Report type:	Environmental Appraisal
Site:	Common Farm, Barton Road, Carlton, Leicestershire
Client:	HSSP Architects
Ref:	GRM/P4635/F.1
Date:	August 2008

GRM is a trading name of GRM Development Solutions Limited

Site Appraisal for
Common Farm, Carlton

SUMMARY OF RECOMMENDATIONS

Where further assessment is required it is indicated with a "Y" in the right hand column		
Proposed Development	Redevelopment of existing barns into 1 storey houses with associated gardens	N
CONTAMINATION ASSESSMENT - REMEDIATION / WASTE DISPOSAL		
End Users	Yes - Hotspot removal required	Y
Site Workers	No	N
Construction Materials	No (consult water authority)	Y
Groundwater	No	N
Surface Water	No	N
Waste Disposal (may include soils, asbestos, oil drums, chemical containers, etc)	Client has a duty of care to ensure that all waste is disposed appropriately to a licensed landfill. The landfill receiving the waste may request additional 'WAC' testing analysis. Waste characterisation can only be confirmed by the landfill site.	
Other Comments	None	N

This summary is based on the full report that provides the detailed assessment of the ground risks affecting the development and how to manage them. It should not be used in isolation.

GRM is a trading name of GRM Development Solutions Limited

TABLE OF CONTENTS

1 INTRODUCTION....1
2 PHASE I DESK STUDY AND SITE OBSERVATIONS....3
3 SUMMARY OF POTENTIAL ENVIRONMENTAL HAZARDS....9
4 PHASE I CONCEPTUAL MODEL....11
5 PHASE II GROUND INVESTIGATION....13
6 QUANTITATIVE RISK ASSESSMENT – HUMAN HEALTH....16
7 QUANTITATIVE RISK ASSESSMENT - CONTROLLED WATERS....19
8 QUANTITATIVE RISK ASSESSMENT - CONSTRUCTION MATERIALS....20
9 PHASE II CONCEPTUAL MODEL....21
10 FURTHER INVESTIGATION....26
13 CONCLUSIONS....27

GRM is a trading name of GRM Development Solutions Limited

APPENDICES

Proposed Development Layout	Appendix A
Site Location and Boundary Plan	Appendix B
Historical OS Maps	Appendix C
Environmental Data Report (Summary & Extracts)	Appendix D
Exploratory Hole Location Plan	Appendix E
Trial Pit Logs	Appendix F
GRM Contaminant Screening Values	Appendix G
Chemical Laboratory Analysis Results SOILS	Appendix H
Statistical Analysis of Chemical Laboratory Results	Appendix I

GRM is a trading name of GRM Development Solutions Limited

1 INTRODUCTION

1.1 PREAMBLE

GRM Development Solutions Limited (GRM) has been appointed by HSSP Architects (Client) to undertake a site appraisal comprising a desk study and ground investigation.

The desk study and site inspection form 'Phase I' of the assessment and allows the geo-environmental setting of the site to be determined and the identification of areas of particular concern that require targeted investigation. The 'Phase II' works comprise the intrusive ground investigation and chemical analysis. The information gained from the Phase II works will be used to refine the conceptual model for the site and determine the most cost effective development solutions for the site.

Although the desk study information was assessed prior to the intrusive investigation works, time constraints have meant that it has not been possible to produce a separate desk study report. Therefore, for ease of reading and efficiency, the Phase I and Phase II aspects of the appraisal are combined within this document.

The Client proposes to redevelop the existing barns on site into residential properties with associated gardens. A proposed development layout is provided in Appendix A.

This site appraisal is intended to provide information that will assist decision making by identifying and recommending solutions to contamination issues only. No geotechnical/foundation assessment has been undertaken.

GRM standard limitations of reporting are provided on the back cover of this report.

Potential General Hazard(s) reported by the Client include:
None

Potential Receptor(s) communicated by the Client include:
Residential end users

Potential Contamination Source(s) communicated by the Client include:
None

1.2 OBJECTIVES OF THE SITE APPRAISAL

The principal aims of the Site Appraisal were as follows:

a) Obtain information, from easily accessible sources, about the soil and groundwater conditions within the area of the site.

b) Determine the possible ground related contamination hazards within the site boundaries that may affect the proposed development.

c) Provide preliminary development recommendations.

d) Provide advice on further works required for the cost-effective reduction of risks to the development and procedures likely to satisfy regulators.

Whilst every effort has been made to pre-empt the likely requirements of the Local Planning Authority and the Environment Agency, they are likely to have specific requirements that will need to be discussed and addressed at a later date.

2 PHASE I DESK STUDY AND SITE OBSERVATIONS

2.1 INFORMATION SOURCES

The following sources have been used for the identification and assessment of potential ground hazards:

- Relevant British Standards
- British Geological Survey (BGS) Geology Map Scale 1:50 000 Sheet 155 Coalville
- Environment Agency Groundwater Vulnerability Map 1:100000 Sheet 23 Leicestershire
- Historical Ordnance Survey (OS) Maps
- Environmental Data Supplier (Groundsure)
- Environment Agency Website: http://www.environment-agency.gov.uk/
- DEFRA/Environment Agency R&D Publication CLR documents and DoE Industry Profiles
- BRE Guide BR211 (2007), Radon: Guidance on protective measures for new buildings
- HPA-RPD-033 (2007), Indicative Atlas of Radon in England and Wales
- NRPB Publication W26, Radon Atlas of England and Wales, 2002
- Client supplied information including: the location of the site and past site usage.

Other technical references used throughout this document are detailed in the text.

2.2 SITE DESCRIPTION

2.2.1 Geographical Setting

The site is approximately 1.5km north of Market Bosworth town centre. The National Grid Reference (NGR) for the approximate centre of the site is SK 403 047. A location plan is provided in Appendix B.

The site covers an area of approximately 0.09 hectares. The north western boundary is formed by open fields and the south eastern boundary by a commercial development. The south western boundary is formed by residential development and the north eastern boundary by derelict farm buildings.

The site presently comprises derelict farm buildings (which are in the process of being redeveloped) and concrete hardstanding.

The topography of the site is flat lying.

2.2.2 Site Inspection Observations

The ground surface of the site is covered by concrete hardstanding, which is in a poor state of repair.

Building structures on site included derelict animal farm buildings. The condition of the buildings is poor, with roofs missing, warped beams, the floors are in a poor state of repair and the walls are uneven (confirmed by building contractors).

There are no services (either underground or overhead), tanks or vegetation within the site boundaries.

Potential General Hazard(s) identified during site inspection:
Derelict buildings – considered unstable

Potential Receptor(s) identified during site inspection:
None

Potential Contamination Source(s) identified during site inspection:
None

2.3 HISTORICAL DEVELOPMENT OF THE SITE

A review of the available historical Ordnance Survey (OS) maps gives an insight into the development of the site and highlights any potential hazards. Extracts of these maps are provided in Appendix C. Relevant differences between each edition are highlighted below.

1885: The earliest map reviewed shows the site as part of Common Farm, surrounded by open fields. A stream is recorded 230m south of the site. The village of Carlton is recorded 750m west of the site.

1886: The site and surrounding area appear to remain largely unchanged. Three buildings are recorded, 2 on the site and 1 adjacent to the site.

1903: A further building is recorded on site and a 2nd is recorded adjacent to the site.

1904: The site and surrounding area appear to remain largely unchanged. A pump is recorded adjacent to site.

1950: The site and surrounding area appear to remain largely unchanged.

1957: The site and surrounding area appear to remain largely unchanged.

1966: The site and surrounding area appear to remain largely unchanged.

1980: Two further buildings, adjacent to the site, are recorded within the farm development.

2002: The site and surrounding area appear to remain largely unchanged.

2005: The site and surrounding area appear to remain largely unchanged.

2007: The site and surrounding area appear to remain largely unchanged.

The hazards identified are summarised in the table below.

Potential General Hazard(s) identified on OS Maps:
Farm buildings

Potential Receptor(s) identified on OS Maps:
Stream (off site)

Potential Contamination Source(s) identified on OS Maps:
Made Ground associated with previous land use as a farm (contamination/ground gas)

2.4 ANTICIPATED GEOLOGY

The BGS Geological Sheet for this area shows superficial deposits of Sand and Gravel Deposits over Solid geology of Mercia Mudstone Group.

The geological memoir for the area describes the Mercia Mudstone as reddish brown mudstone and silty mudstone with subordinate bands of sandstone and siltstone.

Made Ground, including buried foundations, can be expected within the site area due to the presence of buildings (both existing and demolished) and hardstanding from its historical development.

The site is not indicated to be directly affected by faulting; the nearest fault being further than 1km away.

Potential General Hazard(s) from geological data:
None

Potential Receptor(s) from geological data:
None

Potential Contamination Source(s) from geological data:
Made Ground – ground gas / contamination

2.5 HYDROGEOLOGICAL INFORMATION

No detailed information regarding the depths to groundwater is available. The groundwater level is likely to be subject to seasonal variations.

Information obtained from the Environment Agency groundwater vulnerability map classify the Mercia Mudstone Group as a Non-Aquifer.

There are no recorded groundwater abstraction licenses within 500m of the site.

Information from Landmark suggests the site is not recorded to be within a Source Protection Zone.

Potential General Hazard(s) from hydrogeological data:
None

Potential Receptor(s) from hydrogeological data:
None

Potential Contamination Source(s) from hydrogeological data:
None

2.6 HYDROLOGICAL INFORMATION

Local surface water features include:

- A stream approximately 230m south of the site.

The underlying geology (Mercia Mudstone Group) is considered likely to be predominately cohesive in nature and so it is considered highly unlikely that a clearly identifiable and consistent pathway between the site and the identified water feature exists.

Although the site is within 250m of an indicative fluvial floodplain (see Appendix D), the Environment Agency's Internet based flood risk maps suggest there is no risk from river flooding.

There are no surface water abstraction licenses within 1000m of the site.

Potential General Hazard(s) from hydrological data:
None

Potential Receptor(s) from hydrological data:
Stream – low risk

Potential Contamination Source(s) from hydrological data:
None

2.7 COAL MINERAL RESOURCES

The Authority's Online Directory (www.coalminingreports.co.uk) confirms that a coal mining search is not required for this site.

The geological mapping also confirms that there are no shallow coal seams beneath the site, and there will be no risk what so ever from shallow coal workings.

Potential Coal Mining Hazards:
None

2.8 OTHER MINERAL RESOURCES

There is no evidence of any non-coal mineral extraction having taken place within, or close to, the site area.

Potential Other Mining Hazards:
None recorded

2.9 ENVIRONMENTAL INFORMATION

Environmental database information has been acquired from GroundSure. There is a considerable amount of data and not all of it is relevant to this appraisal (e.g. air pollution controls). Therefore, summary sheets are provided in Appendix D. The full set of data will be held on file by GRM.

A summary of the relevant information provided is presented below:

- There are no Recorded Landfill sites, Waste Treatment Sites, Waste Management Sites or Waste Transfer Sites within 500m of the site.
- There are no recorded Control of Major Accident Hazard sites (COMAH) or Notification of Installations Handling Hazardous Substances sites (NIHHS) Planning Hazardous Substance Consents within 500m of the site.
- There are two Current Industrial Land Uses within 500m of the site, these are a moorings and unloading facilities company (125m north west) and a vehicle repair and service station (489m north west). These are considered not to have affected the site.

Potential Geo-environmental/General Hazard(s) from Environmental data:
None

Potential Receptor(s) from Environmental data:
None

Potential Contamination Source(s) from Environmental data:
None

2.10 ARCHAEOLOGY

Archaeological information has not been sought as part of this desk study and has not been identified as an issue by the Client. Some Local Authorities require at least an initial archaeological appraisal for development sites. GRM would be happy to provide contact details of suitable professionals for such work. Archaeological investigations occasionally reveal ground-related problems from ancient times (prior to the 1st Edition OS maps) and can occasionally cause foundation and contamination development hazards.

Archaeological Hazards:
Not researched

2.11 INVASIVE PLANT SPECIES / ECOLOGY

Ecological issues can have a significant effect on developments. GRM is not a specialist in this topic and has not conducted such a survey. However, GRM endeavour to report easily recognisable issues such as Japanese Knotweed, Giant Hogweed, badger sets etc, when seen on site.

If the level of disturbance of the site due to past development / demolition works has created an environment for the potential growth of such invasive plant species, then GRM will recommend that an ecological survey by a specialist company should be undertaken.

No invasive plant species were observed on the site, an ecological survey should be undertaken to confirm this assessment.

Invasive Plant Species / Ecological Hazards:
None observed

2.12 RADON GAS (DESK STUDY ASSESSMENT)

The site has been assessed following the guidelines in "Radon: guidance on protective measures for new dwellings" (BR211 2007).

The site is not within an area recorded to require Radon precautions, as shown by map 9, 'Oxfordshire, Northamptonshire and Warwickshire', of the BR211 (2007) guidance.

According to latest available information from the Health Protection Agency (HPA-RPD-033, BGS Radon Atlas), between 0% & 1% of homes are reported to have Radon levels above the 'Action Level' in this area.

The environmental report (Appendix D) suggests that based on information provided by the BGS (equivalent to a standard radon report), no radon protective measures will be required.

We suggest that **NO Radon protection measures will be required on this site**.

Radon Hazard Assessment (Desk Study):
None

3 SUMMARY OF POTENTIAL ENVIRONMENTAL HAZARDS

Potential hazards have been identified in earlier sections and are now summarised in tabular form, with their consequences and possible risk management actions.

3.1 GENERAL HAZARD(S)

General Hazard(s) are those that pose a threat to public safety, or site safety to personnel.

Potential Hazard	Consequence	Action
Existing buildings	Danger to personnel	Demolition / refurbishment required – Health & Safety guidelines

3.2 CONTAMINATION/ENVIRONMENTAL HAZARDS

These hazards have the potential to adversely affect human health, controlled waters and the built environment.

Source	Pathway	Receptor	Assessment Method
Made Ground (associated with previous site use)	Direct contact; Inhalation of contaminated dust; Consumption of vegetables	End-Users; Site workers; Water supply pipes	See section 3.4
Ground gas	Inhalation	End-Users	See section 3.4

3.3 CONTAMINANTS OF CONCERN

Based on the historical development of the site, there is no particular DoE Industry Profile available and accordingly a general screening suite has been used for contaminants covered by CLEA and common contaminants from the Industry Profiles.

Asbestos and PCBs are listed in the vast majority of profiles. PCBs are listed as the profiles expect electricity substations and switch boxes on all industrial sites. None have been recorded for this site. There is the potential for asbestos material to be mixed up with made ground, following any demolition works. Asbestos will be tested for if there is visual evidence found within the ground during the fieldwork.

There are contaminants that are generally tested for as a matter of course as their prevalence on brownfield sites is renowned. These include: arsenic, cadmium, chromium, lead, mercury, selenium, copper, nickel, zinc, phenols, cyanide (total), sulphate (water soluble), pH, and speciated PAH (polycyclic aromatic hydrocarbons).

In addition, petroleum hydrocarbons (aliphatic and aromatic bands) will be analysed if there is any evidence observed during the fieldwork.

The contaminants discussed will be compared with fieldwork observations to determine laboratory analysis suites for testing soils and waters (see later section).

4 PHASE I CONCEPTUAL MODEL

4.1 POTENTIAL SOURCE – PATHWAY – RECEPTOR

The consideration of contamination is based upon the principles of risk assessment. Risk assessment is founded upon the use of so called 'source-pathway-receptor' principles in order to establish the presence, or potential presence, of a pollutant linkage.

To create a risk, contamination must have the potential to cause harm to susceptible targets or receptors such as humans, the water environment or the built environment. The potential for harm to occur requires three conditions to be satisfied:

The presence of substances that may cause harm (SOURCE),
The presence of a target which may be harmed (RECEPTOR),
The existence of a plausible pollutant linkage between the source and the receptor (PATHWAY).

In the absence of a plausible pollutant linkage or pathway there is no risk. For this site not to pose a risk to the end-users or controlled waters the pollutant linkage must be broken.

The site consists of two former farm buildings and is approximately 0.09 hectares in area. No potential asbestos containing materials were observed on site.

Potential contaminants of concern for the whole site include those listed in Section 3.4.

The development proposals incorporate refurbishment of existing barns into residential housing and/or apartments with areas of hardstanding (e.g. car parking), domestic gardens and soft landscaping.

For end-users, the primary human health receptors are residents of the completed development and construction workers. The primary pathways of concern include dermal contact with contaminated soil and soil dust, the ingestion of contaminated soil and soil dust, ingestion of vegetables that have taken up the contamination, indoor and outdoor inhalation of ground gas and soil vapours, and migration of contamination into water supply pipes.

For controlled waters, the primary receptor for the site is the steam 230m south of the site. The primary pathways of concern are leaching of contaminants and vertical migration to the groundwater table.

The pollutant linkage model is illustrated in detail on the following page.

4.2 POLLUTANT LINKAGE MODEL

Human Health		
Source	**Pathway**	**Receptor**
Potentially contaminated Made Ground. Contaminants of concern include metals & organics.	Dermal contact with contaminated soil and soil dust, the ingestion of contaminated soil and soil dust, ingestion of vegetables that have taken up the contamination, indoor and outdoor inhalation of ground gas and soil vapours.	End-users (residents) of the completed development and construction workers.
Controlled Waters		
Potentially contaminated Made Ground. Contaminants of concern include metals & organics.	None.	Stream.
Construction Materials		
Potentially contaminated Made Ground. Contaminants of concern include metals and organics.	Migration of contamination through leaks and joints, and degradation of pipe materials.	Water Pipes.

5 PHASE II GROUND INVESTIGATION

5.1 FIELDWORK

The ground investigation (including fieldwork, sampling, and laboratory analyses) has been designed to identify and assess potential ground related problems and to allow cost effective solutions to be advised. It has been planned on the basis of the desk study, site inspection and the proposed development layout (where available). All fieldwork and soil descriptions were carried out in general accordance with relevant British Standards.

Due to site constraints the exploratory holes were positioned where possible as a result of active site works. The holes were advanced to shallow depths only to determine the potential for contamination and provide sufficient information based on the current proposed layout scheme. The resultant exploratory hole density is commensurate with the complexity of the site conditions and detail of information required for this phase of the investigation.

The exploratory hole location plan and exploratory hole logs are presented in Appendix E and Appendix F respectively. A total of 4 exploratory holes were undertaken, to a maximum depth of 1m begl.

The ground investigation fieldwork was conducted on 25th July 2008. The holes were positioned in areas that would not disrupt the construction works and at a distance from the unstable buildings.

Samples not used for testing will be stored for a month after issue of this report and then disposed of, unless the client requests in writing that they be kept.

5.2 MONITORING INSTALLATIONS

As the Phase I assessment and ground investigation have not revealed any significant potential gas sources, monitoring wells have not been installed as part of this appraisal.

5.3 PROVEN GROUND

The encountered ground conditions were:

- Concrete
- Made Ground
- Glacial Till (Superficial Deposits)

5.3.1 Concrete

The concrete was observed in all the exploratory holes to depths of between 0.15 and 0.2m.

5.3.2 Made Ground

Types of Made Ground

Various types of made ground were observed:

Made Ground A generally consisted of a brown silty clayey sand with gravel including brick and quartzite.

Made Ground B generally consisted of silty sandy clay with gravel including quartzite, ash and brick.

Possible Source(s) of Made Ground

The source of the fill is likely to be from the construction of the barns on site and the previous land use as a farm.

Distribution of Made Ground Types

The Made Ground was observed in all the trial pits to depths of between 0.30m and 0.80m, the average depth was 0.50m.

5.3.3 Superficial Deposits

Superficial deposits were interpreted as Glacial Till.

These deposits were found across the site from depths of between 0.3 and 0.8m, but generally 0.5m.

This stratum generally comprised firm to stiff brown and grey slightly silty slightly sandy CLAY and SILT with gravel including quartzite and sandstone.

5.3.4 Solid Strata

Strata representative of the Mercia Mudstone Group were not encountered.

5.4 GROUNDWATER

Groundwater (flow/seepage) was not observed in any of the exploratory holes. The techniques used were rapid and may not have allowed water to exhibit its presence.

5.5 CONTAMINATION OBSERVATIONS

Fieldwork observations (visual and olfactory)
Potential contamination was noted visually in TP3 during fieldwork, as ash at 0.20-0.40m.

5.6 SUMMARY OF FIELDWORK OBSERVATIONS

The fieldwork has revealed / confirmed the following potential hazards, receptors and sources that may not have been apparent from preceding work, which should be included when assessing the site.

Potential General Hazards identified during fieldwork
Unstable buildings

Potential Receptor(s) identified during fieldwork
None

Potential Contamination Source(s) during fieldwork
Made Ground – ash deposits

5.7 LABORATORY ANALYSES AND MONITORING RATIONALE

Chemical laboratory analyses were selected to provide the parameters necessary to make an initial assessment of potentially contaminated soils and/or waters, for the budgetary design of the development. The choice of contamination testing was based on the identified past use of the site and site observations.

The chemical laboratory analysis results are presented in Appendix G.

6 QUANTITATIVE RISK ASSESSMENT – HUMAN HEALTH

6.1 INTRODUCTION

The proposed development comprises the refurbishment of barns for residential end use.

Various sources of contamination have been put forward in earlier text and summarised in the conceptual model. The most likely contaminated material on site was observed to be Made Ground.

Representative samples of the Made Ground were collected for further examination and/or potential testing.

The Contaminated Land Report (CLR) model procedures (R&D publications CLR 7, 9, 10 and associated reports) have been used to assess the risks posed to human health. For this assessment, where available, the default Soil Guideline Values (SGVs) for 'residential land with plant uptake' have been used, i.e. a female with a start age class of one and an end age class of six. All pathways have been considered including the consumption of home-grown vegetables. This has been carried out in order to provide a precautionary screening approach to assessing the risks posed to human health.

The list of contaminants covered by specific SGVs is not comprehensive. For selected organic and inorganic contaminants, GRM have derived Tier 1 Assessment Criteria (TAC) using CLEA UK risk assessment software or have adopted WS Atkin's ATRISK^{soil} values. The ATRISK^{soil} values have been formulated using a version of the BP RISC 4.0 risk assessment model, adapted according to the CLEA methodology.

Where soil chemical analysis results are found to exceed TAC, Site-Specific Risk Assessments will be undertaken using CLEA UK risk assessment software.

CLEA SGVs and TAC used in the assessment of the site are presented in Appendix H.

Due to the lack of putresible material within the Made Ground, preferential venting pathway to atmosphere due to shallow depth, and lack of significant thickness, the Made Ground is not considered to be a major source of ground gas.

For Radon the site has been assessed following the guidelines in "Radon: guidance on protective measures for new dwellings" (BRE 211 1999). See Sections 2.12 and 5.6.2.

6.2 RISK TO END USERS

The results of contamination testing on soils are given in Appendix G.

Statistical analysis in accordance with the principals outlined in the CLR guidance has been used to assess the chemical analysis test results. This statistical analysis is further explained in Appendix I along with the analysis spreadsheets.

As the Made Ground is relatively similar across the site, the statistical analysis has been carried out on the full data set.

6.2.1 Analysis of Similar Distribution Soil Contamination Data

None of the contaminants tested for were calculated to have a US95 which exceeded the relevant SGVs / TAC. Accordingly these contaminants are considered to pose a negligible risk to the end user.

6.2.2 Analysis of Soil Hotspot Contamination Data

The statistical assessment of the test results revealed the following hotspots (recorded concentrations different to the main data set) of contamination across the site:-

- Hotspot of Cadmium in TP4 (0.50mg/kg),
- Hotspots of Acenaphthene (0.20mg/kg), Acenaphthylene (0.30mg/kg), Anthracene (1.0mg/kg), Benzo(a)anthracene (4.80mg/kg), Benzo(a)pyrene (5.30mg/kg), Benzo(k)fluroanthene (2.10mg/kg), Chrysene (5.10mg/kg), Fluorene (0.20mg/kg), Ideno(1,2,3-cd)pyrene, Phenanthrene (2.40mg/kg) and Pyrene (9.10mg/kg) in TP3,

Of the hotspots identified, only that for Benzo(a)pyrene in TP3 @ 0.2-0.3m exceeded the relevant SGV / TAC. Accordingly whilst the hotspots of contamination do pose a greater risk to the end user, the risk is not generally considered to be high. Limited remediation will be required to protect the end user in the vicinity of TP3.

6.2.3 Summary of Risk to End User

In summary limited remediation may be required to protect the end user from the hotspot of contamination in TP3, if this is confirmed to correspond to a soft landscaped area.

6.3 RISK TO SITE WORKERS

Demolition and dismantling (if undertaken) must be carried out to a safe and acceptable standard, which should be in accordance with current UK guidance and best practice.

Whilst not ground related, asbestos and hazardous substances surveys should be conducted prior to any demolition.

Ground and construction workers should be provided with basic Personal Protective Equipment including high visibility clothing, safety footwear, hard-hats, gloves and overalls based on the site's general health and safety risk assessment.

In addition, a risk assessment should be carried out for all additional hazards identified within the ground investigation in accordance with current health and safety legislation. This assessment should provide measures to reduce the risks i.e. providing further Personal Protective Equipment, welfare facilities and if necessary preventing access to certain areas.

Whilst this appraisal has considered the long-term effects of contamination, GRM can also help during the formulation of Health and Safety documentation, if required.

Any unusual colours, odours and suspicious ground should be reported immediately to site management and then GRM.

7 QUANTITATIVE RISK ASSESSMENT - CONTROLLED WATERS

7.1 INTRODUCTION

No leachate testing has be carried out for the site as the underlying strata is classified as a non-aquifer and there are not considered to be any surface water receptors within influencing distance of the site.

7.2 SUMMARY OF RISK TO CONTROLLED WATERS

The risk to controlled waters (either aquifer or surface waters) is NEGLIGIBLE.

No remedial measures for environmental reasons, to protect controlled waters, will be necessary.

8 QUANTITATIVE RISK ASSESSMENT – WATER SUPPLY PIPES

8.1 INTRODUCTION

The 'screening levels' adopted for the assessment of risk to water supply pipes are taken from the following document:

- Water Regulations Advisory Scheme (WRAS) contaminated thresholds for sub-surface water pipes (extract included in Appendix H), for the protection of buried pipes

8.2 WATER SUPPLY PIPES

The recorded concentration of PAH in the Made Ground (from TP3) exceeds the acceptable levels listed in the WRAS documentation. It is however considered that, as it is proposed to remove the Made Ground in the area surrounding TP3 and water supply pipes will be placed within the natural underlying strata, the risk to water supply pipes is negligible and that plastic MDPE pipes will be appropriate. However GRM would recommend that the local Water Authority is contacted to confirm their requirements.

9 PHASE II CONCEPTUAL MODEL

9.1 SOURCE – PATHWAY – RECEPTOR

The intrusive investigation has revealed that Made Ground in TP3 is contaminated with Benzo(a)pyrene.

Development proposals have been confirmed as incorporating residential houses with areas of hardstanding (e.g. car parking), domestic gardens and soft landscaping.

For end-users, the primary human health receptors are residents of the completed development and construction workers. The pathways of concern include dermal contact with contaminated soil and soil dust, the ingestion of contaminated soil and soil dust and ingestion of vegetables that have taken up the contamination.

For controlled waters, there is considered to be no pathway or receptor for any identified contamination.

The concentrations of PAH present in Made Ground deposits (in TP3) exceed thresholds for water pipes.

Considering the above, it is considered that the site poses a negligible risk to controlled waters, a low risk to water pipes and a low risk to end users.

Further investigation, assessment and remediation as detailed below should act to reduce the risk posed to the identified receptors to negligible.

- Removal of contaminated soils in the area surrounding TP3.

The pollutant linkage model is illustrated in detail on the following page.

9.2 POLLUTANT LINKAGE MODEL

HUMAN HEALTH			
Source	**Pathway**	**Receptor**	**Solution**
Contaminated Made Ground. Contaminants of concern include Benzo(a)pyrene.	Dermal contact with contaminated soil and soil dust, the ingestion of contaminated soil and soil dust, and ingestion of vegetables that have taken up the contamination.	End-users (residents) of the completed development and construction workers.	Removal of contaminated soils.

CONTROLLED WATERS			
Contaminated Made Ground. Contaminants of concern include Benzo(a)pyrene.	None.	None.	None.

CONSTRUCTION MATERIALS			
Contaminated made ground. Contaminants of concern include total PAH.	Migration of contamination through leaks and joints and degradation of pipe materials.	Water Pipes.	Upgraded water pipes and/or clean backfill material. Removal of contaminated soils.

10 REMEDIATION

10.1 RECOMMENDED RISK REDUCTION AND REMEDIAL MEASURES

10.1.1 Protection of End Users

Based on the assessment undertaken to date using the CLEA Model, the levels of contamination in TP3 will require remediation as part of the proposed residential development. Recommended remedial measures include removal of soils close to TP3.

Should any material suspected of being significantly contaminated be encountered during the redevelopment of the site, GRM can be contacted to undertake additional investigation if necessary. The local Environmental Health Officer should be contacted and informed of any additional remedial work required.

Hotspot areas of contaminated soil should be excavated and disposed to an appropriate landfill waste facility or placed under hardstanding areas. An area measuring approximately 5m length by 5m width by 0.45m depth, from the centre of the exploratory hole, should be remediated. This may not be achievable on all sides of the exploratory hole due to its close proximity to the building, in this case soils should be removed up to the proposed start of the hardstanding pathway around the building. The sides and base of the excavation should be sampled for validation testing, to ensure no residual contamination remains.

Following removal of the concrete hardstanding, an inspection should be undertaken to assess any potential risk of hydrocarbon contamination of the underlying soils.

10.1.2 Protection of Controlled Waters

The risk to controlled waters is negligible. No remedial measures are required.

10.1.3 Protection of Site Workers

The risk to site workers from the soil contamination is negligible. No remedial measures are required.

However the use of suitable PPE should be enforced during the ground works stage of construction and suitable precautions should be taken.

10.1.4 Protection of Construction Materials

Remedial measures to protect underground plastic water pipes may be required, following consultation with the relevant water authority. This may take the form of an alternative pipe material or backfilling of service trenches with clean inert material.

As long as the Made Ground from TP3 is removed, the risk becomes negligible and plastic MDPE pipes will be appropriate.

10.2 POST REMEDIATION VALIDATION

The remedial methods employed are to be designed to avoid the need for monitoring after validation.

Once the remedial measures have been undertaken to protect end-users against any potentially contaminated Made Ground, validation of these works will be required. Verification of the remedial works will comprise validation testing (laboratory analysis) of the sides of the hotspot removal excavation to confirm that the contaminated material has been removed.

Validation testing of any imported topsoil/subsoil is best conducted prior to importing the material. If subsoil/topsoil is to be imported with an existing test certificate, then it is recommended that this be forwarded to GRM to ensure that the material is suitable for use. The test certificate should be for the same suite of contaminants as contained within the GRM soils testing suite, details of which are included in Appendix H.

Details of the validation testing of the imported material will be required by the local Environmental Health Officer and the NHBC.

10.3 REMEDIATION METHOD STATEMENT

A remediation method statement requires formulation after liaison with the Statutory Authorities. The statement will include the procedures to be adopted to achieve the recommended remedial measures and the form of validation testing following remediation. The recommended remedial strategy will need to be discussed with the local Environmental Health Officer / Contaminated Land Officer.

Following your review of this document, we would recommend that a copy of our site appraisal report is forwarded to the Local Authority for comment and approval, prior to commencing development of the site. The Local Authority may choose to include other consultees as part of the planning process (such as the Environment Agency).

Consultation should be undertaken at the earliest possible opportunity to avoid subsequent abortive or delayed works.

10.4 DISPOSAL AND CLASSIFICATION

Under current waste regulations, waste soil materials produced from the site will require characterisation to enable it to be disposed of correctly.

The analysis results presented in Appendix G should be provided to the relevant landfill operators to establish the characterisation of the waste, confirm its suitability for landfill disposal and provide estimated costings. If material is classified as hazardous then the development site will need to be registered with the Environment Agency prior to the movement of the waste. Depending on the receiving landfill's current permit, further chemical analysis, incorporating Waste Acceptance Criteria (WAC) leachate analysis, may be required.

An initial assessment of the Made Ground classes it as non-hazardous with the possibility of being inert. The non-hazardous, inert assessment can only be confirmed by undertaking Waste Acceptance Criteria (WAC) testing of the soils.

All materials removed from the site are classified as 'waste' and therefore must be removed by a suitably licensed carrier of waste. This applies whether or not the waste is contaminated.

The developer/builder are likely to be classed as the waste producer. Therefore, they have a duty of care to ensure that all waste is disposed of appropriately. This includes ensuring the waste carrier is licensed and disposes of the waste to a suitably licensed landfill site. They are also required to keep a paper trail from 'cradle to grave' including copies of the waste disposal tickets.

Efficient materials management on site is recommended as it can lead to significant cost savings when compared to the traditional side casting or single stockpile of arisings. Likewise making the site as volume neutral as possible will reduce the costs of development.

The contaminated soils (waste) removed to landfill as part of an approved remediation method statement will attract Landfill Tax. GRM can assist in the application for landfill tax exemption if waste is to be removed to protect the end user or controlled waters. It should be noted that contaminated materials arising as part of normal construction activities do not normally attract the exemption. Exemption should be applied for in advance and sufficient time (6 weeks) should be allowed for this prior to development.

10.5 SITE WASTE MANAGEMENT PLANS

Site Waste Management Plans allow better waste management practices, help to reduce the amount of waste produced and identify best environmental disposal options. Implementing a Site Waste Management Plan (SWMP) can reduce costs (increasing business profits) and maximise resource efficiency.

SWMPs will be a legal requirement for projects over £300k from the 6th April 2008. GRM can assist in the production of SWMPs which comply with the Code of Practice and identify best environmental disposal options when dealing with waste.

11 FURTHER INVESTIGATION

Some further investigation, to determine more accurately the effect of some of the identified hazards on the development, is recommended. This includes;

- Inspection of soils beneath the concrete hardstanding, following its removal, to assess the risk from any hydrocarbon contamination.

- A remediation method statement may be required by the Local Authority / NHBC, if the contaminated soils are to be removed.

- Validation inspection and testing will be required, post remediation, to satisfy the Local Authority / NHBC.

- Validation testing of imported soils should be conducted prior to them being brought to site.

A copy of this report should be submitted to the Planning Department of the Local Authority / Local Authority EHO for review, if planning conditions exist for this site. A copy should also be sent to the NHBC for their records.

12 CONCLUSIONS

This site assessment has shown the site is suitable for the proposed development, assuming compliance with all the recommendations contained within this report.

See 'Summary of Recommendations' table at the beginning of the report.

Document prepared by	**Nicola Rowley BSc** **(Assistant Engineering Geologist)**
Reviewed by	**Richard Upton BSc MSc** **(Senior Geo-Environmental Engineer)**
Approved by	**Dr W S Peacock FGS CGeol** **(Director)**
When required in-house geological, geotechnical, environmental, structural and civil staff helped to produce this document.	

NOTES ON LIMITATIONS

General

GRM Development Solutions Limited has prepared this report solely for the use of the Client and those parties with whom a warranty agreement had been executed, or with whom an assignment had been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from GRM Development Solutions Limited; a charge may be levied against such approval.

GRM Development Solutions Limited accepts no responsibility or liability for:

a) the consequences of this document being used for any purpose or project other than for which it was commissioned, and

b) the consequences of this document being used by any third party with whom an agreement has not been executed.

Phase I Environmental Audits/ Desk Studies

The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the site and meetings and discussions with relevant authorities and other interested parties. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, GRM Development Solutions Limited reserves the right to review such information and, if warranted, to modify the opinions accordingly. It should be noted that any risks identified in a Phase 1 report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

Phase II Environmental Audits (Contamination Investigations)

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, ground and groundwater conditions to allow a reasonable risk assessment to be made. The objectives of the investigation have been limited to establishing the risks associated with potential human targets, building materials, and controlled waters.

The amount of exploratory work and chemical testing undertaken has necessarily been restricted by the short timescale available, and the locations of exploratory holes have been restricted to the areas unoccupied by the building(s) on the site and by buried services. A more comprehensive investigation may be required if the site is to be redeveloped as, in addition to risk assessment, a number of important engineering and environmental issues need to be resolved.

For these reasons if costs have been included in relation to site remediation these must be considered as tentative only and must, in any event, be confirmed by a commercial adviser.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. The number of sampling points and methods of sampling and testing do not preclude the existence of localised “hotspots” of contamination where concentrations may be significantly higher than those actually encountered.

The risk assessment and opinions provided, inter alia, take in to consideration currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

Phase II Geo-environmental Investigations (Combined Geotechnical and Contamination Investigations)

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, geotechnical characteristics, and ground and groundwater conditions to provide a reasonable assessment of the environment risks together with engineering and development implications. If costs have been included in relation to site development a commercial adviser must confirm these.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions apparent at the site for each of the exploratory holes. There may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.

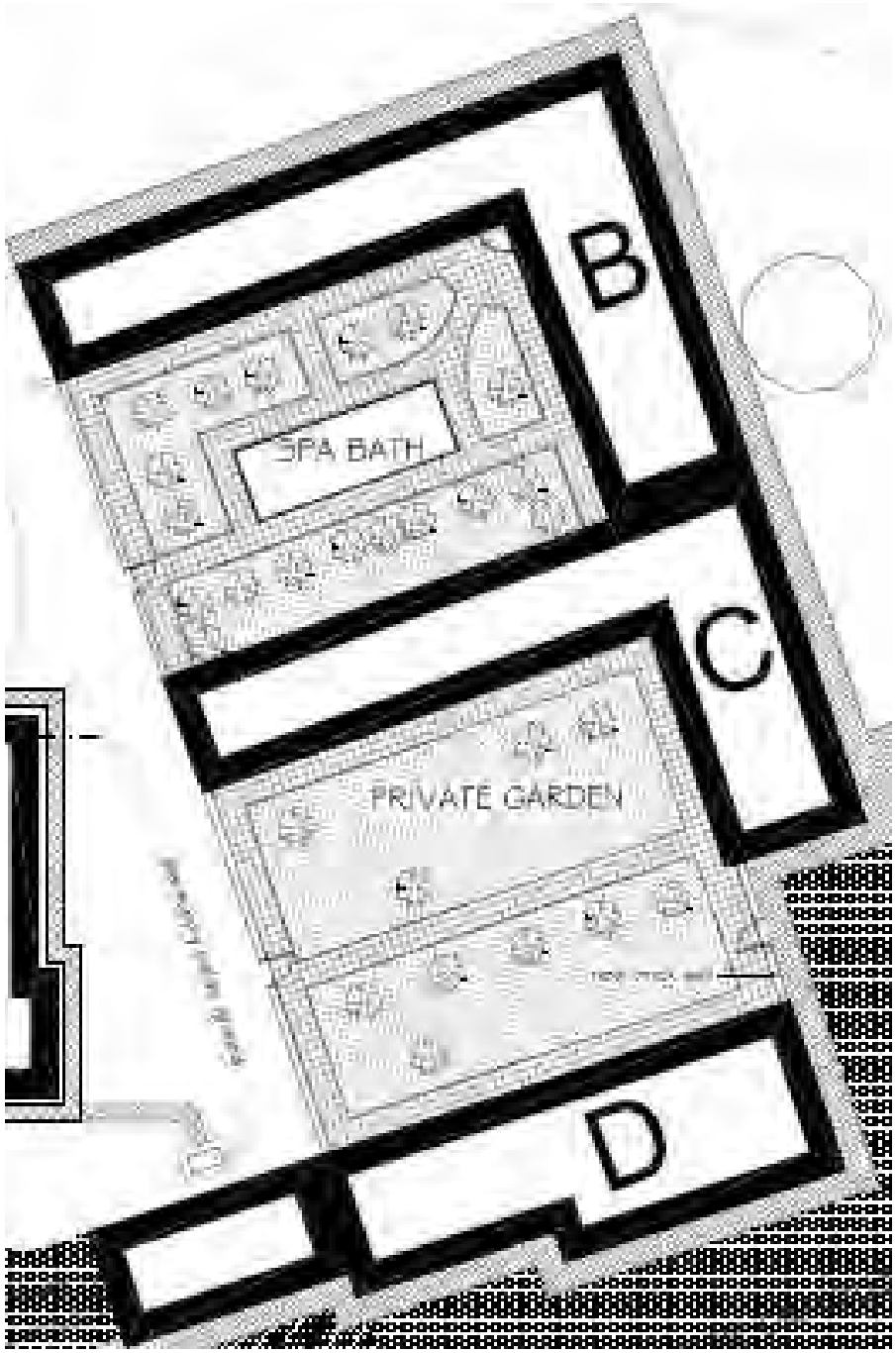
The comments made on groundwater conditions are based on observations made at the time the site work was conducted. It should be noted that groundwater levels will vary owing to seasonal, tidal and weather related effects.

The scope of the investigation was selected on the basis of the specific development proposed by the Client and may be inappropriate to another form of development or scheme.

The risk assessment and opinion provided, inter alia, take into consideration currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

APPENDIX A

GRM Development Solutions
geoenvironmental - civil - structural



DO NOT SCALE

NOTES:

GRM Development Solutions Ltd
Laurus House, First Avenue, Centrum 100,
Burton upon Trent, Staffordshire, DE14 2WH
Tel: 01283 551249 Fax: 01283 211968
mail@grm-uk.com www.grm-uk.com

CLIENT:
HSSP Architects

PROJECT:
Common Farm, Barton Road, Carlton

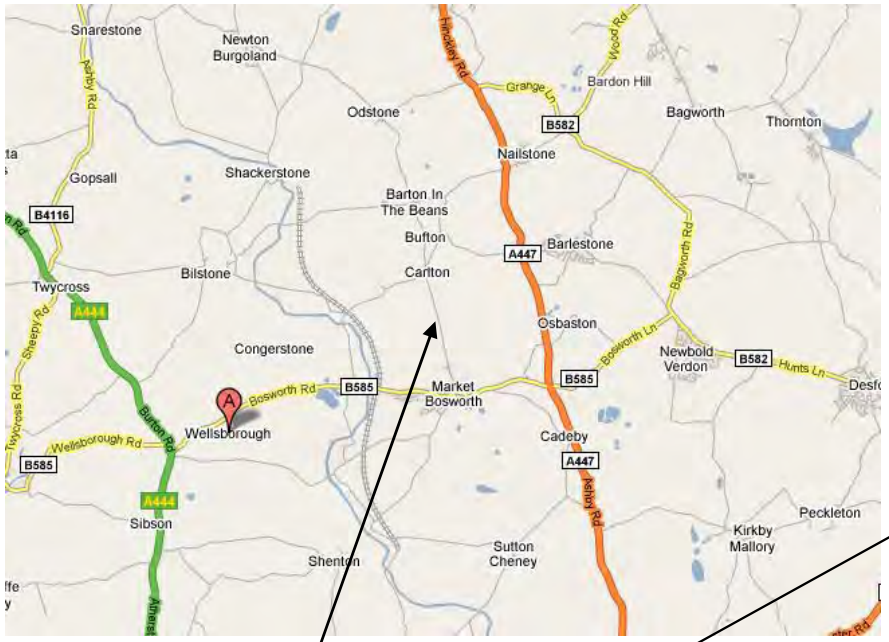
TITLE:
Proposed Development Layout

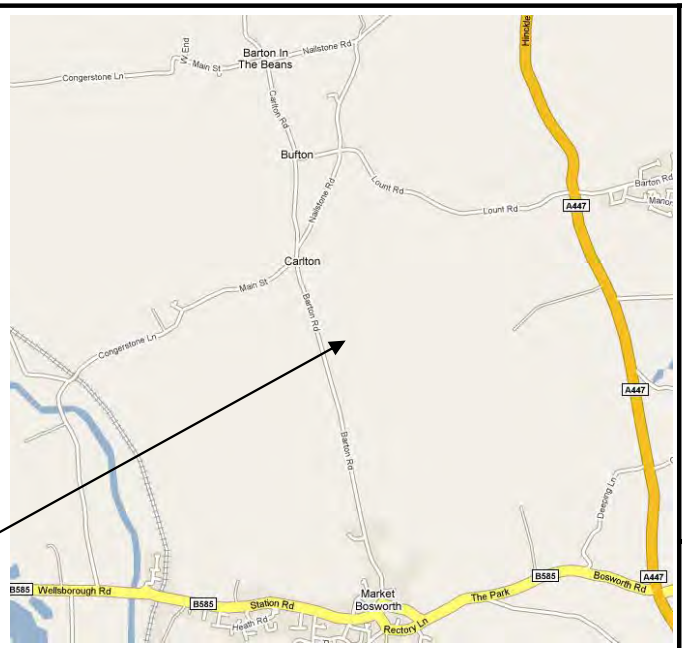
SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN :	DATE:
NR	**07/2008**
PROJECT No:	DRAWING No:
P4635	1

© GRM Development Solutions Ltd
© Crown Copyright. AL 100014100

APPENDIX B

GRM Development Solutions
geoenvironmental - civil - structural





Site Location



N

DO NOT SCALE

NOTES:

Site Boundary

GRM Development Solutions Ltd
Laurus House, First Avenue, Centrum 100,
Burton upon Trent, Staffordshire, DE14 2WH
Tel: 01283 551249 Fax: 01283 211968
mail@grm-uk.com www.grm-uk.com

CLIENT:

HSSP Architects

PROJECT:

Common Farm, Barton Road, Carlton

TITLE:

Site Location and Boundary Plan

SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN :	DATE:
NR	**07/2008**
PROJECT No:	DRAWING No:
P4635	2

© GRM Development Solutions Ltd
© Crown Copyright. AL 100014100

APPENDIX C

GRM Development Solutions
geoenvironmental - civil - structural



GroundSure

Site Details:

COMMON FARM, BARTON ROAD, CARLTON, NUNEATON, CV13 0RL

Client Ref: P4635
Report Ref: HMD-6-184460
Grid Ref: 440330, 304800

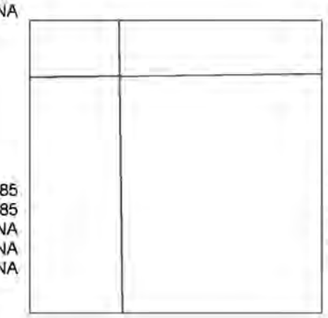
Map Name: County Series

Map date: **1885**

Scale: 1:10,560

Printed at: 1:10,560

Surveyed 1885
Revised 1885
Edition NA
Copyright NA
Levelled NA



Surveyed 1885
Revised 1885
Edition NA
Copyright NA
Levelled NA

Surveyed 1885
Revised 1885
Edition NA
Copyright NA
Levelled NA

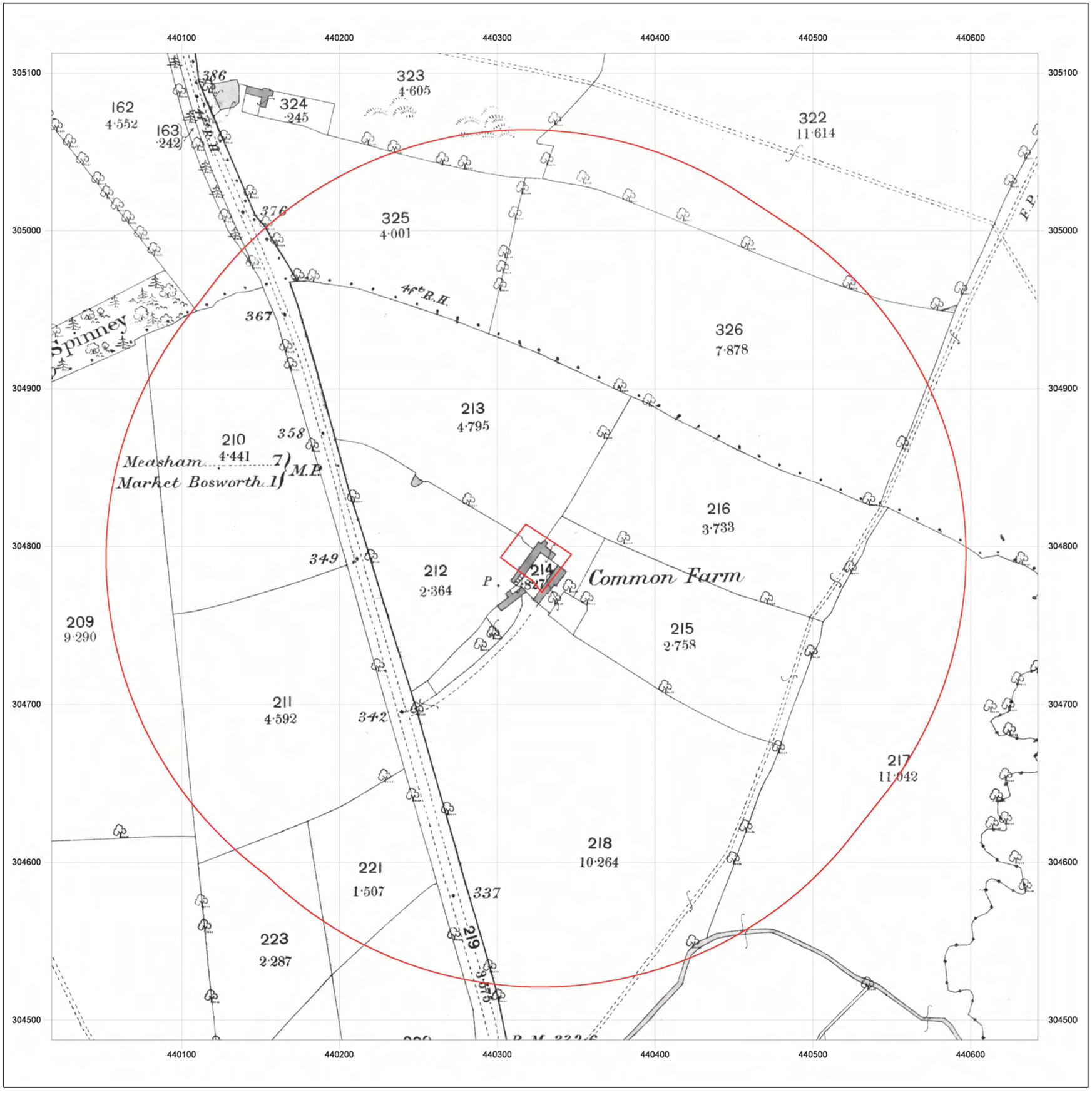
Surveyed 1885
Revised 1885
Edition NA
Copyright NA
Levelled NA

Ordnance Survey Licensed Partner

Produced by GroundSure Ltd.
Tel: 01273 819500
Email:
maps&data@groundsure.com

Crown copyright all rights reserved. Licence No: 10001511162

Production date:31 July 2008



GroundSure

Site Details:

COMMON FARM, BARTON ROAD, CARLTON, NUNEATON, CV13 0RL

Client Ref: P4635
Report Ref: HMD-6-184460
Grid Ref: 440330, 304800

Map Name: County Series

Map date: **1886**

Scale: 1:2,500

Printed at: 1:2,500

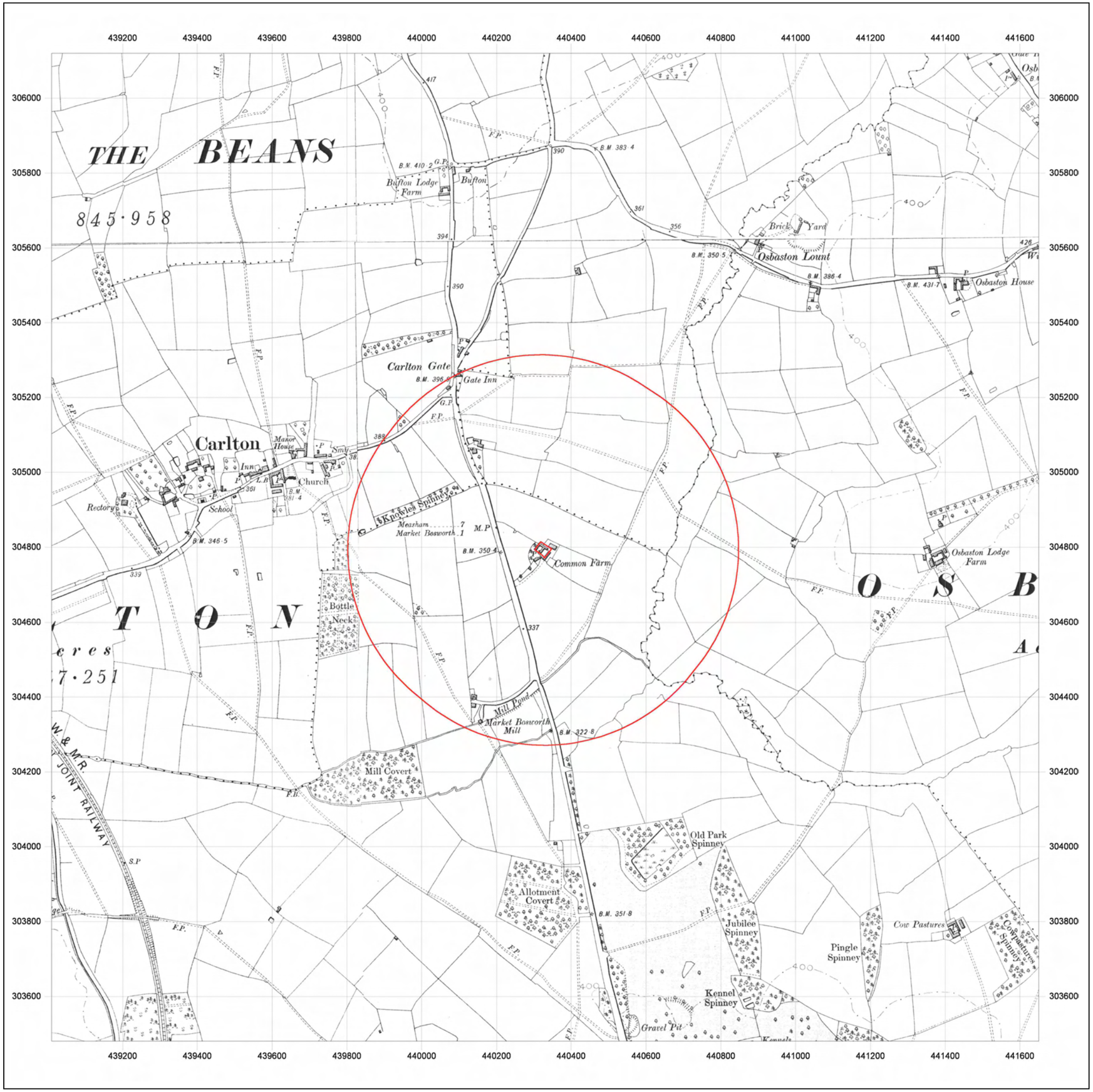
Surveyed 1886
Revised 1886
Edition NA
Copyright NA
Levelled NA

Ordnance Survey Licensed Partner

Produced by GroundSure Ltd.
Tel: 01273 819500
Email:
maps&data@groundsure.com

Crown copyright all rights reserved. Licence No: 10001511162

Production date:31 July 2008



GroundSure

Site Details:

COMMON FARM, BARTON ROAD, CARLTON, NUNEATON, CV13 0RL

Client Ref: P4635
Report Ref: HMD-6-184460
Grid Ref: 440330, 304800

Map Name: County Series

Map date: **1901-1904**

Scale: 1:10,560

Printed at: 1:10,560

Surveyed 1885
Revised 1903
Edition NA
Copyright NA
Levelled NA

Surveyed 1885
Revised 1904
Edition NA
Copyright NA
Levelled NA

Surveyed 1885
Revised 1901
Edition NA
Copyright NA
Levelled NA

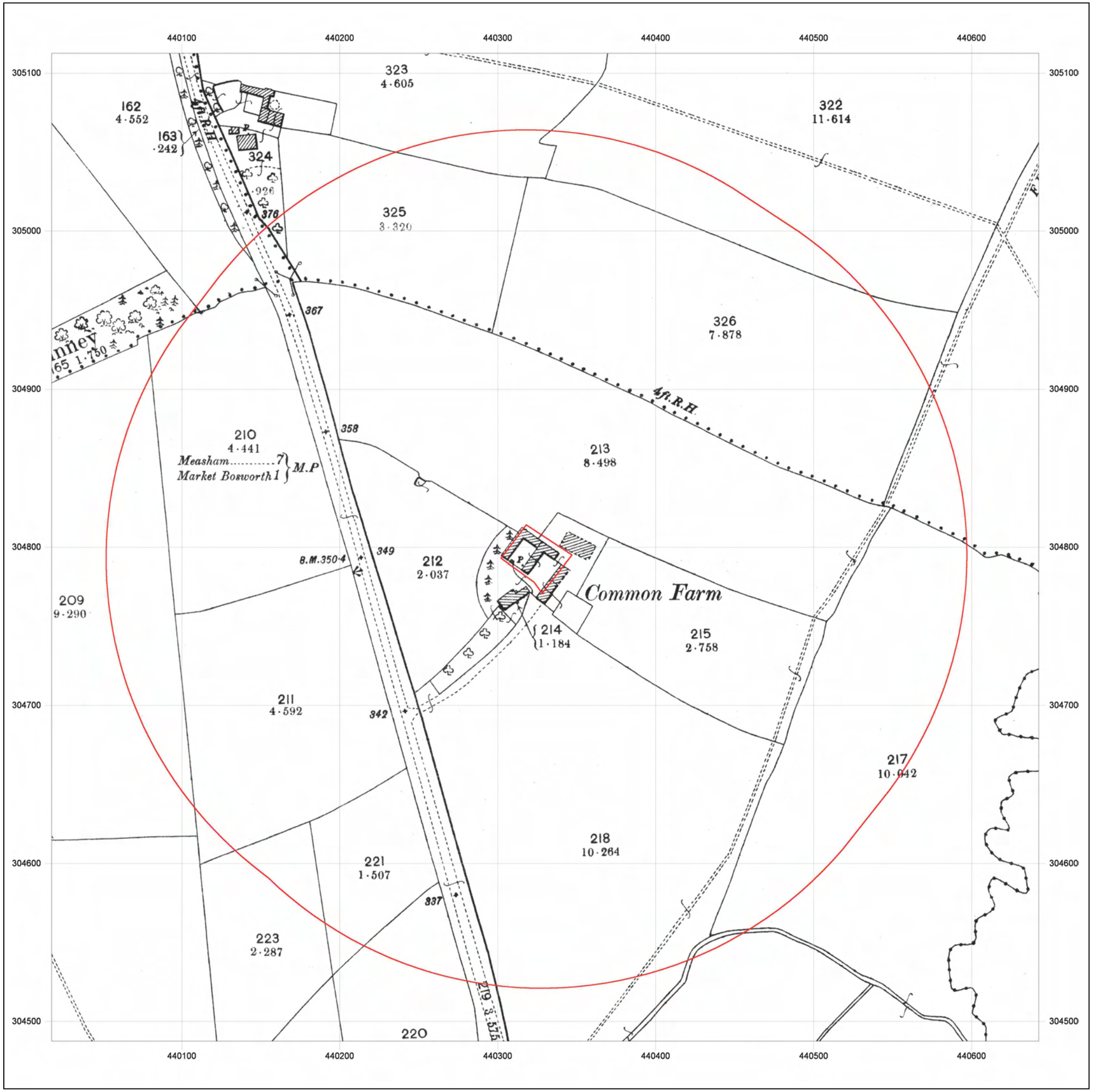
Surveyed 1885
Revised 1904
Edition NA
Copyright NA
Levelled NA

Ordnance Survey Licensed Partner

Produced by GroundSure Ltd.
Tel: 01273 819500
Email:
maps&data@groundsure.com

Crown copyright all rights reserved. Licence No: 10001511162

Production date:31 July 2008



GroundSure

Site Details:

COMMON FARM, BARTON ROAD, CARLTON, NUNEATON, CV13 0RL

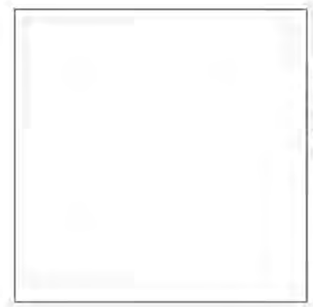
Client Ref: P4635
Report Ref: HMD-6-184460
Grid Ref: 440330, 304800

Map Name: County Series

Map date: **1903**

Scale: 1:2,500

Printed at: 1:2,500



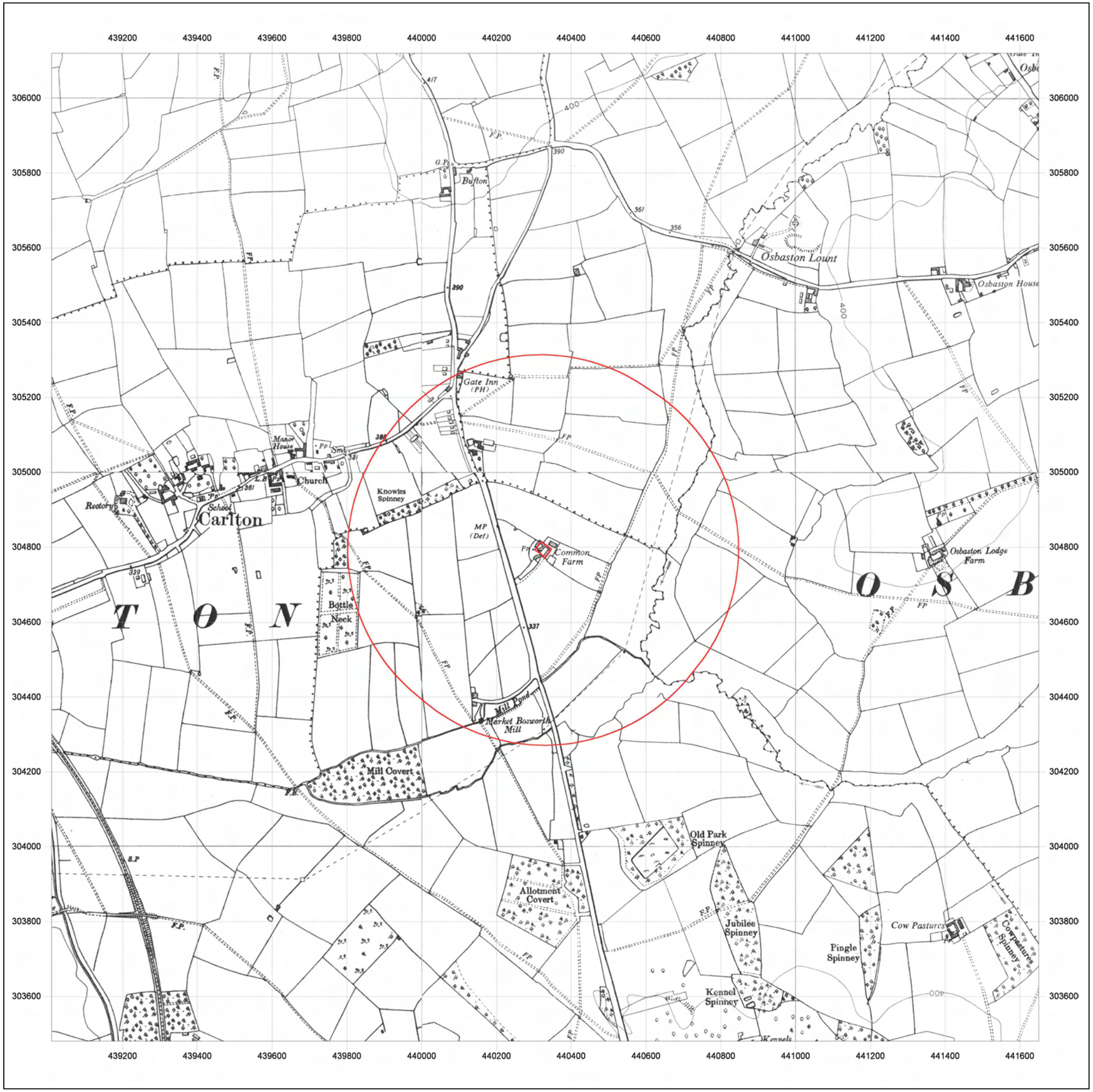
Surveyed 1903
Revised 1903
Edition NA
Copyright NA
Levelled NA

Ordnance Survey Licensed Partner

Produced by GroundSure Ltd.
Tel: 01273 819500
Email:
maps&data@groundsure.com

Crown copyright all rights reserved. Licence No: 10001511162

Production date:31 July 2008



GroundSure

Site Details:

COMMON FARM, BARTON ROAD, CARLTON, NUNEATON, CV13 0RL

Client Ref: P4635
Report Ref: HMD-6-184460
Grid Ref: 440330, 304800

Map Name: Provisional

Map date: **1950**

Scale: 1:10,560

Printed at: 1:10,560

Surveyed 1950
Revised 1950
Edition NA
Copyright NA
Levelled NA

Surveyed 1950
Revised 1950
Edition NA
Copyright NA
Levelled NA

Surveyed 1950
Revised 1950
Edition NA
Copyright NA
Levelled NA

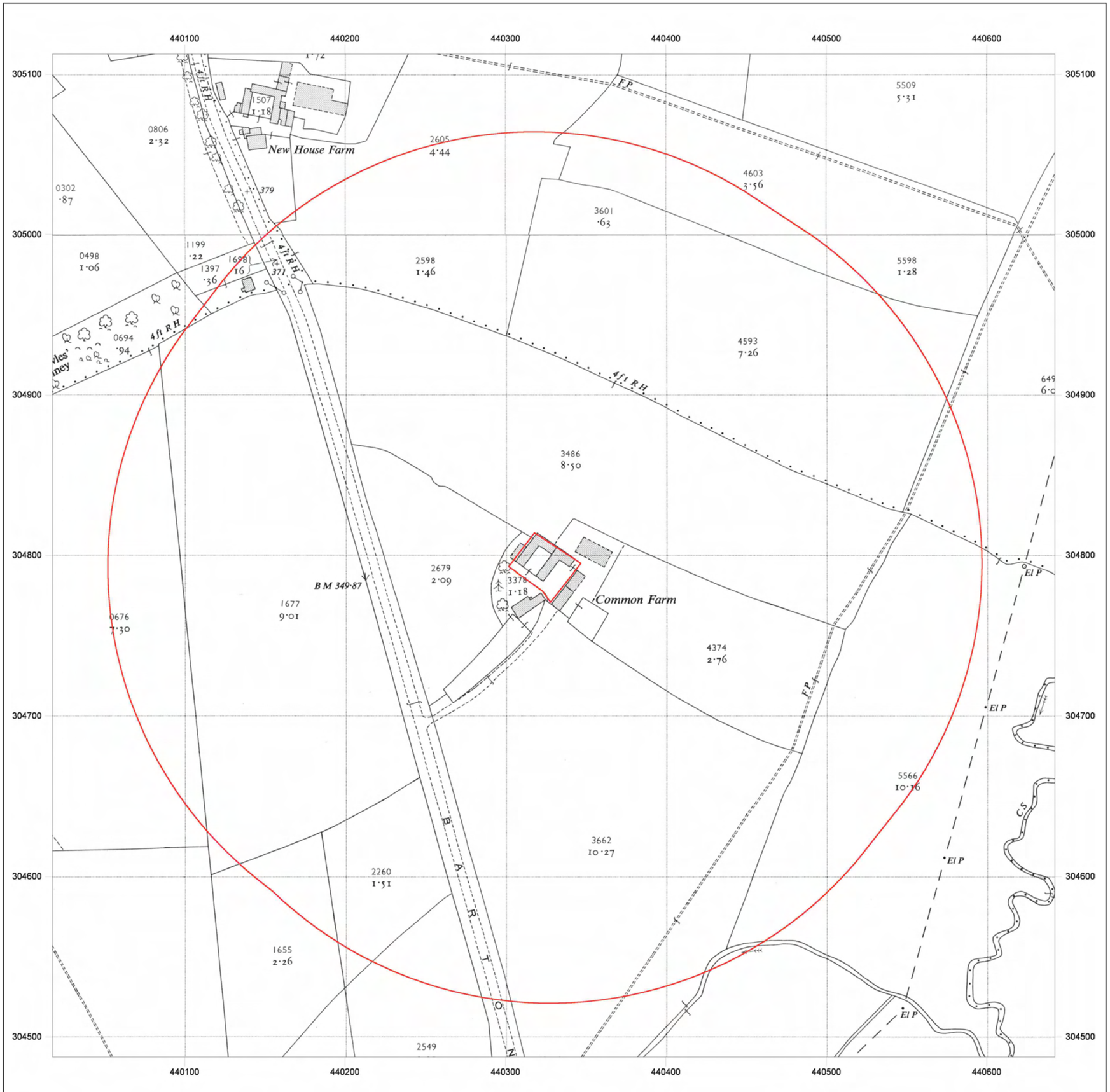
Surveyed 1950
Revised 1950
Edition NA
Copyright NA
Levelled NA

Ordnance Survey Licensed Partner

Produced by GroundSure Ltd.
Tel: 01273 819500
Email:
maps&data@groundsure.com

Crown copyright all rights reserved. Licence No: 10001511162

Production date:31 July 2008



GroundSure

Site Details:

COMMON FARM, BARTON ROAD, CARLTON, NUNEATON, CV13 0RL

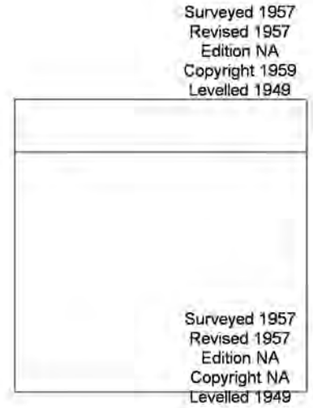
Client Ref: P4635
Report Ref: HMD-6-184460
Grid Ref: 440330, 304800

Map Name: National Grid

Map date: **1957**

Scale: 1:2,500

Printed at: 1:2,500

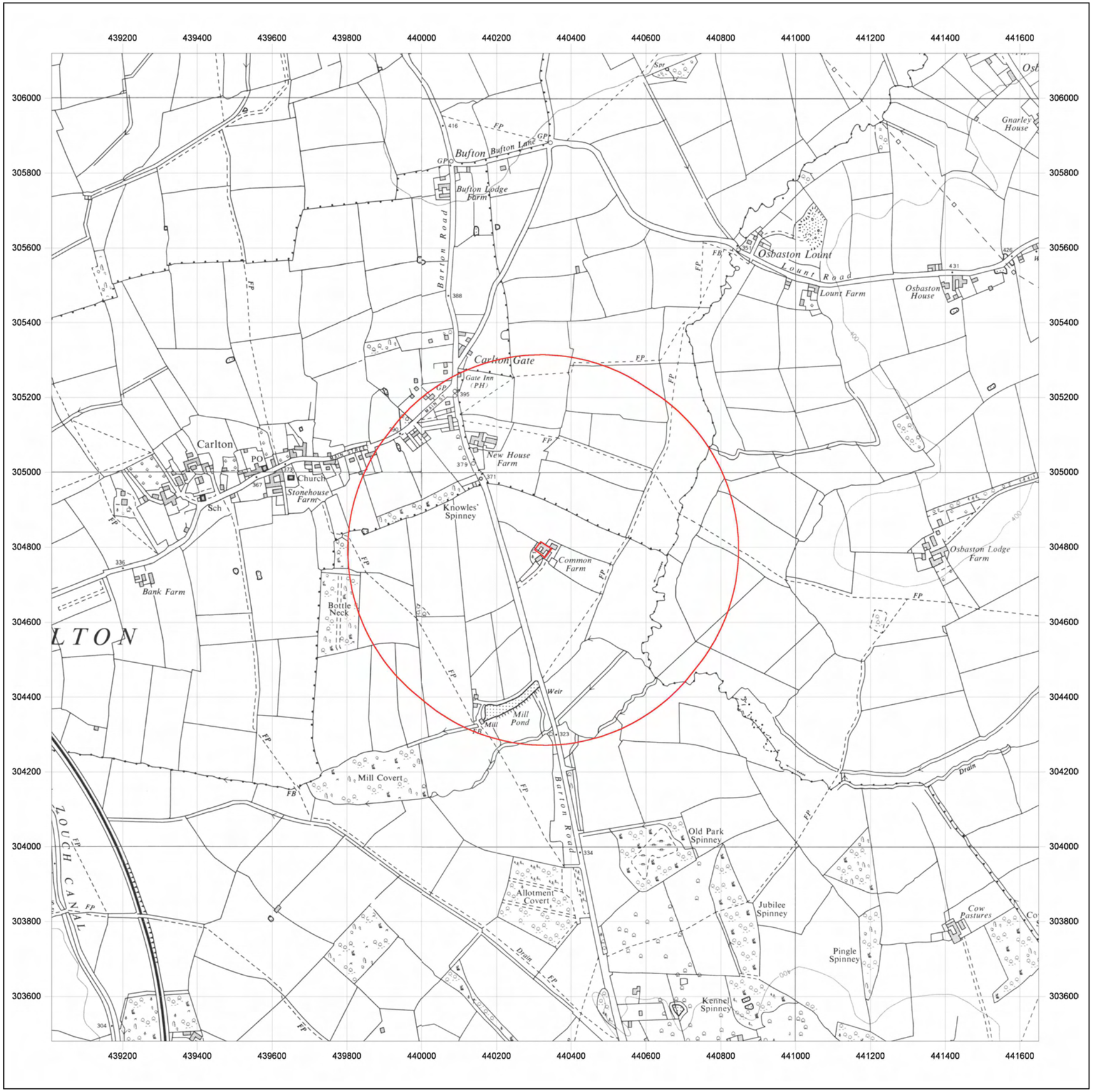


Ordnance Survey Licensed Partner

Produced by GroundSure Ltd.
Tel: 01273 819500
Email:
maps&data@groundsure.com

Crown copyright all rights reserved. Licence No: 10001511162

Production date:31 July 2008



GroundSure

Site Details:

COMMON FARM, BARTON ROAD, CARLTON, NUNEATON, CV13 0RL

Client Ref: P4635
Report Ref: HMD-6-184460
Grid Ref: 440330, 304800

Map Name: Provisional

Map date: **1966**

Scale: 1:10,560

Printed at: 1:10,560

Surveyed 1966
Revised 1966
Edition NA
Copyright NA
Levelled NA

Surveyed 1966
Revised 1966
Edition NA
Copyright NA
Levelled NA

Surveyed 1966
Revised 1966
Edition NA
Copyright NA
Levelled NA

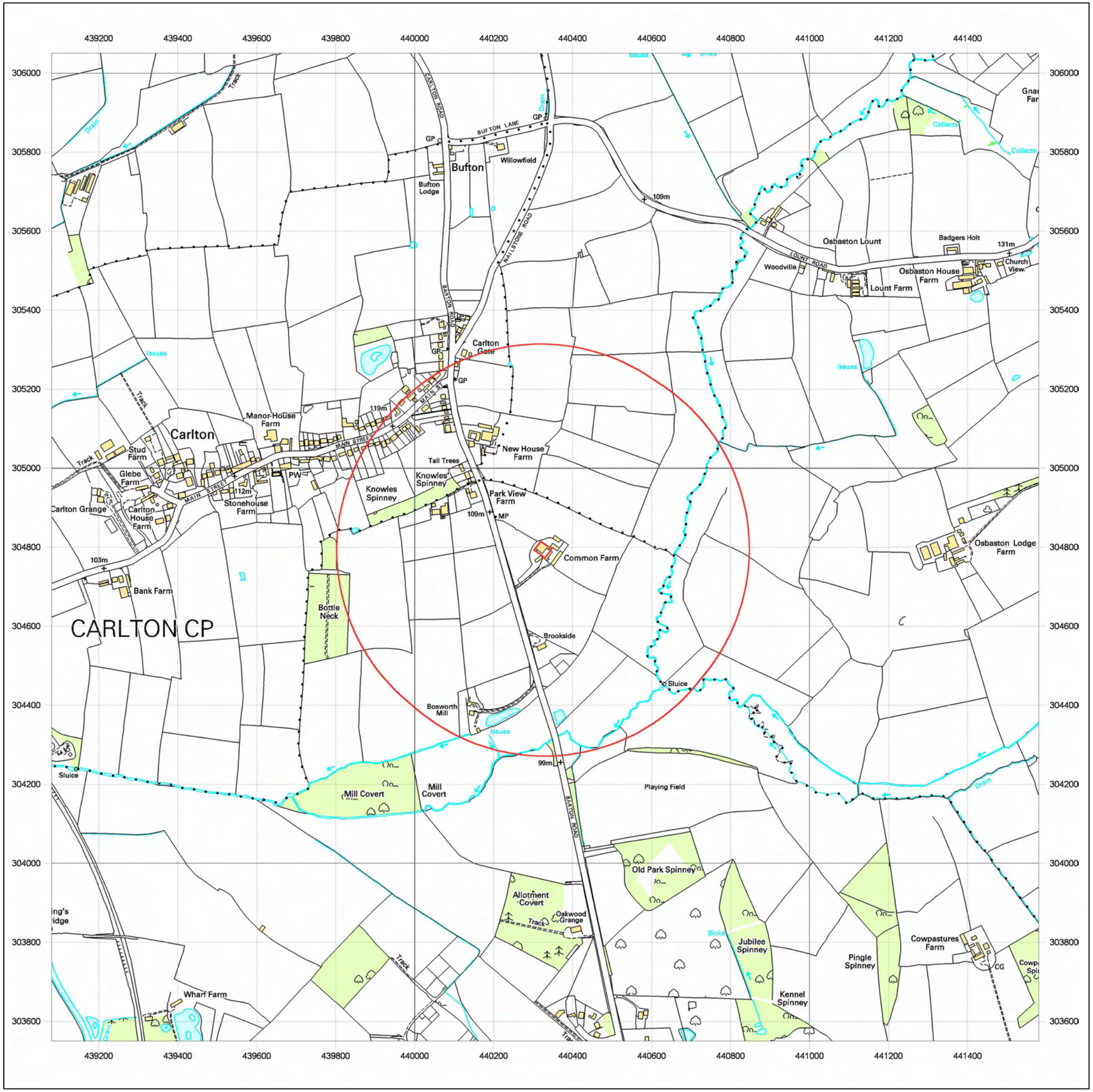
Surveyed 1966
Revised 1966
Edition NA
Copyright NA
Levelled NA

Ordnance Survey® Licensed Partner

Produced by GroundSure Ltd.
Tel: 01273 819500
Email:
maps&data@groundsure.com

Crown copyright all rights reserved. Licence No: 10001511162

Production date:31 July 2008



GroundSure

Site Details:

COMMON FARM, BARTON ROAD, CARLTON, NUNEATON, CV13 0RL

Client Ref: P4635
Report Ref: HMD-6-184460
Grid Ref: 440330, 304800

Map Name: 1:10,000 Raster

Map date: **2002**

Scale: 1:10,000

Printed at: 1:10,000

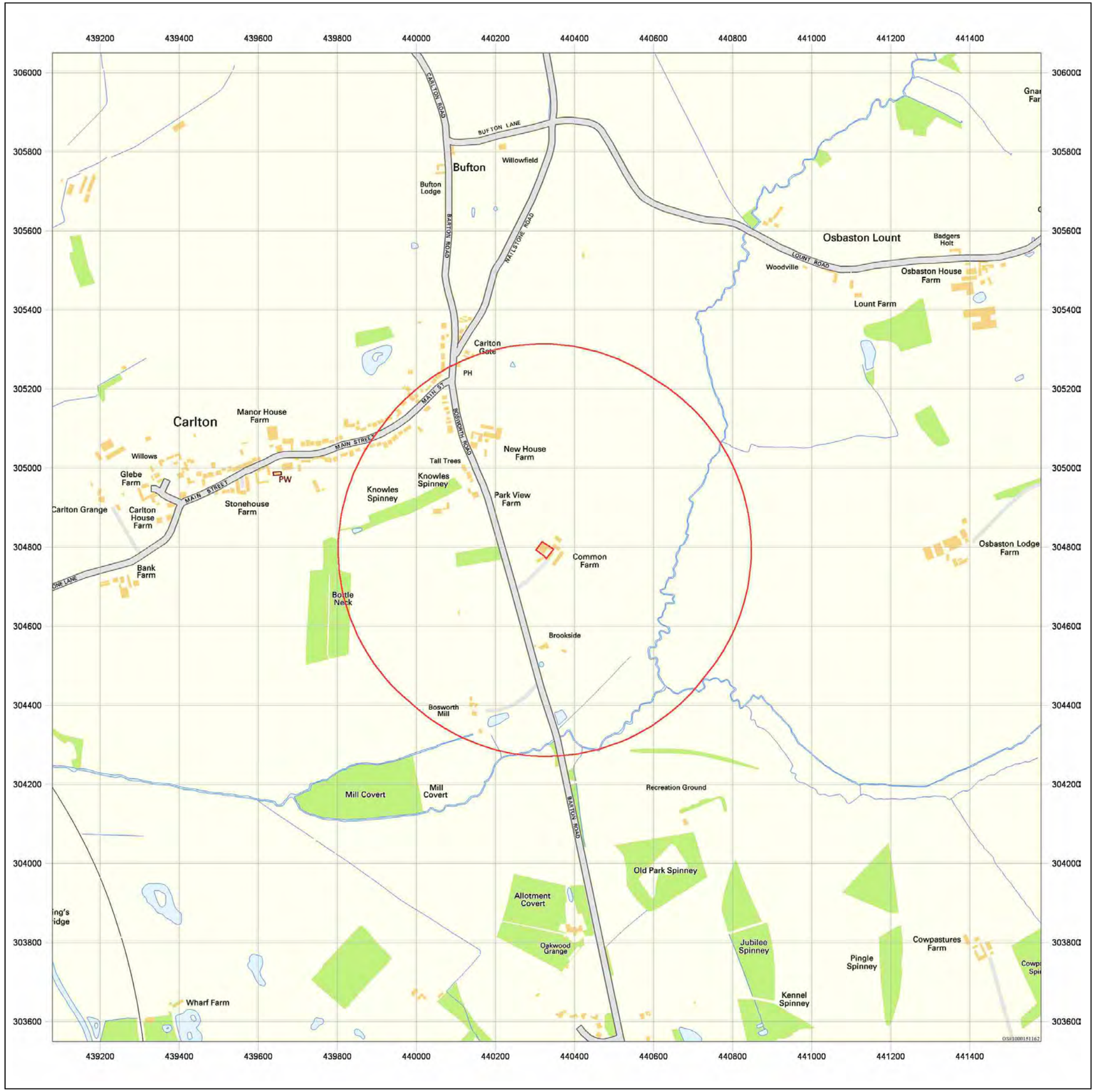


Ordnance Survey Licensed Partner

Produced by GroundSure Ltd.
Tel: 01273 819500
Email:
maps&data@groundsure.com

Crown copyright all rights reserved. Licence No: 10001511162

Production date:31 July 2008



GroundSure

Site Details:

COMMON FARM, BARTON ROAD, CARLTON, NUNEATON, CV13 0RL

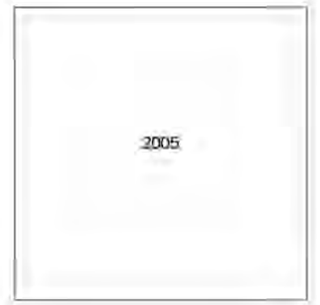
Client Ref: P4635
Report Ref: HMD-6-184460
Grid Ref: 440330, 304800

Map Name: National Grid

Map date: **2005**

Scale: 1:10,000

Printed at: 1:10,000

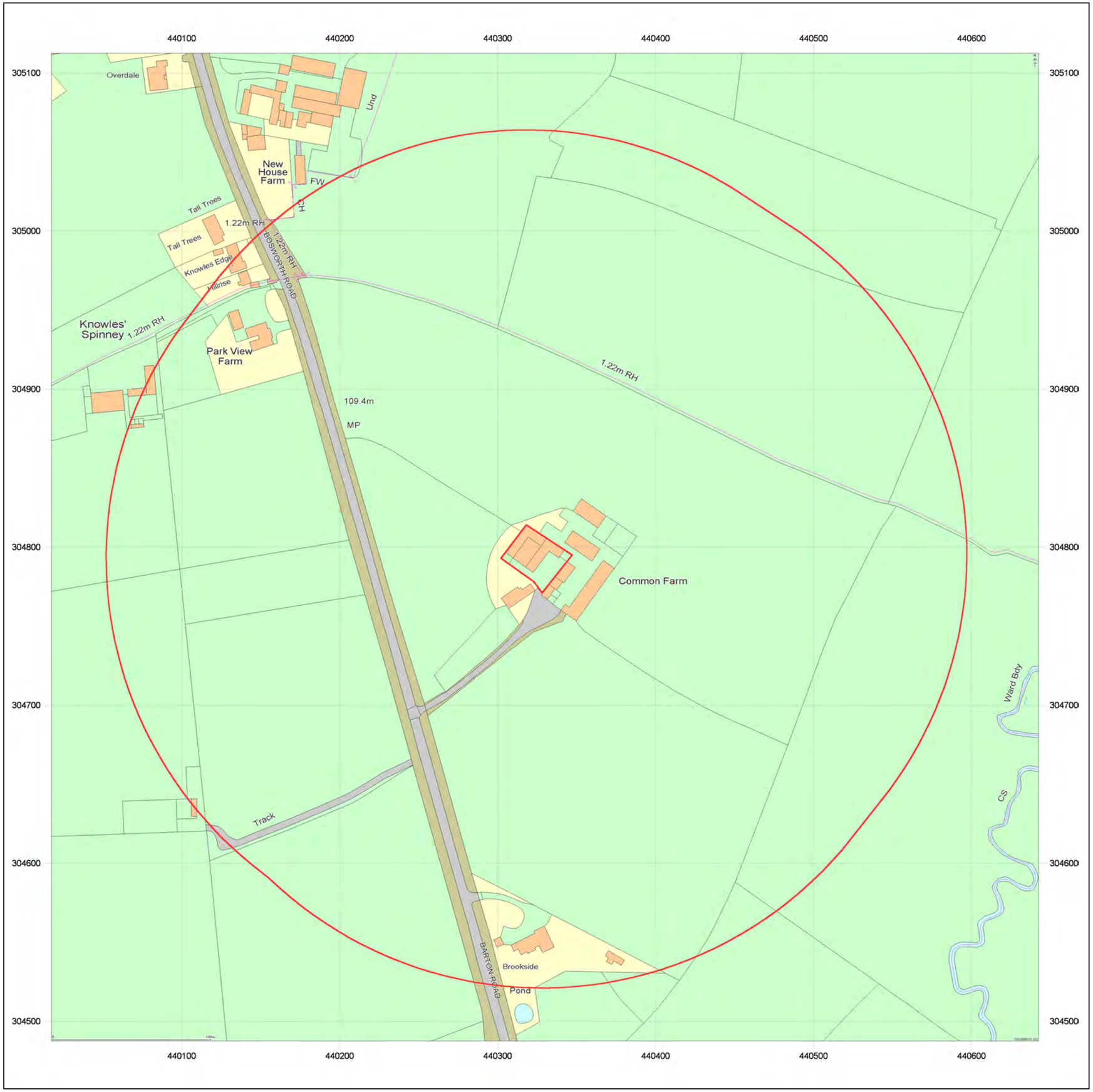


Ordnance Survey Licensed Partner

Produced by GroundSure Ltd.
Tel: 01273 819500
Email:
maps&data@groundsure.com

Crown copyright all rights reserved. Licence No: 10001511162

Production date:31 July 2008



GroundSure

Site Details:

COMMON FARM, BARTON ROAD, CARLTON, NUNEATON, CV13 0RL

Client Ref: P4635
Report Ref: HMD-6-184460
Grid Ref: 440330, 304800

Map Name: MasterMap

Map date: **2007**

Scale: 1:2,500

Printed at: 1:2,500



Ordnance Survey Licensed Partner

Produced by GroundSure Ltd.
Tel: 01273 819500
Email:
maps&data@groundsure.com

Crown copyright all rights reserved. Licence No: 10001511162

Production date:31 July 2008

APPENDIX D

GRM Development Solutions
geoenvironmental - civil - structural

GroundSure Environmental Data Report

Address: COMMON FARM, BARTON ROAD, CARLTON, NUNEATON, CV13 0RL

Date: Jul 31, 2008

GroundSure Reference: HMD-6-184461

Your Reference: P4635

Client: GRM



Brought to you by GroundSure

Aerial Photograph of Study Site

NW ▲ N NE

◄W  E►

SW S ▼ SE

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

Site Name:COMMON FARM, BARTON ROAD, CARLTON, NUNEATON, CV13 0RL
Grid Reference: 440313,304769

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. Authorisations, Incidents and Registers	on-site	0-50	51-250	251-500	501-1000	1000-1500
1.1 Industrial Sites Holding Licenses and/or Authorisations						
Records of IPC Authorisations	0	0	0	0	0	-
Records of IPPC Authorisations	0	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	0	-	-
Records of LAPPC (LAPC) Authorisations	0	0	0	0	-	-
Records of Category 3 or 4 Radioactive Substances Authorisations	0	0	0	0	-	-
Records of Licensed Discharge Consents	0	0	1	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	0	-	-	-
National Incidents Recording System, List 1	0	0	0	-	-	-
1.4 Sites Determined as Contaminated Land under Part IIA 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	0
Landfill Data – Operational Landfill Sites	0	0	0	0	0	0
Environment Agency Historic Landfill Sites	0	0	0	0	1	1
Landfill Data – Non-Operational Landfill Sites	0	0	0	0	0	0
BGS/DoE Landfill Site Survey	0	0	0	0	0	0
GroundSure Local Authority Landfill Sites Data	0	0	0	0	0	0
2.2 Landfill and Other Waste Sites Findings						
Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	-	-
Non-Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	-	-
Environment Agency (REGIS) 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	1	1	-	-
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? *	None
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 155	

* 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 Environment Agency Groundwater Vulnerability and Soil Classification						
Minor Aquifer (within 200m)	No	No	Yes	-	-	-
Major Aquifer (within 200m)	No	No	No	-	-	-
Soil Classification (within 200m)	No	No	Yes	-	-	-
5.2 Groundwater Abstraction Licences (within 2000m of the study site).	0	0	0	0	0	1
5.3 Surface Water Abstraction Licences (within 1000m of the study site).	0	0	0	0	0	-
5.4 Source Protection Zones						
Source Protection Zones within 500m of the study site.	0	0	0	0	-	-
5.5 Potable Water Abstraction Licences (within 2000m of the study site).	0	0	0	0	0	0
5.6 River Quality						
Is there any Environment Agency information on river quality within 500m of the study site?	No	No	No	No	-	-
5.7 Main Rivers						
Main Rivers within 500m of the study site.	0	0	0	0	-	-

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 Areas benefiting from Flood Defences within 250m of the study site?	No
6.4 Are there any Areas used for Flood Storage within 250m of the study site?	No
6.5 What is the maximum BGS groundwater flooding susceptibility within 50m of the study site?	Moderately High
6.6 What is the BGS confidence rating for the groundwater flooding susceptibility areas?	Moderate

7. Ecological Designated Sites

	on-site	0-50	51-250	251-500	501-1000	1001-1500
7.1 Records of Sites of Special Scientific Interest (SSSI):	0	0	0	0	0	-
7.2 Records of National Nature Reserves (NNR) :	0	0	0	0	0	-
7.3 Records of Local Nature Reserves (LNR):	0	0	0	0	0	-
7.4 Records of Special Areas of Conservation (SAC):	0	0	0	0	0	-
7.5 Records of Special Protection Areas (SPA):	0	0	0	0	0	-
7.6 Records of Ramsar sites:	0	0	0	0	0	-
7.7 Records of World Heritage Sites:	0	0	0	0	0	-

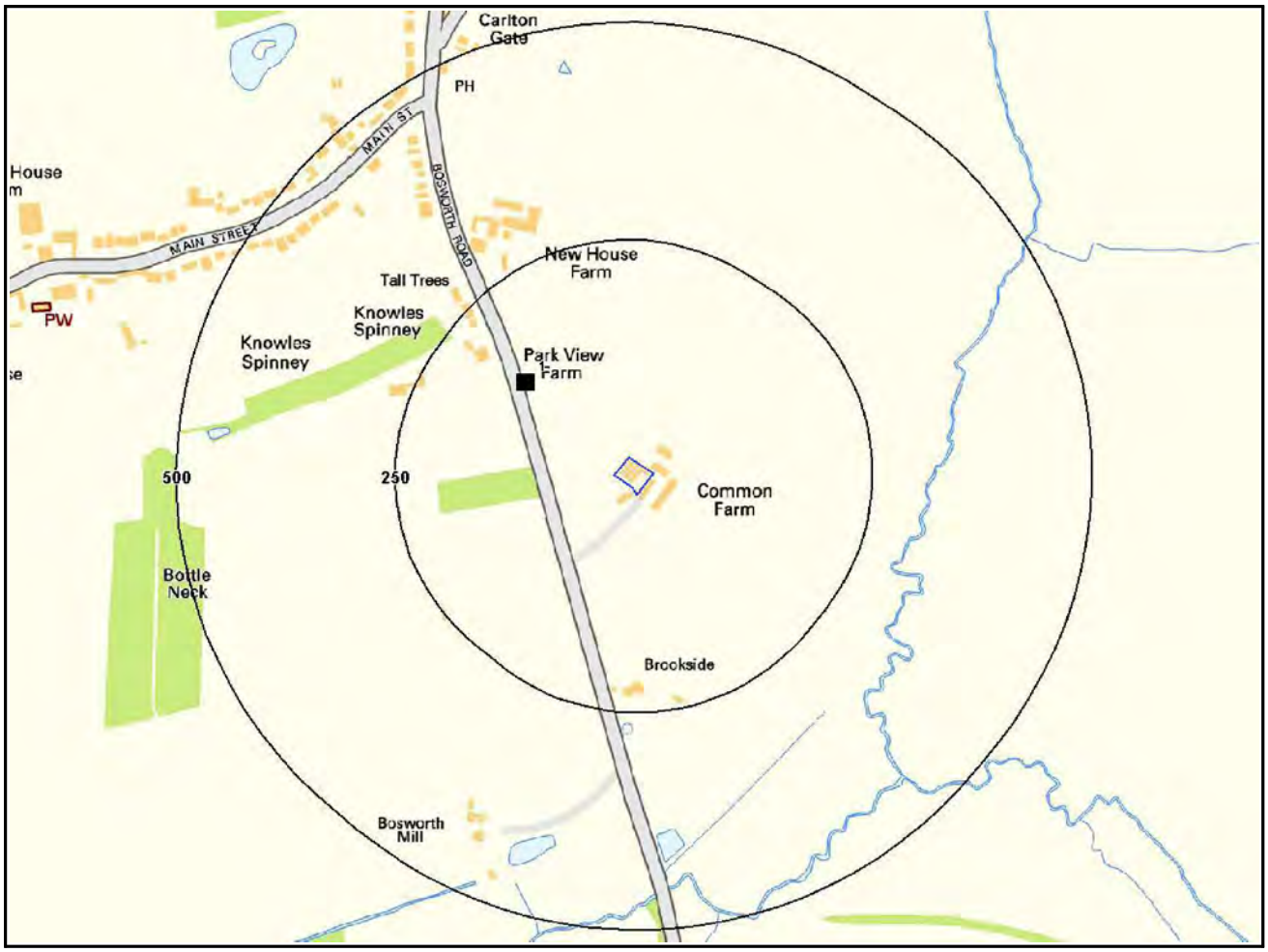
8. Natural Hazards

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

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

1. Authorisations, Incidents and Registers Map



Incidents and Registers Legend

Enabled by Ordnance Survey

Crown Copyright. All Rights Reserved
Licence Number: 100035207

- 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
- IPPC & IPC Authorisations
- LAPPC Authorisations
- COMAH / NIHHS Sites
- Sites Determined as Contaminated Land

2. Landfill and Other Waste Sites Map

NW N NE



W E

SW S SE

Landfill & Other Waste Sites Legend

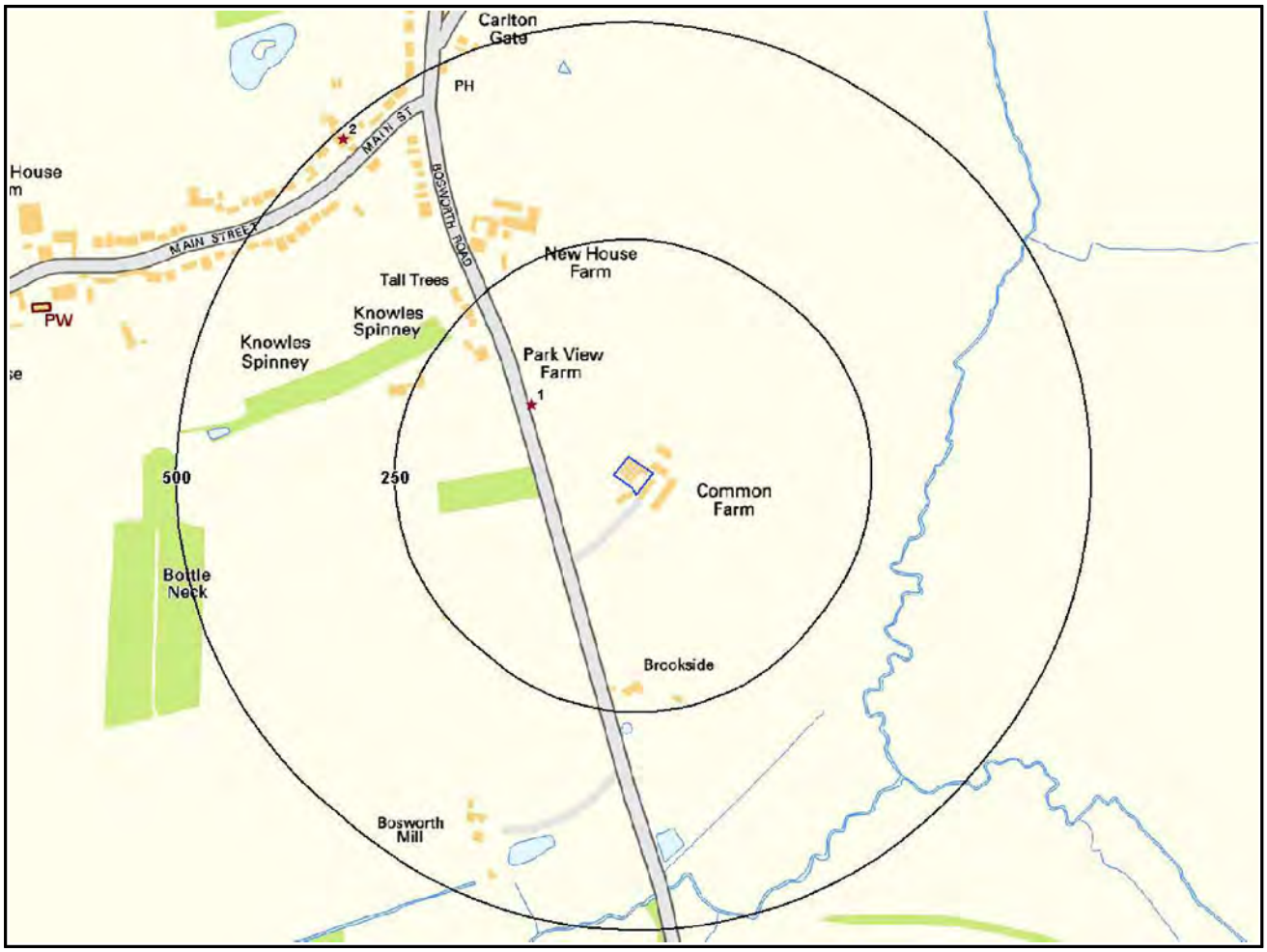
Enabled by Ordnance Survey

Crown Copyright. All Rights Reserved
Licence Number: 100035207

- Site Outline
- Search Buffers (m): 250, 500
- E.A. Active Landfill
- E.A. Historic Landfill (Area Data)
- E.A. Historic Landfill (Point Data)
- BGS / DoE Survey Landfill
- Local Authority Landfill (Area Data)
- Local Authority Landfill (Point Data)
- Operational Waste Treatment Licence
- Closed Waste Treatment Licence
- REGIS Waste Licence
- Operational Landfill
- Closed Landfill

3. Current Land Use Map

NW N NE



◄W E►

SW S SE

Current Land Use Legend

Enabled by Ordnance Survey

Crown Copyright. All Rights Reserved
Licence Number: 100035207

Site Outline

250 / 500 Search Buffers (m)

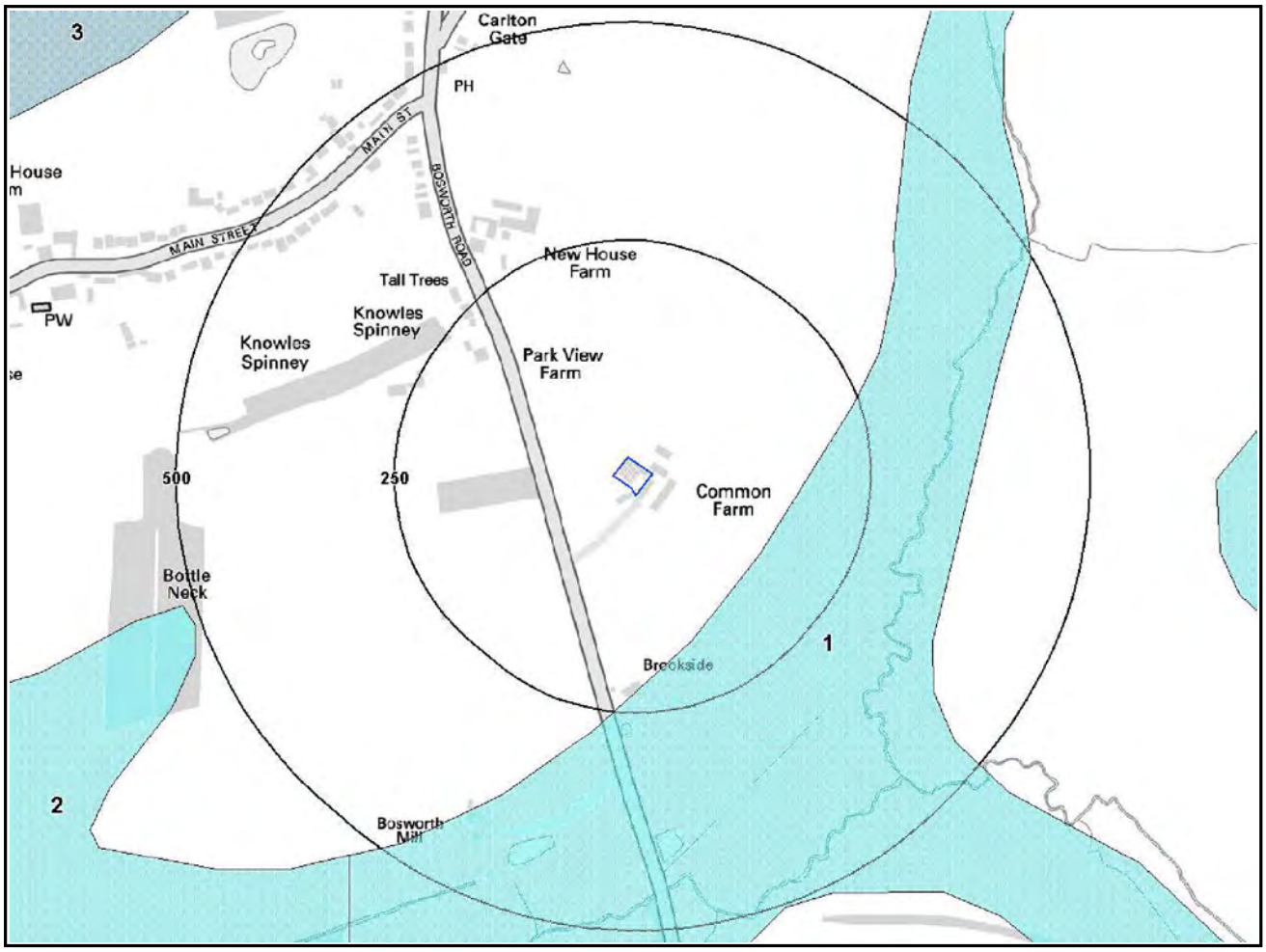
Current Industrial Sites

Petrol & Fuel Sites

Underground High Pressure Oil & Fuel Pipelines

5. Hydrogeology and Hydrology: - Aquifer and Abstraction Licence Map

NW N NE



W E

SW S SE

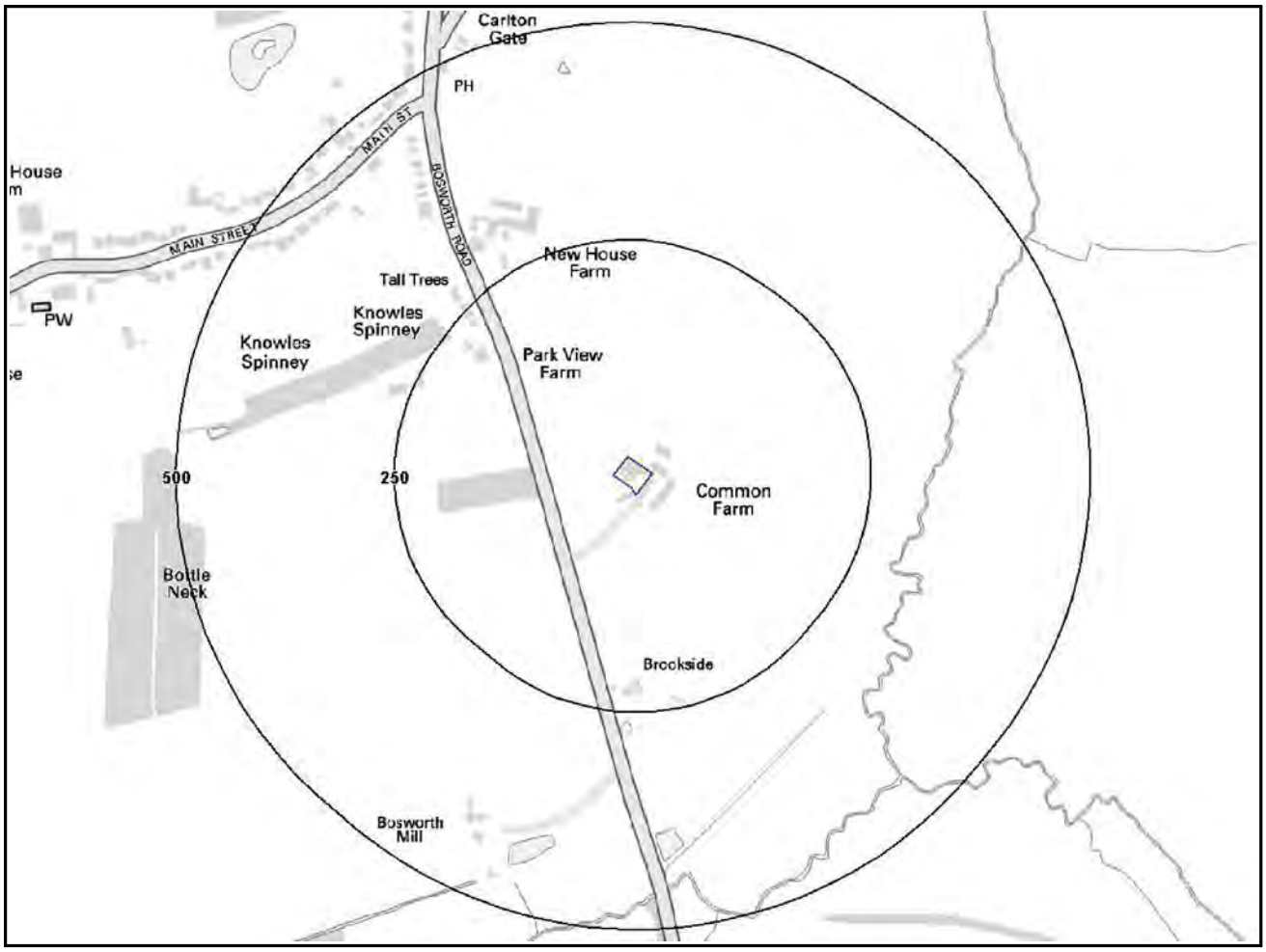
Hydrogeology and Hydrology Legend

Enabled by Ordnance Survey
Crown Copyright. All Rights Reserved
Licence Number: 100035207

- Site Outline
- Search Buffers (m) 250 500
- Minor Aquifer - Low Leaching Potential
- Minor Aquifer - Intermediate Leaching Potential
- Minor Aquifer - High Leaching Potential
- Major Aquifer - Low Leaching Potential
- Major Aquifer - Intermediate Leaching Potential
- Major Aquifer - High Leaching Potential
- Main River
- Groundwater Abstraction Licence
- Surface Water Abstraction Licence

5b. Hydrogeology and Hydrology: - SPZ and Potable Water Abstraction Map

NW N NE

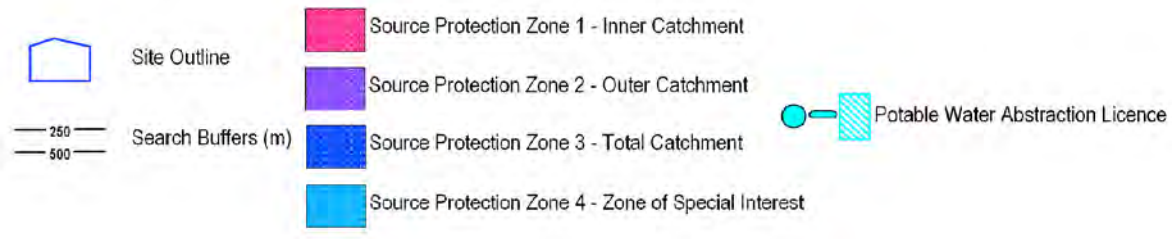


W E

SW S SE

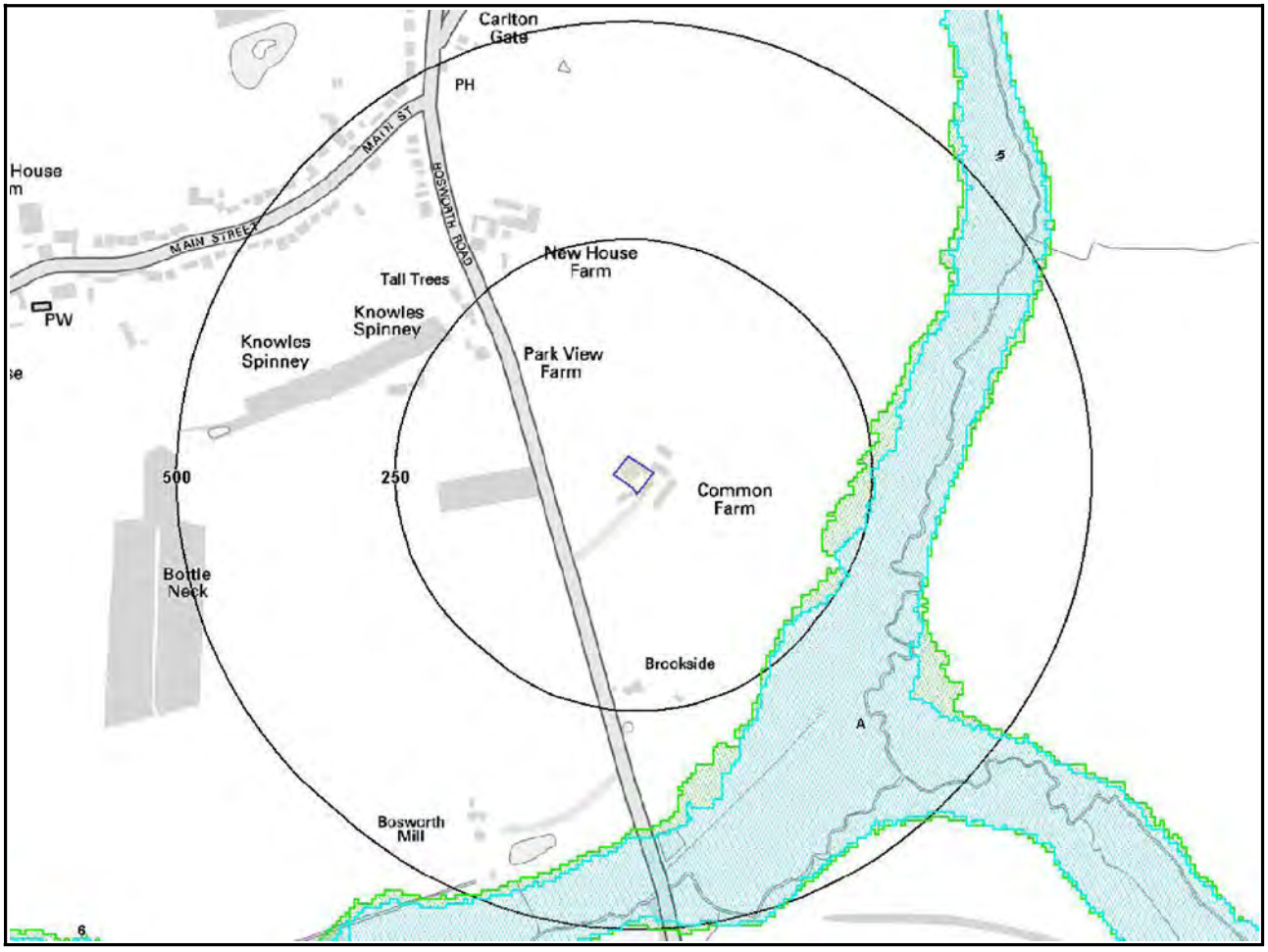
Hydrogeology and Hydrology Legend

Enabled by Ordnance Survey
Crown Copyright. All Rights Reserved
Licence Number: 100035207



6. Surface Water Flood Map

N



S

Flood Legend

Enabled by Ordnance Survey

Crown Copyright. All Rights Reserved
Licence Number: 100035207

Site Outline

250
500
Search Buffers (m)

Zone 2 Floodplain

Zone 3 Floodplain

Flood Storage Area

Area Benefiting from Flood Defences

Flood Defences

7. Ecological Designated Sites Map



Ecological Designated Sites Legend

Enabled by Ordnance Survey

Crown Copyright. All Rights Reserved
Licence Number: 100035207

Site Outline
SAC
SSSI
NNR
World Heritage Sites
250
500
Search Buffers (m)
SPA
Ramsar
LNR

GroundSure Geology & Ground Stability Report

Address: COMMON FARM, BARTON ROAD, CARLTON, NUNEATON, CV13 0RL

Date: Jul 31, 2008

GroundSure Reference: HMD-6-184462

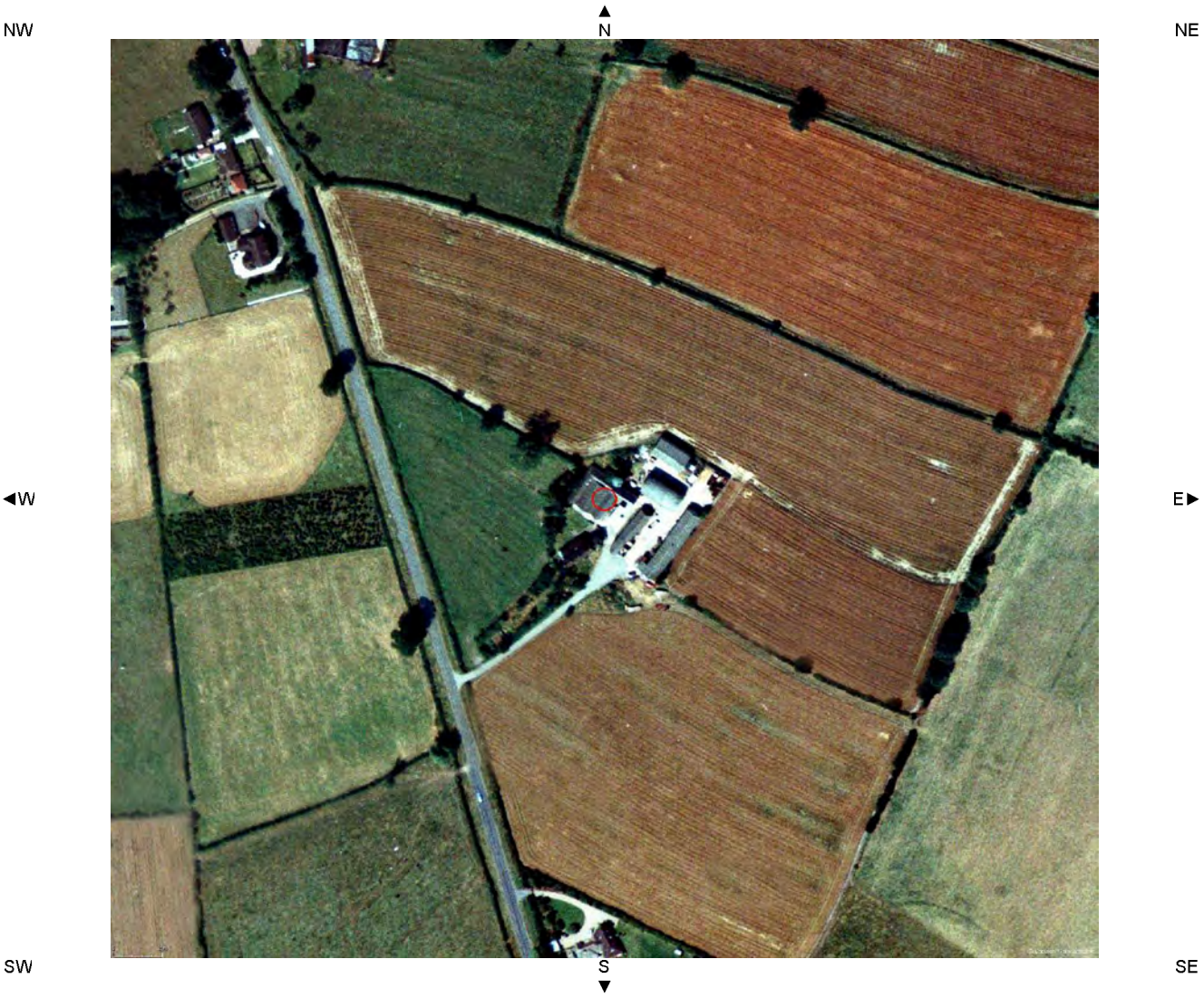
Your Reference: P4635



Brought to you by GroundSure

If you would like any further assistance regarding this report then please contact
GroundSure on [T] 01273 819700, [F] 01273 377902, email: info@groundsure.com

Aerial Photograph of Study Site



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

Site Name:COMMON FARM, BARTON ROAD, CARLTON, NUNEATON, CV13 0RL
Grid Reference: 440313,304769

Overview of Findings

The GroundSure Geology and Ground Stability Report 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 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?	No
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 not in a radon Affected Area, as less than 1% 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 Resea rch 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:155

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	0	-	-
2.2 Historical Underground Workings Features from Small Scale Mapping	0	0	0	0	0
2.3 Current Ground Workings	0	0	0	0	0

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 Shallow Mining*	1	-	-	-	-
3.4 Non – Coal Mining Cavities	0	0	0	0	0
3.5 Natural Cavities	0	0	0	0	0
3.6 Brine Extraction	0	0	0	0	0
3.7 Gypsum Extraction	0	0	0	0	0
3.8 Tin Mining	0	0	0	0	0
3.9 Clay Mining	0	0	0	0	0

*This includes an automatically generated 150m buffer zone around the site

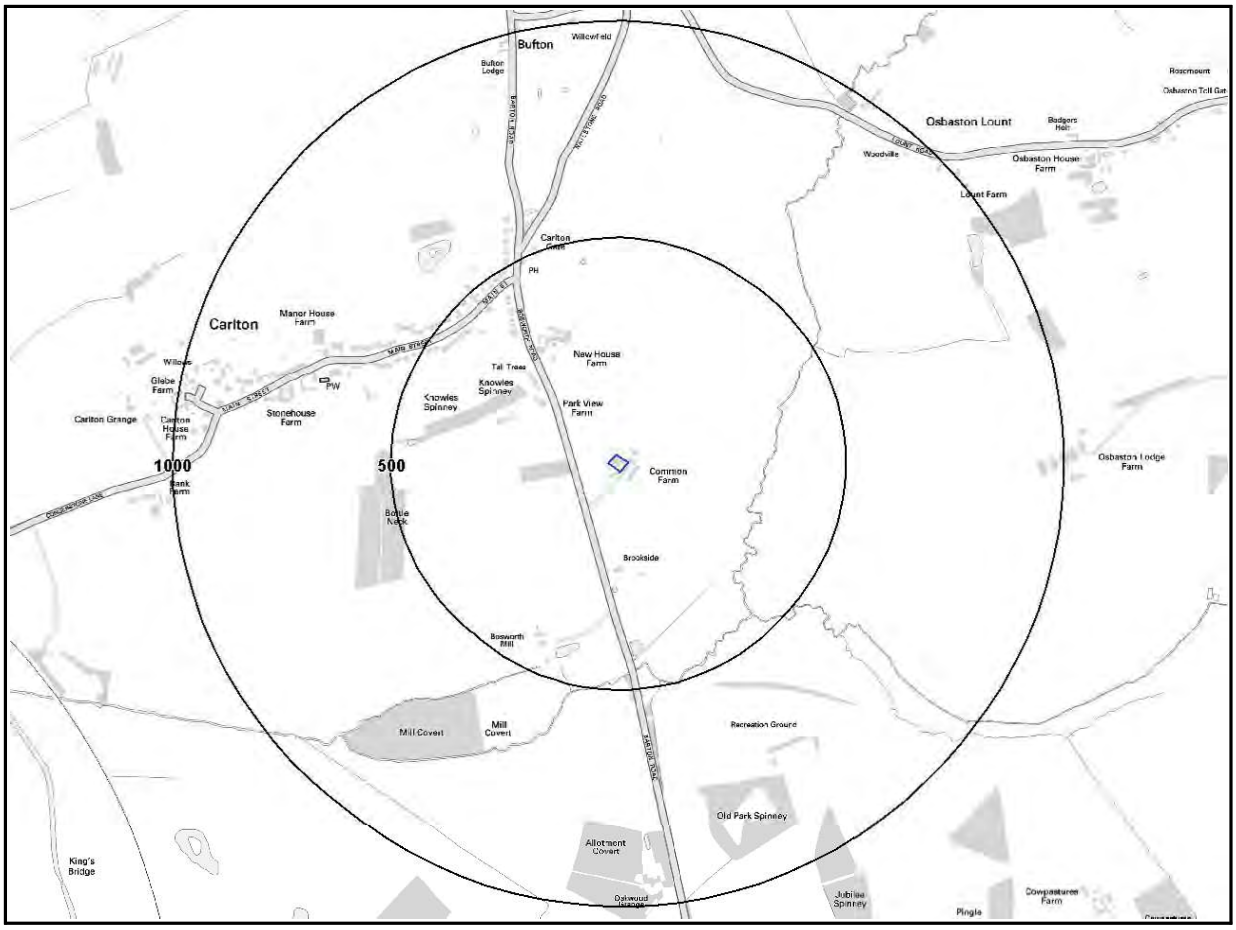
4. Natural Ground Subsidence	on-site*	0-50	51-250	251-500	501-1000
4.1 Shrink-Swell Clay	Low	-	-	-	-
4.2 Landslides	Very Low	-	-	-	-
4.3 Ground Dissolution of Soluble Rocks	Negligible	-	-	-	-
4.4 Compressible Deposits	Negligible	-	-	-	-
4.5 Collapsible Deposits	Negligible	-	-	-	-
4.6 Running Sand	Very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

1.1 Artificial Ground Map

NW N NE



W E

SW S SE

Artificial Ground Legend

Enabled by Ordnance Survey

Crown Copyright. All Rights Reserved
Licence Number: 100035207

Site Outline

500
1000
Search Buffers (m)

Made Ground (undivided)

Worked Ground (undivided)

Infilled Ground

Disturbed Ground (undivided)

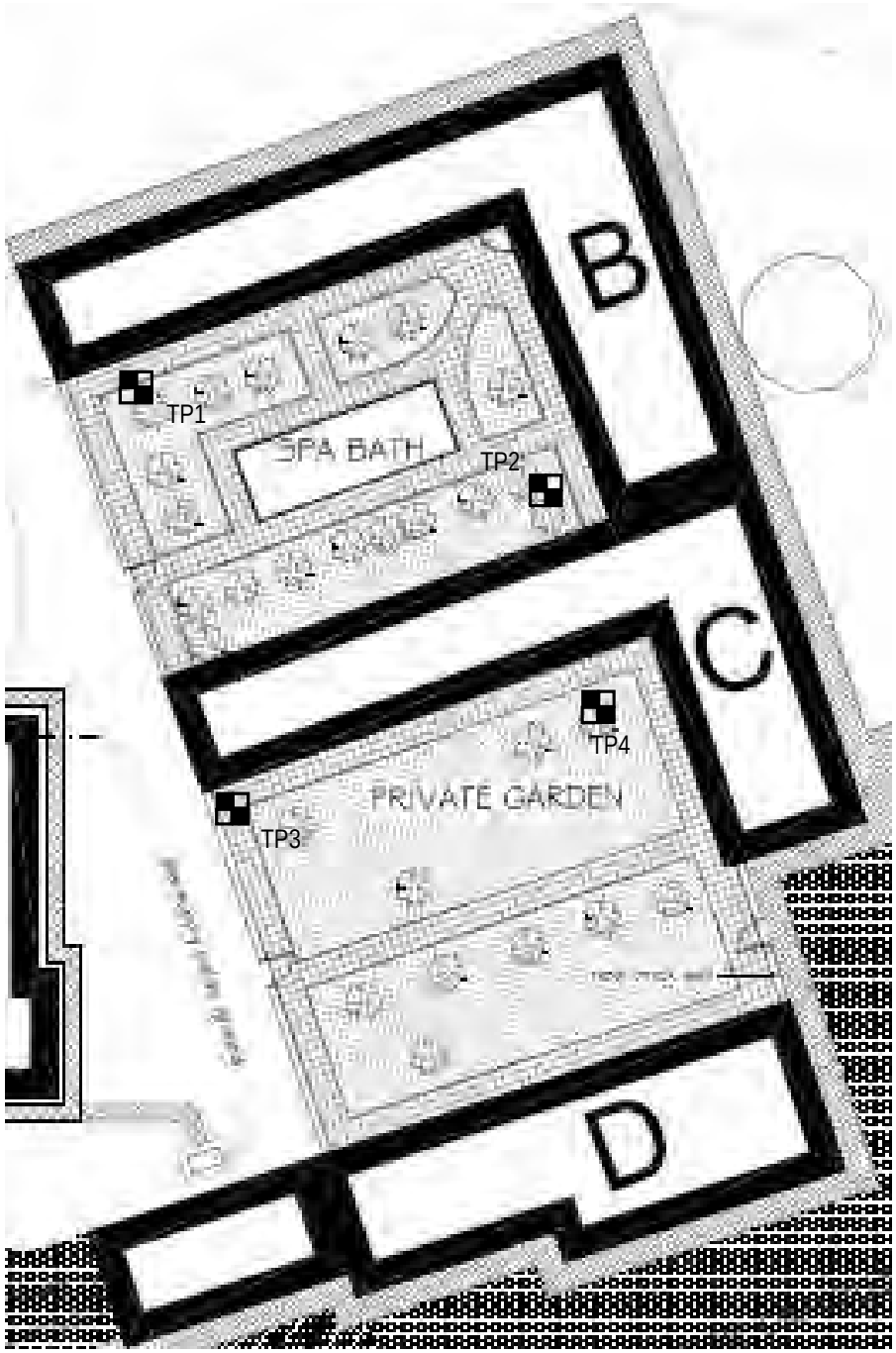
Landscaped Ground (undivided)

Reclaimed Ground

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

APPENDIX E

GRM Development Solutions
geoenvironmental - civil - structural



DO NOT SCALE

NOTES:

Site boundary

TP1 Trial Pit Location

GRM Development Solutions Ltd
Laurus House, First Avenue, Centrum 100,
Burton upon Trent, Staffordshire, DE14 2WH
Tel: 01283 551249 Fax: 01283 211968
mail@grm-uk.com www.grm-uk.com

CLIENT:
HSSP Architects

PROJECT:
Common Farm, Barton Road, Carlton

TITLE:
Exploratory Hole Location Plan

SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN :	DATE:
NR	**07/2008**
PROJECT No:	DRAWING No:
P4635	3

© GRM Development Solutions Ltd
© Crown Copyright. AL 100014100

APPENDIX F

GRM Development Solutions
geoenvironmental - civil - structural

GRM Development Solutions
geoenvironmental - civil - structural
Burton-on-Trent (HQ) Tel: 01283 551249
Market Harborough Tel: 01858 414981
Email: mail@grm-uk.com Web: www.grm-uk.com

Trial Pit Log

Trial Pit Number **TP1**

Site Common Farm, Carlton

Ground Level mAOD 0.000

Client HSSP Architects

GRM Project ref: E6598

Coordinates: 0.00E 0.00N

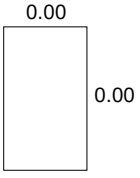
Scale: 1:25

GROUNDWATER		SAMPLES	INSITU TESTING		STRATA		STRATA RECORD	
Strike	Depth (m)	Depth/Type/Ref (m)	Depth (m)	Hand Vane Strength (kN/m²)	Depth (m)	Level (mAOD)	Legend	Description
		0.15-0.20/D/ 0.20-0.30/D/			0.15	-0.15		Concrete.(Made Ground)
		0.40-0.50/D/			0.30	-0.30		Medium dense brown silty clayey fine to coarse sand with some fine to coarse subangular to subrounded gravel including quartzite and brick.(Made Ground)
	1				0.50	-0.50		Firm brown silty slightly sandy CLAY with some fine to coarse subangular to subrounded gravel including quartzite.(GLACIAL TILL)
	2							*End of Trial Pit at 0.50 m*

Excavation Details

Date excavated: 25/07/2008
Date backfilled: 25/07/2008
Shoring:
Stability:
Plant: Mini-digger
Logged by: NR

Dimensions (m)



Final Depth (m): 0.50

Groundwater Observations

No groundwater observed

General Remarks:

For contamination testing only

Strata strengths/densities determined by observation only.

GRM Development Solutions
geoenvironmental - civil - structural
Burton-on-Trent (HQ) Tel: 01283 551249
Market Harborough Tel: 01858 414981
Email: mail@grm-uk.com Web: www.grm-uk.com

Trial Pit Log

Trial Pit Number **TP2**

Site Common Farm, Carlton

Ground Level mAOD 0.000

Client HSSP Architects

GRM Project ref: E6598

Coordinates: 0.00E 0.00N

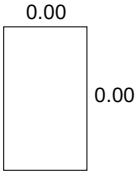
Scale: 1:25

GROUNDWATER		SAMPLES	INSITU TESTING		STRATA		STRATA RECORD	
Strike	Depth (m)	Depth/Type/Ref (m)	Depth (m)	Hand Vane Strength (kN/m²)	Depth (m)	Level (mAOD)	Legend	Description
		0.20-0.30/D/			0.20	-0.20		Concrete.(Made Ground)
		0.30-0.40/D/						Firm brown silty sandy clay with some fine to coarse angular to subrounded gravel including brick and quartzite.(Made Ground)
		0.60-0.70/D/			0.50	-0.50		Firm brown and grey silty locally sandy CLAY with occasional fine to coarse subangular to subrounded gravel including sandstone and quartzite.(GLACIAL TILL)
	1				0.80	-0.80		*End of Trial Pit at 0.80 m*
	2							

Excavation Details

Date excavated: 25/07/2008
Date backfilled: 25/07/2008
Shoring:
Stability:
Plant: Mini-digger
Logged by: NR

Dimensions (m)



Final Depth (m): 0.80

Groundwater Observations

No groundwater observed

General Remarks:

For contamination testing only.

Strata strengths/densities determined by observation only.

GRM Development Solutions
Geoenvironmental - civil - structural
Burton-on-Trent (HQ) Tel: 01283 551249
Market Harborough Tel: 01858 414981
Email: mail@grm-uk.com Web: www.grm-uk.com

Trial Pit Log

Trial Pit Number **TP3**

Site Common Farm, Carlton

Ground Level mAOD 0.000

Client HSSP Architects

GRM Project ref: E6598

Coordinates: 0.00E 0.00N

Scale: 1:25

GROUNDWATER		SAMPLES	INSITU TESTING		STRATA		STRATA RECORD	
Strike	Depth (m)	Depth/Type/Ref (m)	Depth (m)	Hand Vane Strength (kN/m²)	Depth (m)	Level (mAOD)	Legend	Description
		0.20-0.30/D/			0.20	-0.20		Concrete.(Made Ground)
		0.30-0.40/D/						Soft brown silty sandy clay with some fine to coarse subangular to subrounded gravel including ash, brick and quartzite.(Made Ground)
		0.40/D/			0.40	-0.40		
		0.50-0.60/D/			0.45	-0.45		Firm black and grey silty locally sandy clay with occasional fine to coarse angular to subrounded gravel including brick, quartzite and wood.(Made Ground)
		0.80-0.90/D/			0.80	-0.80		Medium dense brown slightly silty slightly clayey fine to coarse sand with some fine to coarse subangular to subrounded gravel including quartzite.(Made Ground)
	1				1.00	-1.00		Firm brown and grey sandy slightly clayey SILT.(GLACIAL TILL)
								End of Trial Pit at 1.00 m
	2							

Excavation Details	Dimensions (m)	Groundwater Observations
Date excavated: 25/07/2008 Date backfilled: 25/07/2008 Shoring: Stability: Plant: Mini-digger Logged by: NR	0.00 0.00 Final Depth (m): 1.00	No groundwater observed

General Remarks:

For contamination testing only.

Strata strengths/densities determined by observation only.

GRM Development Solutions geoenvironmental - civil - structural
Burton-on-Trent (HQ) Tel: 01283 551249
Market Harborough Tel: 01858 414981
Email: mail@grm-uk.com Web: www.grm-uk.com

Trial Pit Log

Trial Pit Number **TP4**

Site Common Farm, Carlton

Ground Level mAOD 0.000

Client HSSP Architects

GRM Project ref: E6598

Coordinates: 0.00E 0.00N

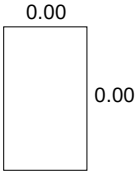
Scale: 1:25

GROUNDWATER		SAMPLES	INSITU TESTING		STRATA		STRATA RECORD	
Strike	Depth (m)	Depth/Type/Ref (m)	Depth (m)	Hand Vane Strength (kN/m²)	Depth (m)	Level (mAOD)	Legend	Description
		0.20-0.30/D/			0.20	-0.20		Concrete.(Made Ground)
		0.30-0.40/D/						Soft silty very sandy clay with some fine to coarse angular to subrounded gravel including brick and quartzite.(Made Ground)
		0.60-0.70/D/			0.50	-0.50		Firm to stiff grey and brown slightly silty CLAY.(GLACIAL TILL)
	1				1.00	-1.00		*End of Trial Pit at 1.00 m*
	2							

Excavation Details

Date excavated: 25/07/2008
Date backfilled: 25/07/2008
Shoring:
Stability:
Plant: Mini-digger
Logged by: NR

Dimensions (m)



Final Depth (m): 1.00

Groundwater Observations

No groundwater observed.

General Remarks:

For contamination testing only.

Strata strengths/densities determined by observation only.

APPENDIX G

GRM Development Solutions
geoenvironmental - civil - structural

CONTAMINANTS	CLEA SGVs			
	Resi with plants	Resi w/out plants	Allotments	Comm/Ind
Arsenic	20	20	20	500
Cadmium* **pH**	***6 7 8***	30	***6 7 8***	1400
	1 2 8		1 2 8	
Chromium (hexavalent)	130	200	130	5000
Chromium (total)				
Lead	450	450	450	750
Mercury	8	15	8	480
Selenium	35	260	35	8000
Nickel	50	75	50	5000
Ethylbenzene* **	***1 2.5 5***	***1 2.5 5***	***1 2.5 5***	***1 2.5 5***
	9 21 41	16 41 80	18 43 85	48,000
Toluene* **	***1 2.5 5***	***1 2.5 5***	***1 2.5 5***	***1 2.5 5***
	3 7 14	3 8 15	31 73 140	150 350 680
Phenols* **	**1 2.5 5**	**1 2.5 5**	**1 2.5 5**	**1 2.5 5**
	78 150 280	21.9 34.4 37.3	80 155 280	21.9 43 78.1
	TIER 1 ASSESSMENT CRITERIA			
Boron (water soluble)				
Copper	653	25,000	No Tier 1 Value	760,000
Zinc**	395	6,089		110,452
PAH	As Per Individual Determinand			
Free Cyanide	34	34	34	34
	TIER 1 ASSESSMENT CRITERIA (PAHs)			
Acenaphthene	536	2540	No Tier 1 Values Calculated	88000
Acenaphthylene^	21.7	3510		88000
Anthracene	4300	12700		351000
Benzo(a)anthracene	4.79	8.47		290
Benzo(a)pyrene ^	1.1	1.36		29.4
Benzo(b)fluoranthene	5.54	8.47		290
Benzo(ghi)perylene	62.6	84.7		2900
Benzo(k)fluoranthene	55.4	84.7		2900
Chrysene	479	847		29000
Dibenzo(ah)anthracene ^	1.03	1.29		29.5
Fluoranthene	796	1690		57700
Fluorene	454	1690		57700
Ideno(1,2,3-cd)pyrene	6.04	8.47		290
Napthalene	4.4	4.4		98
Phenanthrene^	1470	2010		44400
Pyrene	590	1270		43400

NOTES:-

Revised January 2008

All figures are in mg/kg

GRM Tier 1 Assessment Criteria are Atkins Atrisk Values

^ Values calculated using CLEA UK

* Cd values linked to *pH* of respective sample

** Values for Zinc calculated using the SNIFFER Model

*** SGV's linked to Soil Organic Matter (SOM) content of sample. SGV's assume that free phase is not present

SGV's for Phenols (Residential w/out plant uptake & Comm/ind) are x 1000

GRM TIER 1 ASSESSMENT CRITERIA - PETROLEUM HYDROCARBON FRACTIONS									
LAND USE / CONTAMINANT	Residential **with** plant uptake			Residential **without** plant uptake			Commercial & industrial		
	% Soil Organic Matter # (equivalent Fraction Organic Carbon - %)								
ALIPHATIC	**1%** (0.6)	**2.5%** (1.4)	**5%** (2.9)	**1%** (0.6)	**2.5%** (1.4)	**5%** (2.9)	**1%** (0.6)	**2.5%** (1.4)	**5%** (2.9)
C6-C8	5.37	11.9	22.7	5.37	11.9	22.7	242	535	1019
C8-C10	1.46	3.55	7	1.46	3.56	7.05	66	160	317
C10-C12	8.53	20.8	40.1	8.6	21.2	41.7	29900	29600	29800
C12-C16	40.7	93.5	162	42.1	101	187	29900	29600	29800
C16-35	16100	16100	16200	26100	26700	27300	618000	610000	613000
AROMATIC									
C5-7 (benzene)	0.57	1.32	2.57	0.61	1.41	2.75	26.9	62.1	121
C7-8 (toluene)	0.62	1.46	2.85	0.69	1.63	3.18	30.4	71.1	139
C8-C10	1.08	2.7	5.34	2.39	5.88	11.6	107	262	512
C10-C12	1.92	4.74	9.36	14.2	34.1	63.9	625	1448	2583
C12-C16	2.13	5.42	10.6	72.4	152	235	12150	12250	12300
C16-C21	116	129	133	289	338	361	9160	9230	9180
C21-C35	160	159	158	397	420	402	9380	9300	9250

NOTES:-

Revised January 2008.

SOM converted to FOC using a conversion factor of 0.58. Where FOC analysis results are decimalised x100 to convert to %.

GRM Tier 1 Assessment Criteria calculated as 'Generic Assessment Criteria' using CLEA UK (SOM content as stated, pH 7).

An explanation to the TACs and CLEA UK data source references are provided on pages 6 and 7 of this Appendix.

All figures are reported in mg/kg.

UK Drinking Water Standards (UKDWS)

Parameter	Concentration	Units
Acrylamide	0.1	µg/l
Aluminium	200	µgAl/l
Ammonium	0.5	mgNH4/l
Antimony	5	µgSb/l
Arsenic	10	µgAs/l
Benzene	1	µg/l
Benzo(a)pyrene	0.01	µg/l
Boron	1	mgB/l
Bromate	10	µgBrO3/l
Cadmium	5	µgCd/l
Chromium	50	µgCr/l
Chloride (i)	250	mgCl/l
Conductivity (i)	2500	µS/cm at 20°C
Copper(ii)	2	mgCu/l
Cyanide	50	µgCN/l
1, 2 dichloroethane	3	µg/l
Epichlorohydrin	0.1	µg/l
Fluoride	1.5	mgF/l
Hydrogen ion	10	pH value
Iron	200	µgFe/l
Lead (ii)	25	µgPb/l
Manganese	50	µgMn/l
Mercury	1	µgHg/l
Mineral Oil (TPH)	10	µg/l
Nickel (ii)	20	µgNi/l
Nitrate (iii)	50	mgNO3/l
Nitrite (iii)	0.5	mgNO2/l
Phenol	0.5	µg/l
Polycyclic Aromatic Hydrocarbons (vii) *	0.1	µg/l
Selenium	10	µgSe/l
Sodium	200	mgNa/l
Sulphate (i)	250	mgSO4/l
Tetrachloroethene and Trichloroethene (viii)	10	µg/l
Tetrachloromethane	3	µg/l
Trihalomethanes: Total (ix)	100	µg/l
Vinyl chloride	0.5	µg/l
Zinc	5000	µg/l

Pesticides		
Aldrin	0.03	µg/l
Dieldrin	0.03	µg/l
Heptachlor	0.03	µg/l
Heptachlor epoxide	0.03	µg/l
other pesticides	0.1	µg/l
Pesticides: Total (vi)	0.5	µg/l

Reference

UK Water Supply (Water Quality) Regulations 2000

* PAHs - sum of specified compounds:
- benzo(b)fluoranthene
- benzo(k)fluoranthene
- benzo(ghi)perylene
- indeno(1,2,3-cd)pyrene

Environmental Quality Standards (EQS) Groundwater Thresholds for List 1 & 2 Substances

Table 1: Environmental Quality Standards (EQS) for List 1 Dangerous Substances

Substance	All Freshwater EQS (ug/l)
Mercury	1
Cadmium	5
Hexachlorocyclohexane	0.1
Carbon tetrachloride	12
Total DDT	0.025
pp DDT	0.01
Pentachlorophenol	2
Dieldrin	0.01
Isodrin	0.005
Aldrin	0.01
Endrin	0.005
Total 'Drins	0.03
Hexachlorobenzene	0.03
Hexachlorobutadiene	0.1
Chloroform	12
1,2-dichloroethane	10
Trichlorethylene	10
Perchlorethylene	10
Trichlorobenzene	0.4

Table 2a: Environmental Quality Standards (EQS) for List 2 Dangerous Substances

Substance	EQS Type	All Freshwater EQS (ug/l)	Substance	EQS Type	All Freshwater EQS (ug/l)
1,1,1-Trichloroethane	Annual average	100	Fenitrothion	Annual average	0.01
1,1,2-Trichloroethane	Annual average	400	Flucofuron	95 percentile	1
2,4-D (ester)	Annual average	1	Iron (dissolved)	Annual average	1000
2,4-D (non-ester)	Annual average	40	Lead (dissolved)	Annual average	Hardness related (see table 2b for details)
2,4-Dichlorophenol	Annual average	20	Linuron	Annual average	2
2-Chlorophenol	Annual average	50	Malathion	Annual average	0.01
4-Chloro-3-methyl-phenol	Annual average	40	Mecoprop	Annual average	20
Arsenic (dissolved)	Annual average	50	Mevinphos	Maximum concentration	0.02
Atrazine & Simazine	Annual average	2	Naphthalene	Annual average	10
Azinphos-methyl	Annual average	0.01	Nickel (dissolved)	Annual average	Hardness related (see table 2b for details)
Bentazone	Annual average	500	Omethoate	Annual average	0.01
Benzene	Annual average	30	PCSDs	95th percentile	0.05
Biphenyl	Annual average	25	Permethrin	95th percentile	0.01
Boron (dissolved)	Annual average	2000	pH	95th percentile	06-Sep
Chloronitrotoluenes	Annual average	10	Sulcofuron	95th percentile	25
Chromium (dissolved)	Annual average	Hardness related (see table 2b for details)	Toluene	Annual average	50
Copper (dissolved)	Annual average	Hardness related (see table 2b for details)	Triazaphos	Annual average	0.005
Cyfluthrin	95th percentile	0.001	Tributyltin	Maximum concentration	0.02
Demeton	Annual average	0.5	Trifluralin	Annual average	0.1
Dichlorvos	Annual average	0.001	Triphenyltin	Maximum concentration	0.02
Dichlorvos	Maximum concentration	-	Vanadium (dissolved)	Annual average	Hardness related (see table 2b for details)
Dimethoate	Annual average	1	Xylene (m and p, o)	Annual average	30
Endosulphan	Annual average	0.003	Zinc (total)	Annual average	Hardness related (see table 2b for details)
Ammonia (as NH3)		15	500		

Table 2b: Environmental Quality Standards (EQS) for hardness related List 2 dangerous substances

Substance	EQS type	EQS (ug/l) for Hardness bands (mg/l CaCO3) 0-50	>50-100	>100-150	>150-200	>200-250	>250
Freshwaters, suitable for all fishlife							
Copper (dissolved)	Annual average	1	6	10	10	10	28
Copper (dissolved)	95th percentile	5	22	40	40	40	112
Nickel (dissolved)	Annual average	50	100	150	150	200	200
Vanadium (dissolved)	Annual average	20	20	20	20	60	60
Freshwaters, suitable for Salmonid (game) fish							
Chromium (dissolved)	Annual average	5	10	20	20	50	50
Lead (dissolved)	Annual average	4	10	10	20	20	20
Zinc (total)	Annual average	8	50	75	75	75	125
Zinc (total)	95th percentile	30	200	300	300	300	500
Freshwaters, suitable for Cyprinid (coarse) fish							
Chromium (dissolved)	Annual average	150	175	200	200	250	250
Lead (dissolved	Annual average	20	125	125	250	250	250
Zinc (total)	Annual average	75	175	250	250	250	500
Zinc (total)	95th percentile	300	700	1000	1000	1000	2000

Contaminant Thresholds for Subsurface Water Pipes

Contaminant	Material selection Threshold Level (mg/kg dried soil)
Corrosion	
Sulphate (SO4)	2000
Sulphur (S)	5000
Sulphide (S)	250
pH	<pH5, >pH8
Toxic Substances	
Antimony (Sb)	10
Arsenic (As)	10*
Cadmium (Cd)	3
Chromium (hexavalent) (Cr)	25
Chromium (total)	600
Cyanide (free) (Cn)	25*
Cyanide (complexed) (Cn)	250*
Lead (Pb)	500
Mercury (Hg)	1
Selenium (Se)	3
Thiocyanate (SCN)	50
Organic Contaminants	
Coal Tar	50
Cyclohexane extractable	50
Phenol	5
Poly Aromatic Hydrocarbons	50
Toluene extractable	50
TPH DRO (diesel, kerosene)	100
Petrol	10
Mineral oils	1000

* It is not recommended that water pipes should be laid in sites where these substances are identified or suspected

Ref: Water Regulations Advisory Scheme (WRAS) (No. 9-04-03 Issue 1)

GRM TIER 1 ASSESSMENT CRITERIA

GRM have derived Tier 1 Assessment Criteria (TAC) to assess the risks posed to human health from petroleum hydrocarbon fractions and selected Polycyclic Aromatic Hydrocarbons (PAHs). TACs have been calculated using CLEA UK risk assessment software and principles laid out in the Contaminated Land Report (CLR) model procedures (R&D publications CLR 7, 9, 10, 11 and associated reports). The CLEA UK risk assessment software has been run in-house by GRM on numerous occasions, with each lowest output value adopted as the TAC. References to physico-chemical and toxicological parameters are provided in the following table and are from the data sources detailed below. TACs for additional PAHs are under development, however in the interim GRM have adopted Atkin's ATRISK^{SOIL} Values which have been formulated using a version of the BP RISC 4.0 risk assessment model, adapted according to the CLEA methodology.

Data source references:-

Tox 12 - DEFRA & E (2003). Contaminants in Soil: Collation of Toxicogical data and intake values for humans. Dioxins, Furans and dioxin-like PCBs

Tox 19 - DEFRA & E (2003). Contaminants in Soil: Collation of Toxicogical data and intake values for humans. Xylenes

Tox 20 - DEFRA & EA (2003). Contaminants in Soil: Collation of Toxicogical data and intake values for humans. Napthalene

Tox 24 - DEFRA & EA (2004). Contaminants in Soil: Collation of Toxicogical data and intake values for humans. Trichloroethene

WHO - World Health Organisation website (http://who.int/en/).

IRIS - Integrated Risk Information System. USEPA.(http://epa.gov/iris).

P5-079-TR1 - Environment Agency (2003). Review of Fate and Transport of Selected Contaminants in the Soil Environment. Draft technical report.

USEPA (2001) - Fact Sheet: Correcting the Henry's law constant for soil temperature

USEPA (2004) - Users guide for evaluating subsurface vapor intrusion into buildings.

RBCA - Risk-Based Corrective Action chemical database

TR - Texas Risk Reduction Program. 30 TAC 350.1-350.5 (2003).

RAIS - Risk Assessment Information System (http://rais.ornl.gov/).

IUPAC-NIST Solubility Database. Schwarz (1977)

GRM TIER 1 ASSESSMENT CRITERIA - REFERENCE DATA SOURCES

Input parameter (units) / Contaminant	Boiling point (K)	Vapour Pressure (Pa at 283K)	Critical temp (K)	Enthalpy of vapourisation (cal/mol)	Air Diffusion coefficient (m^2/s)	Water Diffusion coefficient (m^2/s)	Henry's Law Constant (atm-m^3/mol)	Solubility (mg/l)	MW -	log koc -	log kow -	CF root FW -	CF leaf FW -	ORAL / DERMAL HCV (µg/kg bw/day)	ORAL / DERMAL AMDI (µg/day)	ORAL / DERMAL TDSI ** (µg/kg bw/day)	INHALATION HCV (µg/kg bw/day)	INHALATION AMDI (µg/day)	INHALATION TDSI ** (µg/kg bw/day)
ALIPHATIC HYDROCARBONS																			
C6-C8	369 P5-079/TR1	6380 P5-079/TR1	554 USEPA (2001)	6038 USEPA (2001)	1.00E-05 P5-079/TR1	1E-09 P5-079/TR1	1.22 P5-079/TR1	5.4 P5-079/TR1	100	3.6 P5-079/TR1	4.1 P5-079/TR1	Briggs	Briggs	5000 P5-079/TR1	350000	1000	5300 P5-079/TR1	371000	1060
C8-C10	423 P5-079/TR1	6380 P5-079/TR1	635 USEPA (2001)	7457 USEPA (2001)	1.00E-05 P5-079/TR1	1E-09 P5-079/TR1	1.96 P5-079/TR1	0.43 P5-079/TR1	130	4.5 P5-079/TR1	5.2 P5-079/TR1	0.0161 Travis & Arm regression	0.0382	100 P5-079/TR1	7000	20	290 P5-079/TR1	20300	58
C10-C12	473 P5-079/TR1	64 P5-079/TR1	710 USEPA (2001)	8482 USEPA (2001)	1.00E-05 P5-079/TR1	1E-09 P5-079/TR1	2.93 P5-079/TR1	0.034 P5-079/TR1	160	5.4 P5-079/TR1	6.3 P5-079/TR1	0.0143 Travis & Arm regression	0.00884	100 P5-079/TR1	7000	20	290 P5-079/TR1	20300	58
C12-C16	533 P5-079/TR1	4.9 P5-079/TR1	800 USEPA (2001)	9060 USEPA (2001)	1.00E-05 P5-079/TR1	1E-09 P5-079/TR1	12.7 P5-079/TR1	7.60E-04 P5-079/TR1	200	6.7 P5-079/TR1	7.9 P5-079/TR1	0.0122 Travis & Arm regression	0.00105	100 P5-079/TR1	7000	20	290 P5-079/TR1	20300	58
C16-35	593 P5-079/TR1	0.1 P5-079/TR1	890 USEPA (2001)	10696 USEPA (2001)	1.00E-05 P5-079/TR1	1E-09 P5-079/TR1	120 P5-079/TR1	2.50E-06 P5-079/TR1	270	8.8 P5-079/TR1	10.4 P5-079/TR1	0.00814 Travis & Arm regression	0.0000377	2000 P5-079/TR1	140000	400	N/A P5-079/TR1	N/A	N/A
AROMATIC HYDROCARBONS																			
C5-7 (benzene)	353 P5-079/TR1	6,400 P5-079/TR1	562 USEPA (2001)	7342 USEPA (2001)	8.80E-06 P5-079/TR1	9.80E-10 P5-079/TR1	0.00 P5-079/TR1	1770 P5-079/TR1	78	2.13 P5-079/TR1	2.13 P5-079/TR1	Briggs	Briggs	200 TOX 14	10	200	74 TOX 14	124	72
C7-8 (toluene)	383 P5-079/TR1	1780 P5-079/TR1	592 USEPA (2001)	7930 USEPA (2001)	8.70E-06 P5-079/TR1	8.6E-10 P5-079/TR1	5.31E-03 P5-079/TR1	535 P5-079/TR1	92	2.25 P5-079/TR1	2.65 P5-079/TR1	Briggs	Briggs	200 TOX 14	10	200	74 TOX 14	124	72
C8-C10	423 P5-079/TR1	638 P5-079/TR1	635 USEPA (2001)	7457 USEPA (2001)	1.00E-05 P5-079/TR1	1E-09 P5-079/TR1	1.15E-02 P5-079/TR1	65 P5-079/TR1	120	3.2 P5-079/TR1	3.7 P5-079/TR1	Briggs	Briggs	40 P5-079/TR1	2800	8	57 P5-079/TR1	3990	11.4
C10-C12	473 P5-079/TR1	63.8 P5-079/TR1	710 USEPA (2001)	8482 USEPA (2001)	1.00E-05 P5-079/TR1	1E-09 P5-079/TR1	3.42E-03 P5-079/TR1	25 P5-079/TR1	130	3.4 P5-079/TR1	3.9 P5-079/TR1	Briggs	Briggs	40 P5-079/TR1	2800	8	57 P5-079/TR1	3990	11.4
C12-C16	533 P5-079/TR1	4.9 P5-079/TR1	800 USEPA (2001)	9060 USEPA (2001)	1.00E-05 P5-079/TR1	1E-09 P5-079/TR1	1.30E-03 P5-079/TR1	5.8 P5-079/TR1	150	3.7 P5-079/TR1	4.3 P5-079/TR1	Briggs	Briggs	40 P5-079/TR1	2800	8	57 P5-079/TR1	3990	11.4
C16-C21	593 P5-079/TR1	0.111 P5-079/TR1	890 USEPA (2001)	10615 USEPA (2001)	1.00E-05 P5-079/TR1	1E-09 P5-079/TR1	3.18E-04 P5-079/TR1	0.65 P5-079/TR1	190	4.2 P5-079/TR1	4.9 P5-079/TR1	0.019 Travis & Arm regression	0.057	30 P5-079/TR1	2100	6	N/A P5-079/TR1	N/A	N/A
C21-35	613 P5-079/TR1	0.0000446 P5-079/TR1	920 USEPA (2001)	16063 USEPA (2001)	1.00E-05 P5-079/TR1	1E-09 P5-079/TR1	1.64E-05 P5-079/TR1	0.0066 P5-079/TR1	240	5.1 P5-079/TR1	6 P5-079/TR1	0.0167 Travis & Arm regression	0.0132	30 P5-079/TR1	2100	6	N/A P5-079/TR1	N/A	N/A
PAHs																			
Benzo(a)pyrene	768 P5-079/TR1	1.46E-06 P5-079/TR1	969.27 P5-079/TR1	19000 P5-079/TR1	4.30E-06 P5-079/TR1	9E-10 P5-079/TR1	4.54E-07 P5-079/TR1	3.80E-03 P5-079/TR1	768	6.01 P5-079/TR1	6.04 P5-079/TR1	0.00221 Travis & Arm regression	0.0125	0.02 (ID) TOX 2	-	-	0.00007 (ID) TOX 2	-	-
Dibenzo(a,h)anthracene	797 P5-079/TR1	3.44E-09 P5-079/TR1	990.41 P5-079/TR1	29995 P5-079/TR1	2.00E-06 P5-079/TR1	5.18E-10 P5-079/TR1	1.47E-08 P5-079/TR1	0.0006 P5-079/TR1	278	6.58 P5-079/TR1	6.75 P5-079/TR1	0.00209 Travis & Arm regression	0.00486	0.02 (ID) TOX 2	-	-	0.00007 (ID) TOX 2	-	-
Acenaphthylene	543 P5-079/TR1	0.93 P5-079/TR1 #	-	11600 USEPA (2001)	5.40E-06 RBCA	6.6E-10 RBCA	8.29E-05 USPEA (2001)	3.9 RBCA	152	3.6 P5-079/TR1	4 P5-079/TR1	Briggs	Briggs	60 (TDI) TR	4200	12	-	-	-
Phenanthrene	612 P5-079/TR1	0.006 P5-079/TR1 #	-	13000 USEPA (2001)	1.00E-05 RBCA	1.00E-05 RBCA	3.20E-05 USPEA (2001)	5.00E-01 IUPAC-NIST	178	4.36 P5-079/TR1	4.57 P5-079/TR1	0.00733 Travis & Arm regression	0.0884	30 (TDI) TR	2100	6	-	-	-

NOTES:

Revised January 2008.

* Where stated, inhalation HCV converted from mg/m^3 to µg/kg/day assuming a 70kg adult breathes 20m^3 air per day.

** TDSI values as stated when published values available; or TDSI has been assumed as 20% x TDI 1. where MDI > 80% x TDI, or 2. where published MDI values are unavailable.

~ No values cited in literature. Enthalpy of vapourisation calculated using formulas contained in USEPA (2001). Critical temperature (K) estimated from BP (K) using using a 1.5 conversion factor.

APPENDIX H

GRM Development Solutions
geoenvironmental - civil - structural

Kelvin House, RTC Business Park,
London Road, Derby DE24 8UP
Tel: 01332 349977
Fax: 01332 263263
http://www.eiag.co.uk

TEST REPORT No 12791

Issue Date: 12 August 2008

CLIENT DETAILS

Client: GRM DEVELOPMENT SOLUTIONS Ltd
Laurus House
Centrum 100
First Avenue
Burton upon Trent
STAFFORDSHIRE
DE14 2WH

Originator: R Upton

JOB DETAILS

Order Ref: Verbal

Our Ref: 13191/1-4/s

Job Reference P4635

Site Reference Common Farm, Carlton

UKAS TESTING
2702

mCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

TEST REPORT No. 12791 (continued)

TESTING REQUIREMENTS

Date of Requisition **30/07/08**

Client Sample Ref	EIAG Ref	Required Test(s)	Standard	UKAS*	MCERTS*
P4635 *Soil*	**13191 /**				
		Metal content analysis:			
		Cd, Se	**IHM/S0106**	**Y**	**N**
		As, Ni	**IHM/S0104**	**Y**	**N**
		Cr, Cu, Pb, Zn	**IHM/S0104**	**Y**	**Y**
TP1 @ 0.2-0.3m	**1**	**Hg**	**IHM/S0102**	**N**	**N**
TP2 @ 0.2-0.3m	**2**	**FOC analysis**	**IHM**	**N**	**N**
TP3 @ 0.1-0.2m	**3**	**Speciated PAHs content analysis**	**IHM**	**N**	**N**
TP4 @ 0.1-0.2m	**4**	**Phenol Index content analysis**	**IHM**	**N**	**N**
		Total cyanide content analysis	**IHM**	**N**	**N**
		Aq sulphate content analysis	**IHM**	**N**	**N**
		pH analysis	**IHM/S0004**	**Y**	**N**

IHM – In-house method

** indicates ISO17025 / MCERTS accreditation status*

Date of Completion of Testing **12/08/08**

TEST REPORT No. 12791 (continued)

SAMPLE DETAILS

Client Ref	EIAG Ref	Sample Description	Sampling date/time	Date received	Other comments
P4635	**13191 /**				
Soil					
TP1 @ 0.2-0.3m	**1**	**Brown sandy clay, stones**	**Unknown**	**30/07/08**	**-**
TP2 @ 0.2-0.3m	**2**	**Brown sandy clay, stones**	**Unknown**	**30/07/08**	**-**
TP3 @ 0.1-0.2m	**3**	**Brown sandy clay, stones**	**Unknown**	**30/07/08**	**-**
TP4 @ 0.1-0.2m	**4**	**Brown sandy clay, stones, organics, red brick**	**Unknown**	**30/07/08**	**-**

The sampling was not carried out by EIAG Limited; sampling is not a UKAS accredited activity of EIAG Limited.

PREPARED SAMPLE DETAILS

Client Ref	EIAG Ref	Results of sieving over 2mm BS Test Sieve	
P4635	**13191 /**	**Amount passing (%)**	**Description of retained material**
Soil			
TP1 @ 0.2-0.3m	**1**	**66.64**	**Stones**
TP2 @ 0.2-0.3m	**2**	**62.44**	**Stones, brick**
TP3 @ 0.1-0.2m	**3**	**67.55**	**Stones**
TP4 @ 0.1-0.2m	**4**	**54.26**	**Stones, brick**

TEST REPORT No. 12791 (continued)

Results: TOTAL CONTAMINANT SUITE ANALYSIS – P4635

Parameter	**TP1 @ 0.2-0.3m**	**TP2 @ 0.2-0.3m**	**TP3 @ 0.1-0.2m**	**TP4 @ 0.1-0.2m**
	mg/kg (unless stated)			
arsenic	**5.3**	**<1.8**	**3.9**	**6.1**
cadmium	**0.25**	**<0.18**	**<0.18**	**0.50**
chromium	**16.9**	**19.3**	**18.1**	**17.8**
copper	**17.5**	**9.3**	**12.3**	**21.0**
mercury	**0.03**	**0.02**	**0.01**	**0.06**
nickel	**18.1**	**12.9**	**19.0**	**19.4**
lead	**26.8**	**9.4**	**7.4**	**50.2**
selenium	**<1**	**<1**	**<1**	**<1**
zinc	**77.2**	**37.9**	**33.0**	**109.1**
FOC (%)	**0.91**	**0.83**	**0.30**	**3.32**
phenols index	**<0.5**	**<0.5**	**<0.5**	**<0.5**
Total cyanide	**<1**	**<1**	**<1**	**<1**
sulphate (g/l)	**<0.01**	**0.18**	**0.05**	**0.06**
pH (no units)	**8.36**	**8.69**	**7.68**	**8.40**

TEST REPORT No. 12791 (continued)

Results: PAH SPECIATION ANALYSIS – P4635

Species	**TP1 @ 0.2-0.3m** (mg/kg)	**TP2 @ 0.2-0.3m** (mg/kg)	**TP3 @ 0.1-0.2m** (mg/kg)	**TP4 @ 0.1-0.2m** (mg/kg)
Naphthalene	**<0.1**	**<0.1**	**<0.1**	**<0.1**
Acenaphthylene	**<0.1**	**<0.1**	**0.3**	**<0.1**
Acenaphthene	**<0.1**	**<0.1**	**0.2**	**<0.1**
Fluorene	**<0.1**	**<0.1**	**0.2**	**<0.1**
Phenanthrene	**0.2**	**<0.1**	**2.4**	**<0.1**
Anthracene	**<0.1**	**<0.1**	**1.0**	**<0.1**
Fluoranthene	**0.5**	**<0.1**	**9.8**	**0.2**
Pyrene	**0.4**	**<0.1**	**9.1**	**0.2**
Benzo(a)Anthracene	**0.3**	**0.2**	**4.8**	**0.1**
Chrysene	**0.3**	**<0.1**	**5.1**	**0.1**
Benzo(b)fluoranthene	**0.5**	**0.1**	**6.1**	**0.2**
Benzo(k)fluoranthene	**0.2**	**<0.1**	**2.1**	**<0.1**
Benzo(a)pyrene	**0.3**	**<0.1**	**5.3**	**0.2**
Indeno(1,2,3-cd)pyrene	**0.2**	**<0.1**	**3.4**	**<0.1**
Dibenzo(ah)anthracene	**0.2**	**0.5**	**0.5**	**<0.1**
Benzo(ghi)perylene	**0.3**	**0.3**	**2.9**	**0.1**
EPA 16 TOTAL	**<3.9**	**<2.3**	**<53.3**	**<2.0**

C A Stroud
Operations Manager
12th August 2008

END OF TEST REPORT

This Test Report is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. This report may not be reproduced other than in full, except with the prior written approval of EIAG Limited.

TEST REPORT No. 12791 (continued)

REPORT NOTES

In House Methods

IHM/S0002: Moisture Content analysis by Oven Drying
IHM/S0003: Organic Matter analysis by LOI @ 425°C
IHM/S0004: pH in Soil (Instrumental Method)
IHM/S0011: Gerhardt Automatic Aqua Regia Digestion of Soils
IHM/S0102: Operation of FIMS for Soil Extracts
IHM/S0104: Operation of ICP-OES for Soil Extracts
IHM/S0106: Operation of ICP-MS for Soil Extracts

Soil Analysis

Metal results expressed as mg/kg on moisture corrected assisted-dried basis
PAH results expressed as mg/kg on as received sample

APPENDIX I

GRM Development Solutions
geoenvironmental - civil - structural

GRM Statistical Analysis Methodology

Chemical analysis has been carried out on representative soil samples from within the subject site.

Statistical analysis in line with the current guidance given in R&D publication CLR 7 (Assessment of Risks to Human Health from Land Contamination: An overview of the Development of Soil Guideline Values and Related Research) has been carried out. These s

The mean value test has been carried out to identify the Upper 95 percentile (US95) of the distribution curve calculated from the test results available. This value is compared with the relevant standards threshold/guidance level, i.e. CLEA SGV or GRM GAC

The maximum value test has also been carried out to identify if the contamination results are consistent with the calculated distribution curve or whether the data set contains an outlier (hotspot).

Where the maximum value test has a similar distribution, i.e. does not contain any outliers, and the calculated US95 is below the relevant action level then the risk posed to the end user is considered to be acceptable.

Where the maximum value test has a similar distribution, i.e. does not contain any outliers, and the calculated US95 is above the relevant action level then the contaminant poses a risk to the end user which needs to be assessed. Once the risk has been as

Sheet V1a is for all of the data available to determine the presence of outliers. Contaminants, which do not have a similar distribution, are highlighted. Also highlighted are those contaminants which do have a similar distribution and whose US95 exceeds

If an outlier of contamination is identified then this area requires either further investigation or special remedial actions. For contaminants with hotspots then the outlier data is removed and the statistical analysis recalculated. This is done to obtai

Where significantly different types of made ground are present, i.e. from different sources, the analysis is carried out for each type to better quantify the risks posed.

Project No:	P4635					*Land Use: 1 = Residential with domestic gardens*					
Project Name:	Common Farm, Carlton					*2 = Residential w/out domestic gardens*					
Land Use:	1					*Other Details*	*MG*				
Run Number:	v1a		Date: 13/08/2008								
Threshold Values mg/kg:	20.00	5.20	130.00	653.00	8.00	50.00	2.65	35.00	395.00	78.00	N/A
Ref for treshold values:	CLEA	CLEA	CLEA	TIER 1	CLEA	CLEA	CLEA	CLEA	TIER 1	TIER 1	TIER 1

Sample Number	Sample Identity	Depth (m)	Arsenic	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Selenium	Zinc	Total Phenols	pH
TP1		0.2-0.3	5.30	0.25	16.90	17.50	0.03	18.10	26.80	1.00	77.20	0.50	8.36
TP2		0.2-0.3	1.80	0.18	19.30	9.30	0.02	12.90	9.40	1.00	37.90	0.50	8.69
TP3		0.1-0.2	3.90	0.18	18.10	12.30	0.01	19.00	7.40	1.00	33.00	0.50	7.68
TP4		0.1-0.2	6.10	0.50	17.80	21.00	0.06	19.40	50.20	1.00	109.10	0.50	8.40
Mean			4.28	0.28	18.03	15.03	0.03	17.35	17.49	1.00	64.30	0.50	8.28
Standard Deviation			1.88	0.15	0.99	5.23	0.02	3.02	19.85	0.00	35.82	0.00	0.43
No of samples			4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Value of t			2.353	2.353	2.353	2.353	2.353	2.353	2.353	2.353	2.353	2.353	2.353
US_{95}			6.49	0.46	19.19	21.18	0.06	20.90	1.66	1.00	106.45	0.50	7.78
Mean y			0.59	-0.60	1.26	1.16	-1.61	1.23	1.20	0.00	1.76	-0.30	0.92
Standard Deviation y			0.24	0.21	0.02	0.16	0.33	0.08	0.39	0.00	0.25	0.00	0.02
y_{max}			0.79	-0.30	1.29	1.32	-1.22	1.29	1.70	0.00	2.04	-0.30	0.94
T			0.83	1.42	1.27	1.05	1.19	0.65	1.29	0.00	1.14	0.00	0.93
T_{crit}			1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
Mean Value Test			Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	N/A
Maximum Value Test			Similar Distribution	Not Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	N/A

Notes: The US95 value for pH relates to the lower bound value and is used for the calculation of the cadmium SGV
The Mean Value Test for lead is calculated using the arithmetic mean of the log of the test results
The Threshold and US95 values for lead are reported as log values in accordance with CLR guidance

Project No:			P4635					*Land Use: 1 = Residential with domestic gardens*					*3 = Allotments*					
Project Name:			Common Farm, Carlton					*2 = Residential w/out domestic gardens*					*4 = Comm/Ind*					
Land Use:			1					*Other Details:*		*MG*								
Run Number:			v1a PAH		Date:	13/08/2008												
Threshold Values mg/kg:			536.00	21.70	4300.00	4.79	1.10	5.54	62.60	55.40	479.00	1.03	796.00	454.00	6.04	4.40	1470.00	590.00
Ref for threshold values:			TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1
Sample Number	Sample Identity	Depth (m)	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(ghi) perylene	Benzo(k) fluoranthene	Chrysene	Dibenzo(ah) anthracene	Fluoranthene	Fluorene	Ideno(1,2,3-cd) pyrene	Napthalene	Phenanthrene	Pyrene
TP1		0.2-0.3	0.10	0.10	0.10	0.30	0.30	0.50	0.30	0.20	0.30	0.20	0.50	0.10	0.20	0.10	0.20	0.40
TP2		0.2-0.3	0.10	0.10	0.10	0.20	0.10	0.10	0.30	0.10	0.10	0.50	0.10	0.10	0.10	0.10	0.10	0.10
TP3		0.1-0.2	0.20	0.30	1.00	4.80	5.30	6.10	2.90	2.10	5.10	0.50	9.80	0.20	3.40	0.10	2.40	9.10
TP4		0.1-0.2	0.10	0.10	0.10	0.10	0.20	0.20	0.10	0.10	0.10	0.10	0.20	0.10	0.10	0.10	0.10	0.20
Mean			0.13	0.15	0.33	1.35	1.48	1.73	0.90	0.63	1.40	0.33	2.65	0.13	0.95	0.10	0.70	2.45
Standard Deviation			0.05	0.10	0.45	2.30	2.55	2.92	1.34	0.98	2.47	0.21	4.77	0.05	1.63	0.00	1.13	4.44
No of samples			4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Value of t			2.353	2.353	2.353	2.353	2.353	2.353	2.353	2.353	2.353	2.353	2.353	2.353	2.353	2.353	2.353	2.353
US_{95}			0.18	0.27	0.85	4.06	4.48	5.16	2.47	1.78	4.30	0.57	8.26	0.18	2.87	0.10	2.03	7.67
Mean y			-0.92	-0.88	-0.75	-0.39	-0.37	-0.30	-0.40	-0.59	-0.45	-0.58	-0.25	-0.92	-0.54	-1.00	-0.58	-0.28
Standard Deviation y			0.15	0.24	0.50	0.74	0.76	0.78	0.61	0.63	0.81	0.34	0.88	0.15	0.73	0.00	0.66	0.86
y_{max}			-0.70	-0.52	0.00	0.68	0.72	0.79	0.46	0.32	0.71	-0.30	0.99	-0.70	0.53	-1.00	0.38	0.96
T			1.50	1.50	1.50	1.45	1.45	1.40	1.40	1.46	1.44	0.81	1.42	1.50	1.47	0.00	1.46	1.44
T_{crit}			1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
Mean Value Test			Pass	Pass	Pass	Pass	Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Maximum Value Test			Not Similar Distribution	Not Similar Distribution	Not Similar Distribution	Not Similar Distribution	Not Similar Distribution	Similar Distribution	Similar Distribution	Not Similar Distributio	Not Similar Distribution	Similar Distribution	Similar Distribution	Not Similar Distribution	Not Similar Distribution	Similar Distribution	Not Similar Distribution	Not Similar Distribution

Project No:	P4635					*Land Use: 1 = Residential with domestic gardens*					
Project Name:	Common Farm, Carlton					*2 = Residential w/out domestic gardens*					
Land Use:	1					*Other Details*	*MG*				
Run Number:	v1b		Date: 13/08/2008			N.B.Suspected Outliers Removed					
Threshold Values mg/kg:	20.00	5.20	130.00	653.00	8.00	50.00	2.65	35.00	395.00	78.00	N/A
Ref for treshold values:	CLEA	CLEA	CLEA	TIER 1	CLEA	CLEA	CLEA	CLEA	TIER 1	TIER 1	TIER 1

Sample Number	Sample Identity	Depth (m)	Arsenic	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Selenium	Zinc	Total Phenols	pH
TP1		0.2-0.3	5.30	0.25	16.90	17.50	0.03	18.10	26.80	1.00	77.20	0.50	8.36
TP2		0.2-0.3	1.80	0.18	19.30	9.30	0.02	12.90	9.40	1.00	37.90	0.50	8.69
TP3		0.1-0.2	3.90	0.18	18.10	12.30	0.01	19.00	7.40	1.00	33.00	0.50	7.68
TP4		0.1-0.2	6.10	0.50	17.80	21.00	0.06	19.40	50.20	1.00	109.10	0.50	8.40
Mean			4.28	0.20	18.03	15.03	0.03	17.35	17.49	1.00	64.30	0.50	8.28
Standard Deviation			1.88	0.04	0.99	5.23	0.02	3.02	19.85	0.00	35.82	0.00	0.43
No of samples			4.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Value of t			2.353	2.920	2.353	2.353	2.353	2.353	2.353	2.353	2.353	2.353	2.353
US_{95}			6.49	0.27	19.19	21.18	0.06	20.90	1.66	1.00	106.45	0.50	7.78
Mean y			0.59	-0.70	1.26	1.16	-1.61	1.23	1.20	0.00	1.76	-0.30	0.92
Standard Deviation y			0.24	0.08	0.02	0.16	0.33	0.08	0.39	0.00	0.25	0.00	0.02
y_{max}			0.79	-0.60	1.29	1.32	-1.22	1.29	1.70	0.00	2.04	-0.30	0.94
T			0.83	1.15	1.27	1.05	1.19	0.65	1.29	0.00	1.14	0.00	0.93
T_{crit}			1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
Mean Value Test			Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	N/A
Maximum Value Test			Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	N/A

Notes: The US95 value for pH relates to the lower bound value and is used for the calculation of the cadmium SGV
The Mean Value Test for lead is calculated using the arithmetic mean of the log of the test results
The Threshold and US95 values for lead are reported as log values in accordance with CLR guidance

Project No:	P4635					*Land Use: 1 = Residential with domestic gardens 3 = Allotments*										
Project Name:	Common Farm, Carlton					*2 = Residential w/out domestic gardens 4 = Comm/Ind*										
Land Use:	1					*Other Details:* *MG*										
Run Number:	v1b PAH		Date: 13/08/2008			N.B.Suspected Outliers Removed										
Threshold Values mg/kg:	536.00	21.70	4300.00	4.79	1.10	5.54	62.60	55.40	479.00	1.03	796.00	454.00	6.04	4.40	1470.00	590.00
Ref for threshold values:	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1	TIER 1
Sample Number	Sample Identity	Depth (m)	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(ghi) perylene	Benzo(k) fluoranthene	Chrysene	Dibenzo(ah) anthracene	Fluoranthene	Fluorene	Ideno(1,2,3-cd) pyrene	Napthalene	Phenanthrene	Pyrene
TP1		0.2-0.3	0.10	0.10	0.10	0.30	0.30	0.50	0.30	0.20	0.30	0.20	0.50	0.10	0.20	0.10	0.20	0.40
TP2		0.2-0.3	0.10	0.10	0.10	0.20	0.10	0.10	0.30	0.10	0.10	0.50	0.10	0.10	0.10	0.10	0.10	0.10
TP3		0.1-0.2	0.20	0.30	1.00	4.80	5.30	6.10	2.90	2.10	5.10	0.50	9.80	0.20	3.40	0.10	2.40	9.10
TP4		0.1-0.2	0.10	0.10	0.10	0.10	0.20	0.20	0.10	0.10	0.10	0.10	0.20	0.10	0.10	0.10	0.10	0.20
Mean			0.10	0.10	0.10	0.20	0.20	1.73	0.90	0.13	0.17	0.33	2.65	0.10	0.13	0.10	0.13	0.23
Standard Deviation			0.00	0.00	0.00	0.10	0.10	2.92	1.34	0.06	0.12	0.21	4.77	0.00	0.06	0.00	0.06	0.15
No of samples			3.00	3.00	3.00	3.00	3.00	4.00	4.00	3.00	3.00	4.00	4.00	3.00	3.00	4.00	3.00	3.00
Value of t			2.920	2.920	2.920	2.920	2.920	2.353	2.353	2.920	2.920	2.353	2.353	2.920	2.920	2.353	2.920	2.920
US_{95}			0.10	0.10	0.10	0.37	0.37	5.16	2.47	0.23	0.36	0.57	8.26	0.10	0.23	0.10	0.23	0.49
Mean y			-1.00	-1.00	-1.00	-0.74	-0.74	-0.30	-0.40	-0.90	-0.84	-0.58	-0.25	-1.00	-0.90	-1.00	-0.90	-0.70
Standard Deviation y			0.00	0.00	0.00	0.24	0.24	0.78	0.61	0.17	0.28	0.34	0.88	0.00	0.17	0.00	0.17	0.30
y_{max}			-1.00	-1.00	-1.00	-0.52	-0.52	0.79	0.46	-0.70	-0.52	-0.30	0.99	-1.00	-0.70	-1.00	-0.70	-0.40
T			-0.82	-0.82	-0.82	0.90	0.90	1.40	1.40	1.15	1.15	0.81	1.42	-0.82	1.15	0.00	1.15	1.00
T_{crit}			1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
Mean Value Test			Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Maximum Value Test			Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution	Similar Distribution