastal waters..., inland freshwaters, waters in any relevant lake or pond or of so much of any relevant river or watercourse as is above the freshwater limit, and ground waters, that is to say, any waters contained in underground strata."*

Note that the definition of groundwater under the Water Resources Act 1991 includes all water within underground strata (including soil / pore water in the unsaturated zone). The definition of groundwater under the Groundwater Directive however is limited to water in the saturated zone. For the purposes of Part IIA of the Environmental Protection Act 1990, the Environment Agency recommends that the groundwater within the saturated zone only is considered as the receptor (rather than soil / pore water).

Environment Agency's Aquifer Designations

The Environment Agency have classified different types of aquifer from which groundwater can be extracted. The aquifer designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems. The aquifer designation data is based on geological mapping provided by the British Geological Survey.

The maps are split into two different types of aquifer designation:

- **Superficial (Drift)** – permeable unconsolidated (loose) deposits.
- **Bedrock** – solid permeable formations e.g. sandstone, chalk, limestone.

The aquifer designations displayed on the Environment Agency maps are as follows:

- **Principal Aquifers (formerly termed Major Aquifers)** – These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as a major aquifer.

- **Secondary Aquifers (formerly termed Minor Aquifers)** – These include a wide range of rock layers or drift deposits with an equally wide range of water permeability and storage. Secondary aquifers are subdivided into two types:

  - **Secondary A** - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers;

  - **Secondary B** - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

  - **Secondary Undifferentiated** - has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

- **Unproductive Strata (formerly termed Non-Aquifer)** – These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Hazardous and Non Hazardous Substances

The Groundwater (England and Wales) Regulations 2009 control the disposal to the hydrogeological environment of potentially polluting substances which are divided into Hazardous Substances and Non-hazardous Contaminants (this roughly approximates to the former List 1 and List 2 substances).

Hazardous Substances are the most damaging and toxic and must be prevented from directly or indirectly entering the groundwater environment. Hazardous Substances include mineral oils and hydrocarbons, pesticides, biocides, herbicides, solvents and some metals. Discharge of Hazardous Substances to Controlled Waters must be prevented.

Non-hazardous Pollutants are any contaminants other than Hazardous Substances. Non-hazardous Pollutants are potentially toxic but are less harmful than Hazardous Substances, but their direct discharge to groundwater is generally not permitted and any indirect discharge to groundwater must be limited and be controlled by technical precautions in order to prevent pollution. Non-hazardous Pollutants include ammonia and nitrites, many metals and fluorides.

APPENDIX L

Summary of Chemical Test Results of Water & Leachate Samples

Job No: 1906
Site: Dale View
Summary of Groundwater- Tier 2 Screening

TerraConsult

Sample Location	Units	Drinking Water Standard	EQS Freshwater	Other	12/10/13 WS1 Water	12/10/13 WS2 Water	12/10/13 WS3 Water	12/10/13 WS4 Water
Water Quality - Laboratory Analysis								
pH	pH units	-	-	-	8.3	8.3	8.3	8.3
Electrical Conductivity	uS/cm	-	-	-	780	570	670	2700
Metals								
Arsenic	µg/l	10	50	50	5.5	9.5	9.9	5.4
Boron	µg/l	1000	2000	-	13	36	<10	13
Cadmium	µg/l	5	5	5	0.26	0.67	0.69	0.09
Chromium (Total)	µg/l	50	50*	-	12	18	19	22
Copper	µg/l	2000	28*	28	5.8	4.8	1.8	1
Lead	µg/l	25	20*	-	0.4	<0.3	<0.3	<0.3
Mercury	µg/l	1	1	-	<0.05	<0.05	<0.05	<0.05
Nickel	µg/l	20	200*	200	13	9	10	9
Selenium	µg/l	10	-	10	1	4.1	4.8	1.3
Zinc	µg/l	5000	125*	500	9	8	9	6
Inorganic								
Sulphate	mg/l	250	400	250	28	61	56	23
Ammoniacal Nitrogen as N	mg/l	-	0.015	1.50				<0.05
Unionized Ammonia as N**	mg/l	-	0.015	1.50	0.004	0.003	0.003	-
Nitrate	mg/l	-	50	-	<0.5	<0.5	<0.5	<0.5
Total Cyanide	mg/l	0.05	-	0.07	<0.05	<0.05	<0.05	<0.05
Organics								
Total Phenols	µg/l	50	30	30	<0.5	<0.5	<0.5	<0.5
PAH								
Total 16 PAH	µg/l	-	-	-	0.23	0.02	0.08	0.15
Naphthalene	µg/l	10[2]	10	10	0.04	0.02	0.03	0.02
Acenaphthylene	µg/l	-	-	-	<0.01	<0.01	0.02	<0.01
Acenaphthene	µg/l	-	-	-	<0.01	<0.01	<0.01	<0.01
Fluorene	µg/l	-	-	-	<0.01	<0.01	<0.01	<0.01
Phenanthrene	µg/l	-	-	-	0.03	<0.01	<0.01	<0.01
Anthracene	µg/l	-	0.40	-	<0.01	<0.01	<0.01	<0.01
Fluoranthene	µg/l	-	0.10	-	0.02	<0.01	<0.01	<0.01
Pyrene	µg/l	-	-	-	0.03	<0.01	<0.01	0.01
Benzo[a]anthracene	µg/l	-	-	-	0.02	<0.01	<0.01	0.01
Chrysene	µg/l	-	-	-	0.02	<0.01	<0.01	<0.01
Benzo[b]fluoranthene	µg/l	-	0.03	-	0.02	<0.01	0.01	0.02
Benzo[k]fluoranthene	µg/l	-	0.03	-	<0.01	<0.01	<0.01	0.02
Benzo[a]pyrene	µg/l	0.01	-	0.01		<0.01	<0.01	
indeno[1,2,3-cd]pyrene	µg/l	-	-	-	0.01	<0.01	<0.01	0.02
dibenzo[a,h]anthracene	µg/l	-	-	-	0.02	<0.01	<0.01	<0.01
Benzo[ghi]perylene	µg/l	-	0.002	-		<0.01	<0.01	
BTEX								
Benzene	µg/l	1.00	30	10	<1	<1	<1	<1
Toluene	µg/l	-	50	700	<1	<1	<1	<1
ethylbenzene	µg/l	-	20	300	<1	<1	<1	<1
m/p xylene	µg/l	-	30	500	<1	<1	<1	<1
p xylene	µg/l	-	30	500	<1	<1	<1	<1
MTBE	µg/l	-	-	-	<1	<1	<1	<1
TPH								
TPH (C5-C6 aliphatic)	µg/l	10	-	-	<0.010	<0.010	<0.010	<0.010
TPH (C6-C8 aliphatic)	µg/l	10	-	-	<0.010	<0.010	<0.010	<0.010
TPH (C8-C10 aliphatic)	µg/l	10	-	-	<0.010	<0.010	<0.010	<0.010
TPH DW(C10-C12 aliphatic)	µg/l	10	-	-	<0.01	<0.01	<0.01	<0.01
TPH DW(C12-C16 aliphatic)	µg/l	10	-	-	<0.01	<0.01	<0.01	<0.01
TPH DW(C16-C21 aliphatic)	µg/l	10	-	-	<0.01	<0.01	<0.01	<0.01
TPH DW(C21-C35 aliphatic)	µg/l	10	-	-	<0.01	<0.01	<0.01	<0.01
TPH (C35-C40 aliphatic)	µg/l	10	-	-	<0.01	<0.01	<0.01	<0.01
TPH (C6-C7 aromatic)	µg/l	10	-	-	<0.010	<0.010	<0.010	<0.010
TPH (C7-C8 aromatic)	µg/l	10	-	-	<0.010	<0.010	<0.010	<0.010
TPH (C8-C10 aromatic)	µg/l	10	-	-	<0.010	<0.010	<0.010	<0.010
TPH DW(C10-C12 aromatic)	µg/l	10	-	-	<0.01	<0.01	<0.01	<0.01
TPH DW(C12-C16 aromatic)	µg/l	10	-	-	<0.01	<0.01	<0.01	<0.01
TPH DW(C16-C21 aromatic)	µg/l	10	-	-	<0.01	<0.01	<0.01	<0.01
TPH DW(C21-C35 aromatic)	µg/l	10	-	-	<0.01	<0.01	<0.01	<0.01
TPH (C35-C40 aromatic)	µg/l	10	-	-	<0.01	<0.01	<0.01	<0.01
"Total" Hydrocarbons (C10-C40)	µg/l	10	-	50	<0.01	<0.01	<0.01	<0.01

Note:

Fail: Above UK EQS

Above Drinking water but below EQS

Pass: Result below Detection Limit

* EQS for substances based on >100-150 mg/l CaCO3 Hardness band and Cyprinid designation for receiving water

** Calculated from ammoniacal nitrogen and pH results using an assumed water temperature of 10 degrees.

Total of 4 Drinking Water Standard PAHs: Benzo[b]fluoranthene, Benzo[k]fluoranthene, Indeno[1,2,3-cd]pyrene, Benzo[ghi]perylene

APPENDIX M

Current Guidance for Ground Gas Risk Assessment

Current Guidance for Ground Gas Risk Assessment

Origin of Ground and Landfill Gases

When carrying out a ground gas risk assessment, the origin or source of the gases is important as potential risks will vary depending on the source. This Appendix relates to the risk of the two main ground gases of concern: methane and carbon dioxide, and does not apply to other ground gases (e.g. radon or vapours from hydrocarbon spills). Methane and carbon dioxide are major constituents of landfill gas but can also occur from a variety of anthropogenic and natural sources, as summarised in Table G1 below:

Table G1. Potential Sources of Ground Gases

Gas	Source	Comments
Landfill Gas	Anaerobic decomposition of degradable waste within landfill sites. Typically 60% methane and 40% carbon dioxide during methanogenic phase.	Composition varies over time, particularly in early stages. Contains a range of minor constituents (particularly carbon monoxide and hydrogen sulphide).
Landfill Associated Gases	- Anaerobic degradation of leachate external to the site; - Degassing of dissolved gases in groundwater; - Evolution of gases following interaction between leachate and groundwater	Can result in secondary (external) production of methane or carbon dioxide.
Made Ground	Anaerobic degradation of organic components	Very variable depending on source
Sewer Gas, Cess Pits	Anaerobic degradation of organic components of sewage producing methane and carbon dioxide.	Often characterised by hydrogen sulphide odour.
Mains Gas	Leakage from underground pipework or storage tanks. Mainly methane but often contains higher alkanes.	An odouriser is added to permit detection of leaks. Typically 90% CH_4, but 1 to 27% C_2-C_4 alkanes, May also contain other trace gases e.g. CO, helium and CO_2 (from degradation of CH_4 in the ground).
Other Anthropogenic Sources	- Degradation of leaked or spilled hydrocarbons or other industrial chemicals; - Anaerobic degradation of organic contaminants in groundwaters (e.g. silage liquor); - Reactions between monitoring well construction components and environment; - Burial grounds/cemeteries.	Hydrocarbon spillages often have an 'oily' odour. Fuel spillages common – Petrol or Diesel and can contain a wide range of VOC's. Can degrade to produce methane / carbon dioxide.
Alluvium / Marsh / Peat Gas	Anaerobic microbial degradation of organic material (usually waterlogged vegetation / peat). Often associated with the presence of alluvial deposits or dredgings.	
Geogenic Gas	Natural seepages of carbon dioxide and hydrocarbon gases derived from geologic sources such as coal seams and deep oil / gas source formations. Can be present in solution in groundwaters.	Methane most common but can contain carbon dioxide and higher alkanes.
Mine Gases	Various types. Most common is "fire damp" with high methane, produced by the desorption of gas trapped in coal. "Black damp" (Stythe gas) with high carbon dioxide and denser than air. "White damp" is high in carbon monoxide.	Methane most common. Can contain higher alkanes, carbon dioxide and carbon monoxide. Often low in oxygen.
Natural Shallow Ground Gas	Various types - high carbon dioxide formed by subsurface aerobic activity leading to depleted oxygen and elevated carbon dioxide; - chemical degradation of rocks (e.g. carbonates) producing carbon dioxide; - carbon dioxide production in root zone of soils by plants.	Gases can be emitted from ground under falling barometric pressure conditions.

This Appendix concentrates on the assessment of risk from methane and carbon dioxide. This Appendix does not provide guidance for the assessment of risk when other gases are present due to 'Other Sources'

1. [illegible];
2. Ground conditions (geology, hydrogeology, anthropogenic pathways etc);
3. Properties of gases present including:
   - Chemical composition;
   - Physical properties;
   - Ratios of components e.g. methane : carbon dioxide.
4. Timeframe of activities such as infilling periods, capping works, installation of gas control systems etc.

Identification of the originating source may be problematic given that there may be more than one source present and trace gas analysis may be required. Identification of the sources of the gases encountered during monitoring is usually carried out through a process of eliminating the most unlikely potential sources (given the site setting) and selecting those which are the more likely candidates.

Hazards Associated with Presence of Ground Gases

Methane gas is combustible and potentially explosive. When the concentration of methane in air is between the limits of 5.0%v/v and 15.0%v/v an explosive mixture is formed. The Lower Explosive Limit (LEL) of methane is 5.0%v/v, which is equivalent to 100% LEL. The 15.0%v/v limit is known as the Upper Explosive Limit (UEL), but concentrations above this level cannot be assumed to represent safe concentrations. Further, the LEL and UEL will vary (up and down) depending upon the proportion of other gases (including oxygen). However, the fact that methane is a colourless, odourless gas means that there is no simple indicator of the presence of the gas until such a time as explosive limits are reached and an incident occurs. Methane is lighter than air and has a low toxicity. However, at high concentrations it can result in asphyxiation due to oxygen displacement.

Carbon dioxide is a colourless, odourless gas, which, although non-flammable, is both toxic and an asphyxiant. As carbon dioxide is denser than air, it will collect in low points and depressions. The UK Health & Safety Executive (HSE) has published information relating to concentrations of carbon dioxide that humans may be exposed to, which uses concentrations contained in the Control of Substances Hazardous to Health Regulations 2002 (as amended). These are the Long Term Occupational Exposure Limit (LTOEL, 8 hour period) and the Short Term Occupational Exposure Limit (STOEL, 15 minute period), which are 0.5% and 1.5% carbon dioxide, respectively.

Parameters Influencing the Rate of Ground Gas Production

Figure G2 is taken from EA guidance document LFTGN 03 illustrates typical ground gas generation curves from biodegradable materials:

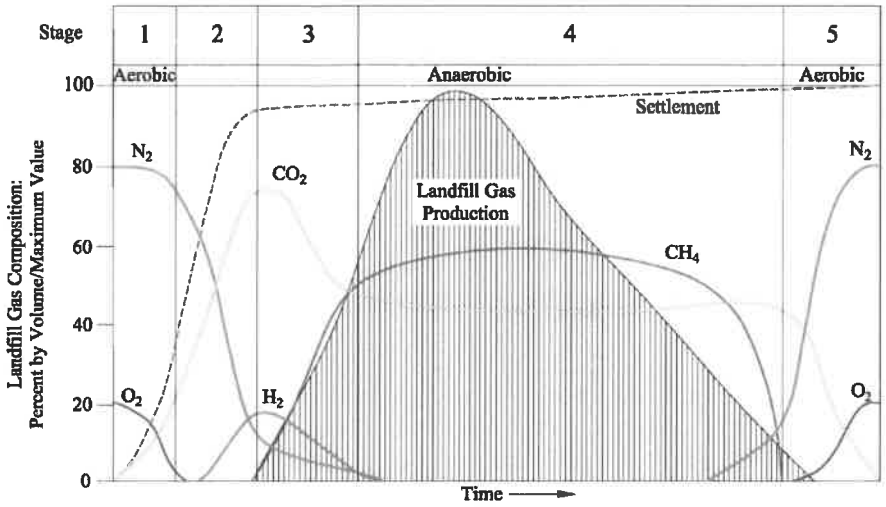


Figure G2. Idealised Representation of Landfill Gas Generation.

The production of methane and carbon dioxide at a landfill site may be expected to be considerable and ongoing. Concentrations of methane will eventually decrease, followed by concentrations of carbon dioxide, but the duration and rate of gas production can vary markedly between sites. Five distinct phases of gas production occur during the process which are, in order of event (as marked on Figure G2), as follows:

1. An aerobic phase involving oxygen depletion and temperature increase through aerobic respiration;
2. The establishment of anaerobic conditions and the evolution of carbon dioxide and hydrogen through acidogenic activity;
3. Commencement of methanogenic activity; the establishment of populations of methanogenic bacteria;
4. A phase of stable methanogenic activity, which may go on for many tens of years;
5. A phase of decreasing methanogenic activity, representing depletion of the organic material and a return to aerobic conditions.

The time scale for the return to the normal ground gas concentrations will be highly variable, depending upon the types and quantities of materials present. In addition, the optimum parameters influencing the rate of decomposition and ground gas production within the ground at a site are as follows:

- High water content with adequate rainfall and water infiltration to provide moisture content between approximately 20 to 26%;
- Conditions that either are or are very close to anaerobic;
- High proportion of biodegradable materials;
- A pH between 6.5 and 8.5, ideally verging slightly on the acidic between pH 6 to 7;
- Temperature between 25°C and 55°C;
- The ratio of the biochemical and chemical oxygen demands (BOD:COD);
- High permeability;
- Small particle size, as finer subsurface materials possess a greater surface area to provide a growing 'face' for the micro-organisms but high fines levels reduces permeability and reduces decomposition rate.

For this reason, it is vital that sources of methane and carbon dioxide are identified prior to the

Factors Influencing the Migration and Behaviour of Ground Gases

There are many factors that influence the migration of ground gases which can effect the risk from a gassing source:

- driving force – pressure differential along a pathway, diffusion and dissolved in solution;
- meteorological conditions – short term and seasonal conditions including atmospheric pressure changes (e.g. rapidly falling pressure causes gas to expand increasing emission rates), rainfall, frozen ground and thawing, temperature;
- geological and groundwater conditions – these can have the over riding influence on the direction/pathways and quantity of migrating gas;
- anthropogenic influences – man-made pathways include mine shafts, service runs/drains, foundation piles, underground voids/pits/basements, foundation/building design/construction

Guidance Documents

Currently in the UK, there are no statutory threshold limits for hazardous gases in the ground as site specific variables mean that standard threshold values cannot be applied. The published guidance relating to development of sites where methane and carbon dioxide are present has been produced in response to building projects on or close to landfill sites, as both gases are principal constituents of landfill gas. Much of the historic guidance that has been produced on gas risk assessment focused on landfill sites and as a result there has previously been a lack of clarity when relating the process to gas conditions on non-landfill sites.

Statutory guidance regarding methane in the ground has previously taken a limiting concentration of 1.0 % by volume methane (equal to 20% of the lower explosive limit of methane in air) above which necessary actions will be appropriate. For carbon dioxide the limiting recommended trigger was 1.5 % by volume (the Long Term Exposure Limit for carbon dioxide). Above these concentrations the Building Regulations Approved Document C (1992) stated that consideration should be given to whether actions may be appropriate, whilst more specific solutions would be likely to be necessary at concentrations greater than 5% by volume of carbon dioxide (Building Regulations Approved Document C, 1992). However, the latest fully revised version of Approved Document C (DoE, 2004) no longer endorses this approach and instead requires the use of a risk-based approach in interpreting the findings of a gas monitoring survey. Further, the latest EA documentation on landfill gas (LFTGN 03, 2004) continues to sanction the use of a risk-based approach through a structured approach to the assessment of ground gases and links with the risk assessment process outlined within CLR 11 for soil contaminants.

With the above in mind, recent guidance has been produced in 2006 and 2007 with the aim of providing up to date advice in relation to residential and commercial development. The guidance does not address issues associated with gas derived from landfills, for this refer to *"Guidance on the Management of Landfill Gas"* (Environment Agency 2004) for an overview.

Recent guidance relevant to gas assessments for residential and commercial development includes;

- **Wilson *et al.* (CIRIA C665, December 2007) *"Assessing Risks Posed by Hazardous Ground Gases for Buildings."***

  This document provides up to date advice on all aspects of ground gas risk assessment such as investigation, monitoring programmes, data collection and interpretation. The guidance presents separate methodologies for the characterisation of:

  - **All development types except low rise housing with gardens and for Low Rise Buildings without a 150mm void** (Situation A) (Table 8.5 CIRIA C665)

  and;

  - **Low rise housing with gardens with a 150mm ventilated sub-floor void** (Situation B) (Table 8.7 CIRIA C665)
    (See below for further explanation of the methods of characterisation)

- **Boyle and Witherington (NHBC / RSK Group, Report 10627-R01(04) January 2007) *"Guidance on the Evaluation of Development Proposals on Sites where Methane and Carbon Dioxide are Present."***
  This document presents the "Traffic Lights System" detailed below and is relevant only for low rise properties (e.g. bungalows and town houses) that have a ventilated sub-floor void (i.e. Situation B as described in CIRIA C665).

- **Wilson and Card (CIEH, expected 2011) *"Ground Gas Handbook for Designers and Regulators"***
  This document is expected to provide practical guidance on ground gas assessments and the design and evaluation of protection measures.

- **British Standard (BS 8485, December 2007) *"Code of Practice for the Characterization and Remediation from Ground Gas in Affected Developments"***
  This document provides an overview of gas characterisation and assessment. The Standard is intended to be used by designers of gas protection measures and regulators involved in the assessment of design solutions. The Standard provides a framework in line with CLR11 allowing designers to judge the adequacy of ground gas and related site investigation data. The document provides an approach to determine appropriate ground gas parameters that can be used to identify a range of possible construction solutions mitigating against the presence of ground gas on a development site.

Each of these documents continues to highlight the importance of, and give further guidance towards, carrying out a tiered risk-based decision-making process in accord with government policy on dealing with contamination from historic or natural sources and highlight the importance of the Conceptual Model in site characterisation. These documents also stress the importance that the assessor should be confident that the ground gas monitoring results are representative of the likely worse case ground gas regime on a site and that the data collected from the site is sufficient. With this in mind, CIRIA C665 sets out ideal monitoring periods as below.

Sensitivity / Developme						
	Moderate (Flats)	6/2	6/3	9/6	12/12	24/24
	High (Residential with Gardens)	6/3	9/6	12/6	24/12	24/24

Notes

1. First number is the number of readings and the second is the minimum period in months (e.g. 6/2 – six sets of readings over two months).

2. At least two sets of readings must be at low (preferably under 1,000 mb) and falling pressure.

3. High sensitivity end use on high or very high hazard site will not normally be acceptable unless the source is treated to reduce gassing potential.

Before the latest guidance, good practice for site characterisation had been based upon the method proposed by Wilson and Card (1999). CIRIA C665 (2007) effectively supersedes Wilson and Card (1999) and includes a modified version of the Wilson and Card method (Tables 8.5, 8.6 and Box 8.1). Gas concentrations and flow rates for either methane and/or carbon dioxide measured at a site to 'Characteristic Situations.' Appropriate protection measures are selected from Table 8.6 (if using modified Wilson & Card method) and from Box 8.4 from CIRIA C665 (if using the NHBC traffic lights method). Throughout the risk assessment process, strong regard must be given to the nature of the gassing source, the flow rates and the estimated surface emissions. Note that certain protection measures are stated in CIRIA Report 149 that are now considered wholly inappropriate to certain developments and consequently should not be used without modification. Throughout the process, it is important to remember that these tables are not intended to be used as a definitive design tool and have been prepared to show the typical scope of measures for gas control.

Both the NHBC (2007) and CIRIA (2007) guidance documents and BS 8485 (2007) propose that both ground gas concentrations and flow rates are used to calculate the limiting gas well gas volume flow rates for methane and carbon dioxide, based on the ground gas conditions monitored for during the worse-case temporal conditions. This limiting gas well volume flow rate is termed the Gas Screening Value (GSV, note that this was termed borehole gas volume flow), and is calculated as follows:

$$\textbf{GSV (l/hr)} = \frac{\text{[gas well gas concentration (\%v/v)]} \times \text{[gas well flow rate (l/hr)]}}{100}$$

These GSVs are then compared to generic 'Traffic Lights' contained within the NHBC guidance, which present typical maximum gas concentrations and limiting GSV's, for 'Situation B Development' (Low rise housing with gardens).

Table 8.7 NHBC Traffic light system for 150 mm void

Traffic light	Methane [1]		Carbon dioxide [2]	
	Typical max concentration[3] (% by volume)	Gas screening value [2,4] (litres /hour)	Typical max concentration[3] (% by volume)	Gas screening value [2,4] (litres /hour)
Green	1	0.13	5	0.78
Amber 1	5	0.63	10	1.60
Amber 2	20	1.60	30	3.10
Red				

Notes:
1. The worst-case ground gas regime identified on the site, either methane or carbon dioxide, at the worst-case temporal conditions that the site may be expected to encounter will be the decider as to what Traffic Light is allocated;
2. Borehole Gas Volume Flow Rate, in litres per hour as defined in Wilson and Card (1999), is the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered;
3. The Typical Maximum Concentrations can be exceeded in certain circumstances should the Conceptual Site Model indicate it is safe to do so;
4. The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.

Box 8.4 of CIRIA C665 Gas protection measures for low-rise housing development based upon allocated NHBC Traffic light (Boyle and Witherington, 2007)

Traffic Light Classification	Protection Measures Required
Green	Negligible gas regime identified and gas protection measures are not considered necessary.
Amber 1	Low to intermediate gas regime identified, which requires low-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to limit the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414. Ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours.
Amber 2	Intermediate to high gas regime identified, which requires high-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to prevent the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414. Membranes should always be fitted by a specialist Contractor. As with Amber 1, ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours. Certification that these passive protection measures have been installed correctly should be provided.
Red	High gas regime identified. It is considered that standard residential housing would not normally be acceptable without a further Gas Risk Assessment and/or possible remedial mitigation measures to reduce and/or remove the source of gas.

For a 'Situation A Development' (All development except low rise housing with gardens), the GSV value

Situation (CIRIA R149)	Technology gas Regime (see Box 8.2)	Risk Classification	Value (CH_4 or CO_2) (l/hr)[1]	Additional Factors	Typical Source of Generation
1	A	Very low risk	<0.07	Typically methane ≤ 1% and/or carbon dioxide ≤ 5%. Otherwise consider increase to Situation 2	Natural soils with low organic content "Typical" made ground
2	B	Low risk	<0.7	Borehole air flow rate not to exceed 70l/hr. Otherwise consider increase to characteristic Situation 3	Natural soil, high peat/organic content. "Typical" made ground
3	C	Moderate risk	<3.5		Old landfill, inert waste, mineworking flooded
4	D	Moderate to high risk	<15	Quantitative risk assessment required to evaluate scope of protective measures.	Mineworking susceptible to flooding, completed landfill (WMP 26B criteria)
5	E	High risk	<70		Mineworking unflooded inactive with shallow workings near surface
6	F	Very high risk	>70		Recent landfill site

It was intended in CIRIA C665 that the characteristic situation allocated to the development from the table above would then be used in Table 8.6 of CIRIA C665 in order to determine the level of gas protection the development requires. However, BS8485:2007 superseded this document and a different set of mitigation standards were put forward.

The recommended gas protection measures should be selected based on the building type. For the majority of development situations the gas protection measures can be based on Tables 2 and 3 of BS8485:2007 (see below).

The first step in the decision making process is to obtain the level of gas protection necessary in the range 0 to 7 from Table 2. Then a combination of ventilation and /or barrier systems should be chosen from Table 3 to meet that requirement. The guidance value is allocated to reflect the risk associated with the characteristic gas situation and the combined effectiveness of the elements in Table 3. The level of gas protection necessary should take into account the characteristic gas situation and a number of other factors. The whole decision making process should be made transparent, where all parties can see the approach being taken, can understand the various steps and decisions made and be confident that a risk-assessed solution has been designed and installed commensurate with the construction and site constraints.

Where the gas situation is 4 or more (and for NHBC Red situations according to CIRIA C665), the site requires a comprehensive risk assessment to confirm the scope of protection measures. These are higher risk sites and reliance on Table 2 and 3 alone is not sufficient.

BS8485:2007 Table 2 Required gas protection by characteristic gas situation and type of building					
Characteristic Gas Situation, CS	**NHBC traffic light**	**Required gas protection**			
		Non-managed property e.g. private housing	**Public building (a)**	**Commercial buildings**	**Industrial buildings (b)**
1	*Green*	0	0	0	0
2	*Amber 1*	3	3	2	1 (c)
3	*Amber 2*	4	3	2	2
4	*Red*	6 (d)	5(d)	4	3
5			6(e)	5	4
6				7	6
NOTE Traffic light indications are taken from NHBC Report no.:10627-RO1 (04) and are mainly applicable to low-rise residential housing[1]. These are for comparative purposes but the boundaries between the traffic light indications and CS values do not coincide.					
a) Public buildings include, for example, managed apartments, schools and hospitals.					
b) Industrial buildings are generally open and well ventilated. However, areas such as office pods might require a separate assessment and may be classified as commercial buildings and require a different scope of gas protection to the main building.					
c) Maximum methane concentration 20% otherwise consider and increase to CS3,					
d) Residential building on higher traffic light/CS sites is not recommended unless the type of construction or site circumstances allow additional levels of protection to be incorporated, e.g. high-performance ventilation or pathway intervention measures, and an associated sustainable system of management of maintenance of the gas control system, e.g. in institutional and/or fully serviced contractual situations.					
e) Consideration of issues such as ease of evacuation and how false alarms will be handled are needed when completing the design specification of any gas protection scheme.					

[1] The NHBC guidance and CIRIA C665 guidance refers to low rise housing (which is up to three storeys without lifts) that is constructed with a 150mm ventilated sub-floor void.

For a site which is impacted by migratory gases from an off-source, the development may be protected by imposing pathway intervention methods, which if successfully validated, could also remove the need for further analysis. It is essential that the gas regime in these circumstances has been fully characterised and that the only source impacting the site is located off site and that the pathway is clearly defined and its interception equally proven before construction commences. Pathway intervention methods may include vertical membrane installations, venting trenches, rows of stone columns, activated trenches and various proprietary systems. These systems are particularly relevant to domestic housing where there is limited scope for foundation type solutions.

Having selected the appropriate gas protection for the building from Table 2, an element, or combination of elements should be chosen from Table 3a, Table 3b, Table 3c and Table 3d, and combined to achieve the required gas protection. A combination of elements should be chosen where high gas protection is required, unless professional judgement and risk assessment show otherwise. The scores are not proportionate and are not to be taken as an indication of relative quantitative performance. This method relies upon the method developed in CIRIA C665 and is intended to be consistent with the CIRIA approach while developing the principle. As such, minor inconsistencies in result might be observed between the two methods.

BS8485:2007 Table 3 Solution Scores

PROTECTION ELEMENT/SYSTEM		SCORE	COMMENTS
Subfloor ventilation with active abstraction/pressurization (venting layer can be a clear void or formed using gravel, geocomposites, polystyrene void formers, etc.)[A]		2.5	*There have to be robust management systems in place to ensure the continued maintenance of any ventilation system. Active ventilation can always be designed to meet good performance.*
Ventilated car park (basement or undercroft)		4	*Mechanically assisted systems come in two forms: extraction and positive pressurization.*
b) Barriers			
Floor slabs			
Block and beam floor slab		0	*It is good practice to install ventilation in all foundation systems to effect pressure relief as a minimum. Breaches in floor slabs such as joints have to be effectively sealed against gas ingress in order to maintain these performances.*
Reinforced concrete ground bearing slab		0.5	
Reinforced concrete ground bearing foundation raft with limited service penetrations that are cast into slab		1.5	
Reinforced concrete cast in situ suspended floor slab with minimal service penetrations and water bars around all slab penetrations and at joints		1.5	
Fully tanked basement		2	
c) Membranes			
Taped and sealed membrane to reasonable levels of workmanship/in line with current good practice with validation [B,C]		0.5	*The performance of membranes is heavily dependent on the quality of design of the installation, resistance to damage after installation, and the integrity of joints.*
Proprietary gas resistant membrane to reasonable levels of workmanship /in line with good practice under independent inspection (CQA)[B,C]		1	
Proprietary gas resistant membrane installed to reasonable levels of workmanship/in line with current good practice under CQA with integrity testing and independent validation		2	
d) Monitoring and detection (not applicable to non-managed property, or in isolation)			
Intermittent monitoring using hand held equipment		0.5	*Where fitted, permanent monitoring systems ought to be installed in the underfloor venting/dilution system in the first instance but can also be provided within the occupied space as a fail safe.*
Permanent monitoring and alarm system [A]	Installed in the underfloor venting/dilution system	2	
	Installed in the building	1	
e) Pathway Intervention			
Pathway intervention		-	*This can consist of site protection measures for off-site or on-site sources (see Annex A, BS8485)*

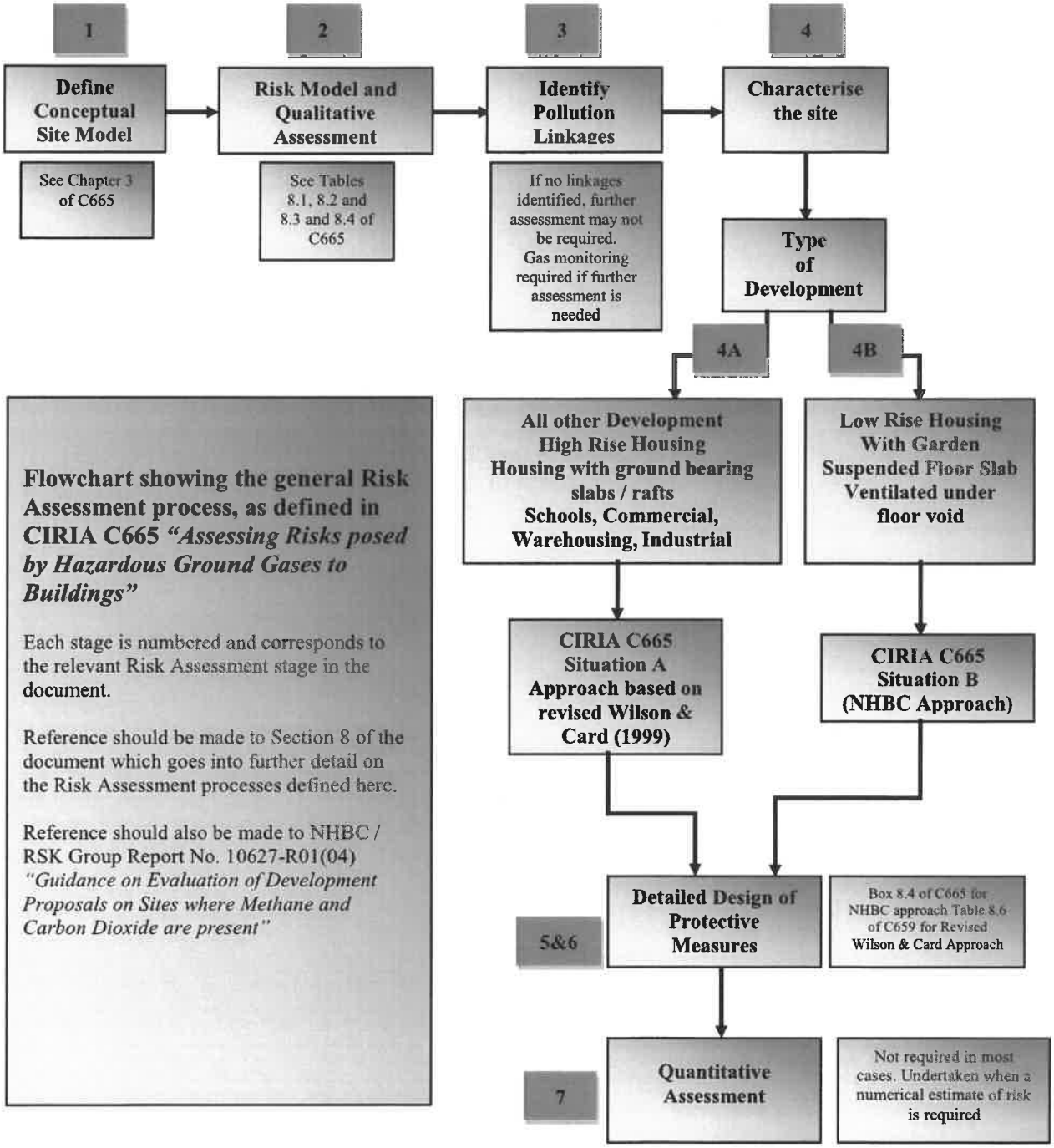
NOTE In practice the choice of materials might well rely on factors such as construction method and the risk of damage after installation. It is important to ensure that the chosen combination gives an appropriate level of protection

A) It is possible to test ventilation systems by installing monitoring probes for post installation validation.

B) If a 1 200g DPM material is to function as a gas barrier it should be installed according to BRE 212 /BRE 414 being taped and sealed to all penetrations

C) Polymeric Materials> 1200 g (proportional to thickness) but their physical properties mean that they are more robust and resistant to damage.

To summarise the main stages in the risk assessment process set out in CIRIA C665 and followed by TerraConsult are as follows:



APPENDIX N

Summary of Guidance for Classification of Soil as a Waste Material

Guidance for Classification of Soil for Off Site Disposal at a Landfill Site

Many site developments create a portion of excess soils and Made Ground which if not re-usable, are required to be disposed off site at a suitably licensed landfill site. The regulations and associated guidance published by the Environment Agency is relatively complex and lengthy. This guidance provides a summary of the following documents which should be referred to when assessing soil (and common constituents found within Made Ground on remediation sites) for off site disposal:

- Guidance for Waste destined for disposal in landfills: Interpretation of the Waste Acceptance Requirements of the Landfill (England and Wales) Regulations 2002 (as amended) (EA, 2004);
- Guidance on Sampling and Testing of Wastes to Meet Landfill Waste Acceptance Procedures (EA, April 2005);
- WM2 - Hazardous Waste: Interpretation of the Definition and Classification of Hazardous Wastes Version 3 (EA, May 2013 and October 2013 errata);
- Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 (CHIP4);
- Guidance on Waste Destined for Disposal in Landfill (EA, June 2006);
- Treatment of Non-hazardous wastes for Landfill (EA, February 2007).

It is important to distinguish between the waste classification system and the designation of materials as "suitable for use" on site. A material may be retained on site for an appropriate end use if that end-use is clearly designated and that a site-specific risk assessment ensures that it does not pose a risk to human health or controlled waters. However, if this material is excavated and sent for disposal, the material is then subject to waste management regulations and the two systems cannot be directly correlated. It is therefore important to note that classifying a material as hazardous (should it be excavated and become a waste) does not necessarily indicate that it might not be suitable to be kept on site for re-use. Separate guidance in the form of a Code of Practice (CL:AIRE Version 2, 2011) has been developed jointly between the development industry and the Environment Agency to provide best practice when assessing whether materials are wastes or not, and for determining when waste can cease to be waste for a particular use.

In accordance with the current waste regulations (or Landfill Directive, as they are more commonly known), from 30th October 2007 all waste materials produced from construction sites have to be pre-treated prior to disposal. Pre-treatment includes waste minimisation, recovery (e.g. separation of demolition waste to be used as hardcore) and separation of materials into different waste categories (e.g. separate inert waste from hazardous waste etc). Mixing of different waste types shall be avoided and intentional mixing of inert materials with hazardous waste to 'dilute it' and hence change its waste classification, is illegal.

The current waste regulations (based on the EU landfill directive) introduced a two tier classification system for waste materials, defining them as either being hazardous or non-hazardous. Landfills are licensed to take wastes based on a three tier classification system with the non- hazardous waste divided into two sum-categories:

- Non-Hazardous - inert:

Made Ground with their waste codes are summarised below (this is not a complete

Waste Code	What is it?	Likely Waste Category–		
		Inert Waste	Non-Hazardous	Hazardous Waste
17 01 01 Concrete	Concrete, possibly with reinforcement (from Construction & Demolition)	✓		
17 01 02 Bricks		✓		
17 01 06* Mixtures of concrete, bricks, tiles & ceramics containing dangerous substances	These are not normally considered hazardous but if they are contaminated (e.g. by asbestos) then could be hazardous – see comment above			✓
17 01 07 Mixtures of concrete, bricks, tiles & ceramics other than those in 17 01 06	This is mixed inerts c.f. 17 09 04	✓		
17 05 03* soils and stones containing dangerous substances				✓
17 05 04 soils and stones other than those mentioned in 17 05 03	Soil and stones only (excluding top soil, peat, soil and stones from contaminated sites)	✓		
17 06 05* Construction materials containing asbestos	e.g. corrugated asbestos sheeting			✓
17 08 02 Gypsum-based construction materials other than those mentioned in 17 08 01	Plaster & plasterboard (although specific disposal requirements are required for high sulphate waste – see EA guidance 'Understanding the Landfill Directive' version 1.0 March 2010.		✓	
17 09 01* Construction & demolition wastes containing mercury				✓
17 09 02* Construction & demolition wastes containing PCBs	Waste with more than 50 mg/kg of PCB's are hazardous			✓
17 09 03* Other mixed construction & demolition wastes containing dangerous substances	Broad range of potentially (see notes below – if asterix the waste is hazardous) hazardous wastes			✓
17 09 04 Mixed construction & demolition wastes other than those mentioned in 17 09 01, 17 09 02 & 17 09 03	Mixed inerts with soil, tarmac, cables, vegetation, plaster, etc. (this waste can only be considered inert if it passes the waste acceptance criteria identified in the regulations).	✓	✓	

Note: all wastes with an asterix code are hazardous regardless of whether they are mirror or absolute entries in the EWC list the decision to with regard to composition must come before applying the code for mirror entries.

Some materials are classified as Inert Waste based in its origin (e.g. 17 01 01 Concrete, or glass) without any requirement for laboratory chemical analysis.

However, most soils will require laboratory testing to confirm whether they are classified as Hazardous Waste. The protocol for assessing these materials and the appropriate threshold values is complicated and are set out in the Environment Agency's "Technical Guidance *WM2* Hazardous Waste – Interpretation of the Definition and Classification of Hazardous Waste" Version 3 (2013). If the test results for the waste indicates that it is not hazardous then further analysis of the waste is required to determine whether it is Inert Waste. If the waste does not meet the criteria for either Hazardous or Inert, then it is by default classified as Non-hazardous Waste.

As an alternative location to landfills for off-site disposal of inert and non-hazardous waste, there are a number of sites which have Waste Permit Exemptions that can accept certain categories of inert and non-hazardous wastes. Additionally some quarries can accept certain types of wastes to be used for quarry restoration material. For both alternatives to disposal at landfill sites the material still requires chemical testing as these sites have site specific acceptance criteria for wastes. It should also be noted that these types of site do not incur landfill tax which in the 2013/14 tax year is £2.50 for inactive waste (inert and some types of non-hazardous waste) and £72.00/Tonne for active waste (some types of non-hazardous waste and hazardous waste and for 2014/15 the landfill tax for active waste will be £80.00/Tonne. Note that the Inland Revenue uses a different classification scheme for waste for tax purposes to the European Waste Classification scheme.

Waste Categorisation

The process of determining the category of wastes is a three stage process:

- Stage 1 – is the waste either Hazardous or Inert by definition without the requirement for chemical analysis (if it is then Stages 2 and 3 are not required);
- Stage 2 - Waste characterisation;
- Stage 3 - WAC classification.

Waste characterisation determines if a waste is hazardous or not. Excavated soil is characterised using a system based on the contaminants present and their hazardous properties. The system uses total concentrations of the contaminants. Thresholds (as a percentage of the waste) have been set for the various hazardous properties.

Fourteen hazardous properties together with other scenarios where material could cause a hazard have been defined:

- Hazardous properties: explosive, oxidising, highly flammable/flammable, irritant, harmful, toxic, carcinogenic, corrosive, infectious, toxic for reproduction, mutagenic and ecotoxic;
- Substances which can release toxic/very toxic gases in contact with water, acid or air;
- Substances which, after disposal, can yield another substance, e.g. a leachate, which possesses any of the above hazardous properties.

Some of the hazardous properties are sub-divided e.g. there are three categories of carcinogenic, mutagenic and toxic for reproduction substances. The hazardous properties were originally defined in the European

Hazardous Waste Directive 91/689/EC. Should a waste contain a contaminant with one or more of the [illegible] at a concentration equal to or above the threshold value for the particular

- Hydrocarbons – this is probably the most common reason for the hazardous classification of soils. For most soils hydrocarbon analysis will be required for both Polycyclic Aromatic Hydrocarbons (PAH) and speciated Petroleum Hydrocarbons (PHCs) but depending on the site's history other groups of organic contaminants may also be is included in any analysis suite for soil samples;
- Metals – Particularly sites from former metal processing or mining sites and also some types of ash have metal concentrations that are sufficiently high to characterise materials requiring disposal as hazardous waste.
- Asbestos;
- Anions – e.g. sulphate in plasterboard (there are special disposal requirements for high sulphate waste and specific WAC requirements); it is possible that sulphate salts of metals and semi-metals could make the waste hazardous – the sulphate concentration could possibly be significant under H12, H13 and H14.

The characterisation of wastes with significant metal concentrations involves some processing of the analysis data. The chemical analysis results for inorganic substances are generally reported as total concentrations e.g. total lead, total arsenic, total sulphate etc. However, CHIP4 (2009) deals with the hazardous properties of actual compounds e.g. lead sulphate, arsenic pentoxide, nickel carbonate. Therefore, the total metal results have to be converted into assessed chemical analysis results for the compound most likely to be present in the soil samples. For example, if the sample contains high total lead concentrations and high sulphate concentrations, then the lead is likely to be present in the soil as lead sulphate. The most likely compounds can often be determined from a desk study or previous site uses. If the site has been derelict for a number of years, consideration should be given as to whether water soluble compounds should or should not be chosen, as rainfall could have removed them from the soil (this does not apply if the soil has been taken from below under a concrete slab etc). Chemical knowledge and common sense needs to be used in choosing a suitable compound.

If no data is available, then a worst case scenario has to be assumed and the most hazardous compound likely to be present has to be chosen. For example, metal chromates (lead chromate, nickel chromate) are often the most hazardous compounds formed by many metals, but if the chromium concentrations in the soil are low, chromates are unlikely to be present. It should also be noted that for many of the hazard categories, the cumulative hazard from different compounds is added (e.g. add the concentrations of the copper, lead and zinc compounds together to assess the Hazard Category H14 Ecotoxicity).

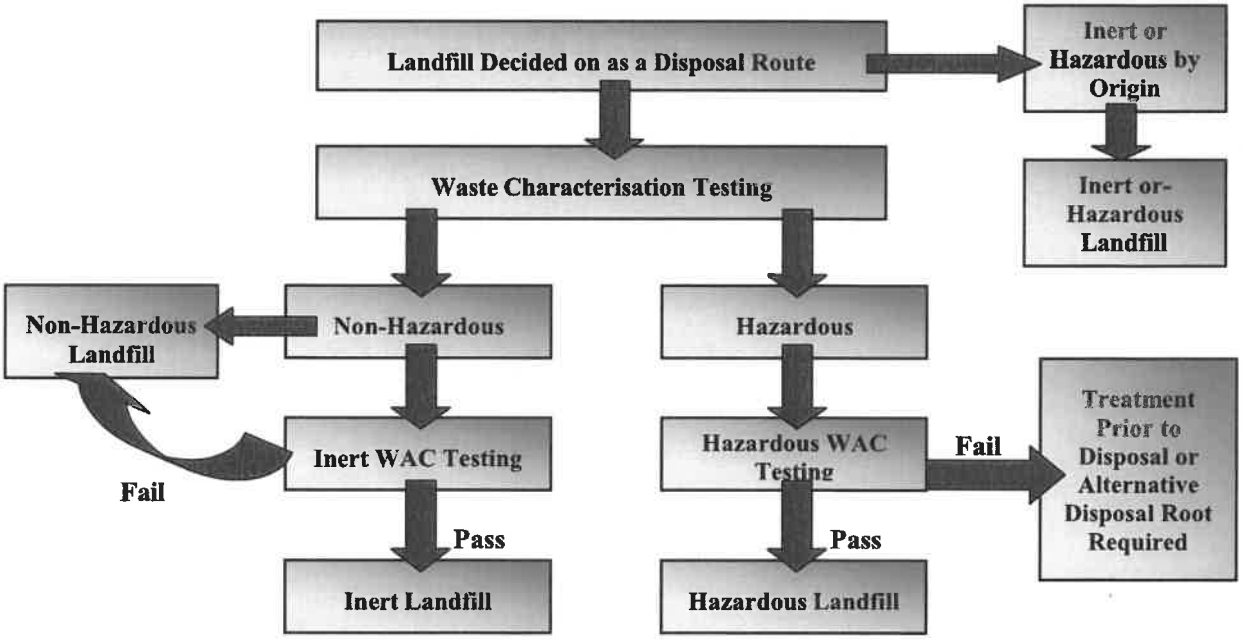
If the results of the above assessment determine that the waste is hazardous, it must then be analysed for the Waste Acceptance Criteria (WAC) analysis contained within appropriate Environmental Permitting Regulations (this comprises mainly leachate but also analysis for TOC and Loss on ignition). WAC limit values have been set for the listed determinands. If any of the determinands exceed their limit value, the waste must be pre-treated to reduce concentrations to below the limit values before the waste may be disposed of at a landfill site licensed to take hazardous waste.

For waste classified as not being hazardous, then there are two options available. Currently, waste correctly characterised as not being hazardous may be disposed of without WAC testing to a non-hazardous landfill. Alternatively WAC testing for Inert Waste can be carried out (this is similar to the list for hazardous waste with the addition of PAH's, BTEX and Mineral Oil). If the results pass the Inert WAC criteria it can be disposed of at an Inert Waste Landfill. If any of the WAC test results exceed the Inert WAC criteria the waste has to be disposed at a non- hazardous landfill. There are WAC limits for non-hazardous waste set for pH and TOC. If these two criteria are not met then the waste must be pre-treated to so that it meets the criteria before it can be disposed.

If materials fail the WAC criteria they can be pre-treated on site or taken to a soil treatment centre for pre-treatment (such as at the facility run by Biffa at Risley near Warrington). Here the soil's hazardous properties may be reduced (e.g. by bioremediation of hydrocarbons).

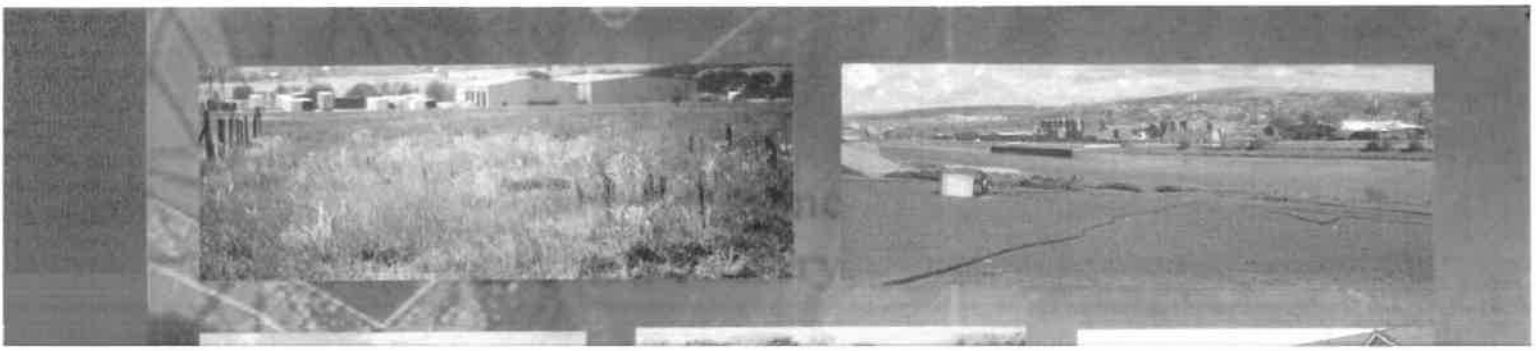
It should be noted that in order to dispose of Hazardous Waste, the site must register as a producer of Hazardous Waste with the Environment Agency. When disposing of waste materials to landfill sites the appropriate Duty of Care Waste Transfer procedures must be followed.

Landfilled Waste Decision Tree



Landfill Tax

It should be noted that HM Revenue and Customs (HMRC) classify wastes for tax purposes using a different scheme to the three fold landfill EU Landfill Directive scheme (i.e. the hazardous, non-hazardous and inert). HMRC have a two fold system for landfill tax. The Standard Landfill Tax is currently £72/T (rising by £8/T per year) and applies to all wastes unless they qualify for the reduced rate of landfill tax of £2.50/T. The wastes that qualify for the reduced rate of Landfill Tax are set out in The Landfill Tax (Qualifying Material) Order 2011 with supplementary information on the interpretation of these regulations in HMRS "Notice LFT1 – A General Guide to Landfill Tax" (May 2012) and HMRC Briefing Notes 15/12 and 18/12.







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