GeoDyne

Geotechnical &
Environmental
Consultants

Peterborough Road
Crowland

Combined Phase I Desk Study & Phase II Exploratory Investigation For Ashley King (Developments) Ltd

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Project No: D34155		**Date: 14th April 2015**	
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EXECUTIVE SUMMARY

Ground Conditions	Topsoil was encountered to depths of between 0.30m and 0.50m begl. The underlying Drift Deposits were highly variable and were encountered to depths of between 4.80m and 12.00m begl. Near surface Drift Deposits comprised a combination of Clay, Sand and Peat. The deeper Drift Deposits (where present) comprised Sand and Silt. Stiff becoming very stiff and hard Clay was encountered at variable depths of between 4.80m and 12.00m begl beneath the Drift Deposits. The Clay locally progressed into very weak Mudstone.
Foundation Design	A piled foundation solution is recommended for the proposed dwellings. Advice from a specialist piling contractor should be sought to confirm the depths of the piles and the most feasible and cost efficient type of pile to be used at the site.
Floor Slab Design & Ground Gas Precautions	The site is classified as 'Amber 2' in accordance with the NHBC 'Traffic Light' system. Therefore, we would recommend the following precautions are adopted: • Suspended ventilated beam and block floors. • Provision of periscopic air brick ventilation on a minimum of two sides of each dwelling. • Adequate ventilation within the buildings. • Provision of a proprietary gas resistant membrane. • We would recommend that a supply, design and install contract is awarded for the membrane installation with appropriate QA/QC measures employed to ensure the integrity of the membrane. • Service penetrations through the membrane should be suitably sealed to the membrane. • Third party inspection of installed membranes should be undertaken in accordance with the requirements of the NHBC.
Building Near Trees	Foundation designs will need to be adjusted in full accordance with NHBC Standards Chapter 4.2 *'Building near trees'*. It is recommended that cohesive soils of a high volume change potential should be assumed for design purposes, in the first instance.
Radon	No radon precautions are required.
Water	Excavations may require dewatering, which may involve sump pumping techniques, in the first instance, particularly where excavations are left open for a significant period of time.
Excavations /Stability	The sides of the majority of trial pits were found to be unstable/collapsing at depths of 2.20m begl or greater. Shallower instability may be encountered if excavations are left open for long periods. Deeper excavations are likely to require trench support for stability and health and safety reasons. The assessment of excavations and provision of support will be the responsibility of the contractor on site.
Sulphate Classification	Design Class DS-3/ACEC Class AC-3. (BRE Spec. Digest 1:2005).
Coal Mning	No specific investigation or mitigation measures are considered to be necessary.
CBRs	A CBR value ranging from <2% to 3% may be anticipated within the shallow Natural Strata, subject to confirmation by in-situ testing.
Surface Water Drainage	The use of soakaways for surface water disposal is considered unlikely to be feasible.
Contamination Assessment	The soils may be considered to be uncontaminated for the proposed end uses.
Remediation Proposals	<u>Proposed Garden Areas / Public Open Space (POS)</u> No remediation works will be required other than the provision of topsoil in proposed gardens/POS to provide a suitable growing media for plants. <u>Proposed Areas of Hard Standing</u> Specific remedial measures are considered not necessary. <u>Re-use of Existing Topsoil and Natural Strata</u> The existing topsoil and Natural Strata are considered suitable for re-use within the proposed development or for landscaping/capping on alternative developments.
Off Site Disposal	If off-site disposal is required a new contamination assessment may be required to include bespoke leachate analysis (i.e. WAC testing) to classify the soils for off-site disposal with testing criteria to assess whether the soil is hazardous, non-hazardous or inert waste.
Flood Risk	The site is revealed to lie within an area identified as being at risk of flooding. It is recommended that advice be sought from a Drainage Consultant with respect to this matter.
Construction Workers	No contamination has been identified that requires specific PPE.
Utilities	Prior to development of the site, we would recommend that a copy of this report is supplied to utility companies, and that their recommendations relating to appropriate supply pipes are adhered to.
Unforeseen Circumstances	Should any areas of potentially contaminated soil be encountered during site construction works we would recommend consultation with GeoDyne Limited to ensure that our recommendations continue to apply.
Licenses, Permits etc.	The Contractor/Developer is responsible for, and must ensure that, all necessary licenses, permits, plans, registrations and approvals are in place prior to commencing with the earthworks at the site.

1.0 INTRODUCTION

1.1 Introduction

GeoDyne Limited has been appointed by the Client, Ashley King (Developments) Ltd, to undertake a Combined Phase I Desk Study and Phase II Exploratory Investigation on a parcel of land located to the southwest of Peterborough Road, Crowland, Lincolnshire.

1.2 Scope of Works

The scope of the Phase I Desk Study included the following:

- Detailed site walkover.
- Review of historical and contemporary Ordnance Survey publications.
- Review of the sites geology, hydrology and hydrogeology (including a visit to the British Geological Survey in Keyworth).
- Review of commissioned Landmark geological maps.
- Review of the sites coal mining status.
- Review of the sites radon status.
- Review of a commissioned Landmark Envirocheck Report.

Phase II Exploratory Investigation works comprised:

- A sub-contracted utility avoidance scan of proposed exploratory hole locations.
- A series of trial pits and cable percussive boreholes across the site.
- Geotechnical and environmental soils testing.
- A programme of ground gas and water monitoring.

1.3 Project Understanding

We understand that it is proposed to develop the site for a predominantly low-rise residential end-use incorporating private gardens. It is also understood that current development proposals incorporate an area of Public Open Space (POS). This understanding has formed the basis of our report.

For the purposes of the assessments detailed herein, we have adopted a residential with plant uptake end-use (where applicable) for the proposed development. If our understanding is incorrect (for example if a commercial/industrial end-use was proposed), it would be necessary to review our report to ensure it continues to apply.

1.4 Limitations

The conclusions and recommendations made in this report are limited to those that can be made based on the findings of the investigation.

Where comments are made based on information obtained from third parties, GeoDyne Limited assumes that all third party information is true and correct. No independent action has been undertaken to validate the findings of third parties, unless specifically stated.

This report has been prepared in accordance with our understanding of current good practice. However changes to good practice, guidance or legislation may necessitate revision of this report after the date of issue.

We would note that the scope of laboratory testing and our assessment of the chemical soil test results have been primarily focussed on potential risks to human health. Our scope of chemical testing and assessment has not been specifically designed to fulfil any landfill or waste disposal company's requirements to suitably characterise any waste soil arising during future redevelopment of the site, or accurately determine disposal costs for any waste soil, although it will assist in such an assessment.

GeoDyne Limited has prepared this report for the sole use and reliance of the Client, Ashley King (Developments) Ltd, in accordance with our Standard Conditions and Limitations (included in Appendix XI). This report may not be used or relied upon by any unauthorised third party without the explicit written agreement of GeoDyne Limited.

1.5 Confidentiality

The risk assessment herein remains the intellectual property and trade secret of GeoDyne Limited. The information contained within this report must not be disclosed or divulged to any commercial Consultant or other third party without the prior written agreement of GeoDyne Limited.

2.0 SITE DESCRIPTION & HISTORY

2.1 Site Description

The site comprises a rectangular shaped parcel of land located to the southwest of Peterborough Road, Crowland, Lincolnshire. The site may be located centred around approximate Ordnance Survey National Grid Reference 523810E 309130N. A site location plan (Figure No. D34155/01) is included in Appendix I. The site covers an area of approximately 1.87 hectares.

The site comprised the northern half of a sensibly level arable field which was planted with a cereal crop at the time of our intrusive works (February 2015). The field surface was locally noted to be waterlogged, in particular in the ruts from agricultural machinery.

Access onto the site was gained via a small slope down from Peterborough Road in the northwestern corner of the site. The access point onto site was not secured. The remainder of the eastern site boundary was formed by a grass verge which incorporated a number of semi-mature trees. The verge separated the site and James Road, located to the sites east.

The southern site boundary was undefined at the time of our works and the field in which the site was located extended beyond the boundary to the south.

The western boundary was formed by a drainage ditch. Whilst water was present within the ditch, the flow direction of the water could not be ascertained at the time of our works as the water appeared stagnant. The drainage ditch continued to the sites north within a pipe.

The northern boundary was formed by garden fences, and locally brick walls, associated with residential dwellings off Harvester Way and Peterborough Road, located to the north.

The areas to the sites south, west and east (beyond James Road) comprised open arable fields. Residential dwellings were present to the sites north and a former filling station, now used as a hand car wash, was located to the sites northeast, beyond Peterborough Road.

The Annotated Site Plan in Appendix II of this report (Figure No. D34155/02) shows the main features of the site and immediate surrounding area. General views of the site are included on the plan in Appendix III of this report (Figure No. D34155/03).

2.2 Site History

The historical and contemporary Ordnance Survey publications included within the Landmark Envirocheck Report have been reviewed by GeoDyne to establish the history of the site and its environmental setting. The historical Ordnance Survey maps are included as Appendix VIII of this report.

It should be noted that the site boundaries marked on the historical sheets within the Envirocheck Report appears to ‘shift’ on several of the maps. This is due to Envirocheck transposition and scaling algorithm inaccuracies.

The key findings of the historical search are summarised in Table 1.

TABLE 1 – HISTORICAL PUBLICATION DATA		
Date	Features on Site	Features off Site
1880s	• The site comprises an undeveloped field. Drainage ditches are shown to form the boundary of the site (i.e. around the perimeter of the field).	• Kennulph's Drove (later Peterborough Road) is present to the east of the site. • The surrounding area comprises undeveloped open fields. The field boundaries are defined by a network of drainage ditches. • A road (Carrington's Drove) leads to the southeast off Kennulph's Drove. • The settlement of Crowland is present to the north of the site.
1900s	• The site remains essentially unchanged.	• A '*Nursery*' is present approximately 220m to the northwest of the site.
1910s to 1940s	• No maps available for viewing.	• No maps available for viewing.
1950s	• The site remains essentially unchanged.	• Residential development has taken place to the north of the site off Kennulph's Drove.
1960s	• No maps available for viewing.	• No maps available for viewing.
1970s	• The drainage ditches previously forming the northern and southern boundaries are no longer shown (potentially infilled or culverted) and the site now comprises the central area of a larger field.	• The route of Peterborough Road (A1073) has been reconfigured with a junction dividing the road now located to the northwest of the site. One fork of the road leads north to Crowland town centre and the other fork leads northeast, forming a bypass around Crowland. • Further residential development has taken place to the sites northeast along Peterborough Road associated with the expansion of Crowland. • A '*Garage*' is present to the sites northeast, beyond Peterborough Road. • Buildings shown as '*Alderlands*' are present approximately 110m to the sites south. • The Nursery previously to the northwest has become developed with a '*Poultry House*'.
1990s	• The site remains essentially unchanged.	• Residential development is ongoing to the sites north, off Harvester Way. • A '*Depot*', comprising a number of commercial/industrial buildings is located to the northwest in the area of the former Poultry House. • An Electricity Sub-station is shown to the sites north, between the sites northern and Harvester Way.
2006	• The drain previously along the sites eastern boundary is no longer shown (potentially infilled or culverted).	• Residential dwellings off Harvester Way are now present immediately beyond the sites northern boundary.
2014	• The site remains essentially unchanged.	• The section of Peterborough Road to the sites east and the northeastern fork of the road to the sites north are now shown as James Road. • The A18 has been constructed to the sites east, with a roundabout for the junction of the A18 and James Road present approximately 250m to the sites south. • Further dwellings are shown beyond the eastern part of the sites northern boundary.

3.0 GEOLOGY & ENVIRONMENTAL SETTING

3.1 Geological References

The following geological publications were referred to:

- BGS 1:50000 Series Sheet 158 '*Peterborough*' (1984).
- BGS 1:10000 Series Sheet TF20NW (1992).
- BGS Publication '*Geology of the Peterborough district*' (1989).
- BGS Publication '*Geology of the country around Kings Lynn and The Wash*' (1994).
- The Coal Authority and The Law Society Publication '*Coal Mining and Brine Subsidence Claim Searches - Directory and Guidance*', Sixth Edition (2006).
- Environment Agency website: www.environment-agency.gov.uk.
- British Geological Survey website: www.bgs.ac.uk.

3.2 Geology

Superficial Drift Deposits

The site is indicated to be underlain by Nordelph Peat which dates from the Recent and Pleistocene. The on-line BGS information notes Nordelph Peat to comprise '… *trunks and roots of oaks and small trees, some in-situ, and woody debris from alder, birch, sallow, buckthorn and pine are common. In the more seaward areas the peat is largely composed of stems and rhizomes of sedges and reeds. In southern Fenland the peat contains thin but extensive, lenticular deposits of shell marl which formed in shallow meres within the peat fens*'. The Nordelph Peat is indicated to be typically less than 1m in thickness, although locally over 3m in thickness where preserved in channels.

In addition, the 1:50000 scale map reveals that Nordelph Peat has the potential to incorporate a series of silt filled channels (tidal creek deposits).

Drift deposits comprising Abbey Gravel described as Marine/Estuarine Sand and Gravel are shown to be present to the sites west and Barroway Drove Beds comprising '*Salt marsh Clays and silty clays*' are shown to be present to the sites east.

Drift deposits have the potential to alter rapidly in character and geotechnical properties both laterally and vertically over relatively short distances and may also be water bearing.

The peat deposits beneath, and in the general vicinity of, the site are considered to represent a potential source of hazardous ground gas (i.e. methane and carbon dioxide) at the site.

Bedrock Geology

The drift deposits at the site and in the immediate surrounding area are indicated to be underlain by Oxford Clay, dating from the Jurassic.

The 1989 BGS publication describes Oxford Clay as '*pale grey, blocky mudstone…defined by burrowed carbonaceous horizons*'. A further description is provided in the 1994 BGS publication which notes Oxford Clay to comprise '*…paler grey, more calcareous and locally, more silty mudstones with siltstone and cementstone bands*'.

3.3 Faults

No faults are indicated beneath the site or within the general vicinity of the site.

3.4 Man-Made Deposits

No man-made deposits (i.e. Made Ground, Worked Ground or Infilled Ground) are indicated on the reviewed geological map publications on the site.

We would note that the historical publications revealed the presence of drainage ditches along the northern, southern and eastern site boundaries. These ditches became absent between the 1970s and 2006 and it is possible that the channels were infilled or culverted at these times. Any infill materials to the former ditches would represent areas of Made Ground at the site which may represent a low-risk source of hazardous ground gas (i.e. methane and carbon dioxide) at the site.

3.5 Coal Mining

The site does not lie within an area requiring the commission of a coal mining report in accordance with The Coal Authority and The Law Society publication '*Coal Mining and Brine Subsidence Claim Searches - Directory and Guidance*', Sixth Edition (2006).

No specific investigation or mitigation in relation to historical coal mining issues is therefore considered to be necessary at the site.

3.6 Landmark Envirocheck Report

A Landmark Envirocheck Report was commissioned to assist in ascertaining the environmental setting of the site. The full Envirocheck Report is presented in Appendix IX and has revealed the following relevant information (details are only listed where they are within potential influencing distance, i.e. 250m, of the site).

3.6.1 Agency & Hydrological

Aquifer Status

The superficial deposits comprising Nordelph Peat and the underlying bedrock geology comprising Oxford Clay are designated as Unproductive Strata.

Aquifer Descriptions

The Environment Agency describes Unproductive Strata as '*…rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow*'.

Source Protection Zones

The Envirocheck report indicates that the site does not lie within a Source Protection Zone (SPZ), as designated by the Environment Agency. SPZs relate to the protection of groundwater used for public drinking water supply.

Surface Water

The closest surface water feature is indicated to be the drainage ditch which defines the western site boundary.

Three river network offline drainage features are present between 104m and 182m to the sites south and east. These are defined as Tertiary Rivers.

Flood Risk

The site and entire surrounding area are indicated to lie within an area identified to be at risk from both flooding and extreme flooding from rivers or sea without defences.

Local Authority Pollution Prevention and Controls

A single entry for Local Authority Air Pollution Control is listed approximately 29m to the sites east, which relates to Crowland Service Station. The entry is described as '*Petrol filling Station*' and the status is recorded as revoked.

3.6.2 Waste

There are no sites associated with waste (e.g. historic landfills, transfer stations etc.) identified within 250m of the site.

3.6.3 Hazardous Substances

There are no sites associated with hazardous substances (e.g. explosives) identified within 250m of the site.

3.6.4 Geological & Radon

Geological Hazards

The has been given a Hazard Potential ranking of '*High*' with regards to Potential for Compressible Ground Stability Hazards and '*Moderate*' with regards to Potential for Shrinking or Swelling Clay Ground Stability Hazards.

No other potentially significant onerous geological issues have been identified within the Envirocheck report which relate to the site.

BGS Estimated Soil Chemistry Data Maps

The BGS has prepared estimated soil concentration maps for several metals (including arsenic, lead, nickel, chromium and cadmium), which are extrapolated from records available for use within their assessments.

Whilst potentially useful for the inference of Natural Metal Enrichment (NME) of the natural soils in a general locale, the data should not be used to inform any detailed decisions with regards to the chemistry of a particular site as it does not allow for anthropogenic effects.

BGS estimates of the soil chemistry at the site indicate anticipated concentrations of arsenic of 15-25mg/kg, cadmium of <1.8mg/kg, chromium of 90-120mg/kg, lead of <150mg/kg and nickel of 45-60mg/kg.

Based on the information supplied within the Envirocheck report, the site is not shown to be located within an area where Natural Metal Enrichment of the underlying natural soils is likely to be present. However, this is only applicable to the specific determinands listed above.

Radon

The Envirocheck report states that '*The property is in a lower probability radon area, as less than 1% of homes are above the action level…No radon protective measures are necessary in the construction of new dwellings or extensions.*' No specific mitigation in relation to radon issues are therefore required at the site.

3.6.5 Industrial Land Use

A single active entry is recorded within 250m of the site which relates to '*Tourmaster Recovery Ltd*', a breakdown and recovery business located approximately 112m to the sites south.

Two inactive entries are listed within 250m of the site, with the closest comprising '*Crowland Service Station*' (garage services), located 29m to the sites east; the other entry relates to a an ironing and home laundry service.

We note that Crowland Service Station is also recorded as an obsolete Fuel Station entry.

None of the active or inactive entries are considered to have the potential to significantly impact upon the proposed development of the site, taking account of their distance from the site.

3.6.6 Sensitive Land Use

No sensitive land uses are recorded at, or within 250m of, the site.

3.6.7 BGS Borehole Records

The Envirocheck report reveals that the BGS do not hold records for any boreholes relating to the site. Two BGS borehole records are revealed within 250m of the site.

We have reviewed the records for the closest borehole information to the site, located approximately 47m to the sites northeast. The record relates to an inland water survey of wells at this location and is dated 1937. No information relating to ground conditions is provided and on this basis the record is considered to not be applicable to the site.

Information relating to the second record held by the BGS is not available to view.

3.7 Land Use Assessment

As part of the land use assessment, reference has been made to the '*Desk Reference Guide to potentially Contaminative Land Uses*' produced by Mr P Syms and published jointly by the ISVA (The Professional Society for Valuers and Auctioneers) in association with The Royal Institution of Chartered Surveyors and the Chartered Institute of Environmental Health.

We have also made reference to the Department for Environment, Food and Rural Affairs and the Environment Agency Contaminated Land Report CLR8 '*Potential Contaminants for the Assessment of Land*' (March 2002). This document identifies key contaminants which may potentially be present at a site as a result of a given historical land use, and whilst formally withdrawn is still considered to be a useful desk based reference guide.

3.7.1 On Site Assessment

Historically, the site has remained undeveloped and currently comprises the northern half of an undeveloped arable field.

Historical information revealed that the northern, southern and eastern site boundaries have been formed by drainage ditches. These became absent between the 1970s and 2006 and it is possible that they were infilled or culverted at this time.

The site is not identified in any of the land-use categories detailed within the publications referenced in Section 3.7. Based on the information obtained from the desk study and our walkover of the site, potential contamination that may be present could include:

- Metals or metalloids associated with any Made Ground.
- Polycyclic Aromatic Hydrocarbons (PAHs) from any ashy inclusions and/or carbonaceous inclusions in the near surface soils.
- Pesticides associated with the growing of crops.
- Hazardous ground gases (i.e. methane and carbon dioxide) associated with any Peat/organic deposits beneath the site and any Made Ground associated with infill materials to the former drainage ditches along the sites northern, southern and eastern boundaries.

3.7.2 Off Site Assessment

Based on the information obtained from the desk study, the following source of potentially hazardous ground gas (i.e. carbon dioxide and methane) has been identified within potential influencing distance (i.e. <250m) of the site:

- Peat/organic deposits within the sites general environs.

4.0 GROUND INVESTIGATION

4.1 Introduction

Sub-Surface Utility Avoidance Scan

Prior to the commencement of our intrusive works at the site a sub-contracted sub-surface utility scan of proposed exploratory hole locations was undertaken to attempt to avoid buried services. Based on the results of the service scan, the exploratory holes were positioned in accessible areas in order to maximise the amount of information obtained during our site works, whilst avoiding known utilities.

Trial Pits

Eight trial pits (TP1 to TP8) were advanced at the site on 9th February 2015. The pits were excavated to depths of between 2.60m and 3.60m below existing ground level (begl).

Cable Percussive Boreholes

Three cable percussive boreholes (BH1 to BH3) were advanced at the site between 9th and 12th February 2015 to depths of between 14.10m and 15.40m begl. Upon completion, all three boreholes were installed with ground gas monitoring points to a depth of 5m begl to facilitate a programme of monitoring.

Exploratory Hole Locations/Logs

The approximate locations of the exploratory holes are shown on the plan presented in Appendix IV (Figure No. D34155/04). The exploratory hole logs are presented in Appendix V of this report.

4.2 Ground Conditions

Made Ground

Made Ground was not encountered within any of the exploratory holes advanced at the site.

Topsoil

Naturally derived TOPSOIL was encountered at the surface of all exploratory holes to depths of between 0.30m and 0.50m begl. The topsoil was typically clayey in composition and locally gravelly.

Natural Strata – Drift Deposits

Highly variable Drift Deposits were encountered to depths of between 4.80m and 12.00m begl.

Beneath the Topsoil, across the majority of the site firm (locally firm to stiff) CLAY was typically encountered. Immediately underlying the Topsoil (BH1), and the Clay within the western half of the site at depths commencing from between 1.30m and 1.80m begl, loose to medium dense silty to very silty SAND was encountered. The Sand was underlain by very soft sandy CLAY in TP3 below 2.20m, and by soft sandy SILT below 9.50m within borehole BH1.

An interbed of Peat was generally encountered within the Clay in the eastern half of the site, and within the Clay in TP3 in the western half of the site. The Peat was encountered at depths commencing from between 1.40m and 2.20m begl and was proven to be between 0.10m and 0.30m in thickness. Underlying the Peat in trial pit TP7, a layer of soft peaty CLAY was encountered. This layer was approximately 0.90m in thickness and extended to a depth of 2.40m begl.

We would note that at a depth commencing from 8.40m within borehole BH1 strata comprising very loose SAND becoming soft sandy SILT were encountered. These low strength and apparently anomalous deposits extended to a depth of 12.00m begl and may be associated with an infilled natural channel within the drift deposits. We would note that the potential presence of further infilled channels may be present beneath the site.

The near surface strata encountered within the exploratory holes are considered to comprise Undifferentiated Drift Deposits, inclusive of the Nordelph Peat which is indicated from geological information to underlie the site.

Natural Strata - Solid

Underlying the Drift Deposits within the cable percussive boreholes, at variable depths commencing from 12.00m (BH1), 5.50m (BH2) and 4.80m (BH3) begl, the Oxford Clay Formation was encountered. This typically comprised stiff becoming very stiff and hard CLAY and was locally found to progress into very weak, completely to highly weathered, MUDSTONE.

We would note that no obvious visual or olfactory evidence of significant soil contamination was identified during the course of the site works.

4.3 Water

Slight to steady ingress of perched water was observed within a number of trial pits during excavation, at depths of between 0.80m and 1.40m begl. Rapid water ingress was encountered within the Peat horizon in trial pit TP4 at 1.90m begl.

Deeper water, locally perched, was encountered at depths of between 2.30m and 3.00m begl and was recorded to be standing at depths of between 2.50m and 2.80m on completion.

Water was encountered at a depth of 2.00m in borehole BH1 during advancement. No water was encountered during advancement of boreholes BH2 and BH3, however, water seepage was encountered at a depth of 2.50m from the borehole sides in BH2, following removal of the casing.

4.4 Stability

The sides of the majority of trial pits were found to be unstable/collapsing at depths of 2.20m begl or greater, typically within wet soils. The collapse of the sides below this depth generally resulted in undermining of the shallower strata.

4.5 Plates

A photographic record of the exploratory investigation was obtained during the intrusive works. Selected photographs of the exploratory holes are presented in the Plates included in Appendix X of this report (Plate Nos. 1 to 6).

4.6 Shear Vane Values

In-situ shear vane testing was undertaken within the visually cohesive soils within the trial pits. The results revealed soil shear strength values of typically between 22kN/m^2 and 74kN/m^2, at depths of between 0.50m and 2.30m begl. Lower soil shear strength values of 10kN/m^2 and 12kN/m^2 were recorded at a depth of 2.30m in trial pit TP3, although the sand content within the Clay strata at this location may have had an adverse effect on the shear vane reading.

Shear vane values taken at depths in excess of 1.20m begl were taken ex-situ due to health and safety reasons.

The shear vane values are detailed on the trial pit logs in Appendix V.

4.7 Standard Penetration Test (SPT) Data

In order to establish a strength/depth profile of the soils beneath the site, in-situ Standard Penetration Testing (SPT) was undertaken at intervals of typically 1m to 1.5m within the cable percussive boreholes.

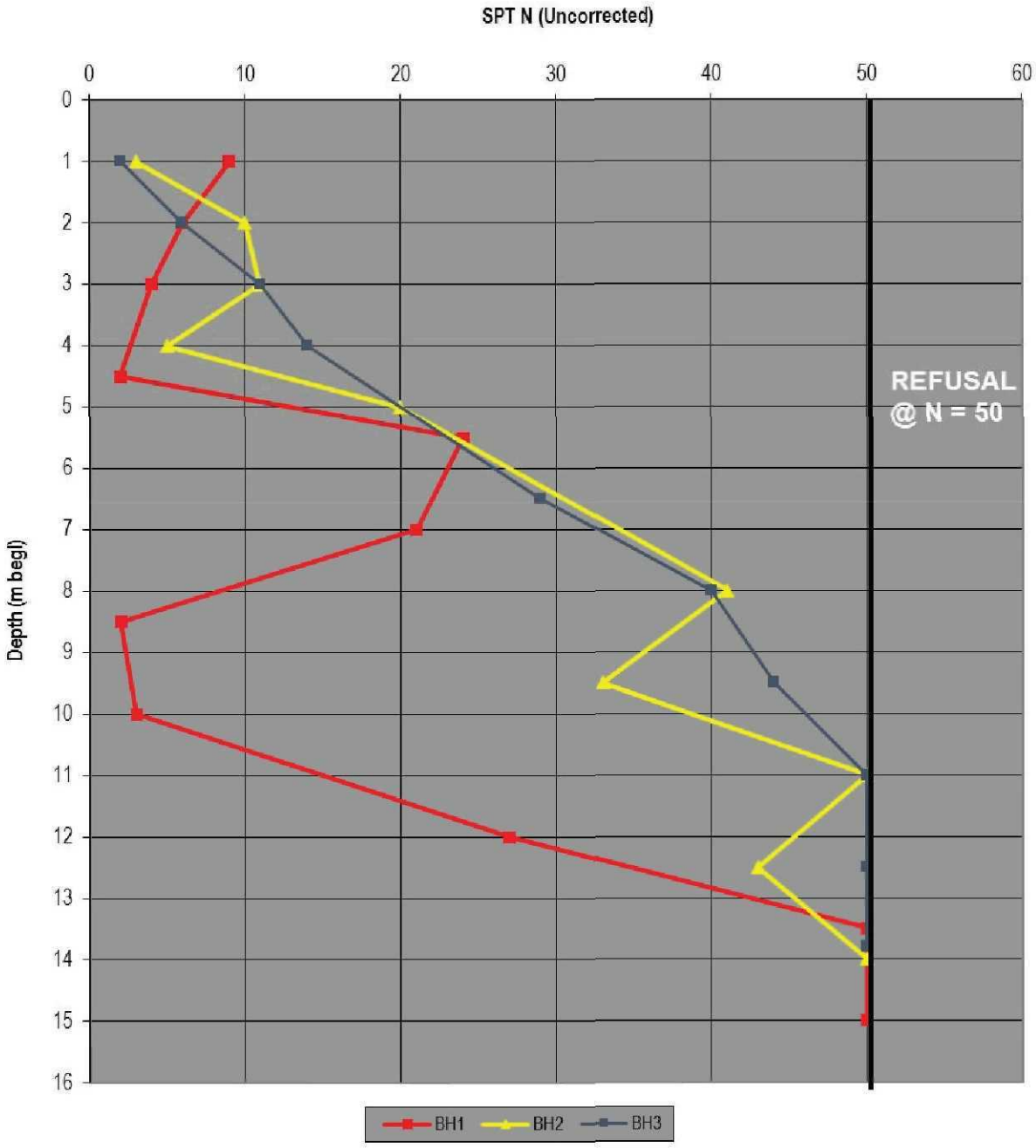
Within the Drift Deposits encountered at depths of between 1m and 4.5m, uncorrected SPT 'N' values ranged between 2 and 14. Uncorrected SPT 'N' values within the drift deposits (where present) at depths of between 5m and 7m ranged between 20 and 24. Significantly lower SPT 'N' values of 2 and 3 were recorded within the potential infilled channel encountered in borehole BH1 at depths of 8.5m and 10m, respectively.

The uncorrected SPT 'N' values within the underlying Oxford Clay, where present, at depths of between 6.50m and the base of the boreholes ranged between 27 and refusal (i.e. N values equal to or greater than 50), with two SPT refusals achieved towards the base of each borehole.

A Chart showing the SPT results with depth is provided below for information, with SPT results for each of the boreholes provided on the logs included in Appendix V.

Peterborough Road,
Crowland

Cable Percussive Boreholes
SPT N Values Vs Depth (m begl)



5.0 GROUND GAS & WATER MONITORING RESULTS

5.1 Introduction

Based on the findings of the Desk Study works, it was considered necessary to install a series of monitoring points to facilitate a programme of ground gas monitoring at the site.

5.2 Monitoring Installations

Upon completion, all three of the cable percussive boreholes were installed with combined ground gas and water monitoring standpipes to depths of 5.00m begl to facilitate a programme of monitoring.

The full set of ground gas and water monitoring data is presented in Appendix VI of this report.

5.3 Results of the Ground Gas Monitoring

A total of six monitoring visits over a six week period have been undertaken at the site as part of our works. The ground gas monitoring results are summarised in Table 2 below.

TABLE 2– SUMMARY OF GROUND GAS MONITORING DATA

Parameter	Minimum % by volume (v/v)	Maximum % by volume (v/v)
Methane	0.0	0.1
Carbon Dioxide	0.0	14.6
Oxygen	8.7	20.9
Flow (l/h)	0.0	0.0

- Atmospheric pressure ranged between 1002mb and 1036mb during the monitoring programme.

- Water was recorded at depths ranging between 0.48m to 1.52m begl within the borehole installations during the course of the monitoring programme.

5.4 Appropriate Guidance

The results of the gas monitoring have been reviewed with reference to the following documentation:

- CIRIA Report C665 '*Assessing risks posed by hazardous ground gases to buildings*' (2007).
- NHBC & RSK Group publication '*Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present*' (March 2007).

CIRIA Report C665 and the NHBC publication recommend a risk-based methodology to ground gas assessment, which includes the calculation of a site-specific Gas Screening Value (GSV). The GSV of a particular ground gas regime equates to:

- GSV (l/hr) = maximum borehole flow rate (l/hr) x maximum gas concentration (expressed as a fraction).

The GSV should be used to assess the risks posed by gassing sites for both low-rise residential and commercial/industrial developments.

CIRIA Report C665 presents a total of six Characteristic Situations (CS) to assist with the relevant ground gas protection measures that should be installed to mitigate the risk posed by ground gases for a residential building (excluding low-rise housing) and commercial/industrial developments. The CS classifications represent a revised approach to the CS tables detailed within CIRIA 149 '*Protecting development from methane*'.

The NHBC have developed a system of '*Traffic Lights*' to characterise gassing sites, which is specific to low-rise residential developments. Classification of the Traffic Lights provides the relevant ground gas protection measures that should be installed to mitigate the risk posed by ground gases for a low-rise residential development. The Traffic Light approach is based on '*Typical Maximum Concentrations*' of methane and carbon dioxide for initial screening purposes.

It is understood that it is proposed to redevelop the site with low-rise residential dwellings. Therefore, the NHBC '*Traffic Light*' characterisation has been adopted for the purpose of this assessment, in the first instance.

Tables 14.1 and 14.2 from the NHBC guidance are reproduced below.

Table 14.1: Gas Risk Assessment - Traffic Lights with Typical Maximum Concentrations and Gas Screening Values

Traffic Light Classification	Methane [1]		Carbon Dioxide [2]	
	Typical Maximum Concentration [3] (%v/v)	Gas Screening Value [2,4] (l/hr)	Typical Maximum Concentration [3] (%v/v)	Gas Screening Value [2,4] (l/hr)
Green				
Amber 1	1	0.13	5	0.78
Amber 2	5	0.63	10	1.60
Red	20	1.60	30	3.10

Notes:

1. The worst-case ground gas regime identified on the site, either methane or carbon dioxide, at the worst-case temporal conditions that the site may be expected to encounter will be the decider as to what Traffic Light is allocated;
2. Borehole Gas Volume Flow Rate, in litres per hour as defined in Wilson and Card (1999), is the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered;
3. The Typical Maximum Concentrations can be exceeded in certain circumstances should the Conceptual Site Model indicate it is safe to do so;
4. The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.

Table 14.2: Ground Gas Protection Measures Required for the Traffic Lights

Traffic Light	Ground Gas Protection Measures Required
Green	Ground gas protection measures are not required.
Amber 1	Low-level ground gas protection measures are required, using a membrane and ventilated sub-floor void that creates a permeability contrast to limit the ingress of gas into buildings. Gas protection measures are to be installed as prescribed in BRE 414. Ventilation of the sub-floor void should be designed to provide a minimum of one complete volume change per 24 hours.
Amber 2	High-level ground gas protection measures are required, creating a permeability contrast to prevent ingress of gas into buildings. Gas protection measures are to be installed as prescribed in BRE 414. **Membranes used should always be fitted by a specialist contractor and should be fully certified (see Appendix E).** As with Amber 1, ventilation of the sub-floor void should be designed to provide a minimum of one complete volume change per 24 hours.
Red	Standard residential housing is not normally acceptable without further Ground Gas Risk Assessment and/or possible remedial mitigation measures to reduce/remove the source of the ground gases. In certain circumstances, active protection methods could be applied, but only when there is a legal agreement assuring the management and maintenance of the system for the life of the property.

The GSV should be calculated for both methane and carbon dioxide and the worst case adopted in order to establish the appropriate protection measures for the site. The higher the classification the greater the risk posed by the presence of ground gas. Both the above guidance documents note that '*…the GSV is a guideline value and not an absolute threshold*'.

5.5 Ground Gas Analysis

The ground gas monitoring undertaken has identified a maximum methane concentration of 0.1% by volume (v/v, expressed as 0.001 as a fraction and a maximum carbon dioxide concentration of 14.6% v/v (expressed as 0.146 as a fraction). Measurable flow rates were not recorded during the monitoring visits. In the absence of a measurable flow rate, the limit of detection of the gas monitoring instrument (0.1 l/hr) should be utilised.

The GSV for methane at the site may be calculated as follows:

- 0.001 x 0.1 = 0.0001 l/hr

The GSV for carbon dioxide at the site may be calculated as follows:

- 0.146 x 0.1 = 0.0146 l/hr

Therefore, with a maximum GSV of 0.0146 l/hr, a maximum methane concentration of 0.1% v/v and a maximum carbon dioxide concentration of 14.6% v/v, and based on the visits undertaken, the site may be classified as '**Amber 2**', in accordance with Table 14.1 of the NHBC Guidance for low-rise dwellings.

6.0 LABORATORY TESTING & CONTAMINATION ASSESSMENT

6.1 Introduction

The following environmental soil testing was carried out on visually representative samples recovered from the exploratory holes:

- 6No. Standard contamination suites (including metals, speciated PAH and TOC).
- 3No. Combined pesticide screens - Organochlorine & Organophosphate (OCP & OPP).

Geotechnical soil testing comprised the following:

- 4No. Water soluble sulphate tests.
- 8No. pH tests.
- 5No. Plasticity Index (PI) tests.
- 1No. Particle Size Distribution (PSD) test.
- 3No. Loss on Ignition.

All laboratory soil test results are included in Appendix VII of this report.

6.2 Geotechnical Soil Test Results

Water Soluble Sulphate/pH

Water soluble sulphate testing was undertaken on 4No. soil samples obtained from the Natural Strata during the site works. The results revealed water soluble sulphate concentrations of between 0.08g/l SO_4 and 2.11g/l SO_4. The pH values of the Natural Strata (excluding topsoil) analysed ranged between 6.00 and 8.45.

In accordance with the Building Research Establishment publication Special Digest 1 *'Concrete in Aggressive Ground'* (2005) the highest sulphate concentrations should be used to indicate the Design Sulphate Class (i.e. 2.11g/l SO_4), together with the lowest of the results for pH (6.00).

Therefore, in accordance with Special Digest 1:2005 the site falls into Design Sulfate Class DS-3 and an Aggressive Chemical Environment for Concrete (ACEC) classification of AC-3.

This classification has been made based on the assumption of natural ground conditions and the presence of potentially mobile groundwater conditions beneath the site.

Plasticity Index (PI) Testing

A total of 5No. Plasticity Index tests have been undertaken on selected samples of the near surface Natural Strata obtained during the site works from across the site. In accordance with NHBC standards Chapter 4.2 '*Building Near Trees*' and BRE Digest 240 '*Low-rise buildings on shrinkable clay soils: Part 1*' (1993) the reported PI values may be modified based on the portion of the sample passing the 425μm sieve.

The result of the PI analysis is summarised in Table 3.

TABLE 3 – SUMMARY OF PLASTICITY INDEX (PI) DATA				
Sample Reference & Location	Reported PI Value (%)	Portion Passing 425µm Sieve (%)	Modified PI Value (%)	Volume Change Potential
TP1, 1.30m (CLAY/SILT)	24	98	24	Medium
TP2, 1.50m (SAND)	-	-	-	Non-plastic
TP3, 0.70m (CLAY)	30	100	30	Medium
TP5, 2.00m (CLAY)	57	94	54	High
TP6, 2.90m (CLAY)	21	100	21	Medium

In accordance with NHBC Guidance, Table 3 reveals that the cohesive soils analysed (i.e. Clay and Clay/Silt) at the site may be regarded as being of medium to high volume change potential. We would recommend soils of a high volume change potential are assumed for design purposes for the site, where applicable.

The PI analysis has revealed that the sample visually comprising silty Sand (TP2, 1.50m) may be regarded as non-plastic in accordance with NHBC guidance.

Particle Size Distribution

Confirmatory particle size distribution (PSD) analysis was undertaken on a sample of the Sand from TP2 (1.50m). The testing revealed that the sample may be classified as very silty/clayey fine to medium SAND, which confirms the visual description of the soil. The PI analysis undertaken on the sample confirmed it to be non-plastic.

Loss on Ignition

Loss on ignition testing was undertaken on two samples of the Peat and one sample of the peaty Clay encountered across the site. The analysis revealed loss on ignition values between 19.7% and 23.6% for the Peat and a lower loss on ignition value of 15.7% for the peaty Clay. Corresponding Total Organic Carbon (TOC) values of 8.37% and 11% were recorded for the Peat, and a TOC value of 7.96% was revealed for the peaty Clay. The results indicate that the Peat has the potential to be compressible and subject to peat wastage (i.e. biodegradation).

We would note, for contrast, that the TOC values for the samples of Natural Strata comprising Clay and Sand from the site were significantly lower and ranged between 0.97% and 2.71%.

6.3 Contamination Assessment Rationale

We understand that it is proposed to develop the majority of the site for a low-rise residential end-use incorporating private gardens. It is also understood that the current development proposals incorporate an area of public open space.

Based on the development proposals, we have adopted a residential with plant uptake end-use scenario for the purposes of the contamination assessment, as this reflects the most sensitive end-use for the development.

6.4 Appropriate Guidance

Reference has been made to documents reflecting current good practice, including (but not limited to) the following:

- Environment Agency Contaminated Land Report 11 '*Model Procedures for the Management of Land Contamination*', September 2004, ISBN: 1844322955.

- British Standard BS10175:2011+A1:2013, '*Investigation of potentially contaminated sites. Code of practice*', March 2011.
- Nathanail, C.P., McCaffrey, C. Gillett, A.G. Ogden, R.C. and Nathanail, J.F 2015. '*The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham. "Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3026. All rights reserved."*'
- DEFRA publication '*SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination*', Final Project Report (Revision 2), dated 24th September 2014 and Erratum dated December 2014.
- DEFRA publication '*SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination*' – Policy Companion Document, dated December 2014.
- EIC/AGS/CL:AIRE publication '*Soil Generic Assessment Criteria for Human Health Risk Assessment*', January 2010, ISBN 978-1-905046-20-1.
- Department of Environment, Food and Rural Affairs (DEFRA) and the Environment Agency publication – '*Contaminated Land Exposure Assessment (CLEA) model*' (March 2002).
- Environment Agency Science Report, '*Using Soil Guideline Values*', SC050021/SGV, March 2009.
- R & D Draft Technical Report P5-079/TR1 '*Review of the Fate and Transport of Selected Contaminants in the Soil Environment*' dated 2003.
- CL:AIRE/CIEH '*Guidance on Comparing Soil Contamination Data with a Critical Concentration*' (May 2008).
- Environment Agency Science Report SC050021/SR7 '*Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values*', dated November 2008, ISBN 978-84432-964-9.
- Environment Agency Science Report Final SC050021/SR2 '*Human health toxicological assessment of contaminants in soil*', dated January 2009, ISBN 978-84432-858-1.
- Environment Agency Science Report SC050021/SR3 '*Updated technical background to the CLEA model*', dated January 2009, ISBN 978-84432-856-7.
- Environment Agency Science Report SC050021/SR4 '*CLEA Software (Version 1.05) Handbook*', dated September 2009, ISBN 978-1-84911-105-8.

6.4.1 Selection of Appropriate Tier 1 Screening Values

Generic Assessment Criteria (GAC)

The assessment of contaminated land in the UK was historically undertaken with reference to ICRCL Guidance Note 59/83 together with successive versions of the CLEA model (inc. CLEA2002 (2002), CLEA UK (2005), CLEA V1.03 beta (2008), CLEA V1.04 (January 2009), CLEA V1.05 (September 2009) and CLEA V1.06 (October 2009)).

The CLEA V1.06 model is a deterministic quantitative risk assessment (QRA) model, which has historically been utilised by the Environment Agency to produce Soil Guideline Values (SGVs) for several contaminants, and has been used and modified by the authors of the LQM/CIEH S4UL publication and the authors of the DEFRA SP1010 series of documents in the derivation of their respective human health screening values.

Of key importance is the basis on which these two differing sets of commercially available screening criteria have been created, with the SP1010 values reflective of a '*Low Level of Toxicological Concern*' (LLTC) and the Suitable 4 Use Level (S4UL) values based on a '*Minimal Risk Level*' (MRL).

Based on our understanding of current good practice within the contaminated land field, we have adopted the S4UL values (representing a compatible approach to risk assessments undertaken since the initial derivation of the CLEA model, and based on an established and fully justifiable methodology) as our initial Generic Assessment Criteria (GAC) values for human health. In the absence of a suitable S4UL value (such as lead), reference has been made to the relevant C4SL, and these have been adopted where considered justifiable and as appropriate (further consideration of their use is provided below).

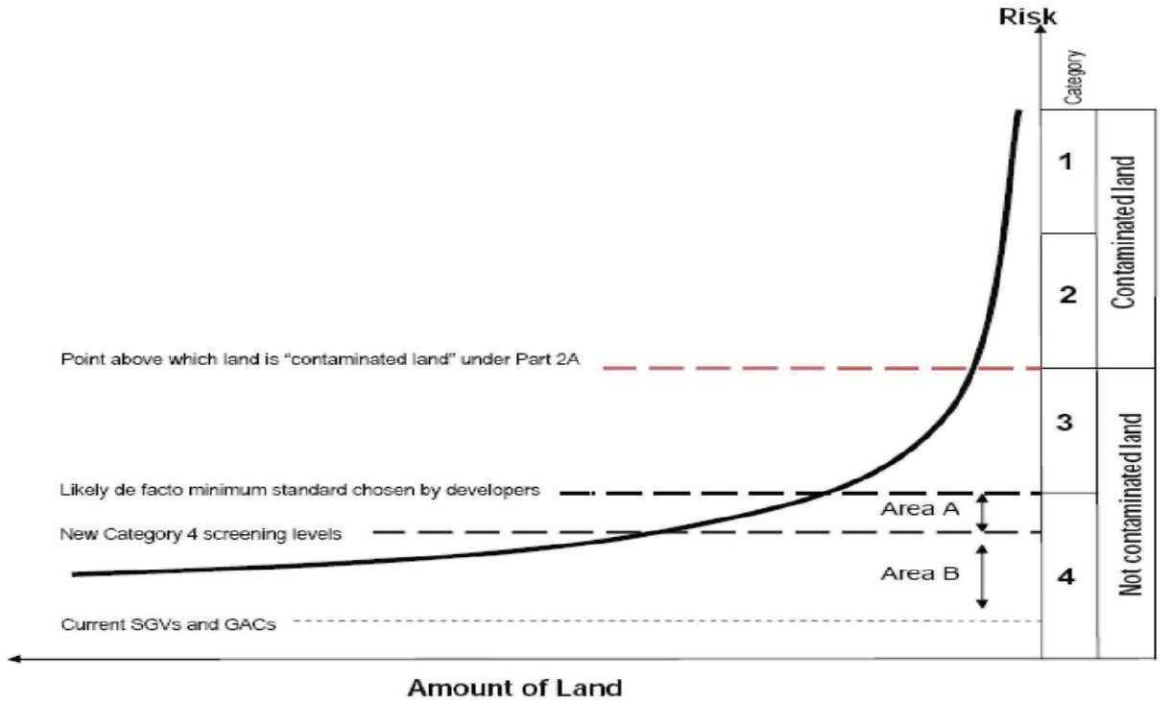
We would additionally note that other GAC values are commercially available, such as the Atkins ATRISKSOIL values (to which GeoDyne subscribe) and the EIC/AGS/CL:AIRE values for organic substances; and these have been referred to where relevant to the site.

Category 4 Screening Levels

Revised Statutory guidance for the assessment of land under Part 2A of the Environmental Protection Act 1990 was published by the Department for Environment, Food and Rural Affairs (Defra) in April 2012. The guidance introduced a new four-part category system for classifying land under Part 2A; Section 4.17 of the Guidance states:

'*In deciding whether or not land is contaminated land on grounds of significant possibility of significant harm to human health, the local authority should use the categorisations described in paragraphs 4.19 – 4.30...Categories 1 and 2 would encompass land which is capable of being determined as contaminated land on the grounds of significant possibility of harm to human health. Categories 3 and 4 would encompass land which is not capable of being determined on such grounds*'.

The foregoing categories are depicted in diagrammatical form in the following graph (taken from Defra publication SP1010):



Defra has subsequently commissioned the production of Category 4 Screening Levels (C4SLs) for a total of six substances (cadmium, benzo(a)pyrene, benzene, arsenic, lead and chromium VI), which are detailed within the SP1010 document titled '*Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document*', dated March 2014. The C4SL values represent a level below which a contaminant concentration is considered to have a 'Low' risk to human health. The C4SL values are stated within the SP1010 document (page 7) as still remaining '*strongly precautionary*' and represent a more pragmatic approach to contaminated land risk assessment than the minimal risk values represented by the SGV/GAC levels.

In addition to the use of C4SLs in contaminated land risk assessment, the SP1010 document states the following with respect to background levels of contaminants:

'*The outputs of Defra-funded research to determine 'normal' background concentrations of various contaminants in England and Wales and the outputs of this research project to develop new screening levels for contaminants in soil, are both designed as tools to be used by contaminated land risk assessors to inform decisions about whether or not it is necessary to proceed to a Detailed Quantitative Risk Assessment (DQRA) on a particular site taking into account the broad aims of the regime as set out in Section 1 of the Statutory Guidance. Questions have been raised about how these tools relate and interact.*

41. Ultimately, it is up to individual risk assessors to make the most appropriate decisions on a site-by-site basis and to use the most appropriate tools in each case. However, with reference to the Part 2A Statutory Guidance, which states that 'normal' background concentrations should not be considered to cause a site to be determined as contaminated under Part 2A unless there is a reason to consider otherwise, it is envisaged that, where available, Category 4 Screening Levels should be the initial value against which site concentrations can be compared. Where a value on a particular site exceeds the Category 4 Screening Level for that substance, reference can then be made to the normal background concentration for that contaminant in that area.

If concentrations are higher than the relevant Category 4 Screening Level but within 'normal' background concentrations for that area, it is not envisaged that a site would be determined as contaminated under Part 2A (unless there was a reason to consider otherwise).

42. The British Geological Survey has derived 'normal' background concentrations for lead for England and Wales. In England, the 'normal' background concentrations of lead are 180 mg/kg for the 'principal' domain, 2,400 mg/kg for the 'mineralisation' domain and 820 mg/kg for the 'urban' domain (Defra, 2012) (see table below). In Wales the 'normal' background concentrations are 230 mg/kg for the 'principal' domain, 280 mg/kg for the 'mineralisation' domain and 890 - 1300 mg/kg for the 'urban' domain (Defra, 2013). Current advances in our understanding of the toxicology of lead have resulted in Category 4 Screening Levels for Residential, Allotments and Public Open Space 1 that are lower than the 'normal' background concentration of lead in ***urban*** *areas. This was also the case for the (now withdrawn) Soil Guideline Value for lead of 450 mg/kg.*

43. The report identifies other relevant considerations that may have a bearing on the final choice of Category 4 Screening Levels and the background level in soil is one of these. A pragmatic approach for lead would be to recommend the use of the 'normal' background concentration when the land use and domain permit (for example, providing other site and contaminant specific characteristics such as chemical form, bioavailability, soil depth, site use, etc. are comparable between the background and the site under investigation) so as not to disproportionately target land where there is widespread diffuse pollution of lead.

Normal background concentrations of contaminants in England

Substance	Principal domain	Urban domain	Mineralisation domain 1	Mineralisation domain 2	Ironstone	Chalk South
Arsenic	32 mg/kg		290 mg/kg		220 mg/kg	
Benzo-a-pyrene	0.5 mg/kg	3.6 mg/kg				
Cadmium	1.0 mg/kg	2.1 mg/kg	17 mg/kg	2.9 mg/kg		2.5 mg/kg
Lead	180 mg/kg	820 mg/kg	2400 mg/kg			

Where a valid Soil Guideline Value exists for a contaminant where a Category 4 Screening Level has also been derived, it is anticipated that risk assessors will use the Category 4 Screening Level in line with the Part 2A Statutory Guidance. In the absence of a suitable C4SL, risk assessors should identify and select appropriate generic assessment criteria in accordance with established good practice....'

The general approach indicated in the SP1010 document has been adopted in this report (as appropriate), although the C4SL values have been used as a second tier of risk assessment, due to the difference in the level of 'acceptable' risk between the various GACs (which we will adopt as the first tier of risk assessment) and the C4SLs.

National Planning Policy Framework (NPPF)

In relation to the requirements of a contaminated land risk assessment, the Department for Communities and Local Government publication titled '*National Planning Policy Framework*' (NPPF), dated March 2012, provides the following commentary:

'*121. Planning policies and decisions should also ensure that:*

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

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

The Defra SP1010 document states: '***The Part 2A Statutory Guidance and accompanying Impact Assessment were developed on the basis that Category 4 Screening Levels could be used under the planning regime, as they would be in Part 2A investigations directly***' [GeoDyne emphasis added].

Summary

Taking account of the foregoing, we consider that industry good practice is currently best represented by GAC (variously LQM/CIEH, Atkins ATRISKSOIL or EIC/AGS/CL:AIRE) that adopt a MRL as the foundation for its derivation. In the case of Lead (which is modelled on blood lead concentrations rather than typical exposure scenarios applicable to other contaminants), the relevant C4SL value has been adopted, as this incorporates the most up-to-date toxicological information in the derivation of the various end-use specific screening criteria.

In relation to the remaining C4SL values, these have been adopted as a second tier of generic assessment criteria, and will be utilised where the GAC has been exceeded at a Tier 1 generic level and where justified in a site-specific context. Whilst representing a LLTC, the C4SL values are considered to represent a suitably conservative assessment tool, given that they fall comfortably within Category 4.

In the following sections, screening criteria have collectively been referred to as Generic Assessment Criteria (GAC). The C4SL values have been referenced as such. The GAC/C4SL adopted herein, i.e. residential with plant uptake, are included in the table in Section 6.8.

6.4.2 Selection of Soil Organic Matter (SOM) Content

The SOM content and soil type are used to provide an assessment of the applicability of the Tier 1 GAC adopted (the GAC are typically based upon SOM of 1%, 2.5% and 6%, as applicable, with Defra C4SL based on the default assumption of a UK Sandy Loam soil with 6% SOM).

Determinands have in the first instance, been compared to GAC adopting a conservative SOM of 1%, or, in the absence of one of the former, a relevant C4SL value. Where the determinand exceeds the relevant GAC at 1% SOM, a site specific SOM may be adopted as appropriate to derive new GAC and the dataset reassessed.

6.4.3 Assessment Methodology

Taking account of the foregoing, an initial qualitative Tier 1 Soil Assessment has been undertaken to assess the soils at the site. We have adopted a policy whereby determinands within the dataset are individually compared to the relevant screening values.

Where determinands within the dataset are less than the appropriate Tier 1 GAC value the determinand is considered to be present at an acceptable concentration and no further assessment is required. However, where a determinand exceeds the relevant Tier 1 GAC value on at least one occasion further assessment is required and will be undertaken in accordance with CL:AIRE/CIEH '*Guidance on Comparing Soil Contamination Data with a Critical Concentration*'.

Further assessment will comprise a quantitative Tier 1 assessment to examine the contamination data set in more detail. The methodology for undertaking the statistical assessment is provided in Section 6.5 below.

6.5 Statistical Considerations

Statistical tests relating to contaminated land, typically referred to as a Mean and Maximum Value Tests, were detailed in Department for Environment, Food and Rural Affairs and The Environment Agency publication CLR 7 '*Assessment of Risks to Human Health From Land Contamination: An Overview of the Development of Soil Guideline Values and Related Research*', dated 2002, ISBN 1-857-05732-5.

This guidance was superseded by publication of CL:AIRE/CIEH '*Guidance on Comparing Soil Contamination Data with a Critical Concentration*' dated May 2008.

6.5.1 Null and Alternative Hypothesis

In consideration of statistical guidance jointly published by CL:AIRE/CIEH *'Guidance on Comparing Soil Contamination Data with a Critical Concentration'*, statistical convention requires consideration of the Null Hypothesis (expressed as H_o) or an Alternative Hypothesis (expressed as H_1). Appropriate statistical tests are then applied to the data to assess whether the strength of evidence favours the Null or the Alternative Hypothesis.

For the purpose of the following contamination assessments and in accordance with the CL:AIRE/CIEH guidance the key question for the site is as follows.

Question - '*Is there sufficient evidence that the true mean concentration of a contaminant in soil (μ) is less than some critical concentration (Cc)?*'

The Null and Alternative hypotheses are therefore defined as follows.

The Null Hypothesis (H_o)

$\mu \geq Cc$ (i.e. Tier 1 or 2 Assessment Criteria).

The Alternative Hypothesis (H_1) (the question the selected statistical test is designed to answer)

$\mu < Cc$ (i.e. Tier 1 or 2 Assessment Criteria).

6.5.2 95th Percentile Upper Confidence Level Mean Values

The selected relevant statistical assessment undertaken to evaluate the Null and Alternative Hypotheses requires consideration of the 95th Percentile Upper Confidence Level Mean value (this is abbreviated as the UCL).

The UCL value takes account the number of samples tested, the data set mean and the standard deviation of the data set and applies a correction factor to take account of the uncertainty of the data set.

CL:AIRE/CIEH guidance states that '*…since the 95% UCL is at most times greater than the true population mean, it follows that if the 95% UCL is less than Cc, the assessor will know (with a defined high level of confidence) that the true population mean (μ, the value which is not known) is also likely to be less than Cc*'.

6.5.3 Considerations for Appropriate Dataset(s)

The CL:AIRE/CIEH statistical guidance requires consideration of the appropriateness of the dataset being subjected to the statistical testing and notes the following three key elements to be considered.

- Consideration of any non-detects within the dataset.
- Consideration of potential outliers within the dataset.
- Consideration of the statistical distribution of the data (i.e. normality/non normality).

6.5.4 Consideration of Normality of Dataset

CL:AIRE/CIEH statistical guidance notes that the choice of statistical test to be applied to the dataset will depend on the assumptions about the distribution of the data being tested. The assumptions of the statistical test adopted therefore must be appropriate to the distribution assumptions of the data being considered.

The CL:AIRE/CIEH statistical guidance details the following two key statistical tests.

- **The one-sample t test** - assumes the data being assessed is approximately normally distributed.
- **The one-sided Chebychev Theorem** - assumes the data being assessed does not demonstrate normality (method makes no assumption about the shape of the distribution).

CL:AIRE/CIEH statistical guidance, however notes '*…with large datasets, minor deviations from normality may be flagged as statistically significant even though small deviations from a normal distribution will not affect the reliability of the one sample t-test'*. The guidance goes on to note '*Conversely, datasets with a small sample size more easily pass normality tests.* ***Failing, however to detect non-normality in a small dataset is unlikely to compromise the validity of the one sample t-test'*** [GeoDyne emphasis added].

CL:AIRE/CIEH statistical guidance further notes '*When considering which of the two tests to use, however, assessors should bear in mind that, in general, the one-sample t-test is more powerful that the method based on the Chebychev Theorem…****Given that the one sample t-test is also not sensitive to moderate departures from normality, it is recommended that assessors use the t-test unless there is good evidence that the dataset departs significantly from normality'*** [GeoDyne emphasis added]**.**

On the basis of the above, an assumption of data normality has been made and the one-sample t-test adopted accordingly.

6.5.5 Consideration of Non-Detects within the Dataset

The dataset may reveal the presence of non-detects for a number of the determinands tested. Where this occurs, we have adopted the LOD (i.e. 1.0LOD) as the chemical concentration, which provides a suitably conservative approach. However, please note that GACs have only been used for determinands where they are present at concentrations in excess of the LOD on at least one occasion.

6.5.6 Consideration of Outliers

The CL:AIRE/CIEH statistical guidance advises that '*…if outliers are identified, assessors have to decide whether they represent genuine soil concentrations or are the result of an error'*.

The guidance further notes that outliers should only be excluded from a dataset where they '*…are obviously and demonstrably the result of an error that can be identified and explained'* or *'…clearly indicate that more than one soil population exists within the dataset and this can be justified by (or informs the further development of) the conceptual model- in which case the different population expressed by the outlier(s) should be explored in more detail*'.

Taking account of the foregoing, we have adopted a policy of interrogating the relevant dataset to calculate the UCL and to ascertain the possible presence of statistical outliers (where relevant). At this point the possible relevance of statistical outliers to the interpretation of the data is considered, in accordance with the following matrix.

TABLE 4– OUTLIER DECISION MATRIX		
	UCL < GAC	UCL > GAC
Outlier Test reveals No Hotspot(s)	Determinand present at acceptable concentrations.	Pervasive contamination present in soil at unacceptable concentrations.
Outlier Test reveals Hotspot(s)	Determinand present at acceptable concentrations. Possible second population identified. Only of potential concern where outlier is at an individual concentration in excess of the Tier 1 GAC.	Pervasive contamination present in soil at unacceptable concentrations with possible hotspots of contamination identified.

6.5.7 CLEA Averaging Area

The CLEA Model requires consideration of an averaging area, i.e. an area within which the UCL is calculated and compared to the Tier 1 GAC. Within our assessments (where appropriate) the entire site has been adopted as the averaging area, in the first instance.

6.6 Sampling Strategy

Our sampling strategy is based on a review of the historical, geological and environmental information obtained as part of our Phase I Desk Study, together with the current site setting and the ground conditions encountered during our Phase II exploratory works, taking account of the proposed end-use.

No specific areas of concern were identified at the site with respect to ground contamination, other than the potential for contamination of the near surface soils from the use of pesticides associated with the growing of crops. Therefore, it was considered appropriate to position the exploratory holes to provide general site coverage.

Table 5 summarises the reasoning behind the exploratory hole positions.

TABLE 5– REASONING FOR EXPLORATORY HOLE LOCATION	
Exploratory Hole Reference	Reasoning Behind Location
TP1 – TP8, BH1 – BH3	General site coverage avoiding known utilities
Key TP – Trial Pit BH – Cable Percussive Borehole	

The ground conditions encountered during our Phase II works revealed the presence of two distinct types of material i) Topsoil and ii) Natural Strata.

Representative samples were obtained during our Phase II works and subjected to chemical analysis for a suite of contaminants deemed appropriate based on the land use assessment.

6.7 Contamination Analysis

A total of 6No. standard chemical contamination tests (including speciated PAH and TOC) were carried out on selected soil samples obtained during the site works, which comprised 3No. tests of the topsoil and 3No. tests of the underlying Natural Strata.

Pesticide screening was undertaken on 3No. samples of the topsoil recovered from the site.

For initial assessment purposes, we have combined the results into a single dataset, for individual comparison of the reported determinand concentrations against appropriate Tier 1 GAC.

6.8 Contamination Soil Test Results

6.8.1 Combined Dataset

The contamination assessment for the soils analysed at the site is summarised in Table 6.

TABLE 6– SUMMARY OF TIER 1 GENERIC ACCEPTANCE CRITERIA DATA ASSESSMENT (RESIDENTIAL WITH PLANT UPTAKE END-USE)

Contaminants – Potentially Harmful to Human Health	No. of Samples Tested	Concentration Range (mg/kg)	Tier 1 GAC (mg/kg)	C4SL (mg/kg)	UCL (mg/kg)	Tier 1 GAC Exceeded (Yes/No)
Metals						
Arsenic	6	7 – 16	37 S4UL	37	NA	No
Chromium III	6	25 – 47	910 S4UL	-	NA	No
Copper	6	10 – 23	2400 S4UL	-	NA	No
Lead	6	11 – 36	200 C4SL	200	NA	No
Inorganic Mercury	6	<0.17 – 0.36	40 S4UL	-	NA	No
Nickel	6	20 – 27	180 S4UL	-	NA	No
Selenium	6	<1 – 2	250 S4UL	-	NA	No
Zinc	6	45 – 71	3700 S4UL	-	NA	No
Speciated PAHs						
Chrysene	6	<0.1 – 0.2	15 S4UL	-	NA	No
Fluoranthene	6	<0.1 – 0.3	280 S4UL	-	NA	No
Pyrene	6	<0.1 – 0.3	620 S4UL	-	NA	No

Key
S4UL – CIEH/LQM Suitable 4 Use Levels (2015). Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3026. All rights reserved.
C4SL –value for Lead taken from DEFRA publication SP1010 and based on a residential (with home-grown produce) end-use.
- See comments below table (where relevant).
NA – UCL not applicable as all individual concentrations are present at concentrations individually below the GAC.

All of the determinands assessed were present either at individual concentrations below the Limit of Detection of the method of analysis adopted by the laboratory or below the appropriate Tier 1 GAC based on a residential with plant uptake end-use. We would note that all determinands were also revealed to be present at concentrations below their respective Tier 1 GAC for a Public Open Space (POS) scenario for POS land within a residential setting.

6.9 Pesticide Screening

Three samples of the topsoil from across the site were screened for pesticides by the laboratory as part of the contamination assessment. The results revealed individual concentrations below the Limit of Detection of the method of analysis adopted by the laboratory.

6.10 Contamination Assessment Summary

Contamination testing was carried out on selected samples of the topsoil, localised Made Ground and the underlying Natural Strata. It was considered appropriate to base our sampling and investigation strategy on the potential contamination issues identified within our land use assessment taking into account the proposed end-use and the historical and existing use of the site.

On the basis of the chemical contamination assessment undertaken, the soils may be considered to be uncontaminated for the proposed residential with plant uptake end-use (i.e. in relation to human health). Similarly, the analysis has revealed that the soils may also be regarded as uncontaminated with respect to a Public Open Space end-use.

We would additionally note that no visual or olfactory evidence of significant contamination was identified during the course of the exploratory investigation works.

Given the low contaminant concentrations revealed by the testing, together with the generally low groundwater sensitivity of the area, there are considered to be no specific risks posed to Controlled Waters by the findings of the laboratory analysis undertaken.

7.0 CONCEPTUAL SITE MODEL

7.1 General

The DEFRA publication '*Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance*' (dated April 2012) states the following with regards to the production of a Conceptual Site Model (CSM) for a site:

'*The process of risk assessment involves understanding the risks presented by land, and the associated uncertainties. In practice, this understanding is usually developed and communicated in the form of a "conceptual model"*'. The development of a CSM is typically undertaken in an iterative process, reflecting the changes in understanding as more detailed site information becomes available.

In developing a CSM, and specifically in the context of land contamination, consideration needs to be given to three essential elements; which form the basis of any risk present. The statutory guidance sections 3.8 and 3.9 (April 2012) states the following with respect to Part 2A.

'Under Part 2A, for a relevant risk to exist there needs to be one or more contaminant-pathway-receptor [CPR] *linkages – "contaminant linkage" – by which a relevant receptor might be affected by the contaminants in question. In other words, for a risk to exist there must be contaminants present in, on or under the land in a form and quantity that poses a hazard, and one or more pathways by which they might significantly harm people, the environment, or property; or significantly pollute controlled waters. For the purposes of this guidance:*

(a) A "contaminant" is a substance which is in, on or under the land and which has the potential to cause significant harm to a relevant receptor, or to cause significant pollution of controlled waters.
(b) A "receptor" is something that could be adversely affected by a contaminant, for example a person, an organism, an ecosystem, property, or controlled waters. The various types of receptors that are relevant under the Part 2A regime are explained in later sections.
(c) A "pathway" is a route by which a receptor is or might be affected by a contaminant.

The term "contaminant linkage" means the relationship between a contaminant, a pathway and a receptor. All three elements of a contaminant linkage must exist in relation to a particular land before the land can be considered potentially to be contaminated land under Part 2A, including evidence of the actual presence of contaminants. The term "significant contaminant linkage", as used in this Guidance, means a contaminant linkage which gives rise to a level of risk sufficient to justify a piece of land being determined as contaminated land. The term "significant contaminant" means the contaminant which forms part of a significant contaminant linkage.'

With respect to the presence of background levels of contaminants, section 3.21 to 3.23 states '*The Part 2A regime was introduced to help identify and deal with land which poses unacceptable levels of risk. It was not intended to apply to land with levels of contaminants in soil that are commonplace and widespread throughout England or parts of it, and for which in the very large majority of cases there is no reason to consider that there is an unacceptable risk.*

Normal levels of contaminants in soil should not be considered to cause land to qualify as contaminated land, unless there is a particular reason to consider otherwise. Therefore, if it is established that land is at or close to normal levels of particular contaminants, it should usually not be considered further in relation to the Part 2A regime...

For the purpose of this Guidance, "normal" levels of contaminants in soil may result from:

(a) The natural presence of contaminants (e.g. caused by soil formation processes and underlying geology) at levels that might reasonably be considered typical in a given area and have not been shown to pose an unacceptable risk to health or the environment.
(b) The presence of contaminants caused by low level diffuse pollution, and common human activity other than specific industrial processes. For example, this would include diffuse pollution caused by historic use of leaded petrol and the presence of benzo(a)pyrene from vehicle exhausts, and the spreading of domestic ash in gardens at levels that might reasonably be considered typical.'

In selecting appropriate generic assessment criteria Section 3.27 of the Guidance states:

'It is common practice in contaminated land risk assessment to use "generic assessment criteria" (GACs) as screening tools in generic quantitative human health risk assessment to help assessors decide when land can be excluded from the need for further inspection and assessment, or when further work would be warranted'.

With respect to assessing contaminated land, section 4.17 of the Guidance states:

'In deciding whether or not land is contaminated land on grounds of significant possibility of significant harm to human health, the local authority should use the categorisations described in paragraphs 4.19 – 4.30 below. Categories 1 and 2 would encompass land which is capable of being determined as contaminated land on the grounds of significant possibility of harm to human health. Categories 3 and 4 would encompass land which is not capable of being determined on such grounds.'

In relation to the use of GAC values in the assessment of contaminated land, section 3.29 of the Guidance states:

'GACs relating to human health risk assessment represent cautious estimates of levels of contaminants in soil at which there is considered to be no risk to health or, at most, a minimal risk to health. With regards to such GACs:

(a) They may be used to indicate when land is very unlikely to pose a significant possibility of significant harm to human health. This is on the basis that they are designed to estimate levels of contamination at which risks are likely to be negligible or minimal and far from posing a significant possibility of significant harm to human health.
(b) They should not be used as direct indicators of whether a significant possibility of significant harm to human health may exist. Also, the local authority should not view the degree by which the GACs are exceeded (in itself) as being particularly relevant to this consideration, given that the degree of risk posed by land would normally depend on many factors other than simply the amount of contaminants in soil.
(c) They should not be seen as screening levels which describe the boundary between Categories 3 and 4 in terms of Section 4 (i.e. the two Categories in which land would not be contaminated land on grounds of risk to human health). In the very large majority of cases, these SGVs/GACs describe levels of contamination from which risks should be considered to be comfortably within Category 4.

(d) They should not be viewed as indicators of levels of contamination above which detailed risk assessment would automatically be required under Part 2A.
(e) They should not be used as generic remediation targets under the Part 2A regime. Nor should they be used in this way under the planning system, for example in relation to ensuring that land affected by contamination does not meet the Part 2A definition of contaminated land after it has been developed.'

In undertaking a risk assessment and deriving a CSM for the purposes of the redevelopment of a site (i.e. planning and development control) reference has been made to both the Model Procedures for the Management of Land Contamination, as well as the National Planning Policy Framework (NPPF, dated March 2012). Reference has also been made to the Contaminated Land Statutory Guidance (referenced above), although this is primarily concerned with Local Government determinations of Statutory '*Contaminated Land*', which is separate to planning framework requirements.

7.2 Contaminant-Pathway-Receptor [CPR] Considerations

The following CPR assessment has been undertaken based on the assumption of a residential with plant uptake end-use for the proposed development.

7.3 Consideration of Potential Sources of Contamination [C]

Based on the findings of our works, the potential key sources of contamination at the site are considered to be the following:

- Metals or metalloids associated with any Made Ground.
- Polycyclic Aromatic Hydrocarbons (PAHs) from any ashy inclusions and/or carbonaceous inclusions in the near surface soils.
- Pesticides associated with the growing of crops.
- Potentially hazardous ground gases (i.e. methane and carbon dioxide).

In addition, consideration has also been given to the following:

- Radon.
- Sulphate/Acid conditions (mainly for constructional reasons).

7.4 Consideration of Potential Pathways [P]

The potential pathways at the site are primarily:

- Direct ingestion of soil.
- Inhalation of dust and vapours.
- Direct skin contact with the ground.
- Direct ground contact with building materials.
- Direct ingestion of home-grown produce.
- Vertical and lateral migration of contamination.
- Vertical and lateral migration of potentially hazardous ground gases/vapours.

7.5 Consideration of Potential Receptors [R]

The potential receptors at the site are:

- The construction personnel (i.e. site workers) involved with the development of the site (typically short term (acute) exposure).
- The final end users (i.e. residents - typically long term (chronic) exposure or site visitors (typically acute exposure).
- Controlled Waters (i.e. underlying groundwater, open drainage ditches).
- Neighbouring properties (off-site receptors).
- Buildings/construction materials (including buried utilities).

7.6 Summary

GeoDyne Limited's conceptual site model of possible CPR pollutant linkages, applicable to the proposed site usage and based on the information currently available, is summarised in Table 7.

TABLE 7 – SUMMARY OF CPR ASSESSMENT

Contaminant	Pathway	Receptor	Comments	Plausible Pollutant Linkage	Possible Mtigation	Possible Statutory 'Contaminated Land' following mitigation
Contaminated Soils	*Direct Ingestion / Direct Contact*	*Site Workers*	The soils may be regarded as uncontaminated, based on a residential with plant uptake end-use.	**No**	No contamination has been identified that requires specific PPE.	**No**
Contaminated Soils	*Inhalation of Dust and Vapours*	*Site Workers*	The soils may be regarded as uncontaminated, based on a residential with plant uptake end-use.	**No**	No contamination has been identified that requires specific PPE.	**No**
Contaminated Soils	*Direct Ingestion / Direct Contact*	*End Users (Residents & Site Visitors)*	The soils may be regarded as uncontaminated, based on a residential with plant uptake end-use.	**No**	None required.	**No**
Contaminated Soils	*Inhalation of Dust and Vapours*	*End Users (Residents & Site Visitors)*	The soils may be regarded as uncontaminated, based on a residential with plant uptake end-use. Following development, generation of significant levels of dust on a chronic basis unlikely.	**No**	None required.	**No**
Contaminated Soils	*Vertical and Lateral Migration*	*Neighbouring properties (off site receptors)*	No sources of potentially mobile contamination have been identified.	**No**	None required.	**No**
Contaminated Soils	*Vertical and Lateral Migration*	*Controlled Waters*	The site is underlain by unproductive strata and does not lie within a designated SPZ. A surface watercourse (drain) forms the sites western boundary.	**No**	No specific mitigation required, based on the findings of the works undertaken.	**No**

TABLE 7 – SUMMARY OF CPR ASSESSMENT						
Contaminant	Pathway	Receptor	Comments	Plausible Pollutant Linkage	Possible Mitigation	Possible Statutory 'Contaminated Land' following mitigation
			The concentrations of determinands detected are considered unlikely to represent a significant risk to controlled waters.			
Water Soluble Sulphate/Acid Contaminated Soils	*Direct Contact*	*Building Materials*	Design Class DS-3/ACEC Class AC-3. (BRE Spec. Digest 1:2005).	*Yes*	Adopt appropriate concrete mix for all concrete in contact with the ground.	No
Radon	*Vertical and Lateral Migration*	*Site Users & Building Envelope*	Based on the Desk Study works, the site does not lie within an area affected by radon.	No	No specific precautions required in proposed dwellings.	No
Ground Gases	*Vertical and Lateral Migration*	*Site Users & Building Envelope*	Based on the ground gas monitoring undertaken, the site may be classified as 'Amber 2' in accordance with NHBC guidance.	*Yes*	Adopt appropriate ground gas precaution measures within proposed dwellings.	No

KEY

Where text is in ***Bold Italic*** item is potentially present. Where normal text is used item is not present/plausible.

No - Pollutant linkage not plausible.
Yes - Pollutant linkage plausible, mitigation required.
? - Insufficient information, further work necessary.
The requirement for mitigation is subject to review and confirmation by the appropriate regulatory authority.

In the foregoing CPR assessment, determinands identified by chemical analysis are only considered to be contaminated with respect to generic guidance where the determinand is present at concentrations above the respective screening criteria.

8.0 CONCLUSIONS & RECOMMENDATIONS

8.1 Site Summary

The site currently comprises the northern half of an arable field, which was planted with a cereal crop at the time of our works.

8.2 Site History

The site has historically remained undeveloped field. The site boundaries were formed by drainage ditches, although the ditches along northern, western and southern boundaries became absent, potentially infilled/culverted, between the 1970s and 2006.

8.3 Site Geology

The site is indicated to be initially underlain by drift deposits comprising Nordelph Peat and underlain at depth by Oxford Clay. We would note that drift deposits have the potential to vary in strength and composition, both laterally and vertically across small areas.

8.4 Ground Conditions

Naturally derived TOPSOIL was encountered at the surface of all exploratory holes to depths of between 0.30m and 0.50m begl.

The underlying Drift Deposits were highly variable and were encountered to depths of between 4.80m and 12.00m begl.

The Drift Deposits predominantly initially comprised a firm (locally firm to stiff) CLAY and locally comprised loose to medium dense silty SAND. These near surface Drift Deposits were underlain by a combination of very soft sandy CLAY, soft Peat (varying in thickness between 0.10m and 0.30m) and locally soft peaty CLAY. The deeper Drift Deposits encountered in BH1 comprised very loose SAND and soft SILT, these deposits extended to a depth of 12.00m begl and may be associated with an infilled natural channel within the Drift Deposits. There remains the potential for further infilled channels to be present beneath the site.

At variable depths of between 4.80m and 12.00m begl, strata of the Oxford Clay Formation, comprising stiff becoming very stiff and hard CLAY was encountered. The Clay was locally found to progress into very weak, completely to highly weathered, MUDSTONE.

8.5 Foundation Design

Shallow footings such as strip/trench fill are considered not to be suitable for the proposed development due to the low geotechnical strength of the variable, but typically low strength and water bearing, Drift Deposits across the site. Furthermore, the presence of Peat/peaty Clay within the Drift Deposits, which was revealed by geotechnical testing to be potentially compressible and subject to peat wastage, is likely to preclude the use of rafts at the site.

On the basis of the foregoing, it is recommended that a piled foundation solution is adopted for the proposed dwellings at the site. Advice from a specialist piling contractor should be sought to confirm the depths of the piles and the most feasible and cost efficient type of pile to be used at the site, based on the cable percussive boreholes advanced at the site.

Depending on the piling technique adopted and impacted energy to drive the piles, final pile depths may potentially exceed the depths at which SPT refusal was achieved in the cable percussive boreholes.

8.6 Floor Slab Design & Ground Gas Precautions

Based on the programme of ground gas monitoring, it is recommended that ground gas precautions are installed within the proposed dwellings in accordance with the requirements of Amber 2, based on the NHBC traffic light system.

On this basis, the following precautions should be included within the proposed dwellings:

- Suspended ventilated beam and block floors.
- Provision of periscopic air brick ventilation on a minimum of two sides of each dwelling. The recommended minimum area of ventilation for the sub-floor void is 1500mm^2 per metre run of wall or 500mm^2 per square of floor area, whichever gives the greater area of opening.
- Adequate ventilation within the buildings.
- Provision of a proprietary gas resistant membrane, suitably lapped and taped and extended across cavity walls to effectively exclude ground gases from the footprint of the dwellings. We would note that the membrane should be suitably robust and able to withstand the construction process and should be appropriately protected during construction to minimise damage.
- We would recommend that a supply, design and install contract is awarded for the membrane installation with appropriate QA/QC measures employed to ensure the integrity of the membrane. The installation of the membrane should be warranted by the contractor and installed in accordance with best practice including BRE414.
- Service penetrations through the membrane should be kept to a minimum and should be suitably sealed to the membrane, preferably with a proprietary 'top hat and collar' type assembly.
- Third party inspection of installed membranes should be undertaken in accordance with the requirements of the NHBC.

8.7 Building Near Trees

The geotechnical laboratory test results have revealed the presence of predominantly cohesive (i.e. Clay) soils and locally non-cohesive soils (i.e. Sand) across the site.

Foundation designs will need to be adjusted in full accordance with NHBC Standards Chapter 4.2 *'Building near trees'* where building near existing, proposed or recently removed trees. It is recommended that cohesive soils of a high volume change potential should be assumed for design purposes.

Assuming that a piled foundation solution is adopted for the proposed development, heave precautions should be incorporated into the design of ground beams.

At this stage, it is recommended that a qualified Arborist undertakes a tree survey of the sites immediate surrounds prior to development, to assist with the foundation design.

8.8 Radon

No radon precautions are required at the site.

8.9 Water

Slight to steady ingress of perched water was observed within a number of trial pits during excavation, at depths of between 0.80m and 1.40m begl. Rapid water ingress was locally encountered within the Peat.

Deeper water, locally perched, was encountered at depths of between 2.30m and 3.00m begl and was recorded to be standing at depths of between 2.50m and 2.80m on completion.

During the monitoring programme, water was encountered at depths of between 0.48m and 1.52m begl within the monitoring installations. This may be a result of surface water run-off standing within the installations, rather than a true indication of groundwater levels.

Therefore, it is anticipated that excavations may require dewatering. This may involve sump pumping techniques, in the first instance, particularly where excavations are left open for a significant period of time.

Excavations may be susceptible to standing water following periods of wet weather. It should be noted that groundwater levels may vary due to seasonal or other effects.

8.10 Excavations / Stability

The sides of the majority of trial pits were found to be unstable/collapsing at depths of 2.20m begl or greater, typically within wet soils. The collapse of the sides below this depth generally resulted in undermining of the shallower strata. Shallower instability may be encountered if excavations are left open for long periods.

During advancement, the borehole sides were cased to prevent collapse.

On the basis of the exploratory works, deeper excavations are likely to require trench support for stability and health and safety reasons. The assessment of excavations and provision of support will be the responsibility of the contractor on site.

The natural cohesive soils may be subject to deterioration and softening if excavations are left open and exposed to wet weather. Any softened soils should be removed from excavations prior to the pouring of concrete (where applicable).

8.11 Sulphate Classification

In accordance with BRE Special Digest 1:2005 the site falls into Design Sulfate Class DS-3 and an Aggressive Chemical Environment for Concrete (ACEC) classification of AC-3, based on the assumption of natural ground conditions and the presence of potentially mobile groundwater conditions beneath the site.

Therefore, an appropriate concrete mix should be adopted in accordance with BRE Special Digest 1 for all buried concrete in contact with the ground.

8.12 Coal Mining

No specific investigation or mitigation measures in relation to coal mining issues are considered to be necessary at the site.

8.13 California Bearing Ratios (CBRs)

A CBR value ranging from <2% to 3% may be anticipated within the shallow Natural Strata, subject to confirmation by in-situ testing.

All organic materials (i.e. topsoil) should be removed from beneath the proposed roads, prior to construction.

8.14 Surface Water Drainage

The use of soakaways for surface water disposal is considered unlikely to be feasible based on the presence of typically low permeability cohesive (i.e. Clay) near surface soils and the localised presence of water-bearing granular (Sand) deposits beneath. It is recommended that alternative methods of draining the site are investigated at this stage.

8.15 Contamination Assessment

Contamination testing was carried out on selected samples of the topsoil and the underlying Natural Strata. It was considered appropriate to base our sampling and investigation strategy on the potential contamination issues identified within our land use assessment taking into account the proposed end-use and the historical and existing use of the site.

On the basis of the chemical contamination assessment undertaken, the soils may be considered to be uncontaminated for the proposed residential with plant uptake end-use (i.e. in relation to human health). Similarly, the analysis has revealed that the soils may also be regarded as uncontaminated with respect to a Public Open Space end-use.

We would additionally note that no visual or olfactory evidence of significant contamination was identified during the course of the exploratory investigation works.

Given the low contaminant concentrations revealed by the testing, together with the low groundwater sensitivity of the area, there are considered to be no specific risks posed to Controlled Waters by the findings of the laboratory analysis undertaken to date.

8.16 Remediation Proposals

8.16.1 Proposed Garden Areas / Public Open Space (POS)

It is considered that taking account of the current setting of the site and development proposals, human health is the principle driver for any remediation works based on the proposed predominantly residential end-use of the site, which locally incorporates an area of public open space.

However, the chemical analysis undertaken to date has revealed the site to be uncontaminated with respect to the determinands tested, based on both a residential with plant uptake end-use and a POS end-use. Therefore, no remediation works will be required other than the provision of topsoil in proposed gardens/POS to provide a suitable growing media for plants.

It may be necessary to increase the thickness of topsoil around the root balls of trees to suit the proposed planting regime.

8.16.2 Proposed Areas of Hard Standing

Specific remedial measures are considered not necessary within areas of proposed hard standing at the site (i.e. external hard standing areas and beneath the floor slabs to the proposed dwellings).

8.16.3 Re-use of Existing Topsoil and Natural Strata

The existing topsoil is considered suitable for re-use within the proposed development. We would recommend that the existing topsoil is stripped and appropriately stockpiled prior to commencement of the development.

Furthermore, where there is an excess volume of topsoil, consideration should be given to re-use on other developments (subject to regulatory approval) rather than off-site disposal. Similarly, the Natural Strata may be regarded as suitable for re-use within proposed gardens as subsoil (to raise levels, as appropriate) or for landscaping/capping on alternative developments (subject to regulatory approval) where surplus arisings are generated from the site. Please note that further sampling and analysis may be required in due course where these options are to be investigated and a Materials Management Plan (MMP) prepared accordingly.

8.16.4 Off Site Disposal & Waste Acceptance Criteria Testing

If off-site disposal is required the chemical testing regime can be different to the chemical testing required to assess the suitability of the soils for retention on site and the risks to human health. Therefore, a new contamination assessment may be required to include bespoke leachate analysis (i.e. Waste Acceptance Criteria [WAC] testing) to classify the soils for off-site disposal with testing criteria to assess whether the soil is hazardous, non-hazardous or inert waste. However, the existing chemical test data will assist this process.

If disposal is necessary then the environmental laboratory test results (included within Appendix VII) should be provided to several landfill operators for consideration and cost provision in the first instance, prior to the material being removed from the site.

8.17 Flood Risk

The Landmark Envirocheck report has revealed the site to lie within an area identified as being at risk of flooding. It is recommended that advice be sought from a Drainage Consultant with respect to this matter.

8.18 Construction Workers

No contamination has been identified that requires specific PPE. However, it is recommended that construction personnel involved with direct contact with the soils at the site use appropriate PPE equipment (i.e. boots, gloves and overalls) together with hygiene facilities in accordance with general health and safety guidelines.

A copy of this report should be included in the site health and safety file, and site workers should be made fully aware of the sites setting.

8.19 Utilities

Prior to development of the site, we would recommend that a copy of this report is supplied to utility companies, and that their recommendations relating to appropriate supply pipes are adhered to.

8.20 Unforeseen Circumstances

Should any areas of potentially contaminated soil be encountered during site construction works we would recommend consultation with GeoDyne Limited to ensure that our recommendations continue to apply. Any potentially contaminated soils should be left in-situ and subjected to further assessment, to potentially include further chemical testing and risk assessment.

The following procedure should be adhered to if any areas of previously unidentified suspected contamination are encountered during the development of the site:

i. Suspected contaminated material will remain in-situ.
ii. GeoDyne Limited to be notified. We will then undertake a visual assessment of the possible contamination, followed by appropriate sampling/testing (as necessary).
iii. If necessary, an appropriate strategy to remove/remediate the contamination will be submitted to the Local Authority.

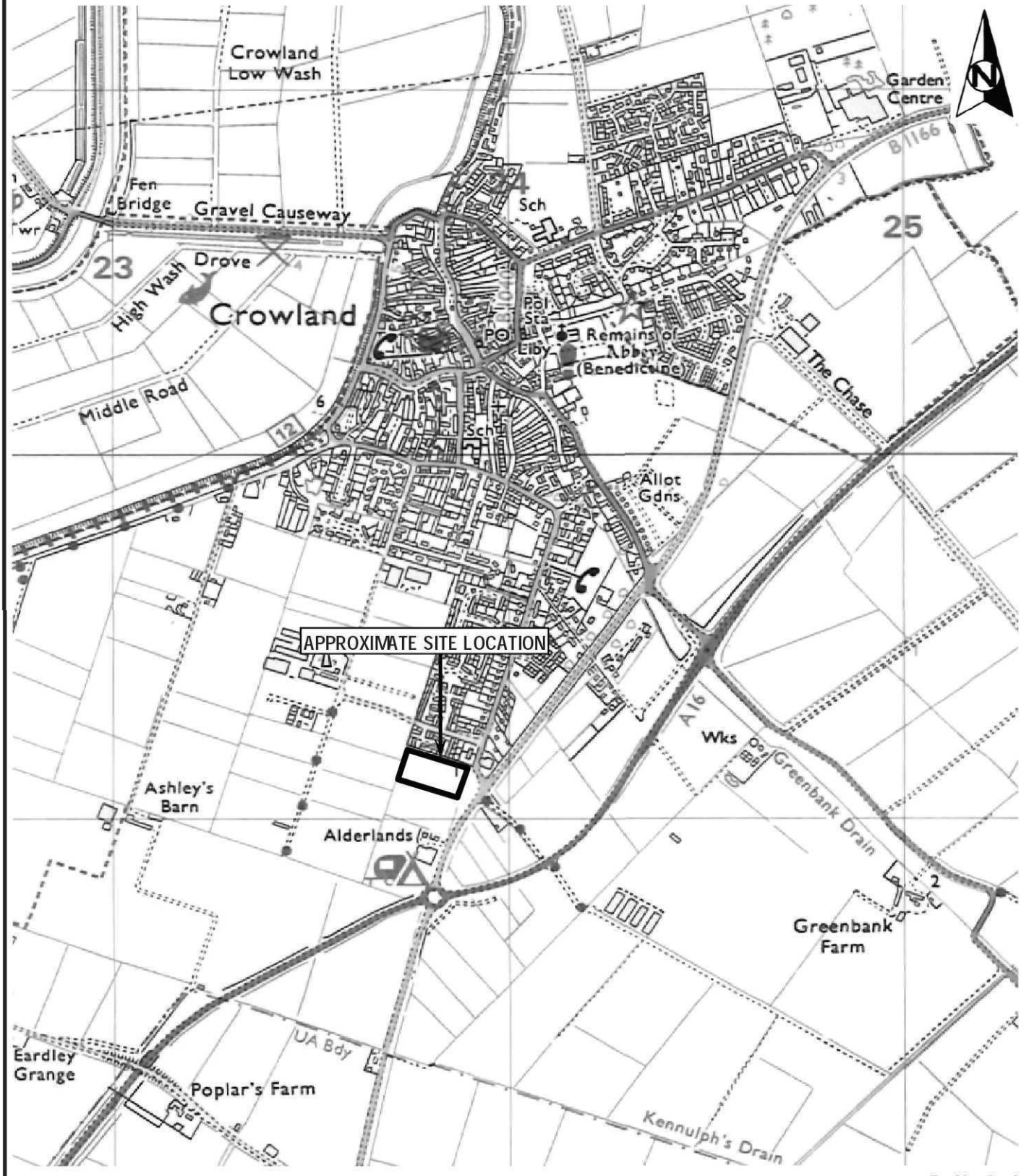
8.21 Licences, Permits, Registrations, Plans & Approvals

The Contractor/Developer is responsible for, and must ensure that, all necessary licenses, permits, plans, registrations and approvals are in place prior to commencing with the earthworks at the site. These will include any Mobile Treatment Licenses (MTLs), Materials Management Plans (MMPs), Site Waste Management Plans (SWMPs) and/or Environmental Permits as necessary to enable the completion of the proposed works.

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APPENDIX I

Site Location Plan
(Figure No. D34155/01)



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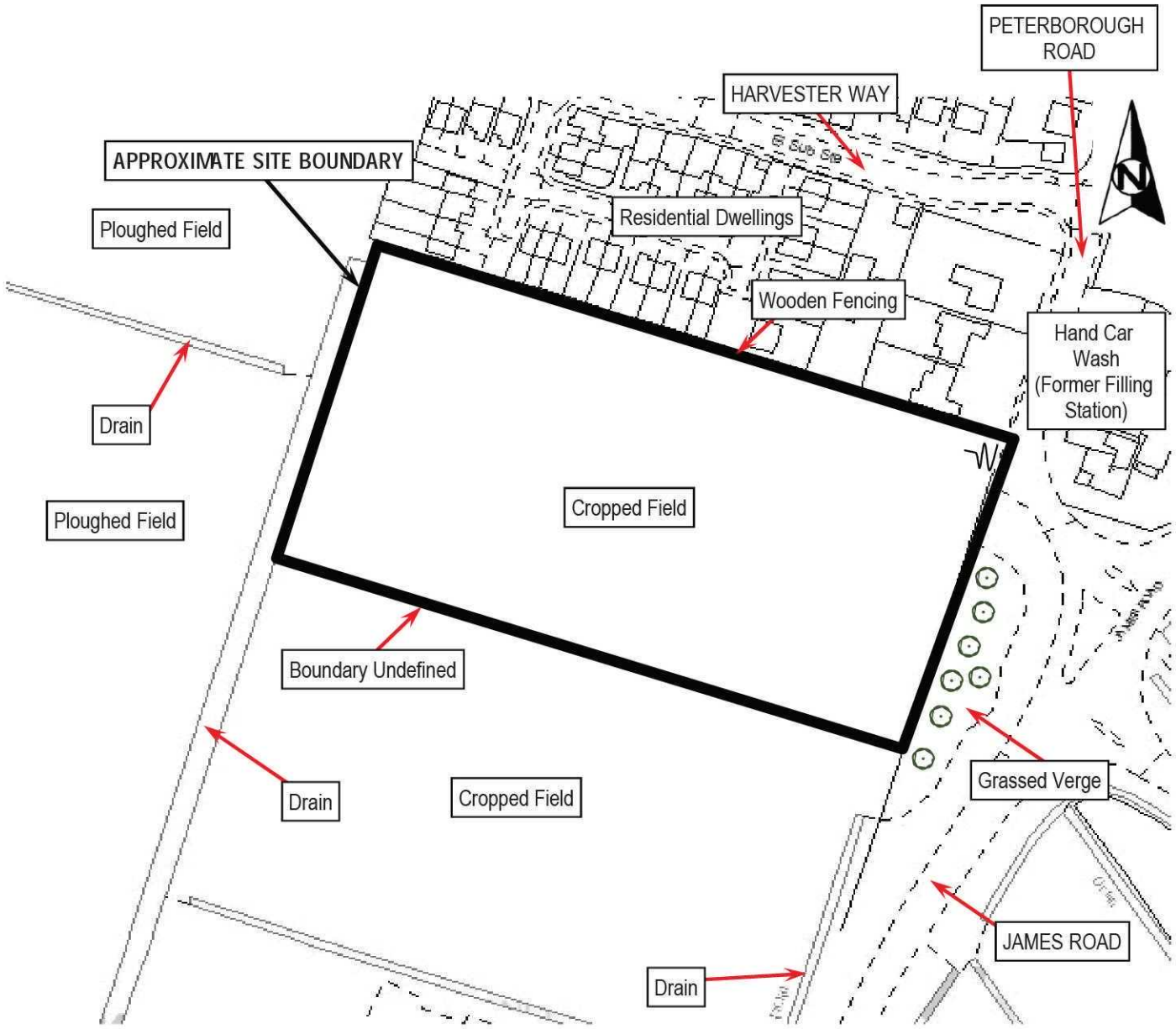
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Project	Peterborough Road Crowland	Approved	*SS*
		Scale	NTS
		Date Drawn	07/04/2015
Title	Site Location Plan	Rev.	
		Figure No.	D34155/01

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APPENDIX II

Annotated Site Plan
(Figure No. D34155/02)



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Project No.	D34155	Drawn	CEH
Client	Ashley King (Developments) Ltd	Checked	SS
Project	Peterborough Road Crowland	Approved	SS
		Scale	NTS
		Date Drawn	07/04/2015
Title	Annotated Site Plan	Rev.	
		Figure No.	D34155/02

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APPENDIX III

Site Plan Showing General Site Views
(Figure No. D34155/03)



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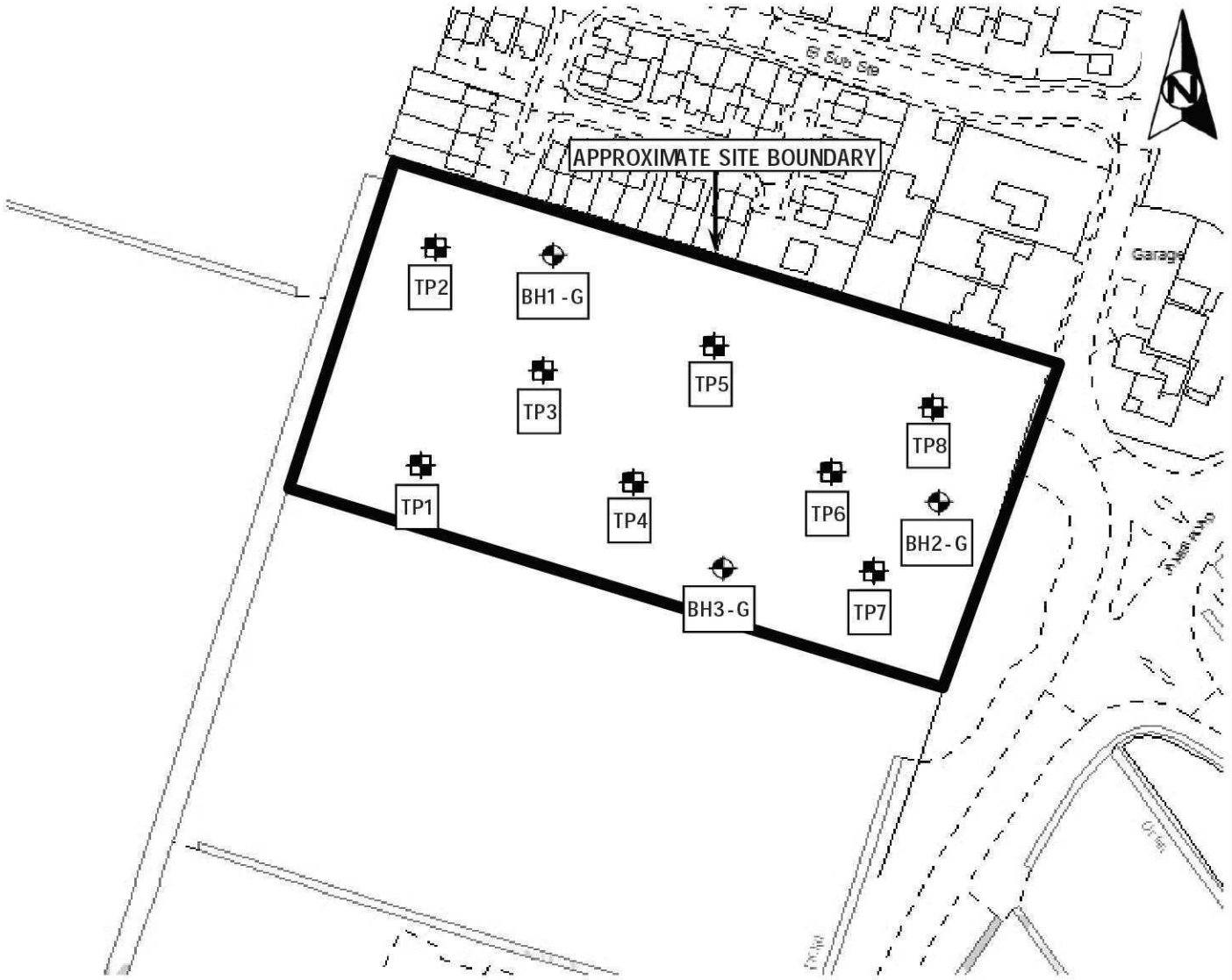
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Client	Ashley King (Developments) Ltd	Checked	SS
Project	Peterborough Road Crowland	Approved	SS
		Scale	NTS
		Date Drawn	07/04/2015
Title	Plan Showing General Site Views	Rev.	
		Figure No.	D34155/03

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APPENDIX IV

Exploratory Hole Location Plan
(Figure No. D34155/04)



KEY

- Approximate Location of Cable Percussive Borehole (BH)
- G — Ground Gas/Water Monitoring Point
- Approximate Location of Trial Pit (TP)

Do Not Scale

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Project No.	D34155	Drawn	CEH
Client	Ashley King (Developments) Ltd	Checked	SS
Project	Peterborough Road Crowland	Approved	SS
		Scale	NTS
		Date Drawn	07/04/2015
Title	Exploratory Hole Location Plan	Rev.	
		Figure No.	D34155/04

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APPENDIX V

Exploratory Hole Logs
(TP1 – TP8 & BH1 – BH3)

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TP1

Project No. D34155

Sheet 1 of 1

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
				Brown clayey TOPSOIL with occasional fine gravel of subrounded quartzite (TOPSOIL)		(0.50) 0.50			
0.40	D	D1							
0.60	D	D2		Firm grey-brown CLAY/SILT (UNDIFFERENTIATED DRIFT DEPOSITS) ...becoming sandy below 0.90m		(1.30)			
1.30	B	B1				1.80			
				Medium dense orange-brown damp silty fine to medium SAND (UNDIFFERENTIATED DRIFT DEPOSITS) ...becoming light grey occasionally mottled brown below 2.20m ...becoming wet fine to coarse sand with depth ...steady water seepage encountered at 3.00m		(1.50)		▽	
				End of Borehole at 3.30 m		3.30			

Remarks:
1.Sides unstable below 2.70m, undermining upper horizons.
2.Water encountered at 3.00m.

Key:
D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
▽ = Water Strike (m)
▼ = Steady Water Level (m)

Project: Peterborough Road, Crowland		**Client:** Ashley King (Developments) Ltd	
Logged: CEH	**Checked:** SS	**Field Book Ref:** CEH1404	**Plant:** JCB 3CX
Date: 09/02/2015	**Approved:** SS		**Scale:** 1:50
			Drawing Ref: TP1

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TP2

Project No. D34155

Sheet 1 of 1

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
0.30	D	D3		Dark brown clayey TOPSOIL (TOPSOIL)		(0.40) 0.40			
				Firm grey-brown silty CLAY (UNDIFFERENTIATED DRIFT DEPOSITS) ...becoming sandy below 0.90m		(0.90) 1.30			
1.50	D/B	D4/B2		Medium dense orange-brown silty fine to medium SAND (UNDIFFERENTIATED DRIFT DEPOSITS) ...becoming damp below 1.50m		(1.10) 2.40		▽	
				Medium dense grey wet slightly silty fine to coarse SAND (UNDIFFERENTIATED DRIFT DEPOSITS) ...steady water seepage at 2.70m		(0.80) 3.20			
				End of Borehole at 3.20 m					

Remarks:
1.Sides unstable below 2.30m, undermining upper horizons.
2.Water encountered at 2.70m.

Key:
D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
▽ = Water Strike (m)
▼ = Steady Water Level (m)

Project: Peterborough Road, Crowland		**Client:** Ashley King (Developments) Ltd	
Logged: CEH	**Checked:** SS	**Field Book Ref:** CEH1404	**Plant:** JCB 3CX
Date: 09/02/2015	**Approved:** SS		**Scale:** 1:50
			Drawing Ref: TP2

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TP3

Project No. D34155

Sheet 1 of 1

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
0.20	D	D5		Brown clayey TOPSOIL (TOPSOIL)		(0.50) 0.50			
0.70	D/B	D6/B3		Firm to stiff grey-brown silty CLAY (UNDIFFERENTIATED DRIFT DEPOSITS) ...becoming sandy with depth		(0.90) 1.40			
				Medium dense orange-brown very silty fine to medium SAND (UNDIFFERENTIATED DRIFT DEPOSITS)		(0.80) 2.20			
				Very soft grey very sandy CLAY (UNDIFFERENTIATED DRIFT DEPOSITS)		(1.00) 3.20			
3.30	D	D7		Firm dark brown and grey very sandy PEAT with occasional fine shell fragments and bark remains (UNDIFFERENTIATED DRIFT DEPOSITS)		3.40			
				Medium dense grey-brown peaty fine to coarse SAND (UNDIFFERENTIATED DRIFT DEPOSITS)		3.60			
				End of Borehole at 3.60 m					

Remarks:
1.Sides generally stable.
2.No water encountered.

Key:
D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
▽ = Water Strike (m)
▼ = Steady Water Level (m)

Project: Peterborough Road, Crowland		**Client:** Ashley King (Developments) Ltd	
Logged: CEH	**Checked:** SS	**Field Book Ref:** CEH1404	**Plant:** JCB 3CX
Date: 09/12/2015	**Approved:** SS		**Scale:** 1:50
			Drawing Ref: TP3

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TP4

Project No. D34155

Sheet 1 of 1

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
0.30	D	D8		Dark brown clayey TOPSOIL with rare pieces of ceramic (TOPSOIL)		(0.40) 0.40			
0.60	D	D9		Firm orange-brown and grey CLAY (UNDIFFERENTIATED DRIFT DEPOSITS) ...slight perched water seepage at 0.90m		(1.50)		▽	
1.50	B	B4		...slight perched water seepage at 1.40m ...becoming grey below 1.50m				▽	
1.95	D	D10		Firm dark brown wet fibrous PEAT with frequent plant remains (rapid water ingress, strong stagnant odour to water) (UNDIFFERENTIATED DRIFT DEPOSITS)		1.90 2.00 (0.70)		▽	
				Firm grey CLAY (UNDIFFERENTIATED DRIFT DEPOSITS)		2.70			
				End of Borehole at 2.70 m					

Remarks:
1.Sides generally stable.
2.Perched water encountered at 0.90m, 1.40m and 1.90m.
3.Terminated due to rapid water ingress from Peat horizon at 1.90m.

Key:
D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
▽ = Water Strike (m)
▼ = Steady Water Level (m)

Project: Peterborough Road, Crowland		**Client:** Ashley King (Developments) Ltd	
Logged: CEH	**Checked:** SS	**Field Book Ref:** CEH1404	**Plant:** JCB 3CX
Date: 09/02/2015	**Approved:** SS		**Scale:** 1:50
			Drawing Ref: TP4

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TP5

Project No. D34155

Sheet 1 of 1

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
0.25	D	D11		Dark brown clayey TOPSOIL (TOPSOIL)		(0.40) 0.40			
				Firm to stiff grey-brown CLAY (UNDIFFERENTIATED DRIFT DEPOSITS)					
				...slight perched water seepage at 0.80m				▽	
1.30	D	D12		...steady perched water seepage at 1.30m		(1.80)		▽	
				...becoming soft/friable with occasional peaty inclusions below 1.70m				▼	
2.00	B	B5		Soft dark brown friable fibrous PEAT (UNDIFFERENTIATED DRIFT DEPOSITS)		2.20 2.30 (0.30)			
				Soft to firm grey CLAY (UNDIFFERENTIATED DRIFT DEPOSITS)		2.60			
				End of Borehole at 2.60 m					

Remarks:
1.Sides unstable below 2.20m, undermining upper horizons.
2.Perched water encountered at 0.80m, 1.30m and 1.50m. Water standing to 1.90m on completion.
3.Terminated due to collapse of sides.

Key:
D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
▽ = Water Strike (m)
▼ = Steady Water Level (m)

Project: Peterborough Road, Crowland		**Client:** Ashley King (Developments) Ltd	
Logged: CEH	**Checked:** SS	**Field Book Ref:** CEH1404	**Plant:** JCB 3CX
Date: 09/02/2015	**Approved:** SS		**Scale:** 1:50
			Drawing Ref: TP5

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TP6

Project No. D34155

Sheet 1 of 1

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
0.20	D	D13		Dark brown clayey TOPSOIL with a peaty lens in southern end of pit (TOPSOIL)		(0.50) 0.50			
				Firm grey-brown CLAY with occasional plant remains (UNDIFFERENTIATED DRIFT DEPOSITS)		(1.00)		▽	
1.50	D	D14		...becoming soft with depth ...with peat horizon at 1.40m including fragments of wood		1.50 1.60			
				Soft brown wet fibrous PEAT with frequent large fragments of partially decomposed wood (UNDIFFERENTIATED DRIFT DEPOSITS)		(1.40)		▽	
2.80	D	D15		Firm grey-brown CLAY with occasional pockets of yellow brown sand (UNDIFFERENTIATED DRIFT DEPOSITS)				▽	
2.90	B	B6		...with occasional fine fragments of shell below 2.30m ...steady water ingress at 2.90m		3.00			
				End of Borehole at 3.00 m					

Remarks:
1. Sides unstable below 2.90m, undermining upper horizons.
2. Perched water encountered at 0.90m, 2.30m and 2.90m. Water standing at 2.80m upon completion.
3. Terminated due to sides collapsing below 2.90m.

Key:
- D = Disturbed Sample
- U = Undisturbed Sample
- B = Bulk Sample
- J = Jar Sample
- V = Vial Sample
- S = Standard Penetration Test (Split Spoon)
- C = Standard Penetration Test (Cone)
- ▽ = Water Strike (m)
- ▼ = Steady Water Level (m)

Project: Peterborough Road, Crowland		**Client:** Ashley King (Developments) Ltd	
Logged: CEH	**Checked:** SS	**Field Book Ref:** CEH1404	**Plant:** JCB 3CX
Date: 09/02/2015	**Approved:** SS		**Scale:** 1:50
			Drawing Ref: TP6

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TP7

Project No. D34155

Sheet 1 of 1

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
0.15	D	D16		Dark brown clayey TOPSOIL (TOPSOIL)		(0.30) 0.30			
				Soft to firm grey CLAY with frequent plant remains (UNDIFFERENTIATED DRIFT DEPOSITS) ...slight perched water seepage in southern end of pit at 0.80m ...becoming soft below 1.00m		(1.10)		▽	
1.65	D	D17		Soft brown fibrous PEAT with frequent root remains (UNDIFFERENTIATED DRIFT DEPOSITS)		1.40 1.50 (0.90)			
2.20	D	D18		Soft grey-brown peaty CLAY with occasional pockets of grey silty sand and peat (UNDIFFERENTIATED DRIFT DEPOSITS) ...with occasional fine fragments of shell below 1.80m ...with occasional thin interbeds of brown damp fine to medium sand below 2.20m		2.40 2.60		▽▼	
				Stiff grey CLAY (UNDIFFERENTIATED DRIFT DEPOSITS)					
				End of Borehole at 2.60 m					

Remarks:
1.Sides unstable below 2.40m, undermining upper horizons.
2.Perched water encountered at 0.80m and 2.40m. Water standing at 2.50m upon completion.
3.Trial pit terminated due to collapse of sides.

Key:
D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
▽ = Water Strike (m)
▼ = Steady Water Level (m)

Project: Peterborough Road, Crowland		**Client:** Ashley King (Developments) Ltd		
Logged: CEH	**Checked:** SS	**Field Book Ref:** CEH1404	**Plant:** JCB 3CX	**Drawing Ref:** TP7
Date: 09/02/2015	**Approved:** SS		**Scale:** 1:50	

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TP8

Project No. D34155

Sheet 1 of 1

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
0.10	D	D19		Dark brown clayey TOPSOIL (TOPSOIL)		(0.40)			
						0.40			
				Firm grey CLAY with occasional plant remains (UNDIFFERENTIATED DRIFT DEPOSITS)				▽	
				...becoming occassionally mottled brown with depth		(1.20)			
1.65	D	D20		Soft brown fibrous PEAT (UNDIFFERENTIATED DRIFT DEPOSITS)		1.60 (0.30) 1.90			
				Firm grey CLAY with occasional fine shell fragments (UNDIFFERENTIATED DRIFT DEPOSITS) ...becoming wet and sandy with frequent fine shell fragments below 2.40m		(1.10)		▽▼	
				End of Borehole at 3.00 m		3.00			

Remarks:
1. Sides unstable below 2.40m, undermining upper horizons.
2. Perched water encountered at 0.90m. Steady water ingress at 2.40m. Water standing at 2.50m upon completion.

Key:
D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
▽ = Water Strike (m)
▼ = Steady Water Level (m)

Project: Peterborough Road, Crowland		**Client:** Ashley King (Developments) Ltd		
Logged: CEH	**Checked:** SS	**Field Book Ref:** CEH1404	**Plant:** JCB 3CX	**Drawing Ref:** TP8
Date: 09/02/2015	**Approved:** SS		**Scale:** 1:50	

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BH1

Project No. D34155

Sheet 1 of 2

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
				Dark brown clayey TOPSOIL (TOPSOIL)		(0.40) 0.40			
				Loose orange-brown very silty fine to medium SAND (UNDIFFERENTIATED DRIFT DEPOSITS)					
1.00-1.45	S		9						
1.00	D	D1							
1.50-2.00	B	B1				(2.00)			
2.00-2.45	S		6					▽	
				Loose grey-brown silty fine SAND (UNDIFFERENTIATED DRIFT DEPOSITS)		2.40			
3.00-3.45	S		4						
3.00	D	D2							
3.50-4.50	B	B2							
4.50-4.95	S		2						
4.50	D	D3		...becoming very loose grey-brown slightly silty fine to medium SAND with occasional slightly carbonaceous laminations of dark grey sand below 4.50m					
5.50-5.95	S		24			(6.00)			
5.50	D	D4		...becoming medium dense and silty with occasional fine subrounded to subangular quartzite and flint below 5.50m					
7.00-7.45	S		21						
7.00	D	D5		...becoming grey-brown fine to coarse SAND below 7.00m					
8.50-8.95	S		2			8.40			
8.50	D	D6		Very loose grey-brown very silty fine to coarse SAND (UNDIFFERENTIATED DRIFT DEPOSITS)		(1.10)			
				Soft dark grey slightly sandy SILT (UNDIFFERENTIATED DRIFT DEPOSITS)		9.50			
				Continued on next sheet					

Remarks:
1. Sides cased to 12.00m. Sides stable below 12.00m
2. Water seepage encountered at 2.00m, rising to 1.90m after approximately 10 minutes.
3. Slow progress in blowing sands below 4.50m.
4. Plain pipe installed from ground level to 1.00m in a bentonite surround. Slotted pipe installed from 1.00m to 5.00m in a gravel surround.
5. Bung, valve and lockable cover installed.

Key:
D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
▽ = Water Strike (m)
▼ = Steady Water Level (m)

Project: Peterborough Road, Crowland		**Client:** Ashley King (Developments) Ltd	
Logged: CEH	**Checked:** SS	**Field Book Ref:** CEH1404	**Plant:** Pilcon
Date: 09/02/2015	**Approved:** SS		**Scale:** 1:50
			Drawing Ref: BH1

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BH1

Project No. D34155

Sheet 2 of 2

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
10.00-10.45	S		3	Soft dark grey slightly sandy SILT (UNDIFFERENTIATED DRIFT DEPOSITS)					
10.00	D	D7				(2.50)			
11.50-12.00	B	B3							
12.00-12.45	S		27	Very stiff grey CLAY (OXFORD CLAY)		12.00	12.00		
12.00	D	D8							
12.50-13.00	B	B4							
13.00-13.45	U	U1							
13.50-13.95	S		50/240mm	...becoming hard and thinly laminated with occasional fine shell fragments below 13.50m		(3.40)			
13.50	D	D9							
15.00-15.45	S		50/240mm						
15.00	D	D10							
				End of Borehole at 15.40 m		15.40			

Remarks:
1. Sides cased to 12.00m. Sides stable below 12.00m
2. Water seepage encountered at 2.00m, rising to 1.90m after approximately 10 minutes.
3. Slow progress in blowing sands below 4.50m.
4. Plain pipe installed from ground level to 1.00m in a bentonite surround. Slotted pipe installed from 1.00m to 5.00m in a gravel surround.
5. Bung, valve and lockable cover installed.

Key:
D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
▽ = Water Strike (m)
▼ = Steady Water Level (m)

Project: Peterborough Road, Crowland		**Client:** Ashley King (Developments) Ltd	
Logged: CEH	**Checked:** SS	**Field Book Ref:** CEH1404	**Plant:** Pilcon
Date: 09/02/2015	**Approved:** SS		**Scale:** 1:50
			Drawing Ref: BH1

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BH2

Project No. D34155

Sheet 1 of 2

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
				Dark brown clayey TOPSOIL (TOPSOIL)		(0.40) 0.40			
				Soft to firm grey occasionally mottled orange-brown slightly silty CLAY (UNDIFFERENTIATED DRIFT DEPOSITS)					
1.00-1.45	S		3						
1.00	D	D1		...becoming soft with depth					
1.50	B	B1				(2.00)			
2.00-2.45	S		10	...becoming firm slightly silty and sandy with thin peaty laminations below 1.80m.					
2.00	D	D2		...becoming blue-grey with sand lens and occasional plant remains below 2.00m		2.40			
2.60	D	D3		Loose yellow-brown damp clayey fine to coarse SAND (UNDIFFERENTIATED DRIFT DEPOSITS)		2.45			
3.00-3.45	S		11						
3.00	D	D4		Firm becoming stiff blue-grey occasionally mottled orange CLAY with occasional plant reamins and rare fragments of shell (UNDIFFERENTIATED DRIFT DEPOSITS)		(1.35)			
						3.80			
4.00-4.45	S		5	Firm yellow-grey CLAY with occasional root traces, damp sand lenses and rare fine shell fragments (UNDIFFERENTIATED DRIFT DEPOSITS)					
4.00	D	D5				(0.70)			
4.50	D	D6		Firm grey-brown slightly sandy CLAY (UNDIFFERENTIATED DRIFT DEPOSITS)		4.50	4.70		
5.00-5.45	S		20						
5.00	D	D7		...becoming stiff to very stiff below 5.00m		(1.00)			
				Stiff grey CLAY (OXFORD CLAY)		5.50			
6.50-6.95	U	U1							
				...becoming very stiff below 7.50m					
8.00-8.45	S		41						
8.00	D	D8				(5.50)			
9.50-9.95	S		33						
9.50	D	D9							
				Continued on next sheet					

Remarks:
1. Sides cased to 4.70m. Sides stable below 4.70m.
2. No water encountered during drilling. Perched water encountered at 2.50m following removal of casing.
3. Plain pipe installed from ground level to 1.00m in a bentonite surround. Slotted pipe installed from 1.00m to 5.00m in a gravel surround.
4. Bung, valve and lockable cover installed.

Key:
D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
▽ = Water Strike (m)
▼ = Steady Water Level (m)

Project: Peterborough Road, Crowland		**Client:** Ashley King (Developments) Ltd	
Logged: CEH	**Checked:** SS	**Field Book Ref:** CEH1404	**Plant:** Pilcon
Date: 11/02/2015	**Approved:** SS		**Scale:** 1:50
			Drawing Ref: BH2

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BH2

Project No. D34155

Sheet 2 of 2

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
				Stiff grey CLAY (OXFORD CLAY)					
11.00-11.45	S		50/275mm			11.00			
11.00	D	D10		Very weak grey completely weathered clayey MUDSTONE (OXFORD CLAY)					
12.50-12.95	S		43						
12.50	D	D11				(3.45)			
14.00-14.45	S		50/220mm						
14.00	D	D12							
						14.45			
				End of Borehole at 14.45 m					

Remarks:
1. Sides cased to 4.70m. Sides stable below 4.70m.
2. No water encountered during drilling. Perched water encountered at 2.50m following removal of casing.
3. Plain pipe installed from ground level to 1.00m in a bentonite surround. Slotted pipe installed from 1.00m to 5.00m in a gravel surround.
4. Bung, valve and lockable cover installed.

Key:
- D = Disturbed Sample
- U = Undisturbed Sample
- B = Bulk Sample
- J = Jar Sample
- V = Vial Sample
- S = Standard Penetration Test (Split Spoon)
- C = Standard Penetration Test (Cone)
- = Water Strike (m)
- = Steady Water Level (m)

Project: Peterborough Road, Crowland		**Client:** Ashley King (Developments) Ltd	
Logged: CEH	**Checked:** SS	**Field Book Ref:** CEH1404	**Plant:** Pilcon
Date: 11/02/2015	**Approved:** SS		**Scale:** 1:50
			Drawing Ref: BH2

GeoDyne
9 Brunel Parkway, Pride Park, Derby DE24 8HR
Tel: 01332 290798 Fax: 01332 208074
email: info@geodyne.co.uk

BH3

Project No. D34155

Sheet 1 of 2

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
				Brown clayey TOPSOIL (TOPSOIL)		(0.40) 0.40			
1.00-1.45 1.00	S D	D1	2	Firm grey-brown mottled orange slightly sandy CLAY with occasional root traces (UNDIFFERENTIATED DRIFT DEPOSITS) ...becoming soft below 1.00m		(1.25)			
				...with occasional small sandy pockets below 1.40m		1.65			
2.00-2.45 2.00	S D	D2	6	Soft dark brown fibrous slightly clayey PEAT with a moderate vegetative odour (UNDIFFERENTIATED DRIFT DEPOSITS)		1.85 (0.45)			
				Firm grey-brown slightly sandy CLAY (UNDIFFERENTIATED DRIFT DEPOSITS)		2.30 (0.40)			
3.00-3.45 3.00	S D	D3	11	Firm blue-grey mottled green-brown CLAY with occasional fine plant remains and carbonaceous pockets (UNDIFFERENTIATED DRIFT DEPOSITS)		2.70 (0.50) 3.20			
				Medium dense yellow-brown clayey fine to coarse SAND (UNDIFFERENTIATED DRIFT DEPOSITS)					
4.00-4.45 4.00	S D	D4	14	Stiff grey-brown slightly silty slightly sandy CLAY (UNDIFFERENTIATED DRIFT DEPOSITS)		(1.60)	4.00		
5.00	U	U1		Stiff grey thinly laminated CLAY with occasional fine shell fragments (OXFORD CLAY)		4.80			
6.50-6.95 6.50	S D	D5	29	...becoming very stiff below 6.50m					
8.00-8.45 8.00	S D	D6	40						
9.00	D	D7							
9.50-9.95	S		44			(9.30)			
				Continued on next sheet					

Remarks:
1. Sides cased to 4.00m. Sides stable below 4.00m.
2. No water encountered.
3. Plain pipe installed from ground level to 1.00m in a bentonite surround. Slotted pipe installed from 1.00m to 5.00m in a gravel surround.
4. Bung, valve and lockable cover installed.

Key:
D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
▽ = Water Strike (m)
▼ = Steady Water Level (m)

Project: Peterborough Road, Crowland		**Client:** Ashley King (Developments) Ltd	
Logged: CEH	**Checked:** SS	**Field Book Ref:** CEH1404	**Plant:** Pilcon
Date: 12/02/2015	**Approved:** SS		**Scale:** 1:50
			Drawing Ref: BH3

GeoDyne
9 Brunel Parkway, Pride Park, Derby DE24 8HR
Tel: 01332 290798 Fax: 01332 208074
email: info@geodyne.co.uk

BH3

Project No. D34155

Sheet 2 of 2

Samples and Tests				Description of Strata	Legend	Depth & (Thickness) (m)	Casing (m)	Ground-water	Installation
Depth (m)	Type	Sample Ref	SPT "N" Value						
				Stiff grey thinly laminated CLAY with occasional fine shell fragments (OXFORD CLAY)					
11.00-11.45	S		50						
11.00	D	D8		...becoming thinly laminated below 11.00m					
12.50-12.95	S		50/195mm						
12.50	D	D9							
13.80-14.25	S		50/165mm						
13.80	D	D10							
				End of Borehole at 14.10 m		14.10			

Remarks:
1. Sides cased to 4.00m. Sides stable below 4.00m.
2. No water encountered.
3. Plain pipe installed from ground level to 1.00m in a bentonite surround. Slotted pipe installed from 1.00m to 5.00m in a gravel surround.
4. Bung, valve and lockable cover installed.

Key:
D = Disturbed Sample
U = Undisturbed Sample
B = Bulk Sample
J = Jar Sample
V = Vial Sample
S = Standard Penetration Test (Split Spoon)
C = Standard Penetration Test (Cone)
▽ = Water Strike (m)
▼ = Steady Water Level (m)

Project: Peterborough Road, Crowland		**Client:** Ashley King (Developments) Ltd	
Logged: CEH	**Checked:** SS	**Field Book Ref:** CEH1404	**Plant:** Pilcon
Date: 12/02/2015	**Approved:** SS		**Scale:** 1:50
			Drawing Ref: BH3

GeoDyne

APPENDIX VI

Ground Gas & Water Monitoring Results

Project No.	D34155
Client	Ashley King (Developments) Ltd
Site Location	Peterborough Road, Crowland
Date	26/02/2015
Weather	Overcast and raining
Atmospheric Pressure (mb)	1002
Equipment	GA2000 (GEO 11=Derby) & Dipmeter
Operator	BP

MONITORING OF SOIL GASES AND GROUNDWATER - IN ACCORDANCE WITH CIRIA C665								
Borehole No.	Peak Steady	Methane (% v/v)	Carbon Dioxide (% v/v)	Oxygen (% v/v)	Gas Flow (l/h)	Depth to Groundwater (mbgl)	Time to steady reading (secs)	Other Issues i.e. odour, condition of installation, etc
BH1	Peak	0.1	1.7	16.8	0.0	1.32	45	Monitored for 120 Seconds
	Steady	0.0	1.7	16.8	0.0			
BH2	Peak	0.0	11.4	17.3	0.0	0.76	50	Monitored for 120 Seconds
	Steady	0.0	11.4	16.9	0.0			
BH3	Peak	0.1	14.6	16.8	0.0	0.52	42	Monitored for 120 Seconds
	Steady	0.1	14.6	16.8	0.0			
Ambient		0.0	0.0	21.1	NA	NA	NA	

Notes

Cell is highlighted in the following conditions

1. Where Methane exceeds 1% v/v (after BR212)
2. Where Carbon Dioxide exceeds 5% v/v (after BR212)

Project No.	D34155
Client	Ashley King (Developments) Ltd
Site Location	Peterborough Road, Crowland
Date	06/03/2015
Weather	Sunny, breezy
Atmospheric Pressure (mb)	1027
Equipment	GA2000 (GEO 11=Derby) & Dipmeter
Operator	CEH

MONITORING OF SOIL GASES AND GROUNDWATER - IN ACCORDANCE WITH CIRIA C665								
Borehole No.	Peak Steady	Methane (% v/v)	Carbon Dioxide (% v/v)	Oxygen (% v/v)	Gas Flow (l/h)	Depth to Groundwater (mbgl)	Time to steady reading (secs)	Other Issues i.e. odour, condition of installation, etc
BH1	Peak	0.0	2.3	16.6	0.0	1.43	35	Monitored for 120 Seconds
	Steady	0.0	2.3	16.5	0.0			
BH2	Peak	0.0	3.2	16.4	0.0	0.53	20	Monitored for 120 Seconds
	Steady	0.0	2.6	17.1	0.0			
BH3	Peak	0.0	0.7	20.9	0.0	0.62	60	Monitored for 120 Seconds
	Steady	0.0	0.6	20.9	0.0			
Ambient		0.0	0.0	21.1	NA	NA	NA	

Notes

Cell is highlighted in the following conditions

1. Where Methane exceeds 1% v/v (after BR212)
2. Where Carbon Dioxide exceeds 5% v/v (after BR212)

Project No.	D34155
Client	Ashley King (Developments) Ltd
Site Location	Peterborough Road, Crowland
Date	18/03/2015
Weather	Calm with hazy sunshine
Atmospheric Pressure (mb)	1028
Equipment	GA2000 (GEO 11=Derby) & Dipmeter
Operator	BP

MONITORING OF SOIL GASES AND GROUNDWATER - IN ACCORDANCE WITH CIRIA C665								
Borehole No.	Peak Steady	Methane (% v/v)	Carbon Dioxide (% v/v)	Oxygen (% v/v)	Gas Flow (l/h)	Depth to Groundwater (mbgl)	Time to steady reading (secs)	Other Issues i.e. odour, condition of installation, etc
BH1	Peak	0.0	2.9	15.3	0.0	1.50	41	Monitored for 120 Seconds
	Steady	0.0	2.9	15.3	0.0			
BH2	Peak	0.0	6.8	19.0	0.0	0.48	78	Monitored for 120 Seconds
	Steady	0.0	6.8	19.0	0.0			
BH3	Peak	0.1	14.4	8.7	5.1	0.90	72	Monitored for 120 Seconds
	Steady	0.1	14.4	8.7	3.5			
Ambient		0.0	0.0	21.3	NA	NA	NA	

Notes

Cell is highlighted in the following conditions

1. Where Methane exceeds 1% v/v (after BR212)
2. Where Carbon Dioxide exceeds 5% v/v (after BR212)

Project No.	D34155
Client	Ashley King (Developments) Ltd
Site Location	Peterborough Road, Crowland
Date	25/03/2015
Weather	Sunny spells
Atmospheric Pressure (mb)	1012
Equipment	GA2000+ (GEO 09=Nottingham) & Dipmeter
Operator	BP

MONITORING OF SOIL GASES AND GROUNDWATER - IN ACCORDANCE WITH CIRIA C665								
Borehole No.	Peak Steady	Methane (% v/v)	Carbon Dioxide (% v/v)	Oxygen (% v/v)	Gas Flow (l/h)	Depth to Groundwater (mbgl)	Time to steady reading (secs)	Other Issues i.e. odour, condition of installation, etc
BH1	Peak	0.0	2.4	15.7	0.0	1.52	55	Monitored for 120 Seconds
	Steady	0.0	2.4	15.7	0.0			
BH2	Peak	0.0	1.9	18.9	0.0	0.53	50	Monitored for 120 Seconds
	Steady	0.0	0.0	20.2	0.0			
BH3	Peak	0.0	3.5	18.1	0.0	0.71	95	Monitored for 120 Seconds
	Steady	0.0	0.7	19.9	0.0			
Ambient		0.0	0.0	21.3	NA	NA	NA	

Notes

Cell is highlighted in the following conditions

1. Where Methane exceeds 1% v/v (after BR212)
2. Where Carbon Dioxide exceeds 5% v/v (after BR212)

Project No.	D34155
Client	Ashley King (Developments) Ltd
Site Location	Peterborough Road, Crowland
Date	01/04/2015
Weather	Cloudy and windy
Atmospheric Pressure (mb)	1022
Equipment	GA2000+ (GEO 09=Nottingham) & Dipmeter
Operator	BP

MONITORING OF SOIL GASES AND GROUNDWATER - IN ACCORDANCE WITH CIRIA C665								
Borehole No.	Peak Steady	Methane (% v/v)	Carbon Dioxide (% v/v)	Oxygen (% v/v)	Gas Flow (l/h)	Depth to Groundwater (mbgl)	Time to steady reading (secs)	Other Issues i.e. odour, condition of installation, etc
BH1	Peak	0.1	1.8	19.7	0.0	1.50	50	Monitored for 120 Seconds
	Steady	0.1	1.8	19.7	0.0			
BH2	Peak	0.0	4.6	18.3	0.0	0.87	80	Monitored for 120 Seconds
	Steady	0.0	0.2	20.5	0.0			
BH3	Peak	0.0	0.1	20.8	0.0	0.71	60	Monitored for 120 Seconds
	Steady	0.0	0.0	20.8	0.0			
Ambient		0.0	0.0	20.9	NA	NA	NA	

Notes

Cell is highlighted in the following conditions

1. Where Methane exceeds 1% v/v (after BR212)
2. Where Carbon Dioxide exceeds 5% v/v (after BR212)

Project No.	D34155
Client	Ashley King (Developments) Ltd
Site Location	Peterborough Road, Crowland
Date	07/04/2015
Weather	Dry, sunny
Atmospheric Pressure (mb)	1036
Equipment	GA2000+ (GEO 09=Nottingham) & Dipmeter
Operator	CEH

MONITORING OF SOIL GASES AND GROUNDWATER - IN ACCORDANCE WITH CIRIA C665								
Borehole No.	Peak Steady	Methane (% v/v)	Carbon Dioxide (% v/v)	Oxygen (% v/v)	Gas Flow (l/h)	Depth to Groundwater (mbgl)	Time to steady reading (secs)	Other Issues i.e. odour, condition of installation, etc
BH1	Peak	0.1	1.5	18.9	0.0	1.52	40	Monitored for 120 Seconds
	Steady	0.1	1.5	18.9	0.0			
BH2	Peak	0.1	5.4	15.7	0.0	0.87	70	Monitored for 120 Seconds
	Steady	0.0	3.5	17.5	0.0			
BH3	Peak	0.0	2.1	19.7	0.0	0.48	65	Monitored for 120 Seconds
	Steady	0.0	1.7	19.9	0.0			
Ambient		0.0	0.0	20.6	NA	NA	NA	

Notes

Cell is highlighted in the following conditions

1. Where Methane exceeds 1% v/v (after BR212)
2. Where Carbon Dioxide exceeds 5% v/v (after BR212)

GeoDyne

APPENDIX VII

Laboratory Soil Test Results

PSL
Professional Soils Laboratory

LABORATORY REPORT

UKAS TESTING
4043

Contract Number: PSL15/1081

Client's Reference: D34155 Report Date: 11 March 2015

Client Name: Geodyne
9 Brunel Parkway
Pride Park
Derby
DE24 8HR

For the attention of: Clare Houghton

Contract Title: Peterborough Road, Crowland

Date Received: 04/03/2015
Date Commenced: 04/03/2015
Date Completed: 11/03/2015

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)
A Watkins (Director)
M Beastall (Laboratory Manager)



D Lambe (Senior Technician)
S Royle (Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
TP1	1	B	1.30	Brown mottled grey slightly gravelly sandy CLAY.
TP2	2	B	1.50	Brown slightly clayey very silty SAND.
TP3	3	B	0.70	Brown mottled grey slightly sandy CLAY.
TP5	5	B	2.00	Grey mottled brown slightly gravelly slightly sandy CLAY with some organic material.
TP6	6	B	2.90	Brown mottled grey sandy CLAY.
BH1	1	B	1.50	To Follow

PSL
Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	11/03/15		11/03/15		11/03/15

PETERBOROUGH ROAD, CROWLAND.

Contract No:	PSL15/1081
Client Ref:	D34155

SUMMARY OF SOIL CLASSIFICATION TESTS

(B.S. 1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Depth m	Moisture Content % Clause 3.2	Bulk Density Mg/m^3 Clause 7.2	Dry Density Mg/m^3 Clause 7.2	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4.4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	% Passing .425mm	Remarks
TP1	1	B	1.30	37				47	23	24	98	Intermediate plasticity CI.
TP2	2	B	1.50	31					NP			
TP3	3	B	0.70	39				57	27	30	100	High plasticity CH.
TP5	5	B	2.00	67				94	37	57	94	Extremely high plasticity CE.
TP6	6	B	2.90	26				41	20	21	100	Intermediate plasticity CI.
BH1	1	B	1.50									

SYMBOLS : NP : Non Plastic * : Liquid Limit and Plastic Limit Wet Sieved.

PSL
Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	11/03/15		11/03/15		11/03/15

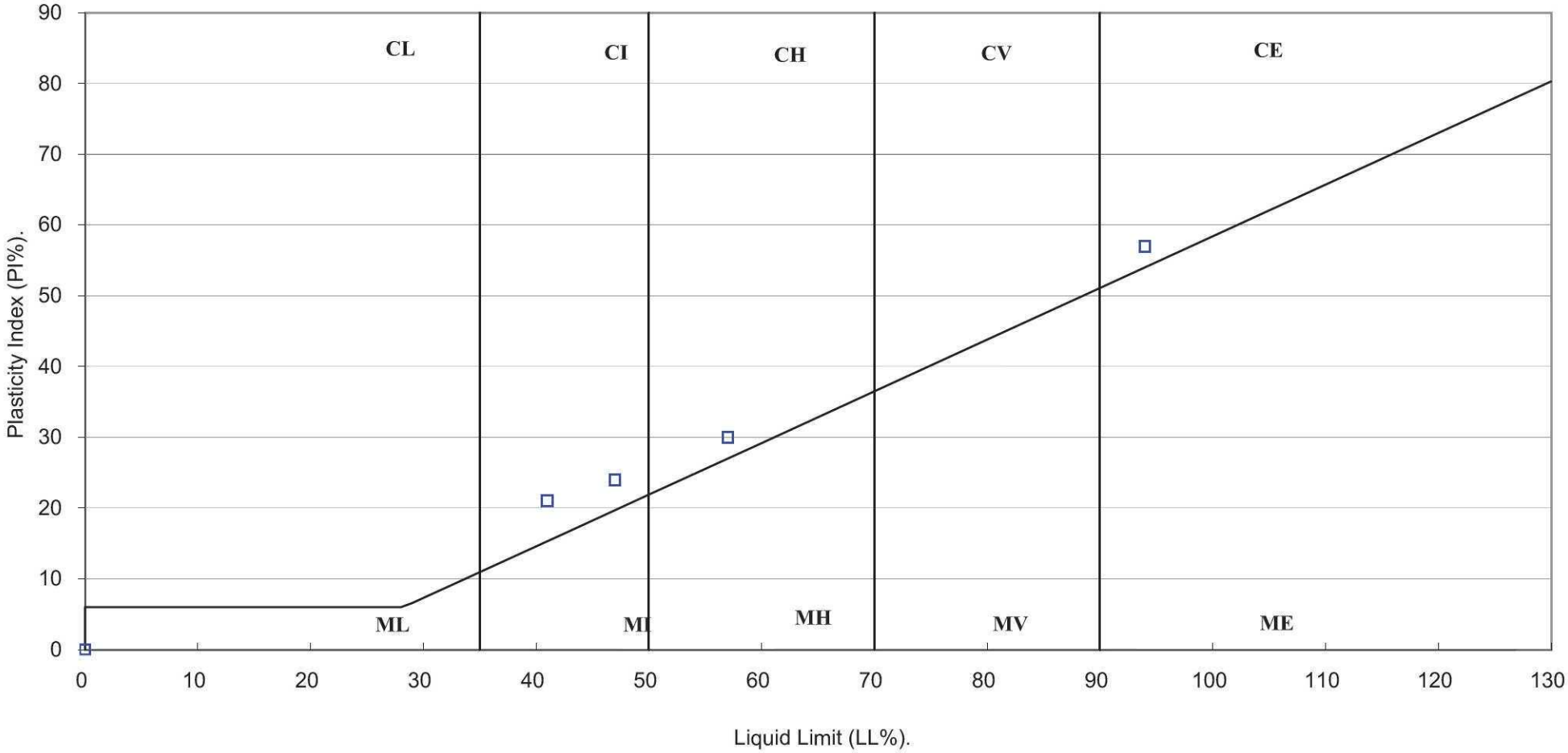
PETERBOROUGH ROAD, CROWLAND.

Contract No: PSL15/1081

Client Ref: D34155

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



PSL Professional Soils Laboratory	Compiled by	Date	Checked by	Date	Approved by	Date
		11/03/15		11/03/15		11/03/15
	PETERBOROUGH ROAD, CROWLAND.				Contract No:	PSL15/1081
					Client Ref:	D34155

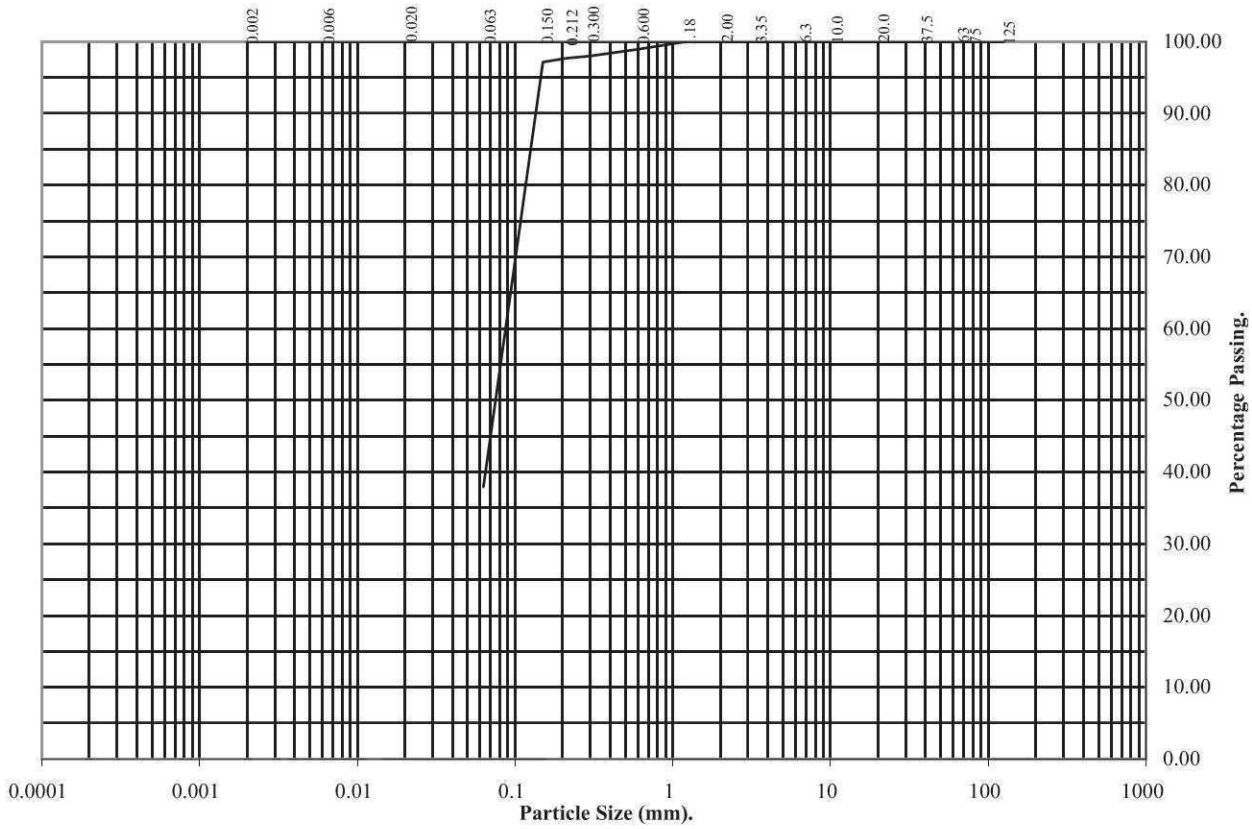
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP2 **Depth (m):** 1.50

Sample Number: 2 **Sample Type:** B



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	100
0.6	99
0.3	98
0.212	98
0.15	97
0.063	38

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	62
Silt / Clay	38

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	11/03/15		11/03/15

PSL Professional Soils Laboratory	**PETERBOROUGH ROAD, CROWLAND.**	**Contract No.: PSL15/1081**

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 15/00946
Issue Number: 1 **Date:** 27 February, 2015

Client:
GeoDyne (Derby)
9 Brunel Parkway
Pride Park
Derby
Derbyshire
UK
DE24 8HR

Project Manager: Clare Houghton
Project Name: Peterborough Road, Crowland
Project Ref: D34155
Order No: D34155/CEH
Date Samples Received: 12/02/15
Date Instructions Received: 18/02/15
Date Analysis Completed: 27/02/15

Prepared by:



Anna Whyatt
Administrative Assistant

Approved by:



Lianne Bromiley
Senior Client Manager

Envirolab Job Number: 15/00946

Client Project Name: Peterborough Road, Crowland

Client Project Ref: D34155

Lab Sample ID	15/00946/1	15/00946/2	15/00946/6	15/00946/7	15/00946/10	15/00946/11	15/00946/12	15/00946/16	Units	Method ref
Client Sample No	D1	D2	D6	D7	D10	D11	D12	D17		
Client Sample ID	TP1	TP1	TP3	TP3	TP4	TP5	TP5	TP7		
Depth to Top	0.40	0.60	0.70	3.30	1.95	0.25	1.30	0.15		
Depth To Bottom										
Date Sampled	09-Feb-15	09-Feb-15	09-Feb-15	09-Feb-15	09-Feb-15	09-Feb-15	09-Feb-15	09-Feb-15		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
MCERTS Sample Matrix Code	5	5E	5	5	6E	6	5A	6AE		
% Stones >10mm$_A$ #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	% w/w	A-T-044
pH$_D$ M#	6.41	8.23	8.45	7.27	-	7.44	6.00	6.95	pH	A-T-031s
Sulphate (water sol 2:1)$_D$ M#	-	0.08	-	2.11	-	-	1.84	-	g/l	A-T-026s
Loss on ignition (550degC)$_D$	-	-	-	19.7	23.6	-	-	-	% w/w	A-T-030s
Total Organic Carbon$_D$ M#	15.4	0.97	1.00	8.37	11	9.73	2.71	14.6	% w/w	A-T-032s
Arsenic$_D$ M#	13	7	9	-	-	14	13	16	mg/kg	A-T-024s
Cadmium$_D$ M#	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5	mg/kg	A-T-024s
Copper$_D$ M#	16	10	10	-	-	21	12	23	mg/kg	A-T-024s
Chromium$_D$ M#	35	26	25	-	-	36	34	47	mg/kg	A-T-024s
Chromium (hexavalent)$_D$	<1	<1	<1	-	-	<1	<1	<1	mg/kg	A-T-040s
Chromium (trivalent)	35	26	25	-	-	36	34	47	mg/kg	Calc
Lead$_D$ M#	20	12	11	-	-	36	14	35	mg/kg	A-T-024s
Mercury$_D$	<0.17	0.36	<0.17	-	-	0.18	<0.17	0.18	mg/kg	A-T-024s
Nickel$_D$ M#	24	22	22	-	-	24	20	27	mg/kg	A-T-024s
Selenium$_D$ M#	1	<1	<1	-	-	1	<1	2	mg/kg	A-T-024s
Zinc$_D$ M#	45	50	49	-	-	63	48	71	mg/kg	A-T-024s

Envirolab Job Number: 15/00946

Client Project Name: Peterborough Road, Crowland

Client Project Ref: D34155

Lab Sample ID	15/00946/1	15/00946/2	15/00946/6	15/00946/7	15/00946/10	15/00946/11	15/00946/12	15/00946/16	Units	Method ref
Client Sample No	D1	D2	D6	D7	D10	D11	D12	D17		
Client Sample ID	TP1	TP1	TP3	TP3	TP4	TP5	TP5	TP7		
Depth to Top	0.40	0.60	0.70	3.30	1.95	0.25	1.30	0.15		
Depth To Bottom										
Date Sampled	09-Feb-15	09-Feb-15	09-Feb-15	09-Feb-15	09-Feb-15	09-Feb-15	09-Feb-15	09-Feb-15		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
MCERTS Sample Matrix Code	5	5E	5	5	6E	6	5A	6AE		
Pest-c										
Mevinphos	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
Dichlorvos	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
alpha-Hexachlorocyclohexane (HCH)	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
Diazinon	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
gamma-Hexachlorocyclohexane (HCH / Lindane)	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
Heptachlor	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
Aldrin	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
beta-Hexachlorocyclohexane (HCH)	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
Methyl Parathion	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
Malathion	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
Fenitrothion	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
Heptachlor Epoxide	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
Parathion (Ethyl Parathion)	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
p,p-DDE	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
p,p-DDT	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
p,p-Methoxychlor	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
p,p-TDE (DDD)	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
o,p-DDE	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
o,p-DDT	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
o,p-Methoxychlor	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
o,p-TDE (DDD)	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
Endosulphan I	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
Endosulphan II	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
Endosulphan Sulphate	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
Endrin	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
Ethion	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
Dieldrin	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon
Azinphos-methyl	<50	-	-	-	-	<50	-	<50	µg/kg	Subcon

Envirolab Job Number: 15/00946

Client Project Name: Peterborough Road, Crowland

Client Project Ref: D34155

Lab Sample ID	15/00946/1	15/00946/2	15/00946/6	15/00946/7	15/00946/10	15/00946/11	15/00946/12	15/00946/16	Units	Method ref
Client Sample No	D1	D2	D6	D7	D10	D11	D12	D17		
Client Sample ID	TP1	TP1	TP3	TP3	TP4	TP5	TP5	TP7		
Depth to Top	0.40	0.60	0.70	3.30	1.95	0.25	1.30	0.15		
Depth To Bottom										
Date Sampled	09-Feb-15	09-Feb-15	09-Feb-15	09-Feb-15	09-Feb-15	09-Feb-15	09-Feb-15	09-Feb-15		
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil		
MCERTS Sample Matrix Code	5	5E	5	5	6E	6	5A	6AE		
PAH 16 (0.1 LOD)										
Acenaphthene (0.1 LOD)$_A^{M\#}$	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	mg/kg	A-T-019s
Acenaphthylene (0.1 LOD)$_A^{M\#}$	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	mg/kg	A-T-019s
Anthracene (0.1 LOD)$_A^{M\#}$	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	mg/kg	A-T-019s
Benzo(a)anthracene (0.1 LOD)$_A^{M\#}$	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	mg/kg	A-T-019s
Benzo(a)pyrene (0.1 LOD)$_A^{M\#}$	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	mg/kg	A-T-019s
Benzo(b)fluoranthene (0.1 LOD)$_A^{M\#}$	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	mg/kg	A-T-019s
Benzo(ghi)perylene (0.1 LOD)$_A^{M\#}$	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	mg/kg	A-T-019s
Benzo(k)fluoranthene (0.1 LOD)$_A^{M\#}$	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	mg/kg	A-T-019s
Chrysene (0.1 LOD)$_A^{M\#}$	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	0.2	mg/kg	A-T-019s
Dibenzo(ah)anthracene (0.1 LOD)$_A^{M\#}$	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	mg/kg	A-T-019s
Fluoranthene (0.1 LOD)$_A^{M\#}$	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	0.3	mg/kg	A-T-019s
Fluorene (0.1 LOD)$_A^{M\#}$	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	mg/kg	A-T-019s
Indeno(123-cd)pyrene (0.1 LOD)$_A^{M\#}$	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	mg/kg	A-T-019s
Naphthalene (0.1 LOD)$_A^{M\#}$	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	mg/kg	A-T-019s
Phenanthrene (0.1 LOD)$_A^{M\#}$	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	mg/kg	A-T-019s
Pyrene (0.1 LOD)$_A^{M\#}$	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	0.3	mg/kg	A-T-019s
PAH (total 16) (0.1 LOD)$_A^{M\#}$	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	1.5	mg/kg	A-T-019s

Envirolab Job Number: 15/00946

Client Project Name: Peterborough Road, Crowland

Client Project Ref: D34155

Lab Sample ID	15/00946/18	15/00946/20							Units	Method ref
Client Sample No	D19	D21								
Client Sample ID	TP7	TP8								
Depth to Top	2.20	1.65								
Depth To Bottom										
Date Sampled	09-Feb-15	09-Feb-15								
Sample Type	Soil	Soil								
MCERTS Sample Matrix Code	5	4								
% Stones >10mm$_A^{\#}$	<0.1	<0.1							% w/w	A-T-044
pH$_D^{M\#}$	8.29	-							pH	A-T-031s
Sulphate (water sol 2:1)$_D^{M\#}$	0.73	-							g/l	A-T-026s
Loss on ignition (550degC)$_D$	-	15.7							% w/w	A-T-030s
Total Organic Carbon$_D^{M\#}$	-	7.96							% w/w	A-T-032s

REPORT NOTES

Notes - Soil chemical analysis
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones >10mm are removed or excluded from the sample prior to analysis and reported results corrected to a whole sample basis. For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis.

Notes - General
This report shall not be reproduced, except in full, without written approval from Envirolab.
Subscript "A" indicates analysis performed on the sample as received. "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve, unless asbestos is found to be present in which case all analysis is performed on the sample as received.
All analysis is performed on the dried and crushed sample for samples with Matrix Code 7 and this supercedes any "A" subscripts.
All analysis is performed on the sample as received for soil samples from outside the European Union and this supercedes any "D" subscripts.
Superscript "M" indicates method accredited to MCERTS.
If results are in italic font they are associated with an AQC failure. These are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

TPH analysis of water by method A-T-007
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Asbestos in soil
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if present as discrete fibres/fragments. Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified a being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER.
Samples with Matrix Code 7 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations.

Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

IS indicates Insufficient sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Analytical results reflect the quality of the sample at the time of analysis only. Opinions and interpretations expressed are outside the scope of our accreditation.

Please contact us if you need any further information.

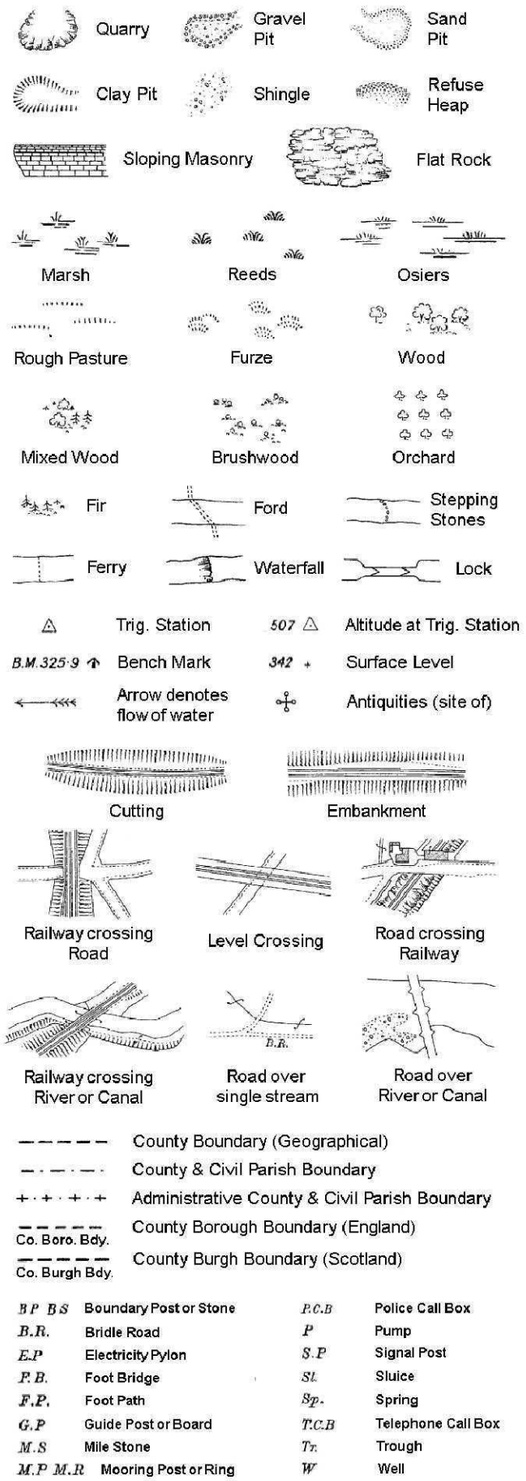
GeoDyne

APPENDIX VIII

Historical Plans

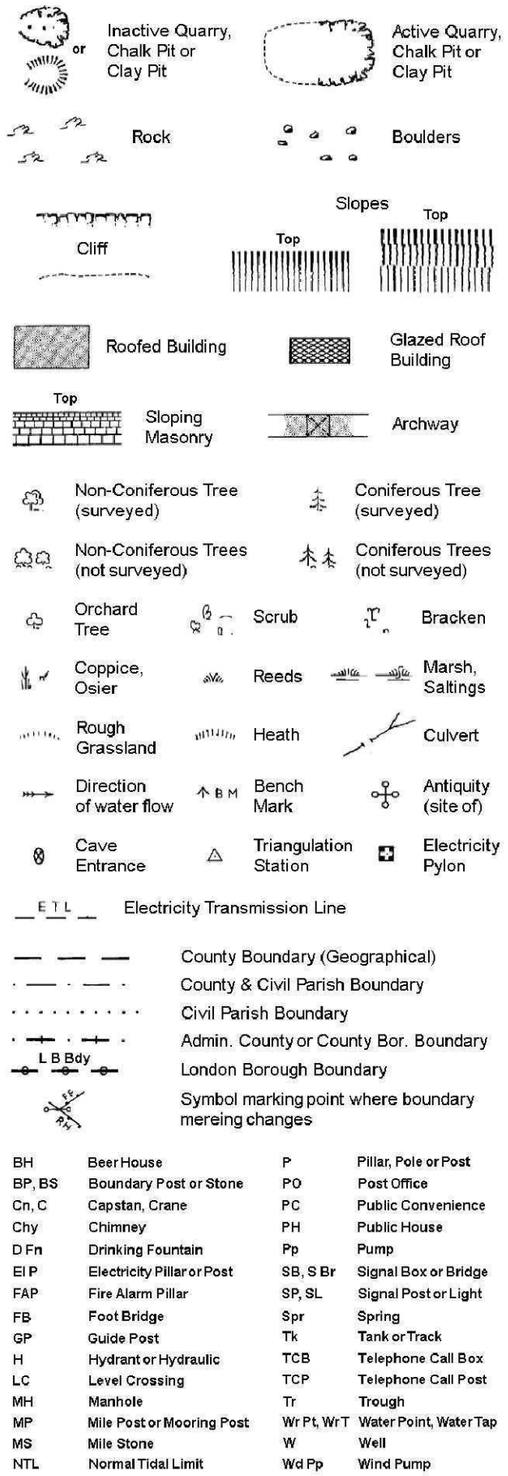
Historical Mapping Legends

Ordnance Survey County Series and Ordnance Survey Plan 1:2,500



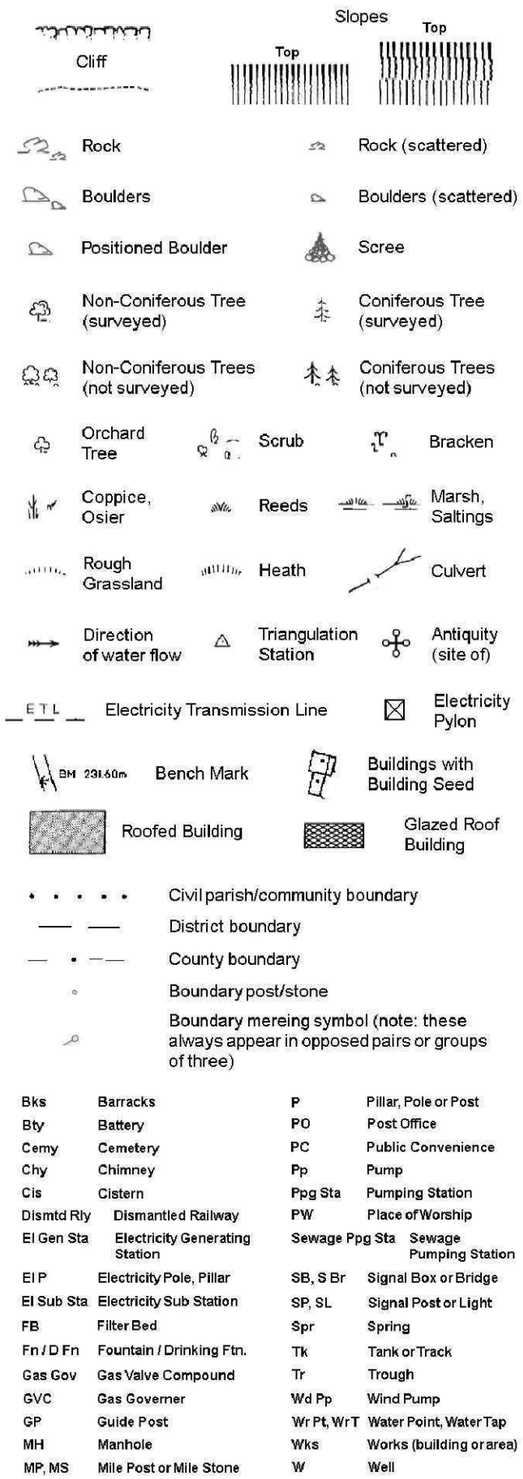
B.P B.S	Boundary Post or Stone	P.C.B	Police Call Box
B.R.	Bridle Road	P	Pump
E.P	Electricity Pylon	S.P	Signal Post
F.B.	Foot Bridge	Sl.	Sluice
F.P.	Foot Path	Sp.	Spring
G.P	Guide Post or Board	T.C.B	Telephone Call Box
M.S	Mile Stone	Tr.	Trough
M.P M.R	Mooring Post or Ring	W	Well

Ordnance Survey Plan, Additional SIMs and Supply of Unpublished Survey Information 1:2,500 and 1:1,250



BH	Beer House	P	Pillar, Pole or Post
BP, BS	Boundary Post or Stone	PO	Post Office
Cn, C	Capstan, Crane	PC	Public Convenience
Chy	Chimney	PH	Public House
D Fn	Drinking Fountain	Pp	Pump
El P	Electricity Pillar or Post	SB, S Br	Signal Box or Bridge
FAP	Fire Alarm Pillar	SP, SL	Signal Post or Light
FB	Foot Bridge	Spr	Spring
GP	Guide Post	Tk	Tank or Track
H	Hydrant or Hydraulic	TCB	Telephone Call Box
LC	Level Crossing	TCP	Telephone Call Post
MH	Manhole	Tr	Trough
MP	Mile Post or Mooring Post	Wr Pt, Wr T	Water Point, Water Tap
MS	Mile Stone	W	Well
NTL	Normal Tidal Limit	Wd Pp	Wind Pump

Large-Scale National Grid Data 1:2,500 and 1:1,250



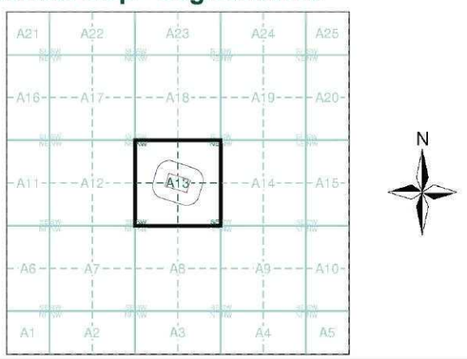
Bks	Barracks	P	Pillar, Pole or Post
Bty	Battery	PO	Post Office
Cemy	Cemetery	PC	Public Convenience
Chy	Chimney	Pp	Pump
Cis	Cistern	Ppg Sta	Pumping Station
Dismtd Rly	Dismantled Railway	PW	Place of Worship
El Gen Sta	Electricity Generating Station	Sewage Ppg Sta	Sewage Pumping Station
El P	Electricity Pole, Pillar	SB, S Br	Signal Box or Bridge
El Sub Sta	Electricity Sub Station	SP, SL	Signal Post or Light
FB	Filter Bed	Spr	Spring
Fn / D Fn	Fountain / Drinking Ftn.	Tk	Tank or Track
Gas Gov	Gas Valve Compound	Tr	Trough
GVC	Gas Governer	Wd Pp	Wind Pump
GP	Guide Post	Wr Pt, Wr T	Water Point, Water Tap
MH	Manhole	Wks	Works (building or area)
MP, MS	Mile Post or Mile Stone	W	Well

GeoDyne

Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Lincolnshire	1:2,500	1887	2
Northamptonshire	1:2,500	1901	3
Ordnance Survey Plan	1:2,500	1975	4
Additional SIMs	1:2,500	1982 - 1989	5
Large-Scale National Grid Data	1:2,500	1995	6
Large-Scale National Grid Data	1:2,500	1996	7

Historical Map - Segment A13



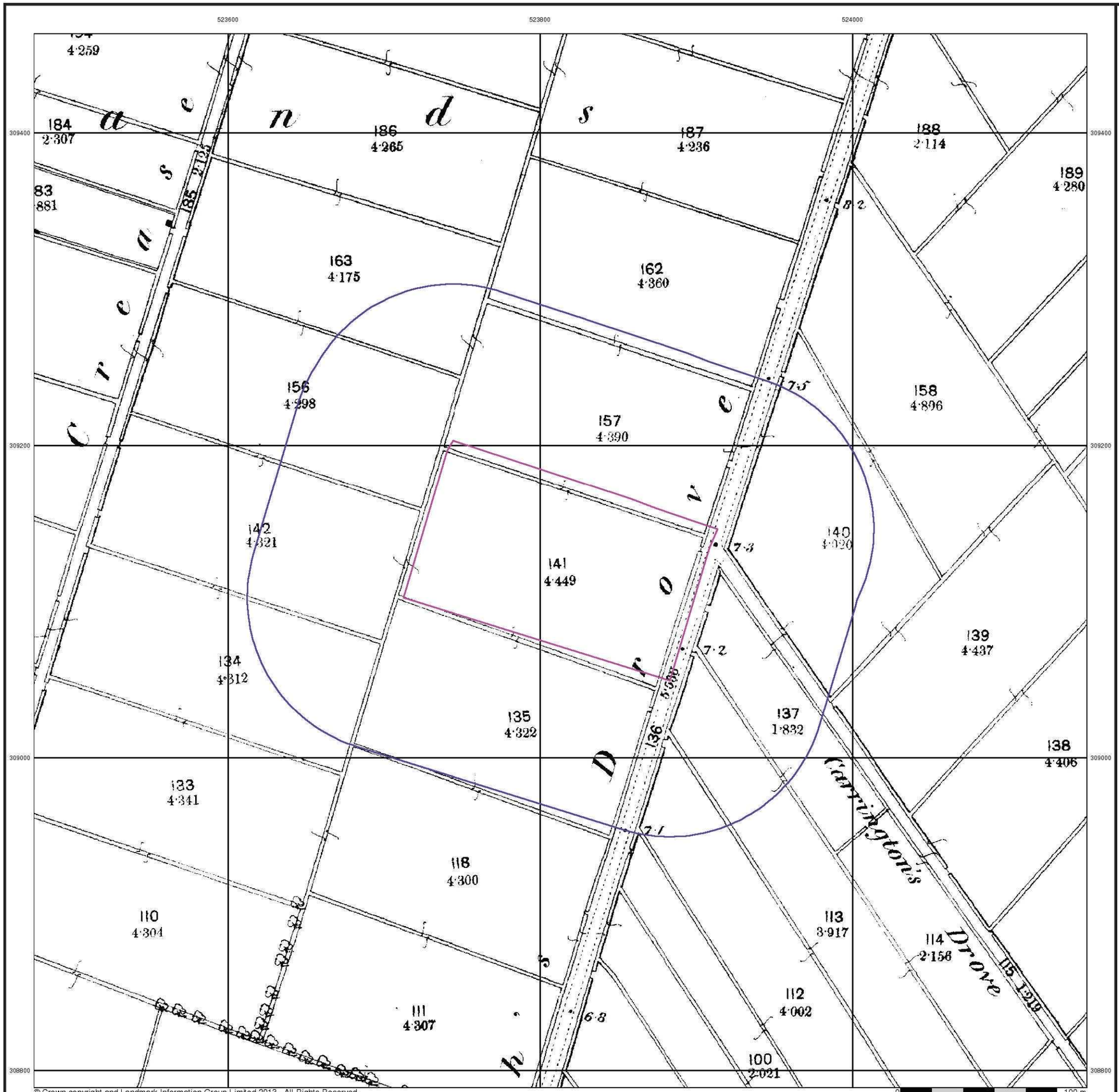
Order Details

Order Number: 63789118_1_1
Customer Ref: D34155
National Grid Reference: 523810, 309130
Slice: A
Site Area (Ha): 1.87
Search Buffer (m): 100

Site Details

Peterborough Road, Crowland

Landmark Information Group
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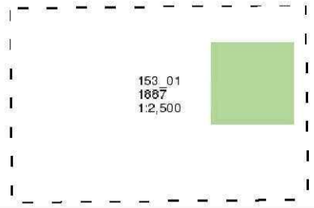
Lincolnshire

Published 1887

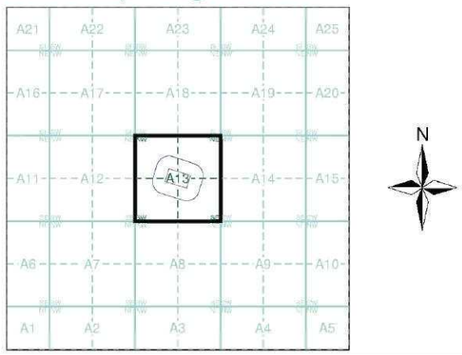
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



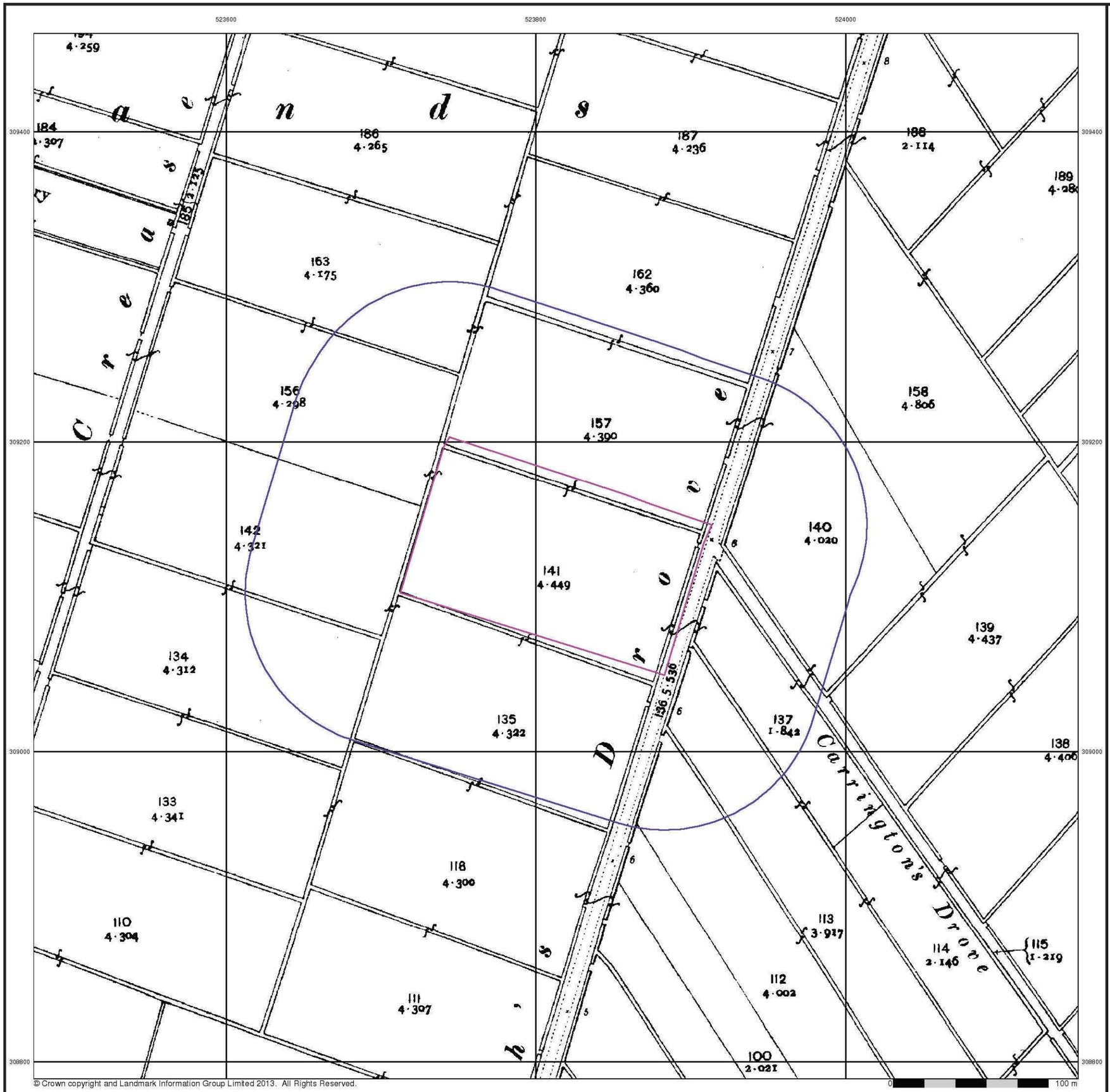
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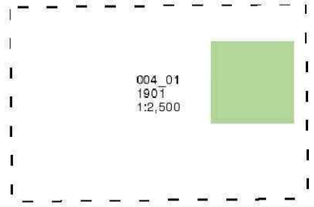
Northamptonshire

Published 1901

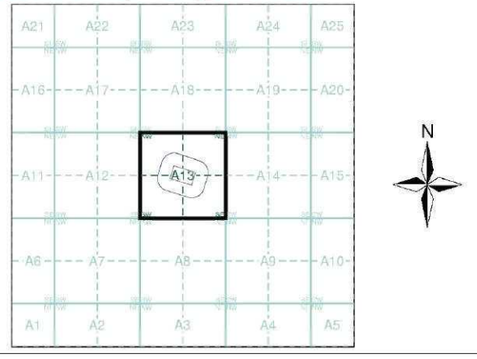
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Historical Map - Segment A13



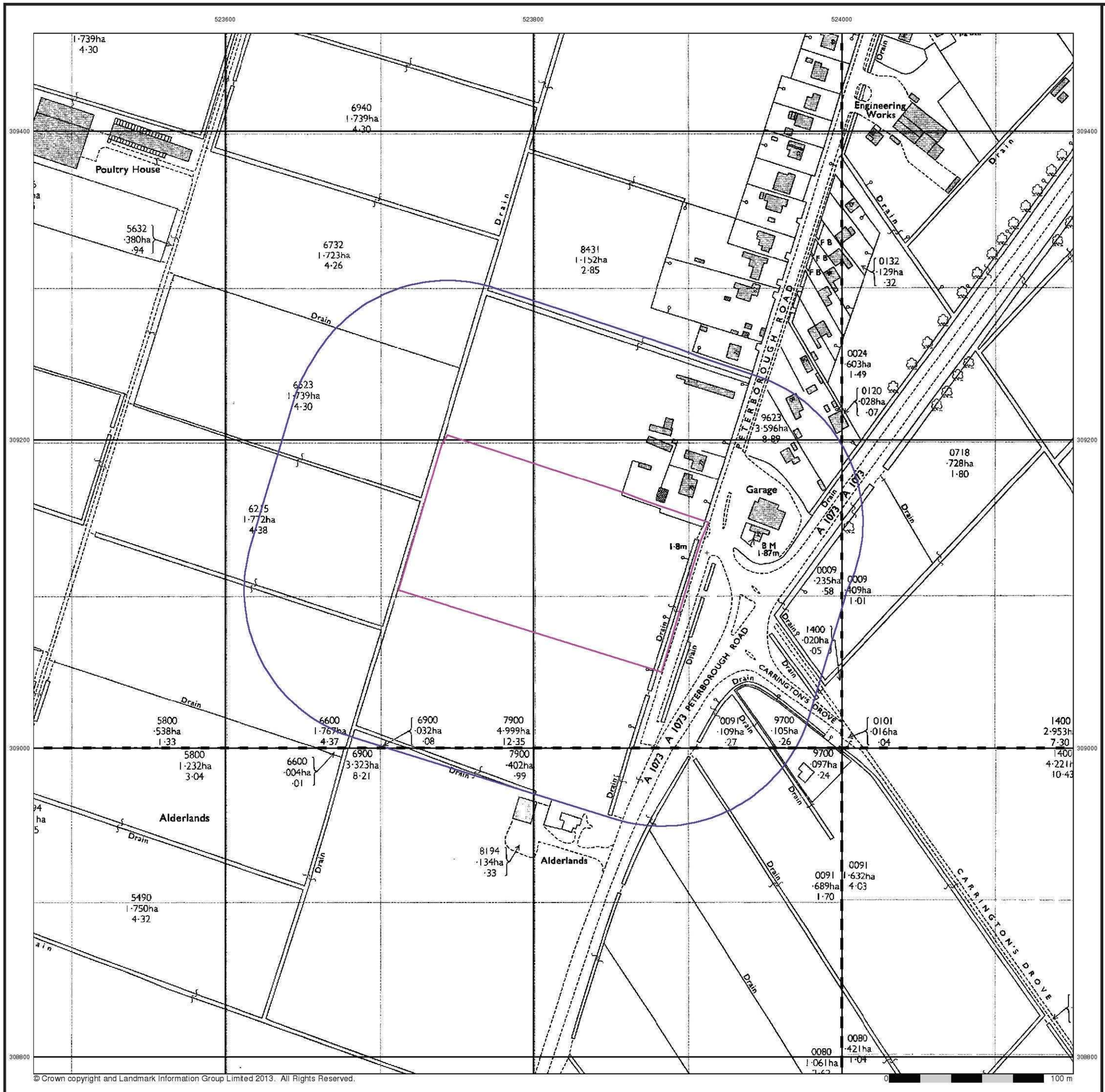
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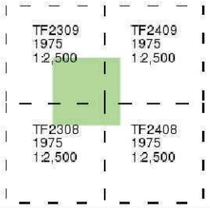
Ordnance Survey Plan

Published 1975

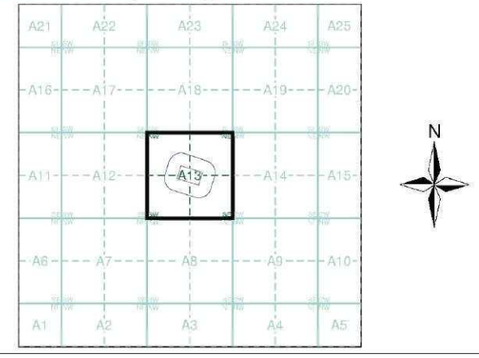
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



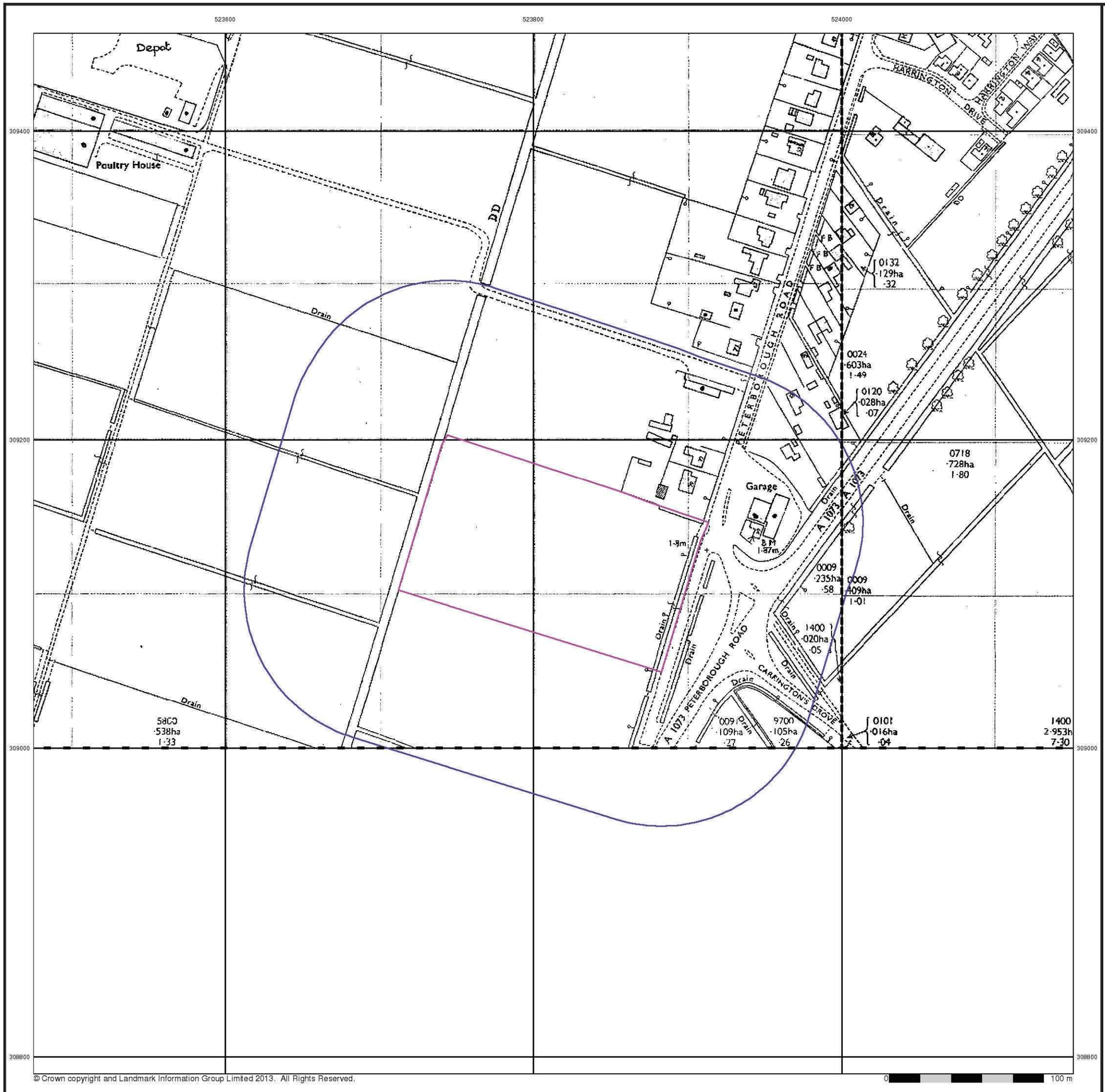
Order Details

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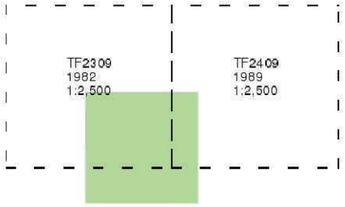
Additional SIMs

Published 1982 - 1989

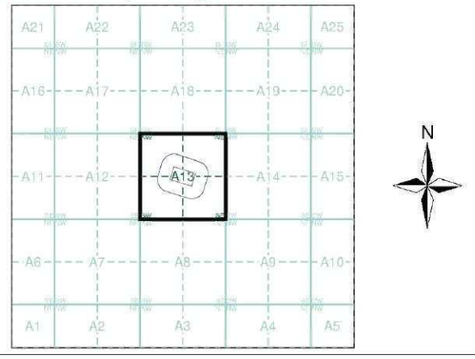
Source map scale - 1:2,500

The SIM cards (Ordnance Survey's `Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



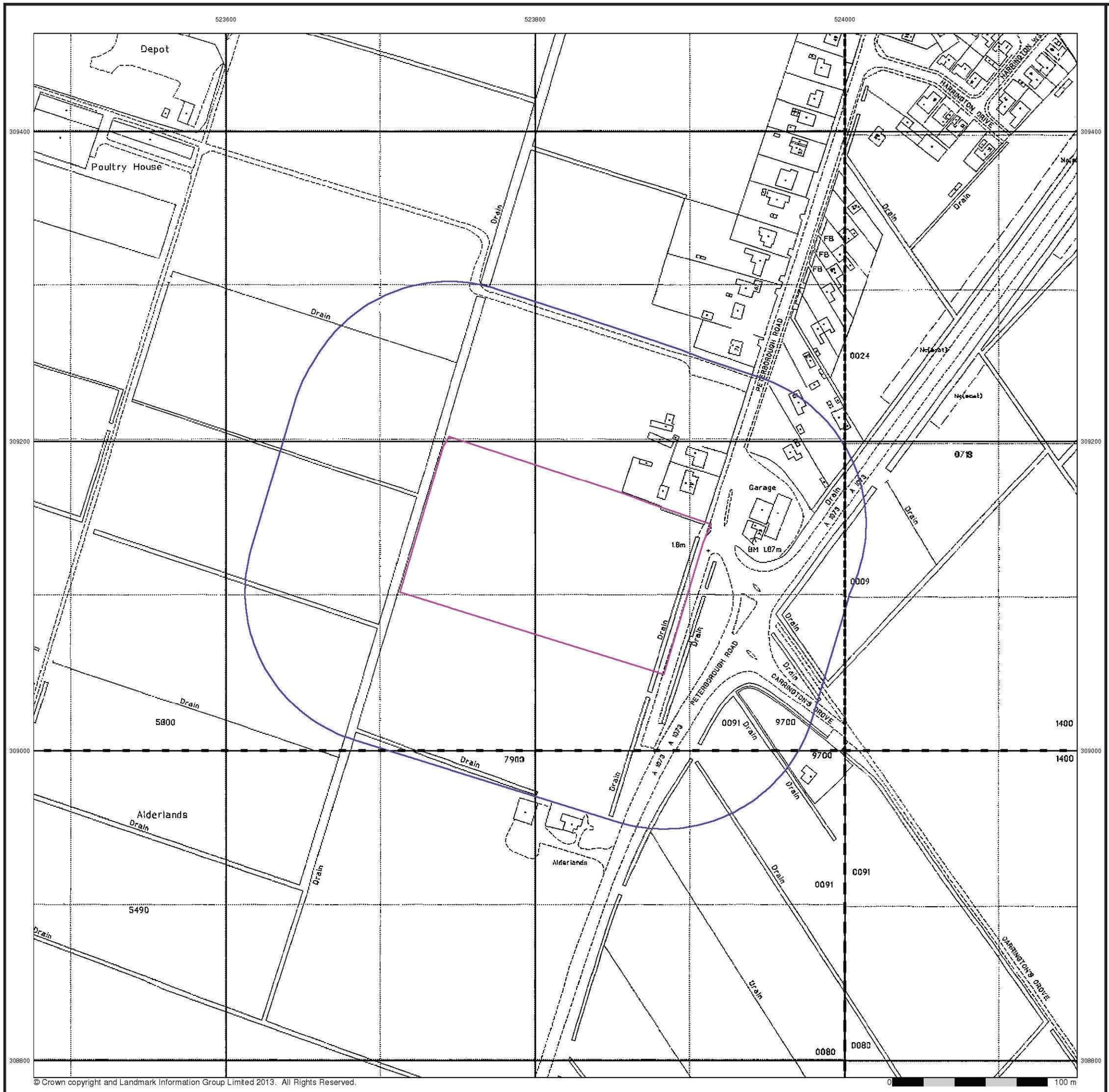
Order Details

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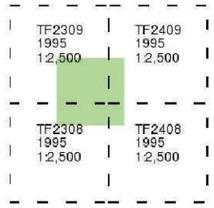
Large-Scale National Grid Data

Published 1995

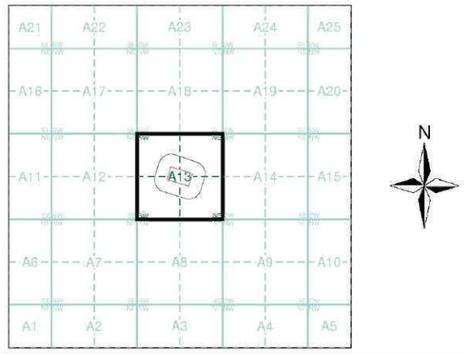
Source map scale - 1:2,500

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number:	63789118_1_1
Customer Ref:	D34155
National Grid Reference:	523810, 309130
Slice:	A
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Search Buffer (m):	100

Site Details

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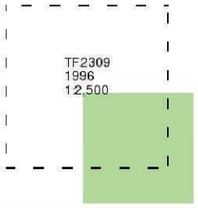
Large-Scale National Grid Data

Published 1996

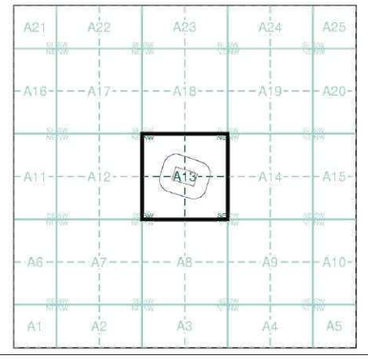
Source map scale - 1:2,500

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Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

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National Grid Reference:	523810, 309130
Slice:	A
Site Area (Ha):	1.87
Search Buffer (m):	100

Site Details

Peterborough Road, Crowland

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Historical Mapping Legends

Ordnance Survey County Series 1:10,560

Gravel Pit
Sand Pit
Other Pits
Quarry
Shingle
Orchard
Osiers
Reeds
Marsh
Mixed Wood
Deciduous
Brushwood
Fir
Furze
Rough Pasture
Arrow denotes flow of water
Trigonometrical Station
Site of Antiquities
Bench Mark
Pump, Guide Post, Signal Post
Well, Spring, Boundary Post
·285 Surface Level
Sketched Contour
Instrumental Contour
Main Roads
Fenced
Un-Fenced
Minor Roads
Fenced
Un-Fenced
Sunken Road
Raised Road
Road over Railway
Railway over River
Railway over Road
Level Crossing
Road over River or Canal
Road over Stream
Road over Stream
County Boundary (Geographical)
County & Civil Parish Boundary
Administrative County & Civil Parish Boundary
Co. Boro. Bdy. County Borough Boundary (England)
Co. Burgh Bdy. County Burgh Boundary (Scotland)
RD. Bdy. Rural District Boundary
Civil Parish Boundary

Ordnance Survey Plan 1:10,000

Chalk Pit, Clay Pit or Quarry
Gravel Pit
Sand Pit
Disused Pit or Quarry
Refuse or Slag Heap
Lake, Loch or Pond
Dunes
Boulders
Coniferous Trees
Non-Coniferous Trees
Orchard
Scrub
Coppice
Bracken
Heath
Rough Grassland
Marsh
Reeds
Saltings
Building
Direction of Flow of Water
Shingle
Sand
Glasshouse
Pylon
Sloping Masonry
Electricity Transmission Line
Pole
Cutting
Embankment
Standard Gauge Multiple Track
Standard Gauge Single Track
Road Under
Road Over
Level Crossing
Foot Bridge
Siding, Tramway or Mineral Line
Narrow Gauge
Geographical County
Administrative County, County Borough or County of City
Municipal Borough, Urban or Rural District, Burgh or District Council
Borough, Burgh or County Constituency
Shown only when not coincident with other boundaries
Civil Parish
Shown alternately when coincidence of boundaries occurs

BP, BS	Boundary Post or Stone	Pol Sta	Police Station
Ch	Church	PO	Post Office
CH	Club House	PC	Public Convenience
F E Sta	Fire Engine Station	PH	Public House
FB	Foot Bridge	SB	Signal Box
Fn	Fountain	Spr	Spring
GP	Guide Post	TCB	Telephone Call Box
MP	Mile Post	TCP	Telephone Call Post
MS	Mile Stone	W	Well

1:10,000 Raster Mapping

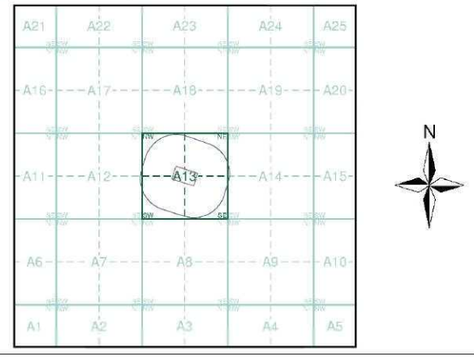
Gravel Pit
Refuse tip or slag heap
Rock
Rock (scattered)
Boulders
Boulders (scattered)
Shingle
Mud
Sand
Sand Pit
Slopes
Top of cliff
General detail
Underground detail
Overhead detail
Narrow gauge railway
Multi-track railway
Single track railway
County boundary (England only)
Civil, parish or community boundary
District, Unitary, Metropolitan, London Borough boundary
Constituency boundary
Area of wooded vegetation
Non-coniferous trees
Non-coniferous trees (scattered)
Coniferous trees
Coniferous trees (scattered)
Positioned tree
Orchard
Coppice or Osiers
Rough Grassland
Heath
Scrub
Marsh, Salt Marsh or Reeds
Water feature
Flow arrows
MHW(S) Mean high water (springs)
MLW(S) Mean low water (springs)
Telephone line (where shown)
Electricity transmission line (with poles)
BM 123.45 m Bench mark (where shown)
Triangulation station
Point feature (e.g. Guide Post or Mile Stone)
Pylon, flare stack or lighting tower
Site of (antiquity)
Glasshouse
General Building
Important Building

GeoDyne

Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Lincolnshire	1:10,560	1886 - 1887	2
Northamptonshire	1:10,560	1901	3
Lincolnshire	1:10,560	1905 - 1906	4
Lincolnshire	1:10,560	1905 - 1906	5
Lincolnshire	1:10,560	1905	6
Lincolnshire	1:10,560	1952	7
Ordnance Survey Plan	1:10,000	1958	8
Ordnance Survey Plan	1:10,000	1975 - 1979	9
Ordnance Survey Plan	1:10,000	1979	10
10K Raster Mapping	1:10,000	2006	11
VectorMap Local	1:10,000	2014	12

Historical Map - Slice A



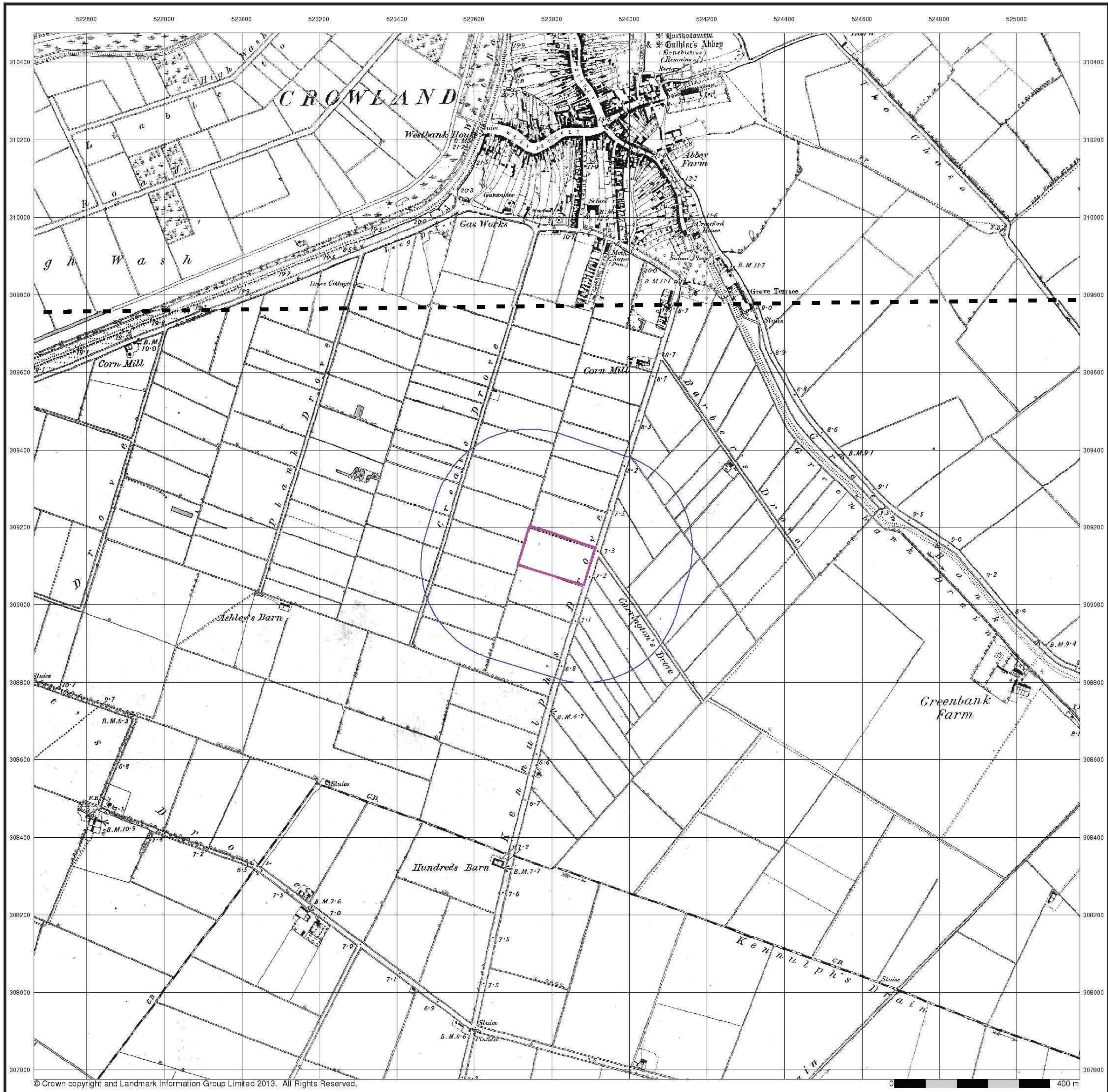
Order Details

Order Number: 63789118_1_1
Customer Ref: D34155
National Grid Reference: 523810, 309130
Slice: A
Site Area (Ha): 1.87
Search Buffer (m): 250

Site Details

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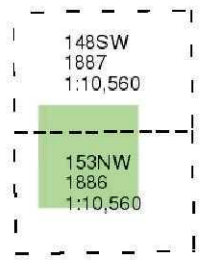
Lincolnshire

Published 1886 - 1887

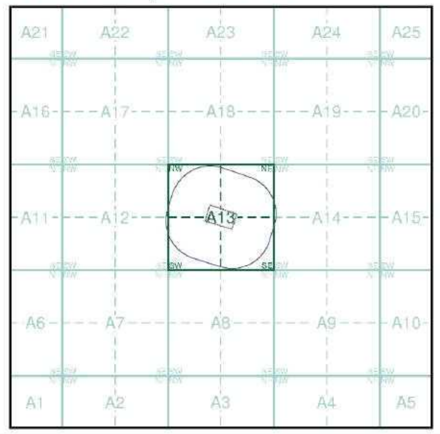
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



N

Order Details

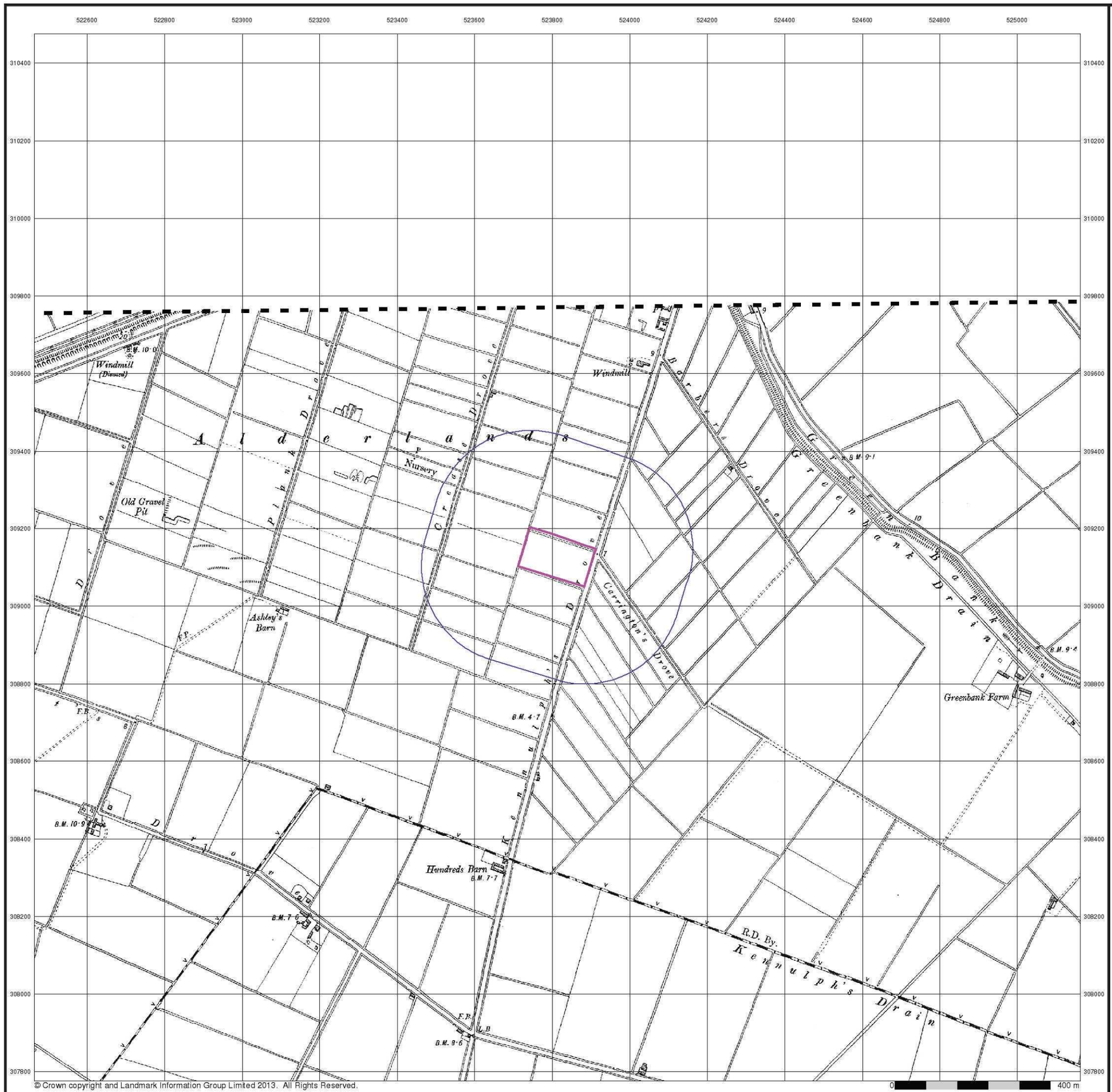
Order Number: 63789118_1_1
Customer Ref: D34155
National Grid Reference: 523810, 309130
Slice: A
Site Area (Ha): 1.87
Search Buffer (m): 250

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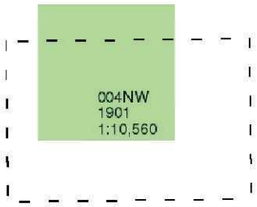
Northamptonshire

Published 1901

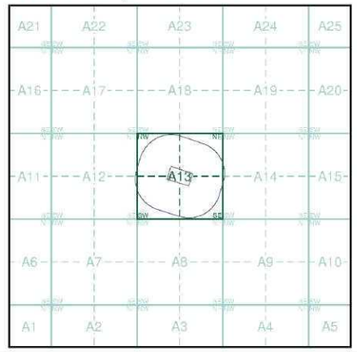
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

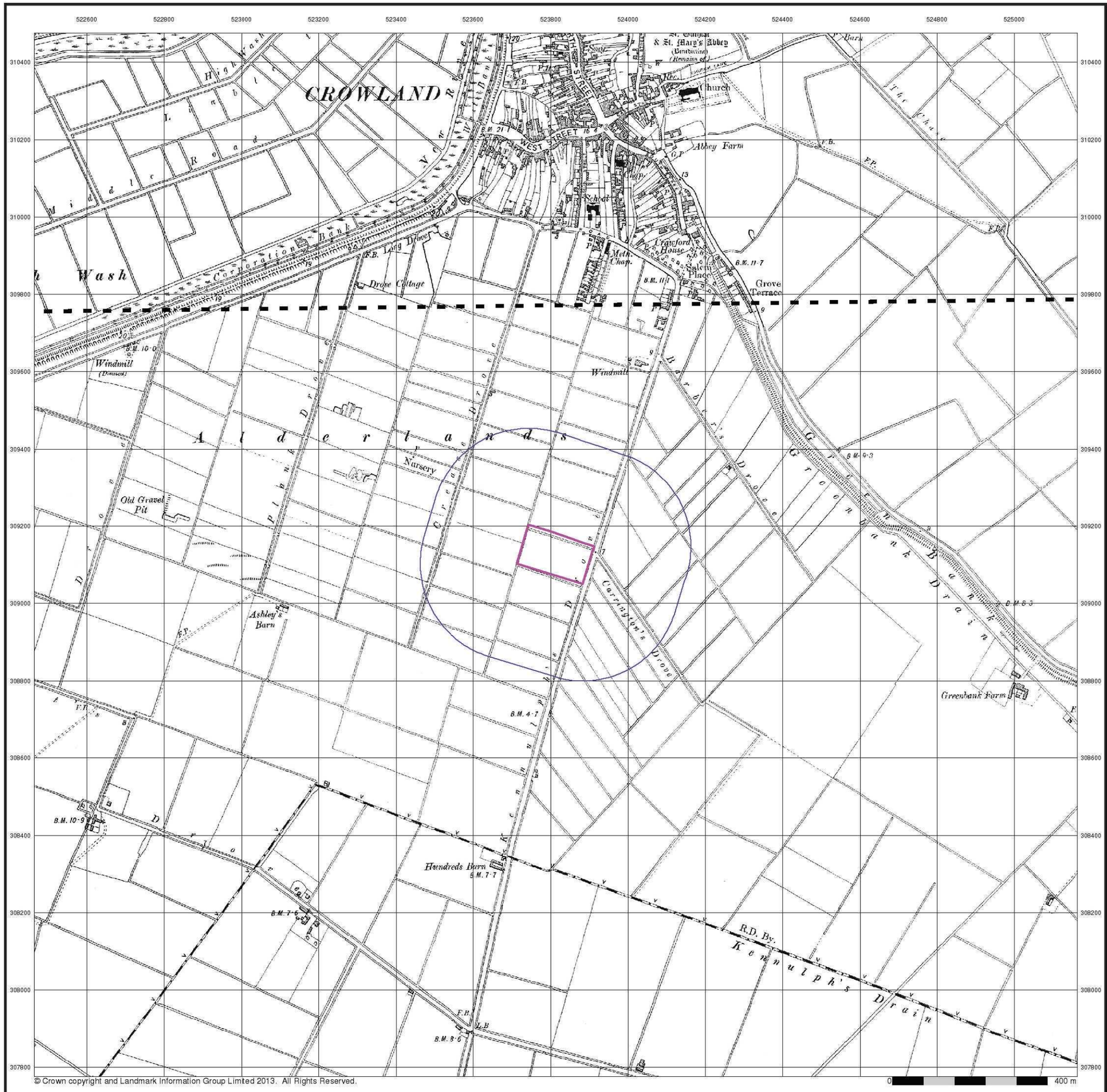
Order Number:	63789118_1_1
Customer Ref:	D34155
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Slice:	A
Site Area (Ha):	1.87
Search Buffer (m):	250

Site Details

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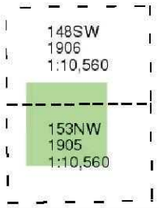
Lincolnshire

Published 1905 - 1906

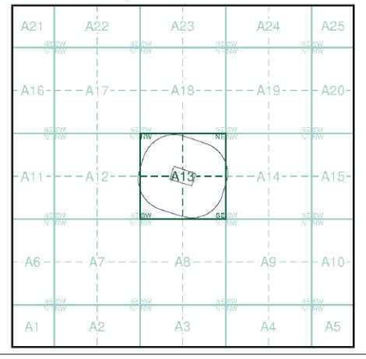
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

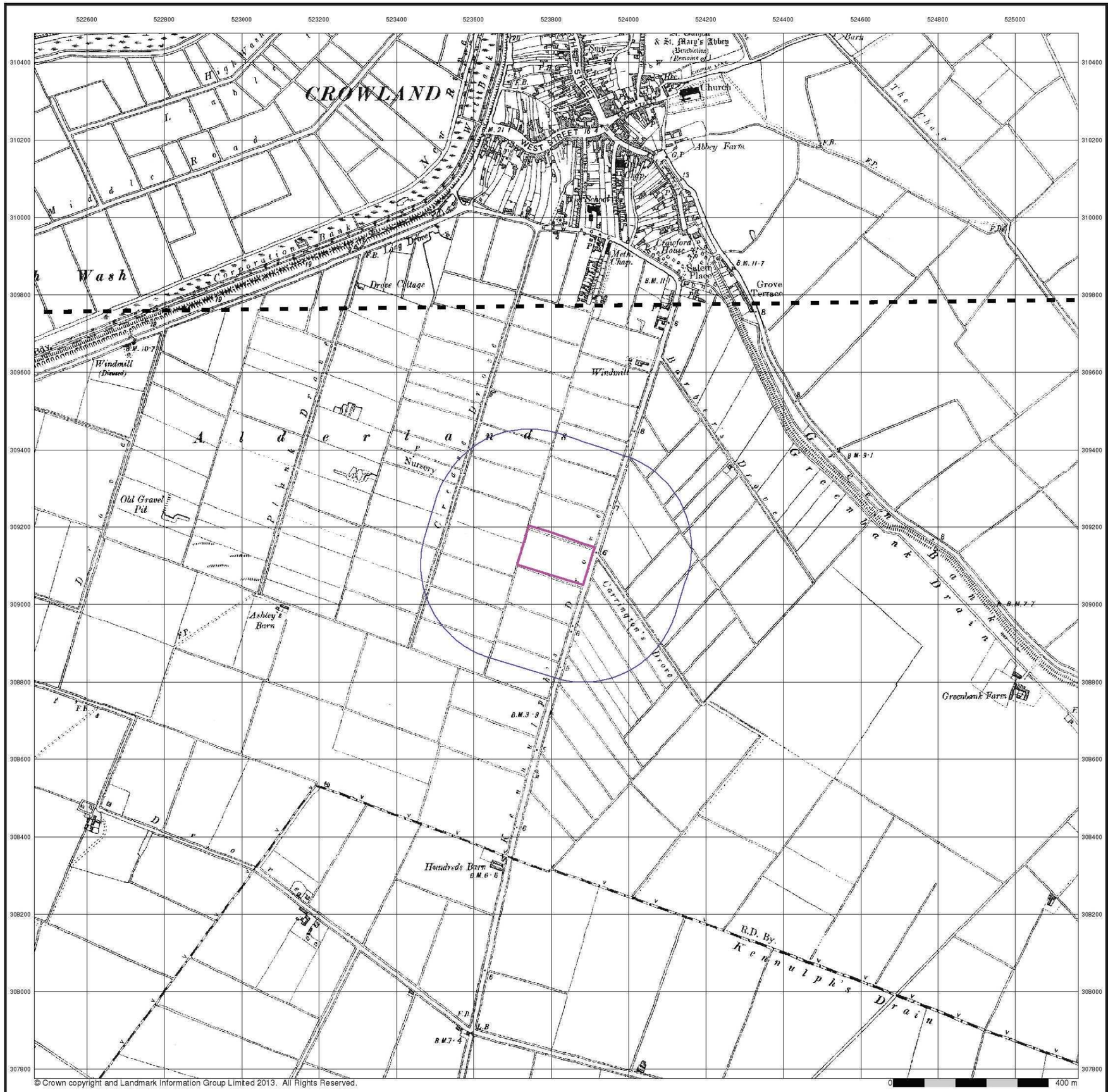
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Customer Ref:	D34155
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GeoDyne

Lincolnshire

Published 1905 - 1906

Source map scale - 1:10,560

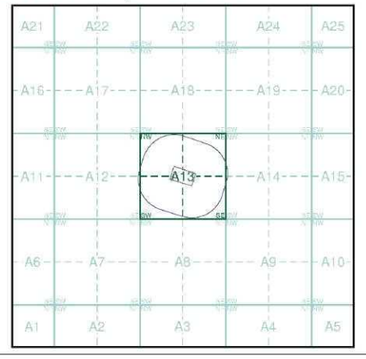
The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)

148SW
1906
1:10,560

153NW
1905
1:10,560

Historical Map - Slice A



Order Details

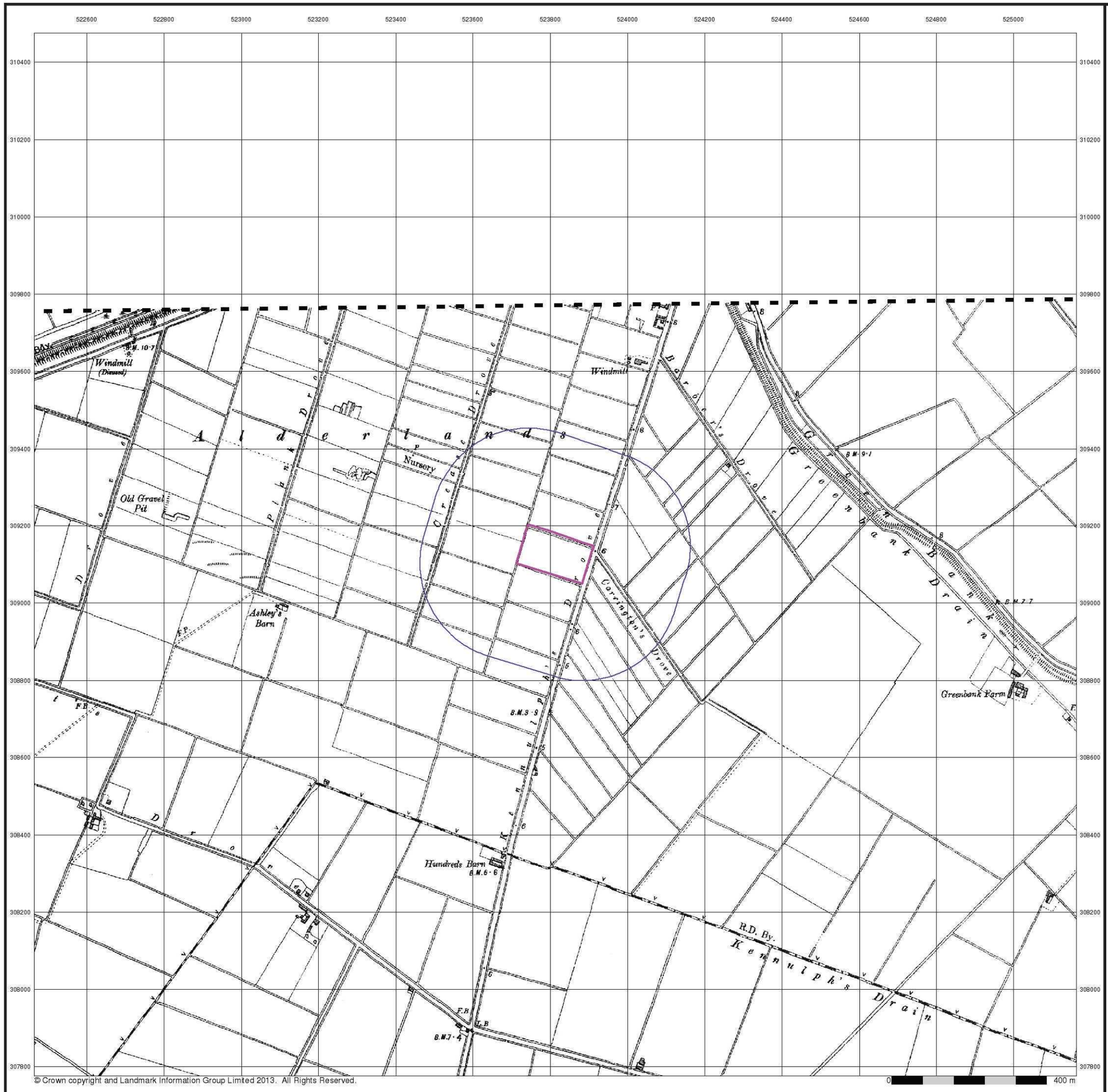
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Slice:	A
Site Area (Ha):	1.87
Search Buffer (m):	250

Site Details

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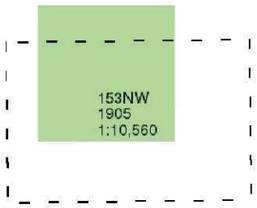
Lincolnshire

Published 1905

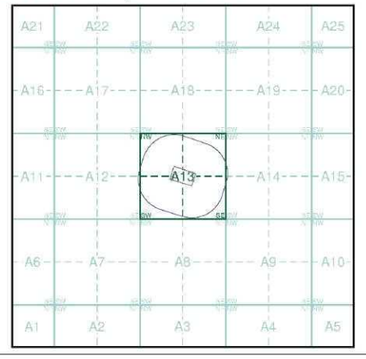
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

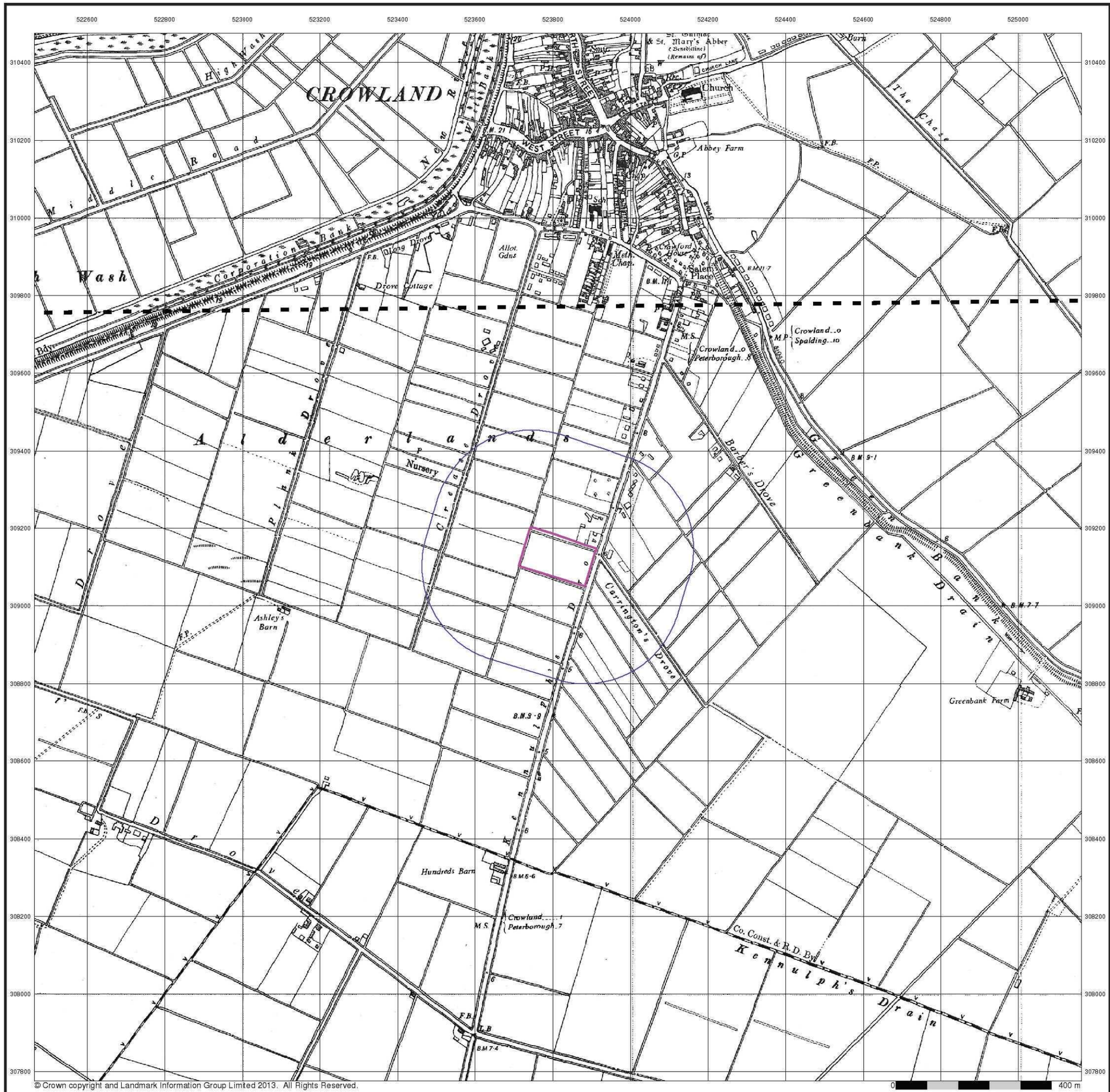
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Customer Ref:	D34155
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Site Area (Ha):	1.87
Search Buffer (m):	250

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GeoDyne

Lincolnshire

Published 1952

Source map scale - 1:10,560

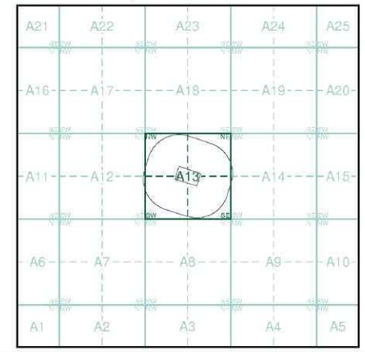
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Map Name(s) and Date(s)

148SW
1952
1:10,560

153NW
1952
1:10,560

Historical Map - Slice A



Order Details

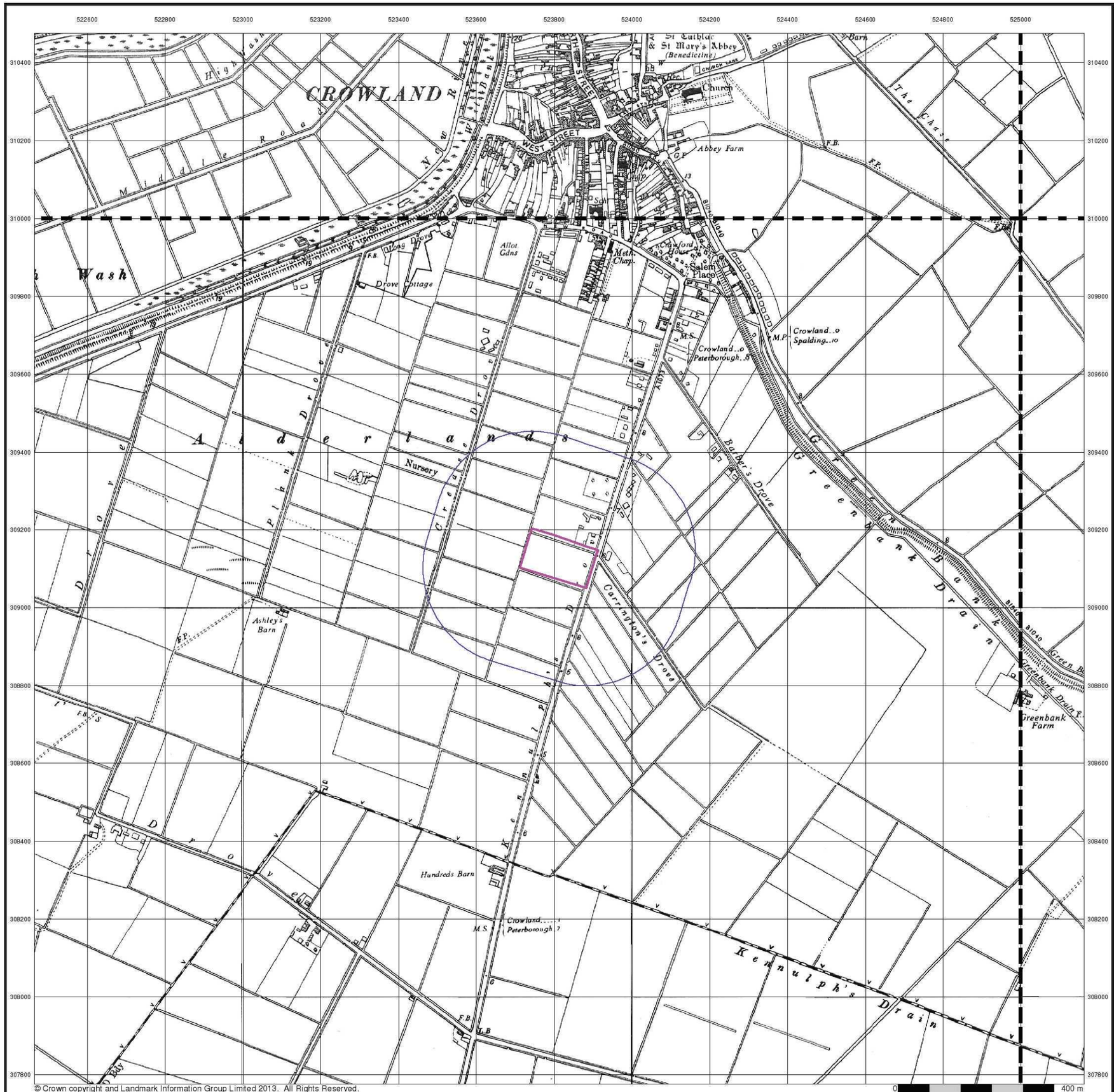
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Search Buffer (m):	250

Site Details

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Ordnance Survey Plan

Published 1958

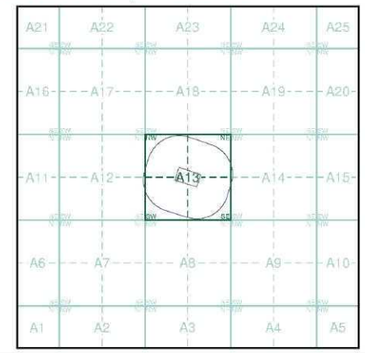
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The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)

TF21SW 1958 1:10,560	TF21SE 1958 1:10,560
TF20NW 1958 1:10,560	TF20NE 1958 1:10,560

Historical Map - Slice A



Order Details

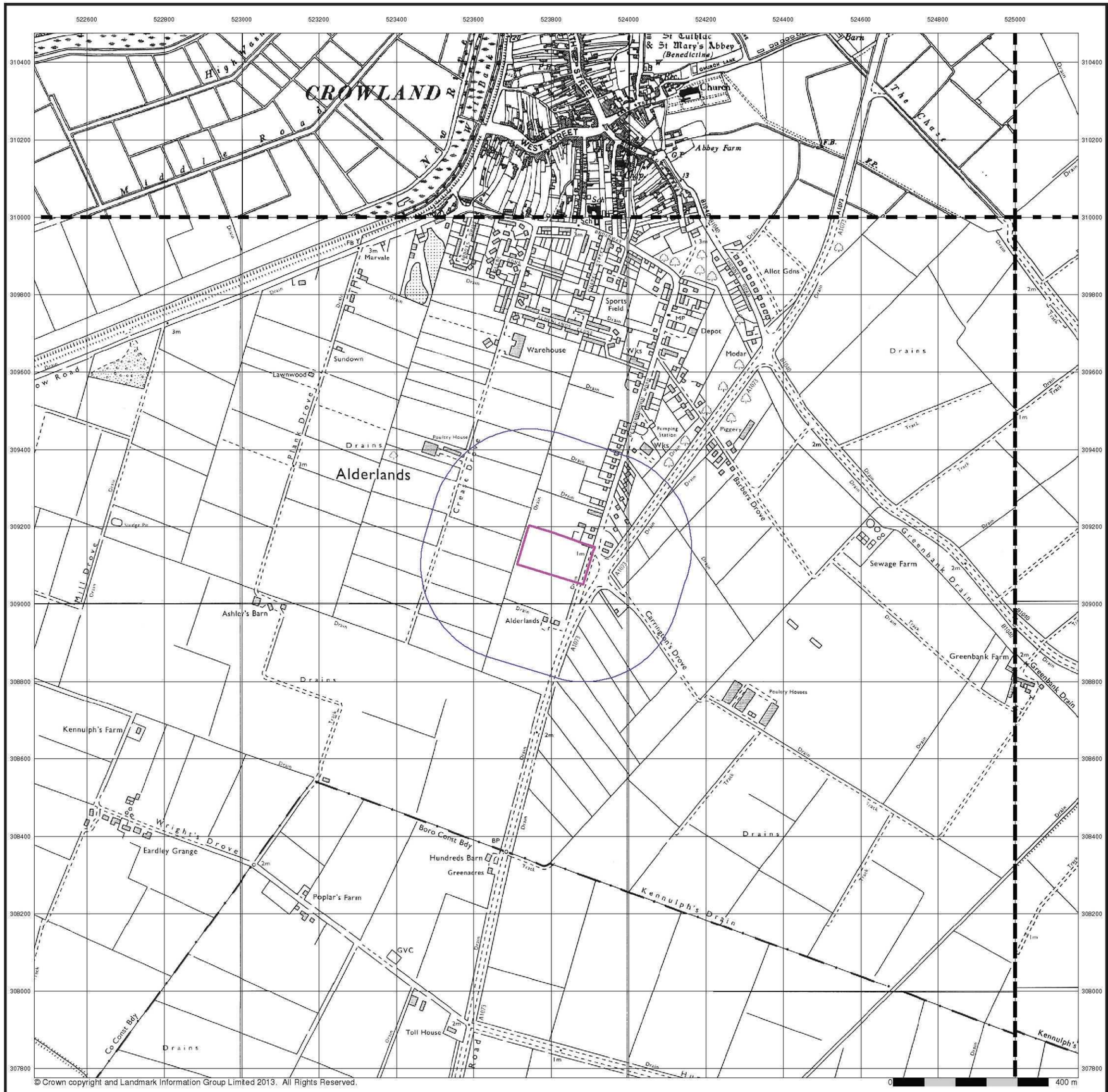
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GeoDyne

Ordnance Survey Plan

Published 1975 - 1979

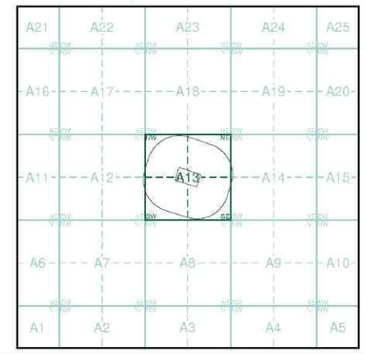
Source map scale - 1:10,000

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Map Name(s) and Date(s)

TF21SW 1975 1:10,560	TF21SE 1979 1:10,000
TF20NW 1978 1:10,000	TF20NE 1978 1:10,000

Historical Map - Slice A



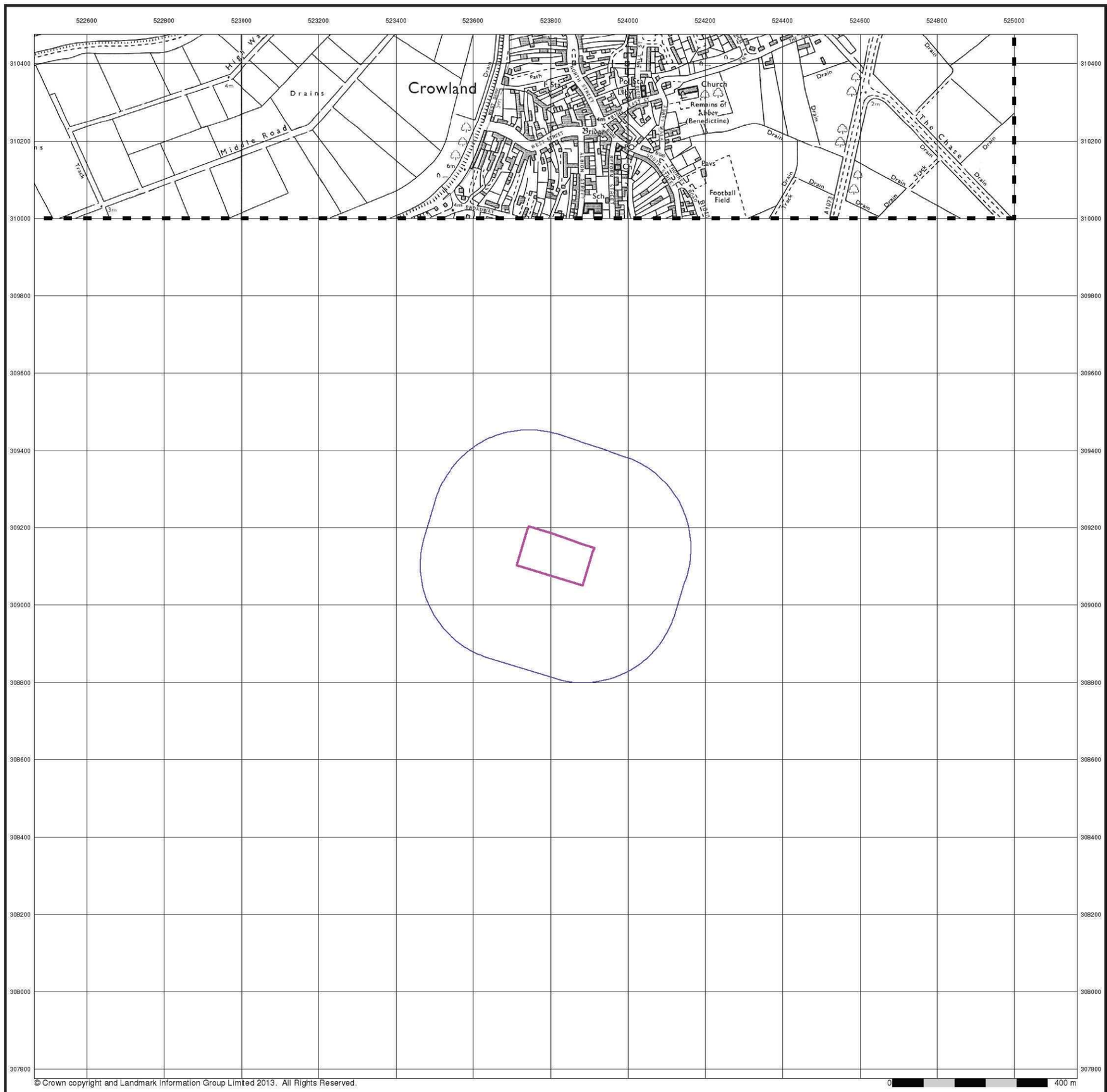
Order Details

Order Number:	63789118_1_1
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National Grid Reference:	523810, 309130
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GeoDyne

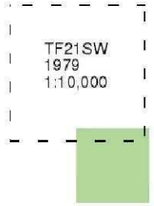
Ordnance Survey Plan

Published 1979

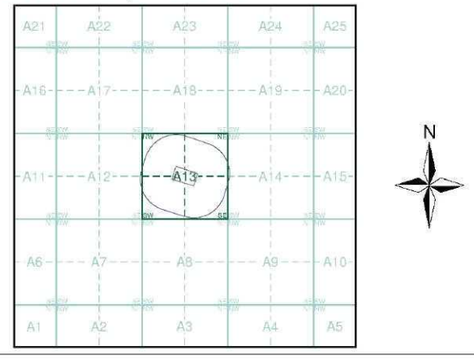
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Map Name(s) and Date(s)



Historical Map - Slice A



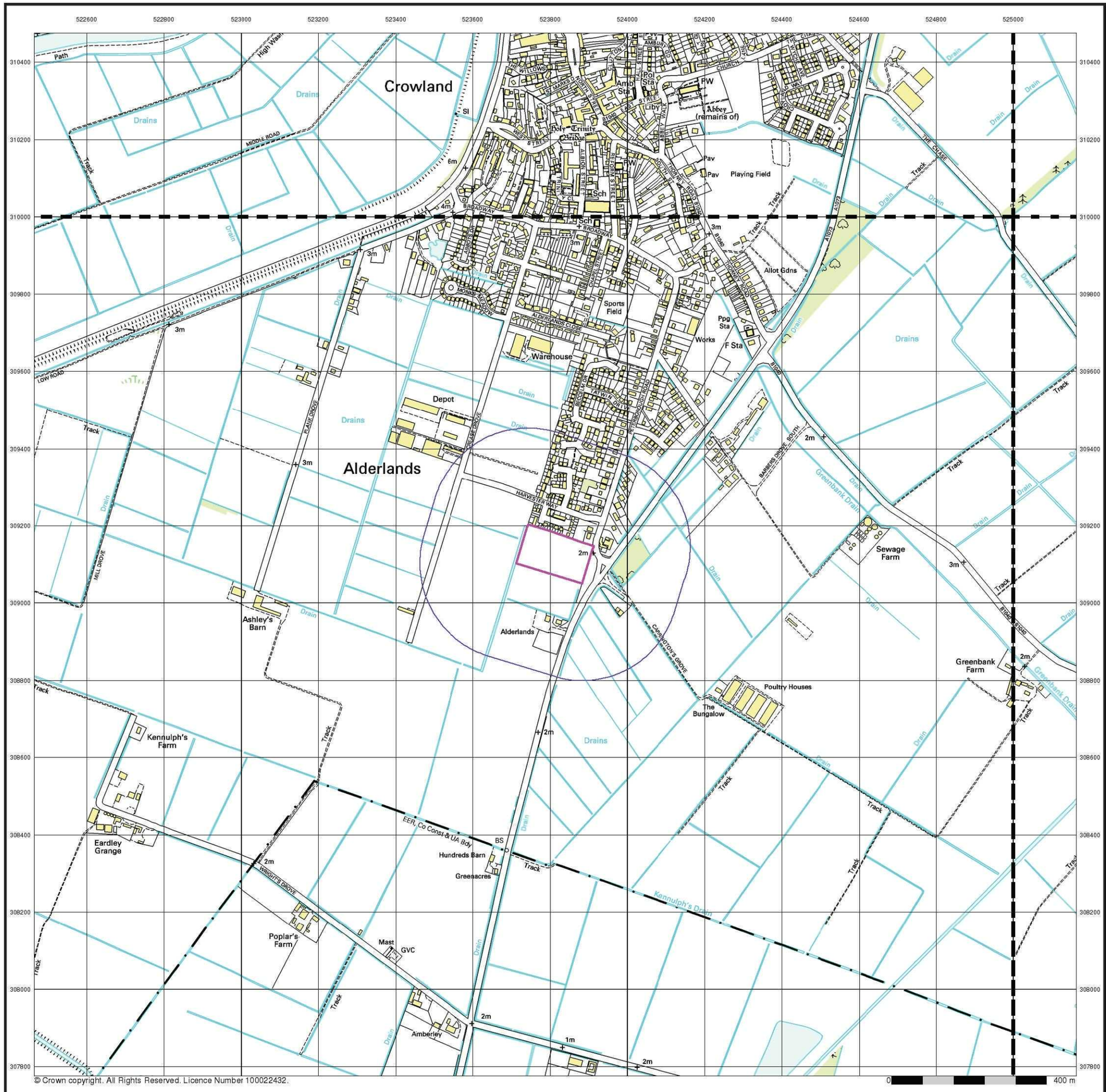
Order Details

Order Number:	63789118_1_1
Customer Ref:	D34155
National Grid Reference:	523810, 309130
Slice:	A
Site Area (Ha):	1.87
Search Buffer (m):	250

Site Details

Peterborough Road, Crowland

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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0 400 m

GeoDyne

10k Raster Mapping

Published 2006

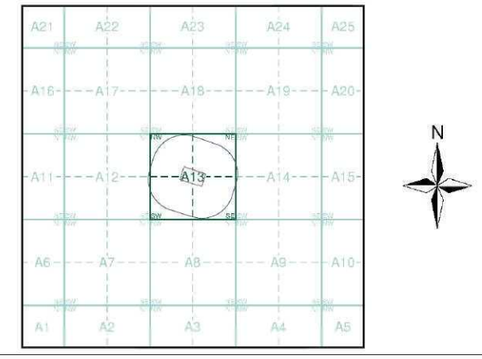
Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey`s 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)

TF21SW 2006 1:10,000	TF21SE 2006 1:10,000
TF20NW 2006 1:10,000	TF20NE 2006 1:10,000

Historical Map - Slice A



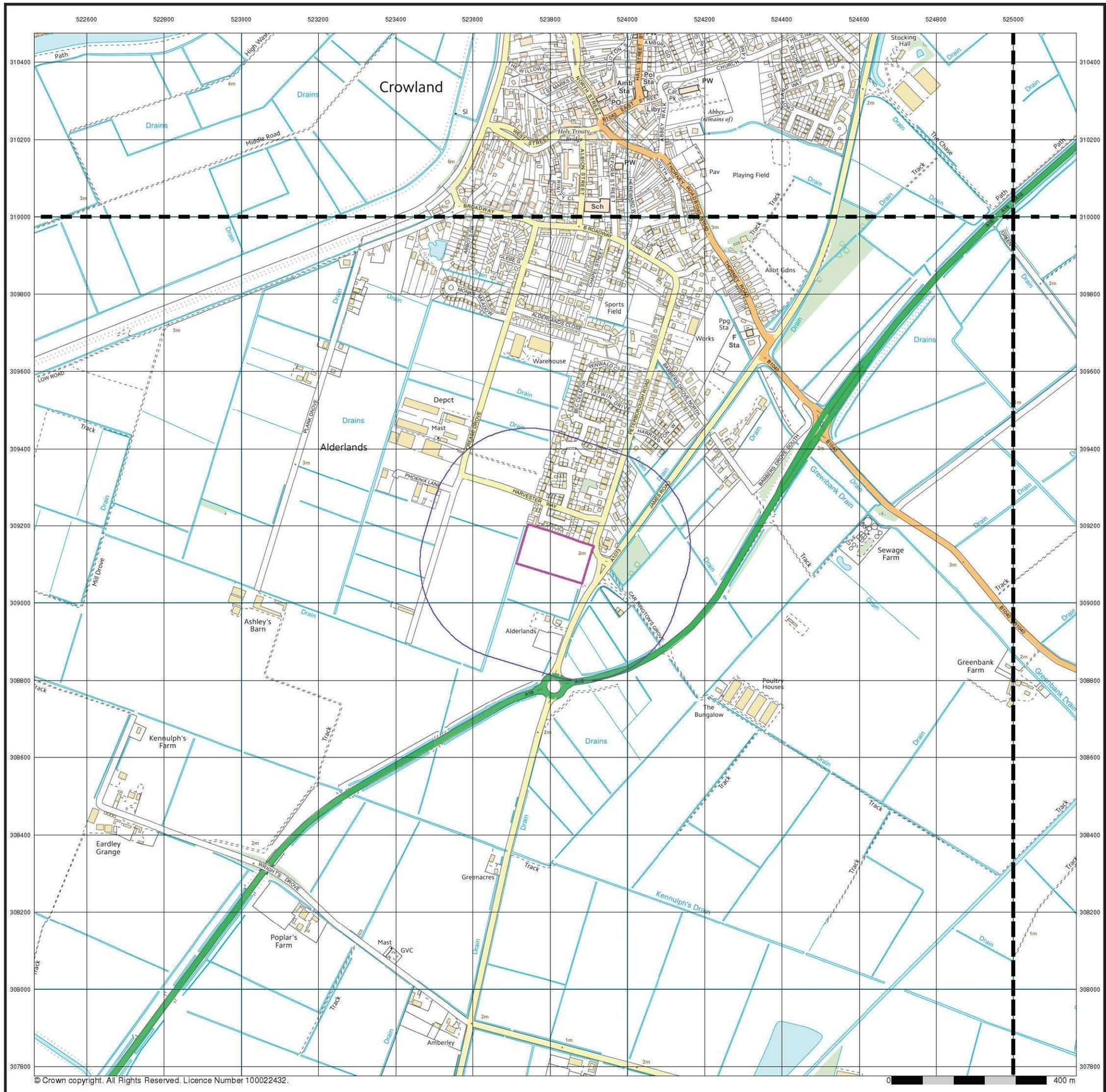
Order Details

Order Number:	63789118_1_1
Customer Ref:	D34155
National Grid Reference:	523810, 309130
Slice:	A
Site Area (Ha):	1.87
Search Buffer (m):	250

Site Details

Peterborough Road, Crowland

Landmark Information Group
Tel: 0844 844 9952
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GeoDyne

VectorMap Local

Published 2014

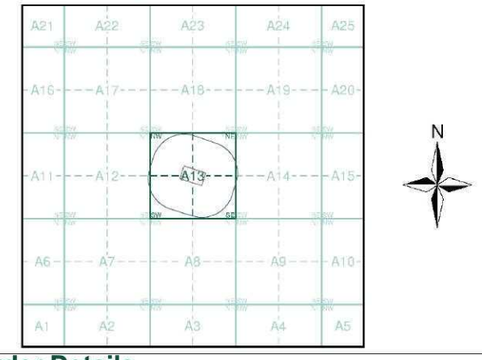
Source map scale - 1:10,000

VectorMap Local (Raster) is Ordnance Survey's highest detailed 'backdrop' mapping product. These maps are produced from OS's VectorMap Local, a simple vector dataset at a nominal scale of 1:10,000, covering the whole of Great Britain, that has been designed for creating graphical mapping. OS VectorMap Local is derived from large-scale information surveyed at 1:1250 scale (covering major towns and cities),1:2500 scale (smaller towns, villages and developed rural areas), and 1:10 000 scale (mountain, moorland and river estuary areas).

Map Name(s) and Date(s)

TF21SW 2014 Variable	TF21SE 2014 Variable
TF20NW 2014 Variable	TF20NE 2014 Variable

Historical Map - Slice A



Order Details

Order Number:	63789118_1_1
Customer Ref:	D34155
National Grid Reference:	523810, 309130
Slice:	A
Site Area (Ha):	1.87
Search Buffer (m):	250

Site Details

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APPENDIX IX

Landmark Envirocheck Report

GeoDyne

Envirocheck® Report:

Datasheet

Order Details:

Order Number:
63789118_1_1

Customer Reference:
D34155

National Grid Reference:
523810, 309130

Slice:
A

Site Area (Ha):
1.87

Search Buffer (m):
250

Site Details:

Peterborough Road
Crowland

Client Details:

Mr R Spencer
GeoDyne Ltd
The Granary
Church Lane
Thrumpton
NG11 0AX

GeoDyne

Contents

Report Section	Page Number
Summary	-
Agency & Hydrological	1
Waste	2
Hazardous Substances	-
Geological	3
Industrial Land Use	5
Sensitive Land Use	-
Data Currency	6
Data Suppliers	10
Useful Contacts	11

Introduction

The Environment Act 1995 has made site sensitivity a key issue, as the legislation pays as much attention to the pathways by which contamination could spread, and to the vulnerable targets of contamination, as it does the potential sources of contamination.
For this reason, Landmark's Site Sensitivity maps and Datasheet(s) place great emphasis on statutory data provided by the Environment Agency/Natural Resources Wales and the Scottish Environment Protection Agency; it also incorporates data from Natural England (and the Scottish and Welsh equivalents) and Local Authorities; and highlights hydrogeological features required by environmental and geotechnical consultants. It does not include any information concerning past uses of land. The datasheet is produced by querying the Landmark database to a distance defined by the client from a site boundary provided by the client.

In the attached datasheet the National Grid References (NGRs) are rounded to the nearest 10m in accordance with Landmark's agreements with a number of Data Suppliers.

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Radon Potential dataset Copyright Notice

Information supplied from a joint dataset compiled by The British Geological Survey and Public Health England.

Report Version v49.0

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Summary

Data Type	Page Number	On Site	0 to 250m (*up to 500m)
Agency & Hydrological			
Contaminated Land Register Entries and Notices			
Discharge Consents			
Enforcement and Prohibition Notices			
Integrated Pollution Controls			
Integrated Pollution Prevention And Control			
Local Authority Integrated Pollution Prevention And Control			
Local Authority Pollution Prevention and Controls	pg 1		1
Local Authority Pollution Prevention and Control Enforcements			
Nearest Surface Water Feature	pg 1		Yes
Pollution Incidents to Controlled Waters			
Prosecutions Relating to Authorised Processes			
Prosecutions Relating to Controlled Waters			
Registered Radioactive Substances			
River Quality			
River Quality Biology Sampling Points			
River Quality Chemistry Sampling Points			
Substantiated Pollution Incident Register			
Water Abstractions	pg 1		(*1)
Water Industry Act Referrals			
Groundwater Vulnerability	pg 1	Yes	n/a
Bedrock Aquifer Designations	pg 1	Yes	n/a
Superficial Aquifer Designations	pg 1	Yes	n/a
Source Protection Zones			
Extreme Flooding from Rivers or Sea without Defences	pg 1	Yes	
Flooding from Rivers or Sea without Defences	pg 1	Yes	
Areas Benefiting from Flood Defences			
Flood Water Storage Areas			
Flood Defences			
Detailed River Network Lines			
Detailed River Network Offline Drainage	pg 1		Yes

GeoDyne

Summary

Data Type	Page Number	On Site	0 to 250m (*up to 500m)
Waste			
BGS Recorded Landfill Sites			
Historical Landfill Sites			
Integrated Pollution Control Registered Waste Sites			
Licensed Waste Management Facilities (Landfill Boundaries)			
Licensed Waste Management Facilities (Locations)			
Local Authority Recorded Landfill Sites			
Registered Landfill Sites			
Registered Waste Transfer Sites			
Registered Waste Treatment or Disposal Sites			
Hazardous Substances			
Control of Major Accident Hazards Sites (COMAH)			
Explosive Sites			
Notification of Installations Handling Hazardous Substances (NIHHS)			
Planning Hazardous Substance Consents			
Planning Hazardous Substance Enforcements			
Geological			
BGS 1:625,000 Solid Geology	pg 3	Yes	n/a
BGS Estimated Soil Chemistry	pg 3	Yes	Yes
BGS Recorded Mineral Sites			
BGS Urban Soil Chemistry			
BGS Urban Soil Chemistry Averages			
Brine Compensation Area			n/a
Coal Mining Affected Areas			n/a
Mining Instability			n/a
Man-Made Mining Cavities			
Natural Cavities			
Non Coal Mining Areas of Great Britain			
Potential for Collapsible Ground Stability Hazards			
Potential for Compressible Ground Stability Hazards	pg 4	Yes	Yes
Potential for Ground Dissolution Stability Hazards			
Potential for Landslide Ground Stability Hazards	pg 4	Yes	
Potential for Running Sand Ground Stability Hazards	pg 4	Yes	Yes
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 4	Yes	
Radon Potential - Radon Affected Areas			n/a
Radon Potential - Radon Protection Measures			n/a

GeoDyne

Summary

Data Type	Page Number	On Site	0 to 250m (*up to 500m)
Industrial Land Use			
Contemporary Trade Directory Entries	pg 5		3
Fuel Station Entries	pg 5		1
Sensitive Land Use			
Areas of Adopted Green Belt			
Areas of Unadopted Green Belt			
Areas of Outstanding Natural Beauty			
Environmentally Sensitive Areas			
Forest Parks			
Local Nature Reserves			
Marine Nature Reserves			
National Nature Reserves			
National Parks			
Nitrate Sensitive Areas			
Nitrate Vulnerable Zones			
Ramsar Sites			
Sites of Special Scientific Interest			
Special Areas of Conservation			
Special Protection Areas			

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
1	**Local Authority Pollution Prevention and Controls** Name: Crowland Service Station Location: 64 Peterborough Road, Crowland, PETERBOROUGH, Cambridgeshire, PE6 0BA Authority: South Holland District Council, Environmental Services Permit Reference: Not Supplied Dated: Not Supplied Process Type: Local Authority Air Pollution Control Description: PG1/14 Petrol filling station **Status: Authorisation revokedRevoked** Positional Accuracy: Automatically positioned to the address	A13NE (E)	29	2	523942 309144
	Nearest Surface Water Feature	A13NW (NW)	1	-	523724 309164
	Water Abstractions Operator: S G Beeken Licence Number: 5/32/11/*g/008 Permit Version: Not Supplied Location: Well At, CROWLAND Authority: Environment Agency, Anglian Region Abstraction: Agriculture (General) Abstraction Type: Not Supplied Source: Groundwater Fed Reservoir Daily Rate (m3): 0 Yearly Rate (m3): 450 Details: Fluvial Sand and Gravel; Status: Revoked Authorised Start: Not Supplied Authorised End: Not Supplied Permit Start Date: Not Supplied Permit End Date: Not Supplied Positional Accuracy: Located by supplier to within 100m	A13NW (NW)	314	3	523500 309400
	Groundwater Vulnerability Soil Classification: Not classified Map Sheet: Sheet 24 North Northamptonshire Scale: 1:100,000	A13SW (S)	0	3	523813 309126
	Drift Deposits None				
	Bedrock Aquifer Designations Aquifer Designation: Unproductive Strata	A13SW (S)	0	4	523813 309126
	Superficial Aquifer Designations Aquifer Designation: Unproductive Strata	A13SW (S)	0	4	523813 309126
	Extreme Flooding from Rivers or Sea without Defences Type: Extent of Extreme Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Models and Fluvial Events Boundary Accuracy: As Supplied	A13SW (S)	0	3	523813 309126
	Flooding from Rivers or Sea without Defences Type: Extent of Flooding from Rivers or Sea without Defences Flood Plain Type: Fluvial Models Boundary Accuracy: As Supplied	A13SW (S)	0	3	523813 309126
	Areas Benefiting from Flood Defences None				
	Flood Water Storage Areas None				
	Flood Defences None				
	Detailed River Network Lines None				
2	**Detailed River Network Offline Drainage** River Type: Tertiary River Hydrographic Area: D005	A13SE (S)	104	3	523875 308946
3	**Detailed River Network Offline Drainage** River Type: Tertiary River Hydrographic Area: D005	A13NE (E)	118	3	524027 309176
4	**Detailed River Network Offline Drainage** River Type: Tertiary River Hydrographic Area: D005	A13SE (S)	182	3	523845 308872

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Local Authority Landfill Coverage Name: South Holland District Council - Has no landfill data to supply		0	2	523813 309126
	Local Authority Landfill Coverage Name: Lincolnshire County Council - Had landfill data but passed it to the relevant environment agency		0	7	523813 309126

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS 1:625,000 Solid Geology Description: Oxford Clay and Kellaways Beds	A13SW (S)	0	4	523813 309126
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Rural Soil Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 45 - 60 mg/kg	A13SW (S)	0	5	523813 309126
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Rural Soil Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A13SW (S)	50	5	523813 309000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Rural Soil Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 45 - 60 mg/kg	A13SE (E)	87	5	524000 309126
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Rural Soil Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A13SE (SE)	127	5	524000 309000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Rural Soil Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A13SE (E)	194	5	524098 309077
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: Rural Soil Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A13SE (SE)	203	5	524080 309000

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Measured Urban Soil Chemistry No data available				
	BGS Urban Soil Chemistry Averages No data available				
	Coal Mining Affected Areas In an area that might not be affected by coal mining				
	Non Coal Mining Areas of Great Britain No Hazard				
	Potential for Collapsible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13SW (S)	0	4	523813 309126
	Potential for Compressible Ground Stability Hazards Hazard Potential: High Source: British Geological Survey, National Geoscience Information Service	A13SW (S)	0	4	523813 309126
	Potential for Compressible Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A13SE (E)	194	4	524098 309077
	Potential for Ground Dissolution Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13SW (S)	0	4	523813 309126
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SW (S)	0	4	523813 309126
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SW (S)	0	4	523813 309126
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A13SE (E)	194	4	524098 309077
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A13SW (S)	0	4	523813 309126
	Radon Potential - Radon Protection Measures Protection Measure: No radon protective measures are necessary in the construction of new dwellings or extensions Source: British Geological Survey, National Geoscience Information Service	A13SW (S)	0	4	523813 309126
	Radon Potential - Radon Affected Areas Affected Area: The property is in a lower probability radon area, as less than 1% of homes are above the action level Source: British Geological Survey, National Geoscience Information Service	A13SW (S)	0	4	523813 309126

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
5	**Contemporary Trade Directory Entries** Name: Crowland Service Station Location: 64, Peterborough Road, Crowland, Peterborough, PE6 0BA Classification: Garage Services **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A13NE (E)	29	-	523942 309144
6	**Contemporary Trade Directory Entries** Name: Tourmaster Recovery Ltd Location: Alderlands, Peterborough Road, Crowland, PETERBOROUGH, PE6 0AA Classification: Breakdown and Recovery **Status: Active** Positional Accuracy: Automatically positioned to the address	A13SE (S)	112	-	523824 308952
7	**Contemporary Trade Directory Entries** Name: Iron X Press Location: 59, Beccelm Drive, Crowland, Peterborough, PE6 0AG Classification: Ironing & Home Laundry Services **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A13NE (NE)	205	-	523916 309362
8	**Fuel Station Entries** Name: Crowland Service Station Location: 64, Peterborough Road, Crowland, Peterborough, PE6 0BA Brand: Total Premises Type: Not Applicable **Status: Obsolete** Positional Accuracy: Automatically positioned to the address	A13NE (E)	29	-	523942 309144

Agency & Hydrological	Version	Update Cycle
Contaminated Land Register Entries and Notices		
Peterborough City Council - Environmental Health Department	April 2013	Annual Rolling Update
South Holland District Council - Environmental Services	October 2013	Annual Rolling Update
Discharge Consents		
Environment Agency - Anglian Region	November 2014	Quarterly
Enforcement and Prohibition Notices		
Environment Agency - Anglian Region	March 2013	As notified
Integrated Pollution Controls		
Environment Agency - Anglian Region	October 2008	Not Applicable
Integrated Pollution Prevention And Control		
Environment Agency - Anglian Region	November 2014	Quarterly
Local Authority Integrated Pollution Prevention And Control		
South Holland District Council - Environmental Services	October 2014	Annual Rolling Update
Peterborough City Council - Environmental Health Department	September 2013	Annual Rolling Update
Local Authority Pollution Prevention and Controls		
South Holland District Council - Environmental Services	October 2014	Annual Rolling Update
Peterborough City Council - Environmental Health Department	September 2013	Annual Rolling Update
Local Authority Pollution Prevention and Control Enforcements		
South Holland District Council - Environmental Services	October 2014	Annual Rolling Update
Peterborough City Council - Environmental Health Department	September 2013	Annual Rolling Update
Nearest Surface Water Feature		
Ordnance Survey	July 2012	Quarterly
Pollution Incidents to Controlled Waters		
Environment Agency - Anglian Region	September 1999	Not Applicable
Prosecutions Relating to Authorised Processes		
Environment Agency - Anglian Region	March 2013	As notified
Prosecutions Relating to Controlled Waters		
Environment Agency - Anglian Region	March 2013	As notified
Registered Radioactive Substances		
Environment Agency - Anglian Region	November 2014	Quarterly
River Quality		
Environment Agency - Head Office	November 2001	Not Applicable
River Quality Biology Sampling Points		
Environment Agency - Head Office	July 2012	Annually
River Quality Chemistry Sampling Points		
Environment Agency - Head Office	July 2012	Annually
Substantiated Pollution Incident Register		
Environment Agency - Anglian Region - Northern Area	November 2014	Quarterly
Water Abstractions		
Environment Agency - Anglian Region	October 2014	Quarterly
Water Industry Act Referrals		
Environment Agency - Anglian Region	November 2014	Quarterly
Groundwater Vulnerability		
Environment Agency - Head Office	January 2011	Not Applicable
Drift Deposits		
Environment Agency - Head Office	January 1999	Not Applicable
Bedrock Aquifer Designations		
British Geological Survey - National Geoscience Information Service	October 2012	Annually
Superficial Aquifer Designations		
British Geological Survey - National Geoscience Information Service	October 2012	Annually

Agency & Hydrological	Version	Update Cycle
Source Protection Zones		
Environment Agency - Head Office	December 2014	Quarterly
Extreme Flooding from Rivers or Sea without Defences		
Environment Agency - Head Office	October 2014	Quarterly
Flooding from Rivers or Sea without Defences		
Environment Agency - Head Office	October 2014	Quarterly
Areas Benefiting from Flood Defences		
Environment Agency - Head Office	October 2014	Quarterly
Flood Water Storage Areas		
Environment Agency - Head Office	October 2014	Quarterly
Flood Defences		
Environment Agency - Head Office	October 2014	Quarterly
Detailed River Network Lines		
Environment Agency - Head Office	March 2012	Annually
Detailed River Network Offline Drainage		
Environment Agency - Head Office	March 2012	Annually
Waste	**Version**	**Update Cycle**
BGS Recorded Landfill Sites		
British Geological Survey - National Geoscience Information Service	June 1996	Not Applicable
Historical Landfill Sites		
Environment Agency - Anglian Region - Northern Area	August 2014	Quarterly
Integrated Pollution Control Registered Waste Sites		
Environment Agency - Anglian Region	October 2008	Not Applicable
Licensed Waste Management Facilities (Landfill Boundaries)		
Environment Agency - Anglian Region - Northern Area	August 2014	Quarterly
Licensed Waste Management Facilities (Locations)		
Environment Agency - Anglian Region - Northern Area	November 2014	Quarterly
Local Authority Landfill Coverage		
Lincolnshire County Council	May 2000	Not Applicable
Peterborough City Council	May 2000	Not Applicable
South Holland District Council - Environmental Services	May 2000	Not Applicable
Local Authority Recorded Landfill Sites		
Lincolnshire County Council	May 2000	Not Applicable
South Holland District Council - Environmental Services	May 2000	Not Applicable
Peterborough City Council	September 2003	Not Applicable
Registered Landfill Sites		
Environment Agency - Anglian Region - Northern Area	March 2003	Not Applicable
Registered Waste Transfer Sites		
Environment Agency - Anglian Region - Northern Area	March 2003	Not Applicable
Registered Waste Treatment or Disposal Sites		
Environment Agency - Anglian Region - Northern Area	March 2003	Not Applicable

Hazardous Substances	Version	Update Cycle
Control of Major Accident Hazards Sites (COMAH)		
Health and Safety Executive	January 2015	Bi-Annually
Explosive Sites		
Health and Safety Executive	October 2014	Bi-Annually
Notification of Installations Handling Hazardous Substances (NIHHS)		
Health and Safety Executive	November 2000	Not Applicable
Planning Hazardous Substance Enforcements		
South Holland District Council	December 2013	Annual Rolling Update
Peterborough City Council	December 2014	Annual Rolling Update
Lincolnshire County Council - Highways and Planning Department	June 2010	Annual Rolling Update
Planning Hazardous Substance Consents		
Lincolnshire County Council - Highways and Planning Department	August 2007	Annual Rolling Update
South Holland District Council	December 2013	Annual Rolling Update
Peterborough City Council	December 2014	Annual Rolling Update

Geological	Version	Update Cycle
BGS 1:625,000 Solid Geology		
British Geological Survey - National Geoscience Information Service	August 1996	Not Applicable
BGS Estimated Soil Chemistry		
British Geological Survey - National Geoscience Information Service	January 2010	Annually
BGS Recorded Mineral Sites		
British Geological Survey - National Geoscience Information Service	October 2014	Bi-Annually
Brine Compensation Area		
Cheshire Brine Subsidence Compensation Board	August 2011	Not Applicable
Coal Mining Affected Areas		
The Coal Authority - Mining Report Service	December 2013	As notified
Mining Instability		
Ove Arup & Partners	October 2000	Not Applicable
Non Coal Mining Areas of Great Britain		
British Geological Survey - National Geoscience Information Service	July 2014	Not Applicable
Potential for Collapsible Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	June 2014	Annually
Potential for Compressible Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	June 2014	Annually
Potential for Ground Dissolution Stability Hazards		
British Geological Survey - National Geoscience Information Service	June 2014	Annually
Potential for Landslide Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	June 2014	Annually
Potential for Running Sand Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	June 2014	Annually
Potential for Shrinking or Swelling Clay Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	June 2014	Annually
Radon Potential - Radon Affected Areas		
British Geological Survey - National Geoscience Information Service	July 2011	As notified
Radon Potential - Radon Protection Measures		
British Geological Survey - National Geoscience Information Service	July 2011	As notified

Industrial Land Use	Version	Update Cycle
Contemporary Trade Directory Entries Thomson Directories	November 2014	Quarterly
Fuel Station Entries Catalist Ltd - Experian	November 2014	Quarterly
Sensitive Land Use	**Version**	**Update Cycle**
Areas of Outstanding Natural Beauty Natural England	August 2014	Bi-Annually
Environmentally Sensitive Areas Natural England	August 2014	Annually
Forest Parks Forestry Commission	April 1997	Not Applicable
Local Nature Reserves Natural England	October 2014	Bi-Annually
Marine Nature Reserves Natural England	July 2013	Bi-Annually
National Nature Reserves Natural England	September 2014	Bi-Annually
National Parks Natural England	August 2014	Bi-Annually
Nitrate Sensitive Areas Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA)	February 2012	Not Applicable
Nitrate Vulnerable Zones Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA)	July 2014	Annually
Ramsar Sites Natural England	March 2014	Bi-Annually
Sites of Special Scientific Interest Natural England	September 2014	Bi-Annually
Special Areas of Conservation Natural England	March 2014	Bi-Annually
Special Protection Areas Natural England	September 2014	Bi-Annually

Data Suppliers

A selection of organisations who provide data within this report

Data Supplier	Data Supplier Logo
Ordnance Survey	
Environment Agency	
Scottish Environment Protection Agency	
The Coal Authority	
British Geological Survey	
Centre for Ecology and Hydrology	
Natural Resources Wales	
Scottish Natural Heritage	
Natural England	
Public Health England	
Ove Arup	
Peter Brett Associates	

Contact	Name and Address	Contact Details
2	**South Holland District Council - Environmental Services** Council Offices, Priory Road, Spalding, Lincolnshire, PE11 2XE	Website: www.sholland.gov.uk
3	**Environment Agency - National Customer Contact Centre (NCCC)** PO Box 544, Templeborough, Rotherham, S60 1BY	Telephone: 08708 506 506 Email: enquiries@environment-agency.gov.uk
4	**British Geological Survey - Enquiry Service** British Geological Survey, Kingsley Dunham Centre, Keyworth, Nottingham, Nottinghamshire, NG12 5GG	Telephone: 0115 936 3143 Fax: 0115 936 3276 Email: enquiries@bgs.ac.uk Website: www.bgs.ac.uk
5	**Landmark Information Group Limited** Imperium, Imperial Way, Reading, Berkshire, RG2 0TD	Telephone: 0844 844 9952 Fax: 0844 844 9951 Email: customerservices@landmark.co.uk Website: www.landmark.co.uk
6	**Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA)** Government Buildings, Otley Road, Lawnswood, Leeds, West Yorkshire, LS16 5QT	Telephone: 0113 2613333 Fax: 0113 230 0879
7	**Lincolnshire County Council** 4th Floor, City Hall, Lincoln, Lincolnshire, LN1 1DN	Telephone: 01522 552222 Fax: 01522 552288 Email: PublicRelations@lincolnshire.gov.uk Website: www.lincolnshire.gov.uk
-	**Public Health England - Radon Survey, Centre for Radiation, Chemical and Environmental Hazards** Chilton, Didcot, Oxfordshire, OX11 0RQ	Telephone: 01235 822622 Fax: 01235 833891 Email: radon@phe.gov.uk Website: www.ukradon.org
-	**Landmark Information Group Limited** Imperium, Imperial Way, Reading, Berkshire, RG2 0TD	Telephone: 0844 844 9952 Fax: 0844 844 9951 Email: customerservices@landmarkinfo.co.uk Website: www.landmarkinfo.co.uk

Please note that the Environment Agency / Natural Resources Wales / SEPA have a charging policy in place for enquiries.

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Envirocheck® Report:

BGS Boreholes Datasheet

Order Details:

Order Number:
63789118_1_1

Customer Reference:
D34155

National Grid Reference:
523810, 309130

Slice:
A

Site Area (Ha):
1.87

Borehole Search Buffer (m):
250

Site Details:

Peterborough Road
Crowland

Client Details:

Mr R Spencer
GeoDyne Ltd
The Granary
Church Lane
Thrumpton
NG11 0AX

GeoDyne

BGS Boreholes Summary

Data Type	Page Number	On Site	0 to 250m
BGS Boreholes	pg 1	None	2

Introduction

The Environment Act 1995 has made site sensitivity a key issue, as the legislation pays as much attention to the pathways by which contamination could spread, and to the vulnerable targets of contamination, as it does the potential sources of contamination.
For this reason, Landmark's Site Sensitivity maps and Datasheet(s) place great emphasis on statutory data provided by the Environment Agency and the Scottish Environment Protection Agency; it also incorporates data from Natural England (and the Scottish and Welsh equivalents) and Local Authorities; and highlights hydrogeological features required by environmental and geotechnical consultants. It does not include any information concerning past uses of land. The datasheet is produced by querying the Landmark database to a distance defined by the client from a site boundary provided by the client.

In the attached datasheet the National Grid References (NGRs) are rounded to the nearest 10m in accordance with Landmark's agreements with a number of Data Suppliers.

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A copy of the BGS Borehole Ordering Form is available to download from the Support section of www.envirocheck.co.uk.

Report Version v49.0

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BGS Boreholes Detail

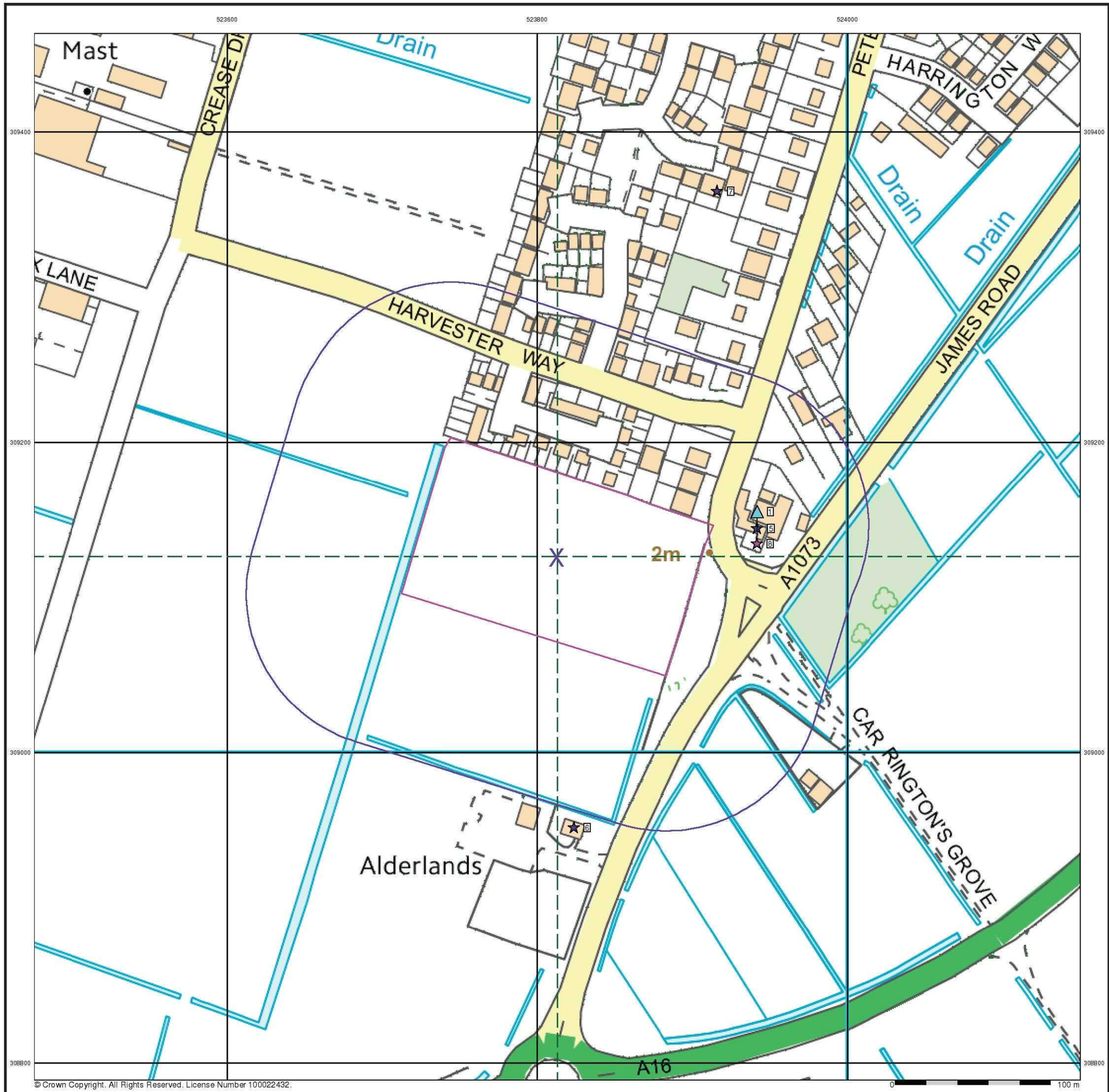
Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
9	**BGS Boreholes** BGS Reference: Tf20nw46 Drilled Length (m): 1.7 Borehole Name: Kennulf'S Drove Link to Borehole Scan: http://scans.bgs.ac.uk/sobi_scans/boreholes/473031/	A13NE (NE)	47	4	523900 309200
10	**BGS Boreholes** BGS Reference: Tf20nw65 Drilled Length (m): Not Supplied Borehole Name: Beccelin Close Crowland Tp3 Link to Borehole Scan: Not Available	A13NE (N)	227	4	523867 309401

GeoDyne

Data Currency and Contact Details

BGS Boreholes	Version	Update Cycle
BGS Boreholes British Geological Survey - National Geoscience Information Service	January 2015	Quarterly

Contact Details	Contact Logo
4 **British Geological Survey - Enquiry Service** British Geological Survey, Kingsley Dunham Centre, Keyworth, Nottingham, Nottinghamshire, NG12 5GG Telephone: 0115 936 3143 Fax: 0115 936 3276 Email: enquiries@bgs.ac.uk Website: www.bgs.ac.uk	British Geological Survey NATURAL ENVIRONMENT RESEARCH COUNCIL
- **Landmark Information Group Limited** Imperium, Imperial Way, Reading, Berkshire, RG2 0TD Telephone: 0844 844 9952 Fax: 0844 844 9951 Email: customerservices@landmarkinfo.co.uk Website: www.landmarkinfo.co.uk	LANDMARK® Information Group



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General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Map ID
Several of Type at Location

Agency and Hydrological

- Contaminated Land Register Entry or Notice (Location)
- Contaminated Land Register Entry or Notice
- Discharge Consent
- Enforcement or Prohibition Notice
- Integrated Pollution Control
- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Waters
- Prosecution Relating to Authorised Processes
- Prosecution Relating to Controlled Waters
- Registered Radioactive Substance
- River Network or Water Feature
- River Quality Sampling Point
- Substantiated Pollution Incident Register
- Water Abstraction
- Water Industry Act Referral

Geological

- BGS Recorded Mineral Site

Industrial Land Use

- Contemporary Trade Directory Entry
- Fuel Station Entry

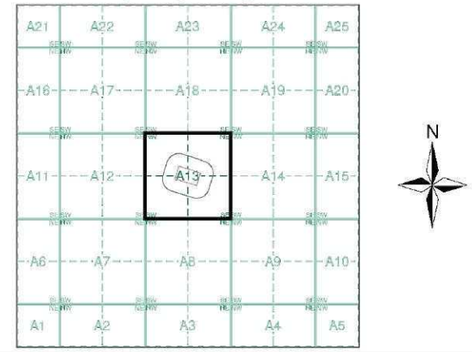
Waste

- BGS Recorded Landfill Site (Location)
- BGS Recorded Landfill Site
- EA Historic Landfill (Buffered Point)
- EA Historic Landfill (Polygon)
- Integrated Pollution Control Registered Waste Site
- Licensed Waste Management Facility (Landfill Boundary)
- Licensed Waste Management Facility (Location)
- Local Authority Recorded Landfill Site (Location)
- Local Authority Recorded Landfill Site
- Registered Landfill Site
- Registered Landfill Site (Location)
- Registered Landfill Site (Point Buffered to 100m)
- Registered Landfill Site (Point Buffered to 250m)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site (Location)
- Registered Waste Treatment or Disposal Site

Hazardous Substances

- COMAH Site
- Explosive Site
- NIHHS Site
- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

Site Sensitivity Map - Segment A13



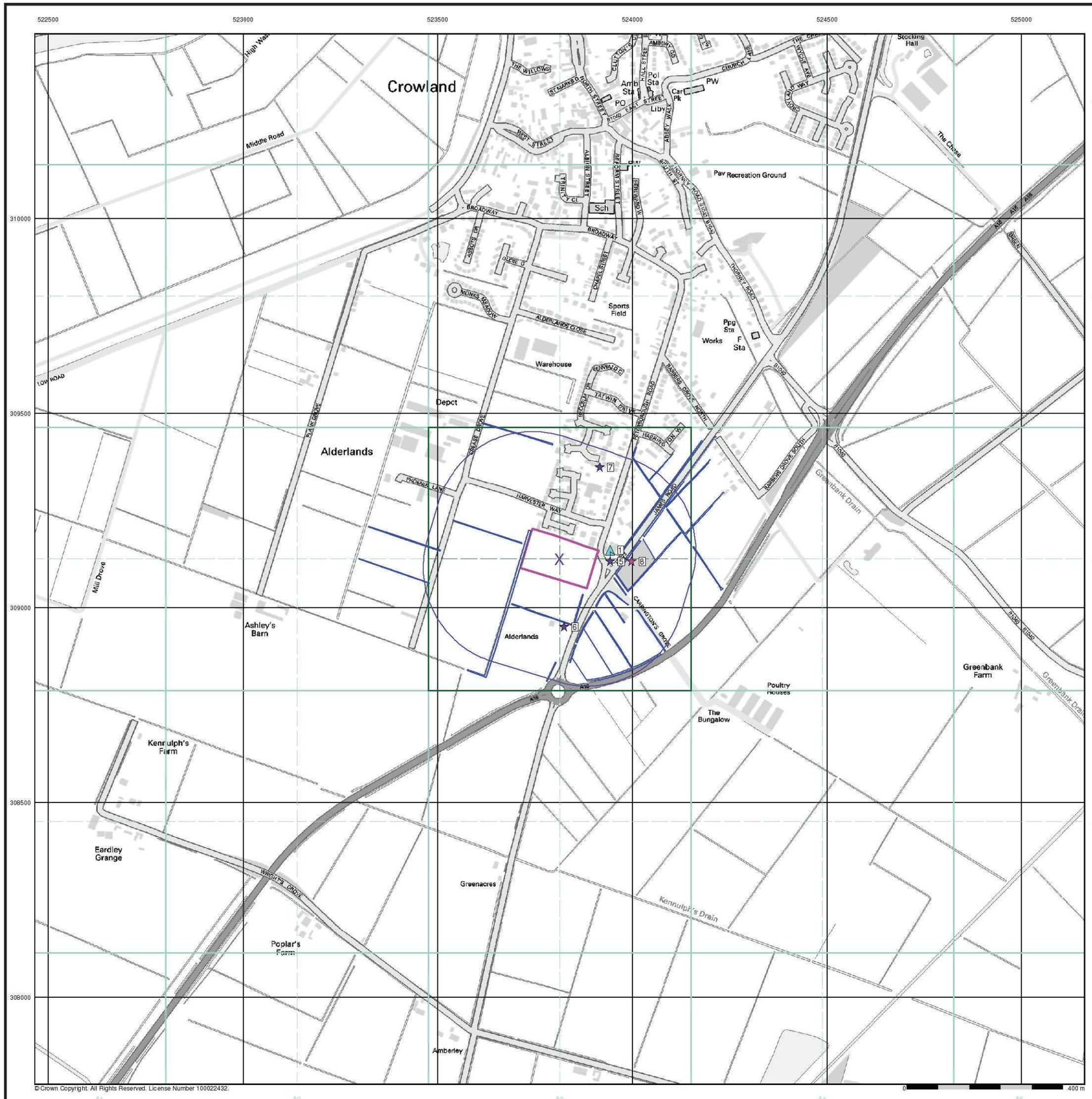
Order Details

Order Number:	63789118_1_1
Customer Ref:	D34155
National Grid Reference:	523810, 309130
Slice:	A
Site Area (Ha):	1.87

Site Details

Peterborough Road, Crowland

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



GeoDyne

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID
- Several of Type at Location

Agency and Hydrological

- Contaminated Land Register Entry or Notice (Location)
- Contaminated Land Register Entry or Notice
- Discharge Consent
- Enforcement or Prohibition Notice
- Integrated Pollution Control
- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Waters
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- Water Abstraction
- Water Industry Act Referral

Geological

- BGS Recorded Mineral Site

Industrial Land Use

- Contemporary Trade Directory Entry
- Fuel Station Entry

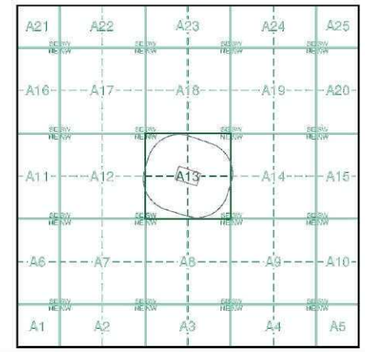
Waste

- BGS Recorded Landfill Site (Location)
- BGS Recorded Landfill Site
- EA Historic Landfill (Buffered Point)
- EA Historic Landfill (Polygon)
- Integrated Pollution Control Registered Waste Site
- Licensed Waste Management Facility (Landfill Boundary)
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- Registered Landfill Site (Point Buffered to 250m)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
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- Registered Waste Treatment or Disposal Site

Hazardous Substances

- COMAH Site
- Explosive Site
- NIHHS Site
- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

Site Sensitivity Map - Slice A



Order Details

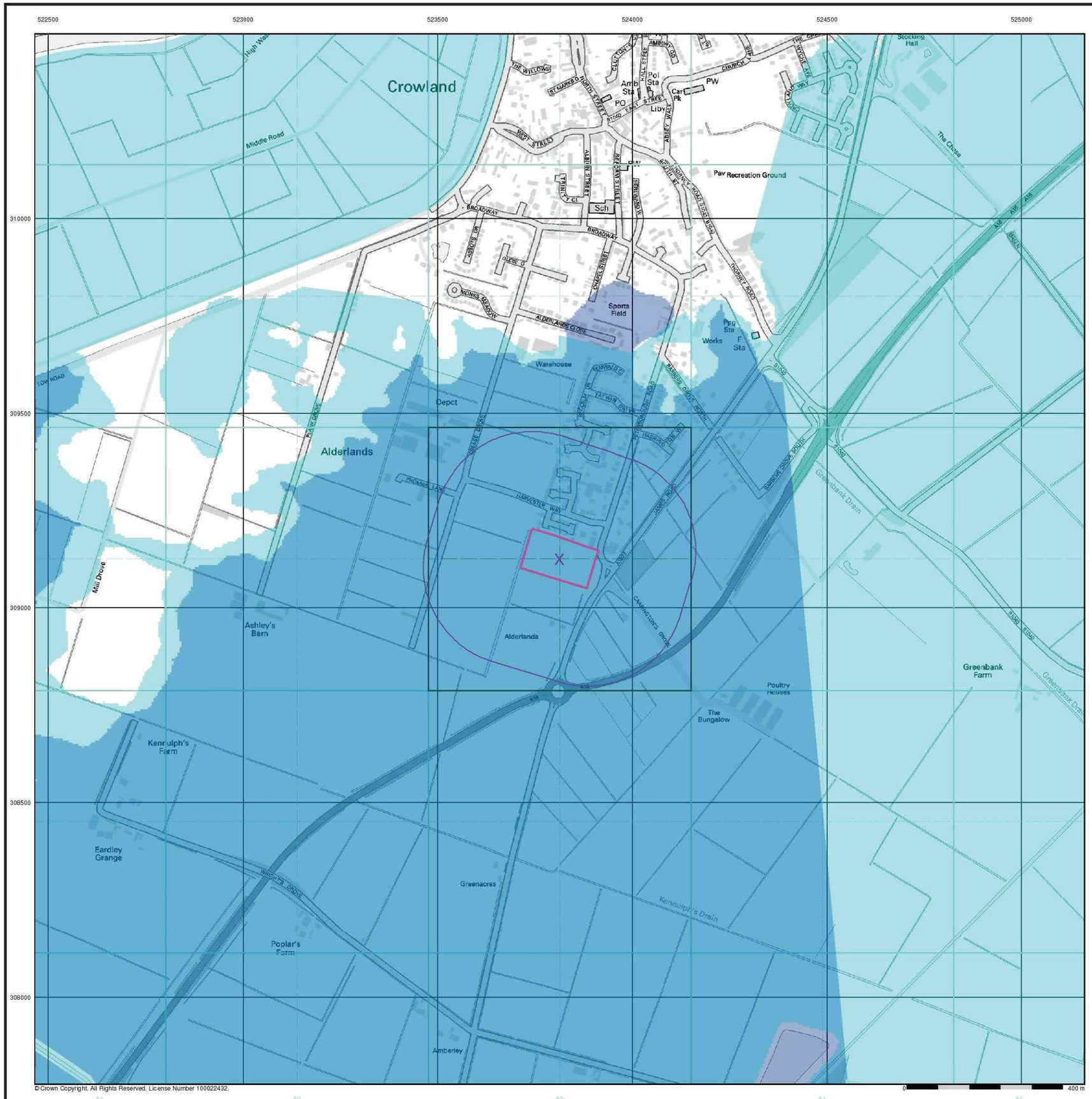
Order Number:	63789118_1_1
Customer Ref:	D34155
National Grid Reference:	523810, 309130
Slice:	A
Site Area (Ha):	1.87
Search Buffer (m):	250

Site Details

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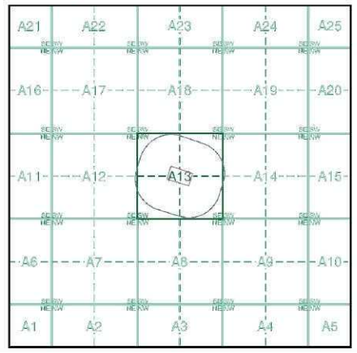
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

Agency and Hydrological (Flood)

- Extreme Flooding from Rivers or Sea without Defences (Zone 2)
- Flooding from Rivers or Sea without Defences (Zone 3)
- Area Benefiting from Flood Defence
- Flood Water Storage Areas
- Flood Defence

Flood Map - Slice A



Order Details

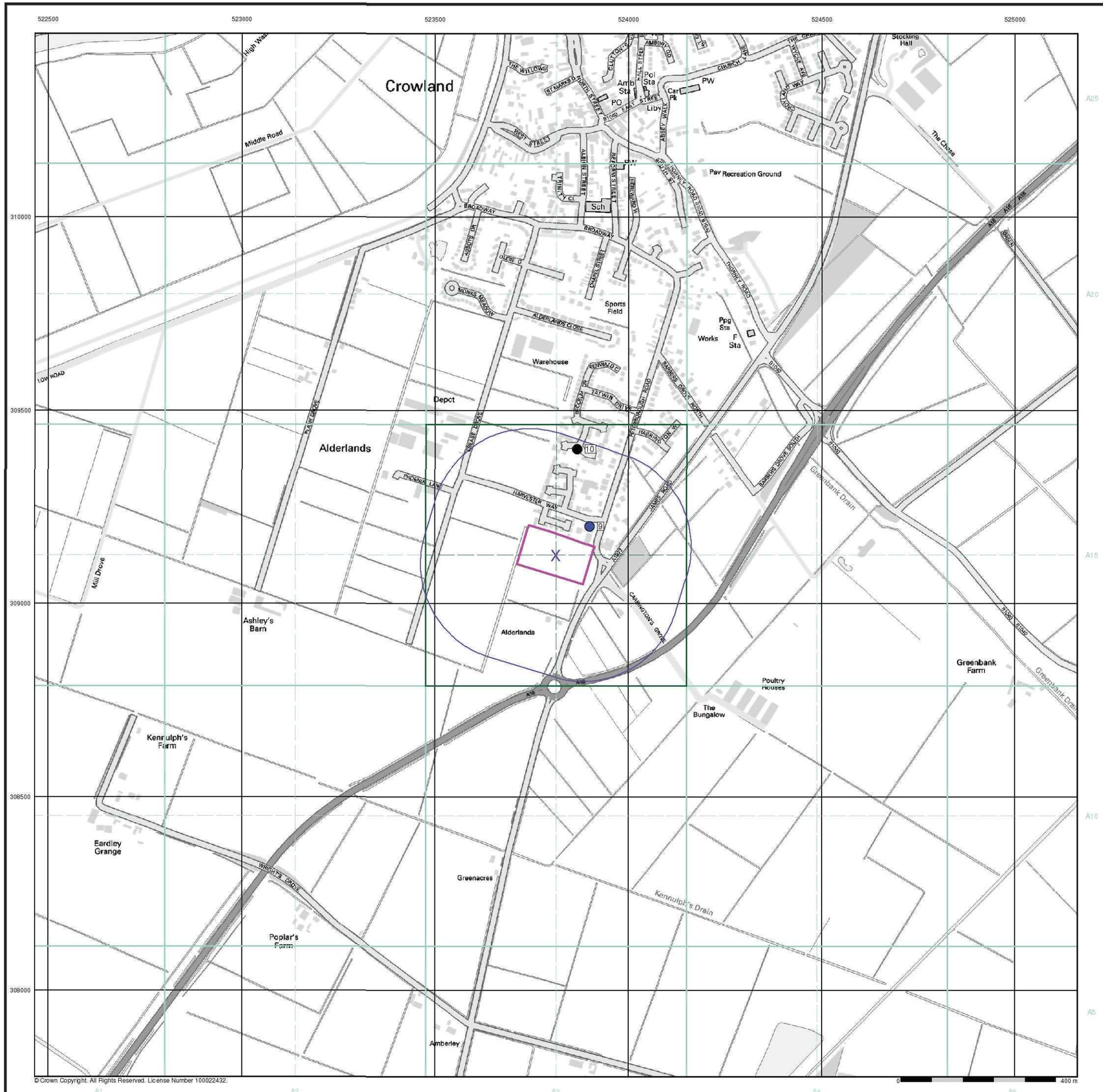
Order Number:	63789118_1_1
Customer Ref:	D34155
National Grid Reference:	523810, 309130
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Site Area (Ha):	1.87
Search Buffer (m):	250

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GeoDyne

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID
- Several of Type at Location

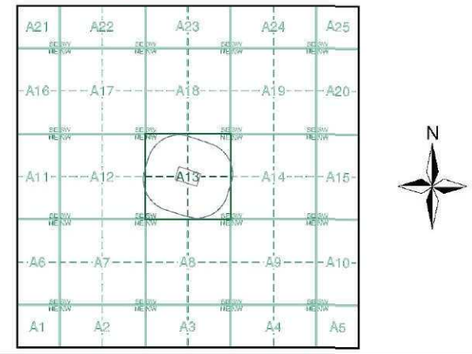
Agency and Hydrological (Boreholes)

- BGS Borehole Depth 0 - 10m
- BGS Borehole Depth 10 - 30m
- BGS Borehole Depth 30m +
- Confidential
- Other

For Borehole information please refer to the Borehole datasheet which accompanied this slice.

A copy of the BGS Borehole Ordering Form is available to download from the Support section of www.envirocheck.co.uk.

Borehole Map - Slice A

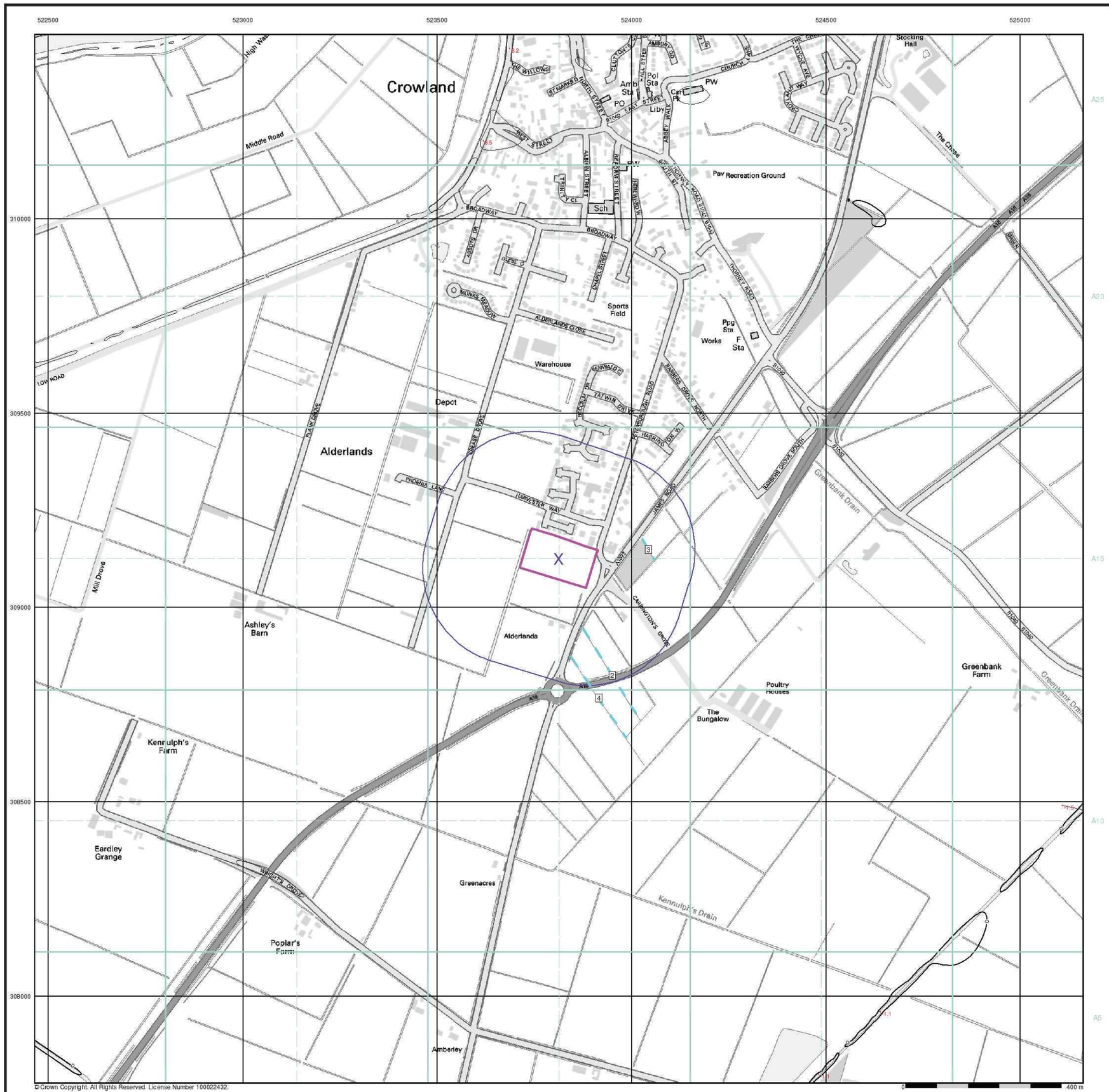


Order Details

Order Number:	63789118_1_1
Customer Ref:	D34155
National Grid Reference:	523810, 309130
Slice:	A
Site Area (Ha):	1.87
Search Buffer (m):	250

Site Details

Peterborough Road, Crowland



GeoDyne

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID

Detailed River Network Data

- Primary River
- Secondary River
- Tertiary River
- Canal
- Canal Tunnel
- Undefined River
- Lake/Reservoir
- Offline Drainage Feature
- Extended Culvert (greater than 50m)
- Underground River (inferred)
- Underground River (local knowledge)
- Downstream of High Water Mark
- Downstream of Seaward Extension
- Not assigned River feature

Contours (height in metres)

Standard Contour 105 100 95

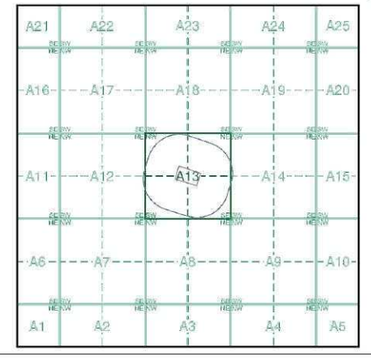
Master Contour

Spot Height *167.3

MLW Mean Low Water

MHW Mean High Water

EA/NRW Detailed River Network Map - Slice A



Order Details

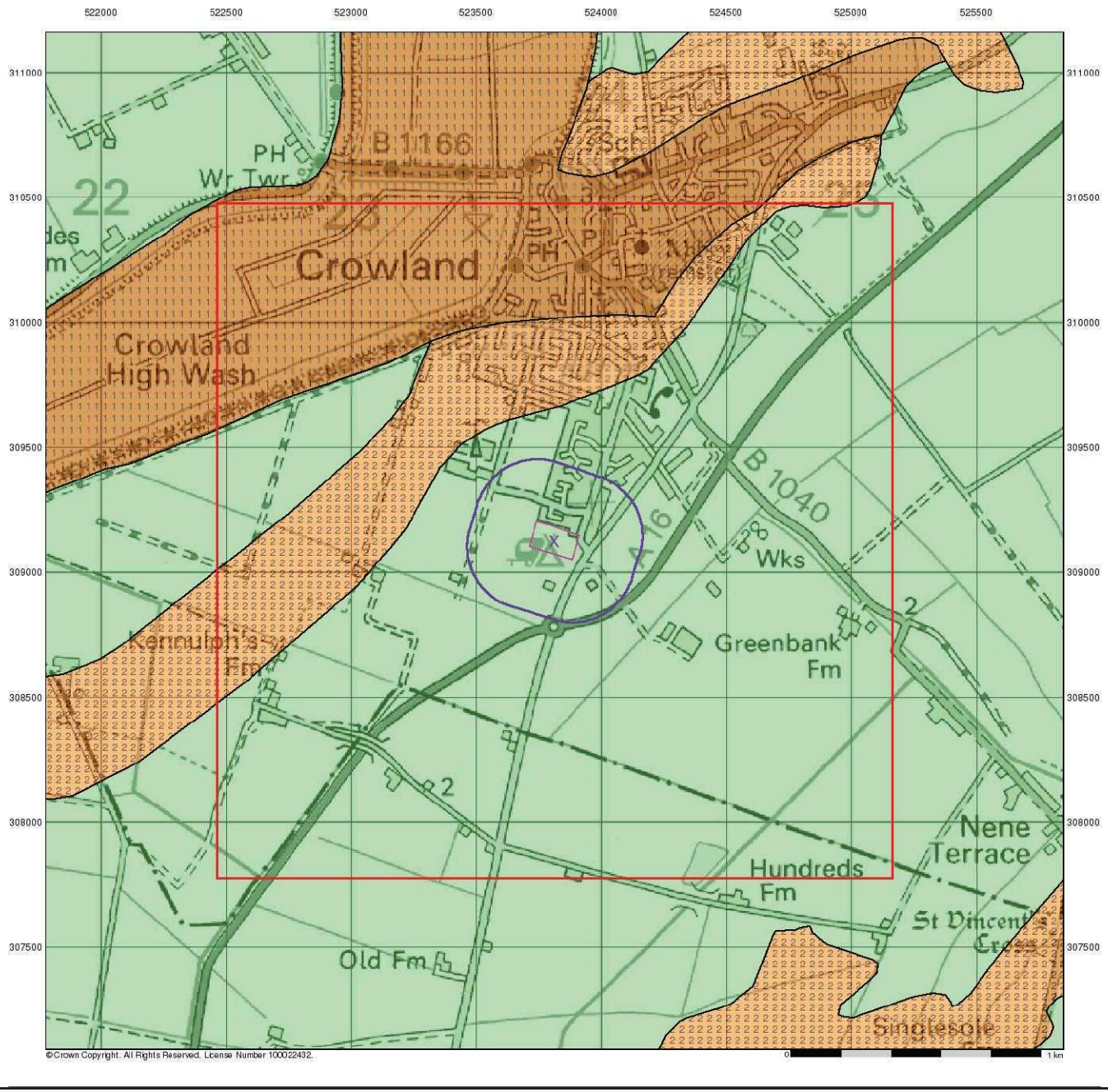
Order Number:	63789118_1_1
Customer Ref:	D34155
National Grid Reference:	523810, 309130
Slice:	A
Site Area (Ha):	1.87
Search Buffer (m):	250

Site Details

Peterborough Road, Crowland

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Groundwater Vulnerability

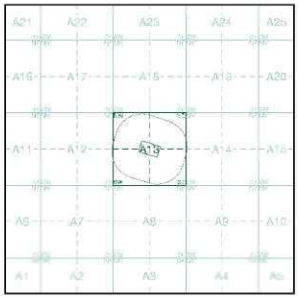
General

Specified Site | Specified Buffer(s) | Bearing Reference Point
Slice | Map ID

Agency and Hydrological

Geological Classes	Soil Classes
Major Aquifer (Highly Permeable)	High (H) 1, 2, 3, U
	Intermediate (I) 1, 2
	Low
Minor Aquifer (Variably Permeable)	High (H) 1, 2, 3, U
	Intermediate (I) 1, 2
	Low
Non Aquifer (Negligibly Permeable)	
Water or Sea	
Drift Deposit	

Site Sensitivity Context Map - Slice A



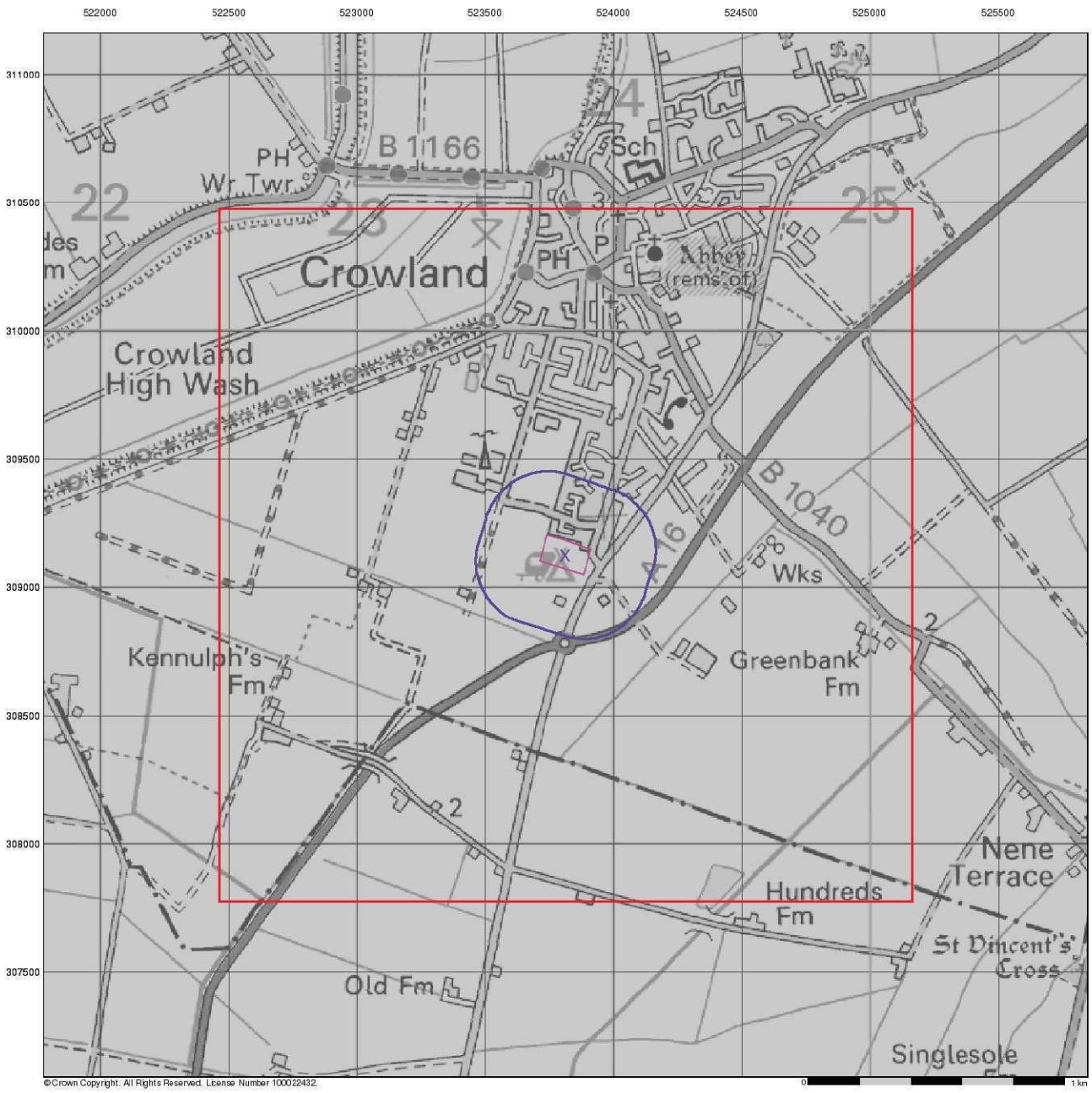
Order Details

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Site Details

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GeoDyne

Bedrock Aquifer Designation

General

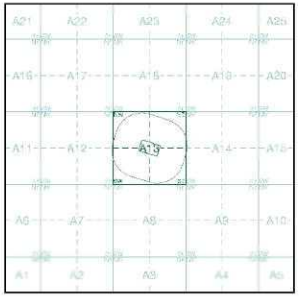
Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown

Site Sensitivity Context Map - Slice A



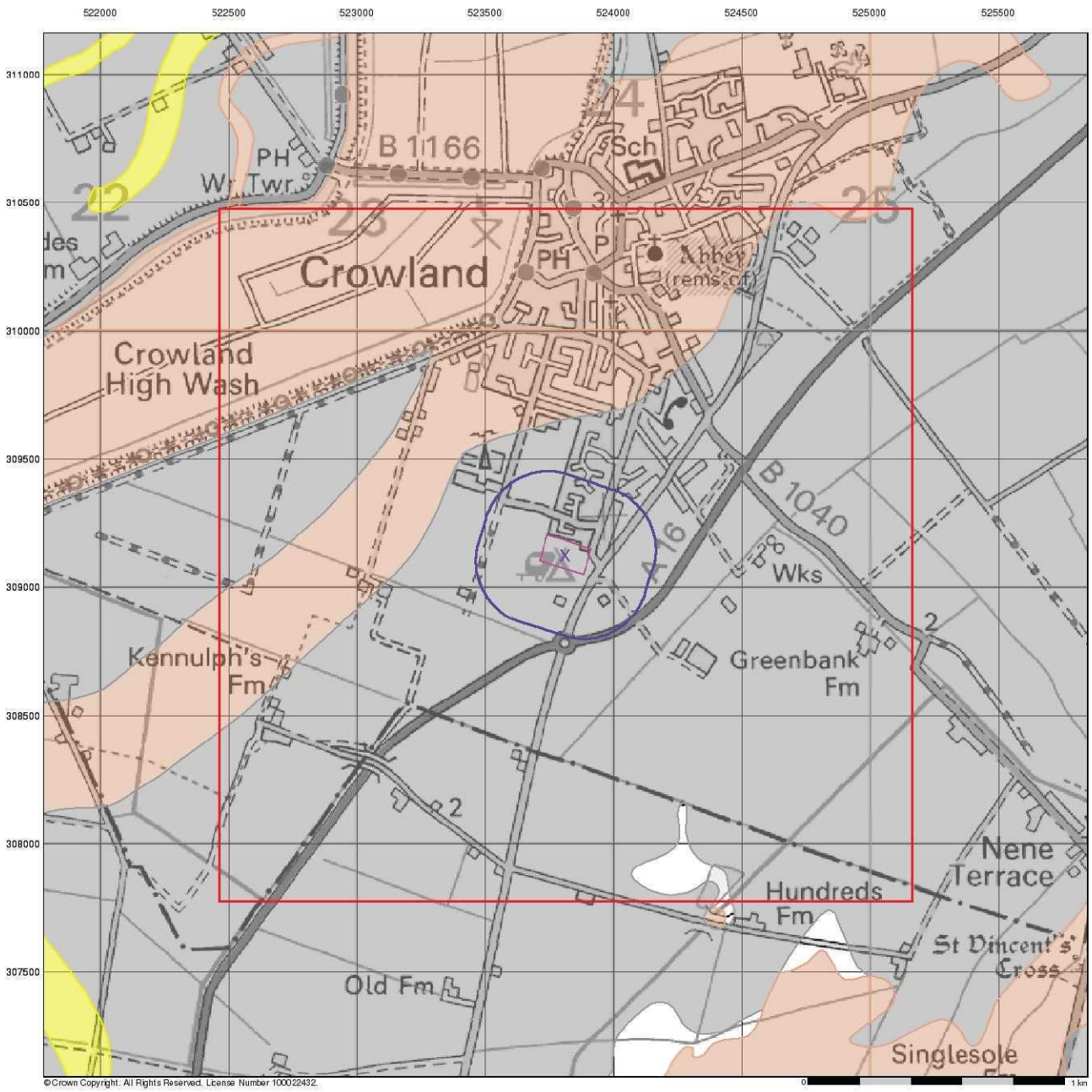
Order Details

Order Number:	63789118_1_1
Customer Ref:	D34155
National Grid Reference:	523810, 309130
Slice:	A
Site Area (Ha):	1.87
Search Buffer (m):	250

Site Details

Peterborough Road, Crowland

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Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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Superficial Aquifer Designation

General

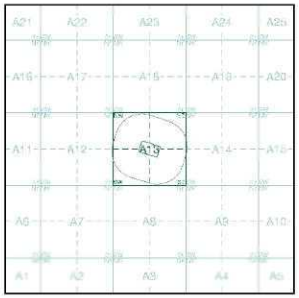
Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown

Site Sensitivity Context Map - Slice A



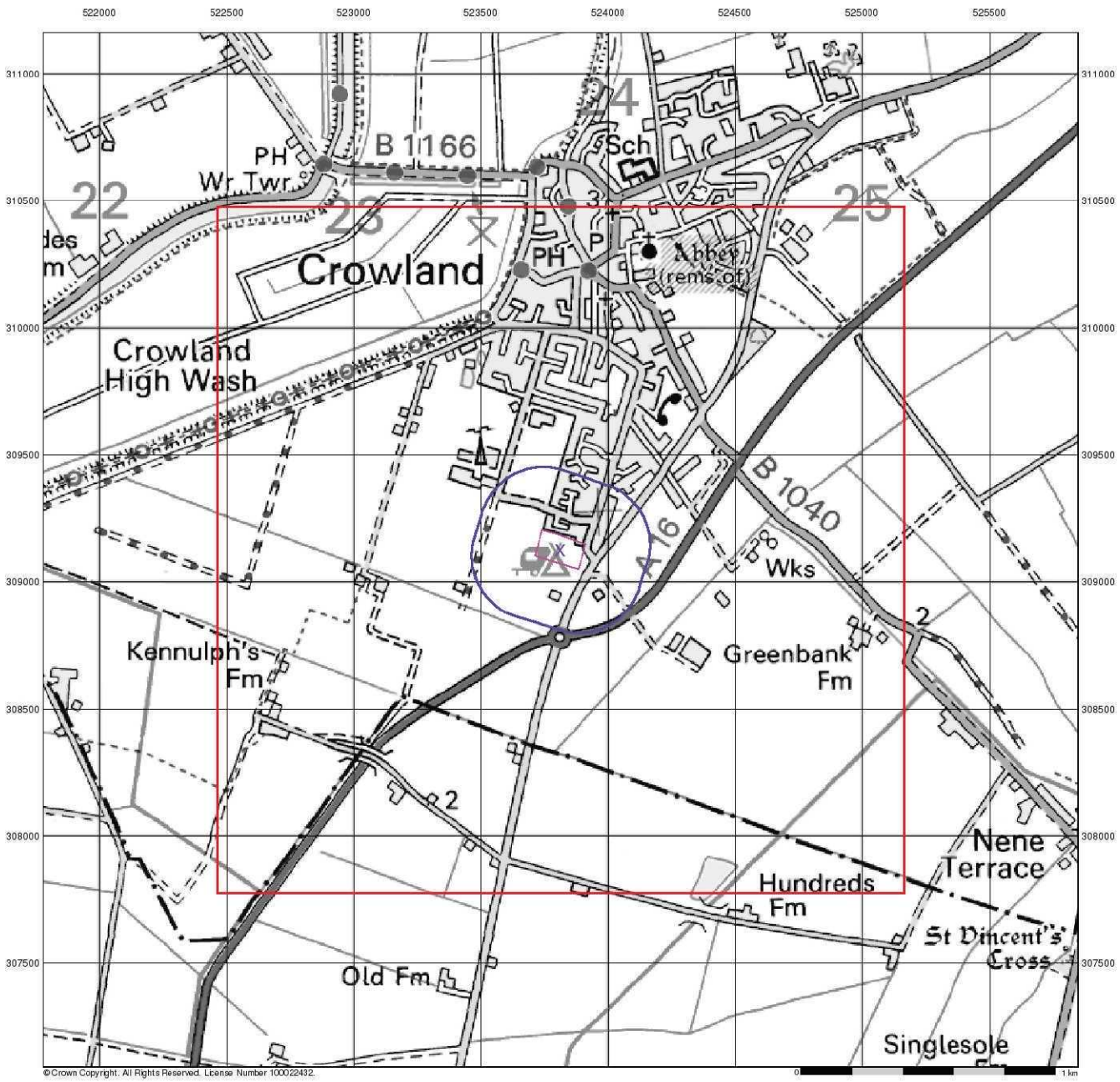
Order Details

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Search Buffer (m):	250

Site Details

Peterborough Road, Crowland

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Source Protection Zones

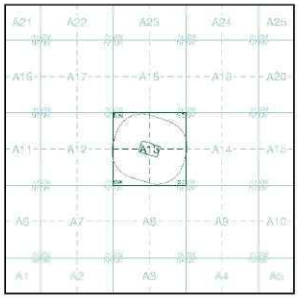
General

Specified Site | Specified Buffer(s) | Bearing Reference Point
Slice | Map ID

Agency and Hydrological

- Source Protection Zone I
- Source Protection Zone II
- Source Protection Zone III
- Zone of Special Interest
- Source Protection Zone Borehole

Site Sensitivity Context Map - Slice A



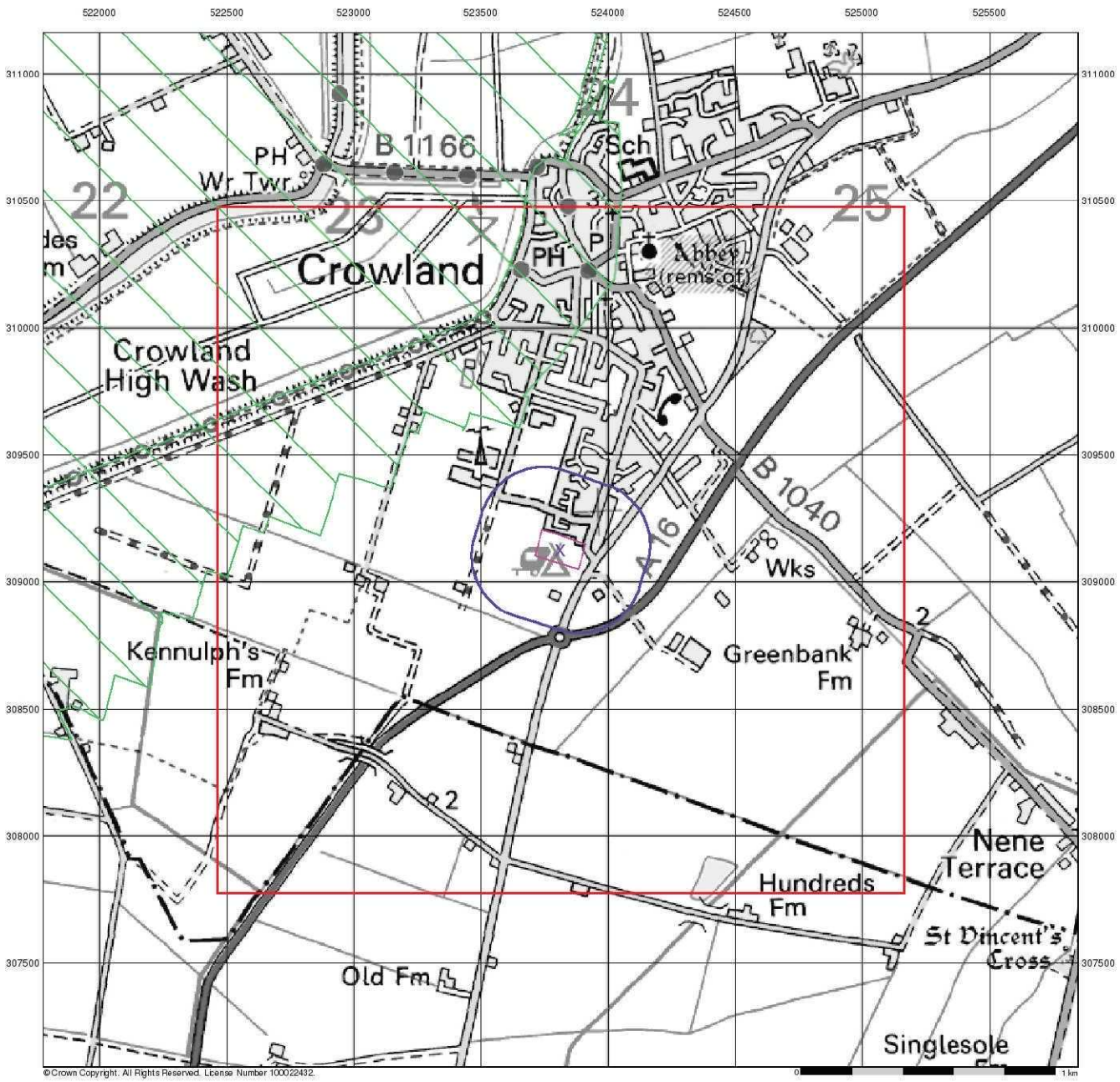
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Customer Ref:	D34155
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Sensitive Land Uses

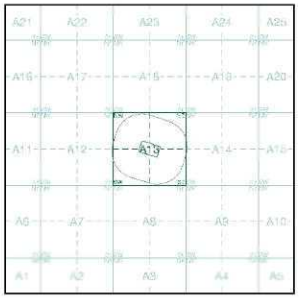
General

Specified Site | Specified Buffer(s) | Bearing Reference Point
Slice | Map ID

Sensitive Land Uses

- Area of Adopted Green Belt
- Area of Unadopted Green Belt
- Area of Outstanding Natural Beauty
- Environmentally Sensitive Area
- Forest Park
- Local Nature Reserve
- Marine Nature Reserve
- National Nature Reserve
- National Park
- Nitrate Sensitive Area
- Nitrate Vulnerable Zone
- Ramsar Site
- Site of Special Scientific Interest
- Special Area of Conservation
- Special Protection Area

Site Sensitivity Context Map - Slice A



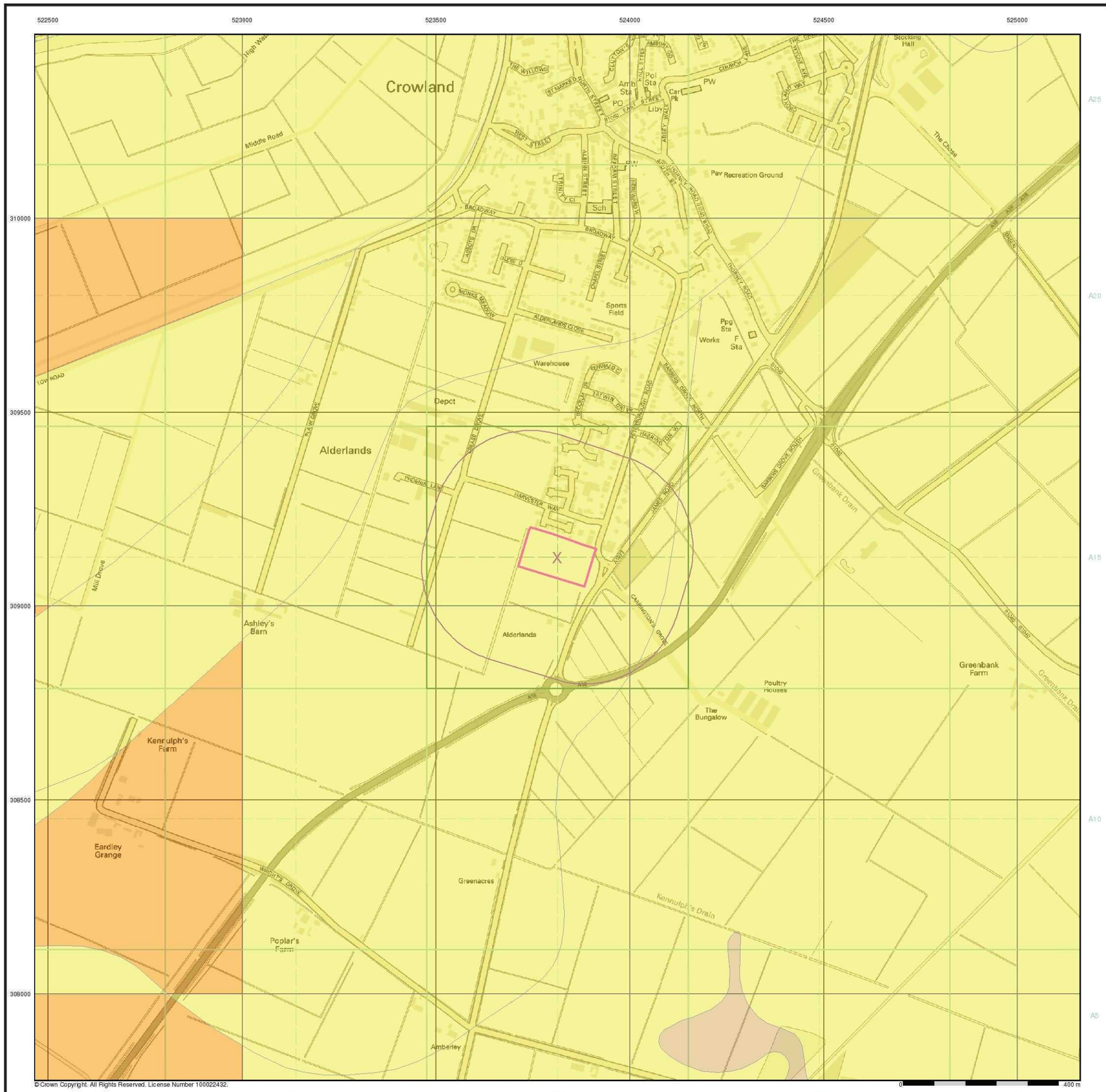
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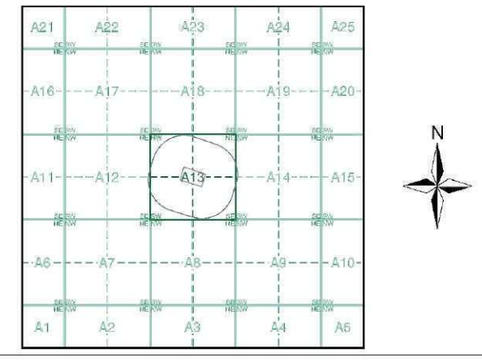
Specified Site | Specified Buffer(s) | X Bearing Reference Point

Estimated Soil Chemistry Arsenic

Arsenic Concentrations mg/kg

- < 15
- 15 - 25
- 25 - 35
- 35 - 45
- 45 - 60
- 60 - 120
- > 120

Estimated Soil Chemistry Arsenic - Slice A



Order Details

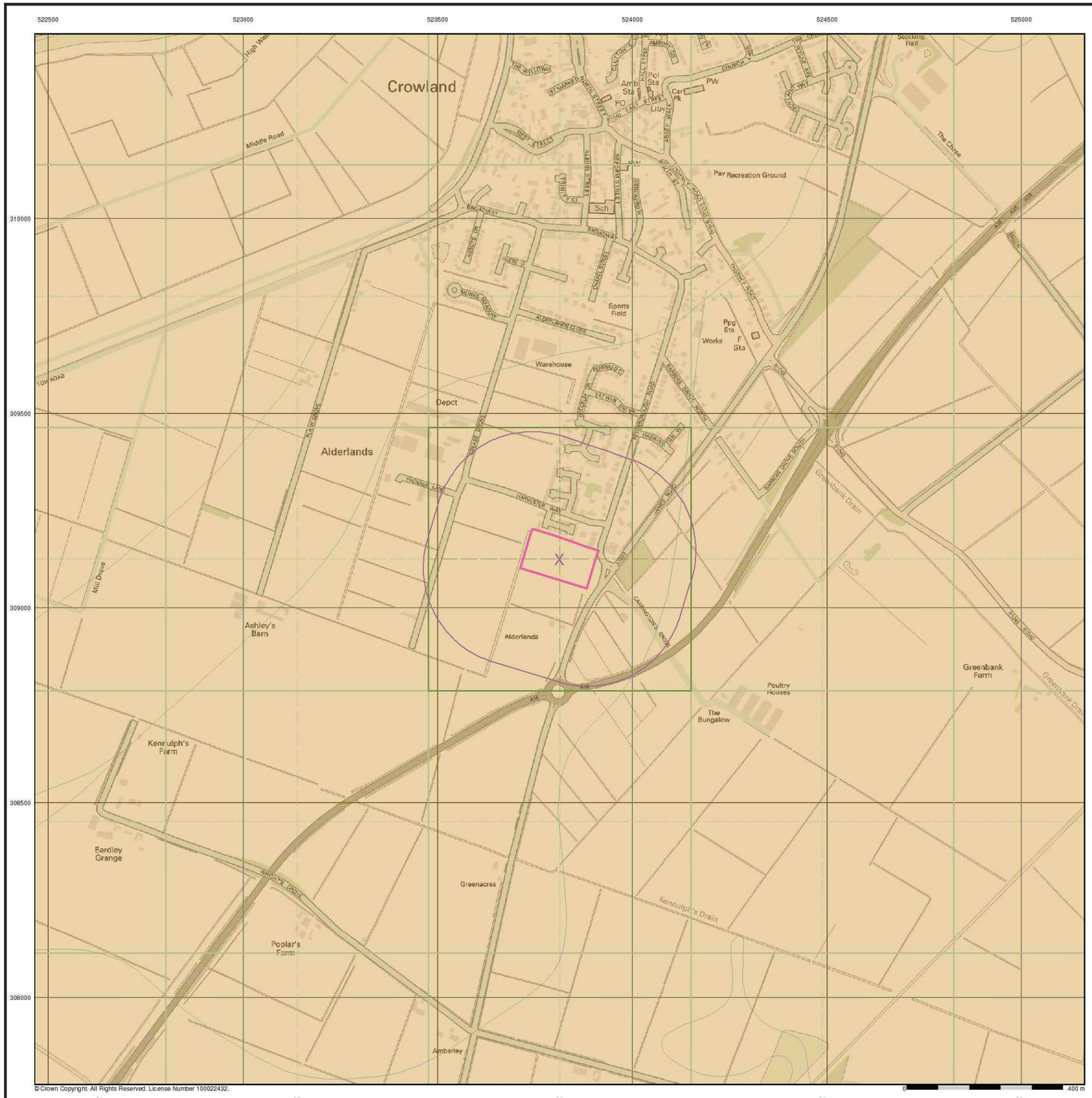
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General

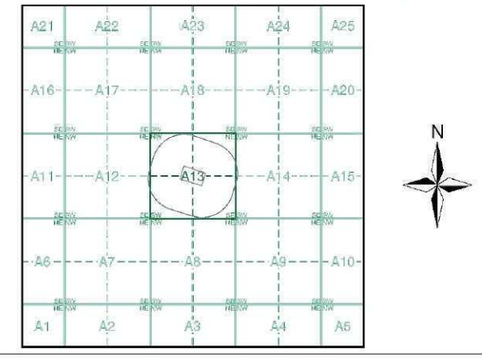
Specified Site | Specified Buffer(s) | X Bearing Reference Point

Estimated Soil Chemistry Cadmium

Cadmium Concentrations mg/kg

- < 1.8
- 1.8 - 2.2
- 2.2 - 3.0
- > 3.0

Estimated Soil Chemistry Cadmium - Slice A



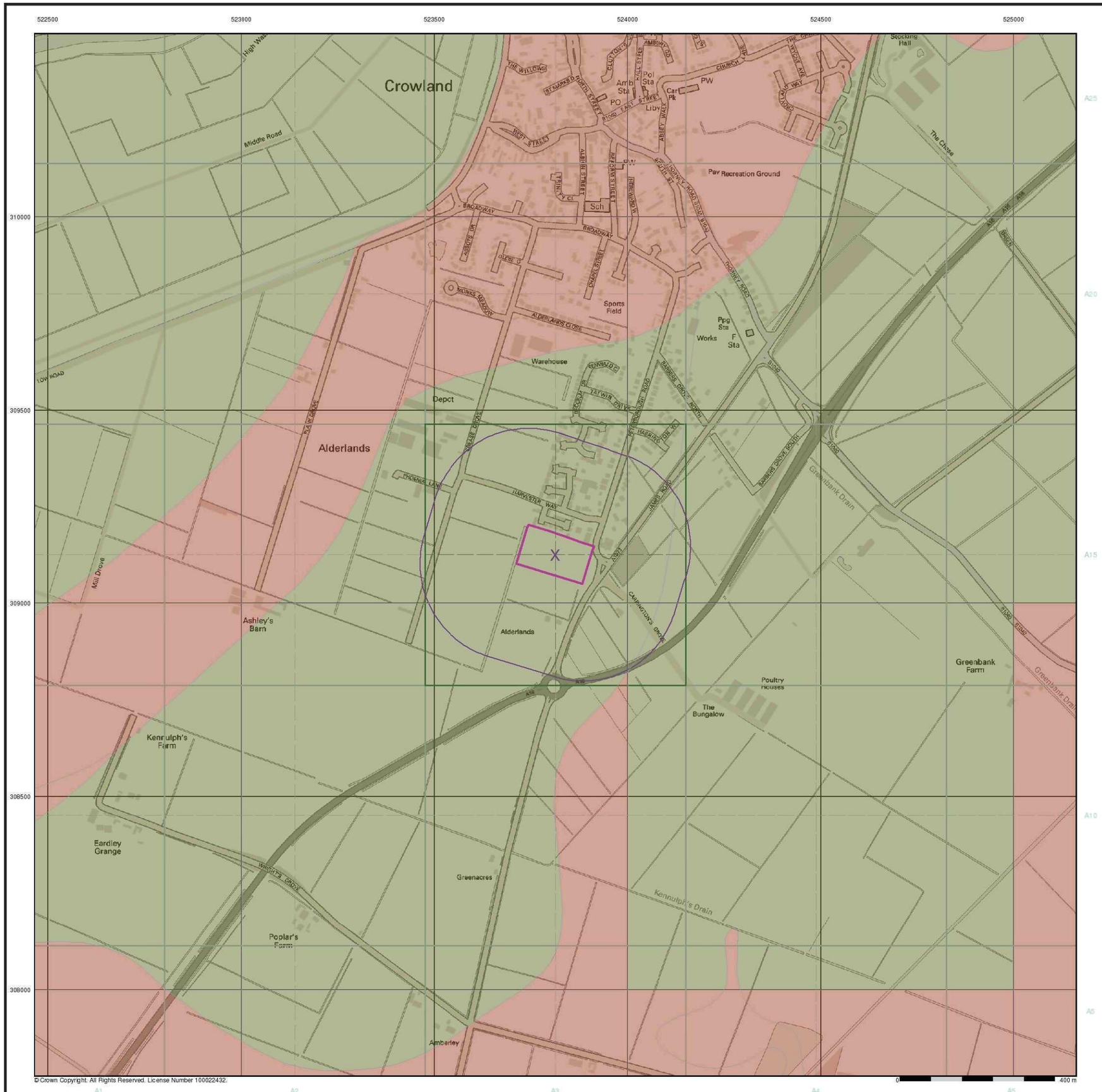
Order Details

Order Details:	63789118_1_1
Customer Ref:	D34155
National Grid Reference:	523810, 309130
Slice:	A
Site Area (Ha):	1.87
Search Buffer (m):	250

Site Details

Peterborough Road, Crowland

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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General

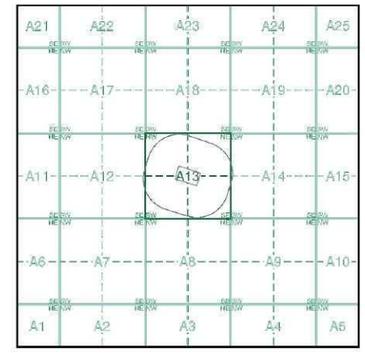
Specified Site | Specified Buffer(s) | X Bearing Reference Point

Estimated Soil Chemistry Chromium

Chromium Concentrations mg/kg

- < 20
- 20 - 40
- 40 - 60
- 60 - 90
- 90 - 120
- 120 - 180
- > 180

Estimated Soil Chemistry Chromium - Slice A



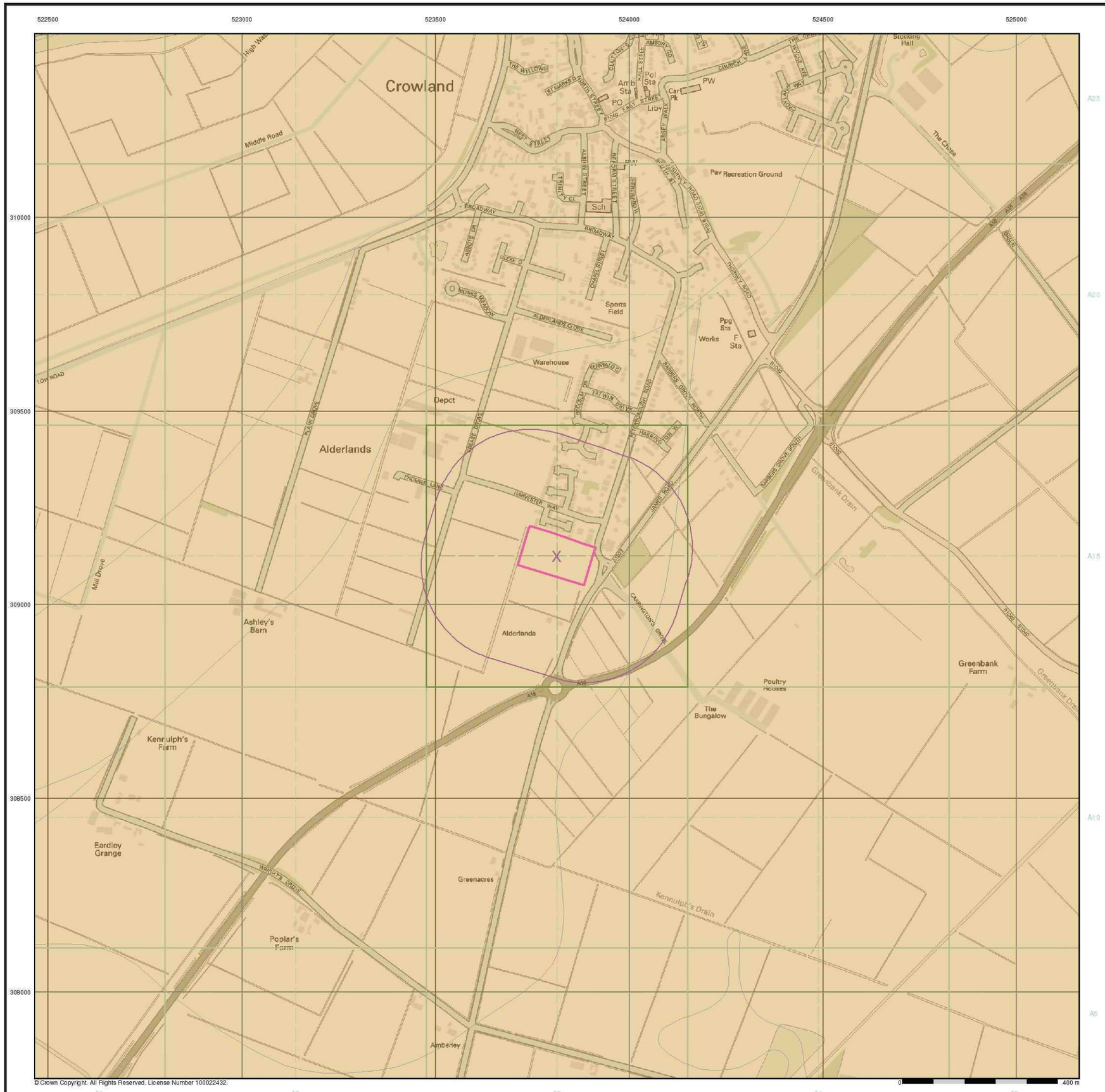
Order Details

Order Details:	63789118_1_1
Customer Ref:	D34155
National Grid Reference:	523810, 309130
Slice:	A
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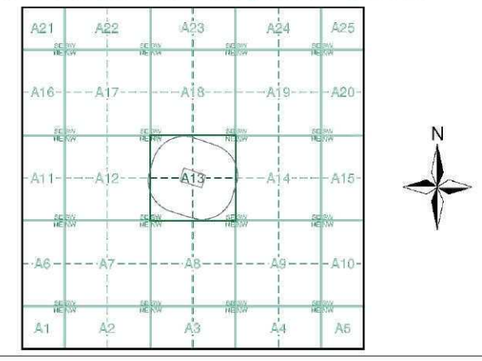
Specified Site | Specified Buffer(s) | X Bearing Reference Point

Estimated Soil Chemistry Lead

Lead Concentrations mg/kg

- < 150
- 150 - 300
- 300 - 600
- 600 - 900
- > 900

Estimated Soil Chemistry Lead - Slice A



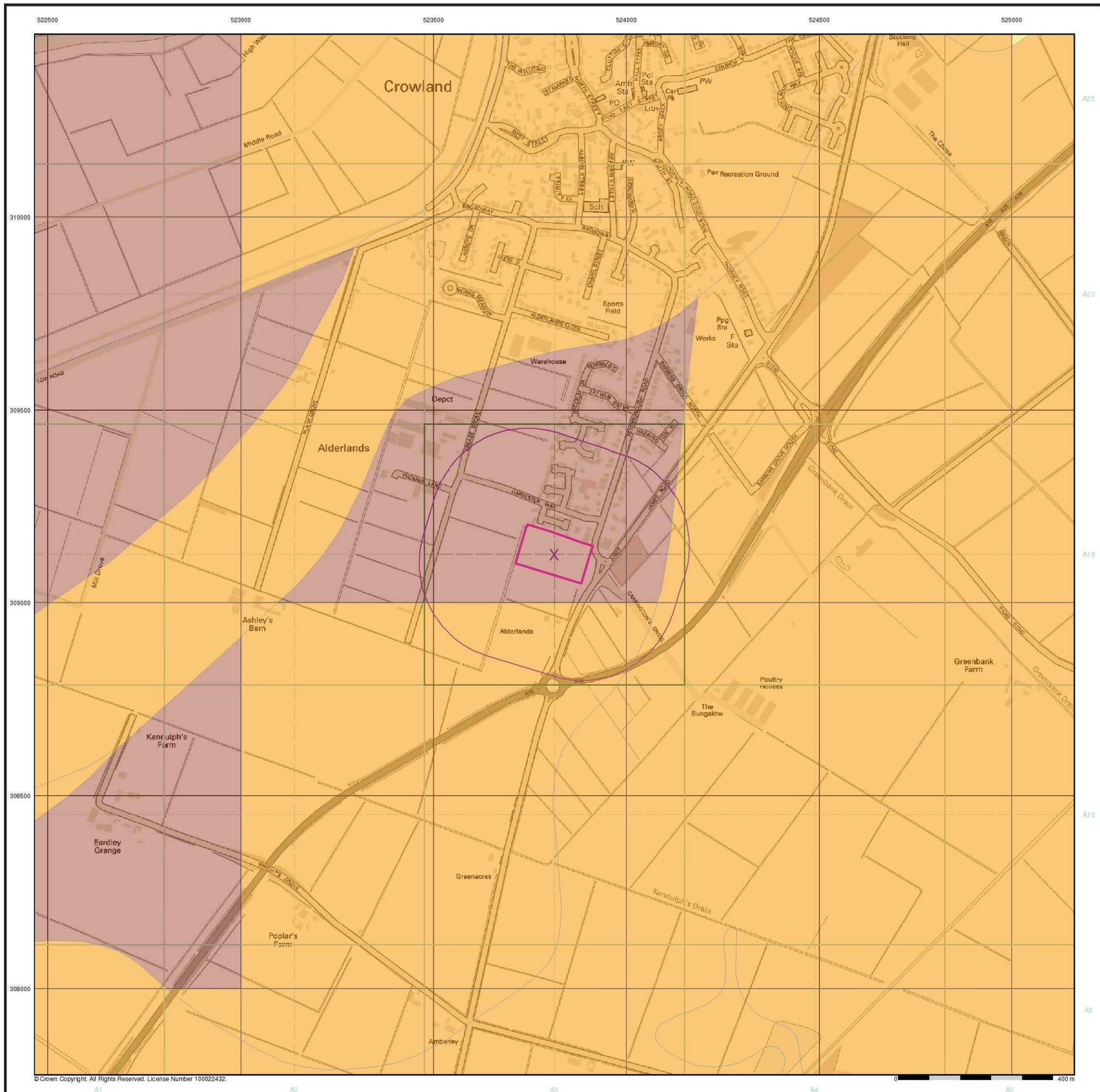
Order Details

Order Details:	63789118_1_1
Customer Ref:	D34155
National Grid Reference:	523810, 309130
Slice:	A
Site Area (Ha):	1.87
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General

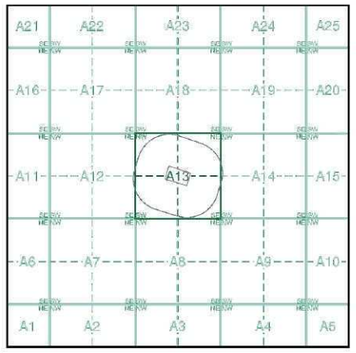
Specified Site | Specified Buffer(s) | X Bearing Reference Point

Estimated Soil Chemistry Nickel

Nickel Concentrations mg/kg

- < 15
- 15 - 30
- 30 - 45
- 45 - 60
- 60 - 80
- 80 - 100
- > 100

Estimated Soil Chemistry Nickel - Slice A



Order Details

Order Details:	63789118_1_1
Customer Ref:	D34155
National Grid Reference:	523810, 309130
Slice:	A
Site Area (Ha):	1.87
Search Buffer (m):	250

Site Details

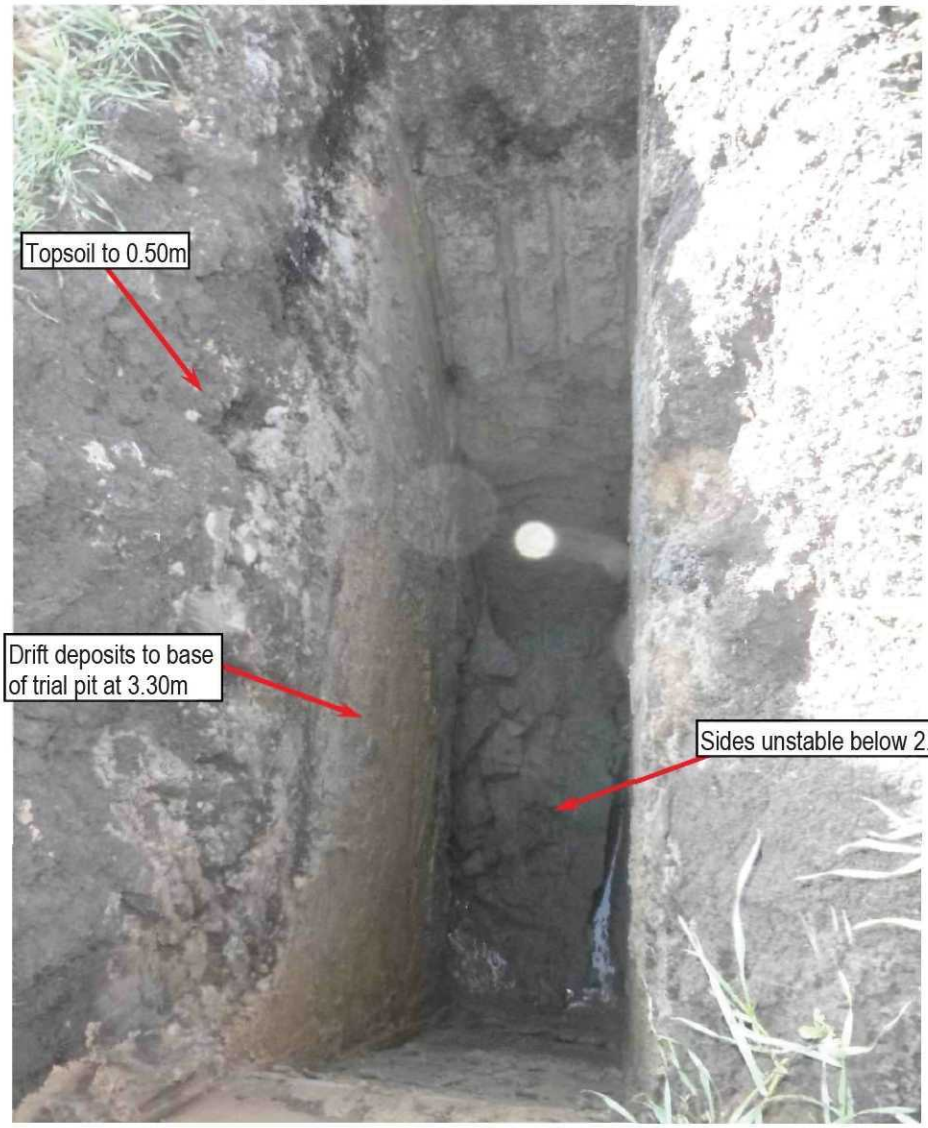
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APPENDIX X

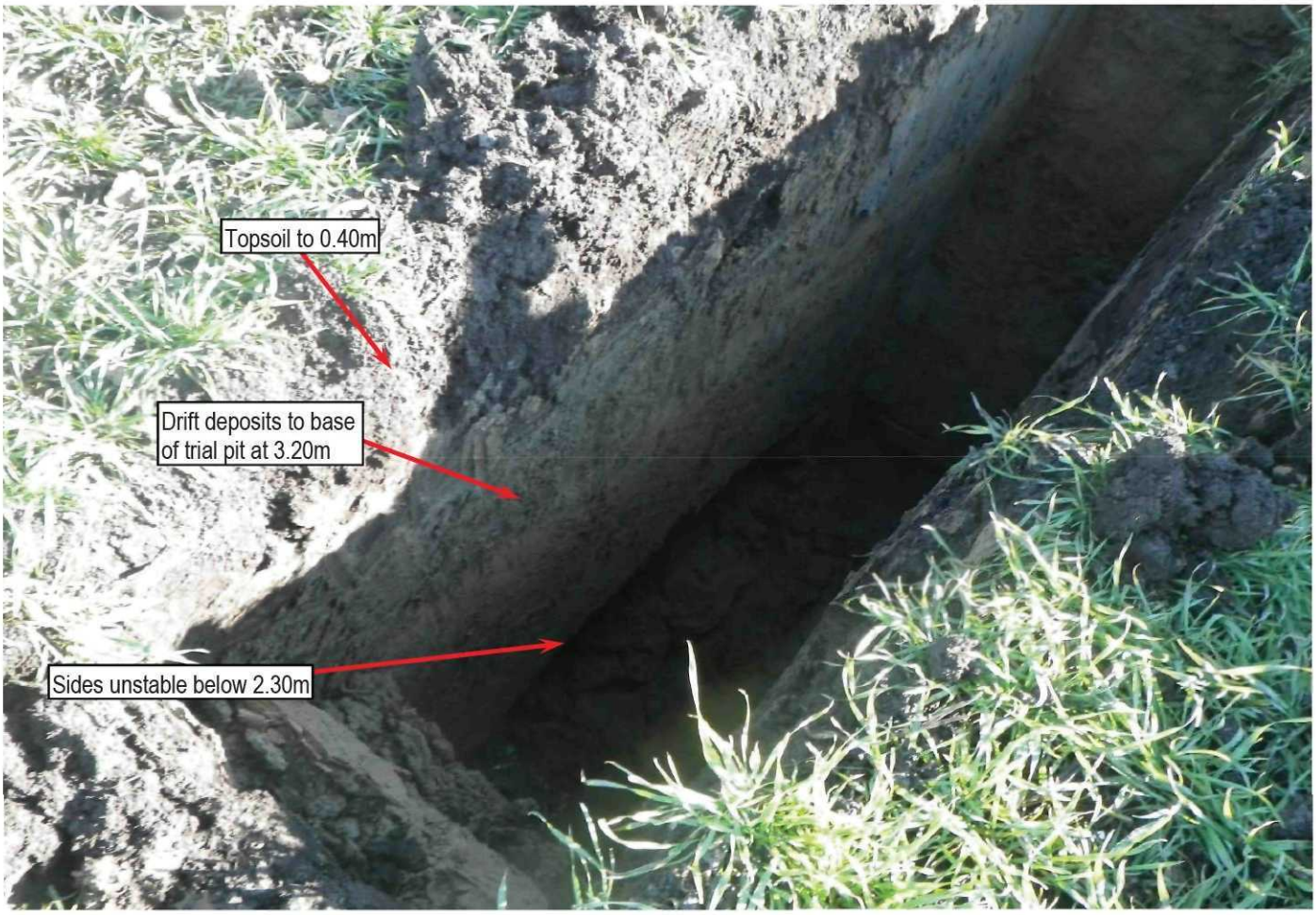
Plates
(Plate Nos. 1 – 6)





Project No.	D34155	Drawn	CEH
Client	Ashley King (Developments) Ltd	Checked	SS
Project	Peterborough Road Crowland	Approved	SS
		Scale	NTS
		Date Drawn	07/04/2015
Title	Trial Pit TP1 - Completed Excavation and Arisings	Rev.	
		Plate No.	1

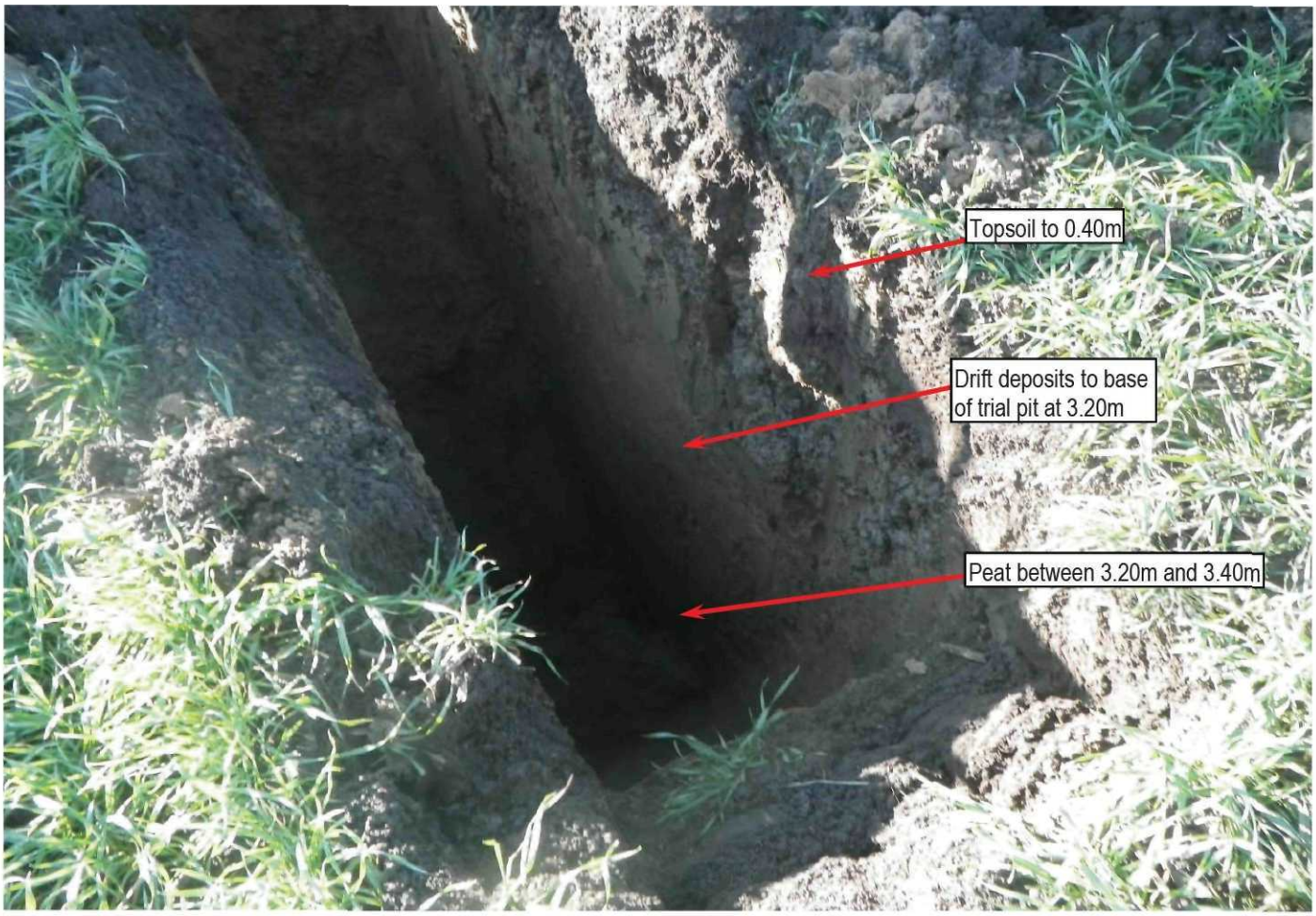
GeoDyne





Project No.	D34155	Drawn	CEH
Client	Ashley King (Developments) Ltd	Checked	SS
Project	Peterborough Road Crowland	Approved	SS
		Scale	NTS
		Date Drawn	07/04/2015
Title	Trial Pit TP2 - Completed Excavation and Arisings	Rev.	
		Plate No.	2

GeoDyne





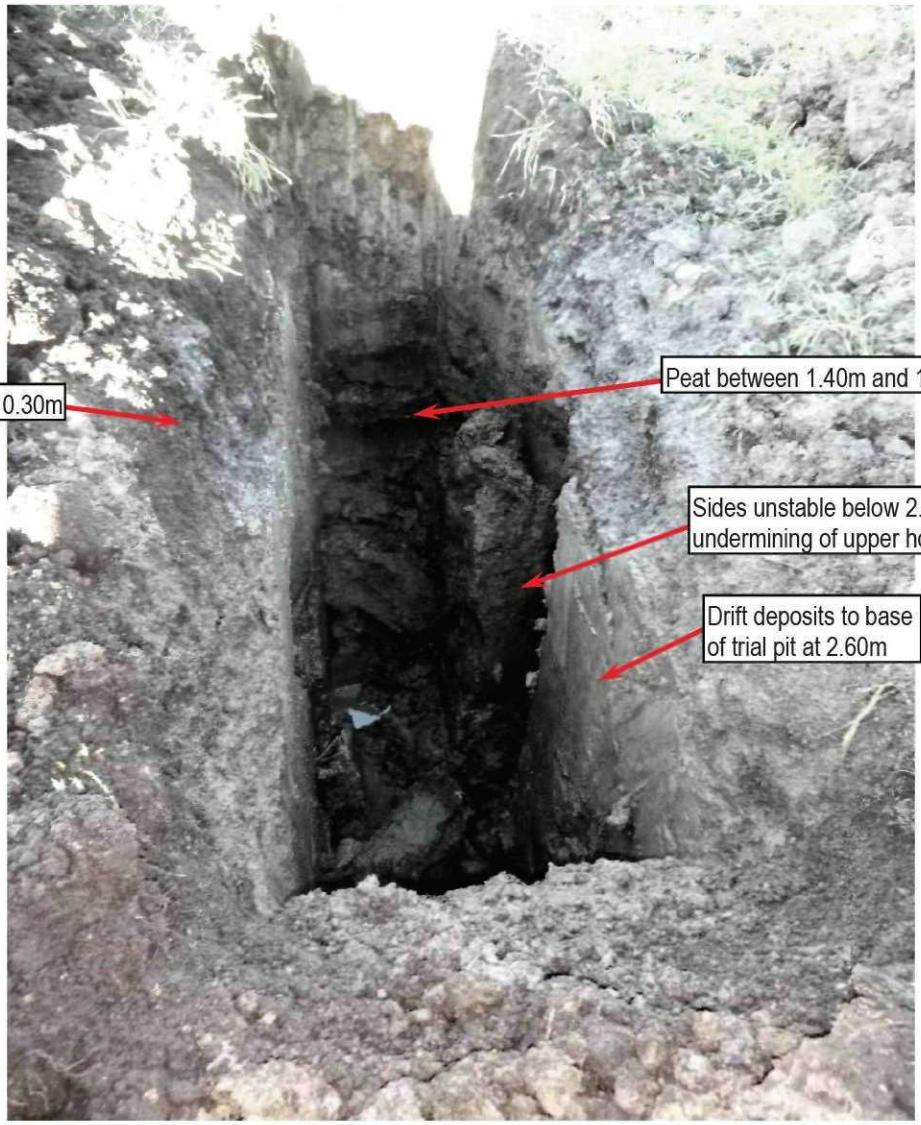
Project No.	D34155	Drawn	CEH
Client	Ashley King (Developments) Ltd	Checked	SS
Project	Peterborough Road Crowland	Approved	SS
		Scale	NTS
		Date Drawn	07/04/2015
Title	Trial Pit TP3 - Completed Excavation and Arisings	Rev.	
		Plate No.	3

GeoDyne



Project No.	D34155	Drawn	CEH
Client	Ashley King (Developments) Ltd	Checked	SS
Project	Peterborough Road Crowland	Approved	SS
		Scale	NTS
		Date Drawn	07/04/2015
Title	Trial Pit TP4 - Completed Excavation	Rev.	
		Plate No.	4

GeoDyne





Project No.	D34155	Drawn	CEH
Client	Ashley King (Developments) Ltd	Checked	SS
Project	Peterborough Road Crowland	Approved	SS
		Scale	NTS
		Date Drawn	07/04/2015
Title	Trial Pit TP7 - Completed Excavation and Arisings	Rev.	
		Plate No.	5

GeoDyne





Project No.	D34155	Drawn	CEH
Client	Ashley King (Developments) Ltd	Checked	*SS*
Project	Peterborough Road Crowland	Approved	*SS*
		Scale	NTS
		Date Drawn	07/04/2015
Title	Samples Recovered from Boreholes BH2 and BH3	Rev.	
		Plate No.	**6**

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APPENDIX XI

Conditions & Limitations

Conditions & Limitations

Phase I Desk Studies

1. Works undertaken to provide the basis of the Phase I Desk Study report comprise a review of information available from a number of sources/parties (potentially also including the Client) together with a walk over of the site (where applicable and included within the quotation). The opinions given in the Phase I Desk Study are based on the information available from third parties/sources that has been obtained within the available timeframe. GeoDyne Limited assumes all third party information to be true and correct and therefore cannot accept liability for the accuracy of such information supplied.

2. Should additional information become available that may affect the comments and opinions made within the Phase I Desk Study, GeoDyne Limited reserves the right to review such information and make modifications to comments/opinions as appropriate.

3. It should be borne in mind that a Phase I Desk Study collates available information to generate a conceptual model of the site. The actual geotechnical and environmental considerations can only be fully quantified by intrusive investigation works to confirm the accuracy of the conceptual site model.

Phase II Intrusive Investigations

1. Our quotation assumes that access to the site will be arranged by others at no cost to ourselves.

2. We have assumed that free access is available throughout to the entire site and that works can be undertaken during a single mobilisation. Where restricted access is encountered, or where additional unscheduled mobilisations are required, additional costs may be incurred to the client.

3. We have assumed that all available information relating to buried services will be supplied by the Client at no cost to ourselves. No responsibility will be accepted for damage to underground services that have not been brought to our prior attention by the Client.

4. All excavations/boreholes will be backfilled with compacted arisings upon completion, with any excess arisings left proud of ground levels. Excess arisings will not be removed from the site unless specifically requested by the Client. Where we are requested to remove excess arisings, all associated costs will be passed to the Client.

5. We will attempt to leave the site in a clean and tidy state, however, it must be understood that some disturbance of the site is unavoidable during intrusive works.

6. Exploratory holes are positioned approximately on site by GeoDyne Limited. Should the client require precise locations of all exploratory points, additional fees will be incurred. It must be borne in mind that backfilled trial pits can create 'soft spots', therefore, should the Client wish to designate 'no dig' zones, for example under the footprint of proposed structures, these must be brought to our attention prior to commencement of works.

7. Groundwater observations relate to conditions encountered at the time of investigation. It must be understood that groundwater levels may vary as a result of recent climatic conditions or seasonal variation.

8. Trial pits and boreholes examine only a small proportion of the total site area. No liability can be accepted for conditions not revealed in exploratory holes, particularly between positions. All extrapolations of available data are given in good faith.

Payment

1 Payment terms are strictly 28 days from the invoice date.

2 Prior to commencement of works, we require receipt of formal written instruction from the party accepting full financial responsibility for the work. In the absence of such an instruction, we would expect the instructing Consulting Engineers/Architects to accept full financial responsibility for the works.

3 Receipt of instruction to commence work shall be taken as acceptance and compliance of the foregoing conditions.

Liability

1. GeoDyne Limited offer £5,000,000.00 Professional Indemnity Insurance (in aggregate over the year). This shall be the limit of our liability for works undertaken. No individual liability shall be implied to, or accepted by, any employee for works undertaken for and on the behalf of GeoDyne Limited.