Phase I Geo-Environmental Desk Study

Land off Worlds End Road
Tydd St Marys
Spalding
PE13 5QW

Prepared for:

R K Wilson Builders Ltd
Sandpits Farm
Wisbech Road
Long Sutton
Spalding
PE12 9AQ

EPS Project Reference:	UK18.4095
Date Issued:	9th July 2018
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LAND OFF WORLDS END ROAD

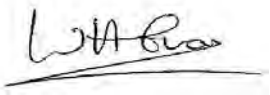
NON-TECHNICAL CLIENT SUMMARY

This report presents the findings of a Phase I Geo-Environmental Desk Study which was carried out to identify potential contamination from previous or current uses of the site and surrounding area and to provide an initial assessment of geological and geotechnical aspects of the site and how the proposed development or surrounding environment might be affected.

- The site is occupied by several buildings previously used as an agricultural farmyard with evidence of above ground tanks also noted. Development proposals include change of use to five residential properties with associated domestic garden areas.
- Ground conditions are indicated to comprise Tidal Flat Deposits overlying Ampthill Clay, neither of which are designated as aquifers of high resource potential and the site does not lie in a source protection zone for groundwater abstraction.
- Historical mapping indicates that the site has been developed since the late 1800's, with gradual construction of buildings associated with the farmyard.
- Given the historical and current use of the site, there is potential for contamination to be present, which could pose a risk to the health of future site users and construction workers. Additionally, potential risks to groundwater could not be discounted. On this basis, it has been necessary to recommend further investigation in the form of shallow soil sampling, in order to determine the quality of shallow soils.
- It is recommended that a copy of this report should be provided to the Environmental Health department of South Holland District Council so that the information may be used to support planning proposals for the site.

By their very nature, the above bullet points represent a simplified summary of our work and should not be relied upon to form the basis for key decisions for the proposed development. A full picture is provided in the following report, or alternatively give us a call and we'll talk you through it.

Project Reference:	UK18.4095
Title:	Phase I Geo–Environmental Desk Study Land off Worlds End Road
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Date:	9th July 2018
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Where ground investigations have been conducted, these have been limited to the level of detail required for the site in order to achieve the objectives of the investigation.

The report has been written, reviewed and authorised by the persons listed above. It has also undergone EPS' quality management inspection. Should you require any further assistance regarding the information provided within the report, please do not hesitate to contact us.

The National Planning Policy Framework 2012 requires a competent person to prepare site investigation information, which is defined as a person with a recognised relevant qualification, sufficient experience in dealing with the type(s) of pollution or land instability, and membership of a relevant professional organisation. EPS considers that it fulfils these criteria and would welcome any request for staff CVs or case studies to demonstrate it.

As stated within DEFRA's Contaminated Land Statutory Guidance (2012), with any complex risk assessment it is possible that different suitably qualified people may reach slightly different conclusions when interpreting the same information. EPS recognises this and considers the conclusions presented within this report to be robust and appropriate but input from the Local Authority and their judgement in line with this guidance would still be welcomed.

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1 INTRODUCTION

In June 2018, Environmental Protection Strategies Ltd (EPS) was commissioned by R K Wilson Builders Ltd. to complete a Phase I Geo-Environmental Desk Study at Land off Worlds End Road, Tydd St Marys, Spalding, PE13 5QW ('the site'); see Figure 1.

This work was commissioned in order to support discharge of a planning condition (Condition 7) relating to potential contamination and associated with development proposals which are understood to include change of use from a disused farm to five residential properties with associated domestic garden areas, under the South Holland District Council Planning Reference: H21-0859-16.

This report presents the findings, conclusions, and recommendations of the Phase I Desk Study undertaken for the site as instructed.

1.1 Background

A Desk Study comprises the first stage of any geo-environmental assessment, the purpose of which is to determine what potentially contaminative activities may have occurred at the property or the surrounding area which may pose an environmental or geological risk to site users, the surrounding environment or proposed development, either at present or in the future.

The method used in this investigation to assess the environmental risk posed is based on the concept of 'contaminant linkage', which considers the following three factors:

Source	The location from which an environmentally hazardous / contaminative substance is, (or was,) derived.
Receptor	An environmentally sensitive object or condition e.g. person, property, controlled water, or ecological system, which may be present now or in future.
Pathway	A route or mechanism via which a source could come into contact with a receptor to cause significant harm.

If all three factors are identified, there is the potential for a 'contaminant linkage' to be active, which could result in significant harm being caused to the environment or human health.

1.2 Objectives

The purpose of this desk study is to evaluate the potential contaminant linkages which may be active at the site in its current condition, or could become active in future, and to determine if any action is required to investigate them further or to break them.

This is achieved by carrying out the following activities:

a) Examining the site history - late 1800s to present day, through collection of historical maps of the area, site records, records held by relevant local authorities, the Environment Agency and review of other information databases.
b) Characterising the site's environmental and geological sensitivity through examination of existing geological, hydrogeological, topographical, and historical maps and aerial photographs of the area.

c) Identifying Potential Areas of Concern (PAOCs) through a combination of historical map and data review and site inspection together with interview of key site personnel.
d) Consideration of any future plans for the site and the effects any proposed changes may have on contaminant linkages over time.
e) Development of a site conceptual model and preliminary risk assessment to determine the potential risks posed by the site and make recommendations for any further work that may be required and to ensure suitability for use and safe development in accordance with the *Model Procedures for the Management of Land Contamination* - Contaminated Land Report 11 and the *National Planning Policy Framework.*

1.3 Scope of Work

To perform an exploratory assessment of the site in accordance with the principles and requirements of DEFRAs '*Contaminated Land Statutory Guidance*' (2012), BS10175 –'*Investigation of Potentially Contaminated Sites*', BS5930:2015 *'Code of practice for ground investigations'* and BS EN 1997 '*Geotechnical Design*', the following tasks were undertaken:

Desk Study:

- Collection of site records.
- Study of existing geological, hydrogeological and historical maps of the area.
- Consultation of environmental databases.
- Review of proposed development plans.
- Development of a Conceptual Site Model (CSM) and Preliminary Risk Assessment.

1.4 Project Limitations and Constraints

The purpose of this report is to present the findings of a Phase I Geo-Environmental Desk Study conducted at the location(s) specified. When examining the data collected from the investigations made during the assessment, EPS makes the following statements:

This report does not include specific investigation for the presence of either Potential Asbestos Containing Material (PACM) or Japanese Knotweed at the subject site however, if obvious evidence of either is observed during EPS site walkover, details will be provided in this report. Specialist contractors should be commissioned to make detailed assessments and recommendations if these materials are suspected.

2 GEO-ENVIRONMENTAL SETTING

The following section provides a summary of the information collected in relation to the site location and history.

2.1 Site Location and Description

Detail	Description
Location	The site is located to the west of Worlds End Road, 0.5km southwest of Tydd St Mary, Lincolnshire.
National Grid Reference	543924, 318225
Topography	Approximately 3m above ordnance datum and levels appears to be generally flat.
Site Description	A walkover was undertaken on the 29th June 2018 with access gained from Worlds End Road to the east. The site was noted to comprise several buildings associated with a former farmyard. The main area was roughly square in shape and the aforementioned Worlds End Road formed the east boundary. The area was predominantly surfaced with grass although a gravel access track was found in the southeast corner with concrete hardstanding found within the on-site buildings. Various waste was seen across the site including brick, burnt materials, metal, rubber, topsoil and wood. The building in the southeast was constructed of brick walls on top of which potential asbestos containing material (PACM) formed a pitched roof. Anecdotal evidence provided by an on-site representative suggests this property was used for the storage of agricultural equipment and machinery. Either side of this structure was a red diesel tank and a water tank (both formed over a concrete bund and base) with no evidence of spillages or staining noted. In the southwest were two units constructed of wooden walls on top of which corrugated tin formed pitched roofing. Further anecdotal evidence suggests the larger of the two was once used for the storage of potatoes whilst the other was used for the storage of agricultural equipment and machinery. Along the north boundary were three adjoining brick-built buildings (one of which was heavily damaged) on top of which corrugated tin, slate and terracotta tiles formed pitched roofing. Additional anecdotal evidence suggests these properties were previously used as stables but were now used for the storage of hay and various agricultural equipment. Towards the centre east of the site was the remains of a former brick-built farmhouse and adjoining storage unit constructed of brick and a flat roof comprising PACM. Vegetation comprised a number of sporadically placed small to medium sized shrubs towards the centre of the site as well as several semi-mature to mature trees within the gardens of residential properties beyond the northern border. The remainder of the site to the south and west appeared to be occupied by crop.

Detail	Description
Surrounding Land Use	The site is surrounded by agricultural fields to the east (beyond Worlds End Road), south and west with several residential properties found immediately north along Hix's Lane within the village of Tydd St Mary.

A plan showing the site location is provided as Figure 1, the current site layout is detailed on Figure 2 and an aerial photograph is included as Figure 3. Selected site photographs are included as Appendix A, an indicative proposed development area plan as Appendix B and relevant extracts of a Landmark Envirocheck report are included as Appendix C.

2.2 Environmental Setting

The following details are taken from the Envirocheck report.

<table>
<tr><th>Detail</th><th colspan="2">Description</th></tr>
<tr><td>Geology</td><td colspan="2">Geological mapping indicates the underlying ground conditions to comprise superficial Tidal Flat Deposits overlying bedrock of the Ampthill Clay Formation. Information on the site's geological context is included as Appendix D.

An historical borehole log formed in 1963 was acquired from the British Geological Survey (BGS) for a location approximately 700m southwest. The log reports topsoil extending to a depth of 0.3m overlying loose, fine multi-coloured sandy silt to 2.7m underlain by very loose, fine grey silty sand (organic) to 6.7m followed by medium dense fine grey sandy silt to 10.6m then compact fine grey silt to the maximum depth of the borehole at 12.2m. Groundwater was encountered at 2.1m. The historical borehole is also included in Appendix D.</td></tr>
<tr><td rowspan="9">Geological Hazards</td><td>Hazard</td><td>On Site Risk</td></tr>
<tr><td>Mining</td><td>Might not be affected</td></tr>
<tr><td>Collapsible Ground</td><td>No Hazard</td></tr>
<tr><td>Compressible Ground</td><td>Moderate</td></tr>
<tr><td>Ground Dissolution</td><td>No Hazard</td></tr>
<tr><td>Running Sand</td><td>Moderate</td></tr>
<tr><td>Landslide</td><td>Very Low</td></tr>
<tr><td>Shrinking/Swelling Clay</td><td>Low</td></tr>
<tr><td colspan="2">The closest BGS mineral site is recorded 390m northwest for the quarrying of common clay and shale.</td></tr>
<tr><td>Radon</td><td colspan="2">The BGS and Health Protection Agency (HPA) report entitled 'Indicative Atlas of Radon in England and Wales' (November 2007) shows the site to lie within a 1km grid section where the percentage of homes above the radon action level is between 0% and 1%. The joint Building Research Establishment Ltd (BRE) report entitled: 'Radon: Guidance on Protective Measures for New Buildings - 2007' reports that the site does not lie within an area where basic radon protection methods will need to be employed.</td></tr>
<tr><td>Hydrogeology</td><td colspan="2">Groundwater vulnerability maps for the area show that both the superficial Tidal Flat Deposits and underlying Ampthill Clay Formation are classified as Unproductive Strata and the site does not lie within a groundwater source protection zone.

There are no groundwater abstractions listed within a 1km radius. Groundwater vulnerability maps are included as Appendix E.</td></tr>
<tr><td>Hydrology</td><td colspan="2">The nearest surface water feature is an unnamed drain located 14m northwest that appears to be part of a wider drainage network.

The nearest surface water abstraction is reported 1.2km southwest and relates to private non-industrial amenity: make-up or top up water.</td></tr>
</table>

Detail	Description
	The nearest discharge consent is reported 107m northwest and relates to an unknown discharge onto land.
Flood Risk	Review of the EA flood zone map for the area indicates that the site lies within Flood Zone 3, which is defined within Table 1 of the technical guidance to the National Planning Policy Framework (NPPF) as '*the area with a high probability of flooding from rivers or the sea*'. It should be noted that the EA maps do not take into account flooding from other potential sources of floodwater, such as from poor drainage, or groundwater. Planning policy designates that all sites that lie within Flood Zone 3 require a site-specific Flood Risk Assessment to be undertaken prior to the submission of a planning application. An indicative flood zone map is included in Appendix E.

2.3 Landfill & Waste

The EA public database does not list any active or historical landfills within 500m.

There are no licensed waste management facilities, registered waste transfer, treatment or disposal sites listed within a 1km radius.

Several records of infilled ground are provided within 1km, the nearest of which is located 315m north and refers to the infilling of an unknown pit or quarry.

2.4 Industrial Land Use & Pollution

There is a total of five sites licensed for industrial activity within the surrounding 1000m, with only three of these being within 500m, the details of which are detailed below.

Land Use	Approximate Distance (Direction)	Status
Photocopiers	240m (NW)	Inactive
Cleaning Services - Domestic	326m (N)	Inactive
Office Equipment Manufacturers & Distributors	461m (NE)	Inactive

There are no fuel station entries listed within a 1km radius.

There are no sites licensed by the local authority, enforcement and prohibition notices or registered radioactive substances reported within a 1km radius.

2.5 Sensitive Land Use

There are no sensitive land uses reported within a 1km radius.

2.6 Site History

A summary of historical map data from 1887 to 2018 is provided below and copies of relevant historical maps and any others examined during the investigation are included in this report as Appendix F.

- Early mapping from the late 1800's to the early 1930's showed the site to be occupied by a number of buildings towards the northeast and southwest corners. The north-to-south trending Worlds End Road formed the east border and Henson House was found immediately north. Several residential dwellings were located beyond Hix's Lane in the north leading towards Rectory Road in the northeast. Around 140m southeast was Angle Farm with Worlds End Cottage mapped 225m southeast. In the larger area, Lowgate House was seen 325m southwest and a number of properties existed 225m northwest along Hix's Lane. Beyond that, a clay pit and Minerva Farm was found 360m north and northwest respectively.
- The site and the surrounding area appeared to remain largely unchanged until the 1970's when the site appeared to resemble its current layout with the addition of two structures found towards the south. A Haulage Depot and Rectory Farm were located 180m northeast and a number of residential cottages were built adjacent in the northwest along Hix's Lane. Further afield a brickyard (cleared in place of residential dwellings off Willow Close in the late 1980's) was constructed next to Minera Farm in the northwest and allotment gardens occupied the land in the east beyond Worlds End Road.
- In the late 1980's and early to mid-1990's, residential development continued along Hix's Lane (immediately north) and Low Gate (275m northwest) with the construction of several units.
- An aerial photograph from 1999 appeared to show the site in its current layout, occupied by several buildings associated with a farmyard. The area was predominantly surfaced with grass (and some form of crop beyond the buildings in the south and west) although a gravel access track was found in the southeast corner. Along the northern border were three adjoining buildings (likely to have been used as stables) with the remains of a former property and a storage shed seen towards the centre east. In the centre south were three storage units and a pigsty was present in the centre north (as suggested by anecdotal evidence provided by an on-site representative).
- The site and surrounding area appeared to remain largely unchanged throughout the remainder of the historical period however a site walkover completed in 2018 found the previously described pigsty had been removed from the site.

3 CONCEPTUAL SITE MODEL & PRELIMINARY RISK ASSESSMENT

The following section provides a review of the contaminant linkages that may be active at the site through the process of a Preliminary Risk Assessment, whereby EPS have examined the potential sources that may be present as a result of historical and / or current site activities and where potential interaction between these sources and the identified human / environmental receptors may occur.

3.1 Source Characterisation

The following potential contaminant sources have been identified at the site and in the surrounding area:

Potential Source	Source Description	Principal Contaminants of Concern
Current / Historical Site Use	Fill material of unknown origin (Made Ground) used to level areas beneath the existing buildings and hardstanding.	ACM, Metals & PAH
	Suspected corrugated sheet bonded asbestos cement present within the fabric of the current buildings.	ACM
	Former use of the site as a farmyard.	ACM, Metals, PAH & TPH
	On-site above ground red diesel storage tank	TPH, PAH
	Evidence of burning.	PAH, Metals
Current & Historical Surrounding Land Use	Electricity substation located 175m northwest.	TPH, PAH, PCBs
	Infilled clay pit located roughly 360m north.	Landfill Gas (CH_4, CO_2)
	Current / historical agricultural, commercial and industrial land use of the surrounding area including allotment gardens, depots and manufacturers.	VOC, TPH, PAH

Notes:

PAH	Polycyclic Aromatic Hydrocarbons	ACM	Asbestos Containing Material
VOC	Volatile Organic Compounds	TPH	Total Petroleum Hydrocarbons
SVOC	Semi-Volatile Organic Compounds	PCB	Polychlorinated Biphenyls
CH_4	Methane	CO_2	Carbon Dioxide

3.2 Potential Receptors

A framework for the assessment of risks arising from the presence of contamination in soils has been produced by the Environment Agency and the Department for the Environment, Food and Rural Affairs (DEFRA) and is presented with the report: '*Using Science to Create A Better Place: Updated Technical Background to the CLEA Model* – Science Report SC050021/SR3'. This guidance document defines a series of standard land-uses, which form a basis for the development of an Environmental Conceptual Model.

The proposed development plan for the site includes change of use to five residential properties with associated domestic garden areas. Therefore, the most sensitive classification as defined within Science Report SC050021/SR3, has been considered as:

- Residential

In view of the environmental setting, current and potential future land use of the site and surrounding sites, the potential receptors for any contaminant impact are discussed below:

Receptor	Site Specific Description
Human	Future site users, site workers involved in the site redevelopment, and those working and living in the surrounding area have the potential to be at risk from exposure to potential contaminants of concern (CoCs).
Groundwater	The site is reported to be directly underlain by Tidal Flat Deposits overlying Ampthill Clay Formation which are both classified by the EA as Unproductive Strata and the site does not lie within a SPZ for nearby groundwater abstraction. Shallow groundwater has been identified through review of the historical borehole logs in the areas. Based on that groundwater beneath the site was considered as a potential receptor to site derived contamination.
Surface Water	The nearest surface water feature is an unnamed drain located 14m northwest that appears to be part of a wider drainage network. It is possible that site derived contaminants of concern may enter these watercourses by overland flow, migration through unsaturated soils or entering shallow surface drainage / historical land drainage which discharges to these drains, therefore surface waters must be considered as a sensitive receptor within the conceptual site model.
Flora and Fauna	The proposed development includes the provision of domestic garden areas. Some of the identified contaminants of concern are known to be phytotoxic and as such the potential for this impact should be considered.
Buildings & Infrastructure	Subsurface structures are likely to be present at the site which may be adversely affected by the potential presence of the identified contaminants of concern. These include concrete used in building foundations, buried potable water supply pipes and other service lines and pipes.
Adjacent Land	Adjacent land/properties including private residential dwellings may be at risk from potential site-derived contaminants.

3.3 Potential Pathways

Where contaminants may be present in soil, there are a number of potential pathways that enable human receptors to come into contact with or be exposed to them. The most direct pathways, considered under current UK legislation, can be summarised as follows:

- Direct ingestion of contaminated soil
- Ingestion of household dust
- Ingestion of contaminated vegetables
- Ingestion of soil attached to vegetables
- Dermal contact with household dust
- Inhalation of fugitive soil dust
- Inhalation of fugitive household dust
- Inhalation of vapours outdoors

- Dermal contact with contaminated soil
- Inhalation of vapours indoors

Clearly, not all of these potential pathways apply for every standard land-use; the simplest example for exclusions being a commercial / industrial site which is covered by concrete hardstanding. The concrete precludes the direct exposure of humans working at the site to any contaminated soils.

However, in addition to direct exposure pathways, a number of physical transport mechanisms / pathways may also exist at a site that allow remote or less accessible contaminants in soil or groundwater to reach human or environmental receptors both at a site and beyond the site boundary. These include the following:

- Downward and lateral movement of contaminants in soil either by gravity or through being 'leached' by percolating rainwater.
- Lateral migration of contaminants dissolved in groundwater.
- Direct seepage or leaching of contaminants from soil into subsurface drains or supply pipework.
- Volatilisation of contaminants from groundwater or unsaturated soils into buildings or outdoor air.

Through examination of the standard land use and environmental setting at each site, the presence of pathways and transport mechanisms described above must be considered when assessing whether a contaminant linkage may plausibly be active, and therefore be included in the conceptual site model.

3.4 Summary of Contaminant Linkages

Considering the site use and environmental setting, and the proposed land use; the plausible contaminant linkages that require further investigation are summarised in the following table:

Source	Pathway	Receptor
Contaminated soil	Direct contact and inadvertent ingestion by eating or smoking with dirty hands	Construction workers during redevelopment & site users
	Inhalation of fugitive dusts	Site users
	Direct uptake and / or adherence of contaminated soil to vegetation and subsequent ingestion	
	Ingress / diffusion through permeable potable water supply pipes	
	Direct uptake via root systems	Plants
	Leaching of contamination towards groundwater	Groundwater

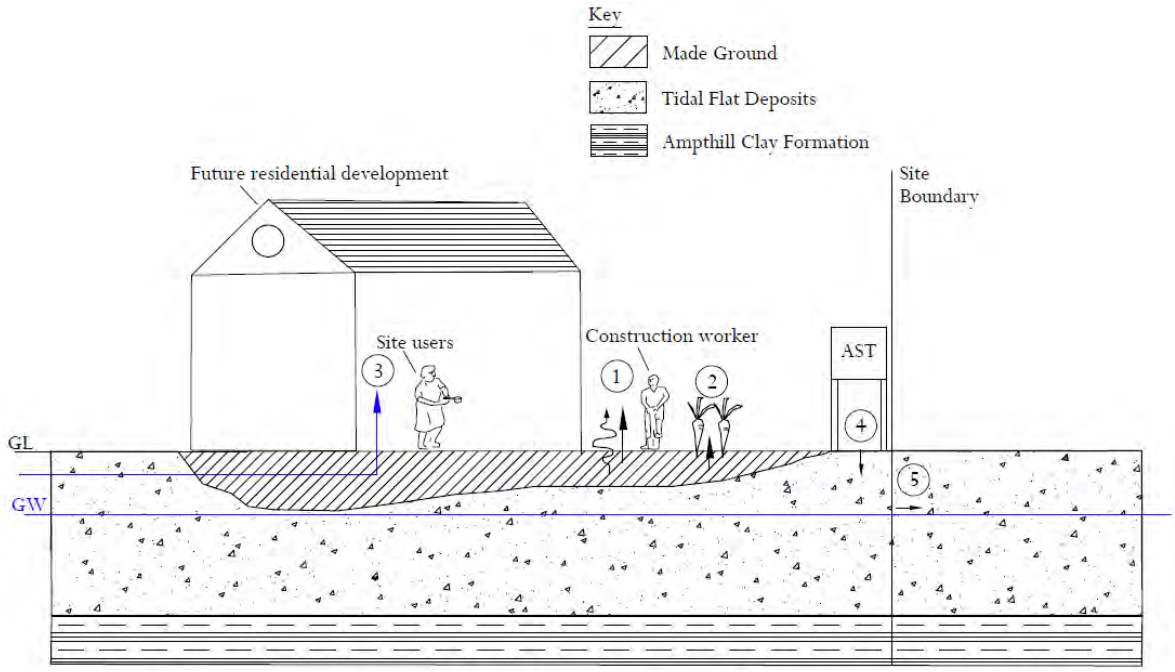
Source	Pathway	Receptor
Contaminated groundwater	Migration within dissolved phase	Surface water / off-site residents

The following comments are made with respect to contaminant linkages which have been considered through development of the conceptual model, but have not been concluded as 'plausible' – i.e. through which a significant possibility of significant harm could occur to an identified receptor:

- Contaminants including PAHs and Metals have been identified as contaminants of concern associated with the historical onsite made ground, however these contaminants are generally considered to be relatively immobile in the environment by virtue of their very low solubility and volatility. On this basis, plausible pathways by which these site derived contaminants could pose a significant risk to groundwater and / or nearby surface watercourses are not considered to be active.
- Whilst PACM and evidence of burning was encountered during the site walkover it is anticipated that this material will be cleared from site prior to the commencement of development activities.
- Whilst the majority of relatively modern electrical transformers do not contain insulation oils containing PCBs, the electricity sub-station identified 175m northwest may represent a potential source that could contain PCBs. However, given the limited environmental mobility of PCBs and that this sub-station appears to still be in use and maintained by EDF, this source is not considered to pose a plausible risk to future site users.
- Whilst a clay pit has been historically in-filled roughly 360m north, given the size, age, (and therefore likely nature of fill material) and distance located over 250m from the site, a plausible contaminant linkage is not recognised from the on-site migration of landfill gas.
- A number of commercial and industrial land uses are located in the surrounding area. However, given the distance and status of these land uses, the likely presence of low permeability clay soils and limited mobility of associated contaminants of concern in the environment, these sources are not considered to pose a significant risk to the proposed development.

The following diagram provides an illustration of the plausible contaminant linkages that may be active at the site and which may need further investigation or control to ensure safe development:

Land off Worlds End Road – Illustrative Conceptual Site Model



Potential Pathways:

1 Direct contact with / ingestion of soil & inhalation of fugitive dusts
2 Direct uptake via root systems and subsequent ingestion
3 Ingress / diffusion through permeable potable supply pipes
4 Vertical migration of contaminants in unsaturated soils
5 Off-site migration of contaminants in groundwater

4 GEOTECHNICAL GROUND MODEL

Geological records indicate the underlying geology to comprise Tidal Flat Deposits overlying bedrock of the Ampthill Clay Formation, although given the historical use, some areas of made ground are anticipated to be present at the surface. A conceptual geotechnical ground model is provided in the table below which assesses design elements, anticipated strata and ground conditions:

Element	Anticipated Strata	Parameter(s)	Anticipated Conditions
Foundations	Made Ground	Allowable Bearing Pressure	Not appropriate as a bearing strata
		Settlement	High sensitivity
		Volume Change	Depends upon the soil composition
	Tidal Flat Deposits	Allowable Bearing Pressure	<75kN/m^2
		Settlement	Moderate Sensitivity
		Volume Change	Moderate volume change potential
	Ampthill Clay Formation	Allowable Bearing Pressure	Maximum of 125kN/m^2
		Settlement	Moderate sensitivity / Long term consolidation under loading
		Volume Change	High volume change potential
Drainage	Made Ground	Permeability	Unlikely to be suitable for infiltration drainage
	Tidal Flat Deposits		
	Ampthill Clay Formation		
Concrete Grade	Made Ground	Grade	Low to moderate risk of high sulphate levels
	Tidal Flat Deposits		
	Ampthill Clay Formation		High risk of high sulphate levels

Potential Hazard	Comment
Trees & Vegetation	Vegetation comprised a number of sporadically placed small to medium sized shrubs towards the centre of the site as well as several semi-mature to mature trees within the gardens of residential properties beyond the northern border. The remainder of the site to the south and west appeared to be occupied by some of crop.
Below Ground Structures	The site has been previously developed for use as a farmyard, therefore foundations will still be present. The presence of underground utilities including electric and water should also be considered.
Excavation Stability	Whilst excavations in the cohesive soils may remain stable for short periods during construction, the stability of reworked soils or disturbed ground arising from removal of below ground structures and granular soils should not be relied upon.
Slopes	No slopes, embankments or cuttings were noted in the immediate area.

5 CONCLUSIONS & RECOMMENDATIONS

This Phase I Desk Study has identified that a number of plausible contaminant linkages have the potential to become active as a result of the site's current and historical use.

The contaminant linkages which carry the greatest potential risks at this site comprise the following:

- Human health risks associated with interaction between future residents and potentially contaminated shallow soils.
- Potential exposure of site workers to contaminated soils during the proposed redevelopment.
- Contaminant leaching towards groundwater and subsequent migration towards surface waters.

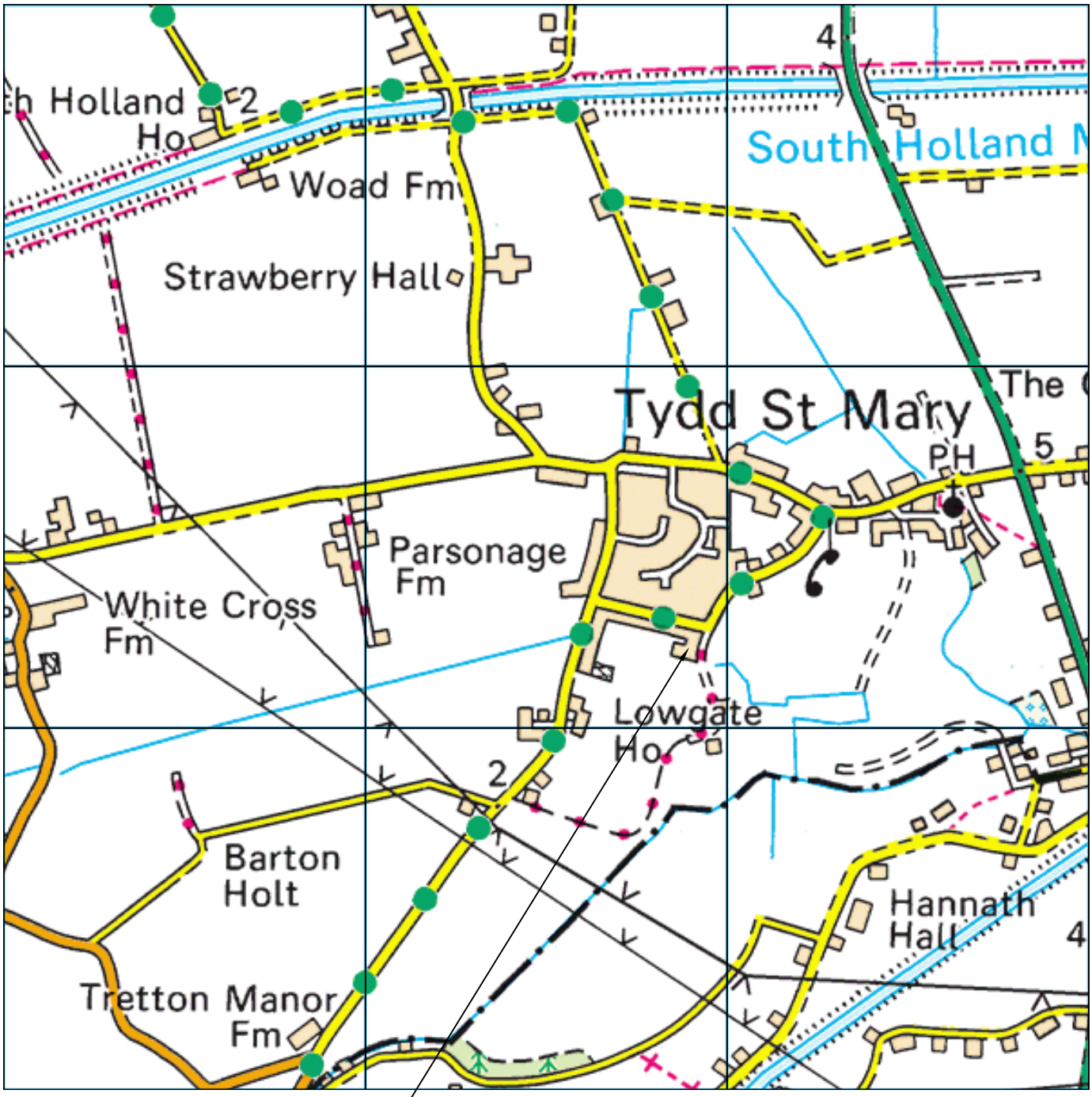
In accordance with the Model Procedures for Management of Land Contamination *(Contaminated Land Report 11)* the risks identified by this work will require further assessment in order to determine the most appropriate action for this site. A summary of the approach outlined in CLR11, marking the work already completed under the risk assessment phase, is presented as a flow diagram in Figure 4 of this report.

It is therefore recommended that, initially, the identified plausible contaminant linkages should be further investigated by means of exploratory intrusive investigation.

Any impacts to soil quality by source contaminants which are identified by the exploratory investigation may require further targeted intrusive investigations in order to delineate the contaminants found and quantitatively evaluate the risks posed.

A copy of this report should be provided to the Environmental Health department of South Holland District Council so that the information may be used to support planning proposals for the site.

FIGURES



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Title:	**Site Location Plan**		
Project:	Land off Worlds End Road, Tydd St Marys, PE13 5QW	Scale:	NTS
		Drawn By: SC	Approved By: WE
		Job No:	UK18.4095
Fig No:	1	Dwg No:	Spalding/0618/01
		Date:	June 2018



— Approximate Site Boundary

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Title: **Current Site Layout**

Project: Land off Worlds End Road, Tydd St Marys, PE13 5QW

Fig No: 2

Scale:	NTS
Drawn By:	SC
Approved By:	WE
Job No:	UK18.4095
Dwg No:	Spalding/0618/02
Date:	June 2018

N



— Approximate Site Boundary

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Licence Number: 100054115

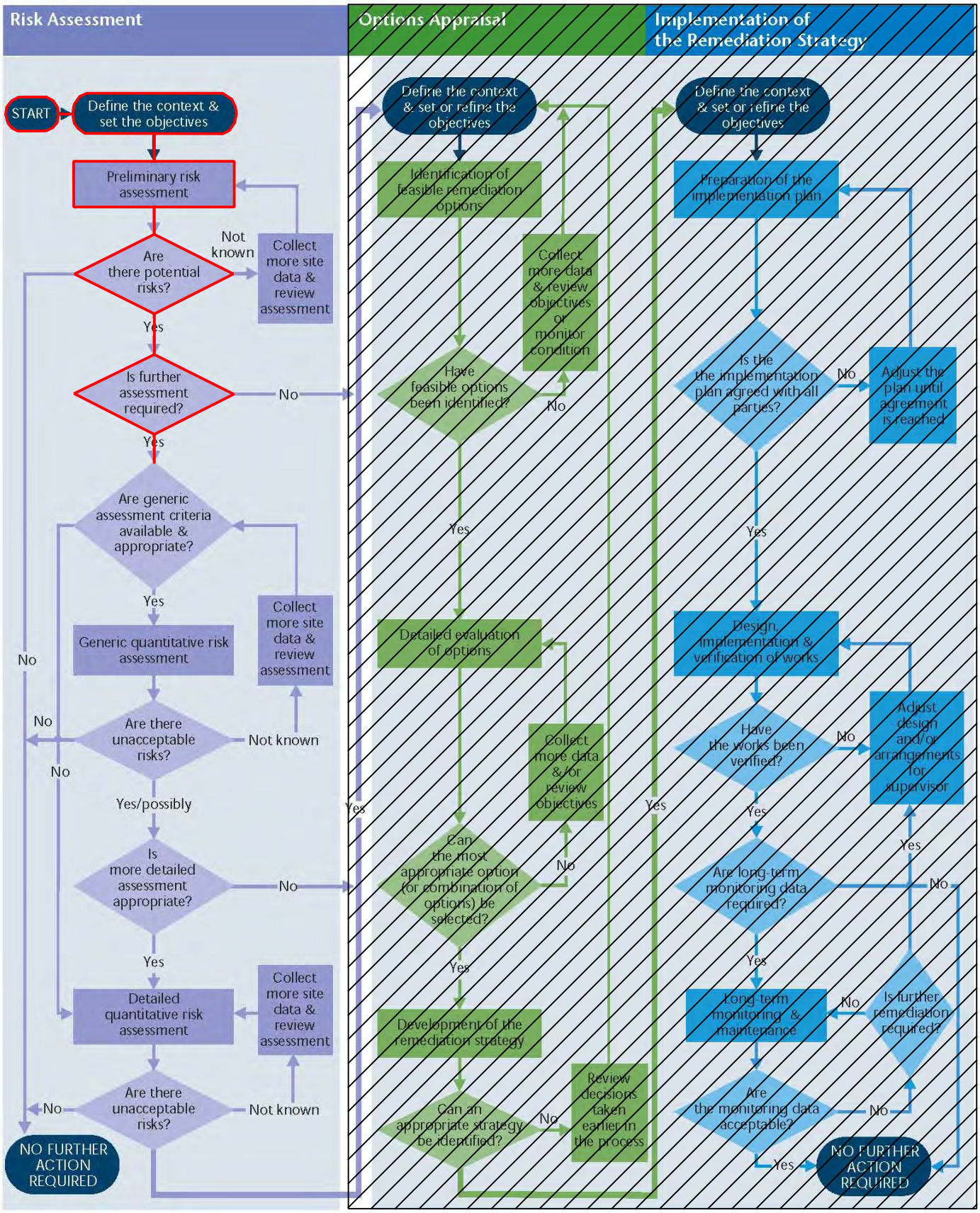
eps

Title: **Aerial Photograph**

Project: Land off Worlds End Road, Tydd St Marys, PE13 5QW

Fig No: 3

Scale:	NTS
Drawn By:	SC
Approved By:	WE
Job No:	UK18.4095
Dwg No:	Spalding/0618/03
Date:	June 2018



Assessment Pathway for Site

Title:	**Site Context - CLR11**		
Project:	Land off Worlds End Road, Tydd St Marys, PE13 5QW	Scale:	n/a
		Drawn By: SC	Approved By: SB
Fig No:	4	Job No:	UK18.4095
		Dwg No:	Spalding/0618/04
		Date:	June 2018

APPENDICES

APPENDIX A

Selected Site Photographs



— Approximate Site Boundary

(1) Approximate Photo Location

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Licence Number: 100054115

Title: **Photo Location Plan**

Project: Land off Worlds End Road, Tydd St Marys, PE13 5QW

Appendix: A

Scale:	NTS
Drawn By:	SC
Approved By:	WE
Job No:	UK18.4095
Dwg No:	Spalding/0618/A
Date:	June 2018

Photo 1: Storage unit and adjoining red diesel tank in the SE with evidence of burning in the foreground	Photo 2: Two wooden and corrugated tin storage structures towards the SW
	
Photo 3: Three adjoining historical stables along the north border	Photo 4: Farmhouse remains and adjacent storage shed in the centre NE
	
Photo 5: Historical stable now used for the storage of hay in the NE corner	Photo 6: Farmhouse remains
	

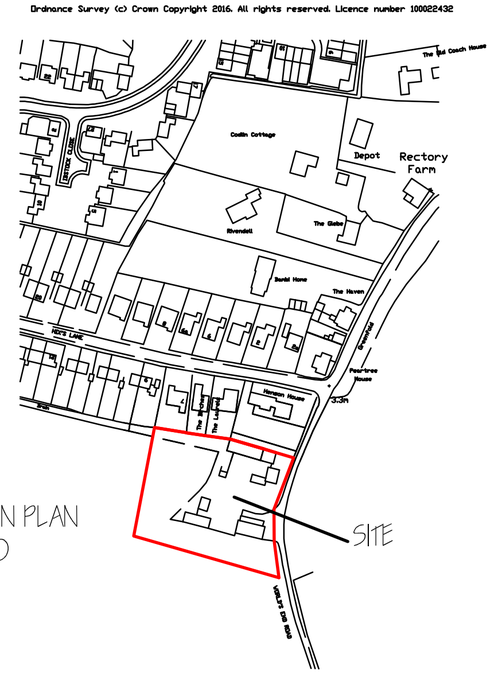
APPENDIX B

Indicative Proposed Development Plan



SITE AREA :- 0.49 Hectares.

SITE PLAN
1/500



LOCATION PLAN
1/2500

INDICATIVE DWELLINGS SCHEDULE :-

PLOT 1 - 4 BEDROOM HOUSE & DETACHED DOUBLE GARAGE.
PLOT 2 - 3 BEDROOM HOUSE & DETACHED SINGLE GARAGE.
PLOT 3 - 3 BEDROOM BUNGALOW WITH ATTACHED SINGLE GARAGE.
PLOT 4 - 3/4 BEDROOM BUNGALOW & DETACHED DOUBLE GARAGE.
PLOT 5 - 3 BEDROOM BUNGALOW & DETACHED DOUBLE GARAGE.

INDIVIDUAL ACCESSES & PRIVATE DRIVEWAY OFF WORLD'S END ROAD TO BE INSTALLED TO THE REQUIREMENTS & SPECIFICATION OF LINC'S C C, HIGHWAYS DEPARTMENT.

- Derelict buildings to be demolished.

ref:	revision	date
B.	FOOTPATH EXTENDED - LCC HIGHWAYS.	JAN 17.
A.	INTRODUCE FOOTPATH - LCC HIGHWAYS.	JAN 2017.

G. R. MERCHANT GRM
I.ENG AMICE FIWO

ARCHITECTURAL, STRUCTURAL AND LAND DRAINAGE CONSULTANTS

Unit 4, Wrights Mews
12A Park Road, Holbeach,
Spalding, Lincs, PE12 7EE
Tel: 01406 490800
Fax: 01406 425744
E-Mail: G. R. Merchant @ Merchant. FS. Co. UK

Project
RESIDENTIAL DEVELOPMENT
WORLD'S END ROAD
TYDD ST MARY
WISBECH, CAMBS, PE13 5QL.

Client
MR & MRS T THORPE.

Drawing
LOCATION & SITE LAYOUT PLANS

Job Ref.	Drawing No.
3019-16.	01B.
Date	**Drawn**
AUG' 16.	GRM/ HLD

Scales
AS INDICATED.

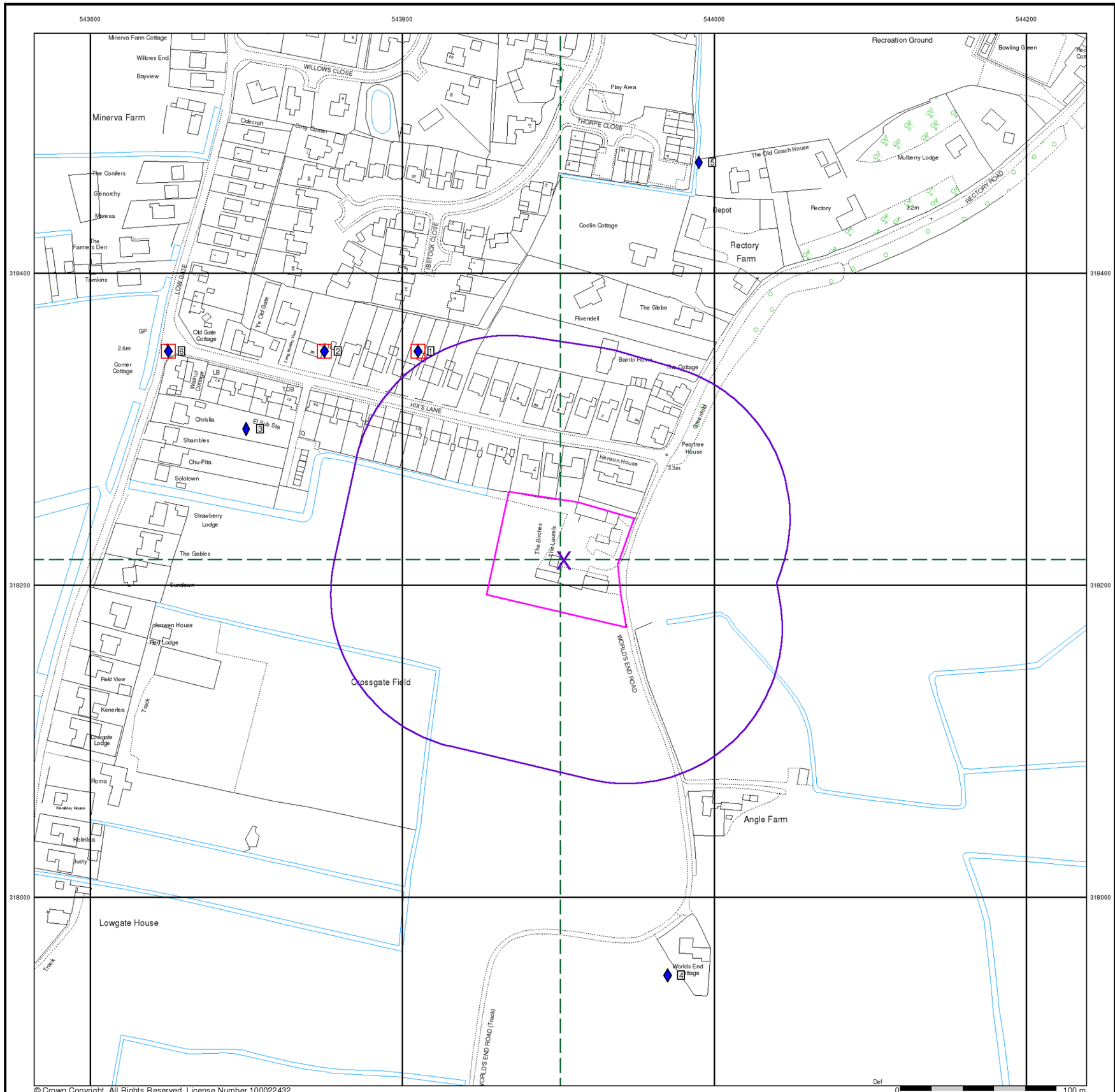
DO NOT SCALE FROM THIS DRAWING

This drawing is copyright and may not be altered, traced, photographed or used for any other purpose other than that for which it is issued. The General Contractor is to check all dimensions on site and report any discrepancies to the Architect. All details shown on this drawing including foundations are based upon typical site conditions related to the area. No responsibility can be accepted for abnormal conditions which may be discovered during construction unless reported to the Architect so that design ammendments may be considered. Site soil surveys are recommended in respect of foundations to establish specific site conditions before foundation work is undertaken. This drawing is limited in the amount of information contained and does not purport to contain a full specification of the works. It is solely for the purpose of obtaining Planning / Building Regulation approval. This drawing must not be used as a contract document alone. The works will not be supervised or inspected on site by G R Merchant or any representative thereof. It is the client or their appointed agents responsibility to control workmanship, substitution of materials, adherance to specification, variations to contract etc.

All materials to be new unless otherwise stated and all components and materials etc. to be used fitted and installed etc., in strict accordance with manufacturers instruction and relevant code of practice. Materials shall conform to appropriate British standard specification or BBA certificate or European code equivalent. The Employer / Client shall ensure that the selected contractor is conversant with and adopts all measures necessary to achieve compliance with Health and Safety legislation for Building sites and Work places. The Employer / Client is advised that should the works need to comply with the Construction Design and Management Regulations an independant Planning Supervisor will be required. The works shall comprise of all that is shown on the drawing and details. Work that may not specifically shown but may be reasonably inferred as necessary to carry out the works shall be deemed to be included.

APPENDIX C

Surrounding Land Use



General

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

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

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
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Water)
- Potentially Infilled Land (Water)
- Potentially Infilled Land (Water)
- 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

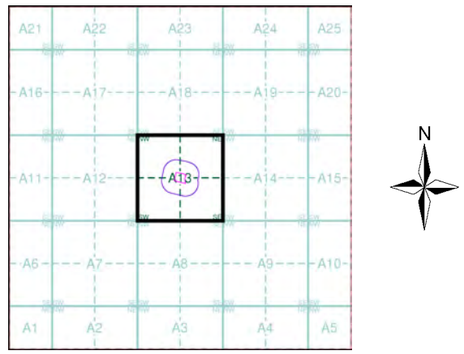
Hazardous Substances

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

Geological

- BGS Recorded Mineral Site

Site Sensitivity Map - Segment A13



Order Details

Order Number:	170654214_1_1
Customer Ref:	UK18.4095
National Grid Reference:	543900, 318220
Slice:	A
Site Area (Ha):	0.58
Plot Buffer (m):	100

Site Details

Site at 543920, 318230

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

APPENDIX D

Geological Context

Geology 1:50,000 Maps Legends

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	TFD	Tidal Flat Deposits	Clay and Silt	Not Supplied - Holocene

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	AMC	Ampthill Clay Formation	Mudstone	Not Supplied - Oxfordian

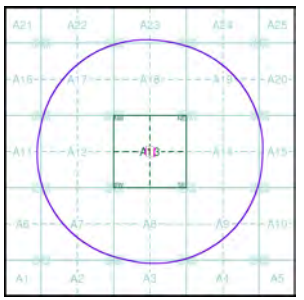
Geology 1:50,000 Maps

This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:50,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around the site. This mapping may be more up to date than previously published paper maps.
The various geological layers - artificial and landslip deposits, superficial geology and solid (bedrock) geology are displayed in separate maps, but superimposed on the final 'Combined Surface Geology' map. All map legends feature on this page. Not all layers have complete nationwide coverage, so availability of data for relevant map sheets is indicated below.

Geology 1:50,000 Maps Coverage

Map ID:	**1**
Map Sheet No:	**145**
Map Name:	**King's Lynn and**
Map Date:	**1978**
Bedrock Geology:	**Available**
Superficial Geology:	**Available**
Artificial Geology:	**Available**
Faults:	**Not Supplied**
Landslip:	**Available**
Rock Segments:	**Not Supplied**

Geology 1:50,000 Maps - Slice A



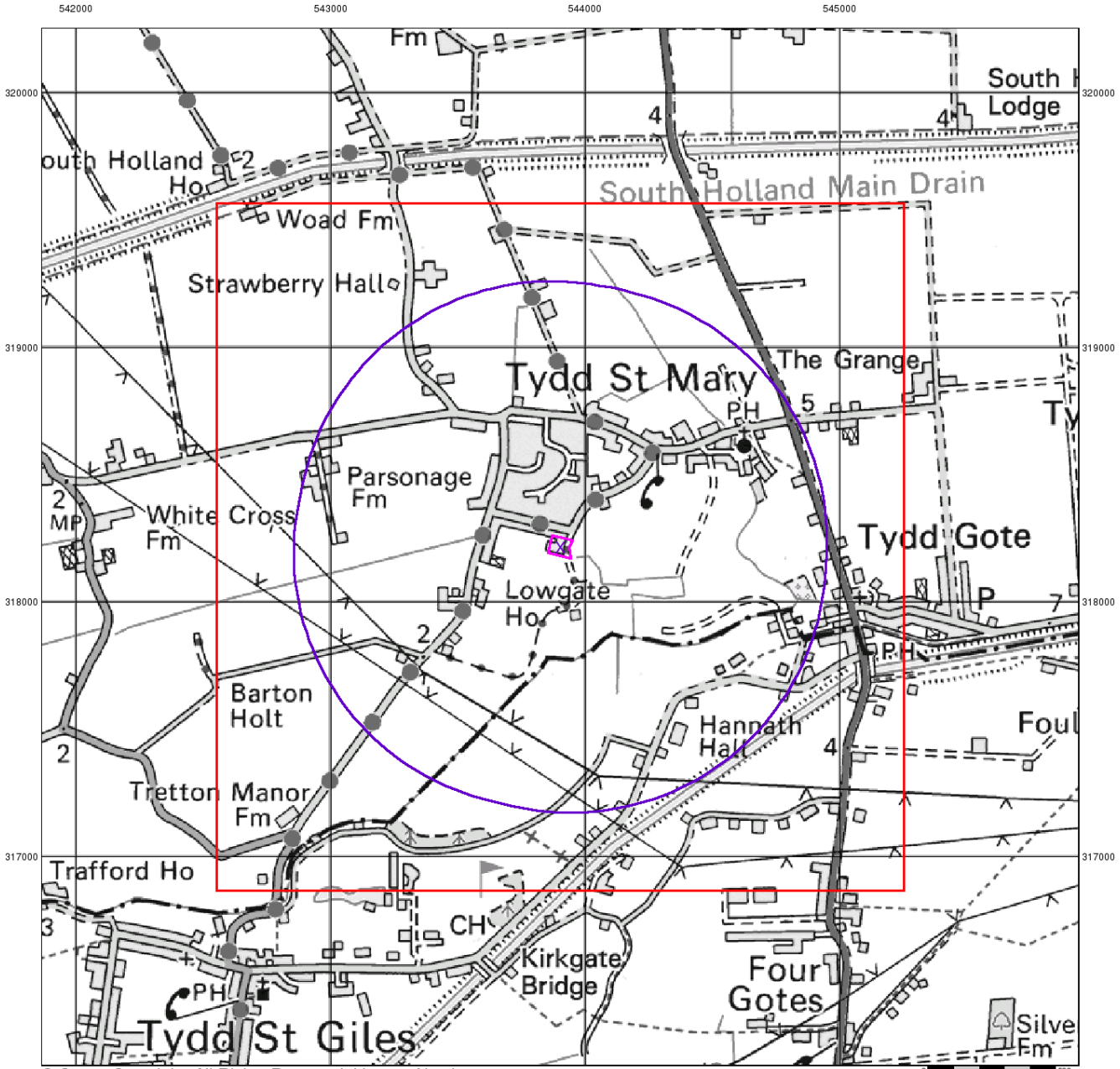
Order Details:

Order Number:	170654214_1_1
Customer Reference:	UK18.4095
National Grid Reference:	543900, 318220
Slice:	A
Site Area (Ha):	0.58
Search Buffer (m):	1000

Site Details:

Site at 543920, 318230

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Artificial Ground and Landslip

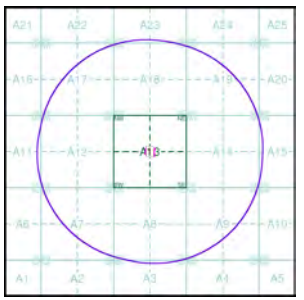
Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions and unstable ground.

Artificial ground includes:

- Made ground - man-made deposits such as embankments and spoil heaps on the natural ground surface.
- Worked ground - areas where the ground has been cut away such as quarries and road cuttings.
- Infilled ground - areas where the ground has been cut away then wholly or partially backfilled.
- Landscaped ground - areas where the surface has been reshaped.
- Disturbed ground - areas of ill-defined shallow or near surface mineral workings where it is impracticable to map made and worked ground separately.

Mass movement (landslip) deposits on BGS geological maps are primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground. The dataset also includes foundered strata, where the ground has collapsed due to subsidence.

Artificial Ground and Landslip Map - Slice A



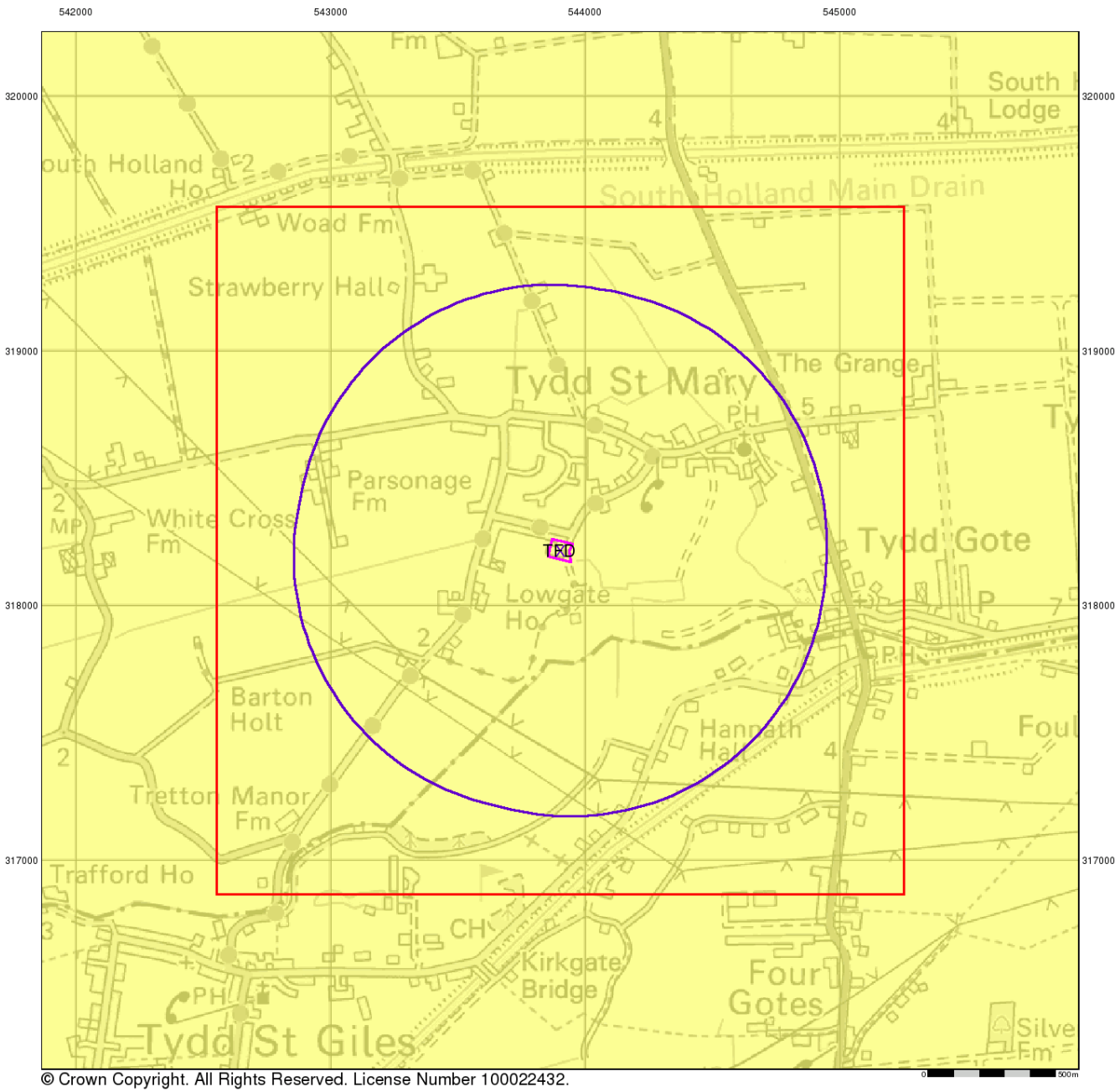
Order Details:

Order Number:	170654214_1_1
Customer Reference:	UK18.4095
National Grid Reference:	543900, 318220
Slice:	A
Site Area (Ha):	0.58
Search Buffer (m):	1000

Site Details:

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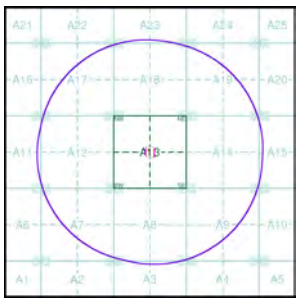
Superficial Geology

Superficial Deposits are the youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 1.8 million years from the present.

They rest on older deposits or rocks referred to as Bedrock. This dataset contains Superficial deposits that are of natural origin and 'in place'. Other superficial strata may be held in the Mass Movement dataset where they have been moved, or in the Artificial Ground dataset where they are of man-made origin.

Most of these Superficial deposits are unconsolidated sediments such as gravel, sand, silt and clay, and onshore they form relatively thin, often discontinuous patches or larger spreads.

Superficial Geology Map - Slice A



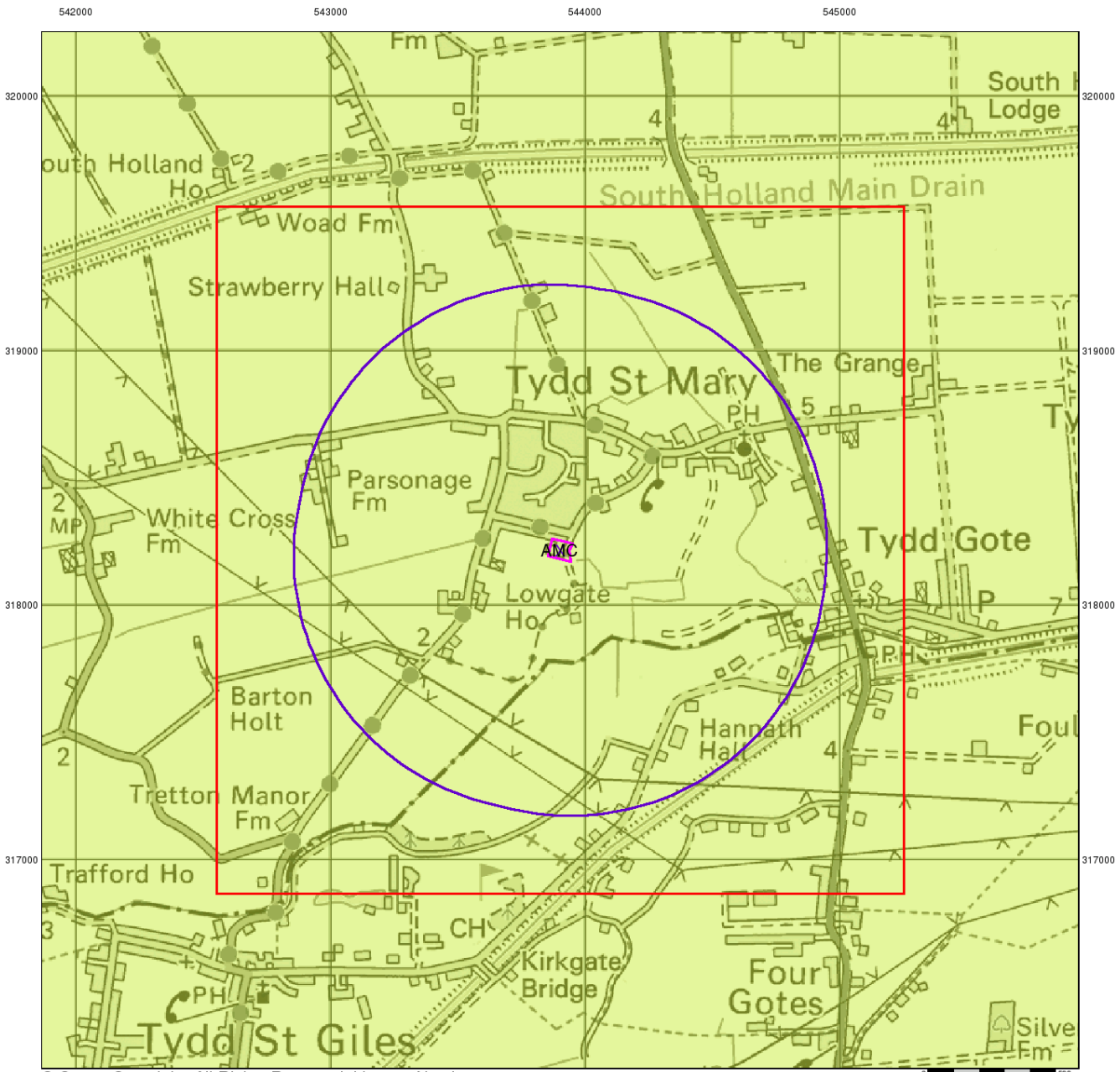
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Customer Reference:	UK18.4095
National Grid Reference:	543900, 318220
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Site Area (Ha):	0.58
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Bedrock and Faults

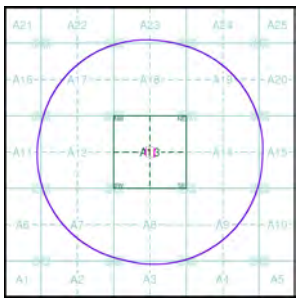
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

The bedrock has formed over vast lengths of geological time ranging from ancient and highly altered rocks of the Proterozoic, some 2500 million years ago, or older, up to the relatively young Pliocene, 1.8 million years ago.

The bedrock geology includes many lithologies, often classified into three types based on origin: igneous, metamorphic and sedimentary.

The BGS Faults and Rock Segments dataset includes geological faults (e.g. normal, thrust), and thin beds mapped as lines (e.g. coal seam, gypsum bed). Some of these are linked to other particular 1:50,000 Geology datasets, for example, coal seams are part of the bedrock sequence, most faults and mineral veins primarily affect the bedrock but cut across the strata and post date its deposition.

Bedrock and Faults Map - Slice A



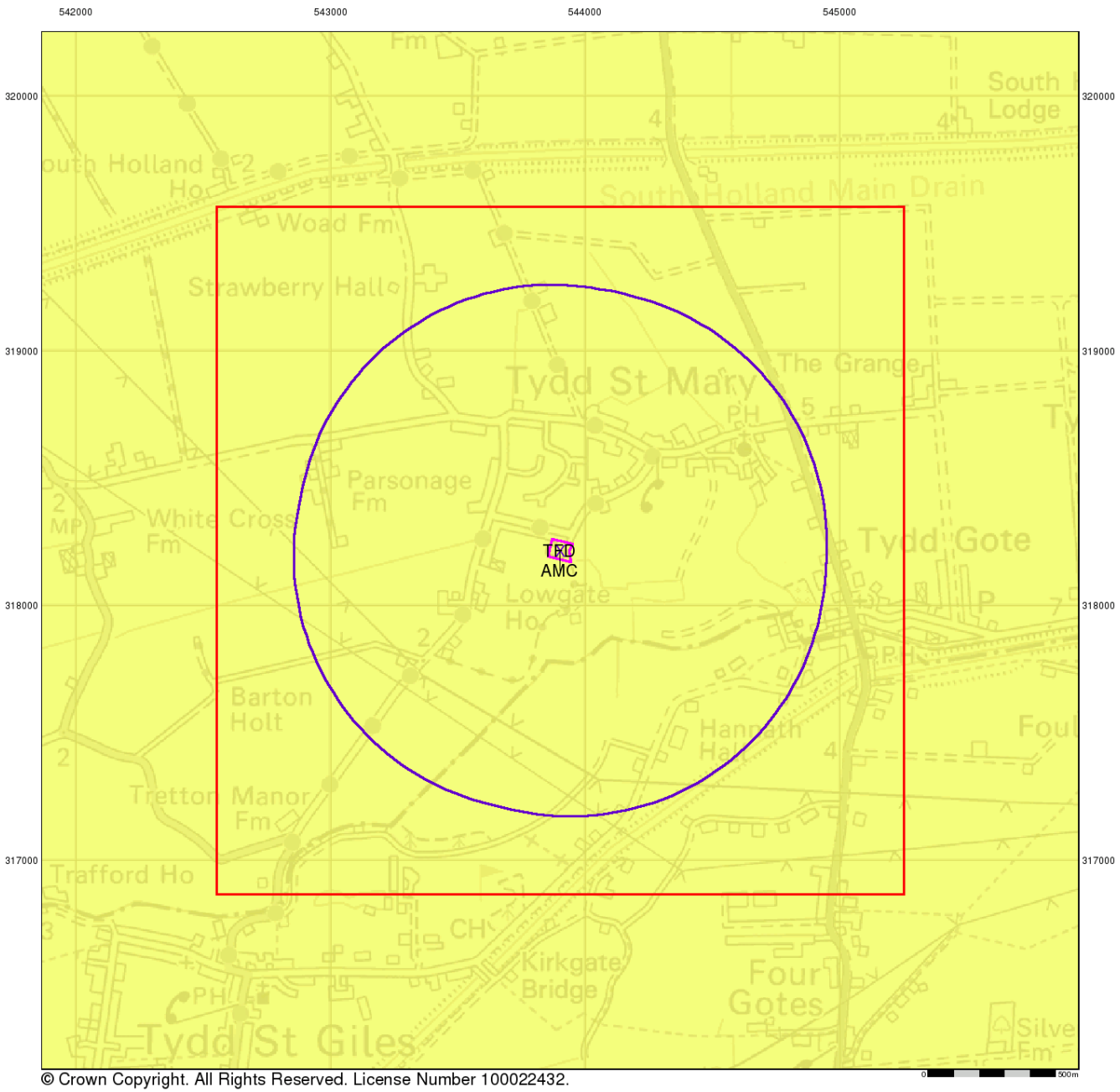
Order Details:

Order Number:	170654214_1_1
Customer Reference:	UK18.4095
National Grid Reference:	543900, 318220
Slice:	A
Site Area (Ha):	0.58
Search Buffer (m):	1000

Site Details:

Site at 543920, 318230

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Combined Surface Geology

The Combined Surface Geology map combines all the previous maps into one combined geological overview of your site.

Please consult the legends to the previous maps to interpret the Combined "Surface Geology" map.

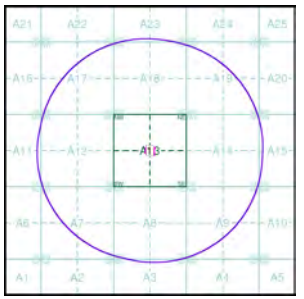
Additional Information

More information on 1:50,000 Geological mapping and explanations of rock classifications can be found on the BGS website. Using the LEX Codes in this report, further descriptions of rock types can be obtained by interrogating the 'BGS Lexicon of Named Rock Units'. This database can be accessed by following the 'Information and Data' link on the BGS website.

Contact

British Geological Survey
Kingsley Dunham Centre
Keyworth
Nottingham
NG12 5GG
Telephone: 0115 936 3143
Fax: 0115 936 3276
email: enquiries@bgs.ac.uk
website: www.bgs.ac.uk

Combined Geology Map - Slice A



Order Details:

Order Number:	170654214_1_1
Customer Reference:	UK18.4095
National Grid Reference:	543900, 318220
Slice:	A
Site Area (Ha):	0.58
Search Buffer (m):	1000

Site Details:

Site at 543920, 318230

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

BGS ID: 505831 : BGS Reference: TF41NW4
British National Grid (27700) : 543710,317520
Report an issue with this borehole

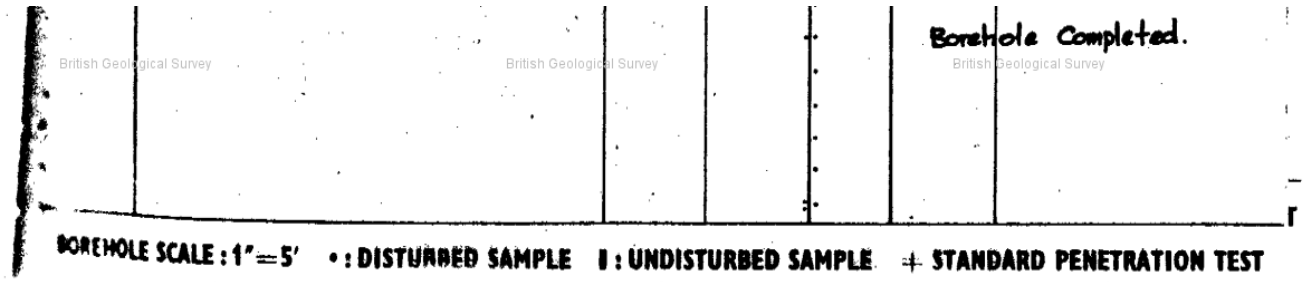
DATION ENGINEERING Ltd.

BOREHOLE LOG

TF 41 NW/4
4371 - 1752
1" 145

LOCATION : WESTBURTON – WALTHAM CROSS – NORTHERN SEC.
BOREHOLE DIA. : 6".
DATE (Start) : 22/5/63.
BOREHOLE No. : 349. + 6 = 355
GROUND LEVEL : —
WATER LEVEL : 7'0" below g.l.

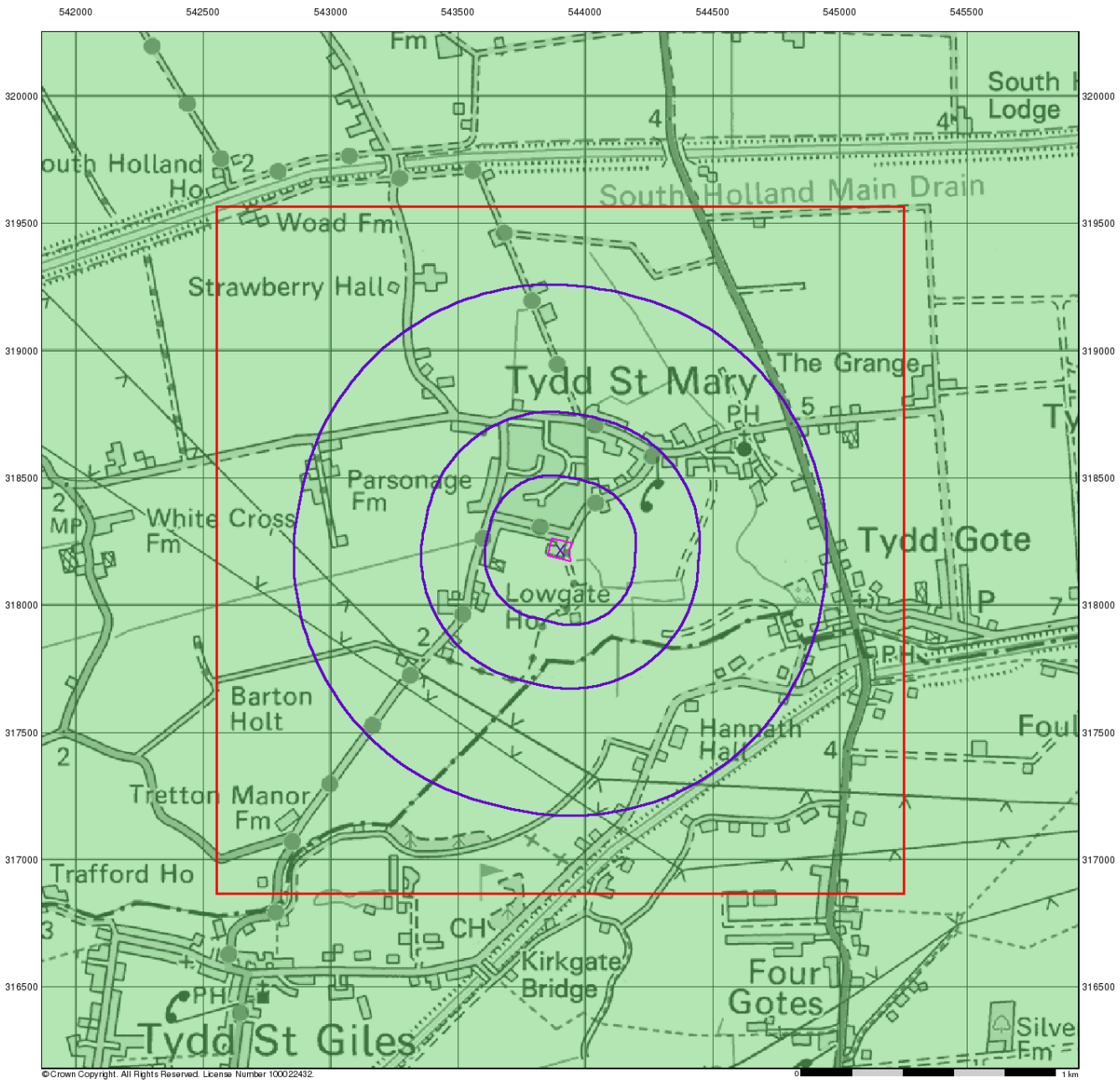
Description	Thickness	Depth	Sample	Remarks
TOPSOIL.	1' 0"	0'-0"		
		1' 0" (0·30m)	•	
Loose Fine multi-coloured sandy SILT.	8' 0"		• +	6 Blows / ft.
		9' 0" (2·74m)	•	
			• +	2 Blows / ft.
Very loose Fine grey silty SAND. (organic)	13' 0"			
		22' 0" (6·71m)	• +	1 Blow / ft.
Medium density Fine grey sandy SILT.	13' 0"			
			• +	12 Blows / ft.
		35' 0" (10·67m)	•	
Compact fine grey SILT.	5' 0"		• +	46 Blows / ft.
		40' 0" (12·19m)		



British Geological Survey British Geological Survey British Geological Survey
British Geological Survey British Geological Survey British Geological Survey

APPENDIX E

Groundwater Vulnerability & Flood Risk Maps



Groundwater Vulnerability

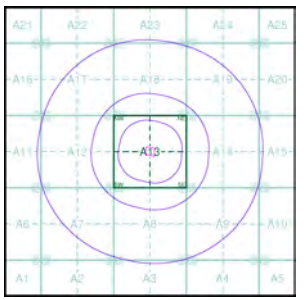
General

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



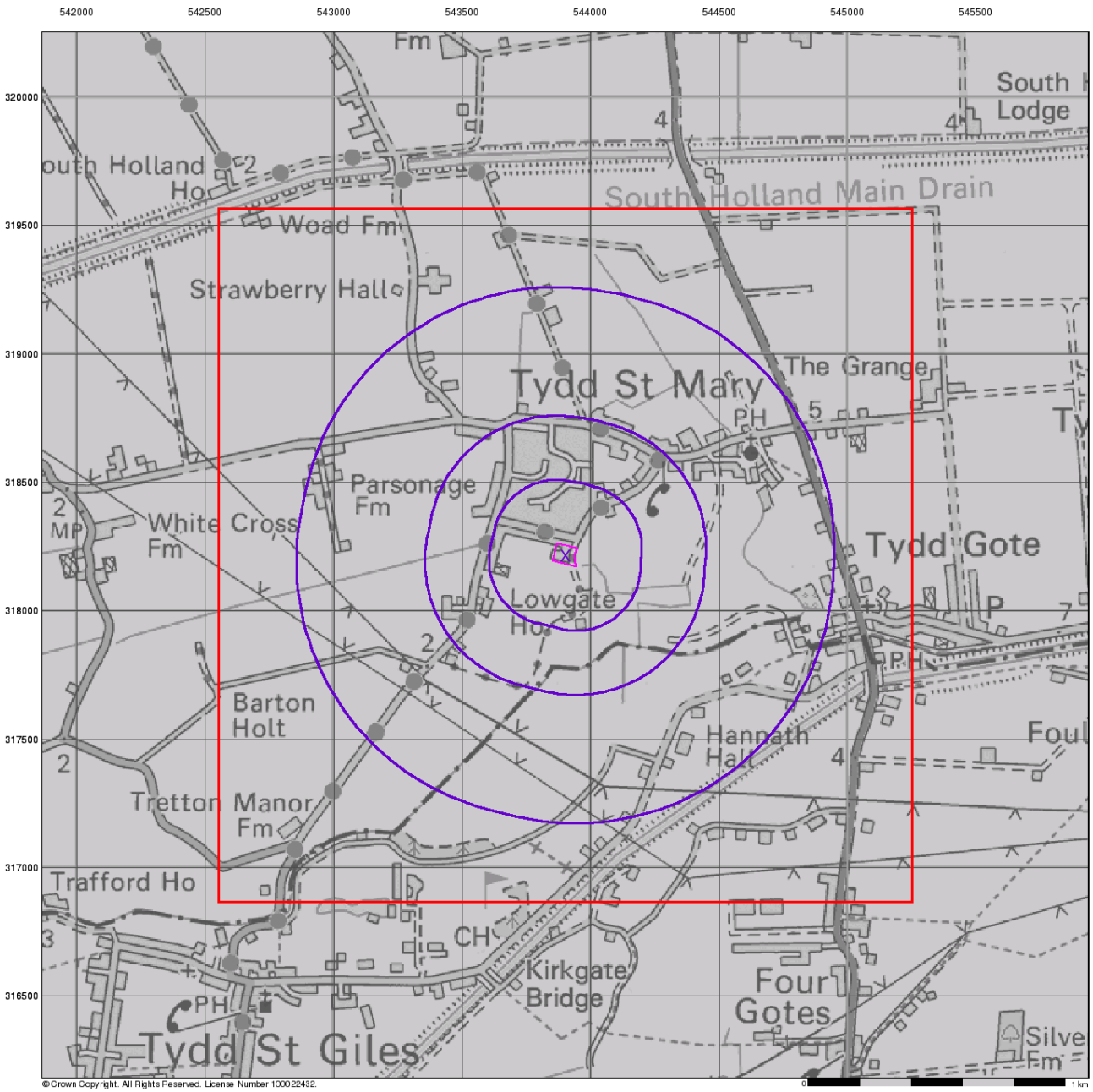
Order Details

Order Number:	170654214_1_1
Customer Ref:	UK18.4095
National Grid Reference:	543900, 318220
Slice:	A
Site Area (Ha):	0.58
Search Buffer (m):	1000

Site Details

Site at 543920, 318230

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Bedrock Aquifer Designation

General

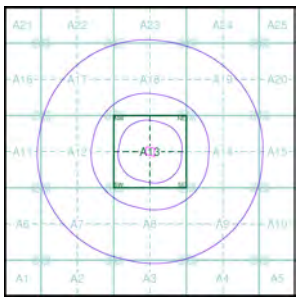
Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice A



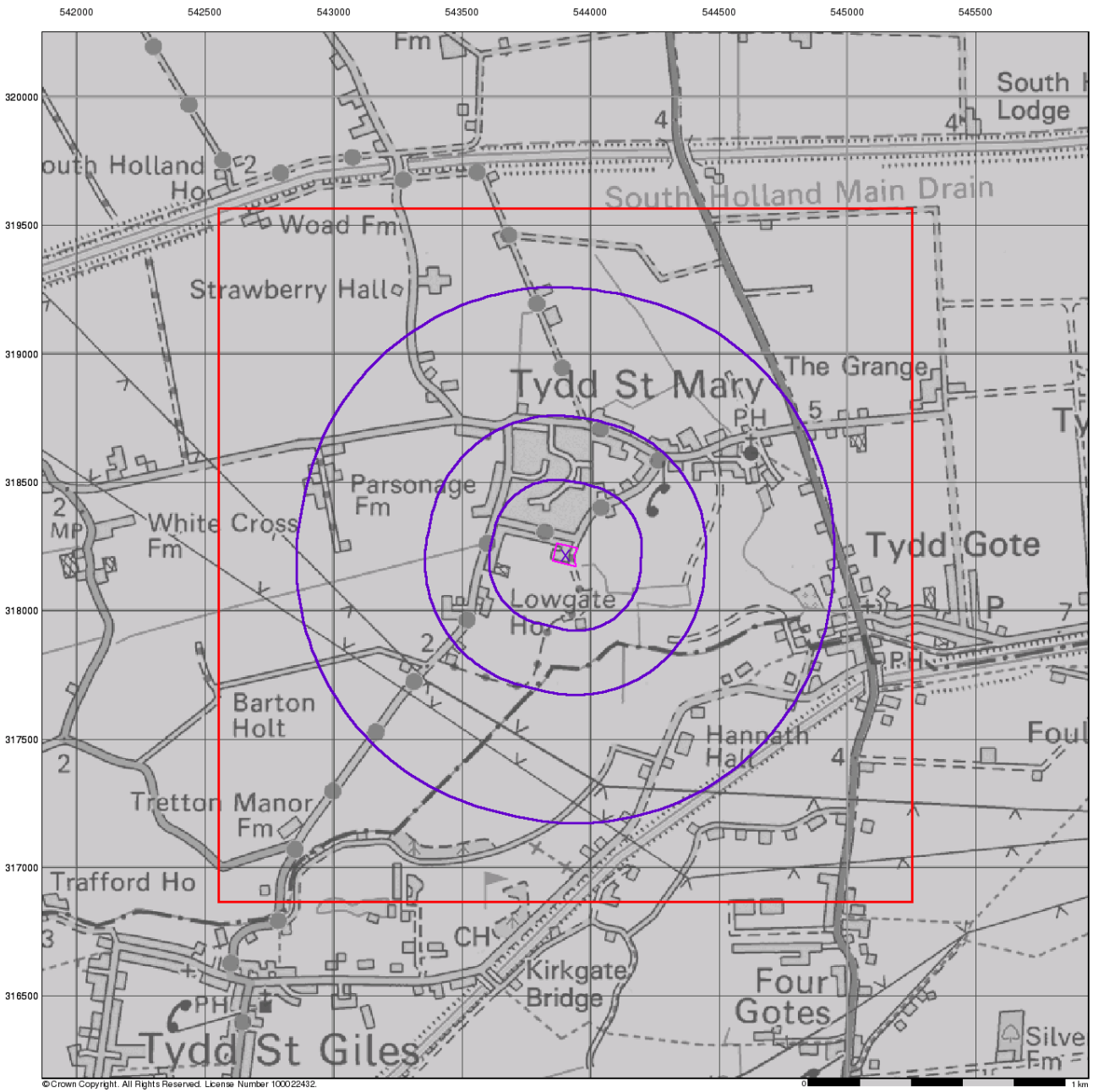
Order Details

Order Number:	170654214_1_1
Customer Ref:	UK18.4095
National Grid Reference:	543900, 318220
Slice:	A
Site Area (Ha):	0.58
Search Buffer (m):	1000

Site Details

Site at 543920, 318230

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



Superficial Aquifer Designation

General

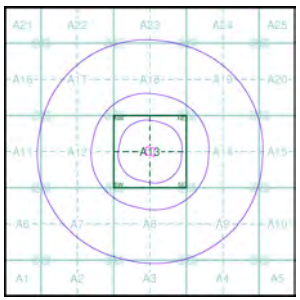
Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice A



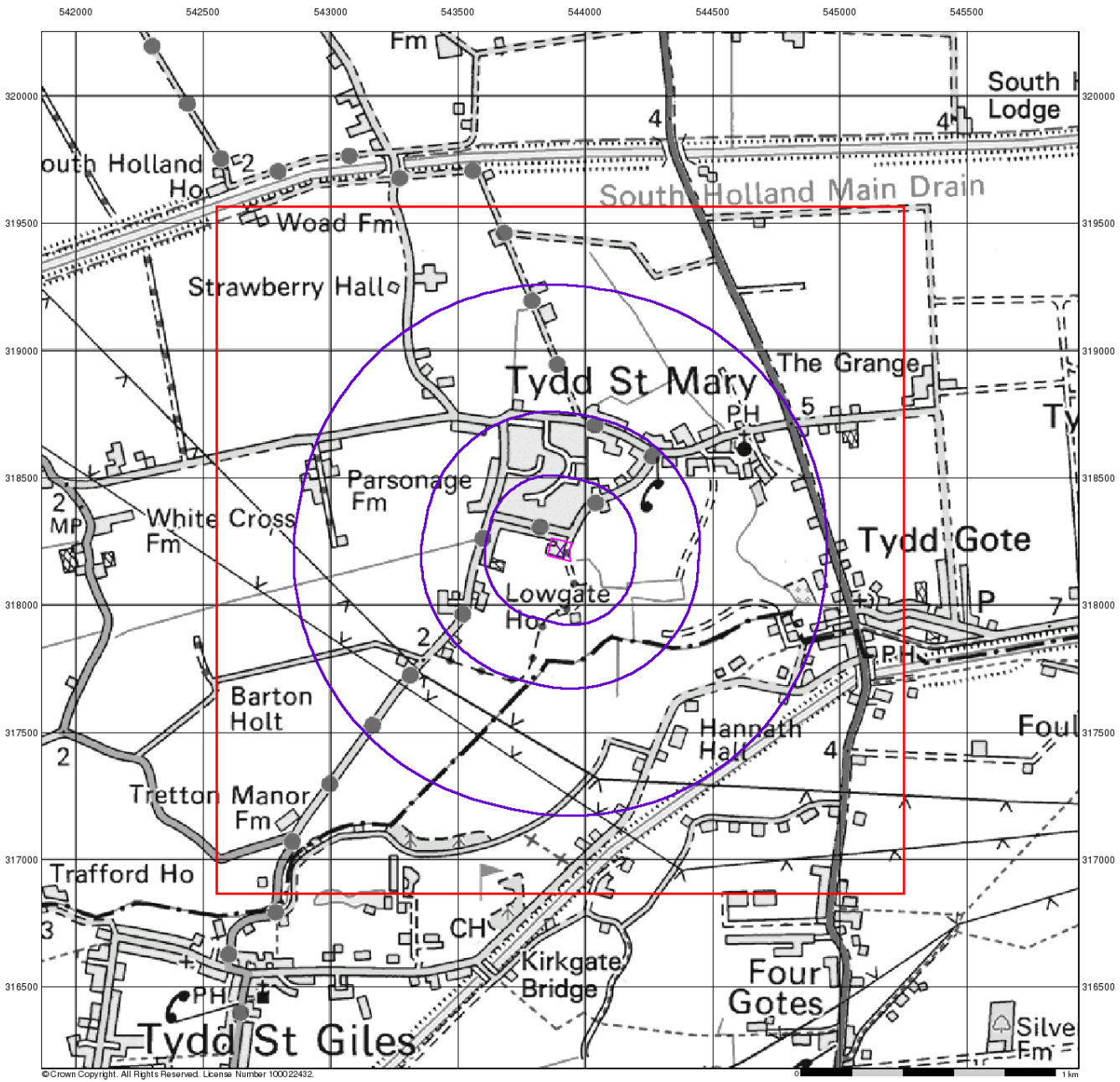
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Customer Ref:	UK18.4095
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Slice:	A
Site Area (Ha):	0.58
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Site Details

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Source Protection Zones

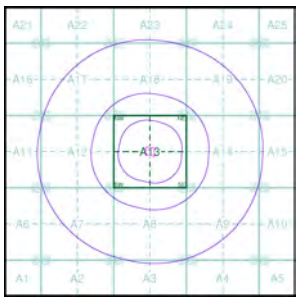
General

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

Agency and Hydrological

- Inner zone (Zone 1)
- Inner zone - subsurface activity only (Zone 1c)
- Outer zone (Zone 2)
- Outer zone - subsurface activity only (Zone 2c)
- Total catchment (Zone 3)
- Total catchment - subsurface activity only (Zone 3c)
- Special interest (Zone 4)

Site Sensitivity Context Map - Slice A



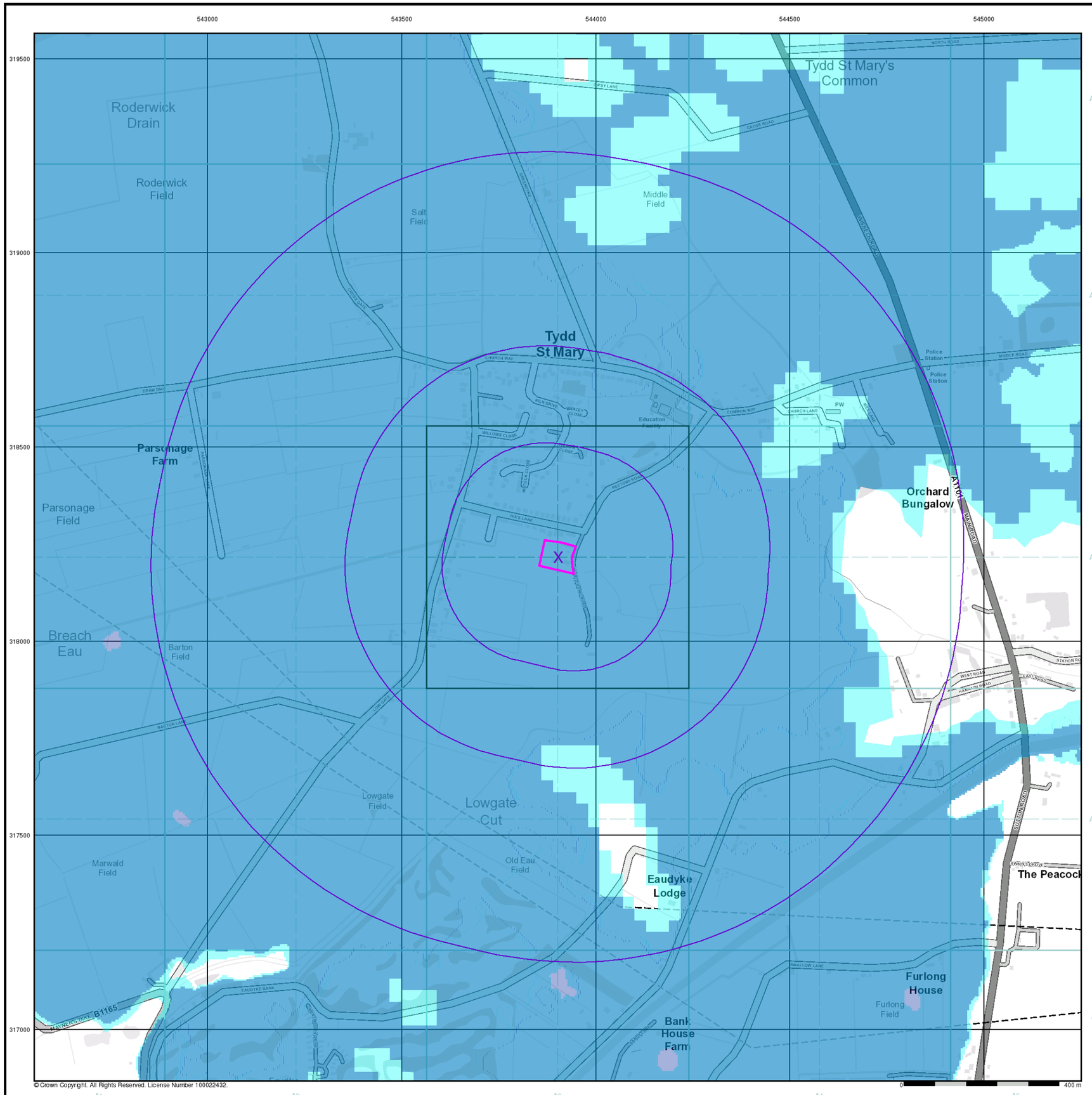
Order Details

Order Number:	170654214_1_1
Customer Ref:	UK18.4095
National Grid Reference:	543900, 318220
Slice:	A
Site Area (Ha):	0.58
Search Buffer (m):	1000

Site Details

Site at 543920, 318230

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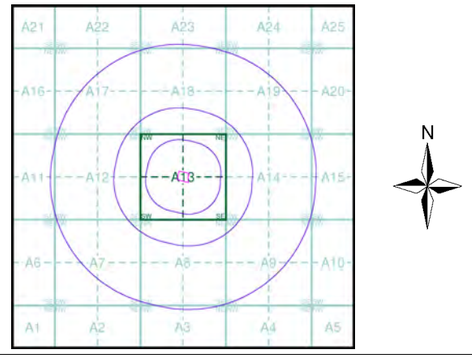
General

- 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:	170654214_1_1
Customer Ref:	UK18.4095
National Grid Reference:	543900, 318220
Slice:	A
Site Area (Ha):	0.58
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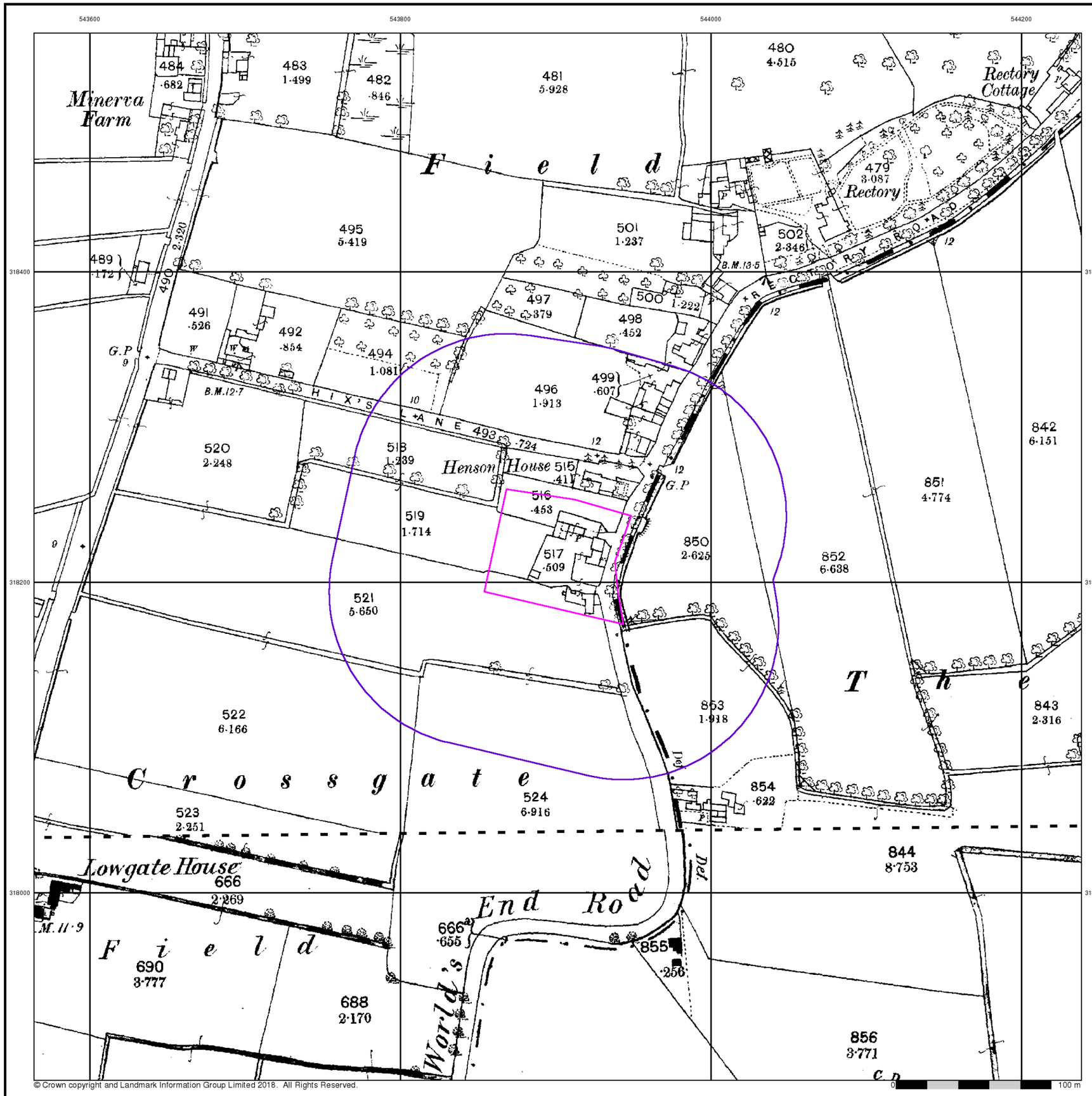
Site Details

Site at 543920, 318230

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APPENDIX F

A Selection of Historical Maps



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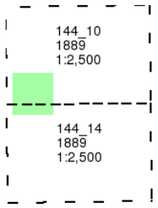
Lincolnshire

Published 1889

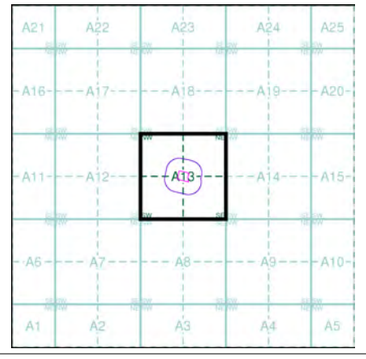
Source map scale - 1:2,500

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



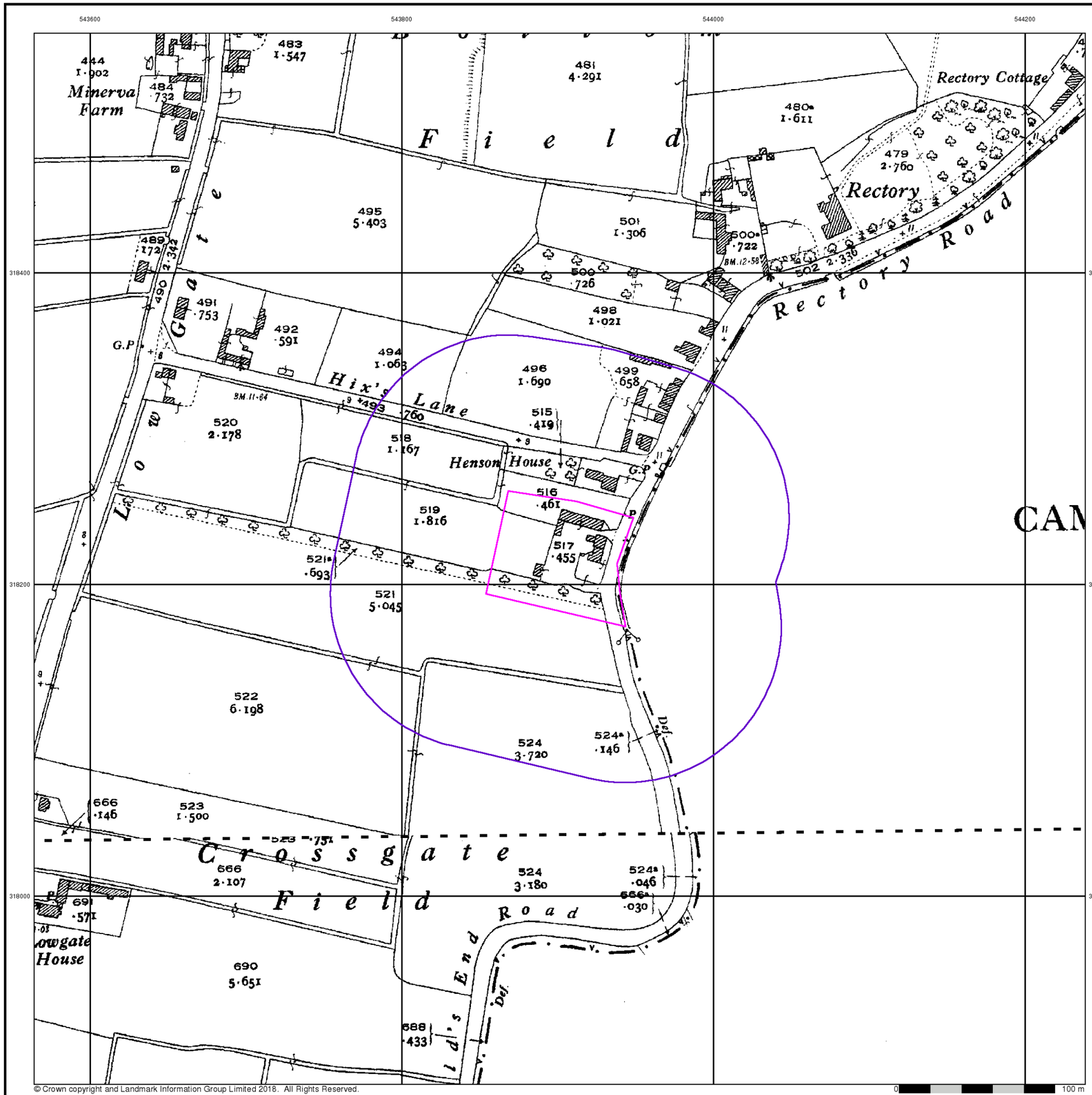
Order Details

Order Number:	170654214_1_1
Customer Ref:	UK18.4095
National Grid Reference:	543900, 318220
Slice:	A
Site Area (Ha):	0.58
Search Buffer (m):	100

Site Details

Site at 543920, 318230

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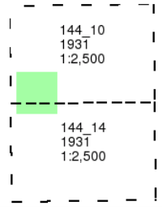
Lincolnshire

Published 1931

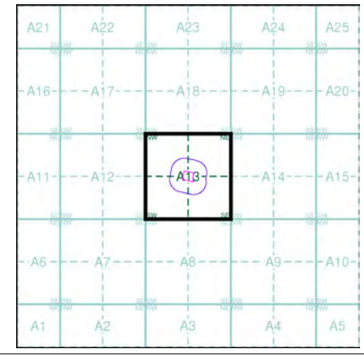
Source map scale - 1:2,500

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



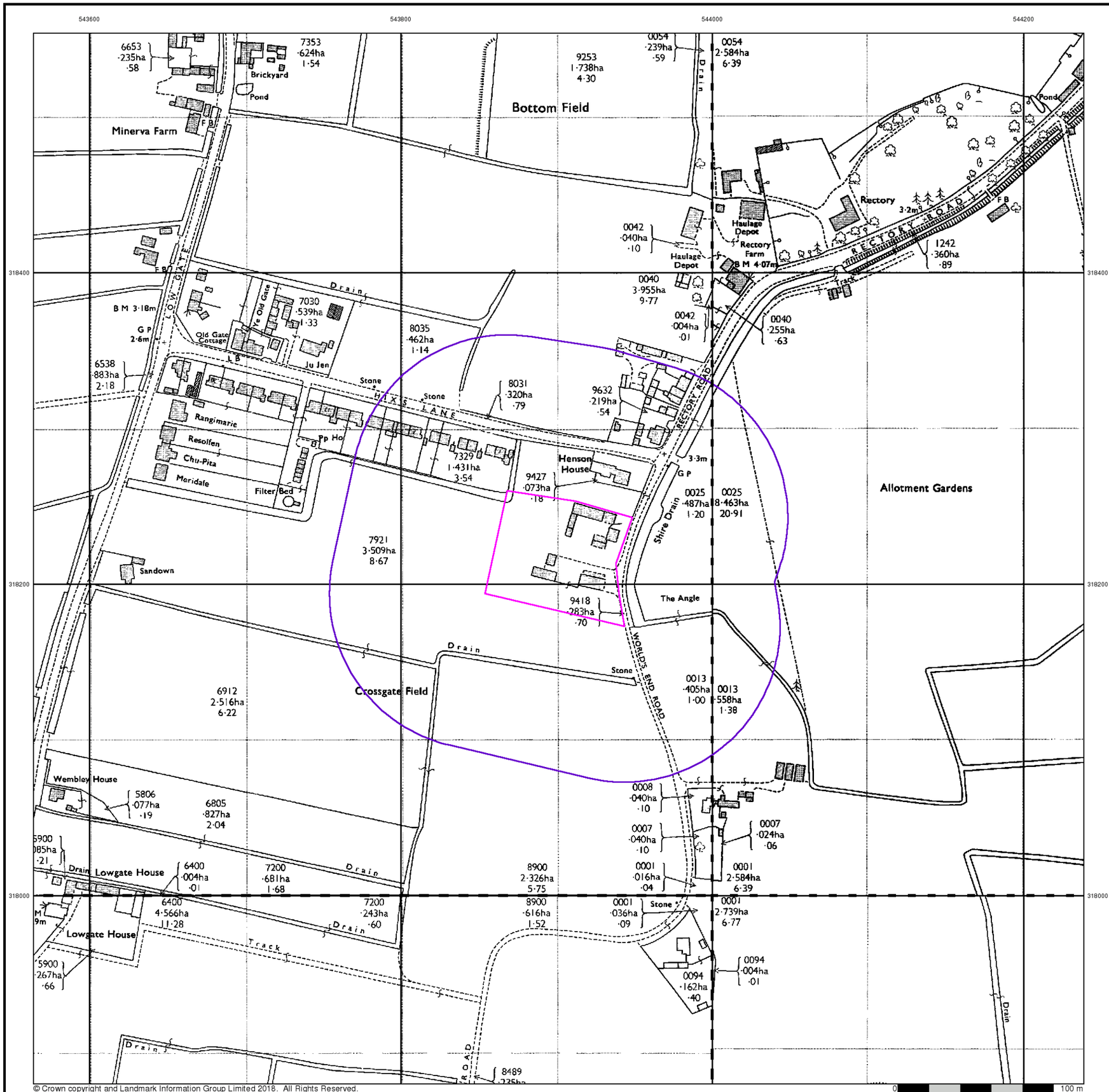
Order Details

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Slice:	A
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Site Details

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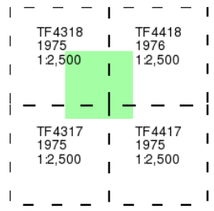
Ordnance Survey Plan

Published 1975 - 1976

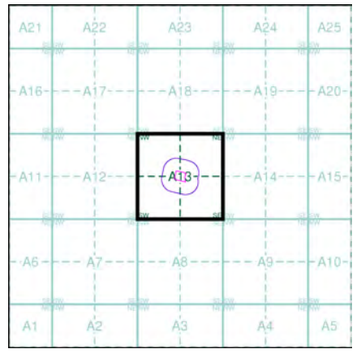
Source map scale - 1:2,500

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



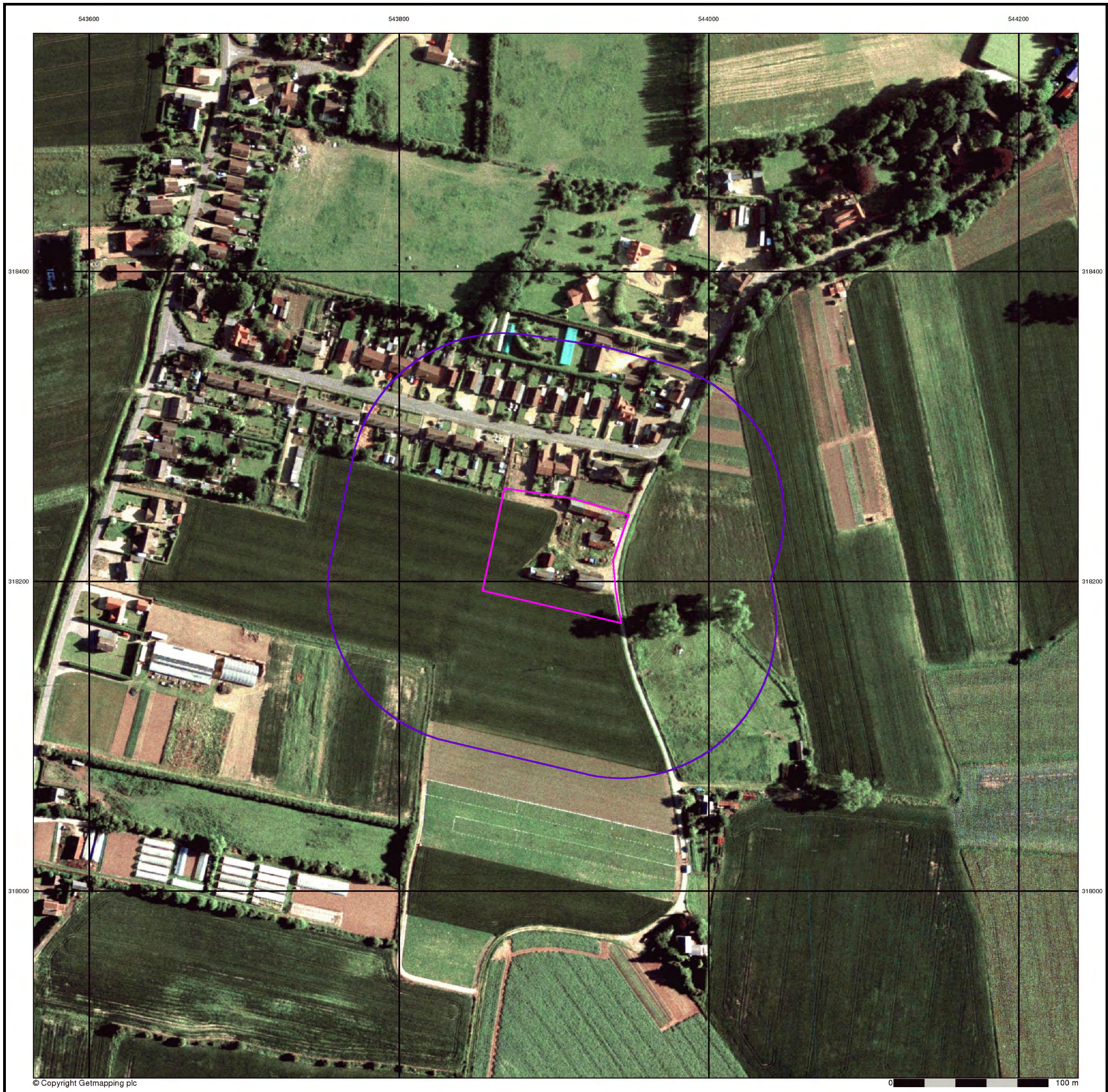
Order Details

Order Number:	170654214_1_1
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Site Details

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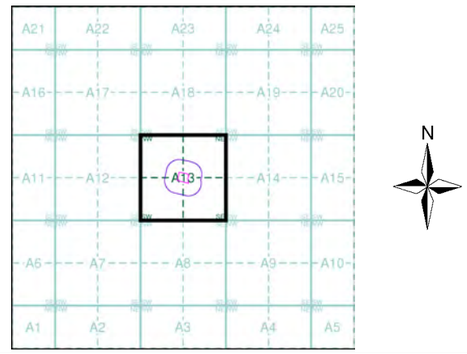


Historical Aerial Photography

Published 1999

This aerial photography was produced by Getmapping, these vertical aerial photographs provide a seamless, full colour survey of the whole of Great Britain

Historical Aerial Photography - Segment A13



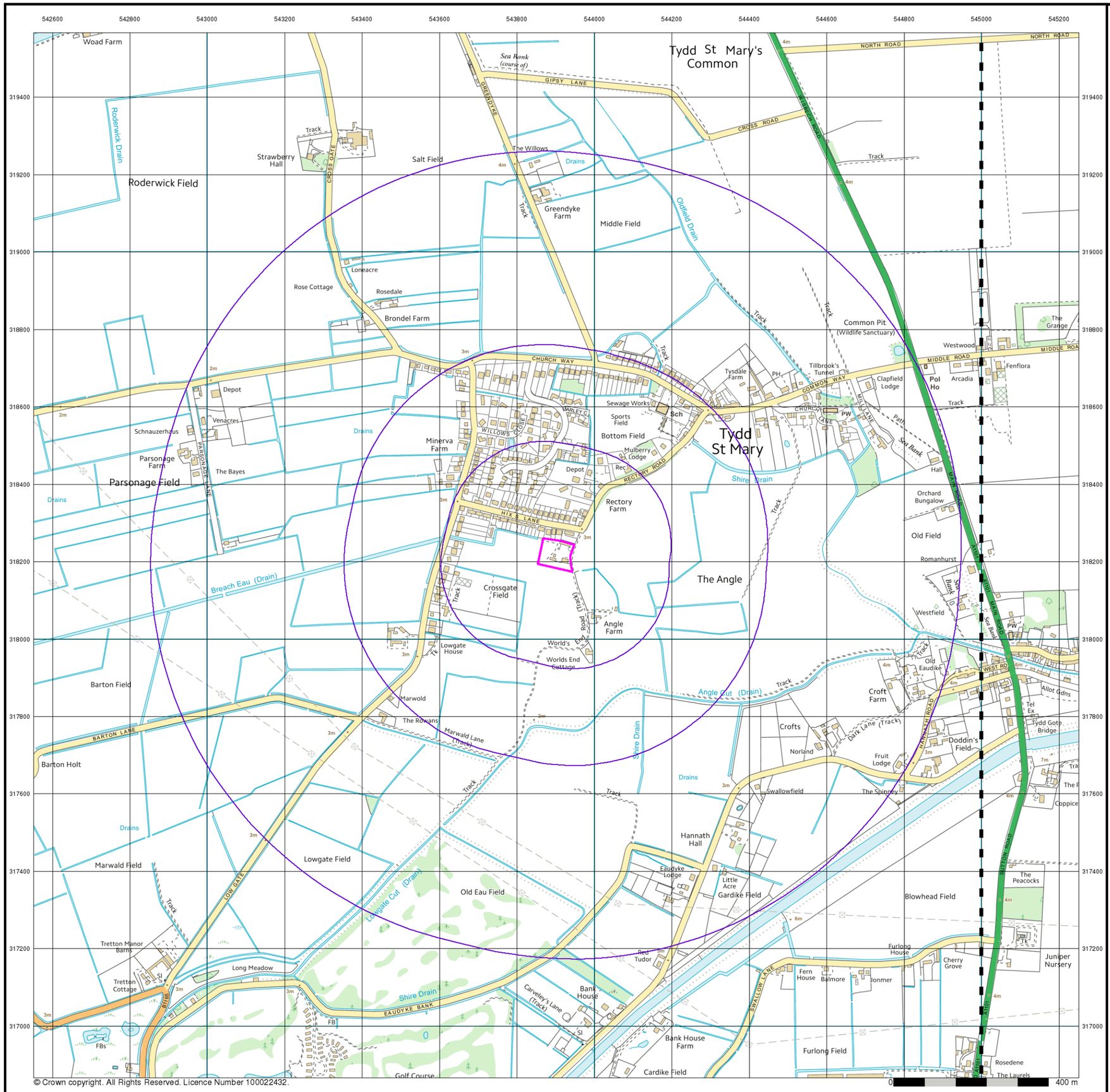
Order Details

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Customer Ref:	UK18.4095
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Site Area (Ha):	0.58
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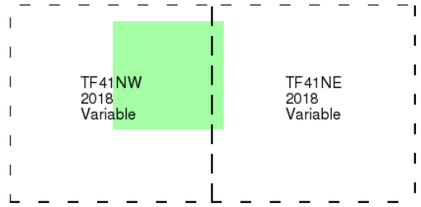
VectorMap Local

Published 2018

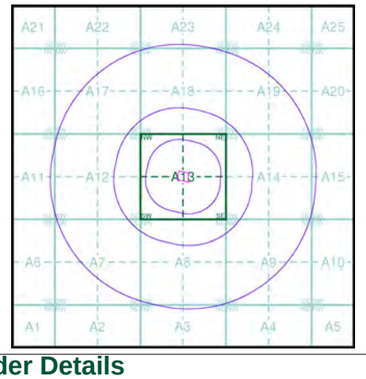
Source map scale - 1:10,000

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)



Historical Map - Slice A



Order Details

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