Phase I Desk Study Report

Title	Phase I Desk Study Report
Client	Romo Holdings Ltd
Location	Land South of A617, Rainworth
Project number	18-0494
BIM reference	RAIN-BSP-ZZ-XX-RP-G-0001-P01_ Phase_1_Site_Investigation
Date	23rd December 2020

Authorisation Sheet & Revisions Record

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1.0 INTRODUCTION

1.1 Introduction

BSP Consulting has been appointed by the Client, Romo Holdings Ltd, to undertake a Phase I Desk Study on a plot of land located to the south of the A617 in Rainworth, Nottinghamshire. A site location plan (Figure No. 18-0494/01) is included in Appendix A.

1.2 Project Understanding

We understand that the Client requires the completion of a Phase I Desk Study report to support a planning application for the development of much of the site with residential dwellings. We understand that the Client has made a pre-application enquiry to the Planning Department at Newark and Sherwood District Council (Ref: PREAPM/00248/20, dated 9th November 2020). We have been forwarded a copy of the response from Newark and Sherwood District Council.

The foregoing understanding has formed the basis of our assessment. Where the proposed site end-use is not consistent with our current understanding, it would be necessary to review our assessment to ensure it continues to apply.

1.3 Objectives

The scope of works detailed herein has been designed to ascertain the key geotechnical and environmental issues pertaining to the proposed development.

1.4 Scope of Works

Based on the defined objectives of the works (detailed in Section 1.3), the scope of the Phase I Desk Study included the following:

- A site walkover.
- Review of available historical and contemporary Ordnance Survey publications relating to the site.
- Review of the sites geology, hydrology, hydrogeology and groundwater vulnerability.
- Review of the sites coal mining status and commission of a coal mining report from the Coal Authority.
- Review of the sites radon status.
- Commission of a full detailed Landmark Envirocheck and Landmark Ground Stability Report relating to the site.
- Commission of Landmark geological mapping data relating to the site.
- Production of a preliminary Conceptual Site Model (pCSM).

1.5 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, BSP Consulting assumes that all third-party information is true and correct.

No independent action has been undertaken to validate the findings of third party information, unless specifically stated.

The Phase I Desk Study undertaken herein comprises entirely of non-intrusive works and provides a strategic overview of the site from a geotechnical and environmental perspective and attempts to identify any potential abnormal issues with regards to the proposals for redevelopment of the site.

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

BSP Consulting has prepared this report for the sole use and reliance of the Client, Romo Holdings Ltd., in accordance with our standard Conditions and Limitations (a copy of which is included as Appendix I). This report may not be relied upon by any third party without the explicit written agreement of BSP Consulting.

2.0 SITE DESCRIPTION & HISTORY

2.1 Site Description

The site comprises an irregular shaped plot of land located to the south of the A617, Rainworth, Nottinghamshire. The site may be located centred around approximate Ordnance Survey National Grid Reference 459030E 358610N and extends to an approximate area of 6.7 hectares.

A site visit was undertaken on 14th December 2020 and at the time of our visit the site essentially comprised an undeveloped parcel of land; bounded to the north by Rainworth Bypass (the A617); to the east by a private access road (Pentaque Way, formerly Rufford Colliery Lane); to the west by a private road (accessed from Churchfield Drive to the sites south) and mature woodland; and to the southwest by residential dwellings off Churchfield Drive and Southwell Road East.

Vehicular access onto the site was not readily possible at the time of our visit due to steep topography or dense vegetation at the access points; although pedestrian access could be gained via narrow informal footpaths entering the sites northeast and southeast off Pentaque Way; the sites northwest through the adjoining woodland and the sites southwest off the access road from Churchfield Drive.

The main body (central area) of the site generally sloped down to the east and was covered by a combination of rough grass, weeds, brambles and sporadic trees. The ground surface was uneven underfoot. The vegetation became denser towards the sites southwestern, northwestern and southeastern boundaries, preventing access across much of these parts of the site. A number of interlinked informal footpaths crossed through the site.

A disused and heavily overgrown former railway embankment was present within the southwestern site boundary. The embankment was colonised by semi-mature trees, shrubs and brambles and was inaccessible.

A watercourse, Rainworth Water, entered the site in the south and flowed in a northerly direction into a culvert located beyond the northern part of the sites eastern boundary. The banks of the watercourse were noted to be locally eroded, indicating variable water levels. Ponded water, presumed from surface flooding, was present along the banks of the watercourse in the sites east. The footpath which entered the site from the sites southeast off Pentaque Way led to the watercourse and embankment.

The northeastern boundary of the site rose steeply up to the A617, which appeared to have been constructed on an embankment beyond the site.

A vehicle compound which appeared to incorporate a vehicle maintenance garage was present beyond the southern part of the sites northwestern boundary. A second vehicle maintenance garage was present beyond the southern part of the sites southeastern boundary. A Pentaque Club and recreation ground were present beyond Pentaque Way, to the sites east. Woodland was present beyond the sites northwestern boundary; although this boundary was undefined at the time of our visit.

An Annotated Site Plan (Figure No. 18-0494/02) is included as Appendix B of this report, which shows the main features of the site and immediate surrounds. General views of the site are included on the plans in Appendix C of this report (Figure No. 18-0494/03a to 18-0494/03e).

An aerial photograph of the site, obtained from the Landmark Analysis tool commissioned as part of our works, is presented in Figure 1 below.

Figure 1: Aerial photograph of the site (2020 image).

2.2 Site History

Available historical and contemporary Ordnance Survey publications (detailed in Appendix D) were reviewed to obtain historical information for the site.

We would note that the boundary marked on the historical sheets within the Envirocheck Report appears to 'shift' on several of the maps due to scaling inaccuracies between maps of differing dates. This is a function of Envirocheck transposition algorithms. We would also note that the site area is reduced (compared to the commissioned desk study searches) with the southwestern extent of the garden area no longer being part of the site.

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 majority of the site appears to comprise undeveloped fields. • A railway line ('*Midland Railway*') on an embankment runs within, and parallel to, the sites southwestern boundary. • A watercourse ('*Rainworth Water*') is present within the southeastern site boundary. The watercourse passes beneath the railway embankment and is indicated to flow to the northeast. • A track is present within (or immediately beyond) the sites northwestern boundary).	• The area immediately surrounding the site comprises undeveloped fields. The fields to the immediate northwest comprise part of '*Rainworth Nursery*'. • The small village of Rainworth, comprising a number of buildings (presumed to be predominantly residential), including '*Robin Hood Inn*' is present approximately 100m to the sites south. • A road (later Southwell Road East) is present approximately 30m to the sites south. • '*Bishophill Plantation*' is present from approximately 170m to the sites southwest.
1900s	• A '*Weir*' is shown on Rainworth Water, to the immediate northeast of the railway embankment within the site.	• The nursery land to the sites northeast is shown to be covered by trees. • '*Water Works (Mansfield Corporation)*' are present approximately 95m to the sites southwest.
1910s	• The site remains essentially unchanged.	• A road (later Rufford Colliery Lane, now Pentaque Way) has been constructed immediately beyond the sites southeastern boundary. • A residential estate has been constructed from approximately 170m to the sites west. • A branch of the railway line (later shown as a Mineral Railway) has been constructed approximately 140m to the sites west, through the nursery land. This links the railway line crossing the site to Rufford Colliery approximately 1.3km to the sites north. • Further residential dwellings and a Mission Church are shown within Rainworth village to the south.
1920s	• The site remains essentially unchanged.	• The surrounding area remains essentially

Date	Features on Site	Features off Site
		unchanged.
1930s	• The site remains essentially unchanged.	• By the late 1930s, a '*Recreation Ground*', '*Sports Ground*' and '*Sports Arena*' are present to the sites east. • Further expansion of Rainworth has taken place to the sites southwest.
1940s	• No maps available for viewing.	• No maps available for viewing.
1950s	• The western field has been divided to form two fields.	• The trees to the immediate northwest of the site have been cleared.
1960s	• A small unlabelled structure is present within the sites northwestern boundary, to the north of the railway line.	• Rainworth has continued to expand to the sites south, southwest and southeast, with properties now shown immediately beyond the sites southwestern boundary.
1970s	• The railway line within the site is shown as '*Dismantled*'. • Further small buildings are shown within the sites northwestern boundary. • The field boundaries within the western area of the site have been reconfigured to form a large field and a small field.	• A '*Caravan Site*' is present to the west of the branch railway line. • Residential development has taken place around *'Churchfield Close'* to the immediate southwest of the site.
1980s	• The route of Rainworth Water within the site appears to have been diverted, with the channel now closer to the sites southeastern boundary. The weir is no longer indicated. It is presumed that the former channel has become infilled. • The site now comprises part of a single field.	• The surrounding area remains essentially unchanged.
1990s	• The majority of the site remains essentially unchanged. • It would appear that the small buildings within the northwestern site boundary appear to have been demolished. • The 1999 aerial view indicates much of the site to comprise an agricultural field, with dense vegetation present along the former railway embankment in the sites southwest. • Hardstanding and possible small structures appear to be present within the sites northwestern boundary	• A '*Nursing Home*' has been constructed approximately 60m to the sites west.
2000	• The site remains essentially unchanged, although the route of the dismantled railway is shown to be a '*Path*'.	• The surrounding area remains essentially unchanged.
2003	• The structures previously indicated in the sites west are now absent.	• A dual carriageway (A617) is present immediately beyond the sites northeastern boundary. • The access track beyond the sites eastern boundary now terminates to the sites east.

Date	Features on Site	Features off Site
2006	• The site remains essentially unchanged.	• The Caravan Site to the west is now shown as '*Woodland Park*'.
2009, 2013	• The site remains essentially unchanged.	• The surrounding area remains essentially unchanged.
2016	• A '*Path*' is shown to cross the site from the westernmost corner to the northeastern corner.	• The surrounding area remains essentially unchanged.
2020	• The site remains essentially unchanged.	• The surrounding area remains essentially unchanged.

Based on our walkover and review of available historical mapping, the site has remained largely undeveloped, with the exception of small structures within the sites western area and these appeared to be related to a compound / vehicle maintenance garage which remains present to the sites west. Aerial photography dating from 1999 reveals that the site was historically used as agricultural land, although it is anticipated that it ceased to be used as agricultural land when the A617 was constructed to the sites north, essentially cutting off vehicular access to the site during the early 2000s. Our walkover revealed the site surface to be currently uneven underfoot and it is possible that this is a relict from historical agricultural practices at the site although it may also be associated with disturbance to the ground surface during construction of the A617.

2.3 Aerial Photography & Historical Map Overlays

As part of the commissioned Landmark Report, the use of the Landmark Envirocheck Analysis tool was purchased to provide site specific aerial photographic imagery, and to provide the ability to undertake limited historical map overlay manipulation.

Figure 2 shows an overlay of the historical map publications from 1958 (1:2500) and 2003 (1:10000) which show the former and current route of Rainworth Water through the site and the location of the railway embankment within the site.

Figure 3 shows an aerial image of the site in 1999, showing the majority of the site as agricultural land, prior to the construction of the A617 to the sites north.

Figure 2: Overlay of 1958 Historical Map (black and white image) with 2003 Historical Map (colour image)

Figure 3: 1999 Aerial Image

3.0 GEOLOGY & ENVIROMENTAL SETTING

3.1 Geological References

The following geological publications were referred to:

- Landmark 1:50000 geological map sheets (included in Appendix E).
- British geological Survey (BGS) Sheet 113 Ollerton (1966) Solid and Drift.
- The BGS online interactive map viewer and Lexicon of Named Rock Units.
- The Coal Authority online interactive map viewer.
- Environment Agency website: www.environment-agency.gov.uk.

3.2 Geology

The bedrock underlying the site is indicated to comprise the Chester Formation (formerly referred to as Bunter Pebble Beds) dating from the Permo-Triassic, which generally comprises '*pinkish red or buff-grey, medium- to coarse-grained, pebbly, cross-bedded, friable sandstone*'. This stratum may weather to gravelly sand / sandy gravel near surface.

Superficial deposits are not indicated to be present beneath the site.

3.3 Faults

No faults are indicated to be present within the boundary of the site or within the immediate vicinity of the site.

3.4 Man-Made Deposits

The geological publications do not show the presence of any man-made deposits (i.e. Made Ground, Worked Ground or Landscaped Ground) beneath the site. However, based on our walkover and review of available mapping, the former railway embankment running within the southwestern site boundary is anticipated to comprise Made Ground. Furthermore, Infilled Ground is anticipated along the former route of Rainworth Water within the southeastern area of the site. Whilst the watercourse remains at the site, the historical map review has revealed that the route was diverted circa 1980s and it is anticipated that the former channel became infilled at this time. The infill materials to the former channel represent a potential source of man-made deposits (i.e. Made Ground) at the site.

The geological plans do not indicate the presence of any Man-Made deposits within potential influencing distance of the site (i.e. <250m).

3.5 Coal Mining Report

The site is indicated to lie within a coal mining reporting area. Therefore, it was necessary to commission a coal mining report from the Coal Authority.

A CON29M Coal Mining Report was commissioned as part of our works (a copy of which is included in Appendix F), the key findings are summarised as follows:

Past Underground Mining

The report states '*The property* [i.e. the site] *is in a surface area that could be affected by underground mining in 5 seams of coal at 380m to 760m depth, and last worked in 1992*'. The report goes on to state '*Any movement in the ground due to coal mining activity associated with these workings should have stopped by now*'.

Present and Future Underground Mining

The site is not affected by present underground mining. The site is unlikely to be affected by plans for future workings.

Mine Entries

The report states that '*There are no recorded mine entries known to the Coal Authority within, or within 20m, of the boundary of the property*'.

Coal Mining Geology

The report states that '*The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining*'.

Opencast Mining

The site is not indicated to be affected by past, present, or plans for future opencast mining.

Mine Gas

The report states that '*The Coal Authority has no record of a mine gas emission requiring action'*.

Hazards Relating to Coal Mining

The report states that *'The property has not been subject to remedial works, by or on the behalf of the Coal Authority, under its Emergency Surface Hazard Call Out procedures.'*

Coal Mining Subsidence

The report shows a triangular shaped area within the eastern boundary of the site to have been the subject of two damage notices or claims relating to alleged coal mining subsidence damage.

With respect to the first claim the report states '*A damage notice or claim for alleged subsidence damage was made in June 2003 for CULVERT ON ACCESS TO FORMER RUFFORD COLLIERY, RAINWORTH, MANSFIELD, NOTTINGHAMSHIRE. However, the claim was rejected*'. With respect to this matter the report further states '*There is no current Stop Notice delaying the start of remedial works or repairs to the property*'.

The report states the following in relation to the second claim '*A damage notice or claim for alleged subsidence damage was made in June 2003 for FIELD* OS 0067 *NORTH OF RAINWORTH WATER, RAINWORTH, NOTTINGHAMSHIRE. However, the claim was rejected*'. With respect to this matter the report further states '*There is no current Stop Notice delaying the start of remedial works or repairs to the property*'.

Three further records of damage notices or claims for alleged coal mining subsidence are recorded at Nos. 269, 271 and 285 Southwell Road East, located immediately beyond the sites southwestern boundary. These claims were made in either 1994 or 1998 and were all rejected.

Comments

Whilst two damage notices or claims for alleged subsidence damage were made in relation to the site, both claims were rejected by the Coal Authority. Further enquiries could be made to the Coal Authority as part of further works to ascertain the nature of these claims.

Based on the foregoing, no specific investigation or mitigation in relation to historical coal mining issues is anticipated 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 G and has revealed the following key information (details are only listed where they are within potential influencing distance of the site).

3.6.1 Agency & Hydrological

Aquifer Status

The aquifer designation maps are presented in Appendix G and are based on geological mapping provided to Landmark by the British Geological Survey. Different aquifer classifications may be applied to superficial (drift) deposits (typically forming shallow perched groundwater units where present) and bedrock aquifers (which may contain regional groundwater units). Possible aquifer designations comprise Principal Aquifers, Secondary (A, B or Undifferentiated) Aquifers and Unproductive Strata.

The underlying bedrock is designated as a *'Principal Aquifer'*. There is no superficial aquifer designation for the site as superficial deposits are not indicated to be present.

The Principal Aquifer is provided with a High Vulnerability designation.

The Environment Agency describe Principal Aquifers as *'layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer'*.

Source Protection Zones

The site and its immediate surrounding area are shown to lie within a Zone III area of a Total Catchment of a Source Protection Zone (SPZ), as designated by the Environment Agency. SPZs relate to the protection of groundwater resources principally for public drinking water supply.

Flood Risk Status

The area in the immediate vicinity of Rainworth Water which passes through the southeastern area of the site is indicated to be at risk of flooding and extreme flooding from rivers or sea without defences.

The area in the vicinity of the watercourse is also indicated to be of low to high risk of flooding from surface water, with the high risk areas closest to the watercourse.

This report does not constitute a formal flood risk assessment.

Surface Water

A surface water feature is identified on the site, this relates to a watercourse known as Rainworth Water which is present in the sites eastern area and is indicated to flow to the north.

Prosecution Relating to Controlled Waters

A single entry is listed 212m to the northeast of the site which related to a blocked sewer which led to sewage entering a nearby watercourse. The incident occurred in 2005.

Local Authority Pollution Prevention and Controls

A single record is detailed approximately 73m to the sites south, relating to a Petrol Filling Station. The status is recorded as '*Authorised*'.

Pollution Incidents to Controlled Waters

A single entry is recorded on site, relating to pollution from '*Crude Sewage*' which entered into a surface watercourse. The pollution was caused by a blocked sewer in 1999. The incident was recorded as '*Category 3 – Minor Incident*'.

Three further records are listed between 205m and 220m from the site and all relate to incidents classified as '*Category 3 – Minor Incident*'.

Substantiated Pollution Incident Register

An entry is recorded 5m to the southeast of the site, relating to '*Crude Sewage*' in 2003, the incident was categorised as '*Category 2 – Significant Impact*' to water, with no impact to air or land reported.

Water Abstractions

Nine records are listed between 80m and 120m from the site. All relate to the abstraction of groundwater from a borehole / well by Severn Trent Water Limited for '*Potable Water Supply – Direct*'.

3.6.2 Waste

There are no waste sites (i.e. current or historic landfill, waste transfer stations etc.) identified on the site, or within 250m of the site, in the Landmark Report.

There are no areas of Infilled Ground noted in the Landmark report, although our review of historical maps and our site visit has revealed the route of Rainworth Water through the site was diverted circa 1980s. It is anticipated the former channel of Rainworth Water within the site became infilled when the watercourse was diverted and therefore, Made Ground may be anticipated in this area of the site. Furthermore, Made Ground is anticipated to be present at the site associated with the former railway embankment.

3.6.3 Hazardous Substances

There are no sites associated with hazardous substances (i.e. sites dealing with explosives etc.) identified on the site, or within a 250m radius of the site, in the Landmark Envirocheck Report.

3.6.4 Geological Issues

BGS Soil Chemistry

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.

Estimates of the soil chemistry at the site indicate anticipated concentrations of Arsenic of <15mg/kg, Cadmium of <1.8mg/kg, Chromium of 20-40mg/kg, Lead of <100mg/kg and Nickel of <15mg/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.

Coal Mining Affected Areas

The Landmark Envirocheck Report reveals the site lies within an area requiring a Coal Mining Report (see Section 3.5).

Ground Stability Hazards

No significant ground stability hazards have been identified that relate to the site (including from compressible, collapsible, running sand, ground dissolution, landslide and shrinking or swelling clay ground stability hazards).

Radon

The Landmark Envirocheck Report identifies that the site lies within a lower probability Radon area (where less than 1% of houses are estimated to be at or above the Action Level). On this basis, radon precautions are not necessary in the construction of new dwellings or extensions.

BGS Borehole Records

There are no relevant BGS borehole records on the site, the closest available record relates to a borehole with an approximate depth of 63m which was drilled approximately 113m to the sites south in 1972. However, the borehole was drilled from a level of -1932.5 feet (589m) below Ordnance Datum (i.e. starting underground) associated with Rufford Colliery. No information on the near surface soils are therefore included on the log (only Coal Measures strata at depth).

Ground Stability Report

The Ground Stability Report within the Envirocheck Report lists the Railway Embankment at the site as an Extractive Industry or Potential Excavation. Two further Extractive Industry or Potential Excavation features are recorded within 250m of the site, relating to The Waterworks approximately 70m to the sites west and an area of 'Unspecified Deposited Material' located 70m to the sites west.

3.6.5 Industrial Land Use

Contemporary Trade Directory Entries

There are no industrial land use entries identified at the site. Eleven entries are recorded within 250m of the site, the closest being an active Used Car Dealers located 5m to the southeast (we would note from our walkover that this feature also appeared to comprise a vehicle maintenance garage) and an active Garage Services business located 14m to the sites west. The remaining entries relate to inactive businesses including '*Exhaust & Shock Absorber Centres*', '*Fencing Manufacturers*', '*Garage Dealers*', '*Computer Recycling & Disposal*' and '*Damp & Dry Rot Control*', the closest of which was 36m to the sites south.

Points of Interest – Commercial Services

There are six records within 250m of the site. Five of these relate to '*Vehicle Repair, Testing and Servicing*' businesses relating between 5m and 52m from the site. The remaining record relates to a '*Recycling Services*' business, 142m to the sites southwest.

Points of Interest – Education and Health

A single entry is listed 239m to the sites south relating to a '*Pain Management Solutions (Rainworth Health Centre*'.

Points of Interest – Recreational and Environmental

There are three records relating a '*Skatepark*' (31m to the southeast) and two Play Areas (35m to the sites southeast & 169m to the sites west).

3.6.6 Sensitive Land Use

Nitrate Vulnerable Zones

The site and surrounding area are identified as being within a Nitrate Vulnerable Zone. In our experience the majority of this area of the country is defined as a Nitrate Vulnerable Zone and this classification is considered not to present a potential risk to the development of the site.

Sites of Special Scientific Interest (SSSI)

An area located approximately 53m to north of the site, immediately beyond the A617, is designated as a SSSI, known as '*Rainworth Heath*'.

3.7 Local Authority Information

Prior to commencing the Desk Study, we were provided with a copy of a pre-application enquiry document (Ref: PREAPM/00248/20, dated 9th November 2020) prepared by the Planning Department at Newark and Sherwood District Council (NSDC) in relation to the proposed residential development.

The document provides a brief summary of the sites setting and planning history together with pre-application comments from Local Authority consultees including the Environment Agency, Natural England, Nottinghamshire County Council Highways Officer and Local Flood Authority and the NSDC Environmental Health Department and Contaminated Land Officer. The document also summarises Nottinghamshire County Council Planning Policy.

Our review of the document has revealed the following pertinent information in relation to the proposed development with respect to the sites environmental setting.

Within the site description, the document states '*…the constraints diagram indicates a disused railway line which runs across the centre of the site. Therefore adequate ground investigation should be undertaken to determine the potential for on site contamination and, if discovered how these will be mitigated*'.

The Environment Agency also state that '*The southern part of the site is a designated Local Wildlife Site*'. The document confirms the presence of a SSSI within 100m (Rainworth Heath) to the sites north with a second SSSI present within 400m to the sites north (Rainworth Lakes). The site also lies within the '*buffer zone area within which the need for the impact on the potential Sherwood Forest Special Protection Area (SPA) for its breeding bird (nightjar and woodlark) needs to be considered*'.

The comments from the Environment Agency states '*an ordinary watercourse (Rainworth Water) does run through the south eastern portion of the site. The flood map for planning confirms that part of the red line boundary* [i.e. the proposed development site boundary] *therefore lies within flood zones 2 and 3 respectively. However, the large majority of the land lies within flood zone 1. We would advise that the applicant avoids development within flood zones 2 and 3 where possible*'.

The Environment Agency also confirm that the site lies within a Source Protection Zone and states '*we would expect foul sewage drainage to be connected to the mains sewer which runs through the site*'.

The comments from Natural England note '*Rainworth Heath SSSI* [from approximately 100m to the sites north] *contains some of the best remaining wet and dry heath in Nottinghamshire and is representative of heathland in central and eastern England. The wet heath community is developed in association with a spring line that issues from pebble beds; this is surrounded by extensive areas of dry heath that support a diverse invertebrate fauna*'. Natural England further comment '*The development has triggered the impact risk zone for Rainworth Heath SSSI. The proposed development has the potential to impact the SSSI through polluted discharge of foul and surface water*'.

The Environmental Health Department provides comments with respect to noise, dust and potential lighting nuisance in relation to the proposed development and notes that the Construction Management Plan should cover most issues.

The comments from the Contaminated Land Officer state the following '*Historic mapping shows the presence of a former mineral railway which crosses the application site. Railway land is a potentially contaminative use and I would therefore recommend the use of the full phase contamination condition.*

Furthermore, the application site is in close proximity to the A617 and I would expect the air quality impact of this busy road on the application site to be assessed as part of the application. In addition I would expect the impact of the site itself on air quality to be considered, both during construction and post development'.

Based on the foregoing, the pre application information from NSDC has revealed that they consider the embankment to the former railway in the sites south to be a source of potential historical contamination. Furthermore, the site is regarded to potentially be located within an ecologically sensitive area associated with the influence zone of Rainworth Heath SSSI. Therefore, consideration should be given to the ecological setting of the site in due course.

Our Desk Study Enquiries and the information provided from NSDC have also revealed areas the site to be susceptible to surface water flooding associated with Rainworth water.

A full copy of the NSDC preapplication response is included in Appendix H.

3.8 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 (RICS) and the Chartered Institute of Environmental Health (CIEH).

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). Although now formally withdrawn, this document identifies key contaminants which may potentially be present at a site as a result of a given historical land use and is considered useful as a desk based ready reference guide.

3.8.1 On Site Assessment

At the time of our site works, the site comprised an undeveloped and disused parcel of land which incorporated a heavily overgrown former railway embankment along the southwestern boundary and a watercourse (Rainworth Water) within the southeastern boundary.

Historically, the majority of the site has remained undeveloped and appeared to have been used as agricultural land until at least 1999 as evidenced on the aerial photograph within the Envirocheck historical plans. It is anticipated that the use of the site as agricultural land ceased during the early 2000s when the A617 was constructed to the sites north, essentially cutting off vehicular access to the site. Small structures were historically present within the sites western area from around the 1930s to the 1990s / early 2000s and latterly these appeared to be related to a compound / vehicle maintenance garage which remains present to the sites west.

The historical plans have revealed that the railway embankment and associated railway line was present from at least the 1880s and the railway remained active until circa 1970s. The embankment remains along the majority of the southern site boundary and is now densely vegetated. Rainworth Water historically passed beneath the railway embankment within a culvert, however, the section of the embankment over the culvert and the culvert itself has now been removed. The route of Rainworth Water was diverted circa 1980s and it is anticipated that the former channel was infilled at this time. Any infill materials would represent a source of localised Made Ground at the site. Our walkover revealed the ground along the banks of Rainworth Water within the site to be boggy and waterlogged, possibly indicative of surface flooding.

The Syms document has revealed that, based on information obtained from the desk study and our site walkover, the railway embankment within the site falls into the generic land use of a *'Railway Land, including yards and tracks'* which has been given a hazard rank of 32 and a Medium perceived risk (Class C). The Syms document states that contamination can occur through the construction process employed in the establishment of the railway tracks, through to the operation of engineering depots, goods yards and substations. Building railway tracks, including embankments, can involve the use of large quantities of clinker ash from local industries, along with crushed slag which was frequently used as ballast to support the track, as was steam locomotive ash.

Based on the information obtained from our desk study enquiries, our walkover of the site and experience of similar sites, potential general soil contamination that may be present could include:

- Metals and metalloids associated with any Made Ground beneath the site.
- Polycyclic Aromatic Hydrocarbons (PAHs) from any ashy inclusions and/or carbonaceous inclusions in the near surface soils and the historical railway line / embankment within the site.
- Total Petroleum Hydrocarbons (TPH) potentially associated with the historical railway line at the site and possible migration from former structures in the sites west, potentially associated with the off-site vehicle maintenance garage.
- Pesticides and herbicides associated with the former agricultural use, together with herbicides potentially used along the railway.
- Asbestos containing materials (ACM) associated with the former structures in the sites west, any Made Ground beneath the site and the former railway embankment in the sites south.
- Ground gas (methane and carbon dioxide) from any infill materials (potentially including buried organic matter) along the infilled route of Rainworth Water. Man-made deposits associated with the railway embankment.

Whilst we note that the on-site railway embankment represents an area of Made Ground (i.e. land raise) any hazardous gases (i.e. methane and carbon dioxide) generated from any organic materials within the embankment are anticipated to migrate laterally upwards and vertically out of the embankment, rather than migrating downwards into the underlying soils. Therefore, the risk of ground gas generation from the on-site embankment is considered to be very low, with the main risk driver for hazardous ground gases at the site considered to be any Made Ground associated with the infilled watercourse.

The Syms document also lists other potential contaminants associated with railway land, however, the majority are considered to be generally associated with activities carried out at goods yards and engineering depots and therefore not likely to be present at significant concentrations at the site given the use as just a railway line.

3.8.2 Off Site Assessment

With regards to potential sources of chemical contamination, based on the findings of the Phase I Desk Study enquiries, the vehicle maintenance garage / compound present immediately beyond the sites western boundary may be regarded as a potential source of contamination. A second vehicle maintenance garage is present beyond the site southeastern boundary. It is unknown whether any fuel / oil storage tanks are present associated with these vehicle maintenance garages. There is the possibility that any leakage or spillage of fuel / oil stored within the vehicle maintenance garages may have migrated onto the subject site, although any contamination is anticipated to be localised at this stage.

On this basis the following contamination may locally be present at the site:

- Total Petroleum Hydrocarbons (TPH).

We would note that the railway embankment continues to the sites west, however, this is anticipated to represent land-raise rather than infilled ground and is therefore not considered to be a source of ground gases in the vicinity of the site.

4.0 PRELIMINARY CONCEPTUAL SITE MODEL

4.1 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:

(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, and ecosystem, property, or controlled waters...

(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.' For a contaminant linkage to be plausible, all three elements need to be present.

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 February 2019).

The preliminary CSM should identify the hazards (source of potential contamination) and should set out the potential pollutant linkages with a view to identifying the nature and magnitude of the potential risks to receptors.

In order to undertake the foregoing assessment, consideration is required with respect to the probability or likelihood of the linkage occurring and the severity and significance of the potential consequences; taking account the nature of the pollutant linkage and the potential severity of the hazard and the sensitivity of the receptor within the context of the proposed land use (in consideration of the planning regime).

Consideration of consequence/severity, probability/likelihood and risk has been based on the following guidance documentation:

- CIRIA C552 '*Contaminated Land Risk Assessment, A Guide to Good Practice*', 2001.
- EA R&D publication 66 '*Guidance for the Safe Development of Housing on Land Affected by Contamination*', 2008.

4.2 Classification of Consequences

In order to apply a consequence classification to a particular potential pollutant linkage, it is first necessary to define the terminology used within the classification system. The following terminology and definitions detailed in Table 2 have been adopted within our assessment, based on the guidance referenced in Section 4.1.

Table 2: Classification of Consequences

Classification	Definition
Severe	• Acute risks to human health. • Short-term risk of pollution of controlled waters or significant impact on controlled waters; e.g. large-scale pollution or very high levels of contamination. • Catastrophic damage to buildings or property (such as building explosion causing collapse). • Ecological system effects – immediate risks of major damage which is likely to result in irreversible substantial adverse changes in the functioning of the ecosystem or harm to a species of special interest that endangers the long-term maintenance of the population.
Medium	• Chronic risks to human health. • Pollution of sensitive water resources (such as leaching of contaminants into controlled waters) causing a significant effect on water quality. • Ecological system effects – Immediate risks of significant damage which may result in substantial adverse changes to the ecosystems functioning or harm to a species of special interest that may endanger the long-term maintenance of the population. • Significant damage to buildings, structures and services (for example foundation damage or rendering the building unsuitable for habitation).
Mild	• Non-permanent health effects to human health (i.e. exposure is unlikely to lead to 'significant harm' in the context of Part 2A of the Environmental Protection Act 1990. • Pollution of controlled waters or non-sensitive water resources (for example non-classified groundwater) that results in a short-lived effect to water quality or a marginal effect on amenity value, agriculture or commerce. • Minor damage to buildings, structures and services. • Ecological system effects – Minor or short-term damage which is unlikely to result in

Classification	Definition
	substantial adverse changes to the ecosystems functioning or harm to a species of special interest. • Substantial damage to non-sensitive environments (such as arable farmland for example).
Minor	• No measurable effects on human health including non-permanent health effects to human health that are easily preventable by appropriate use of PPE/RPE. • Minor pollution of controlled waters including non-sensitive water resources with no discernible effects on water quality or ecosystems. • Minor damage to non-sensitive environments (including arable farmland for example). • Easily repairable effects of damage to buildings, structures, services or the environment (for example discolouration of concrete, loss of plants in a landscaping scheme etc.).

4.3 Classification of Probability

Once the possibility of a pollutant linkage has been established (noting that probability classification does not apply when there is no possibility of a linkage being present), the probability should be classified in accordance with Table 3.

Table 3: Classification of Probability

Classification	Definition	Likelihood
High Likelihood	There is a pollutant linkage and an event is highly likely to occur in the short-term, and is almost inevitable over the long-term OR there is evidence at the receptor of harm or pollution occurring.	>95% likelihood of Consequence Occurring
Likely	There is a pollutant linkage and it is probable that an event will occur. It is not inevitable, but possible in the short-term and likely over the long-term.	50 – 95% likelihood of Consequence Occurring
Low Likelihood	There is a pollutant linkage and circumstances are possible under which an event could occur. It is by no means certain that even over a longer period such an event would take place, and less likely in the short-term.	5 – 49% Likelihood of Consequence Occurring
Unlikely	There is a pollutant linkage and it is improbable that an event would occur even in the very long-term.	<5% likelihood of Consequence Occurring

4.4 Classification of Risk

In order to establish the relevant risk term applicable to the identified pollutant linkage, one of the risk phrases identified within Table 4 must be adopted, with the definitions of each risk term detailed within Table 5.

Table 4: Risk Classification Matrix (Based on C552 CIRIA, 2001)

		Consequence of Risk			
		Severe	Medium	Mild	Minor
Probability (Likelihood)	High Likelihood	Very High	High	Moderate	Moderate/Low
	Likely	High	Moderate	Moderate/Low	Low
	Low Likelihood	Moderate	Moderate/Low	Low	Negligible
	Unlikely	Moderate/Low	Low	Negligible	Negligible or No Potential Risk

Table 5: Risk Classification Definitions (Based on C552 CIRIA, 2001); Modified by BSP

Very High	There is a high probability that severe harm will arise to a designated receptor from an identified hazard OR there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, there is a low likelihood that such harm would be severe, or if any harm were to occur it is more likely that the harm would be mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Moderate/Low	It is possible that harm could arise to a receptor. However, a combination of likelihood and consequence results in a risk that is above low but is not of sufficient concern to be classified as moderate. It can be driven by cases where there is an acute risk which carries a severe consequence, but where the exposure is unlikely. Such harm would at worse normally be mild. The risk is unlikely to present a substantial liability. Some limited further investigation may be required to clarify the risk and any associated liability. If subsequent remediation works are necessary, they are likely to be limited in extent.
Low	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Negligible	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is unlikely to be any worse than mild. No liability would be associated with such risks.
No Potential Risk	There is no potential risk or liability where no pollutant linkage has been established.

4.5 Contaminant [C] – Pathway [P] – Receptor [R] Considerations

The following CPR assessment has been undertaken based on the assumption that it is proposed to develop the site for a residential end-use.

4.6 Consideration of Potential Sources of Contamination [C]

Based on the findings of our works, the potential key sources of contamination at the site that would require consideration for the derivation of an initial CSM would be the following:

Table 6: Summary of Potential Contaminant Sources

Areas of Potential Concern (APCs)	Associated Contaminants
Made Ground & Near Surface Natural Soils	• Metals or metalloids • PAHs • TPHs • Pesticides and herbicides • Asbestos containing materials
On Site Man-Made Deposits	• Ground gases including (methane and carbon dioxide)
Off Site Contamination	• TPHs (associated with vehicle maintenance garages to the sites west and southeast)

4.6 Consideration of Potential Pathways [P]

The potential pathways at the site are primarily:

- Direct ingestion of soil (either directly or as soil particles attached to produce).
- Inhalation of fugitive dust and vapours.
- Direct skin contact with the ground.
- Direct ground contact with construction materials (including supply pipes).
- Vertical and lateral migration of contamination.
- Vertical and lateral migration of potentially hazardous ground gases.

4.7 Consideration of Potential Receptors [R]

The potential receptors at the site are:

- The final end users (employees and residents - typically long term (chronic) exposure) and site visitors – (typically short term (acute) exposure).
- The construction personnel (i.e. site workers) involved with the development of the site (typically short term (acute) exposure).
- Neighbouring properties (off-site receptors).
- Controlled Waters (i.e. underlying groundwater and nearby surface waters).
- Buildings and construction materials (including buried utilities).

4.8 Preliminary Risk Assessment / Conceptual Site Model

Our preliminary conceptual model of possible pollutant linkages, applicable to the proposed site usage and based on our current understanding, is summarised in Table 7.

Table 7: Preliminary Risk Assessment Summary Table – Desk Study

Areas of Potential Concern [C]	Potential Pathway(s) [P]	Potential Receptor [R]	Probability of CPR Linkage	Consequence of CPR Linkage	Risk Level	Comments / Justification
Made Ground & Near Surface Natural Soils	Direct contact, ingestion or inhalation of fugitive dust	End users	Likely	Medium	Moderate	Made Ground is anticipated to be present locally associated with the infilled former route of Rainworth Water in the southeastern portion and also potentially associated with former buildings in the sites western area. Man Made deposits are also anticipated along the route of the disused railway embankment. Potential contamination may be associated with the Made Ground and the former activities including the railway land. End users are likely come into contact with the in-situ soils. Further consideration of this potential linkage should be provided during the course of the Phase II Exploratory Investigation works.
	Direct contact, ingestion or inhalation of fugitive dust	Site personnel	Likely	Medium	Moderate	Made Ground is anticipated to be present locally associated with the infilled former route of Rainworth Water in the southeastern portion and also potentially associated with former buildings in the sites western area. Man Made deposits are also anticipated along the route of the disused railway embankment. Potential contamination may be associated with the Made Ground and the former activities including the railway land. Site personnel will inevitably come into contact with the in-situ soils. Further consideration of this potential linkage should be provided during the course of the Phase II Exploratory Investigation works.

Areas of Potential Concern [C]	Potential Pathway(s) [P]	Potential Receptor [R]	Probability of CPR Linkage	Consequence of CPR Linkage	Risk Level	Comments / Justification
	Vertical and lateral migration	Neighbouring properties	Low Likelihood	Medium	Moderate/Low	Made Ground is anticipated to be present associated with the infilled former route of Rainworth Water, the former buildings and the disused railway embankment. Potential contamination may be associated with the Made Ground and the former activities including the railway land. In addition, other potential sources of contamination have been locally identified in close proximity to the site. Further consideration of this potential linkage should be provided during the course of the Phase II Exploratory Investigation works.
	Leaching of Contaminants through unsaturated zone	Controlled Waters	Likely	Medium	Moderate	Made Ground is anticipated to be present locally associated with the infilled former route of Rainworth Water, the former buildings and the disused railway embankment. Potential contamination may be associated with the Made Ground and the former activities including the railway land. Rainworth Water passes through the eastern area of the site. The underlying bedrock deposits comprise a Principal Aquifer (high vulnerability). Hence, any groundwater beneath the site may be regarded as being potentially susceptible to contamination. The site lies within a Zone III Source Protection Zone. Further consideration of this potential linkage should be provided during the course of the Phase II Exploratory Investigation works.
	Direct contact or contact with vapours	Plastic buildings products (i.e. water supply pipes and buried concrete)	Low Likelihood	Medium	Moderate/Low	Made Ground is anticipated to be present associated with the infilled former route of Rainworth Water and the disused railway embankment. Potential contamination may be associated with the Made Ground and the former activities including the railway land. The Made Ground may contain elevated levels of contaminants that may affect plastic building products. Further consideration of this potential linkage should be provided during the course of the Phase II Exploratory Investigation works.

Areas of Potential Concern [C]	Potential Pathway(s) [P]	Potential Receptor [R]	Probability of CPR Linkage	Consequence of CPR Linkage	Risk Level	Comments / Justification
On-site Man-Made Deposits	Vertical and lateral migration of ground gases to indoor air	End users of new buildings (asphyxiation) or new buildings (damage via explosion)	Likely	Medium	Moderate	Man-made deposits (i.e. Infilled Ground) associated with the former route of Rainworth Water. This represents a potential source of hazardous ground gases. Further consideration of this potential linkage (including a potential programme of ground gas monitoring) should be provided during the course of the Phase II Exploratory Investigation works.

The foregoing preliminary conceptual model highlights the potential plausible pollutant linkages that may relate to the site and would therefore require addressing by appropriate Phase II Exploratory Works. The information contained within the conceptual model should be confirmed and revised upon completion of an appropriate intrusive investigation.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Site Summary

- At the time of our site visit (December 2020), the site comprised a disused parcel of land which predominantly comprised scrubland with rough grass, weeds and sporadic trees. Historically the site was used as agricultural land and it is anticipated the site ceased to be used for this purpose during the early 2000s when the A617 was constructed to the sites north which essentially cut off vehicular access to the site. Small structures were historically present within the sites western area from around the 1930s to the 1990s / early 2000s and latterly these appeared to be related to a compound / vehicle maintenance garage which remains present to the sites west.
- Rainworth Water passes through the eastern area of the site, flowing to the northeast. Ponded water was noted at the surface along the banks of the watercourse at the time of our site visit. The route of this watercourse was diverted during the 1980s and any infill materials to the former channel are considered to represent Made Ground at the site.
- A disused and overgrown railway embankment is present within the southwestern boundary of the site.
- The geological publications indicate that the site is underlain by bedrock of the Chester Formation.
- The bedrock at the site is designated as a Principal Aquifer and is located within a Zone III catchment area of a SPZ.

5.2 Geotechnical Assessment

The bedrock geology underlying the site is indicated to comprise the Chester Formation. This may be a geotechnically suitable bearing stratum for shallow foundations, however, the foundation solution for the proposed dwellings will depend on the results of intrusive investigation works, together with the proposed site levels. The ground investigation works should determine the presence and nature of any man-made deposits (i.e. Made Ground infilling the former channel of Rainworth Water and any disturbed ground across the site) and provide an assessment of the depth to, and strength of, the Natural Strata beneath the site.

A disused and overgrown railway embankment is present within the southwestern boundary of the site and a relatively steep slope exists in the northeast portion of the site. Therefore consideration should be given to the stability of the embankment and slope should any proposed excavation or construction works be undertaken in close proximity / on the slope features themselves.

An appropriate scope of geotechnical tests should also be included within a suitable Phase II investigation for the purposes of designing foundations (including plasticity index analysis and/or particle size distribution analysis, water soluble sulphate/pH etc.).

5.3 Building Near Trees

Foundation designs may need to be locally adjusted when building near existing, recently removed or proposed trees and hedgerows should any cohesive natural soils be encountered. Appropriate geotechnical soils testing should be undertaken as part of Phase II works, to assist in detailed foundation design. Deepening of foundations will not be required where competent granular bedrock is encountered at shallow depth.

5.4 Gas Precautions

The Desk Study works have revealed the presence of potential on-site sources of potentially hazardous ground gas (i.e. carbon dioxide and methane) associated with the infilled former route of Rainworth Water and potentially the existing railway embankment. However, given that the railway embankment is anticipated to comprise land-raise rather than buried Made Ground materials, it is considered that any ground gases generated from the Made Ground materials within the embankment will escape vertically or laterally to air, rather than into the underlying ground. Therefore, the key risk driver for ground gases at the site is considered to be the infilled watercourse.

Taking account of the foregoing, it will be necessary to undertake a robust programme of ground gas monitoring to establish the ground gas regime and to assist in determining the level of any gas precautions required. Monitoring should be undertaken in accordance with CIRIA Report C665 '*Assessing risks posed by hazardous ground gases to buildings*' (2007).

5.5 Radon

Based on the Landmark Envirocheck report, no radon precautions are required at the site.

5.6 Coal Mining

The Coal Mining report has revealed that there were two alleged subsidence claims relating to the site, although these claims were both rejected by the Coal Authority. Enquiries could be made to the Coal Authority as part of further works to ascertain the nature of these claims.

No coal mining precautions, or associated investigation works are anticipated to be necessary at the site.

5.7 Water

The results of the intrusive investigation will assist in establishing the groundwater regime beneath the site.

5.8 Sources of Contamination

The Phase I Desk Study has identified the following key contaminants that may potentially be present at the site:

- Metals and metalloids associated with any Made Ground beneath the site.
- Polycyclic Aromatic Hydrocarbons (PAHs) from any ashy inclusions and/or carbonaceous inclusions in the near surface soils and the historical railway line / embankment within the site.
- Total Petroleum Hydrocarbons (TPH) potentially associated with the historical railway line at the site and possible migration from former structures in the sites west, potentially associated with the off-site vehicle maintenance garage..
- Pesticides and herbicides associated with the former agricultural use, together with herbicides potentially used along the railway.
- Asbestos containing materials (ACM) associated with the former structures in the sites west, any Made Ground beneath the site and the former railway land in the sites south.
- Ground gas (methane and carbon dioxide) from any infill materials (potentially including buried organic matter) along the infilled route of Rainworth Water. Man-made deposits associated with the railway embankment.

Whilst we note that the on-site railway embankment represents an area of Made Ground (i.e. land raise) any hazardous gases (i.e. methane and carbon dioxide) generated from any organic materials within the embankment are anticipated to migrate laterally upwards and vertically out of the embankment, rather than migrating downwards into the underlying soils. Therefore, the risk of ground gas generation from the on-site embankment is considered to be very low, with the main risk driver for hazardous ground gases at the site considered to be any Made Ground associated with the infilled watercourse.

The foregoing potential contaminants should form the basis of an assessment for human health and controlled waters as part of a suitable scope of Phase II Exploratory Investigation works at the site.

5.9 Flood Risk Assessment

The area of the site in the immediate vicinity of Rainworth Water is indicated to be at risk of surface water flooding. The Pre-Application comments from NSDC included comments from the Environment Agency which state that they would advise not building in flood Zones 2 and 3 wherever possible.

This may require further consideration with respect to site layout, floor levels and ground levels etc, subject to discussion with the Local Planning Authority. This report does not constitute a flood risk assessment.

5.10 Ecological Assessment

The Desk Study Enquiries and Pre-Application Enquiry response from NSDC have revealed that the site lies approximately 60m to the north of a SSSI and the Environment Agency also state that the southern part of the site is a designated Local Wildlife Site. On this basis it may be prudent to consult an Ecologist with regards the sites ecological setting and the potential requirement for an Ecological Assessment of the site.

5.11 Statutory Consultation

We would recommend that a copy of this Phase I Desk Study report is issued (by the Client) to the Local Planning Authority for review and comment as part of the planning application process.

Any comments made by the Local Authority, or their appointed consultees, should be incorporated into the Phase II Exploratory Investigation to ensure that the intrusive investigation is acceptable to all parties.

5.12 Recommended Phase II Exploratory Investigation Works

Proposed Phase II Exploratory Works should be sufficient to investigate the possible issues raised in the Phase I Desk Study and should be undertaken in general accordance with current industry good practice.

Based on our current understanding (conceptual site model) it is recommended that Phase II works comprise the following as an initial stage of investigation:

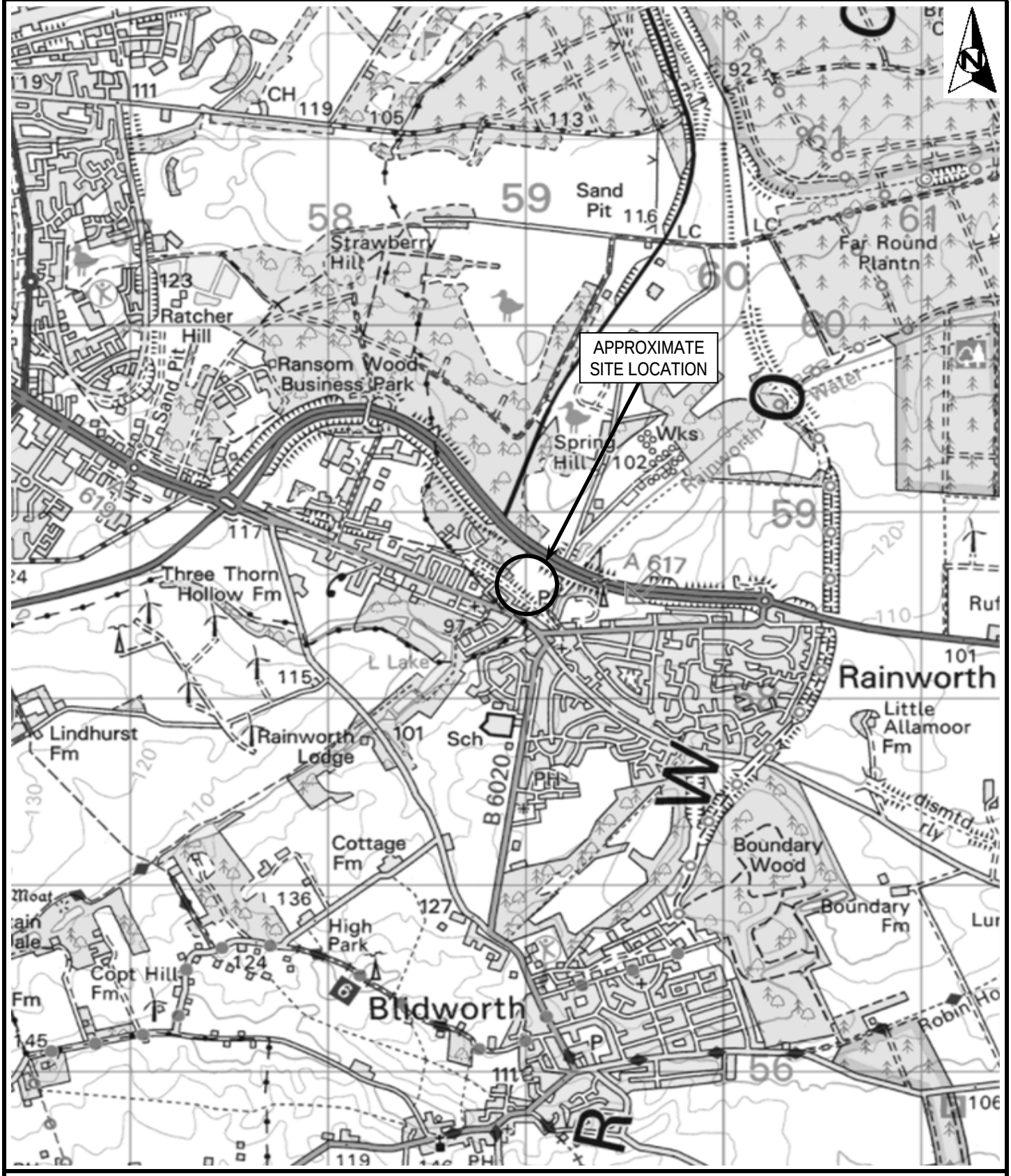
- A programme of exploratory holes across the site to provide an initial inspection of the near surface ground conditions for geotechnical and environmental purposes (anticipated to comprise window sample boreholes / trial pits). It should be noted that it is likely to be necessary to undertake clearance of some vegetation to enable vehicular access onto the site. Appropriate geotechnical and environmental soil analyses should be undertaken.
- A programme of ground gas monitoring to confirm the ground gas regime and the requirement for ground gas precautions within proposed development.
- Revision of the Conceptual Site Model.

5.13 Closing Comment

Based on the evidence of the findings of the Phase I desk study enquiries and following the implementation of any necessary remedial measures, the site is considered likely to be suitable for the proposed end-use from a geotechnical and environmental perspective.

Appendix A

Site Location Plan



Project No.	18-0494	Drawn	SJ
Client	Romo Holdings Ltd	Checked	
Project	Land South of A617 Rainworth	Approved	
		Scale	NTS
		Date Drawn	21/12/2020
Title	Site Location Plan	Rev.	
		Figure No.	18-0494/01

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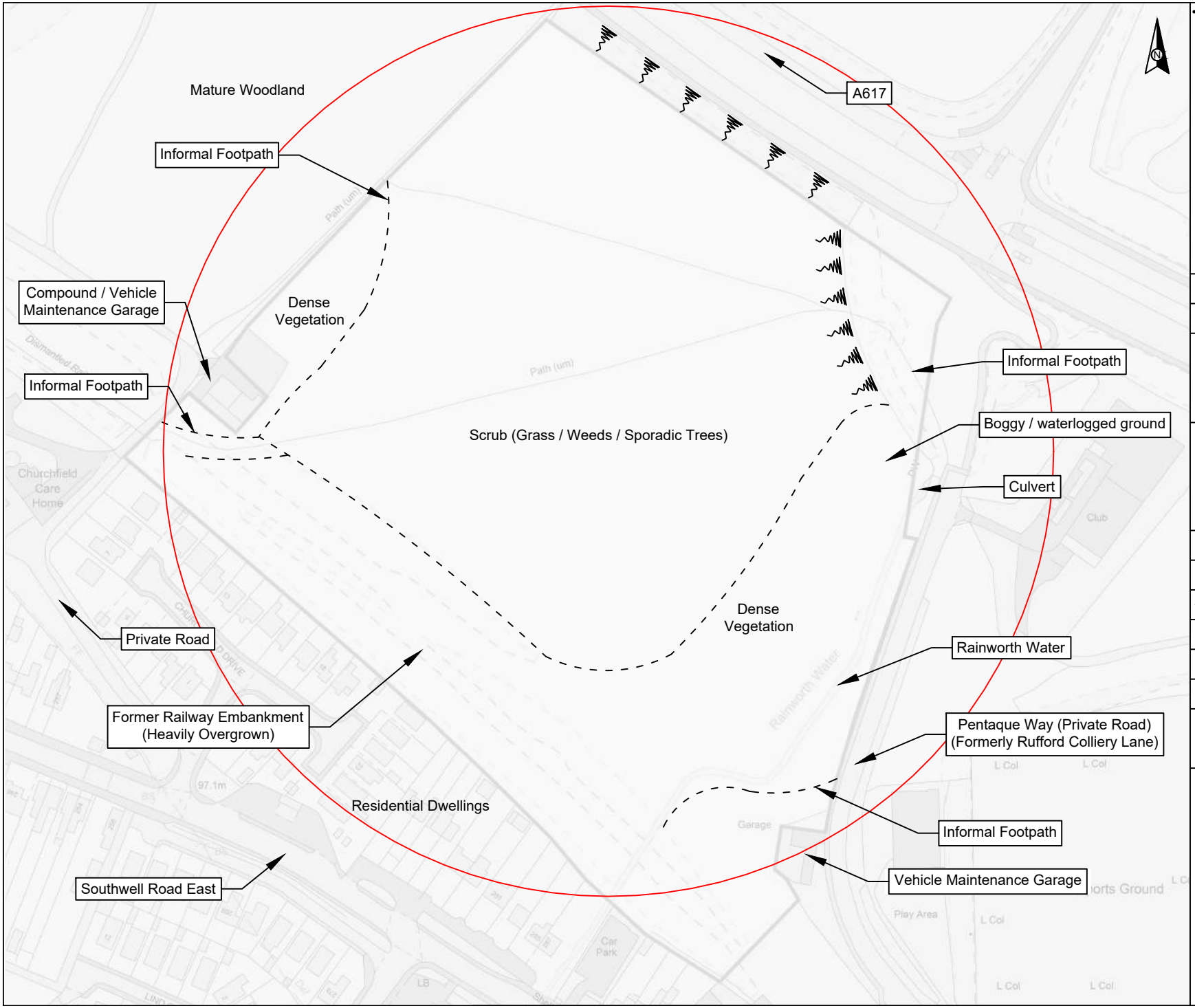
Appendix B

Annotated Site Plan



Project No.	18-0494
Client	Romo Holdings Ltd
Project	Land South of A617, Rainworth
Title	Annotated Site Plan
Drawn By	SJ
Checked By	
Approved By	
Scale	NTS
Date Drawn	17/12/2020
Revision	
Figure No.	18-0494/02

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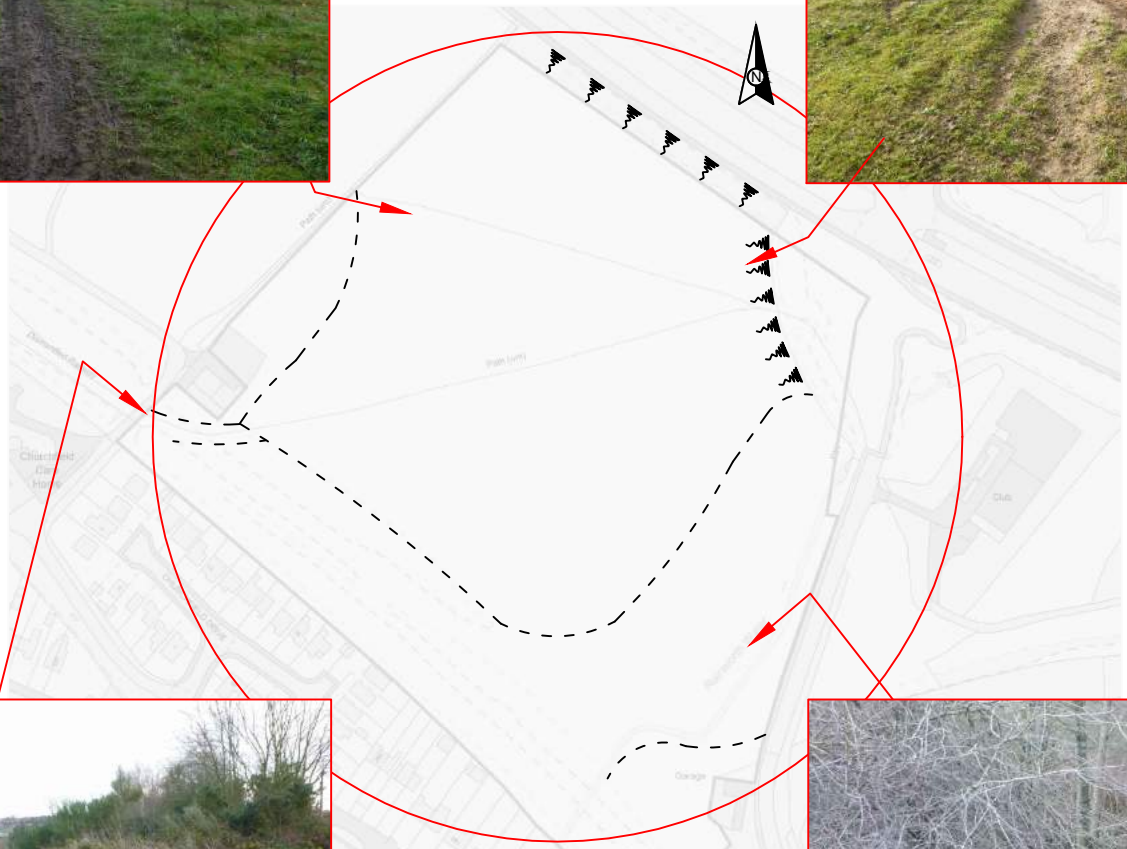
Appendix C

Site Plans Showing General Site Views



Project No.	18-0494
Client	Romo Holdings Ltd
Project	Land South of A617, Rainworth
Title	Site Plan Showing General Site Views (1 of 5)
Drawn By	SJ
Checked By	
Approved By	
Scale	NTS
Date Drawn	17/12/2020
Revision	
Figure No.	18-0494/03a

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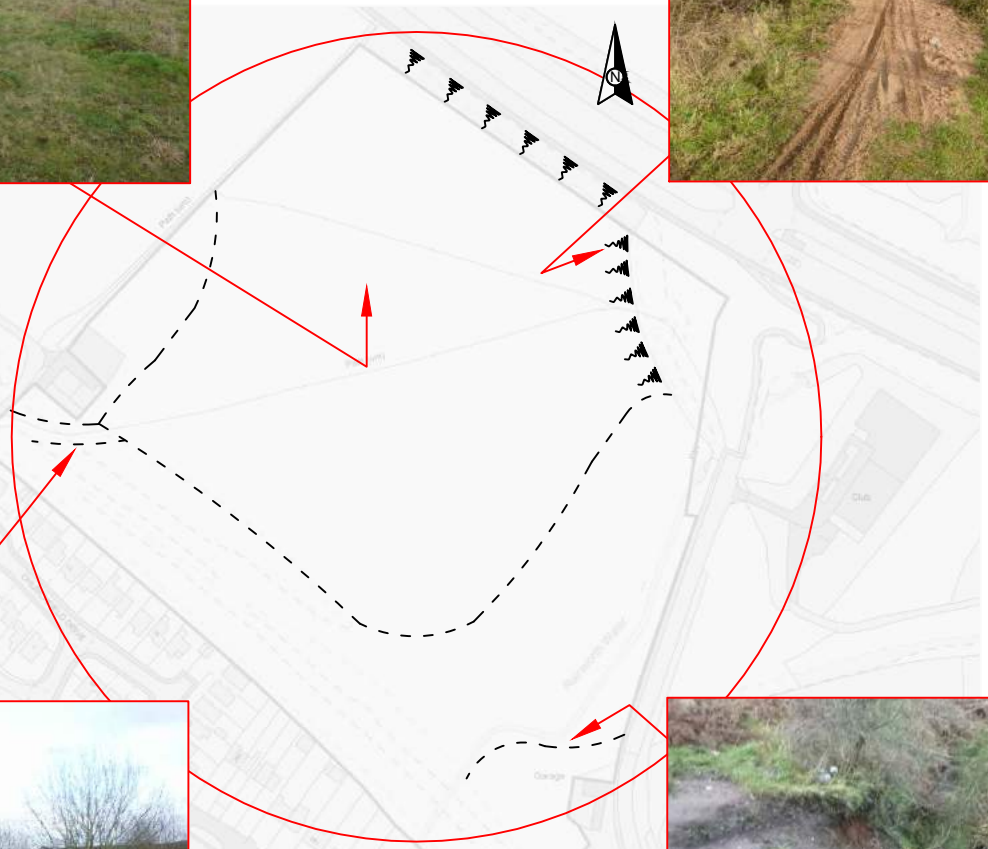

Project No.	18-0494
Client	Romo Holdings Ltd
Project	Land South of A617, Rainworth
Title	Site Plan Showing General Site Views (2 of 5)
Drawn By	SJ
Checked By	
Approved By	
Scale	NTS
Date Drawn	17/12/2020
Revision	
Figure No.	18-0494/03b

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Project No.	18-0494
Client	Romo Holdings Ltd
Project	Land South of A617, Rainworth
Title	Site Plan Showing General Site Views (3 of 5)
Drawn By	SJ
Checked By	
Approved By	
Scale	NTS
Date Drawn	17/12/2020
Revision	
Figure No.	18-0494/03c

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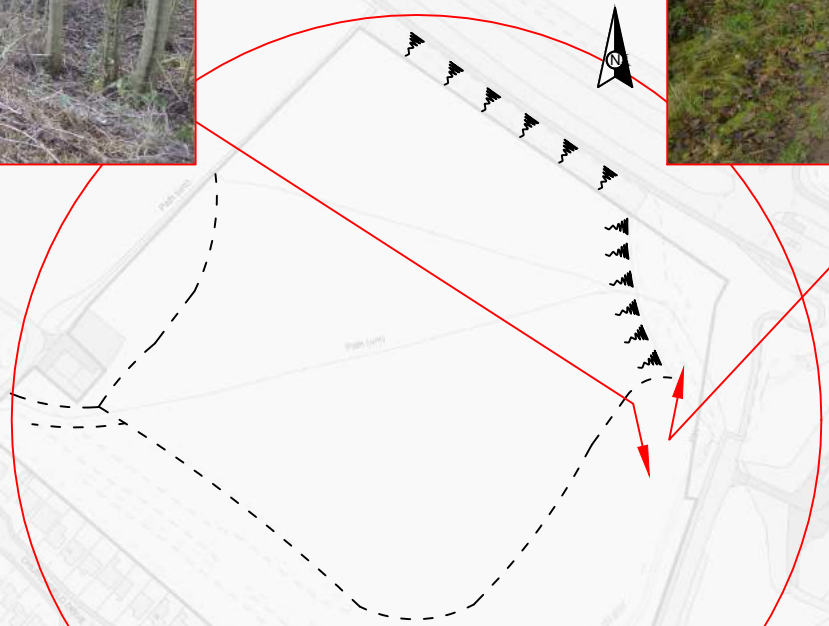

Project No.	18-0494
Client	Romo Holdings Ltd
Project	Land South of A617, Rainworth
Title	Site Plan Showing General Site Views (4 of 5)
Drawn By	SJ
Checked By	
Approved By	
Scale	NTS
Date Drawn	17/12/2020
Revision	
Figure No.	18-0494/03d

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Project No.	18-0494
Client	Romo Holdings Ltd
Project	Land South of A617, Rainworth
Title	Site Plan Showing General Site Views (5 of 5)
Drawn By	SJ
Checked By	
Approved By	
Scale	NTS
Date Drawn	17/12/2020
Revision	
Figure No.	18-0494/03e

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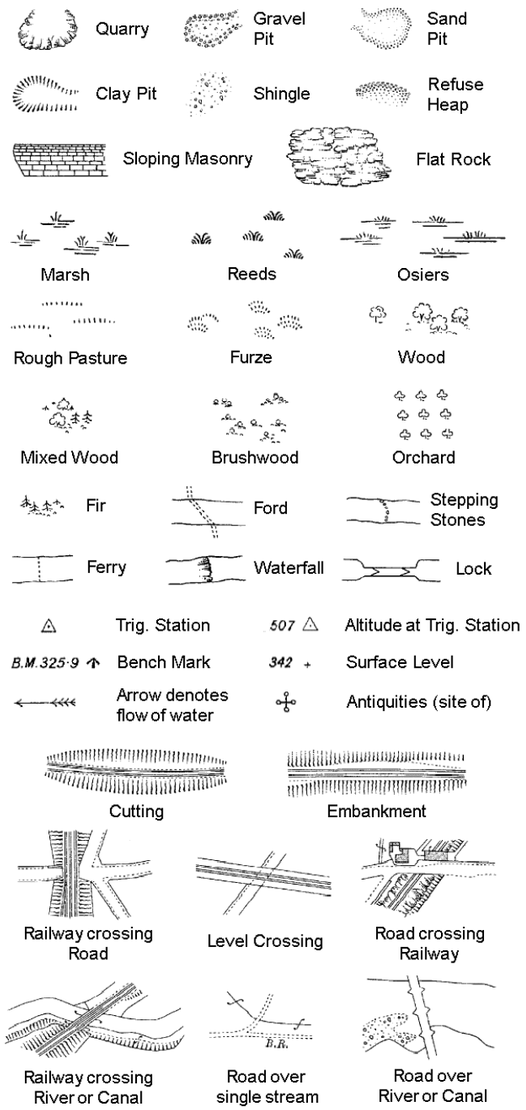
Appendix D

Historical Plans

Historical Mapping Legends

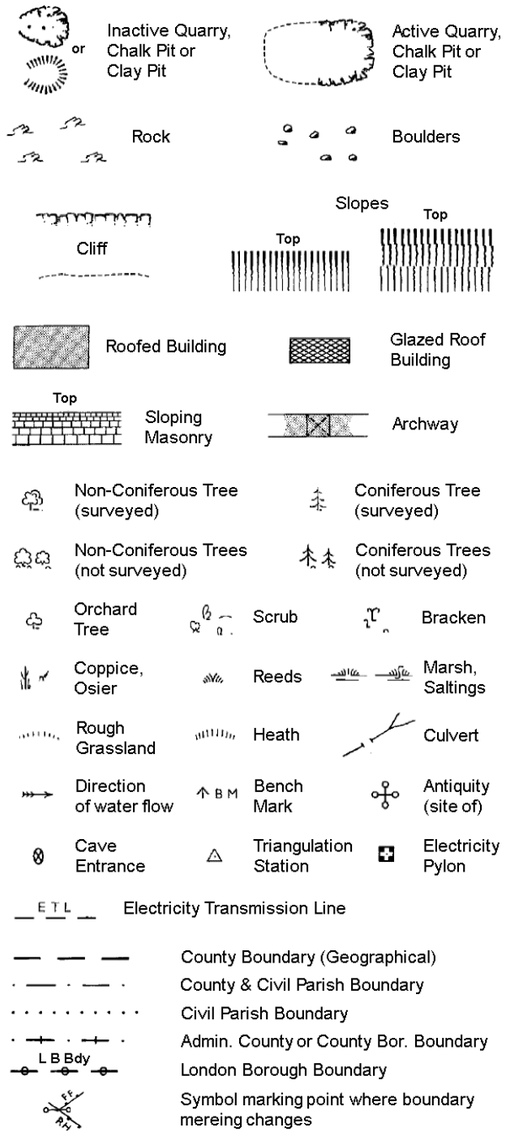
Ordnance Survey County Series and Ordnance Survey Plan 1:2,500



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)

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	St.	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

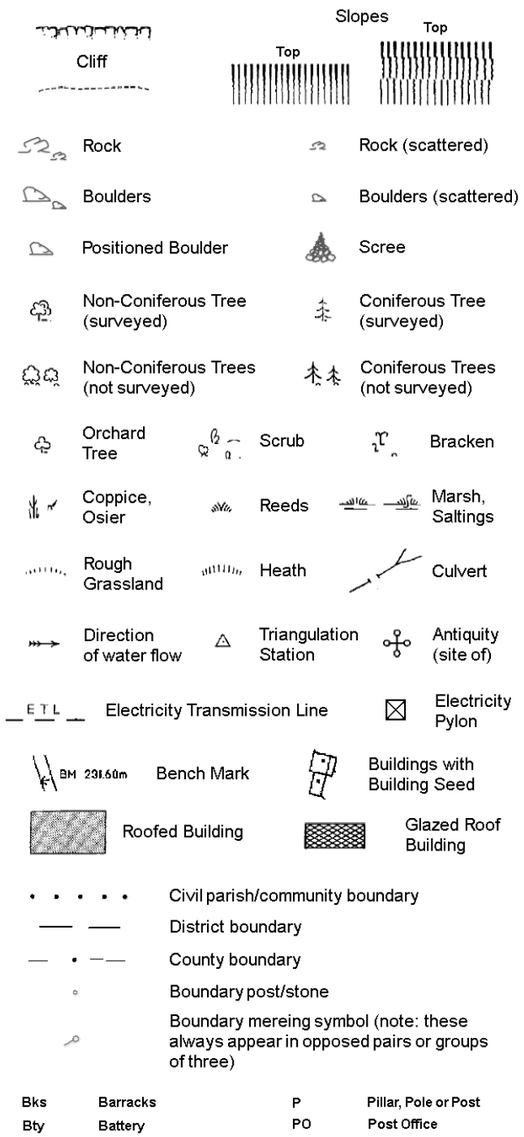
Ordnance Survey Plan, Additional SIMs and Supply of Unpublished Survey Information 1:2,500 and 1:1,250



County Boundary (Geographical)
County & Civil Parish Boundary
Civil Parish Boundary
Admin. County or County Bor. Boundary
L B Bdy
London Borough Boundary
Symbol marking point where boundary mereing changes

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



Civil parish/community boundary
District boundary
County boundary
Boundary post/stone
Boundary mereing symbol (note: these always appear in opposed pairs or groups of three)

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

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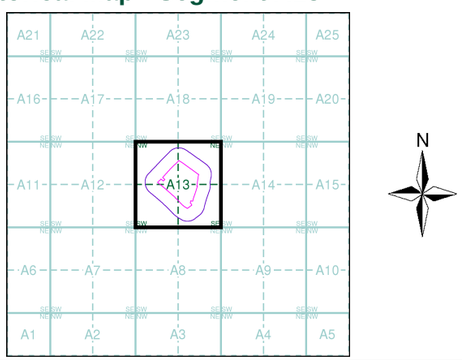
Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Nottinghamshire	1:2,500	1885 - 1886	2
Nottinghamshire	1:2,500	1899 - 1900	3
Nottinghamshire	1:2,500	1915	4
Nottinghamshire	1:2,500	1939	5
Ordnance Survey Plan	1:2,500	1960	6
Ordnance Survey Plan	1:2,500	1970	7
Supply of Unpublished Survey Information	1:2,500	1973	8
Additional SIMs	1:2,500	1977 - 1978	9
Additional SIMs	1:2,500	1982 - 1986	10
Additional SIMs	1:2,500	1989	11
Ordnance Survey Plan	1:2,500	1992	12
Large-Scale National Grid Data	1:2,500	1993	13
Historical Aerial Photography	1:2,500	1999	14

Historical Map - Segment A13



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Slice:	A
Site Area (Ha):	6.72
Search Buffer (m):	100

Site Details

Land South of A617, Rainworth

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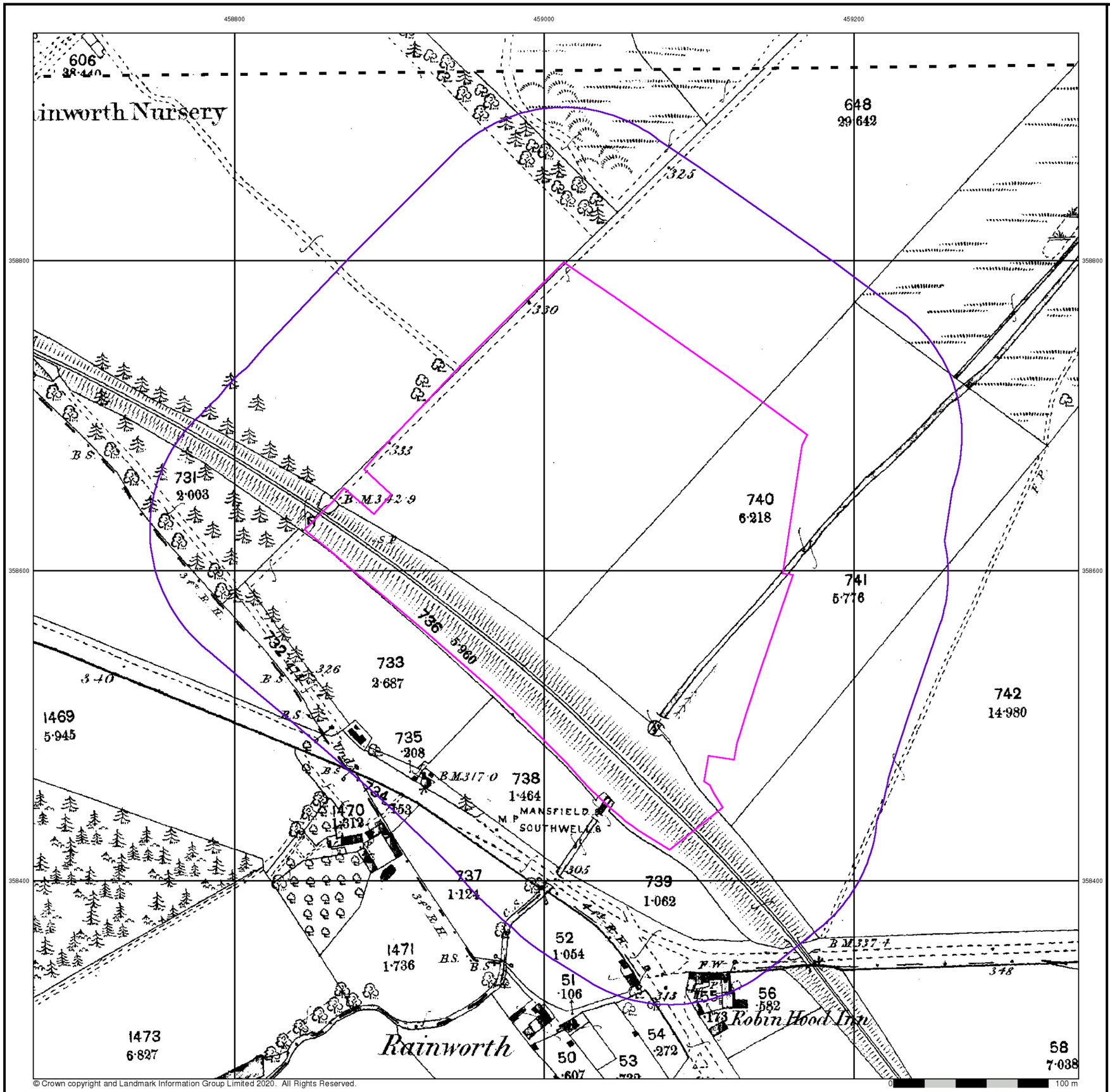
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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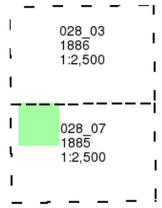
Nottinghamshire

Published 1885 - 1886

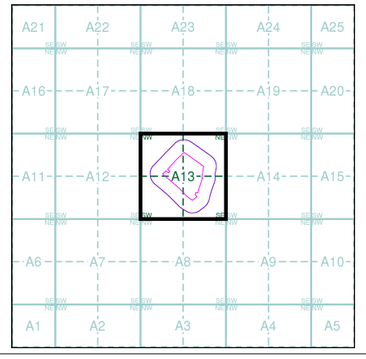
Source map scale - 1:2,500

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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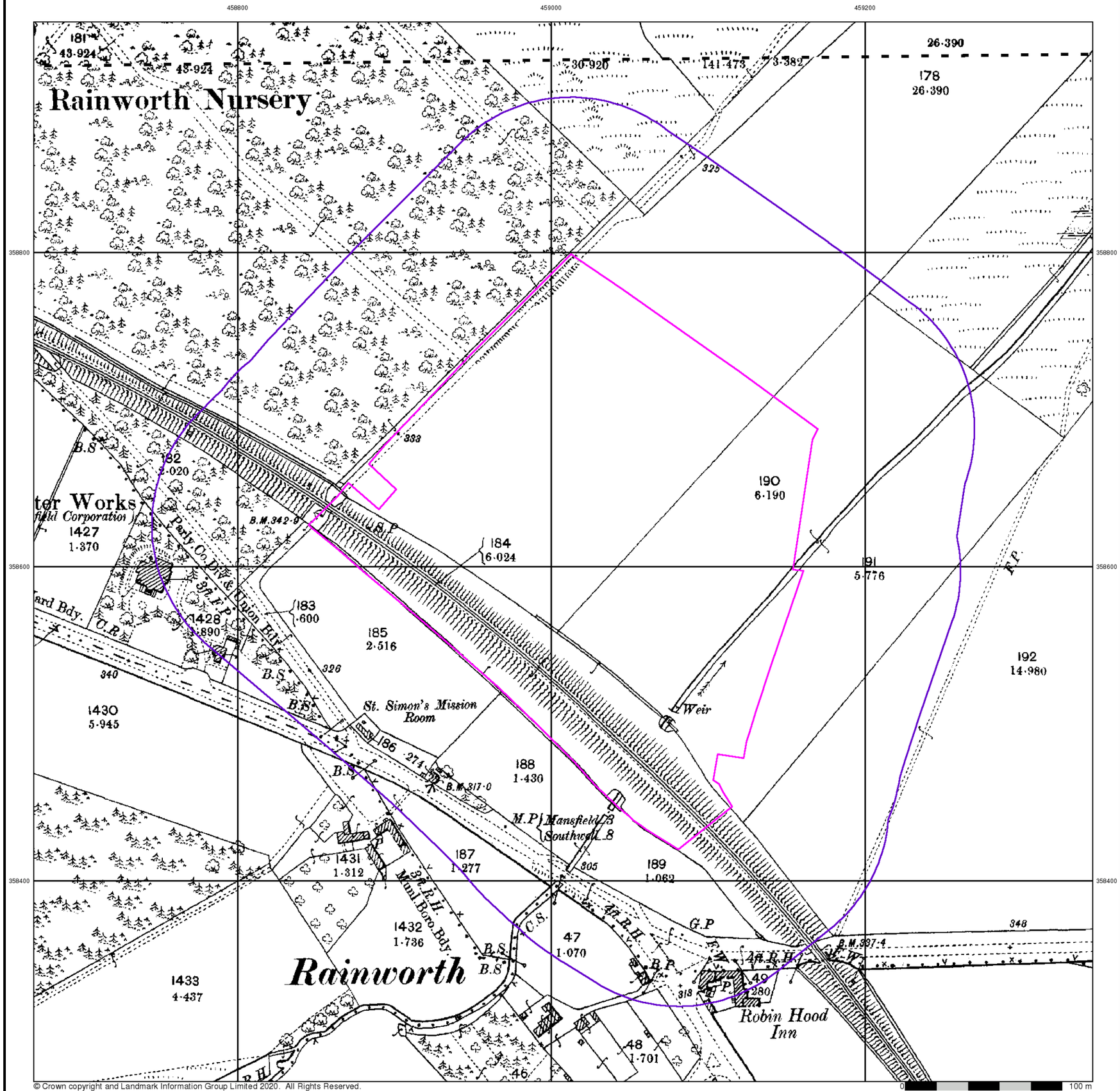

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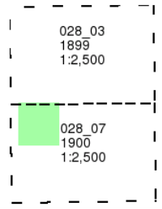
Nottinghamshire

Published 1899 - 1900

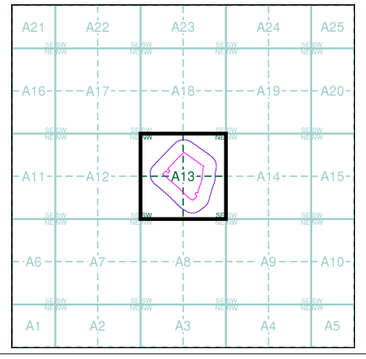
Source map scale - 1:2,500

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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Slice:	A
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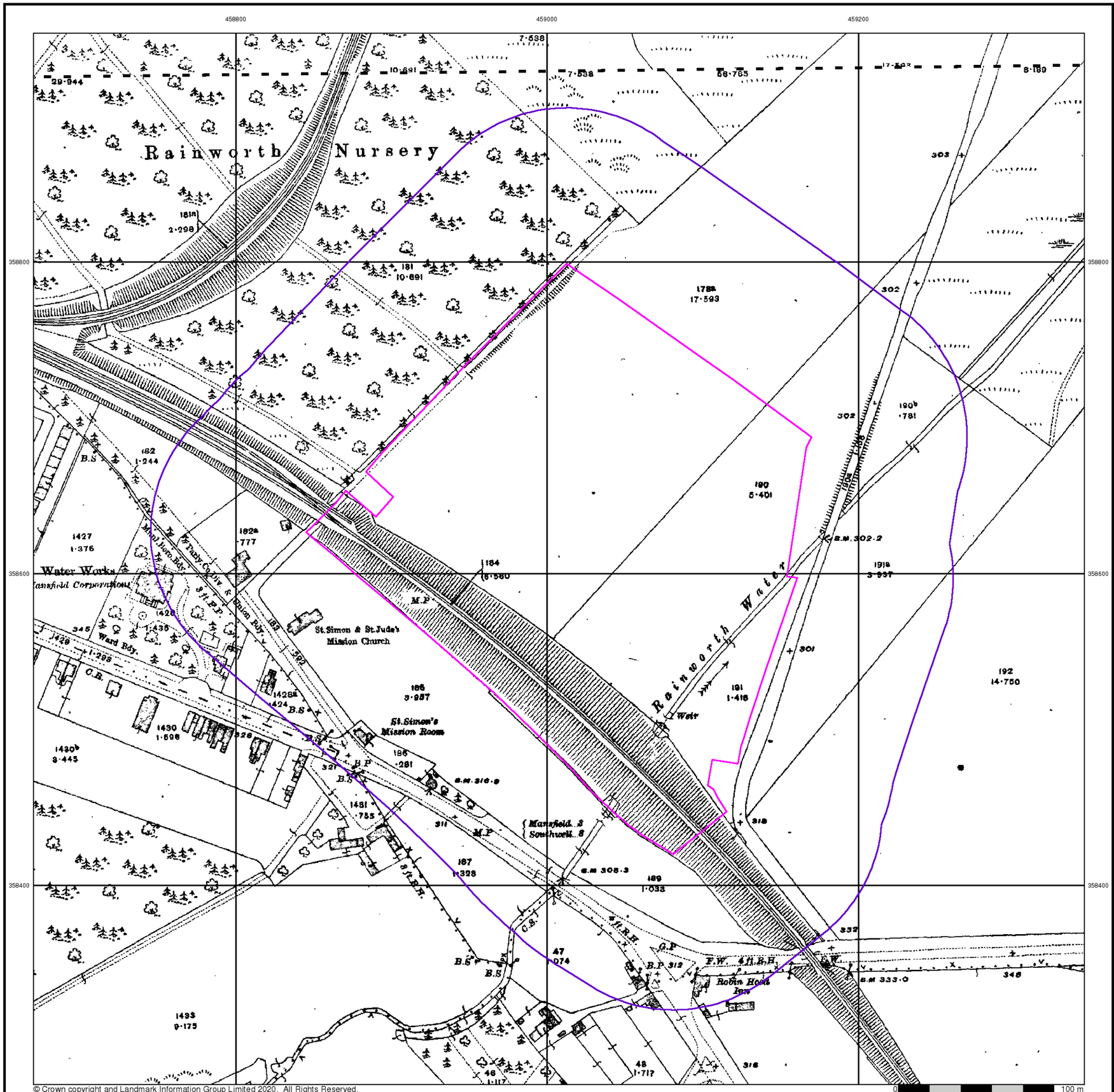

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Nottinghamshire

Published 1915

Source map scale - 1:2,500

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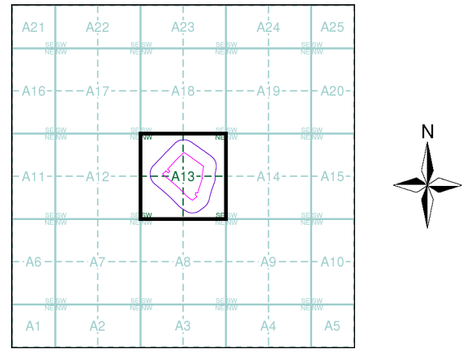
Map Name(s) and Date(s)

028_03
1915
1:2,500

028_07
1915
1:2,500

Historical Map - Segment A13



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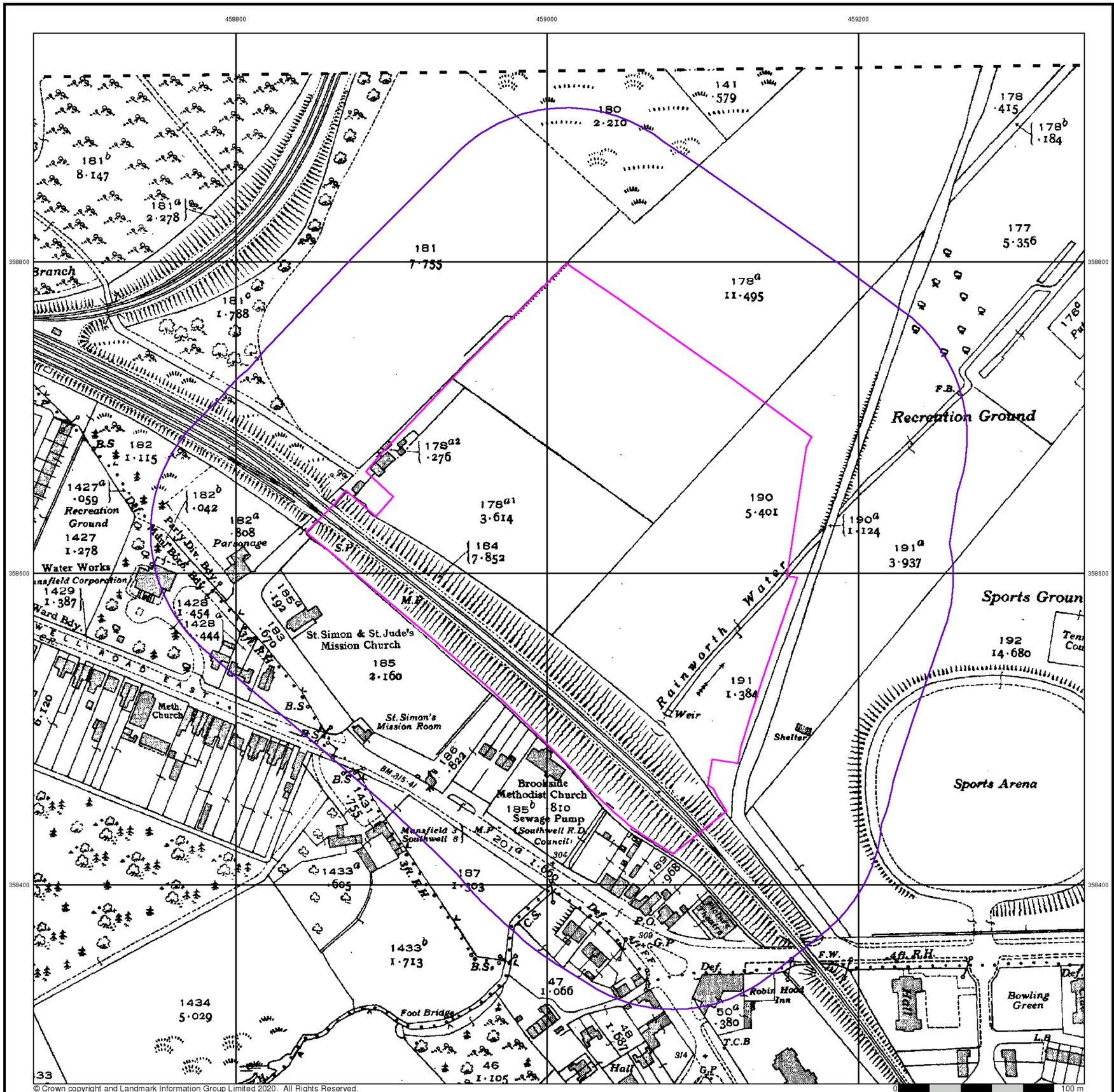

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Nottinghamshire

Published 1939

Source map scale - 1:2,500

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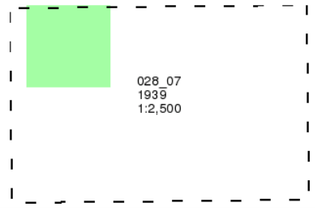
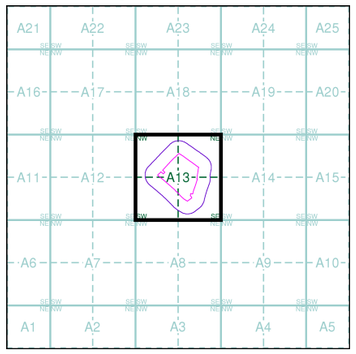
Map Name(s) and Date(s)



Historical Map - Segment A13



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Customer Ref:	D40188
National Grid Reference:	459030, 358610
Slice:	A
Site Area (Ha):	6.72
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Site Details

Land South of A617, Rainworth

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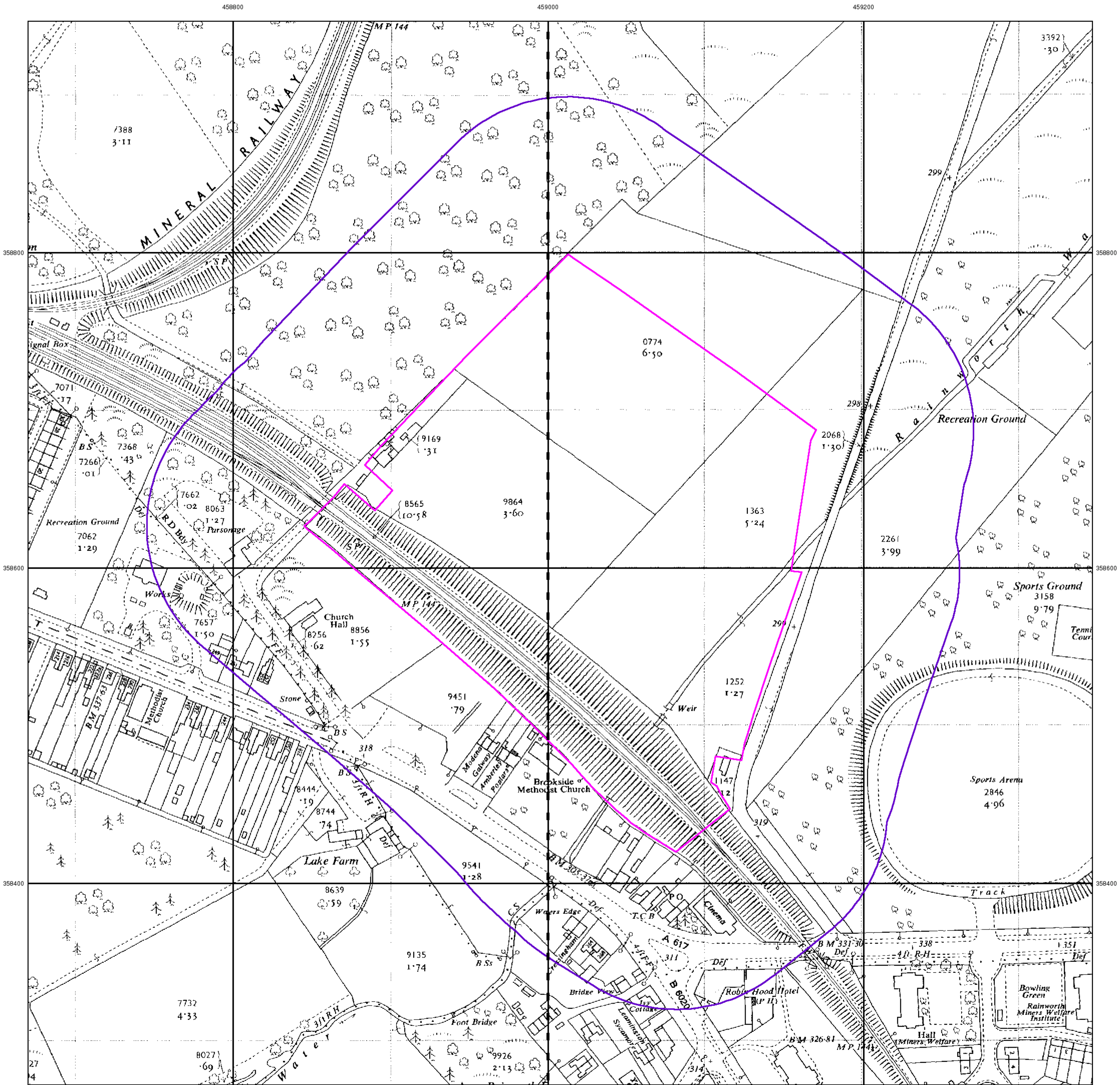

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Ordnance Survey Plan

Published 1960

Source map scale - 1:2,500

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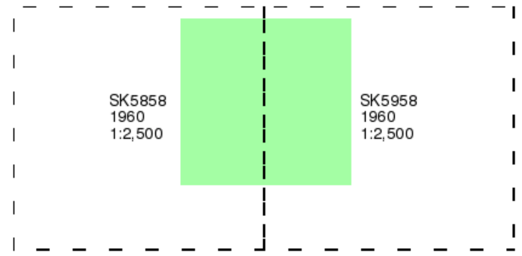
Map Name(s) and Date(s)



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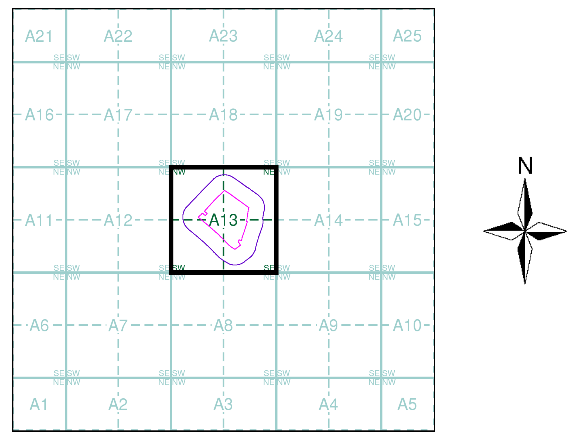

Order Details

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Customer Ref: D40188
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Slice: A
Site Area (Ha): 6.72
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Site Details

Land South of A617, Rainworth

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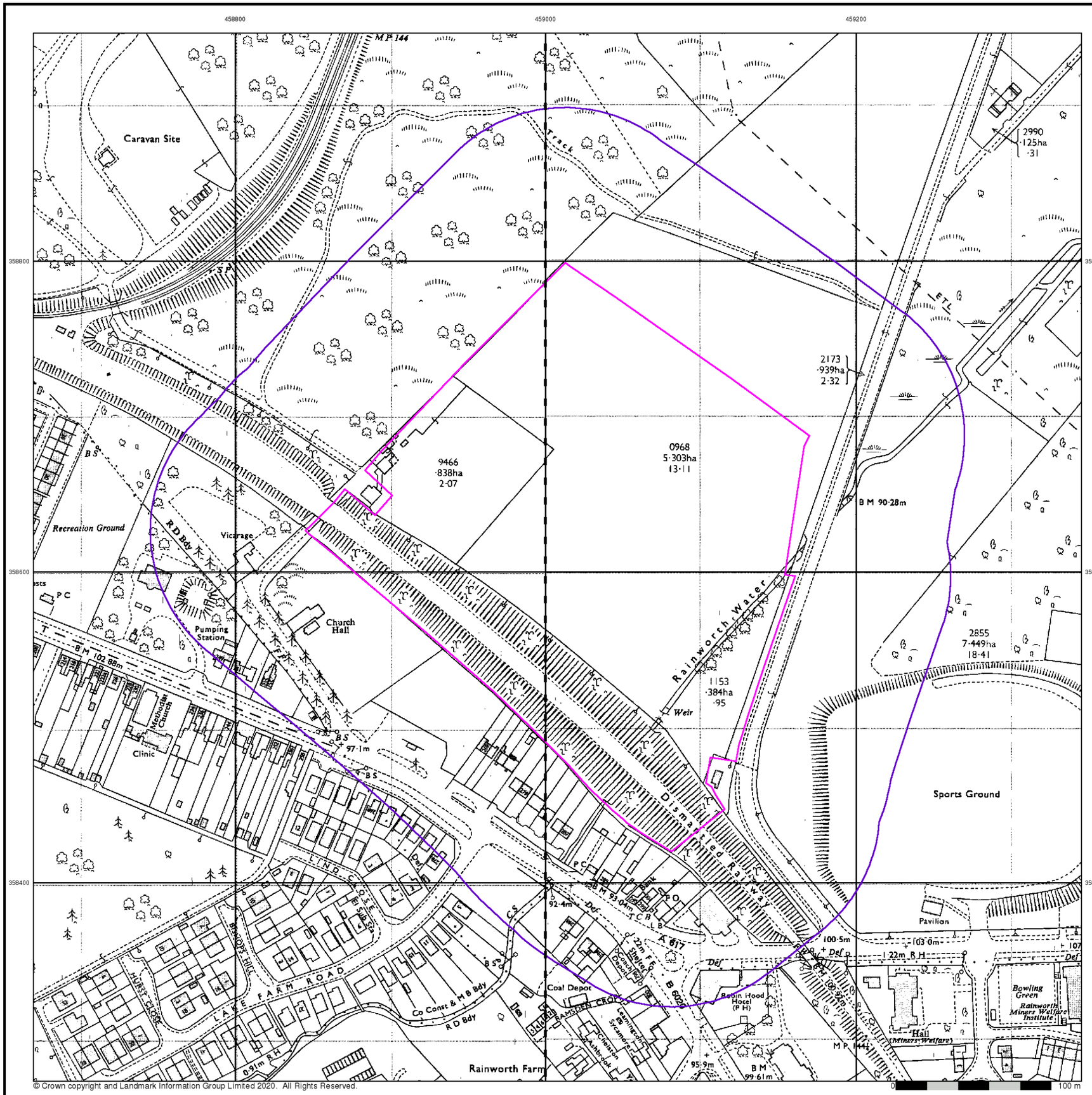

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Ordnance Survey Plan

Published 1970

Source map scale - 1:2,500

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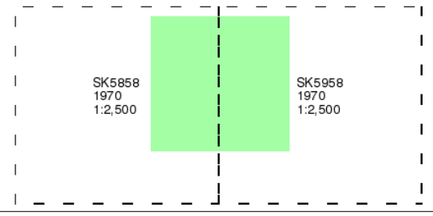
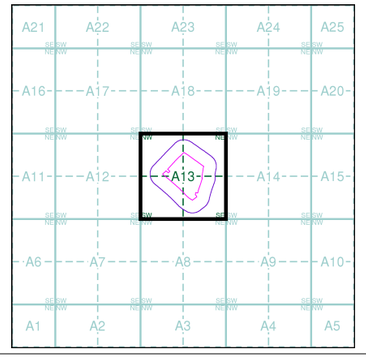


Historical Map - Segment A13



Order Details

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Customer Ref:	D40188
National Grid Reference:	459030, 358610
Slice:	A
Site Area (Ha):	6.72
Search Buffer (m):	100

Site Details

Land South of A617, Rainworth

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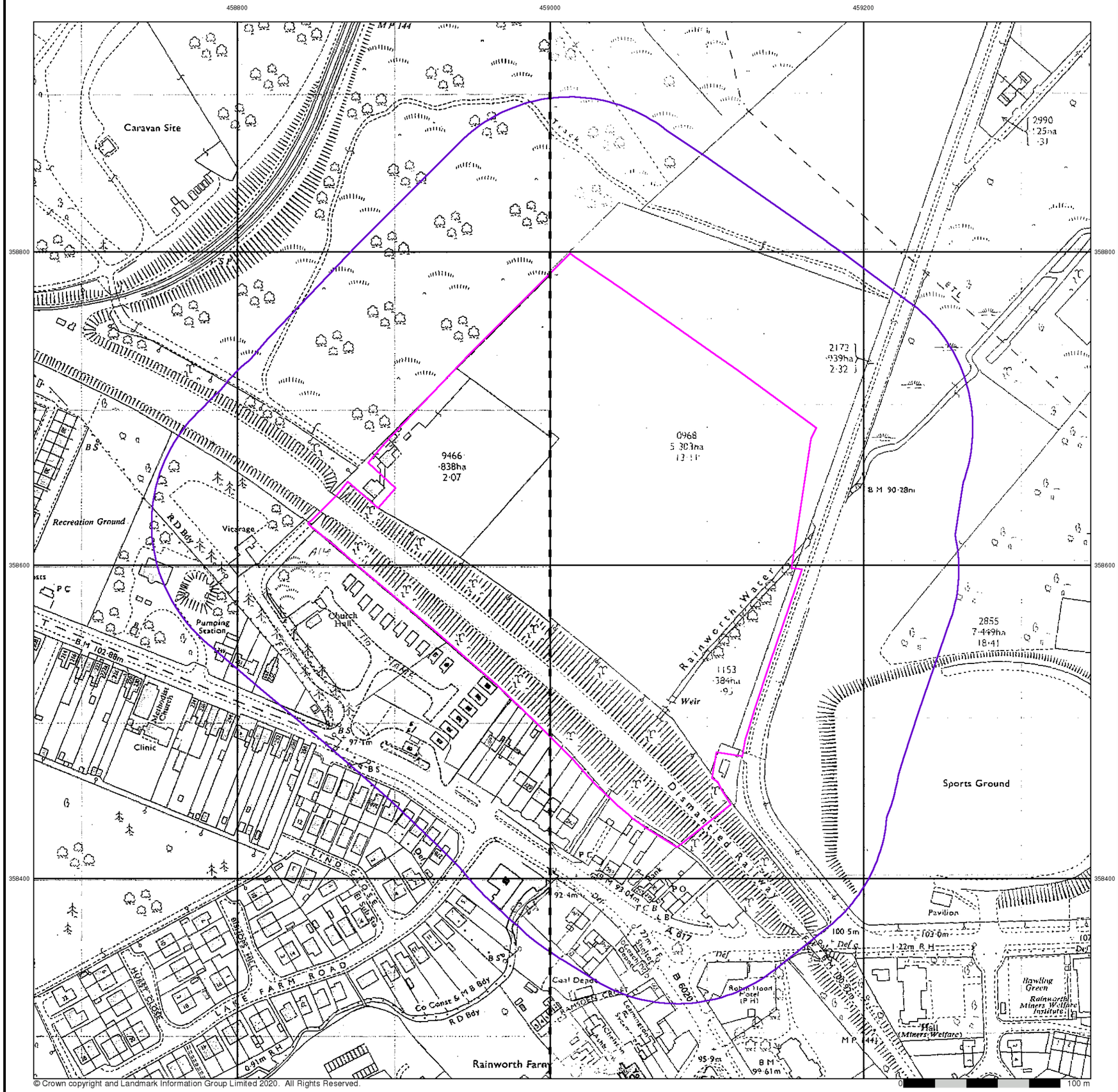

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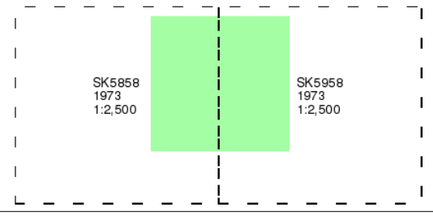
Supply of Unpublished Survey Information

Published 1973

Source map scale - 1:2,500

SUSI maps (Supply of Unpublished Survey Information) were produced between 1972 and 1977, mainly for internal use at Ordnance Survey. These were more of a `work-in-progress' plan as they showed updates of individual areas on a map. These maps were unpublished, and they do not represent a single moment in time. They were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



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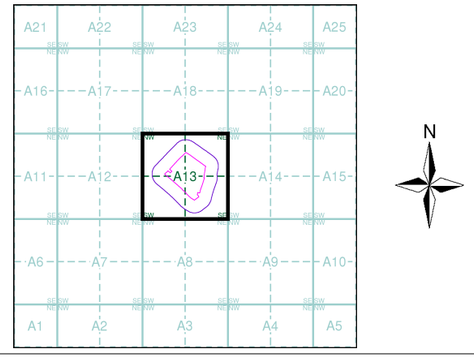

Order Details

Order Number:	269925584_1_1
Customer Ref:	D40188
National Grid Reference:	459030, 358610
Slice:	A
Site Area (Ha):	6.72
Search Buffer (m):	100

Site Details

Land South of A617, Rainworth

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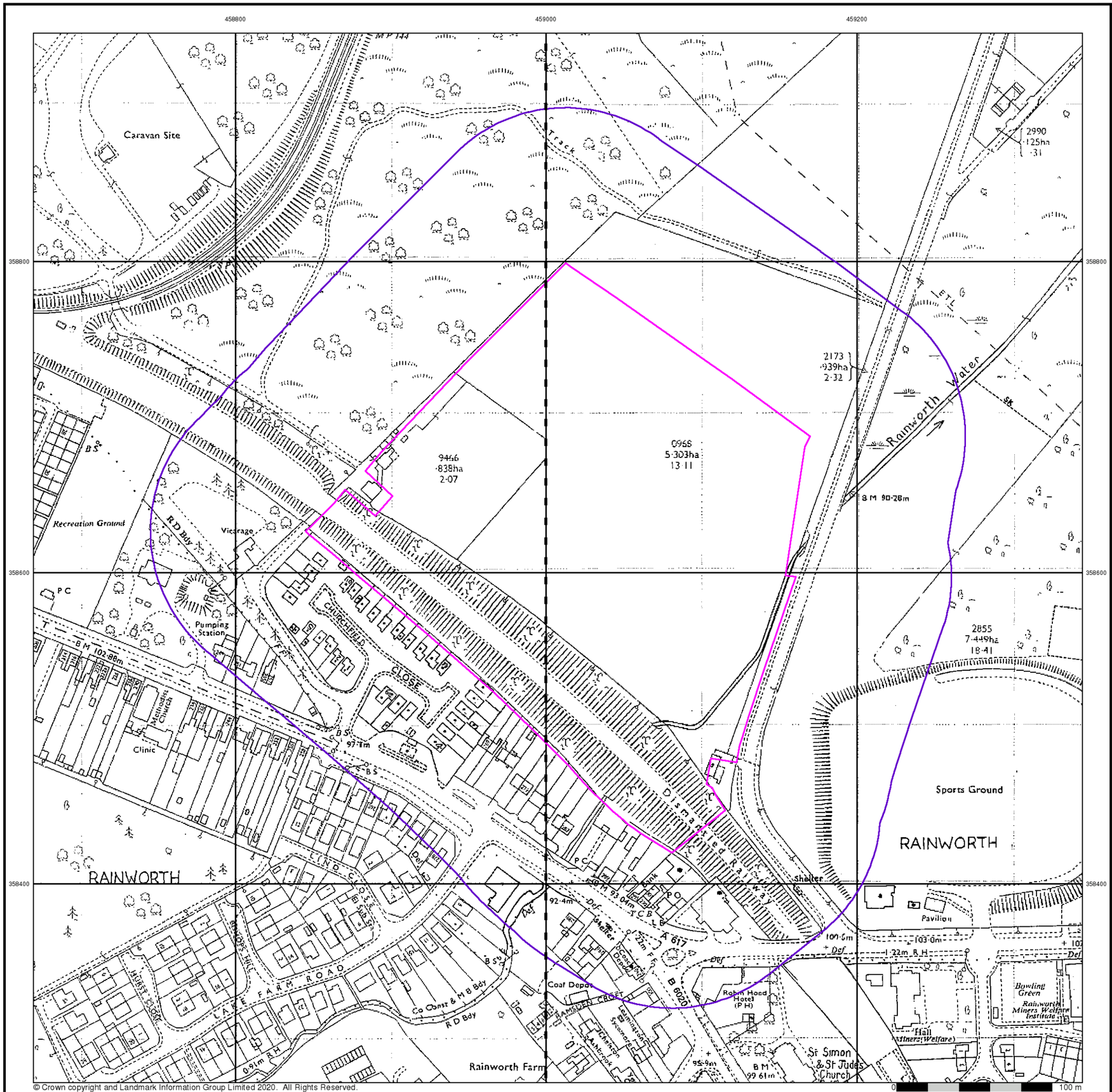

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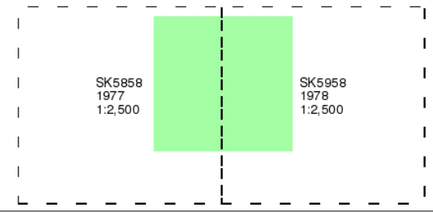
Additional SIMs

Published 1977 - 1978

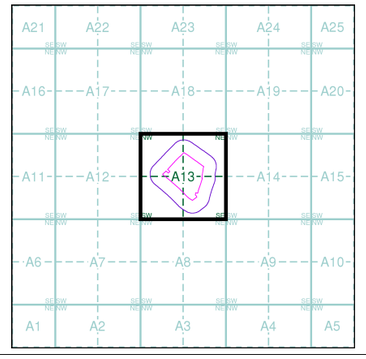
Source map scale - 1:2,500

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



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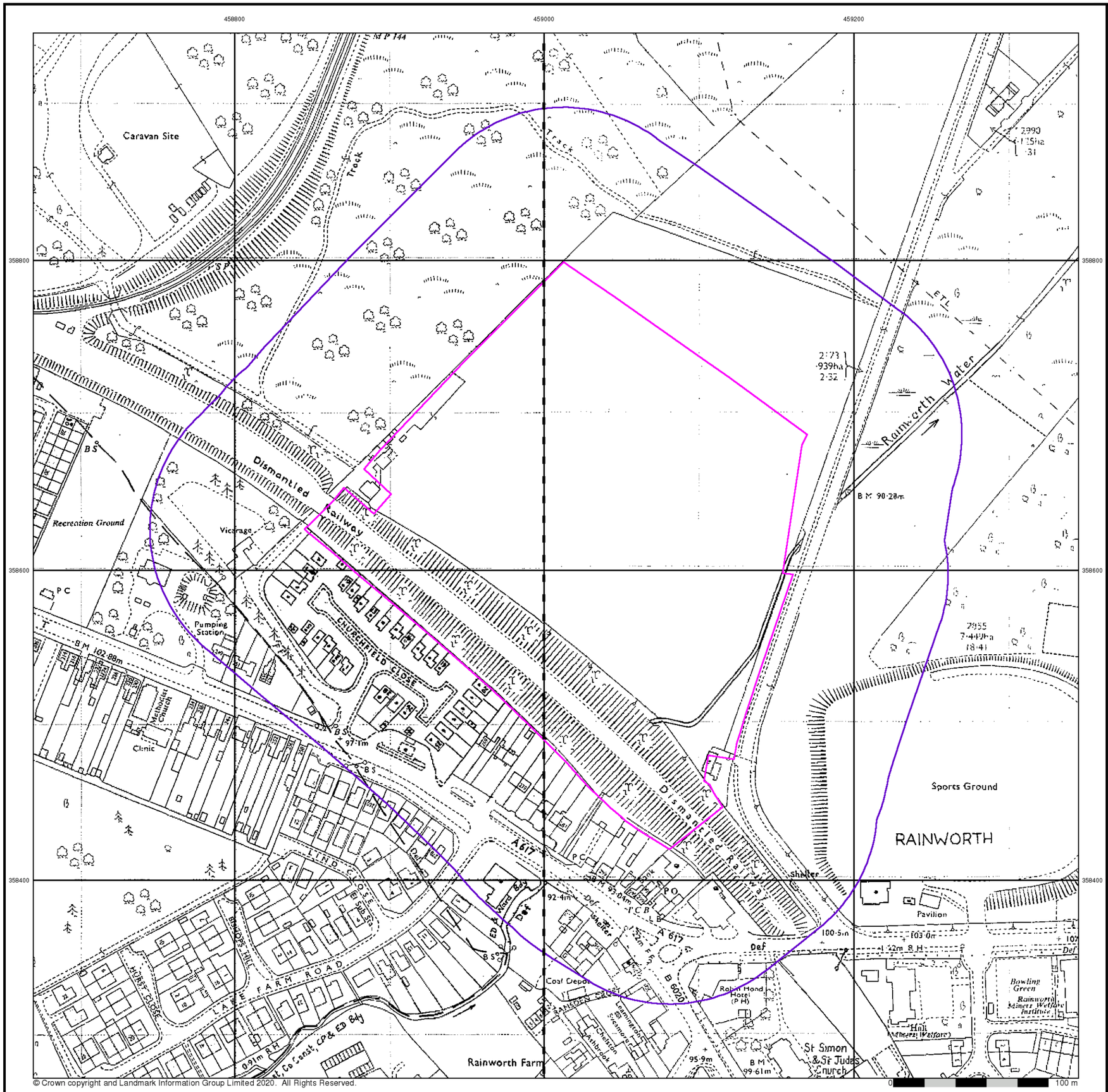

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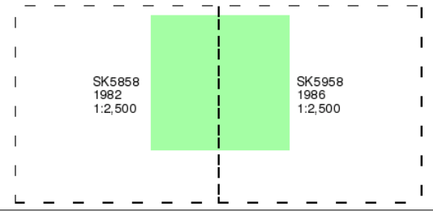
Additional SIMs

Published 1982 - 1986

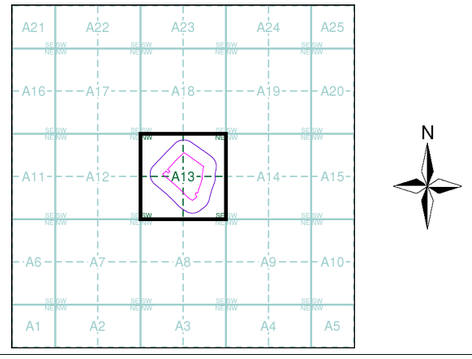
Source map scale - 1:2,500

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



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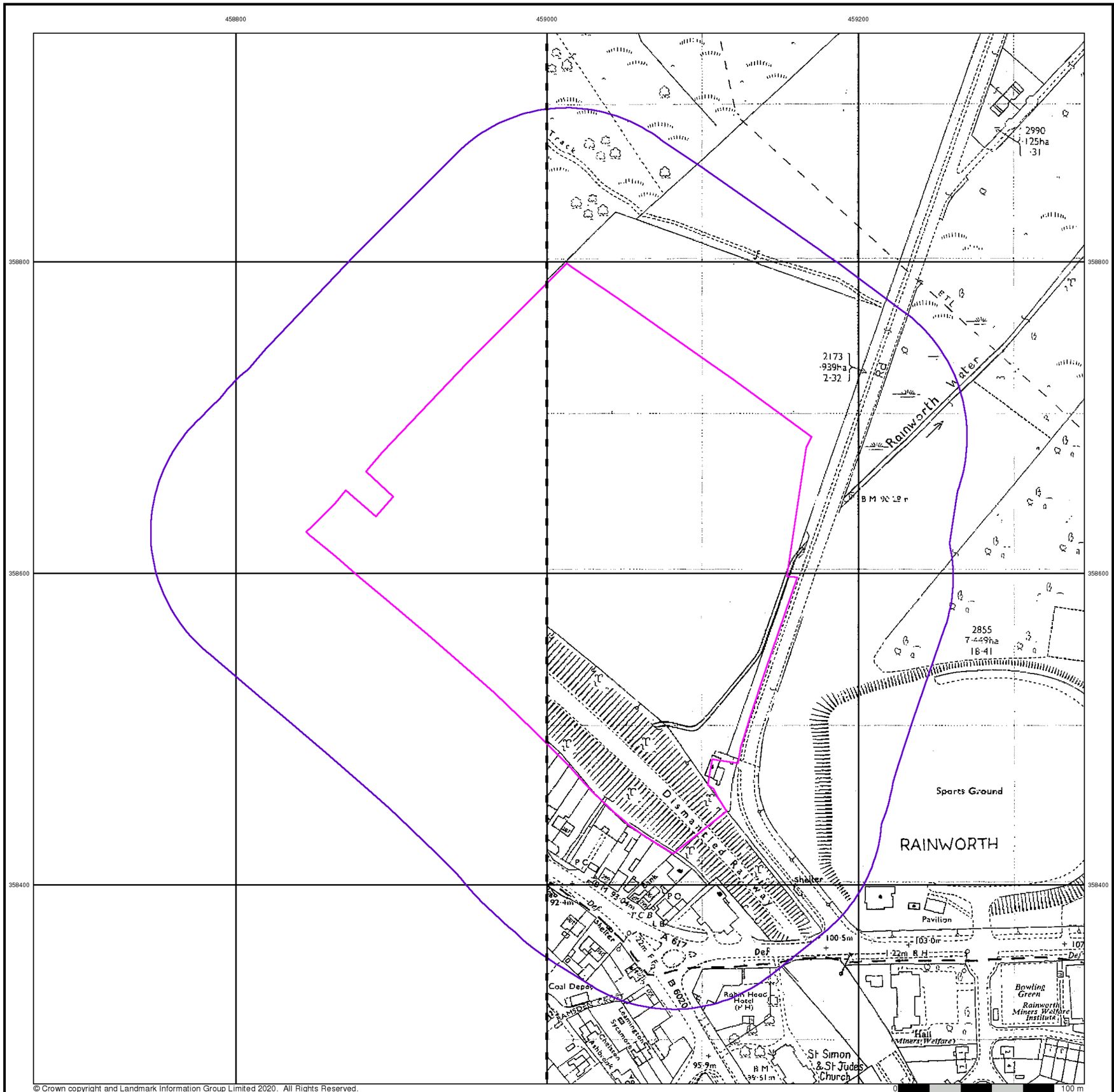
Customer Ref:	D40188
National Grid Reference:	459030, 358610
Slice:	A
Site Area (Ha):	6.72
Search Buffer (m):	100

Site Details

Land South of A617, Rainworth

Landmark INFORMATION GROUP

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



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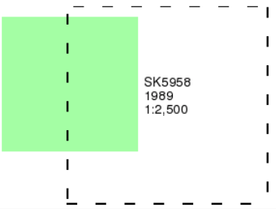
Additional SIMs

Published 1989

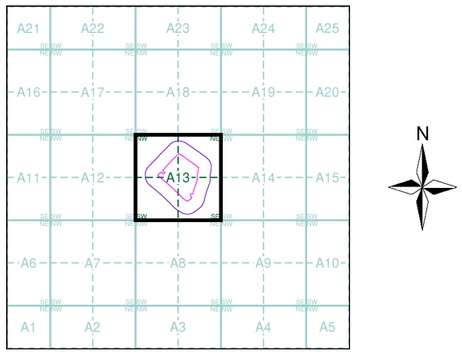
Source map scale - 1:2,500

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

Order Number:	269925584_1_1
Customer Ref:	D40188
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Slice:	A
Site Area (Ha):	6.72
Search Buffer (m):	100

Site Details

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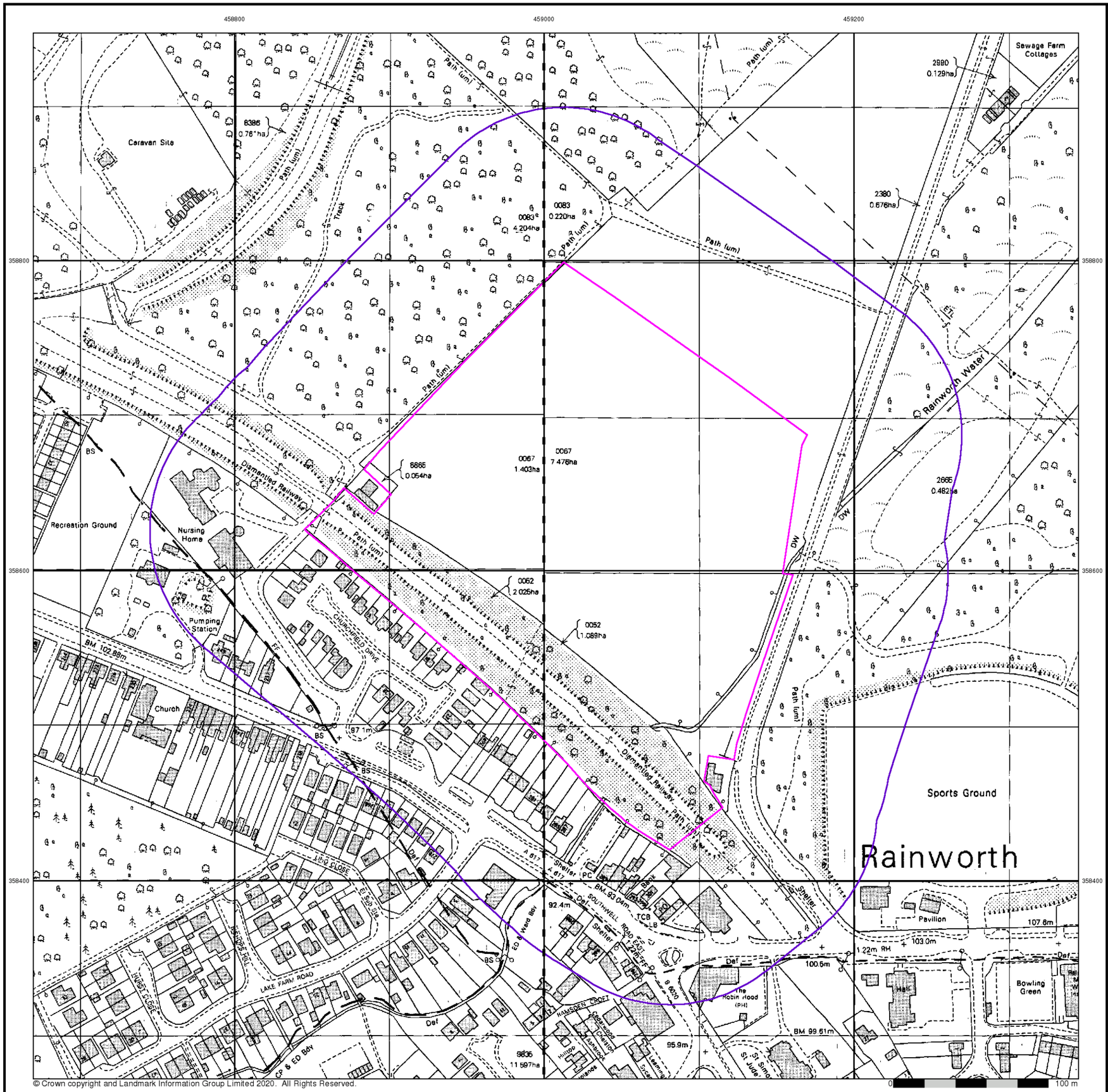

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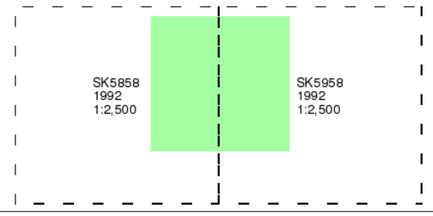
Ordnance Survey Plan

Published 1992

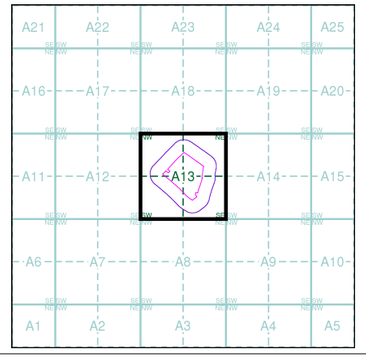
Source map scale - 1:2,500

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:	269925584_1_1
Customer Ref:	D40188
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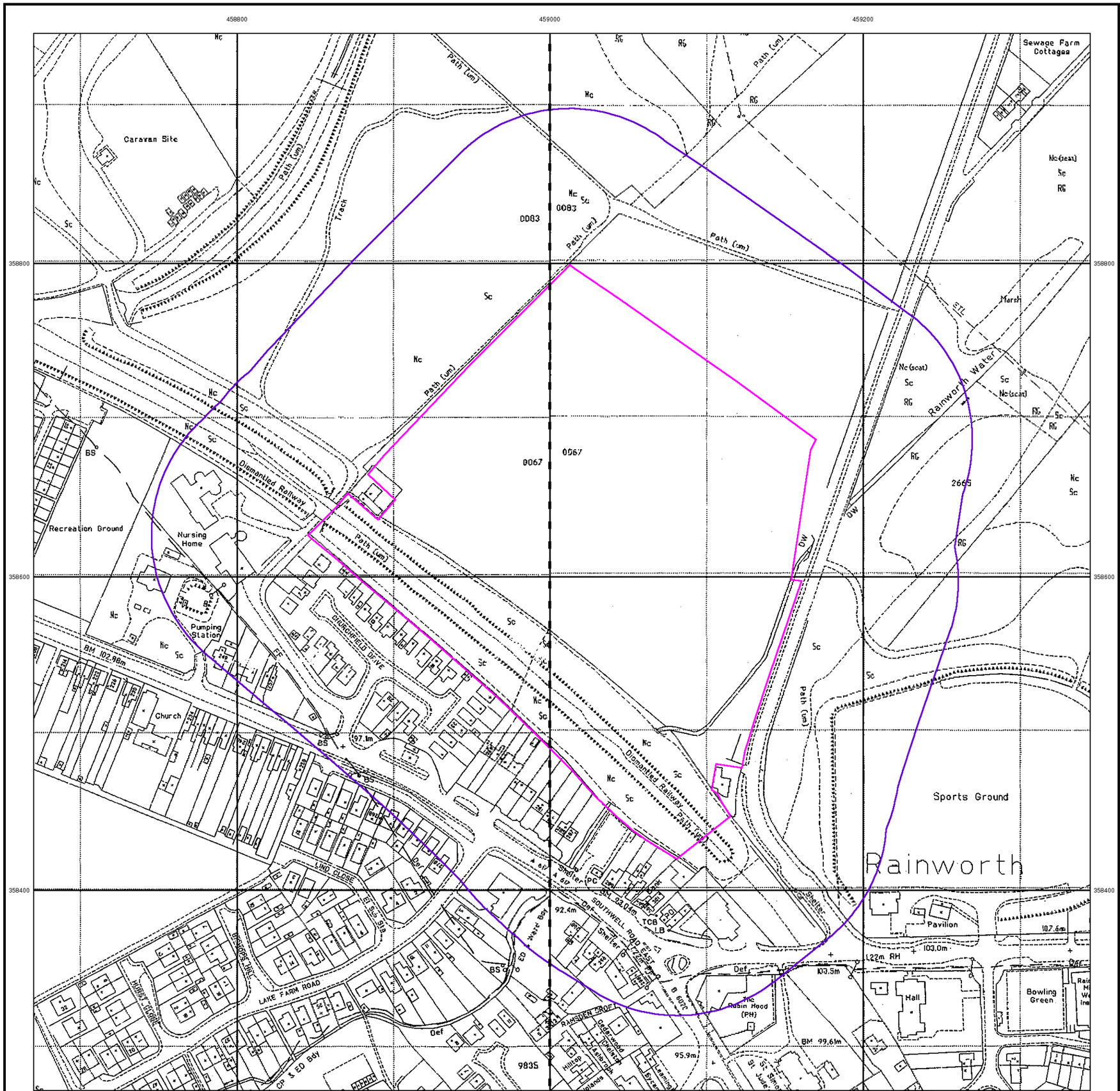

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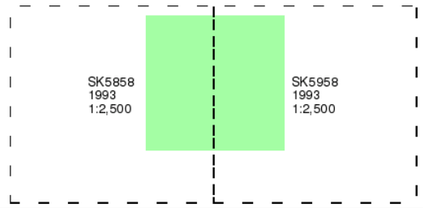
Large-Scale National Grid Data

Published 1993

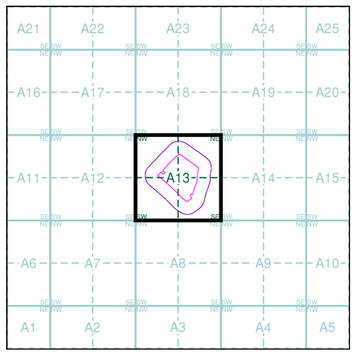
Source map scale - 1:2,500

'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:	269925584_1_1
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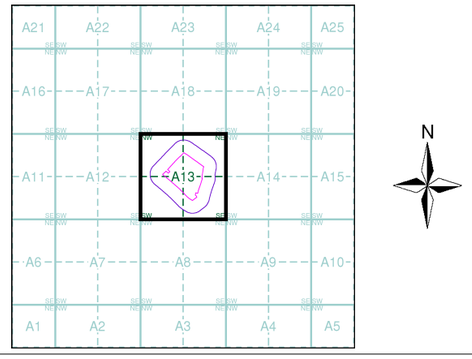
Historical Aerial Photography

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



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National Grid Reference:	459030, 358610
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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)
R.D. 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
Electricity Transmission Line
Pole
Sloping Masonry
Cutting
Embankment
Standard Gauge Multiple Track
Road Under
Road Over
Level Crossing
Foot Bridge
Standard Gauge Single Track
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

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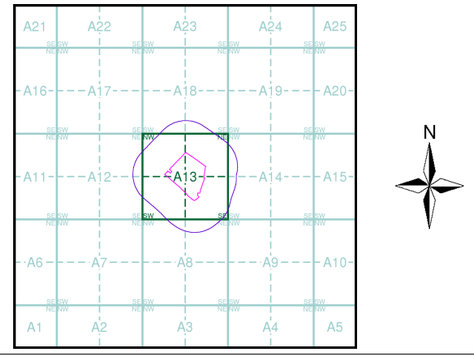
Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Nottinghamshire	1:10,560	1884 - 1885	2
Nottinghamshire	1:10,560	1900	3
Nottinghamshire	1:10,560	1920	4
Nottinghamshire	1:10,560	1938 - 1939	5
Ordnance Survey Plan	1:10,000	1955	6
Ordnance Survey Plan	1:10,000	1966 - 1967	7
Ordnance Survey Plan	1:10,000	1974	8
Ordnance Survey Plan	1:10,000	1991	9
10K Raster Mapping	1:10,000	2000	10
10K Raster Mapping	1:10,000	2006	11
VectorMap Local	1:10,000	2020	12

Historical Map - Slice A



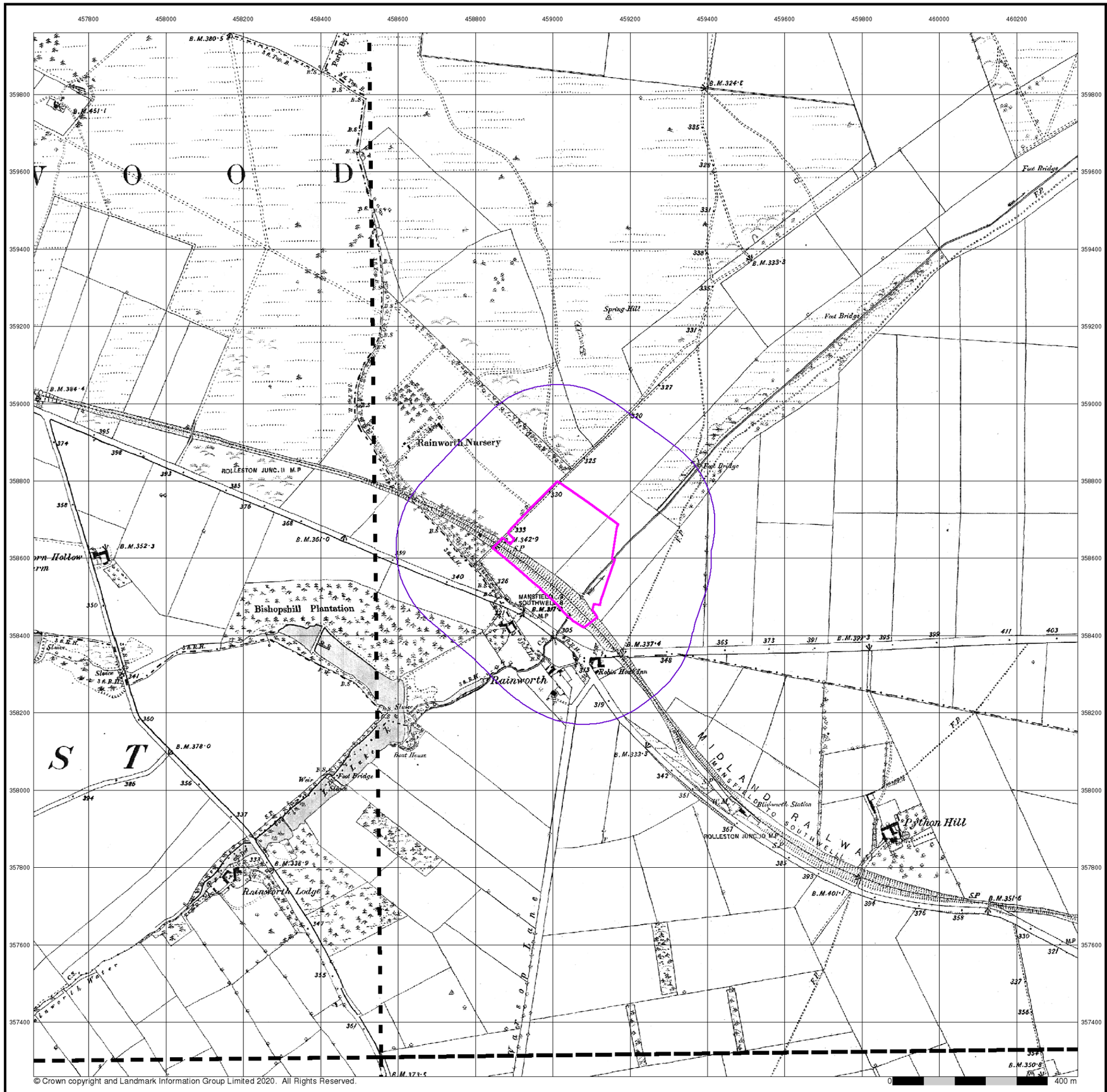
Order Details

Order Number: 269925584_1_1
Customer Ref: D40188
National Grid Reference: 459030, 358610
Slice: A
Site Area (Ha): 6.72
Search Buffer (m): 250

Site Details

Land South of A617, Rainworth

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



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LANDMARK INFORMATION GROUP®

Nottinghamshire

Published 1884 - 1885

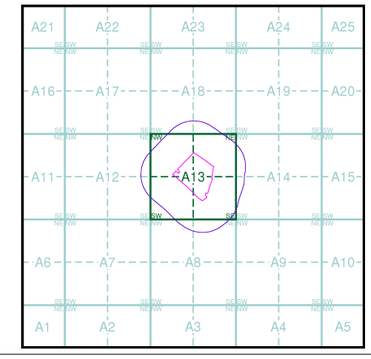
Source map scale - 1:10,560

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)

028NW 1885 1:10,560	028NE 1884 1:10,560
028SW 1885 1:10,560	028SE 1884 1:10,560

Historical Map - Slice A



Order Details

Order Number:	269925584_1_1
Customer Ref:	D40188
National Grid Reference:	459030, 358610
Slice:	A
Site Area (Ha):	6.72
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Site Details

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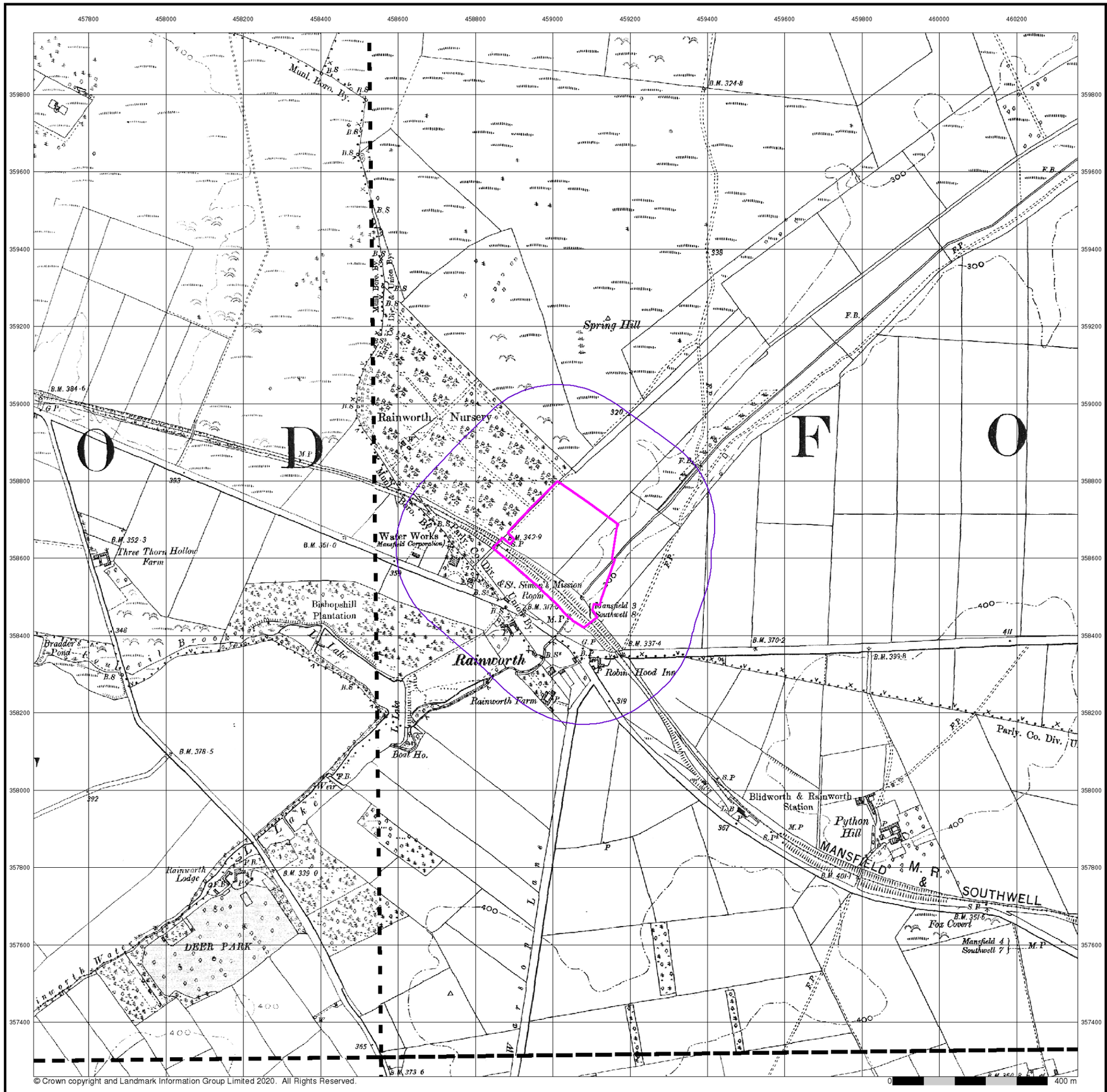


Envirocheck®

LANDMARK INFORMATION GROUP®

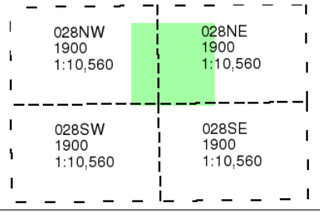
Nottinghamshire

Published 1900

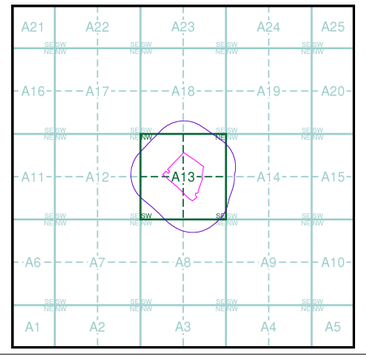
Source map scale - 1:10,560

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



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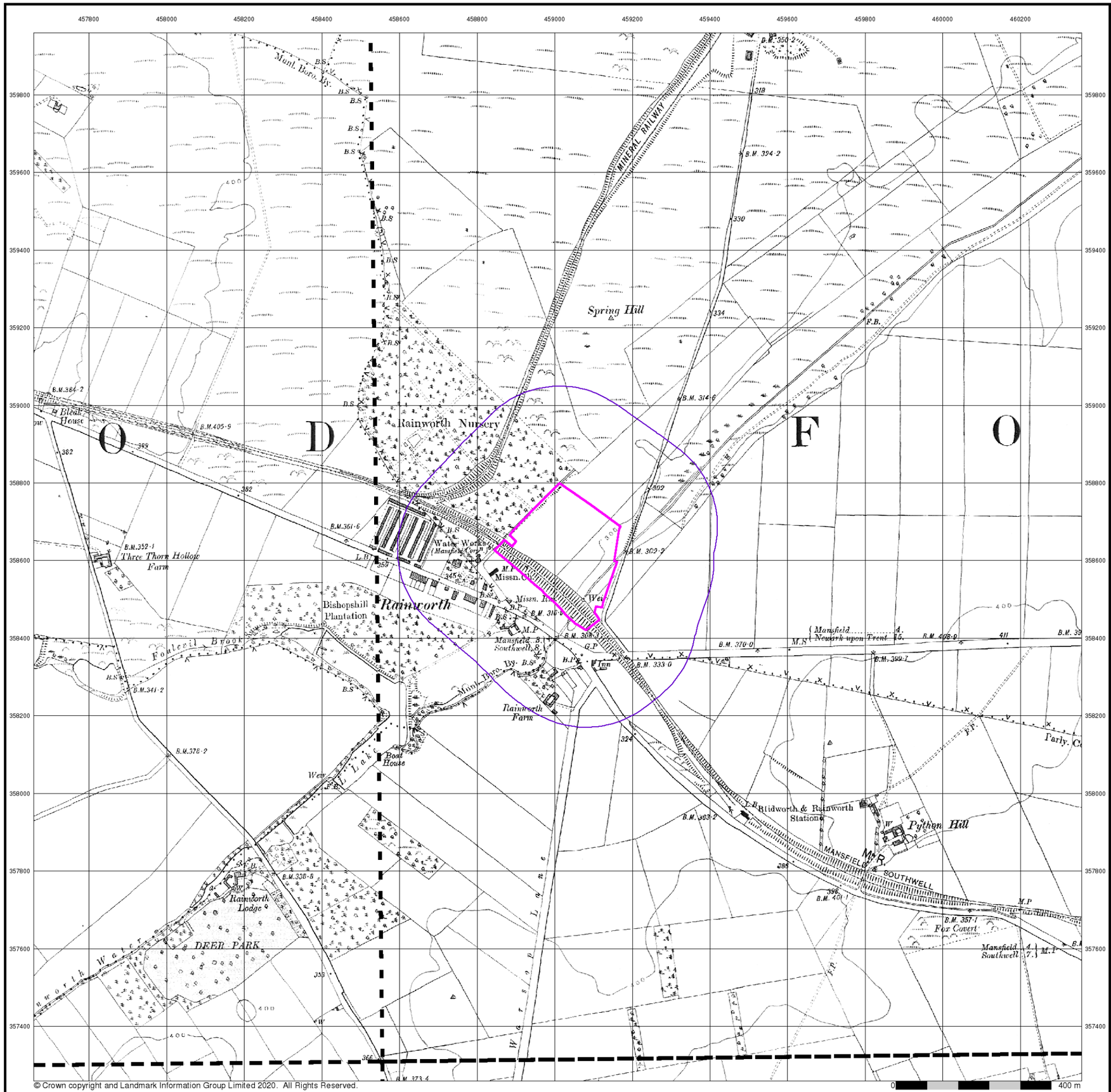

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LANDMARK INFORMATION GROUP®

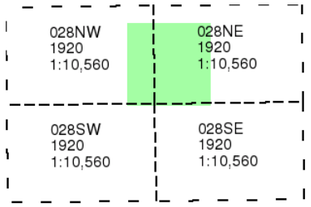
Nottinghamshire

Published 1920

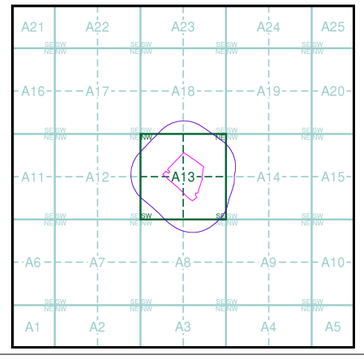
Source map scale - 1:10,560

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



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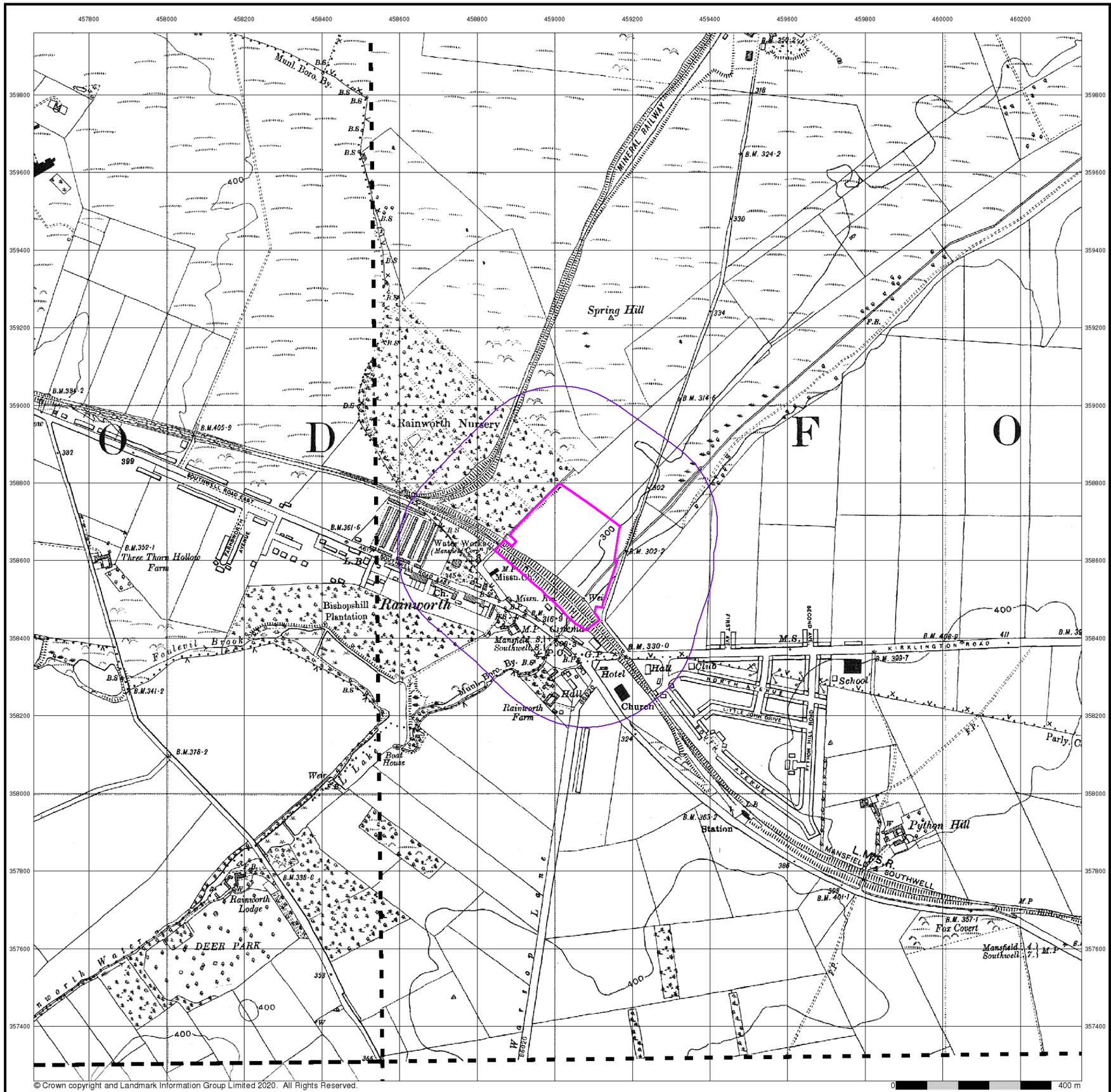

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LANDMARK INFORMATION GROUP®

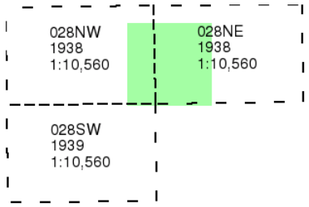
Nottinghamshire

Published 1938 - 1939

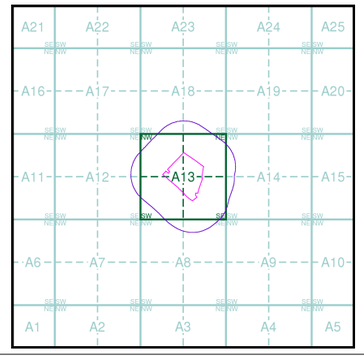
Source map scale - 1:10,560

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



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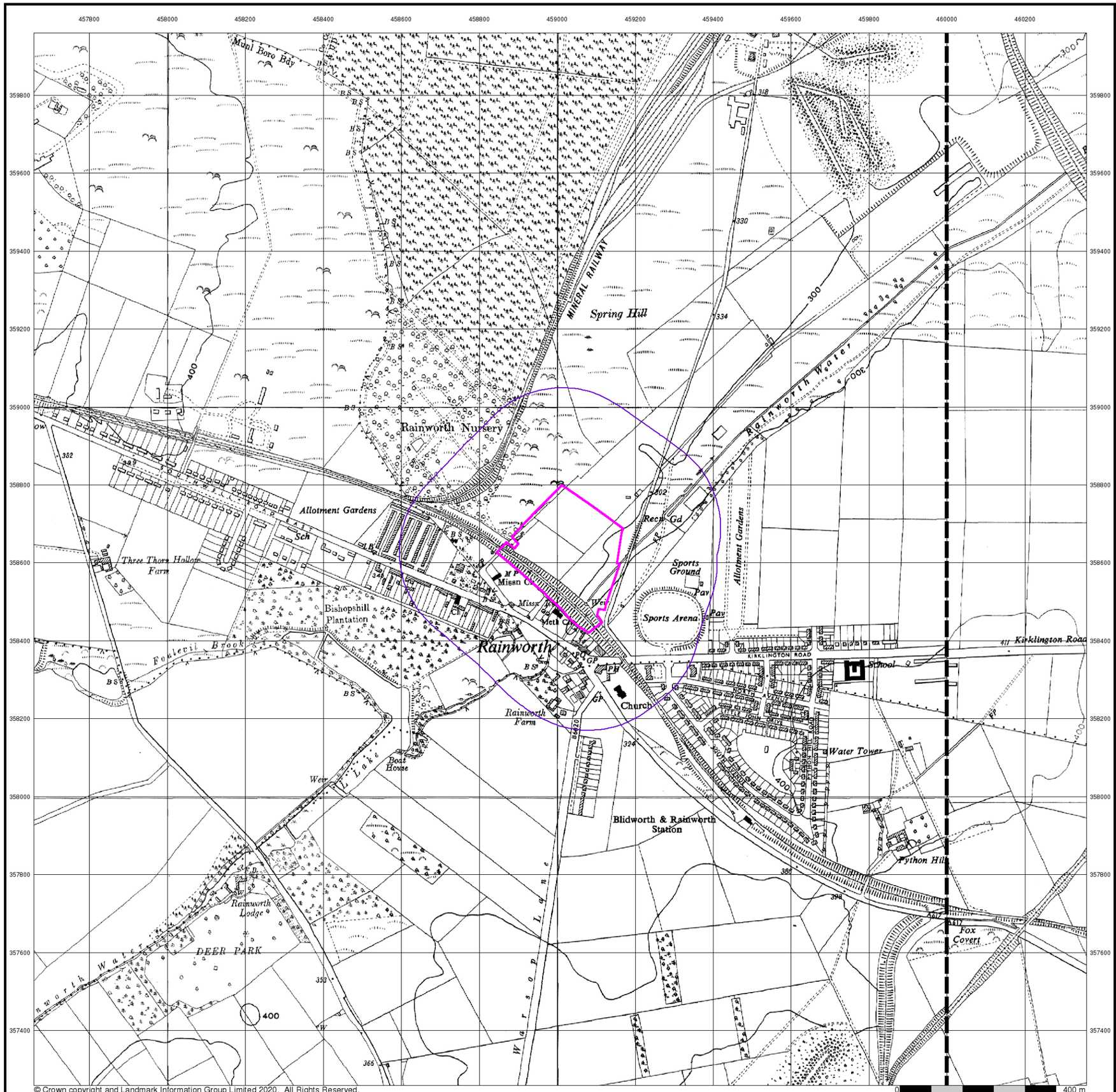

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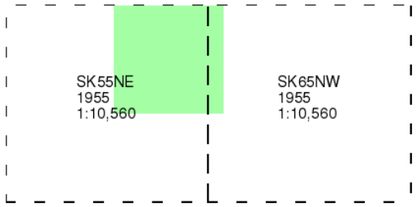
Ordnance Survey Plan

Published 1955

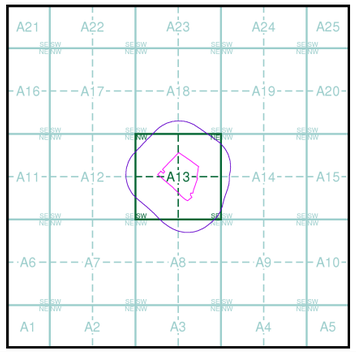
Source map scale - 1:10,000

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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Search Buffer (m):	250

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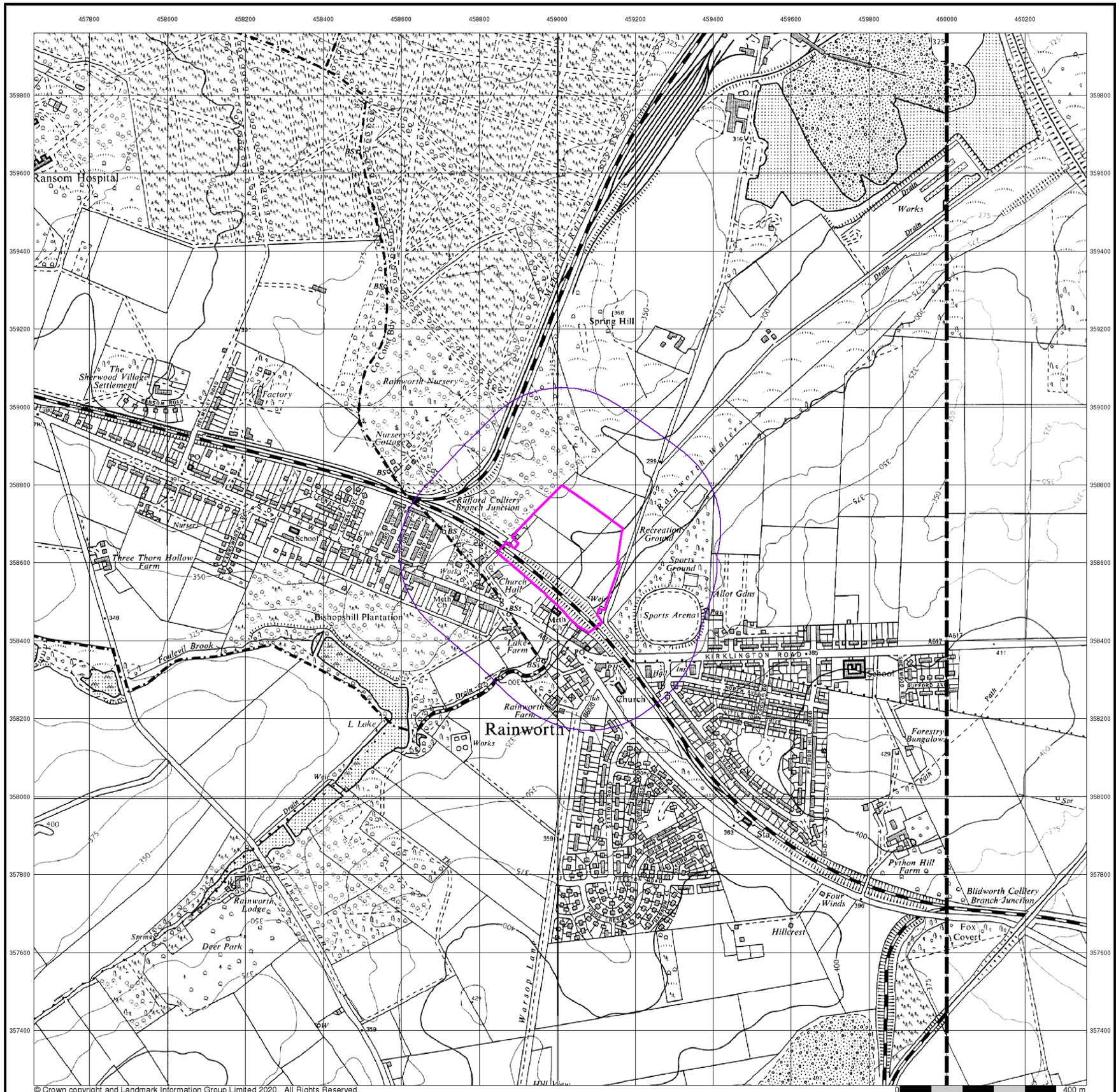

Envirocheck®

LANDMARK INFORMATION GROUP®

Ordnance Survey Plan

Published 1966 - 1967

Source map scale - 1:10,000

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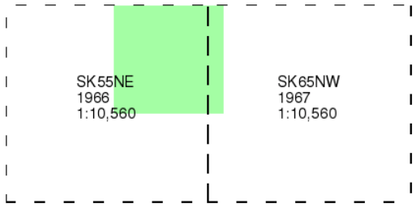
Map Name(s) and Date(s)



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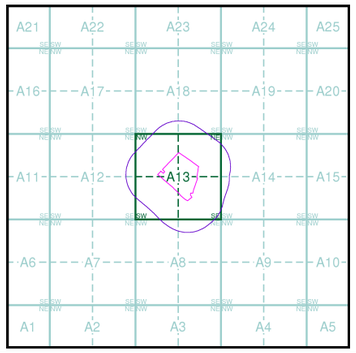

Order Details

Order Number:	269925584_1_1
Customer Ref:	D40188
National Grid Reference:	459030, 358610
Slice:	A
Site Area (Ha):	6.72
Search Buffer (m):	250

Site Details

Land South of A617, Rainworth

Landmark® INFORMATION GROUP

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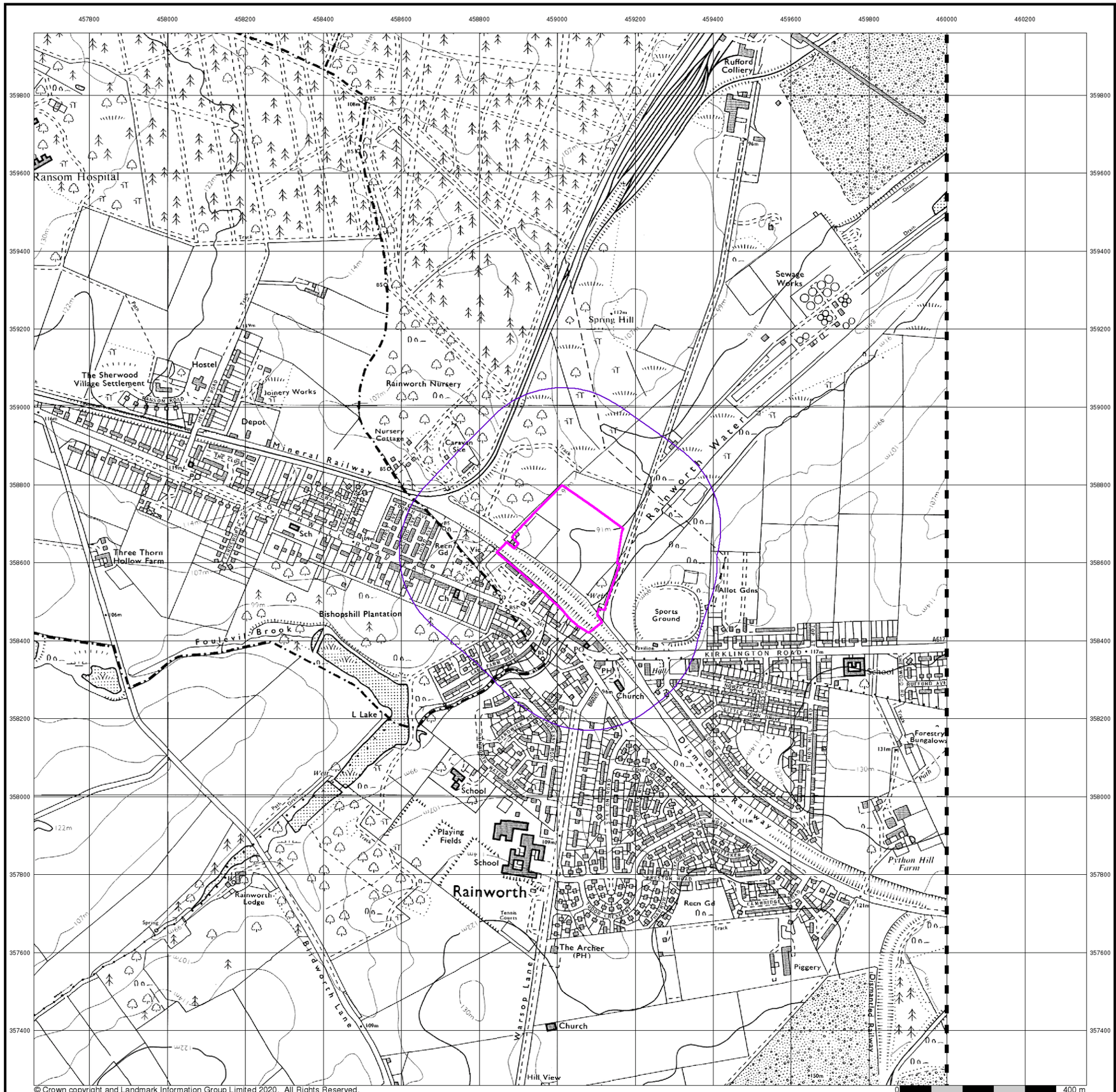
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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Ordnance Survey Plan

Published 1974

Source map scale - 1:10,000

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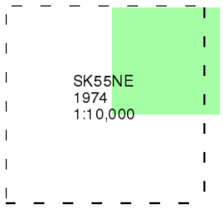

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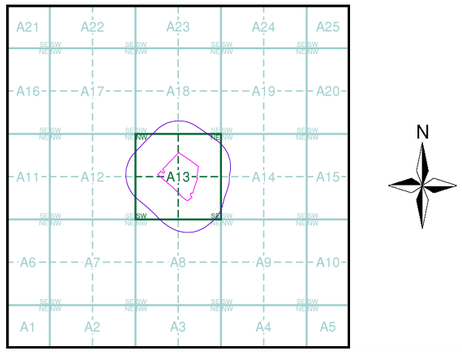

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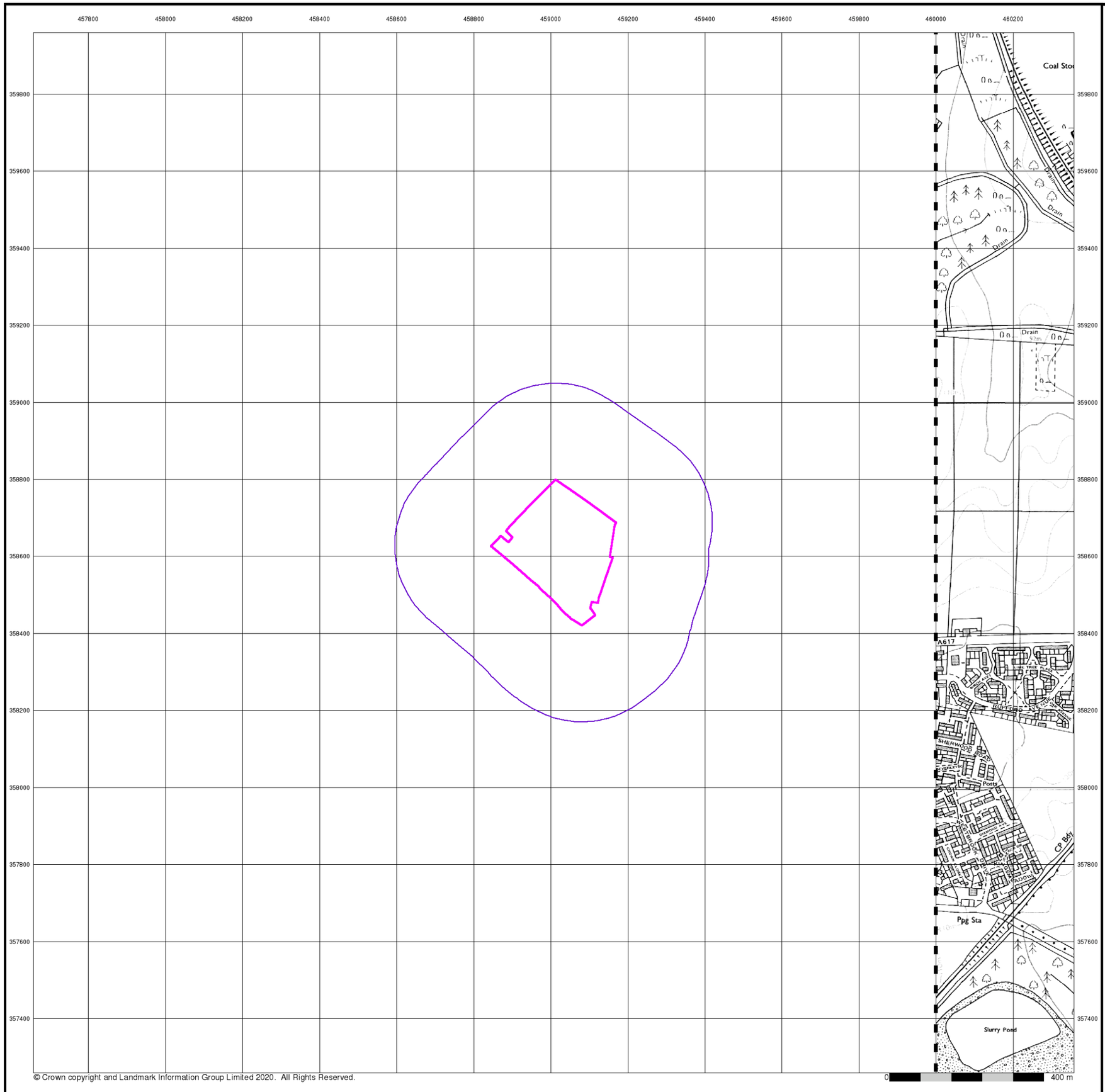

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Ordnance Survey Plan

Published 1991

Source map scale - 1:10,000

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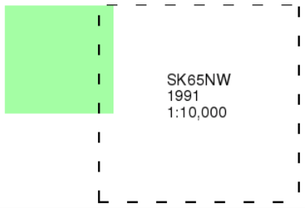

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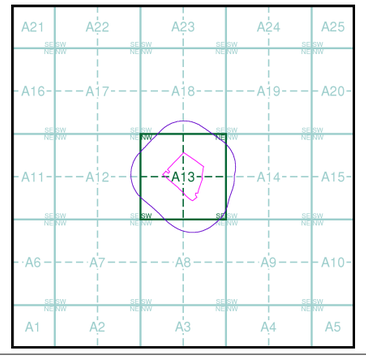

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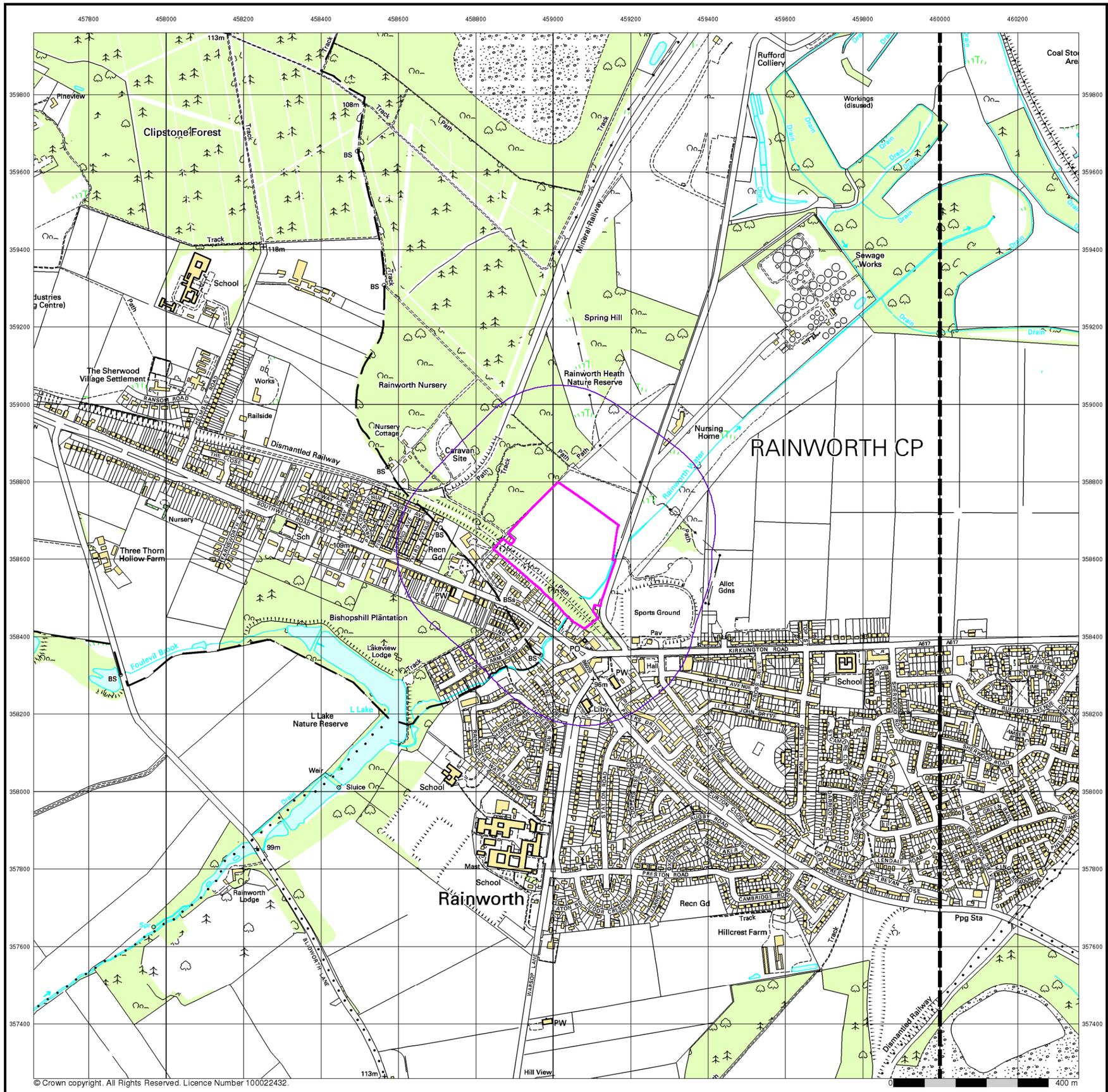

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10k Raster Mapping

Published 2000

Source map scale - 1:10,000

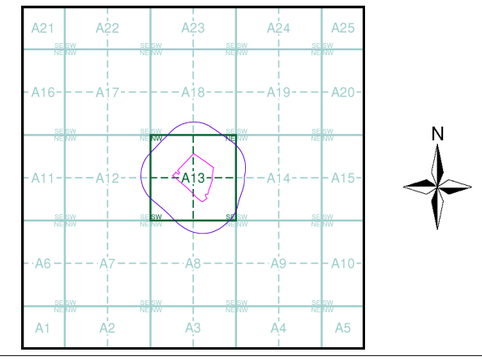
The historical maps shown were produced from the Ordnance Survey`s 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks 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)

SK55NE
2000
1:10,000

SK65NW
2000
1:10,000

Historical Map - Slice A



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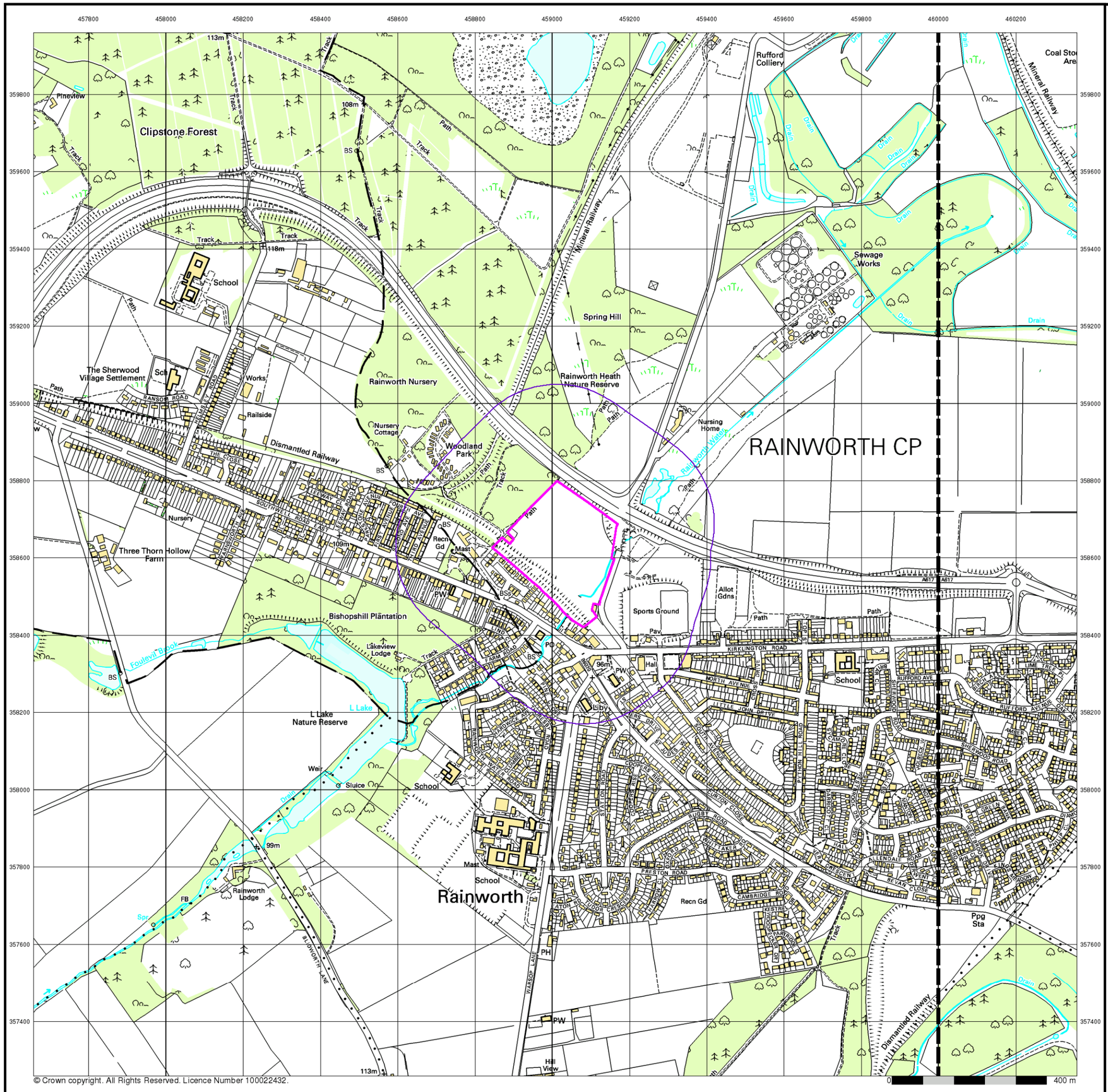

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10k Raster Mapping

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.

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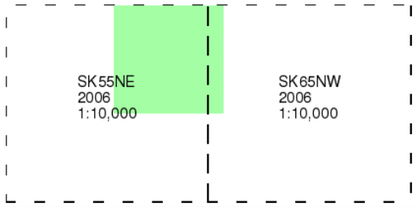
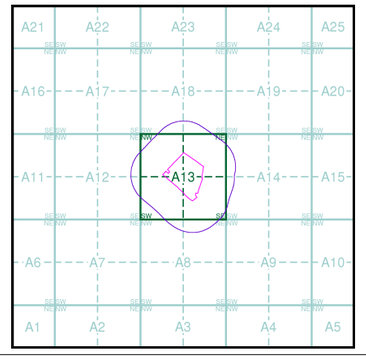


Historical Map - Slice A



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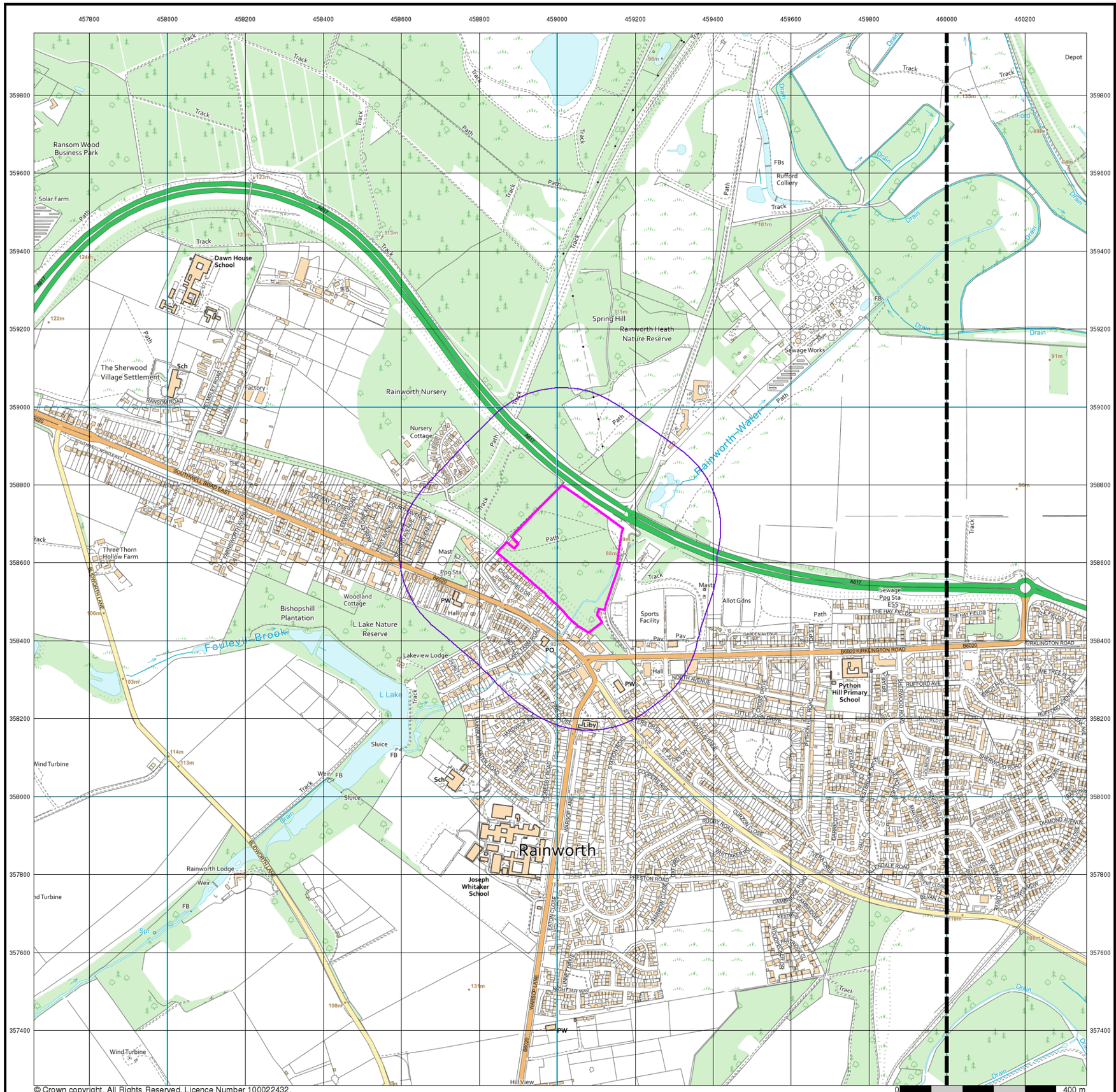

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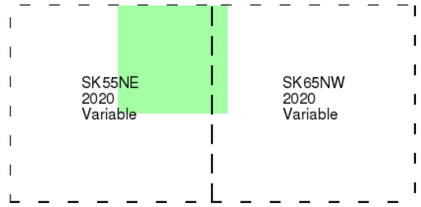
VectorMap Local

Published 2020

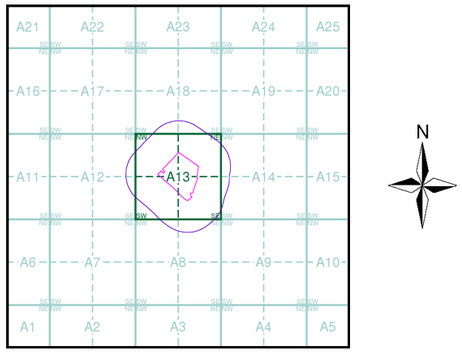
Source map scale - 1:10,000

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



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Appendix E

Landmark Geology Report

Geology 1:50,000 Maps Legends

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	ALV	Alluvium	Clay, Silt, Sand and Gravel	Not Supplied - Holocene

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	CHES	Chester Formation	Sandstone, Pebbly (Gravelly)	Not Supplied - Olenekian

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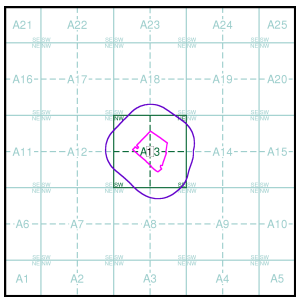
Geology 1:50,000 Maps

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:	**113**
Map Name:	**Ollerton**
Map Date:	**1966**
Bedrock Geology:	**Available**
Superficial Geology:	**Available**
Artificial Geology:	**Not Available**
Faults:	**Not Supplied**
Landslip:	**Not Available**
Rock Segments:	**Not Supplied**

Geology 1:50,000 Maps - Slice A



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Site Details:

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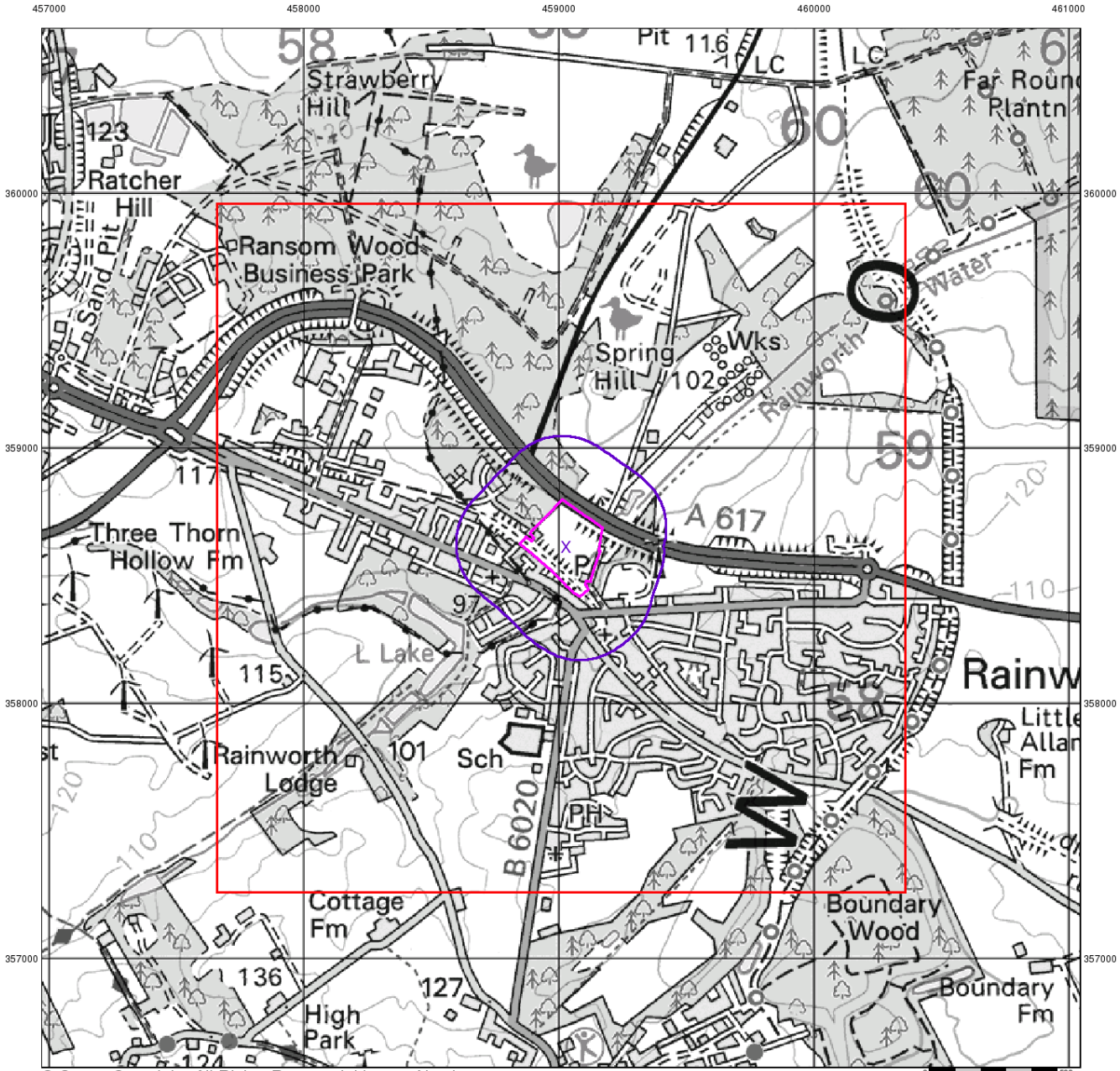

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Artificial Ground and Landslip

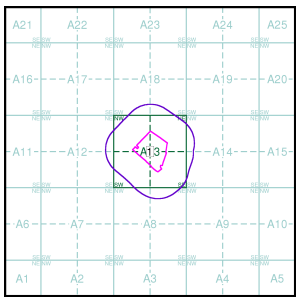
Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions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



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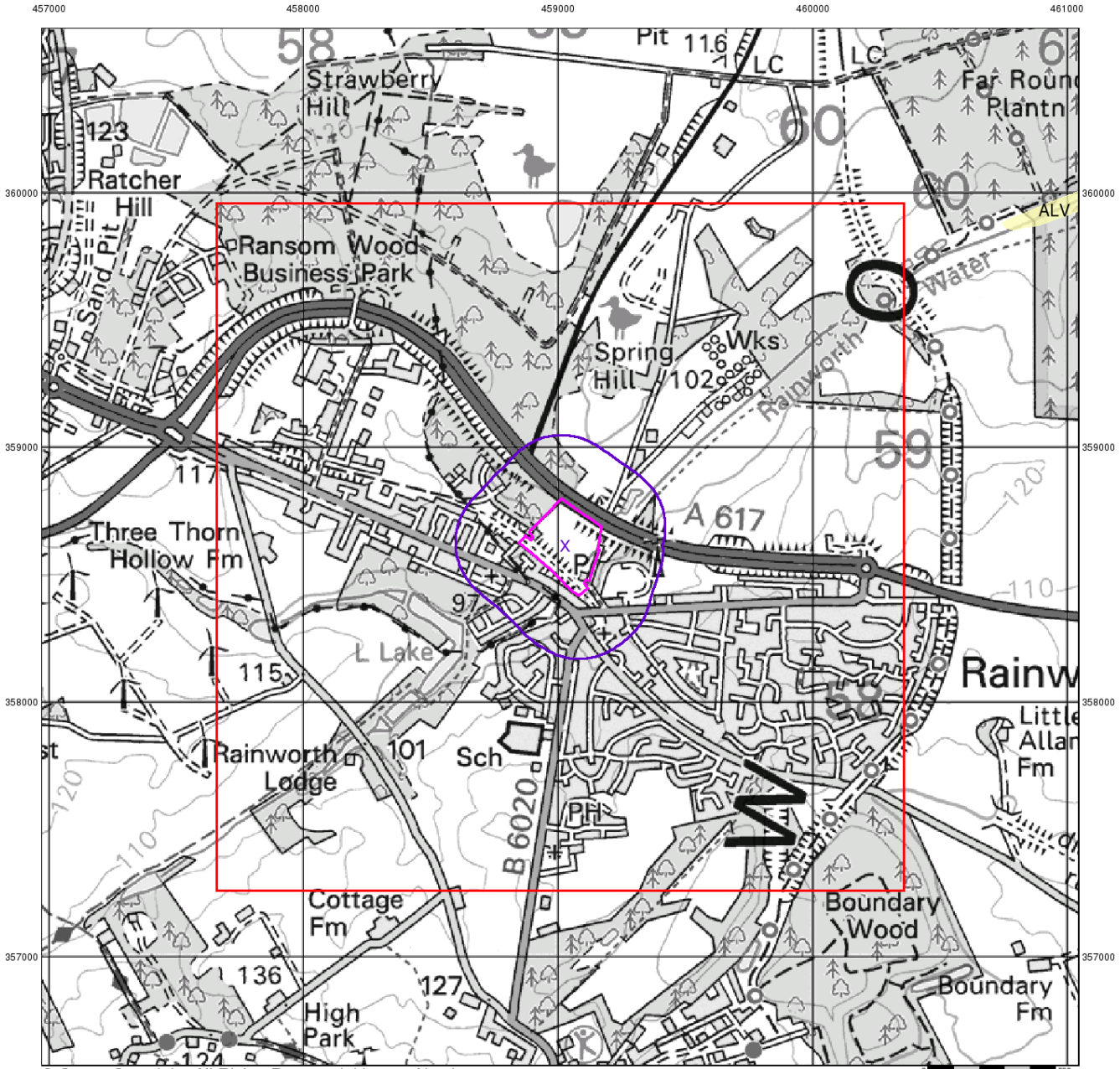

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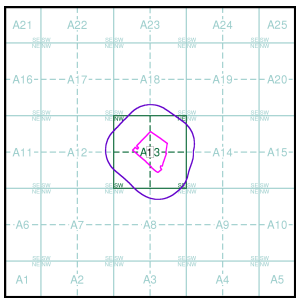
Superficial Geology

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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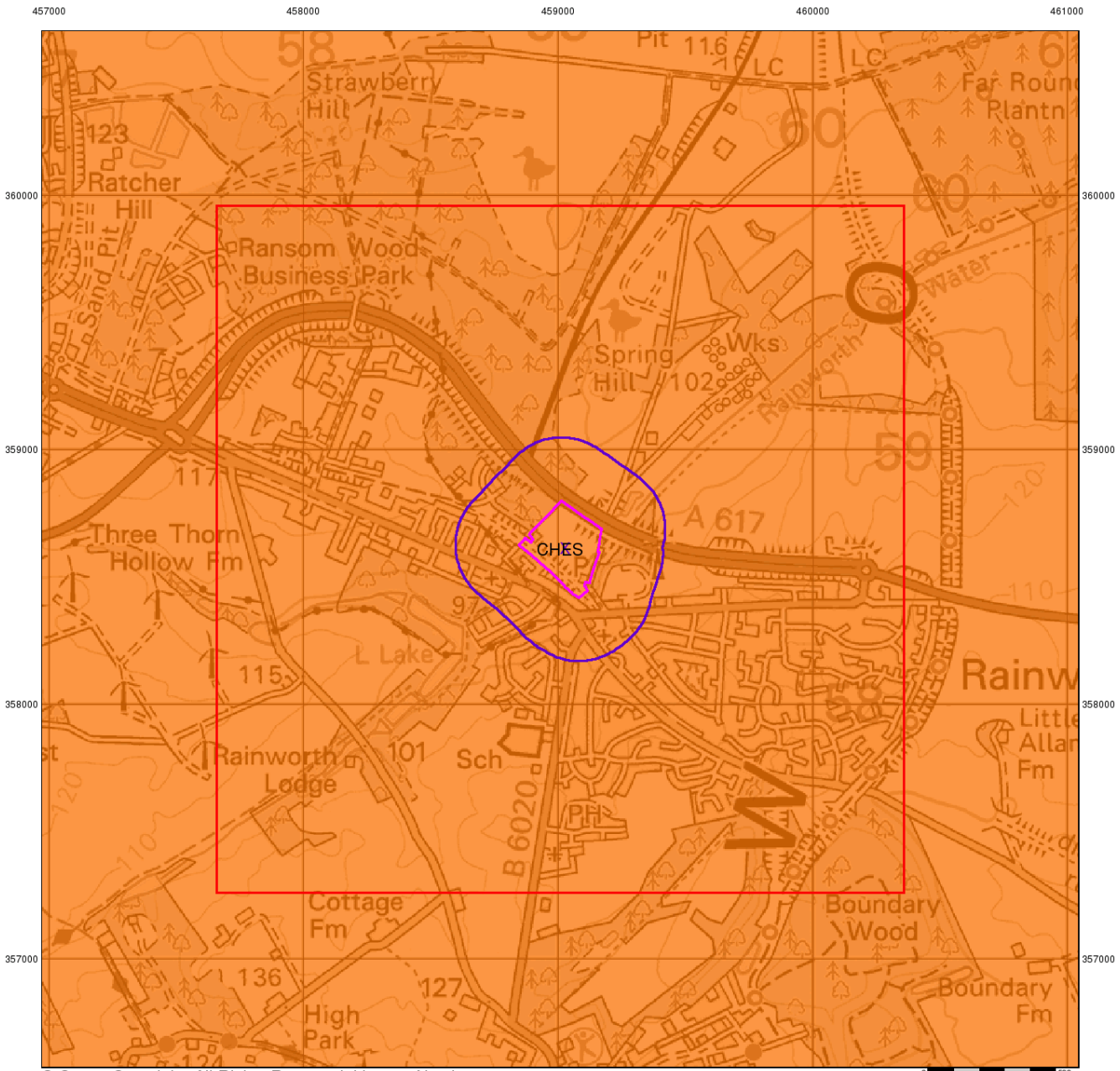

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Bedrock and Faults

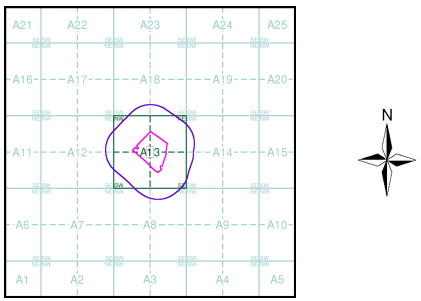
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

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



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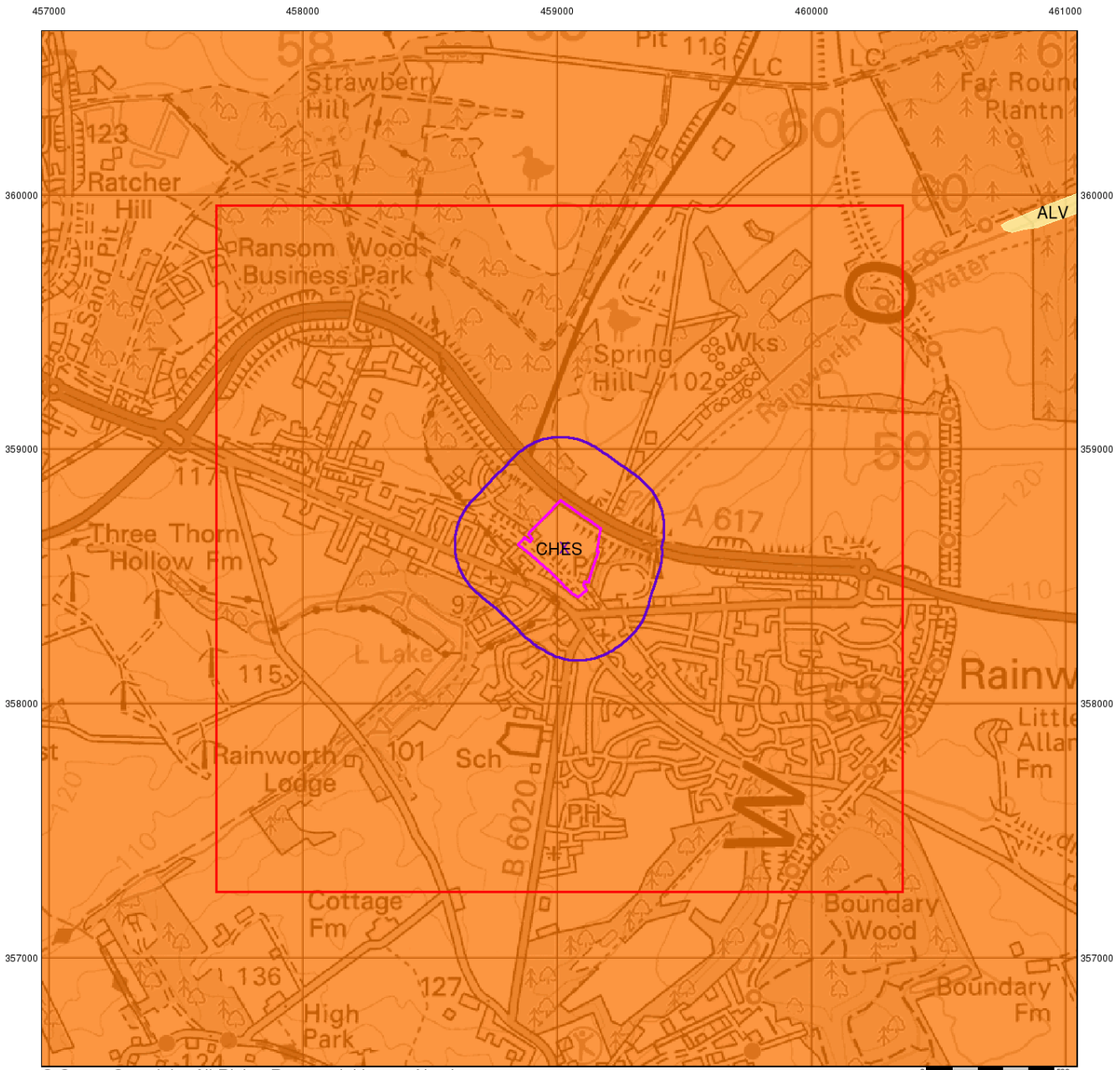

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Combined Surface Geology

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.

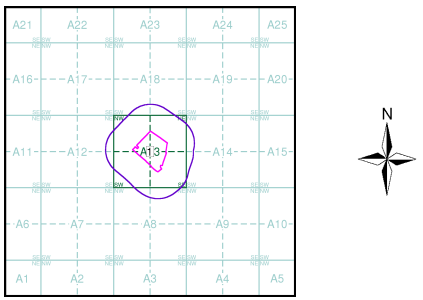
Additional Information

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



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Site Details:

Land South of A617, Rainworth

Appendix F

Coal Mining Report

The Coal Authority

CON29M
coal mining report

LAND TO THE SOUTH OF THE A617, RAINWORTH

Known or potential coal mining risks

Further action

These additional reports can give further detail on the risks identified:

- Subsidence claims history

For more information please see our Further action reports on page 9

Professional opinion

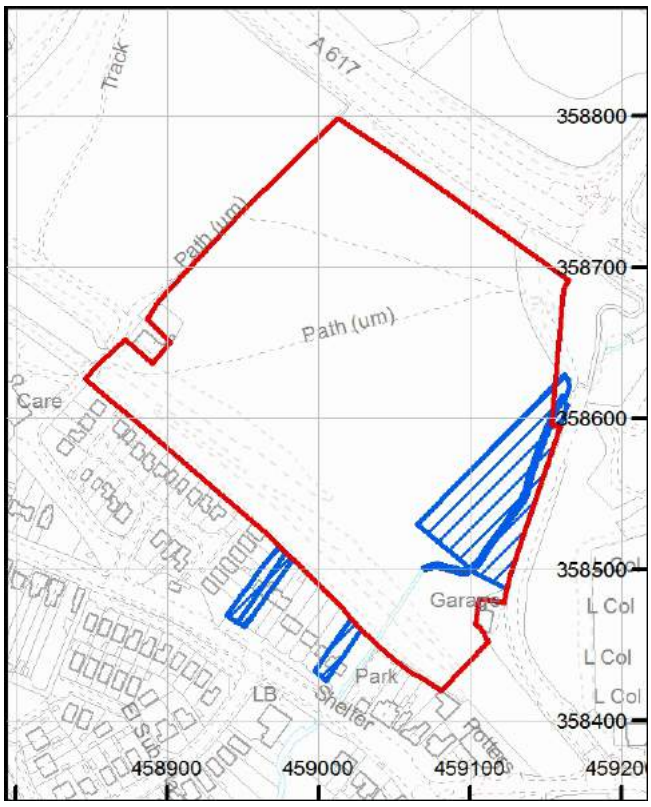
According to the official mining information records held by the Coal Authority at the time of this search, evidence of, or the potential for, coal mining related features have been identified. It is unlikely that these features will impact on the stability of the enquiry boundary.

Enquiry boundary

Key

Approximate position of enquiry boundary shown

Coal claims



We can confirm that the location is **on the coalfield**

Map data

This report is prepared in accordance with the latest Law Society's Guidance Notes 2018, the User Guide 2018 and the Coal Authority's Terms and Conditions applicable at the time the report was produced.

Accessibility

If you would like this information in an alternative format, please contact our communications team on 0345 762 6848 or email communications@coal.gov.uk.

Detailed findings

Information provided by the Coal Authority in this report is compiled in response to the Law Society's CON29M Coal Mining enquiries. The said enquiries are protected by copyright owned by the Law Society of 113 Chancery Lane, London WC2A 1PL.

The Coal Authority owns the copyright in this report and the information used to produce this report is protected by our database rights. All rights are reserved and unauthorised use is prohibited. If we provide a report for you, this does not mean that copyright and any other rights will pass to you. However, you can use the report for your own purposes.

1 Past underground coal mining

The property is in a surface area that could be affected by underground mining in 5 seams of coal at 380m to 760m depth, and last worked in 1992.

Any movement in the ground due to coal mining activity associated with these workings should have stopped by now.

2 Present underground coal mining

The property is not within a surface area that could be affected by present underground mining.

3 Future underground coal mining

The property is not in an area where the Coal Authority has received an application for, and is currently considering whether to grant a licence to remove or work coal by underground methods.

The property is not in an area where a licence has been granted to remove or otherwise work coal using underground methods.

The property is not in an area likely to be affected from any planned future underground coal mining.

However, reserves of coal exist in the local area which could be worked at some time in the future.

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

4 Mine entries

There are no recorded coal mine entries known to the Coal Authority within, or within 20 metres, of the boundary of the property.

5 Coal mining geology

The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining.

6 Past opencast coal mining

The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.

7 Present opencast coal mining

The property does not lie within 200 metres of the boundary of an opencast site from which coal is being removed by opencast methods.

8 Future opencast coal mining

There are no licence requests outstanding to remove coal by opencast methods within 800 metres of the boundary.

The property is not within 800 metres of the boundary of an opencast site for which a licence to remove coal by opencast methods has been granted.

9 Coal mining subsidence

A damage notice or claim for alleged subsidence damage was made in June 2003 for CULVERT ON ACCESS TO FORMER RUFFORD COLLIERY, RAINWORTH, MANSFIELD, NOTTINGHAMSHIRE. However, the claim was rejected.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

A damage notice or claim for alleged subsidence damage was made in June 2003 for FIELD OS 0067 NORTH OF RAINWORTH WATER, RAINWORTH, NOTTINGHAMSHIRE. However, the claim was rejected.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

A damage notice or claim for alleged subsidence damage was made in February 1998 for 271 SOUTHWELL ROAD EAST, RAINWORTH, MANSFIELD, NOTTINGHAMSHIRE, NG21 0BL. However, the claim was rejected.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

A damage notice or claim for alleged subsidence damage was made in February 1998 for 269 SOUTHWELL ROAD EAST, RAINWORTH, MANSFIELD, NOTTINGHAMSHIRE, NG21 0BL. However, the claim was rejected.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

A damage notice or claim for alleged subsidence damage was made in November 1994 for 285 SOUTHWELL ROAD EAST, RAINWORTH, MANSFIELD, NOTTINGHAMSHIRE, NG21 0BL. However, the claim was rejected.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

If further subsidence damage claims information is required, please visit www.groundstability.com.

10 Mine gas

The Coal Authority has no record of a mine gas emission requiring action.

11 Hazards related to coal mining

The property has not been subject to remedial works, by or on behalf of the Coal Authority, under its Emergency Surface Hazard Call Out procedures.

12 Withdrawal of support

The property is in an area where a notice to withdraw support was given in 1983.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

13 Working facilities order

The property is in an area for which the Mansfield & Rufford Order dated 1937 has been made under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification or amendment thereof.

14 Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Statutory cover

Coal mining subsidence

In the unlikely event of any coal mining related subsidence damage, the Coal Authority or the mine operator has a duty to take remedial action in respect of subsidence caused by the withdrawal of support from land or property in connection with lawful coal mining operations.

When the works are the responsibility of the Coal Authority, our dedicated public safety and subsidence team will manage the claim. The house or land owner ("the owner") is covered for these works under the terms of the Coal Mining Subsidence Act 1991 (as amended by the Coal Industry Act 1994). Please note, this Act does not apply where coal was worked or gotten by virtue of the grant of a gale in the Forest of Dean, or any other part of the Hundred of St. Briavels in the county of Gloucester.

If you believe your land or property is suffering from coal mining subsidence damage and you need more information on what to do next, please use the following link to our website which sets out what your rights are and what you need to consider before making a claim.
www.gov.uk/government/publications/coal-mining-subsidence-damage-notice-form

Coal mining hazards

Our public safety and subsidence team provide a 24 hour a day, 7 days a week hazard reporting service, to help protect the public from hazards caused by past coal workings, such as a mine shaft or shallow working collapse. To report any hazards please call 01623 646 333. Further information can be found on our website: www.gov.uk/coalauthority.

Glossary

Key terms

adit - horizontal or sloped entrance to a mine

coal mining subsidence - ground movement caused by the removal of coal by underground mining

Coal Mining Subsidence Act 1991 - the Act setting out the duties of the Coal Authority to repair damage caused by coal mining subsidence

coal mining subsidence damage - damage to land, buildings or structures caused by the removal of coal by underground mining

coal seams - bed of coal of varying thickness

future opencast coal mining - a licence granted, or licence application received, by the Coal Authority to excavate coal from the surface

future underground coal mining - a licence granted, or licence application received, by the Coal Authority to excavate coal underground. Although it is unlikely, remaining coal reserves could create a possibility for future mining, which would be licensed by the Coal Authority

mine entries - collective name for shafts and adits

payments to owners of former copyhold land - historically, copyhold land gave rights to coal to the copyholder. Legislation was set up to allow others to work this coal, but they had to issue a notice and pay compensation if a copyholder came forward

shaft - vertical entry into a mine

site investigation - investigations of coal mining risks carried out with the Coal Authority's permission

stop notice - a delay to repairs because further coal mining subsidence damage may occur and it would be unwise to carry out permanent repairs

subsidence claim - a formal notice of subsidence damage to the Coal Authority since it was established on 31 October 1994

withdrawal of support - a historic notice informing landowners that the coal beneath their property was going to be worked

working facilities orders - a court order which gave permission, restricted or prevented coal mine workings

Further action reports

Subsidence claims history - gives unique copies of original documents from the subsidence claim file in the Coal Authority archives . To order this report, use the boundary and address of where the claim was made.

For more information and to order this report please visit:
https://www2.groundstability.com/subsidence-claims-history