

Phase 1: Desk Study

Trinity Academy, Barnsley

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PHASE 1 DESK STUDY

TRINITY ACADEMY, BARNSELEY

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Revision	Date	Prepared By	Signed
REV_1	May 2023	S. Donald <i>Engineering Geologist</i>	
		Checked By	
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1 EXECUTIVE SUMMARY

Site Address	9 Eastgate, Barnsley S70 2EX
Site Description	The desk study area is located on a parcel of land west of County Way. The site is approximately irregularly shaped and has a mostly flat and even topography. The site spans two private carparks, and a section of school yard which is confined by fences on all sides. A small brick building is present in the south eastern carpark and is noted as being an Electrical Sub-station. Mature deciduous trees were noted across the eastern and western boundaries of the site. The remainder of the site consists of hardstanding. The site perimeter of the carparks are open to the public, and the schoolyard is bound by tall fences and walls on all sides.
Site History <i>On Site</i>	The earliest maps (1855) show that the site was used for agricultural purposes but by the 1890s a railway was constructed running through the centre of the site. This was present until between 1962 and 1968 where an electrical sub-station was constructed in the south eastern corner of the site. Little has changed on-site since, with the site currently being used as a carpark.
<i>Offsite</i>	From the earliest mapping the area around the site was predominantly built up, with the site in the centre of the town of Barnsley. Over the years many developments have occurred in the surrounding areas including railways, gas works, timber yards and bus stations. From the 1970's the land directly to the north was developed into office buildings, however these were all demolished by the 2000's. The site use around the site at the moment is predominantly a mixture of commercial buildings and car parks.
Proposed End Use	The proposed development is outlined to be three story temporary classroom units
Environmental Setting <i>Landfill & Waste</i>	There are 6no Landfills or facilities handling or managing waste within 500m of the site.
<i>Regulated Industries</i>	There are 65no contemporary trade directory entries within 500m of the site. There is 1no fuel station entry within 500m of the site.
<i>Geology</i>	The solid geology beneath the site is likely to mostly comprise Pennine Middle Coal Measures of sandstones, siltstones, and mudstones. The drift deposits on site are likely to comprise of silty, sandy and gravelly Glacial Till.
<i>Hydrogeology</i>	Using the Environment Agency's Policy and Practice for the Protection of Groundwater the solid geology beneath the site is classified as a Secondary Aquifer – A. The overlying drift is not classified.
	The site does not lie within a source protection zone.
	There are 2no Ground Water Abstractions located within 1km of the site.
<i>Hydrology</i>	The nearest surface water feature is Sough Dike located 208m south of the site.
<i>Flooding</i>	The Envirocheck Report states the site is not at risk of Flooding from Rivers and the Seas without defences, and there are no flood defences, flood water storage areas or areas benefiting from flood defences and flood storage present within 250m of the site.
<i>Radon Gas</i>	The site is in an Intermediate Radon Affected Area, as 1 – 3% of properties are above the Action Level. No radon protection measures are necessary for new buildings or extensions on the site.
Preliminary Mining Assessment	The site is located within a Development High Risk Area. Further investigation into coal workings is considered necessary.
Preliminary Geotechnical Assessment	Given the proposed development and expected ground conditions, the use of strip or deep strip foundations is anticipated at present.
Preliminary Contamination Assessment	The desk study has shown that the site may have been exposed to some contamination, with construction/demolition waste, historic railway waste, electrical substation contamination and possibly oils or fuel from vehicle spills the most likely source local to the structures. Asbestos may also be present on the site from previous/existing building materials used on-site.
Potential Sources of Ground Gas	Made ground is expected on site and gas works, historic railways and burial grounds are recorded in the vicinity of the site, therefore ground gas assessment is recommended due to the nature of the development.
Phase Two Recommendations	• A series of small percussive boreholes to ca. 5.00m depth • A series rotary boreholes to ca. 30.00m depth • Gas monitoring comprising six visits over three months. • A series of machine dug trial pits for sampling. • Geotechnical testing. • Chemical testing.

2 INTRODUCTION AND SCOPE OF INVESTIGATION

Solmek were instructed by William Saunders to undertake a desk study on a parcel of land at 9 Eastgate, Barnsley S70 2EX. The proposed development is outlined to be temporary single storey portacabin classroom units.

The following steps may be required in the investigation and remediation of potentially contaminated land:

- Phase 1: Desk Study
- Phase 2: Intrusive Investigation
- Phase 3: Remediation Statement
- Phase 4: Validation Reports

Phases 1 and 2 are generally required in the redevelopment of most sites. Phases 3 and 4 are subject to the findings of the initial stages. This report represents Phase 1 of the site investigation.

The purpose of this Phase 1 Desk Study is to evaluate likely ground conditions and significant environmental issues at the site, and to plan the scope of subsequent phases of investigation.

This report may be regarded as a Preliminary Risk Assessment in accordance with respect to the Environment Agency's guidance document Environment Agency *Land Contamination Risk Management*, which replaced the now-withdrawn *Contaminated Land Report 11 – Model Procedures for the Management of Land Contamination (2004)*.

This Phase 1 Desk Study has been undertaken with due regard to current contaminated land guidance issued by the Royal Institution of Chartered Surveyors (RICS) together with BS 10175:2011+A1:2013, *“Investigation of Potentially Contaminated Land - Code of Practice”* and relevant sections of BS 5930:2015+A1:2020, *“Code of Practice for Ground Investigations”*.

The objectives of the investigation are as follows:

- Determine the land use history of the site from an inspection of available Historical Maps
- Determine the environmental setting of the site from available sources
- Determine whether past mining may have had an influence on the site
- Determine whether the site has previously been used for purposes that may have given rise to significant ground contamination
- Provide recommendations for further investigation.

3 SITE WALKOVER AND DESCRIPTION

3.1 General

The centre of the site is located at OS Grid Ref 434567, 406632 and covers an area of approximately 0.06Ha. The area is located at 9 Eastgate, Barnsley S70 2EX.

The preliminary site inspection was undertaken on 18th April 2023 and site photographs are presented in Appendix A.

3.2 Site Description

The desk study area is located on a parcel of land west of County Way.

The site is approximately irregularly shaped and has a mostly flat and even topography. The site spans two private carparks, and a section of school yard which is confined by fences on all sides.

A small brick building is present in the south eastern carpark and is noted as being an Electrical Sub-station.

Mature deciduous trees were noted across the eastern and western boundaries of the site.

The remainder of the site consists of hardstanding.

The site perimeter of the carparks are open to the public, and the schoolyard is bound by tall fences and walls on all sides.

3.3 Off Site Features

A combination of commercial buildings and car parks surrounds the site, with the town centre of Barnsley located approximately 200m to the south of the site.

4 SITE HISTORY

4.1 Map Descriptions

In order to determine the history of the site, previous editions of Historical Maps and Ordnance Survey Plans were inspected. The Historical Maps are presented in Appendix B.

Table 1 presents a summary of the history of the area which includes plots from 1855 to 2023. The summary focuses on the historical land uses and changes relevant to the site and the proposed end use. Measurements are taken from the nearest boundary of the site and all distances quoted are approximate.

TABLE 1: SUMMARY OF SITE HISTORY

OS Map Edition	On-site Features	Off-site Features
1855 1:10,560	The site is located within a larger field and appears to be used for agricultural purposes.	The site is located 100m to the north east of the centre of the town of Barnsley. Buildings are located along the southern boundary of the site. A Railway Station is located 50m to the south east of the site. The associated railways run approximately N-S to the east of the site and come within 55m of the north eastern corner of the site.
1892 – 1893 1:2,500 & 1894 1:10,560	The site is now within the grounds of the railway, with a line running through the centre of the site orientated approximately N-S. An area of hardstanding is located along the eastern boundary of the site. A small building has been constructed in the north western corner of the site. A timber yard is present in the north-western portion of the site.	Goods Sheds are located 25m to the north and north east of the site. A Railway Foundry is located 125m to the south east of the site. A Saw Mill is located 150m to the south of the site. A Burial ground is located 150m to the west of the site. A Tannery is located 650m to the north east of the site, A Colliery is located 900m to the south of the site.
1906 1:2,500 & 1907 1:10,560	A small building has been constructed along the southern boundary of the site.	Buildings directly to the south and east of the site have been redeveloped. A Drill Hall has been identified 100m to the north west of the site. Tanks have been noted 150m to the north of the site. A Hospital has been identified 150m to the north west of the site. A Linin Mill has been identified 200m to the south west of the site. A Glass Works has been identified 650m to the north east of the site. A Gas Works has been identified 800m to the north east of the site.
1931 1:2,500 & 1932 & 1938 1:10,560	No significant change.	Cattle Pens have been identified 20m to the north east of the site. A Gas Works has been identified 125m to the north west of the site. The 'Mines Rescue Station' has been identified 150m to the north west of the site. A Gas Works has been noted 350m south of the site. A Colliery has been identified 450m to the east of the site.
1948 1:10,560	No significant change.	No significant change.
1955 – 1956	No significant change.	A Builders Yard has been identified 75m to the north west

1:10,000 & 1962 1:2,500		of the site. A Garage has been identified 75m to the south west of the site. A Factory has been identified 100m to the north of the site. A Bus Station has been constructed 125m to the south east of the site.
1968 – 1977 1:1,250 & 1966 & 1973 – 1974 1:10,000	An Electrical Sub-station has been constructed in the south eastern corner of the site.	The Railway ground located directly to the north east of the site have been demolished along with associated buildings and tracks. Carparks have been constructed directly to the east of the site. A Printing Works is located 125m to the north west of the site.
1977 – 1987 1:1,250 & 1983 – 1984 1:10,000	The north-western portion of the site is now marked as a carpark.	Government Offices have been constructed directly to the west of the site. A 'Works' has been constructed 50m to the north of the site. A Timber Yard has been identified 100m to the north of the site. An Electricity Board Depot has been identified 125m to the east of the site. Offices have been constructed 150m to the north of the site.
1993 1:1,250 & 1993 1:10,000	Multiple buildings have been constructed along the eastern boundary of the site. The centre of the site is now noted as being a car park.	Carparks have been identified directly to the north and north east of the site.
2000 1:10,000	No significant changes.	No significant changes.
2023 1:10,000	No significant changes.	A Building has been constructed directly to the east of the site. The office buildings to the north of the site have been demolished.

4.2 Potential Contamination Sources Identified via Historical Plans

Possible contamination from historical land uses which may have impacted the site have been identified:

Made ground from materials used to infill depressions and form a level area for access or building. This may include brick, concrete, timber, ash, slag, coal and metals.

Construction/demolition waste from construction and demolition immediately around the site over the documented history. This may include brick, concrete, timber, asbestos and metals.

Roads/Parking Areas may have utilised coal tar, which can result in high levels of PAHs and Phenols and may require disposal as hazardous waste. In addition, historically road construction used ash as a sub-base material, which could be a further source of PAHs.

Timber Yard Potential contamination arising from timber yards/joinery workshops may include substances used in the treatment of wood such as creosote, metal contamination such as lead from paints and potentially other hydrocarbon contamination from oils/lubricants used on-site.

Railway Contamination based on proximity to current and historic railway features. This may include ash, clinker, heavy metals and asbestos.

Electrical substation may have produced contaminants including Polychlorinated Biphenyls (PCBs), which were often blended with carrier fluids such as chlorobenzenes and mineral oil prior to distribution.

Gas works potential contaminants could include hydrocarbons and cyanide (blue billy).

Iron Works contaminants that may arise from Iron Works (or Forges) typically include metals such as lead, arsenic, cadmium or zinc and organic pollutants such as fuels, oils or PAHs.

Garages contaminants may include metals or organic pollutants from petroleum, diesel, oils and lubricants or metal contamination from car repairs.

Clothing Factory on-site may have produced metalloid contamination such as chromium (from chrome salts) or arsenic (arsenic sulphides) or organic contamination such as chlorinated solvents or phenols, cresols and naphthalene.

5 ENVIRONMENTAL SETTING

5.1 Information Sources

The environmental setting of the site was determined through reference to the following:

- Envirocheck Report (including historical map extracts)
- British Geological Survey (BGS): 1:50 000 geological map series sheet 87 Barnsley Solid and Drift Edition (2008)
- British Geological Survey (BGS): 1:10 000 geological map series sheet SE30NW Solid and Drift Geology
- The Coal Authority Consultants Coal Mining Report
- BRE Publication BR211 Radon: Guidance on Protective Measures for New Dwellings

5.2 Landfill and Waste

There are no Landfills located within 200m of the site.

The Envirocheck Report indicates that there are 2no Waste Treatment, Transfer and Disposal Sites entries located within 250m of the site. The nearest is located 219m to the east of the site operated by 'Yorkshire Electricity' under the authority of 'Environment Agency - North East Region, Ridings Area' categorised as 'Transfer, Small (Equal to or greater than 10,000 and less than 25,000 tonnes per year)' handling 'Mineral Oils and Max.Store, Non-Haz. Building Waste, Non-Haz. Com./Ind. Waste, Non-Haz. Excavation & Max.Store, Scrap Metal Max.Store, Synthetic Oils' whose status is 'Licence has completion certificate/Surrendered'.

The Envirocheck Report indicates that there is 1no Licenced Waste Management Facility located within 250m of the site. This is located 219m to the east of the site operated by 'Yorkshire Electric' whose status is 'Surrendered'.

5.3 Significant Nearby Regulated Industries

The Envirocheck Report indicates that there are 15no Contemporary Trade Directory Entries located within 250m of the site. The nearest is located 32m east of the site named 'Tyre Store' classified as 'Tyre Dealers' whose status is 'Active'.

The Envirocheck Report indicates that there are no Recorded Fuel Sites located within 250m of the site.

The Envirocheck Report indicates that there are no records of Integrated Pollution controls located within 500m of the site.

The Envirocheck Report indicates that there are 2no records of Integrated Pollution Prevention and Control entries located within 500m of the site. The nearest is located 405m south west of the site named 'Monckton Coke and Chemical Co Ltd' described as 'Combustion; Any Fuel Greater Or Equal To 20MW But Less Than 50Mw, Inorganic Chemicals; Bases Eg Ammonium Hydroxide, Organic Chemicals; Hydrocarbons Eg Aromatics, Other Mineral Activities; Crushing Etc Of Coal Etc (Unless Exempt Location), Gasification, Liquifac. And Refining; Operating Coke Ovens'.

The Envirocheck Report indicates that there are 2no Local Authority Pollution Prevention and Control sites or enforcements located within 500m of the site. The nearest is located 340m to the south west of the site named 'Johnson Dry Cleaners' described as 'PG6/46 Dry cleaning' whose status is 'Site Closed'.

The Envirocheck Report indicates that there are no sites dealing with Hazardous, Explosive or Radioactive Substances located within 500m of the site.

The Envirocheck Report indicates that there are no Substantiated Pollution Incidents located within 500m of the site.

The Envirocheck Report indicates that there are no Sites Determined as Contaminated Land under Part 2A EPA 1990 entries located within 500m of the site.

5.4 Geology

Though no information is available from the BGS, the drift deposits on site are likely to consist of thin deposits of Glacial Till (Figure 3).

The site is shown to be underlain by solid geology of Pennine Middle Coal Measures Formation (PMCM) most likely comprising sedimentary cyclothems (e.g. sandstone, mudstone, siltstone, limestone and coal seams) (Figure 4).

A Coal seam (Beamshaw Low) runs through the site and dips to the south east.

There are no faults on or in the vicinity of the site.

BGS Borehole SE30NW552 located 150m to the south west of the site shows a combination of made ground and natural clays are present to a depth of 1.70mbgl underlain by a sandstone bedrock which was proven to a depth of 3.50m.

There are no significant geological hazards noted within the Envirocheck Report.

5.5 Mining & Quarrying

The site is within both a Coal Mining Affected Area and a Development High Risk area as defined by the Coal Authority, as a result a coal mining search report was required to assess the risks posed by historic and possible future coal mining to any current or future developments on the site.

The Consultants Coal Mining Report by The Coal Authority dated 18th April 2023 is presented in Appendix D.

The mining report highlights that the site is situated in an area where one seam has been worked within the likely zone of physical influence on the surface. The seam is the Barnsley seam last worked pre 1860 at a depth of 122m with a section thickness of 2.40m.

The report highlights that the site is not situated within the boundary of a former opencast coal mining site. Neither is the site located within 500m of a currently operating opencast coal mine or 500m of a future opencast coal mine.

The report follows on to state that they have no knowledge of any shafts or adits within 20m of the site or the boundary of the site. Also there are no tips or lagoons in the vicinity of the site. **It is highlighted that there are possible ancient shallow coal mining workings within the likely zone of influence on the surface in the vicinity of the property, for which no accurate plans or records exist.**

The report concludes by stating that old workings are present, but all settlement is likely to have completed long ago. In their opinion it is unlikely that coal will be worked in the foreseeable future.

The Envirocheck Report indicates that there are 8no BGS recorded Mineral Sites located within 1km of the site. The nearest is located 479m north-west of the site with the commodity listed as Coal (deep).

The site is within 1km of a Non-Coal mining area of Great Britain.

The site is not within 1km of a Man-Made Mining Cavity.

The site is not within 1km of a Natural Cavity.
The site is not within 1km of a Brine Compensation area.

5.6 Hydrogeology

Using the Environment Agency's Policy and Practice for the Protection of Groundwater the solid geology beneath the site is classified as a Secondary Aquifer – A. The overlying drift is not classified.

The groundwater vulnerability is categorised as Secondary Bedrock Aquifer – Medium Vulnerability.

The site does not lie within a Source Protection Zone.

The Envirocheck Report indicates that there are 2no Groundwater Abstractions located within 1km of the site. The nearest is located 772m east of the site operated by 'Barnsley Football Club 2002 Ltd' located within 'Borehole - Coal Measures - Oakwell Road – Barnsley' classified as Sports Grounds/Facilities: Spray Irrigation – Direct, Water may be abstracted from a single point'.

5.7 Hydrology

The nearest surface water feature is a river named Sough Dike located 208m south of the site.

The Envirocheck Report states there are 43no Licensed Discharge Consents entries within 500m of the site. The nearest is located 267m to the south east of the site classified as Sewage Discharges - Stw Storm Overflow/Storm Tank - Water Company, Freshwater Stream/River' into 'Don Tributaries' whose status is Transferred from Rivers (Prevention of Pollution) Act 1951-1961'.

The Envirocheck Report states there are no Records of Water Industry Act Referrals (potentially harmful discharges to the public sewer) located within 500m of the site.

The Envirocheck Report indicates that there are 2no Surface Water Abstractions located within 1km of the site. The nearest is located 631m north east of the site operated by 'C C Cooper Limited' classified as 'Surface, 295m3'.

5.8 Flooding

The Envirocheck Report states the site is not at risk of Flooding or Extreme Flooding from Rivers and the Seas without defences.

The Envirocheck Report indicates that there are no flood defences, flood water storage areas or areas benefiting from flood defences and flood storage present within 250m of the site.

The Envirocheck Report states that there is Potential for Groundwater Flooding of property situated below ground level.

5.9 Sensitive Land Use

A Local Nature Reserve is located 955m north east of the site.

The site is within the boundaries of a Nitrate Vulnerable Zone.

An area of Adopted Green Belt land is located 560m north east of the site.

The site does not lie within 2km of any other form of Designated Environmentally Sensitive Sites or Protected Areas.

5.10 Radon Gas

The site lies within an Intermediate probability radon area (1 to 3% of homes are estimated to be at or above the Action Level).

In accordance with the procedure described in BRE Publication BR211 Radon: Guidance on Protective

Measures for New Dwellings, no radon protection measures are necessary for new buildings or extensions on the site.

6 CONCEPTUAL SITE MODEL

6.1 General

Based on the information presented in the preceding Sections, and in accordance with the LCRM guidance noted in Section 1, a Preliminary Conceptual Site Model has been produced.

The main features of the model are discussed in the following sections together with preliminary recommendations where appropriate.

6.2 Likely Ground Conditions

It is expected that, based on available information, ground conditions are likely to be made ground comprising areas of both topsoil and hardstanding. The surface deposits are likely to be underlain by further made ground, likely to consist of construction/demolition waste, possible infilled ground and railway waste. Made ground likely to be deepest in the centre of the site around the historic railway. The drift deposits on site are likely to comprise relatively thin glacial till (clay) deposits overlying a sandstone, siltstone and mudstone bedrock.

6.3 Potential Buried Obstructions

Based on the site history, buried obstructions are likely, expected to primarily consist of relict foundations, railway sleepers, cobbles, bricks, and stone blocks.

6.4 Coal Mining Risk Assessment

The site is within a Coal Mining Reporting Area as defined by the Coal Authority.

The ten times seam thickness rule states that where competent rock exceeds ten times the extracted seam thickness, then no major crown holing should occur at the surface (Structural Foundations Manual; M. F. Atkinson, *Spon Press* 2003). If the competent rock cover is less than ten times the extracted seam thickness, then recommendations suggest the workings must be grouted using a mixture of pulverised fuel ash (PFA) and cement placed into the area under pressure.

Multiple situations may mean a ratio in excess of 10x seam thickness is required to prevent crown hole collapse, including but not exclusive to; steeply dipping strata, presence of groundwater, a high extraction ratio noted, and multiple seam extractions underlying the site (CIRIA C758D, Table 5.1). Additionally, weak basement rock underlying the workings has potential to cause a separate collapse mechanism via pillars sinking.

Conversely, there are scenarios where the acceptable cover criterion may be decreased from 10x seam thickness, these include where a rigid non-degradable roof strata is present to stop the upward void migration and where low residual voidage is proven either via infilling or extensive collapse (CIRIA C758D, Table 5.1).

For certain developments, a ratio of less than 10x may be addressed via bridging techniques i.e. utilising raft foundations, however this would be dependent on approval from the regulatory authorities.

From the Coal Mining Report, the shallowest known worked coal seam is the Barnsley seam at 122m depth with a section thickness of 2.40m. In this situation the Barnsley seam is at a sufficient depth to give a ratio well in excess of 10x the seam thickness.

In addition, the Beamshaw Low seam is predicted to outcrop beneath the south-eastern portion of the site, dipping to the south east.

Given the presence of possible ancient shallow coal mine workings (likely in the Beamshaw Low seam) it is recommended that a series of rotary boreholes are required as part of any site investigation for any new permanent development which is to be situated in the south-eastern portion of the site. The boreholes are

necessary to investigate potential voids, collapsed workings and possible weak/broken areas of rock due to mine workings underlying the proposed new development.

6.5 Preliminary Geotechnical Assessment

Pending no adverse findings from the rotary drilling, given the expected ground conditions noted in the sections above, the use of strip foundations (possible deep strip) for the new development is anticipated at present. Where loose made ground or soft/loose natural deposits are encountered, foundations will need to be taken through the made ground/disturbed ground into underlying natural strata of adequate bearing capacity.

Should the rotary boreholes record adverse findings of voids/broken rock beneath the proposed building footprint, it may be necessary to implement structural precautions in the foundations such as raft or reinforced strips, or potentially, grouting of the site may be necessary.

The above suggestions should be regarded as tentative until Phase 2 intrusive works are undertaken and information is available regarding design loads and development layout.

6.6 Preliminary Contamination Assessment

The desk study has shown that the site has been exposed to some contamination, with construction/demolition waste, railway waste, Electrical Sub-station contamination and possibly oils or fuel from vehicle spills the most likely sources local to the structures. Asbestos may also be present on the site from previous building cladding and roofing.

In view of the historic, current and future site use, chemical contamination testing is considered necessary. The following chemical testing suite should be considered for selected soil samples:

TABLE 2: POTENTIAL PRIORITY CONTAMINANTS

Inorganic Contaminants	Organic Contaminants
Antimony, Arsenic, Boron, Cadmium, Chromium, Lead, Mercury, Nickel, Zinc, Selenium, Free Cyanide, Soluble Sulphate, pH, Asbestos	Phenol, Organic Matter, speciated PAH, TPH CWG and PCB, VOCs, SVOCs

It should be noted that the above potential contaminants are considered to be commonly associated with the specified past land uses of the site, and adjacent land use. Risk assessment should be undertaken for contamination identified during intrusive investigation.

Potential pathways which link the potential contaminants to end users of the site and controlled waters (receptors) include the following:

- Ingestion of soil (outdoors) / dust (indoors)
- Skin contact with soil (outdoors) / dust (indoors)
- Inhalation of dust (outdoors and indoors)
- Contamination via buried water pipes
- Surface water run-off, including via existing drainage infrastructure
- Downward infiltration of leachable contaminants to groundwater

6.7 Potential Sources of Ground Gas

Ground gases such as carbon dioxide and methane can be classed as a form of contamination. Potential sources of ground gases include:

- Made Ground
- Quarries, Infilled Clay Pits & Infilled Ponds
- Underlying Natural Strata (alluvium, peat and chalk)
- Petrol re-fuelling sites (which also includes Volatile Organic Compounds)
- Landfill (on and off-site)
- Coal measures

Based on historical map evidence and consideration of the sites environmental setting the table below shows a preliminary comparison of *consequence* against *probability* where ground gas is considered a potential threat to human health.

TABLE 3: POTENTIAL GROUND GAS POLLUTION LINKAGES

Potential Sources	Potential Pathway	Receptor
Made ground (CO ₂ , CO and CH ₄). Coal measures (CO ₂ , CO and CH ₄) and stythe gas or oxygen depletion. Burial Grounds (CO ₂ and CH ₄). Gas Works (CO ₂ , CO and CH ₄).	Ingress and Accumulation into buildings from vertical and horizontal migration	Future users of site are likely to include adults and children. Construction workers (in particular utility workers).
Preliminary Comparison of Consequence verses Probability		
Probability	Classification	Justification
(Based on Table 8.1, CIRIA C665, 2007)	LOW LIKEIHOOD	Ground gas from made ground (Inc. railway on-site).
		Historic Gas Works within 250m.
		Coal mining in area. (Seam outcropping on-site)
Consequence	MEDIUM	Commercial (School Buildings)
(Based on Table 8.2, CIRIA C665, 2007)		
	Risk	Details
Consequence vs. Probability	LOW-MOD RISK	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the long-term. (Based on Table 8.4, CIRIA C665, 2007)
(Based on Table 8.3, CIRIA C665, 2007)		

Given the conditions noted above a ground gas assessment is considered necessary for the site to observe standing groundwater levels and to allow measurements to be made of hazardous gases and/or contamination levels in groundwater. Monitoring should be undertaken following site works on a minimum of six occasions over three months.

6.8 Risk Assessment for Contaminated Land

As part of this Phase 1 Desk Study, a preliminary conceptual model and risk assessment is produced. This assessment should be revised following the Phase 2 Site Investigation outlining a qualitative risk assessment. Should there be unacceptable risks to the various receptors/end-users following the Phase 2 works, then a remediation strategy may be required to outline measures to satisfy Part 2A of the Environmental Protection Act (1990). The above measures are in line with Environment Agency *Land Contamination Risk Management*, which replaced the now-withdrawn Contaminated Land Report 11 – *Model Procedures for the Management of Land Contamination* (2004).

The results of the chemical contamination testing as part of the Phase 2 investigation should be compared to a current Land Quality Management (LQM) – Suitable 4 Use Levels (S4UL) December 2014.

6.9 Conceptual Site Model

The conceptual model collates the salient aspects of the site to form a model which should enable comparison after fieldwork and testing. This model identifies the potential pollution linkages that may influence the proposed development and geotechnical considerations.

The risk ratings are based on the current potential liabilities and likely potential future liabilities. The risks posed by the geotechnical and contamination aspects of the site will be revised following site works, and any mitigating action required added.

The Preliminary Conceptual Model has been undertaken in accordance with CIRIA C552. The Preliminary

Conceptual Model assesses the consequence and the likelihood of a risk being realised to provide a risk classification, which is then used to produce the Preliminary Conceptual Model. Full details of the tables used to assess consequence, likelihood and risk classification are presented in Appendix F.

TABLE 4: PRELIMINARY CONCEPTUAL MODEL

Source	Pathway	Receptor	Risk Rating	Comments
Asphyxiating or explosive ground gases - Made ground - Coal mining area - Gas Works - Burial Grounds - Intermediate Affected Area Radon	Ground gas migration - Migration through permeable soils - Inhalation	Future site users Transient Adult and Infants	Moderate	Gas monitoring recommended. Six visits over three months proposed.
		Users during development Construction workers	Moderate	
Areas of contamination - Potential contaminants in made ground: - Railway Contamination - Electrical Sub-Station on-site - Current use as car park. - Potential demolition/construction waste - Historic sources of contamination: - Timber Yard > 100m - Railways >100m - Garages > 100m - Gas Works > 150m - Foundry > 150m - Clothing Factory > 250m	- Inhalation - Dust ingestion - Dermal contact	Future site users Transient Adult and Infants	Moderate /Low	Mitigated by proposed structure hard standing – no gardens proposed.
		Users during development Construction workers	Moderate	Contamination testing required to determine risks posed during construction. Consideration to be given to Health and Safety Executive Guidance. <i>Protection of Workers and the General Public During the Development of Contaminated Land.</i>
	- Inhalation - Dust ingestion	Users of surrounding sites General Public	Low	Potential low risk during construction from dust generation. Contamination testing required to quantify the risks.
		Drift geology Unclassified	Low	Unlikely to contain significant groundwater.
	Leaching of mobilised contaminants	Solid geology Secondary Aquifer - A	Low	Medium sensitivity Aquifer located beneath low permeability drift deposits.
		Surface water features River 208m south	Low	Very limited potential for contamination from site to reach surface water, either via surface run-off or groundwater movement.
	- Drainage - Lateral migration - Accumulation of contaminated sediment	Vegetation None on site or proposed	Very Low	No potential for Vegetation impact as no vegetation is present or proposed.
	Uptake via roots and leaf surfaces	Vegetation None on site or proposed	Very Low	No potential for Vegetation impact as no vegetation is present or proposed.
Areas of contamination above service fabric or BRE Special Digest 1 thresholds	Direct contact	Construction Materials Concrete	Moderate	pH and sulphates to be assessed during Site Investigation.
	Direct contact	Construction Materials Service Fabric	Moderate	Consideration to be given to Pipe Material Table (Appendix F) during Site Investigation.

7 PROPOSED PHASE TWO INTRUSIVE WORKS

A Phase 2 Site Investigation should be undertaken to verify the assumptions made in the Preliminary Conceptual Site Model and to provide data for foundation design.

An outline ground investigation strategy is summarised below, based on the preliminary conceptual site model and information obtained during the desk study.

7.1 Site Investigation Rationale

The Conceptual Model highlights that there is potential for contamination on the site. Therefore, an intrusive investigation should be undertaken with the sampling strategies outlined within BS10175:2011 +A1:2013 and CLR4:1994. These strategies can be considered as:

- Non targeted (BS10175) – If no obvious hotspots or potential sources of contamination have been outlined in the desk study, it would be recommended to utilise a stratified random pattern of sampling locations.
- Targeted (CLR4) – If a possible hotspot is suspected on the site, it is recommended to adopt a targeted approach to sample the immediate vicinity of the hotspot. Highly focussed sampling consisting of several samples within the area of the hotspot may be necessary to delineate the extent of the hotspot.

These strategies can be employed either separately or in conjunction and any site investigation should be individually tailored to each site.

The density of sampling required is defined within BS10175 which notes that the density required is dependent on a number of factors including confidence and robustness required, and contaminants, pathways and receptors present.

7.2 Site Specific Sampling Rationale

The analysis of the historical maps and the Conceptual Model has highlighted that specific point sources of contamination may be present, or may historically have been present, on the site. It is recommended that a targeted approach is utilised in order to prove and delineate the extent of these hotspots. The hotspots outlined for targeted analysis are detailed below.

TABLE 5: HOTSPOT INVESTIGATION LOCATIONS

Proposed Exploratory Method	Possible Hotspot
Boreholes (ca 5.00mbgl) and Trial Pits (ca.3.00mbgl)	Historical railway in the centre of the site. Recommended location for a gas monitoring well and contamination testing. Electrical Substation located in the south west corner of the site. Recommended location for contamination testing.

In addition to the proposed targeted approach, it is recommended that the remainder of the site away from the hotspots is investigated using a non-targeted approach.

The chemical testing proposed for the site is outlined in Section 6.6.

7.3 Proposed Methods of Investigation

The methods of investigation outlined within Table 6 are considered necessary to address the risks outlined within the Conceptual Model. The locations of these investigation positions will be set out in line with the proposed sampling methodology outlined in Section 7.2.

TABLE 6: SITE INVESTIGATION RECOMMENDATIONS

Proposed method of investigation	Purpose	Comments
Hand dug trial pits	Hand dug trial pits to 1.20mbgl to ensure positions are clear of underground services.	To be undertaken prior to the drilling of all boreholes and following CAT scanning and service plan inspection.
A series of small percussive boreholes to ca. 5.00mbgl	• To determine shallow ground conditions. • To collect soil samples for geotechnical and chemical testing. • To observe soils profile, localised variations in materials and presence of groundwater.	• Ensure positions are CAT scanned and service plans inspected prior to any excavation. • Hand vanes to be taken in cohesive deposits. • SPT samples in granular strata and rock head. • Disturbed and jar samples to be undertaken for chemical testing.
Trial pitting to ca. 3.00mbgl	• To assess the shallow ground conditions and obtain samples for chemical testing. • To undertake insitu hand shear vanes. • To undertake soakaway tests and insitu CBR testing.	• Ensure positions are CAT scanned and service plans inspected prior to investigation.
Gas/groundwater monitoring wells	To observe standing groundwater levels and to allow measurements to be made of hazardous gases and/or contamination levels in groundwater.	Monitoring to be undertaken following site works on a minimum of six occasions.
Provisional - A series of rotary boreholes drilled to ca. 30.00mbgl (minimum of 3no. boreholes)	The boreholes are necessary to investigate potential voids and possible weak/broken areas of rock due to mine workings underlying the proposed new structure.	Ensure positions are CAT scanned and service plans inspected prior to excavation.
Chemical testing	To allow the potential risks identified within the conceptual model to be addressed.	Chemical soils testing to cover potential priority contaminants from Table 2.
Geotechnical testing	To confirm material properties and to provide concrete classification of materials.	Tests may include sulphate analysis, pH, moisture content, Atterberg limit determination, particle size distribution tests and triaxial testing. Further tests may be required depending on the materials encountered.

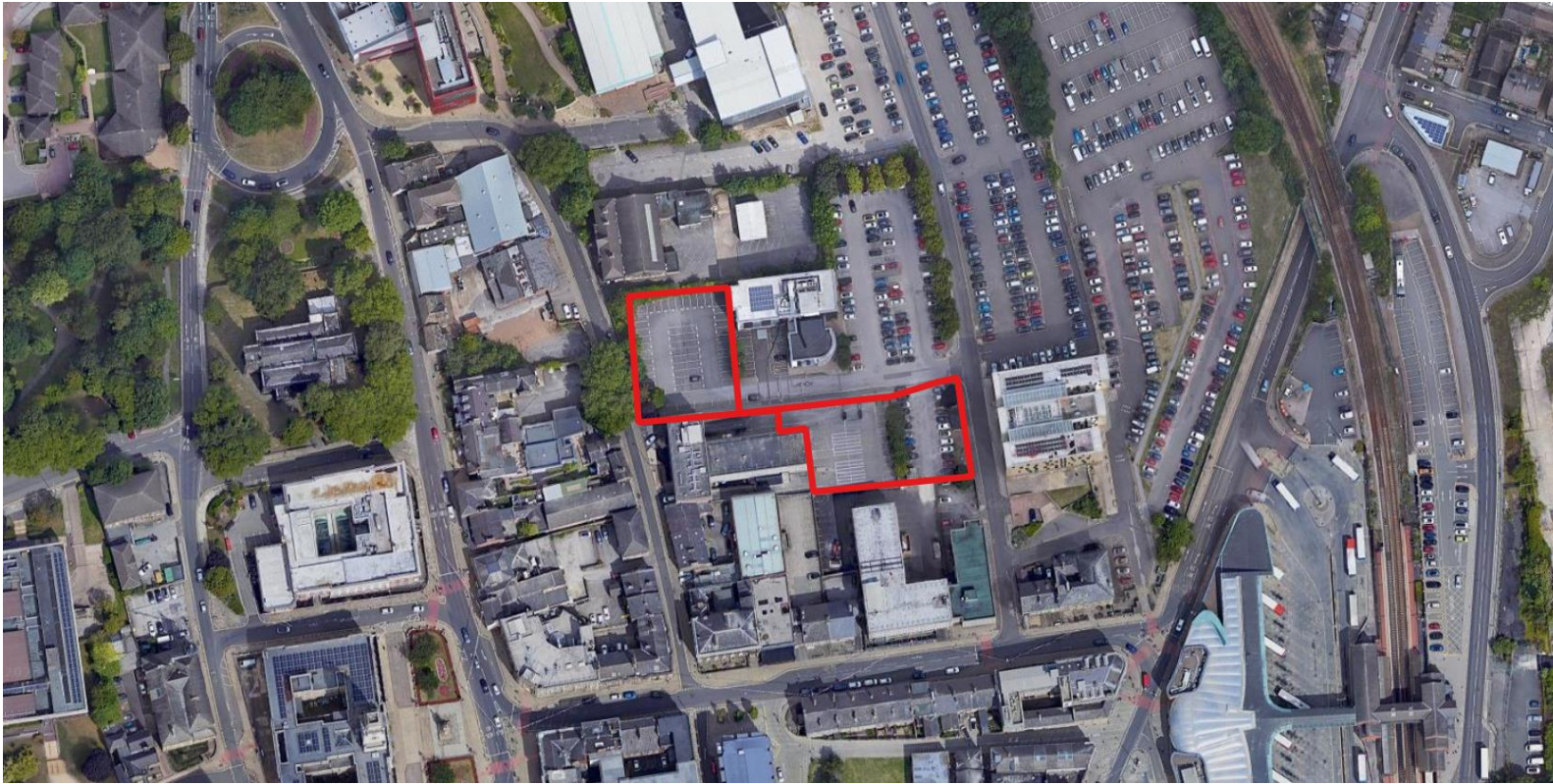
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Appendix A



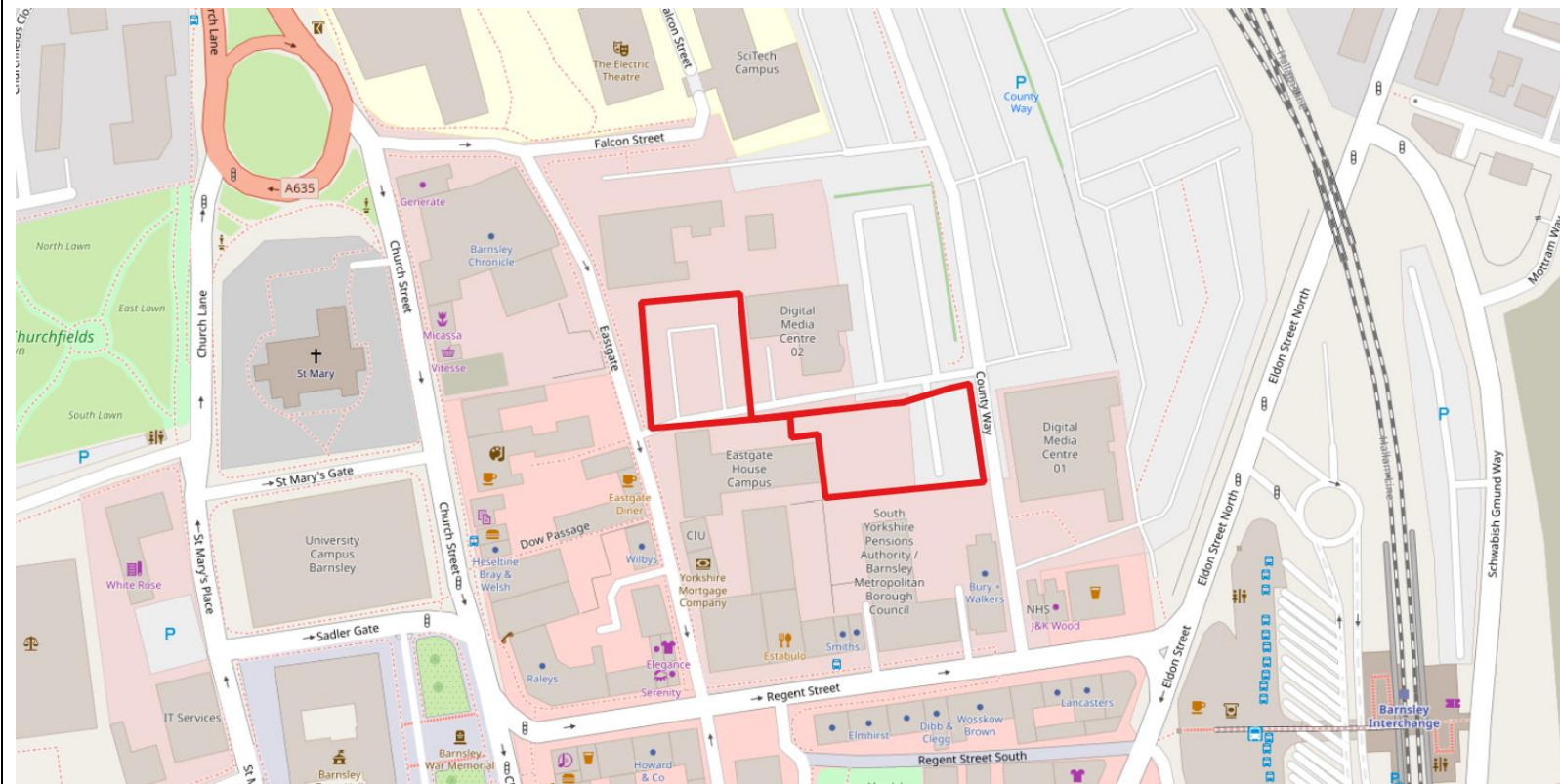
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Title	Site Location Map
Project	Trinity Academy, Barnsey
Client	William Saunders
Date	May 2023
Fig No.	Figure 1
Scale	1:2,500
Key	Site Boundary  N
Solmek Ltd. 12 Yarm Road Stockton-on-Tees TS18 3NA Tel: +44 (0) 1642 607083 Fax: +44 (0) 1642 612355 e-mail: south@solmek.com www.solmek.com  SOLMEK	



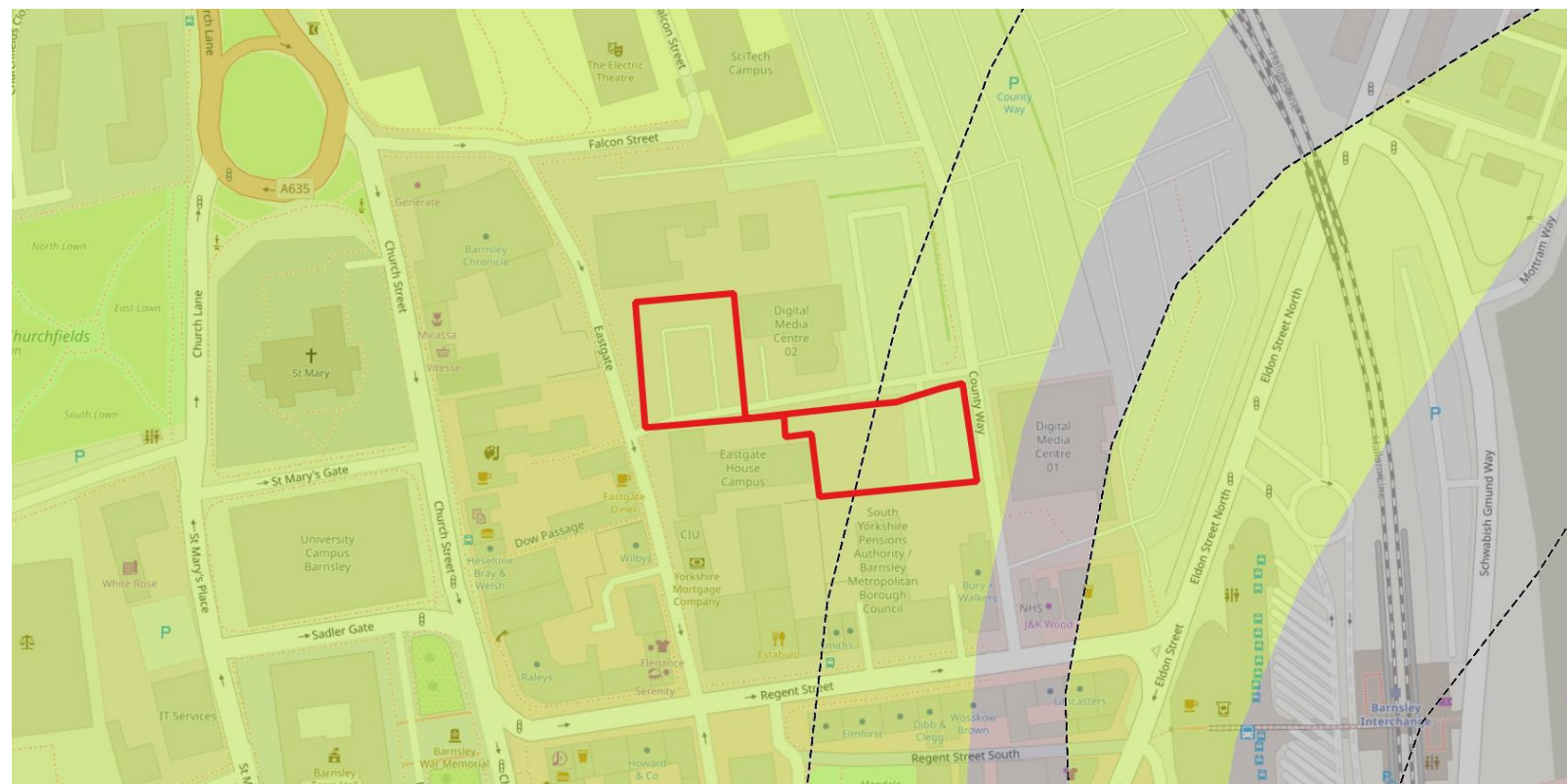
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Title
Site Location Plan
Project
Trinity Academy, Barnsley
Client
William Saunders
Date
May 2023
Fig No.
Figure 2
Scale
1:2,500
Key
Site Boundary
N
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Title	Drift Geology Map
Project	Trinity Academy, Barnsley
Client	William Saunders
Date	May 2023
Fig No.	Figure 3
Scale	1:2,500
Key	Site Boundary No information available
↑ N	
Solmek Ltd. 12 Yarm Road Stockton-on-Tees TS18 3NA Tel: +44 (0) 1642 607083 Fax: +44 (0) 1642 612355 e-mail: south@solmek.com www.solmek.com	
	



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Title	Bedrock Geology Map
Project	Trinity Academy, Barnsley
Client	William Saunders
Date	May 2023
Fig No.	Figure 4
Scale	1:2,500
Key	 Site Boundary  Inferred Coal Seam  Pennine Middle Coal Measures Formation - Sandstone  Pennine Middle Coal Measures Formation - Mudstone, Siltstone and Sandstone  N
Solmek Ltd. 12 Yarm Road Stockton-on-Tees TS18 3NA Tel: +44 (0) 1642 607083 Fax: +44 (0) 1642 612355 e-mail: south@solmek.com www.solmek.com  SOLMEK	



Photo 1: Photo taken looking south east across site.



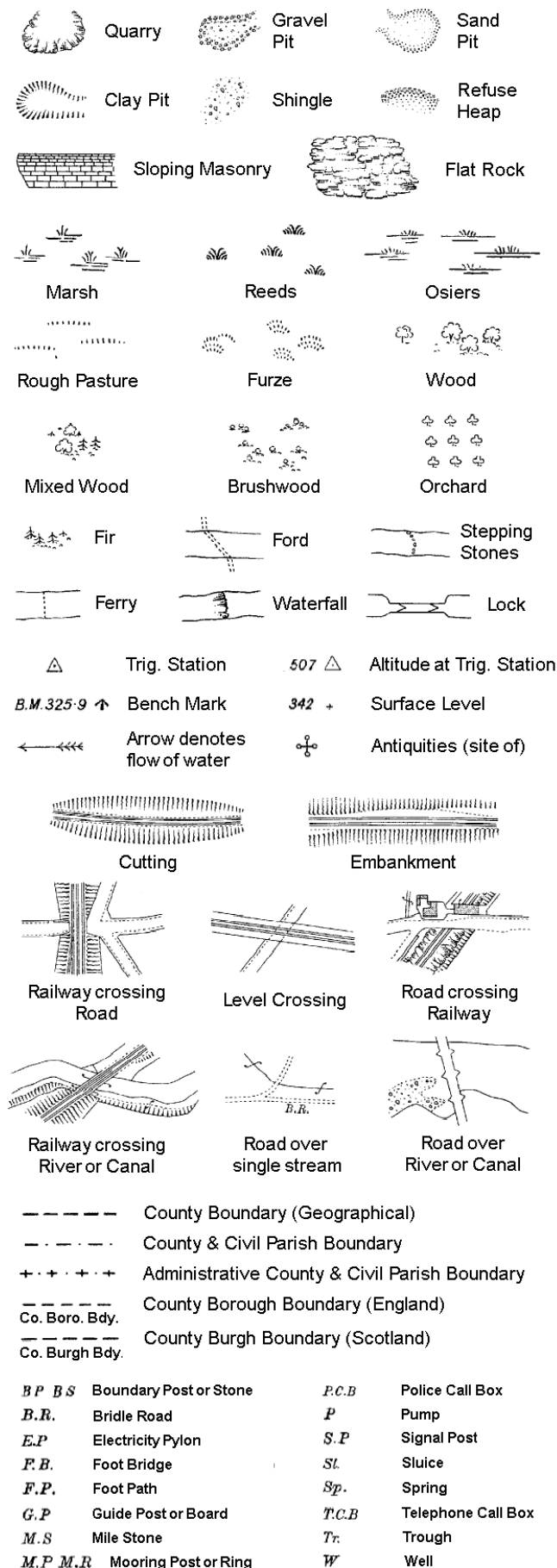
Photo 2: Photo taken looking north west across site.

Title	Date	Solmek Ltd. 12 Yarm Road Stockton-on-Tees TS18 3NA Tel: +44 (0) 1642 607083 Fax: +44 (0) 1642 612355 e-mail: south@solmek.com www.solmek.com  SOLMEK
Site Walkover Photos	May 2023	
Project	Figure No.	
Trinity Academy, Barnsley	5	
Client		
William Saunders		

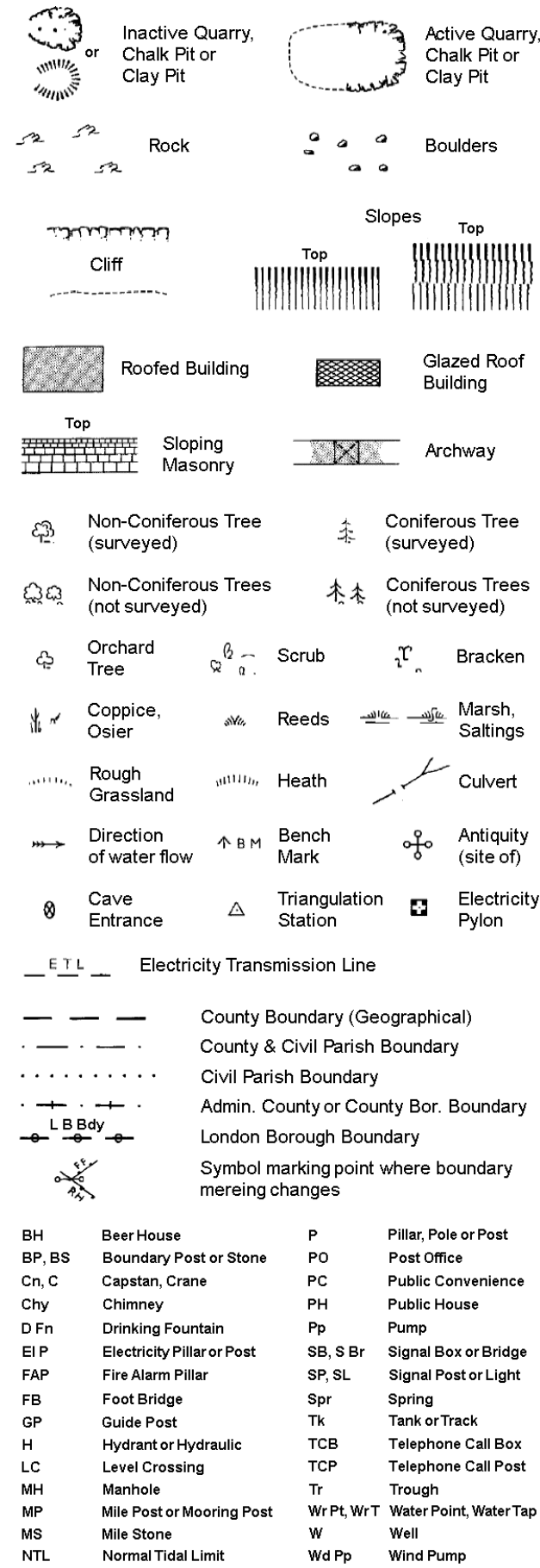
Appendix B

Historical Mapping Legends

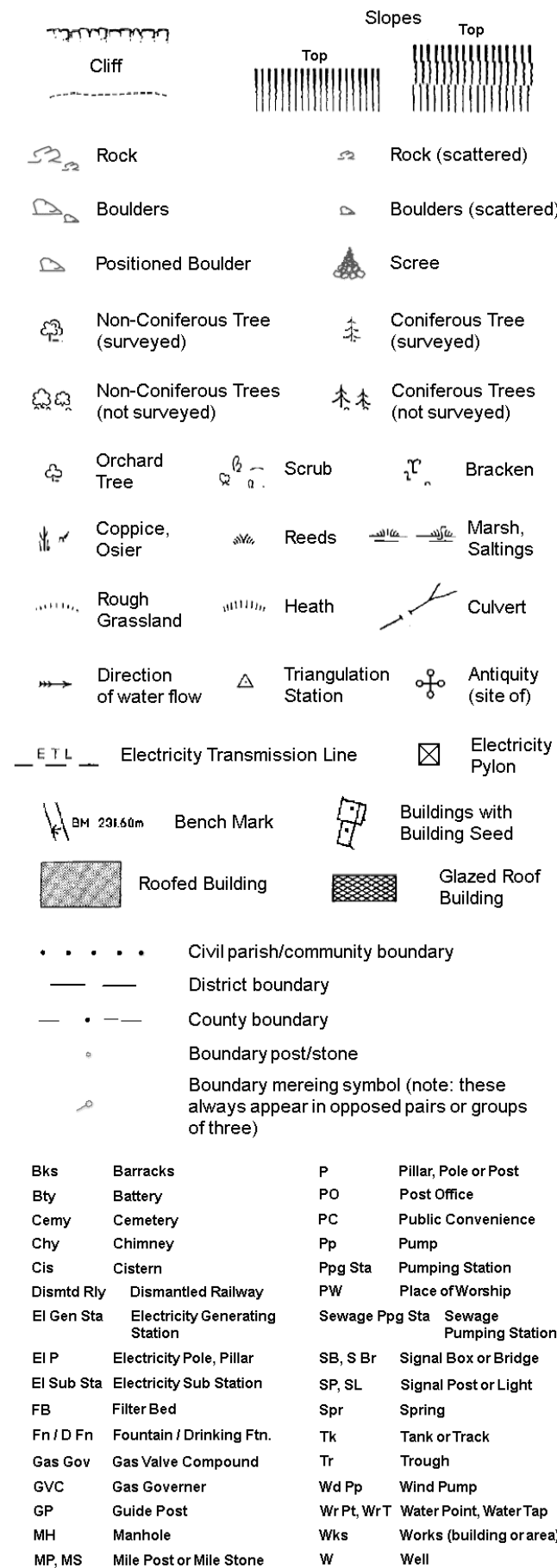
Ordnance Survey County Series and Ordnance Survey Plan 1:2,500



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



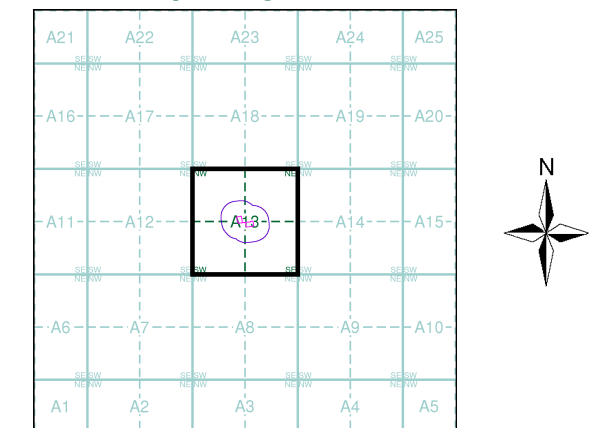
Large-Scale National Grid Data 1:2,500 and 1:1,250



Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Yorkshire	1:2,500	1892 - 1893	2
Yorkshire	1:2,500	1906	3
Yorkshire	1:2,500	1931	4
Ordnance Survey Plan	1:1,250	1961	5
Ordnance Survey Plan	1:2,500	1962	6
Ordnance Survey Plan	1:1,250	1968 - 1977	7
Additional SIMs	1:1,250	1977 - 1987	8
Additional SIMs	1:1,250	1982 - 1991	9
Ordnance Survey Plan	1:1,250	1984 - 1988	10
Additional SIMs	1:1,250	1991	11
Large-Scale National Grid Data	1:1,250	1993	12
Large-Scale National Grid Data	1:1,250	1993	13
Large-Scale National Grid Data	1:1,250	1996	14

Historical Map - Segment A13



Order Details

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Customer Ref: S230406
National Grid Reference: 434520, 406640
Slice: A
Site Area (Ha): 0.28
Search Buffer (m): 100

Site Details

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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		Minor Roads		
	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				
	County Borough Boundary (England)				
	County Burgh Boundary (Scotland)				
	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
	Bracken		Heath
	Marsh		Reeds
	Building		Glasshouse
	Sloping Masonry		Pylon
	Cutting		Embankment
	Road Under		Road Over
	Level Crossing		Foot Bridge
	Standard Gauge Multiple Track		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
	Civil Parish		
	BP, BS Boundary Post or Stone		Police Station
	Church		Post Office
	Club House		Public Convenience
	Fire Engine Station		Public House
	Foot Bridge		Signal Box
	Fountain		Spring
	Guide Post		Telephone Call Box
	Mile Post		Telephone Call Post
	Mile Stone		Well

1:10,000 Raster Mapping

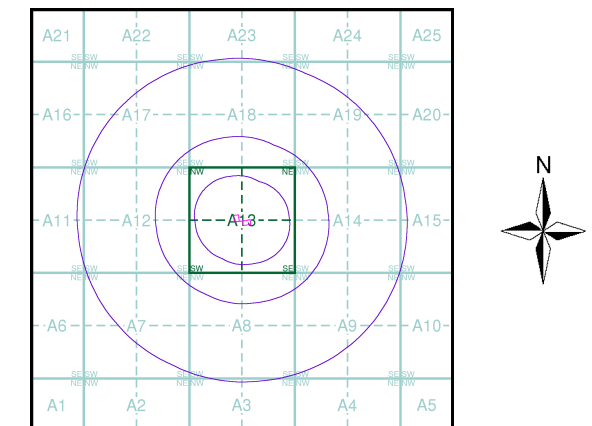
	Gravel Pit		Refuse tip or slag heap
	Rock		Rock (scattered)
	Boulders		Boulders (scattered)
	Shingle		Mud
	Sand		Sand Pit
	Slopes		Top of cliff
	General detail		Underground detail
	Overhead detail		Narrow gauge railway
	Multi-track railway		Single track railway
	County boundary (England only)		Civil, 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
	Mean high water (springs)		Mean low water (springs)
	Telephone line (where shown)		Electricity transmission line (with poles)
	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



Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Yorkshire	1:10,560	1855	2
Yorkshire	1:10,560	1894	3
Yorkshire	1:10,560	1907	4
Yorkshire	1:10,560	1932	5
Yorkshire	1:10,560	1938	6
Yorkshire	1:10,560	1948	7
Ordnance Survey Plan	1:10,000	1955 - 1956	8
Ordnance Survey Plan	1:10,000	1966	9
Ordnance Survey Plan	1:10,000	1973 - 1974	10
Ordnance Survey Plan	1:10,000	1983 - 1984	11
Ordnance Survey Plan	1:10,000	1993	12
10K Raster Mapping	1:10,000	2000	13
Street View	Variable		14

Historical Map - Slice A



Order Details

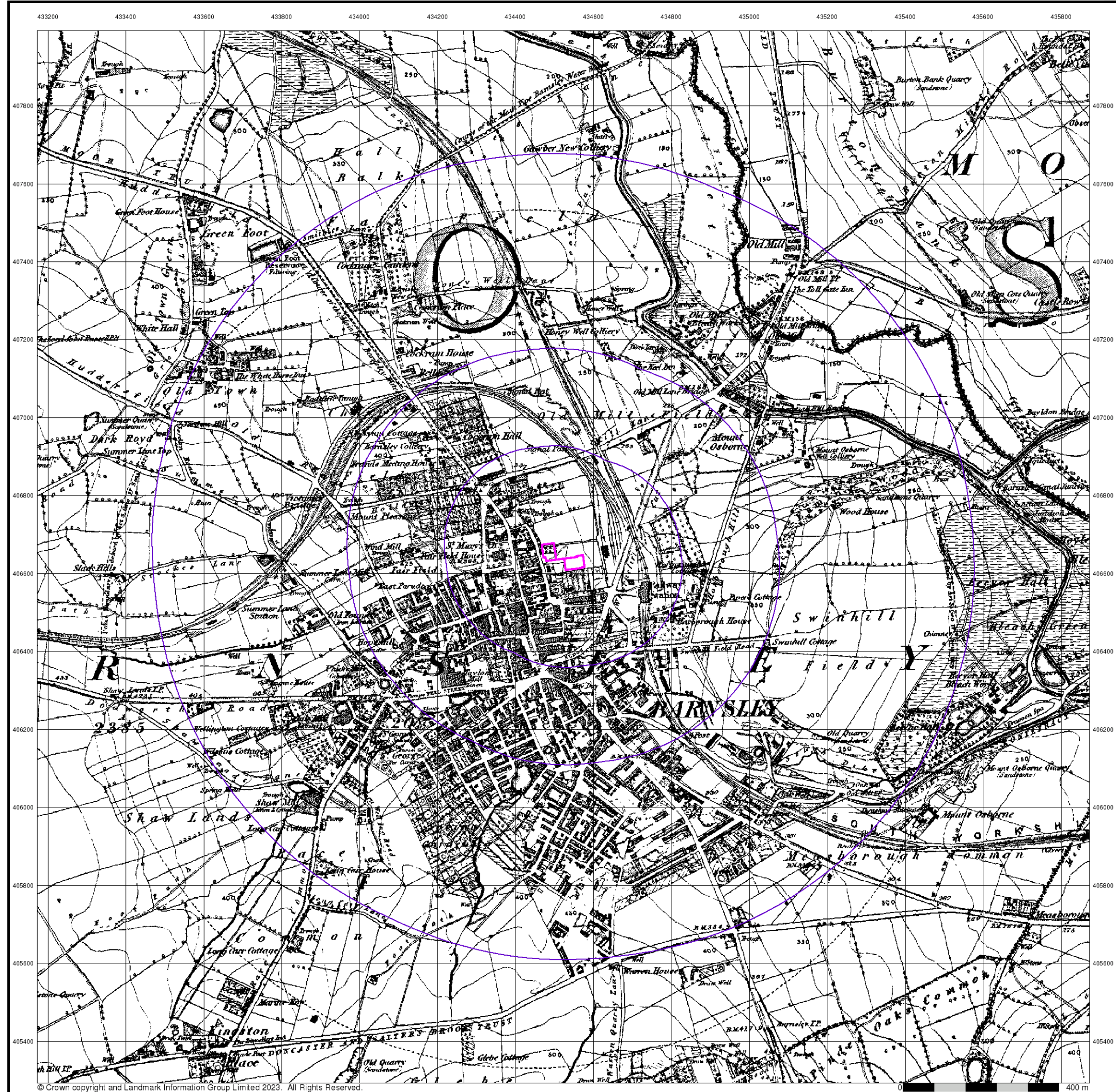
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Search Buffer (m): 1000

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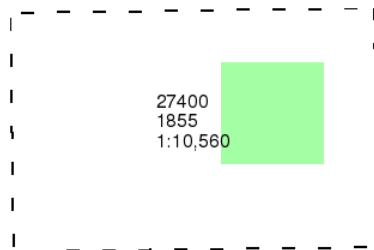
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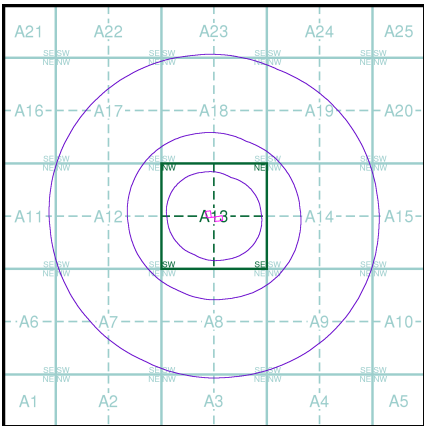
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Map Name(s) and Date(s)



Historical Map - Slice A



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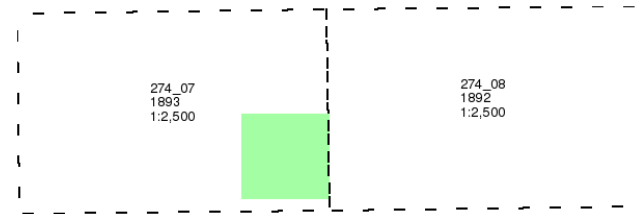
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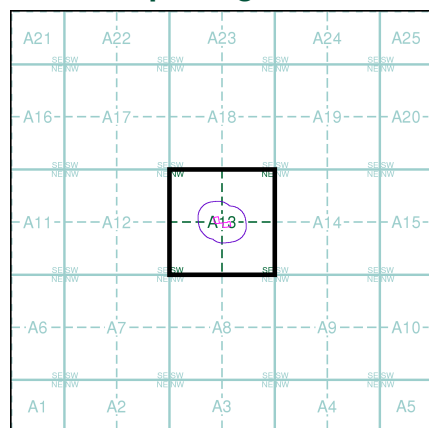
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Map Name(s) and Date(s)



Historical Map - Segment A13



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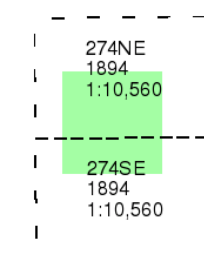
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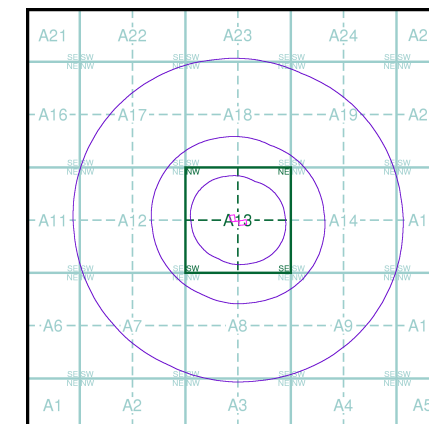
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Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

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Customer Ref: S230406
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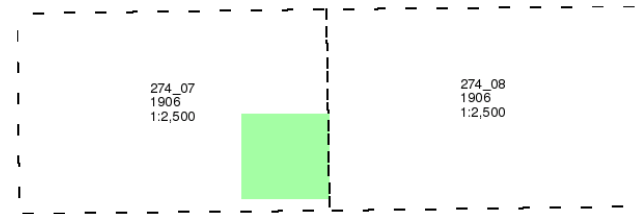
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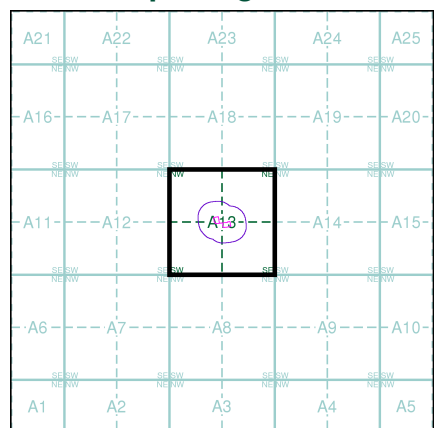
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Published 1906
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Map Name(s) and Date(s)



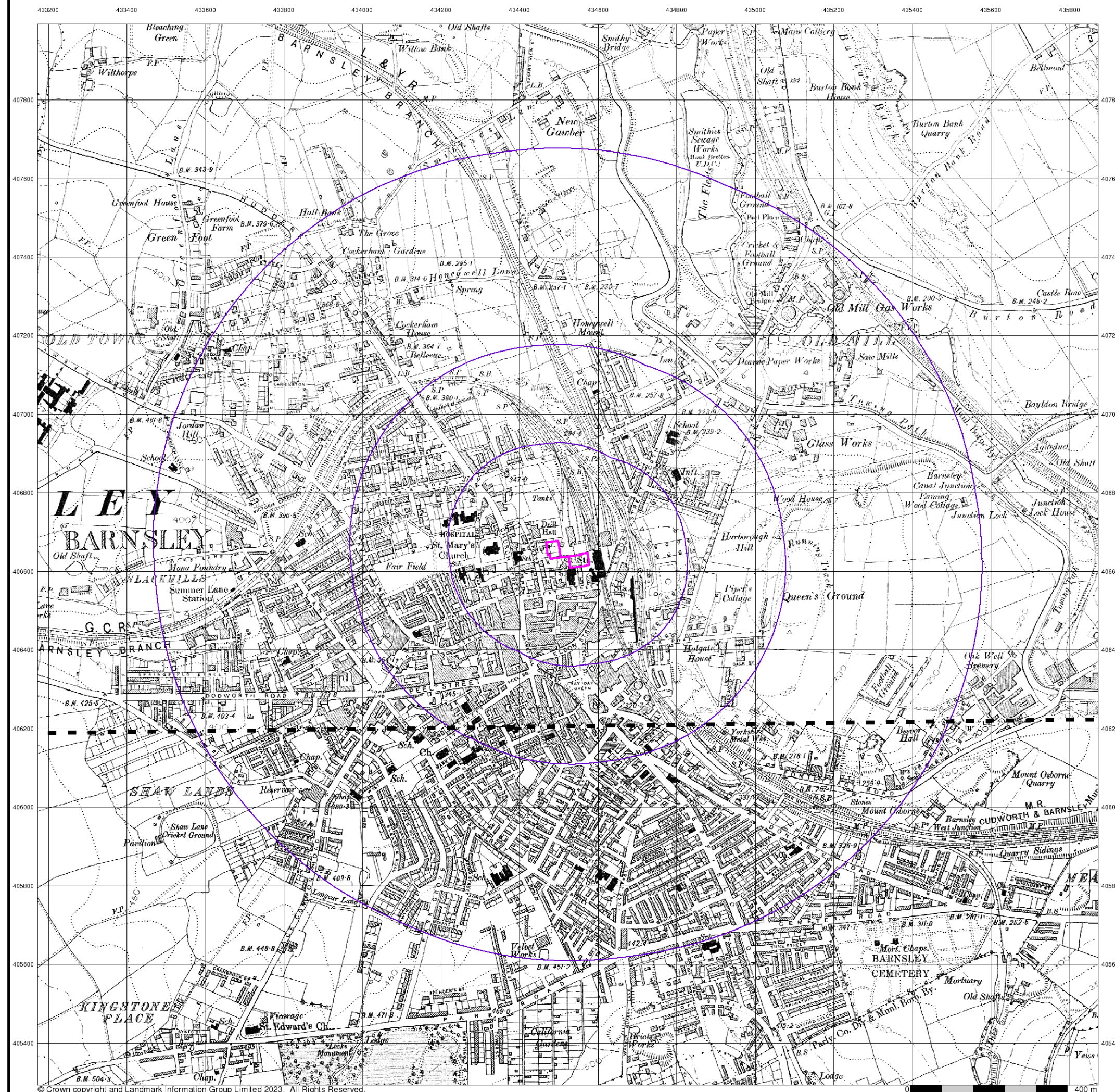
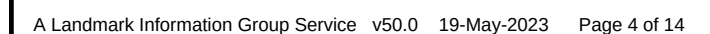
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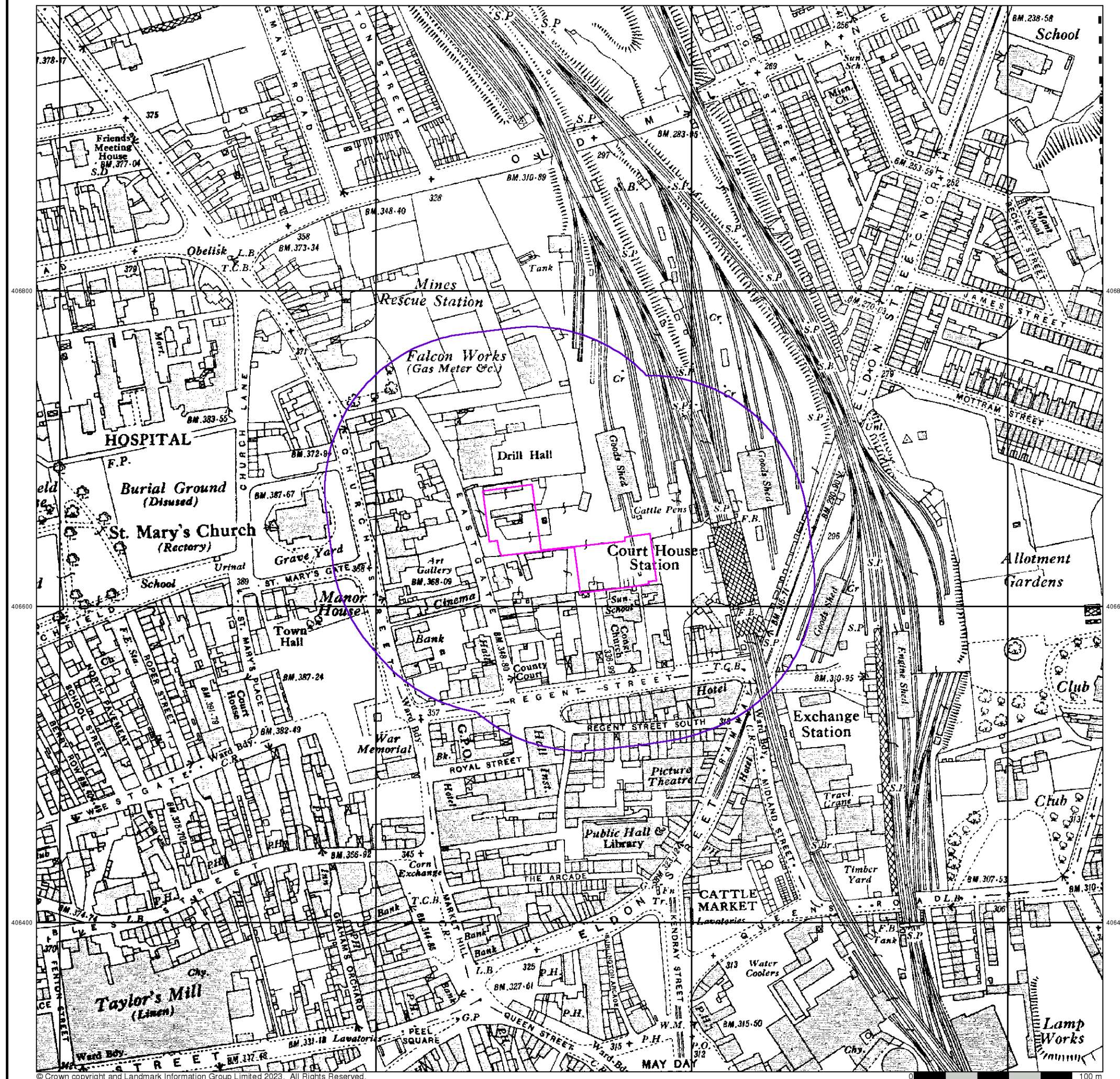
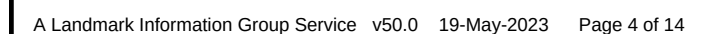


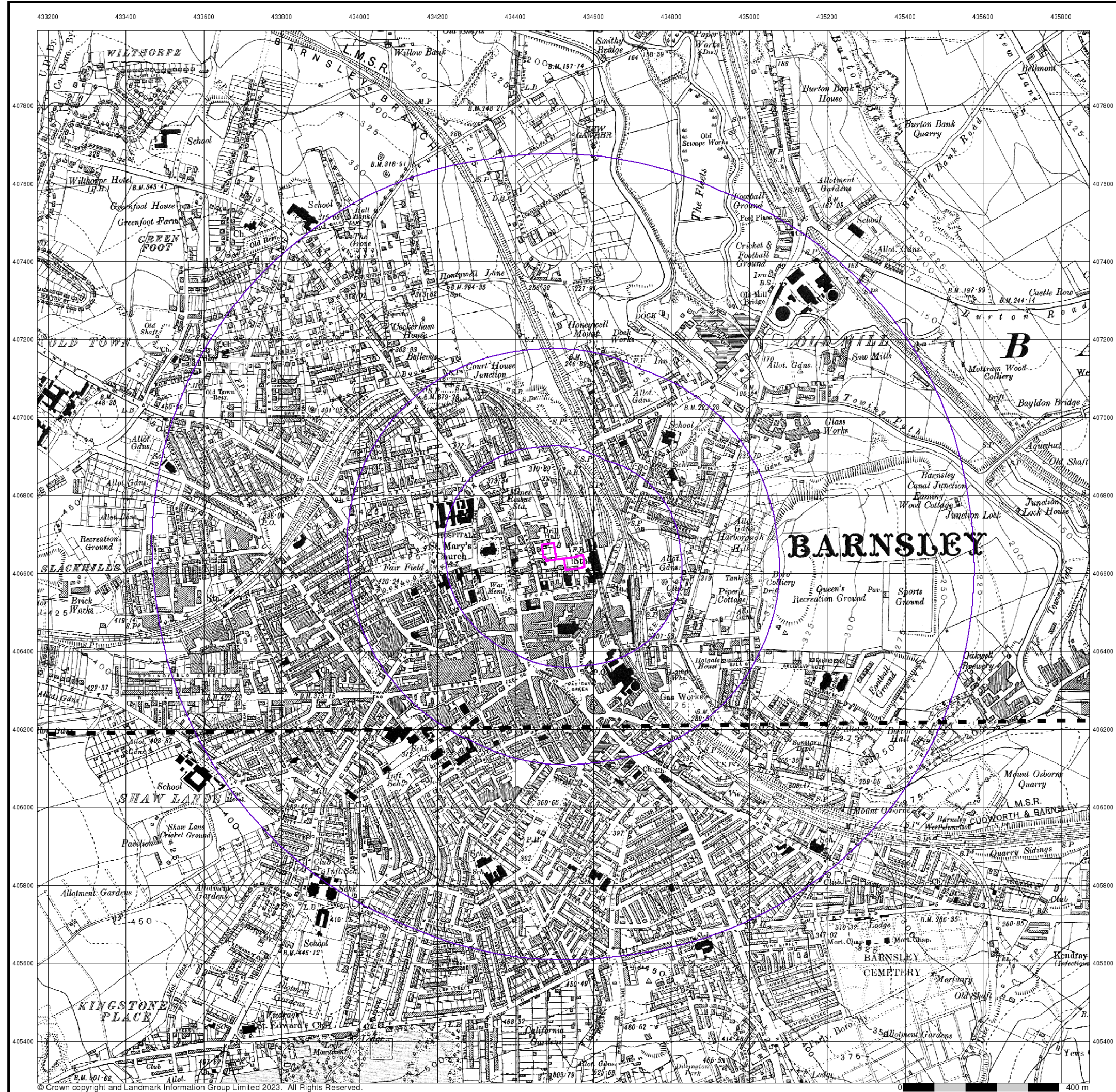
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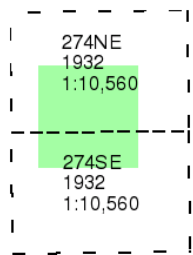
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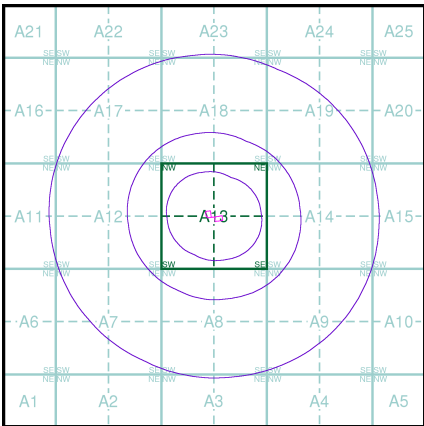
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Map Name(s) and Date(s)



Historical Map - Slice A



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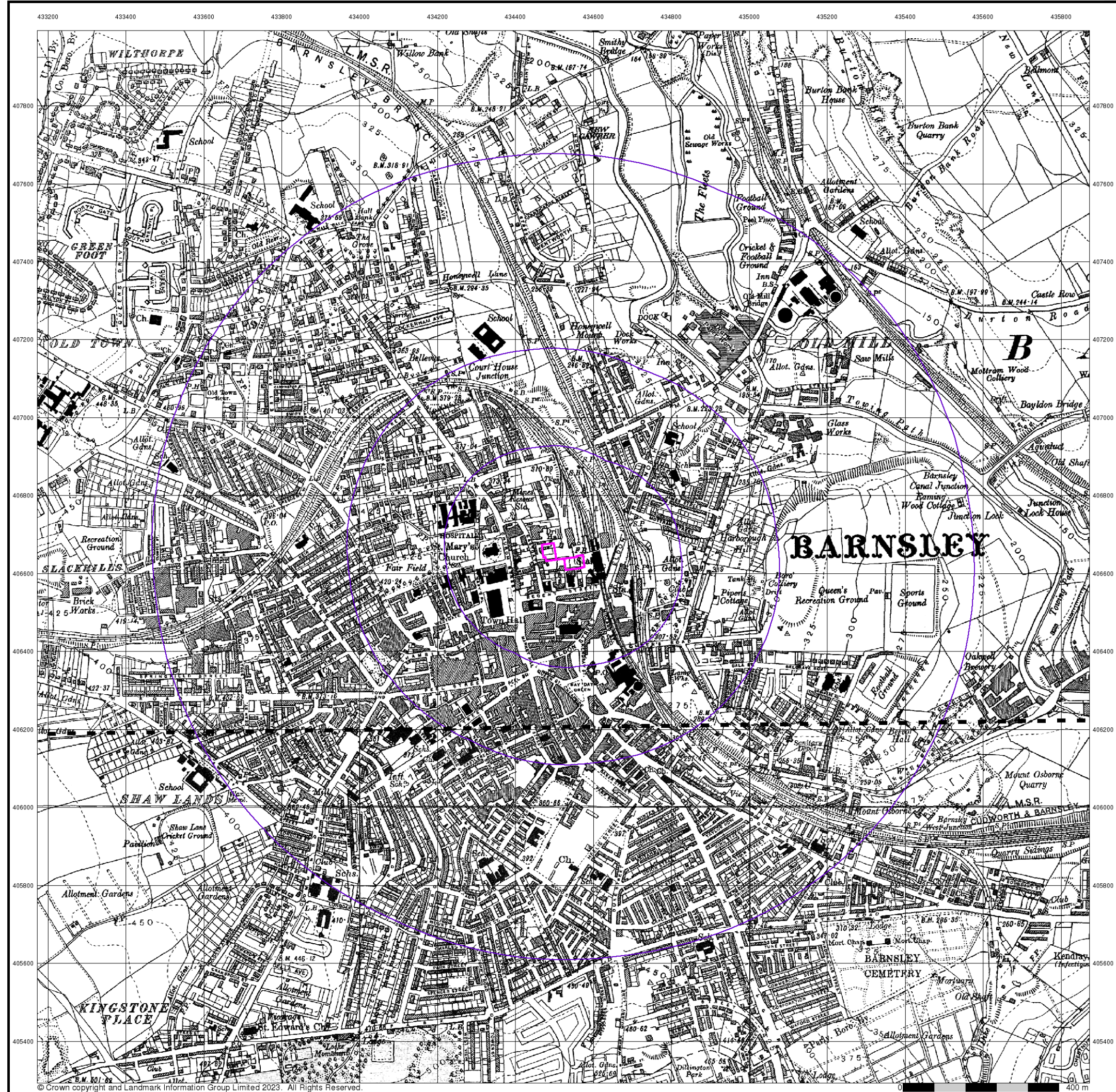
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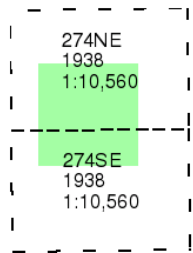
Yorkshire

Published 1938

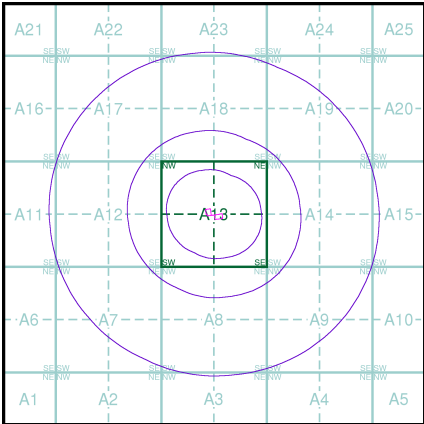
Source map scale - 1:10,560

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

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

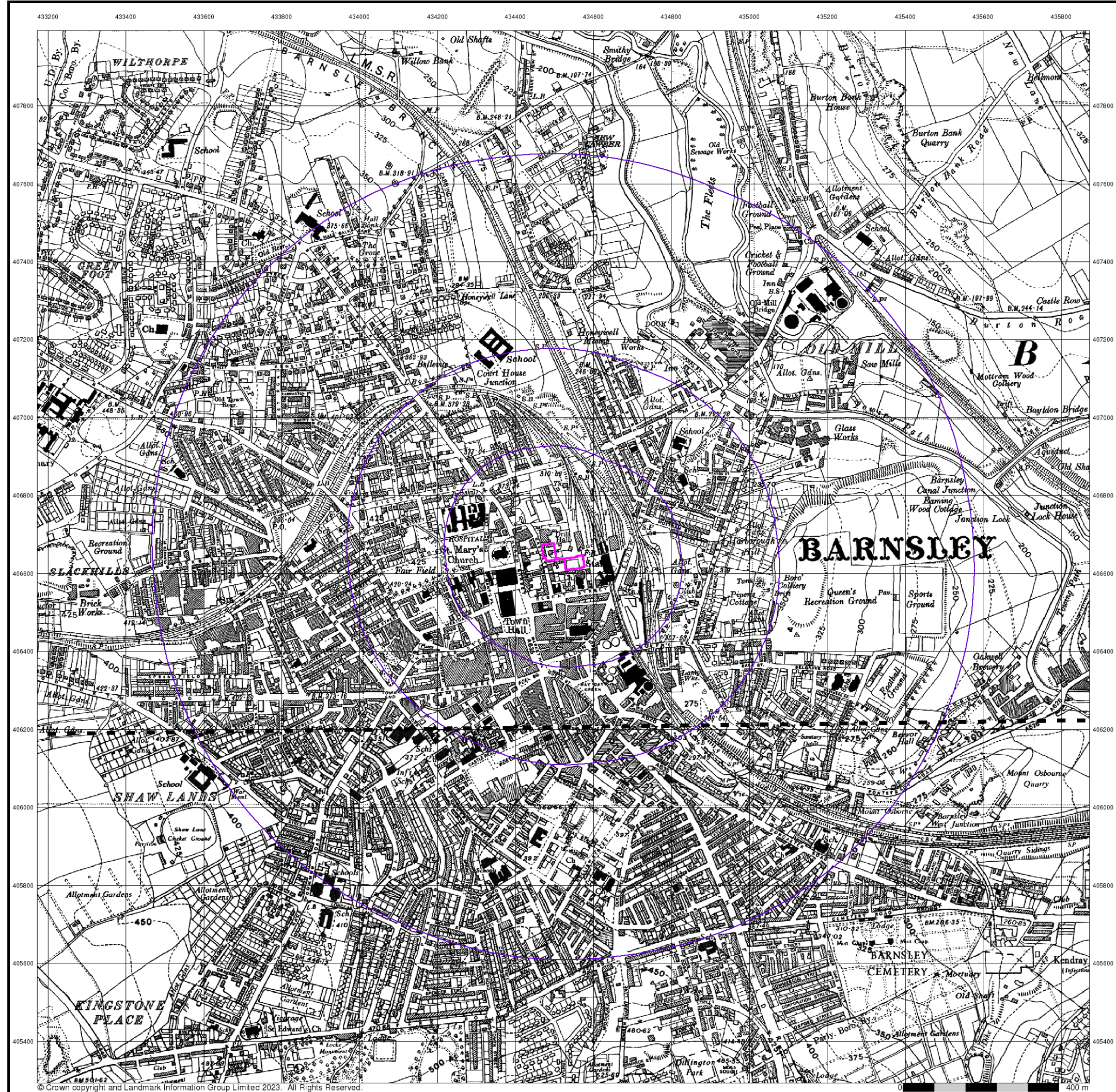
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Customer Ref: S230406
National Grid Reference: 434520, 406640
Slice: A
Site Area (Ha): 0.28
Search Buffer (m): 1000

Site Details

, Joint Secretariat, 18, Regent Street, Barnsley, S70 2HG



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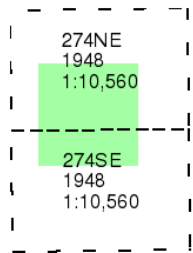
Yorkshire

Published 1948

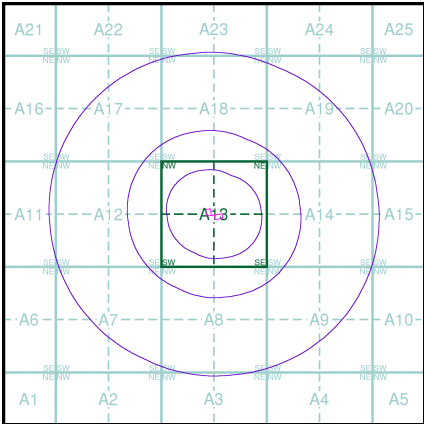
Source map scale - 1:10,560

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.

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