

**DESKTOP GEOTECHNICAL AND
GEO-ENVIRONMENTAL SITE INVESTIGATION**

**LAND SOUTH OF NEW SMITHY AVENUE
THURLSTONE**

FOR

MR P. MULLINS

ISSUE 3



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Envirocheck Report

Coal Authority Mining Report

EXECUTIVE SUMMARY

1. This report presents the findings of a desktop geotechnical and geo-environmental site investigation carried out by Eastwood & Partners (Consulting Engineers) Limited for, and on the instructions of, Mr P Mullins.
2. The site is located to the south of New Smithy Avenue in Thurlstone, near Penistone, South Yorkshire, centred on National Grid Reference 423190, 403510. It is proposed to develop the site with residential dwellings.
3. The site is currently an undeveloped field with trees and hedges bordering it, with a small separate garden area in the south east. The only development on the site in the past was a single building, possibly a barn or residential dwelling, in the east of the site. The surrounding area has been a combination of agricultural, residential and commercial/industrial uses. The commercial/industrial uses include quarries, mills, a blacking works and timber yard..
4. The geology at the site comprises the Grenoside Sandstone of the Pennine Lower Coal Measures. No superficial deposits are shown to be present. Significant amounts of made ground are not expected to be present.
5. The site is not considered to be at risk from shallow mining.
6. The site overlies a Secondary A Aquifer but is not within a groundwater source protection zone.
7. There are no landfill sites within 250 m of the site.
8. No radon precautions will be required at the site.
9. Strip or trench fill foundations taken through any made ground and onto the natural ground are expected to be appropriate for the proposed development. If clay is encountered and trees are located within influencing distance, the foundations will require deepening and construction in accordance with NHBC Standards Chapter 4.2.
10. Where less than 600 mm of made ground is present and the footing depth due to trees is less than 1.5 m, ground bearing slabs may be considered. Elsewhere, reinforced suspended slabs or precast concrete floors with a ventilated void should be used.
11. It is unlikely that any of contamination will be encountered. However, allowance should be made at this stage for installing a 600mm thick capping layer wherever made ground is

present. An intrusive investigation is recommended to confirm the extent of made ground that is present.

12. At this stage we recommend that Class 2 precautions are allowed for in below ground concrete as a minimum.
13. Testing has shown that soakaway drainage will be viable within the natural sandstone. The results of the testing will be included in our Phase 2 site investigation report which is currently underway.
14. Before more definite information regarding the properties of the ground and any contamination present can be given, an intrusive ground investigation will be required. A Phase 2 investigation has been undertaken, and the results will be reported on in due course.

1.0 INTRODUCTION

1.1 Terms of Reference

This report presents the findings of a Phase 1 geotechnical and geo-environmental site investigation carried out by Eastwood and Partners (Consulting Engineers) Limited for, and on the instructions of Mr P. Mullins. Any other parties using the information in this report do so at their own risk and any duty of care is excluded.

1.2 Context

Eastwood & Partners are not aware of any other site investigations which may have been undertaken on the site or on the surrounding land in the past.

1.3 Aims and Objectives

The aims and objectives of this investigation were as follows.

- To assimilate and review information extracted from published documentation to derive an outline conceptual model identifying potential contaminants, pathways and receptors, as well as possible linkages between these;
- To detail the expected ground conditions and their geotechnical properties enabling outline foundation proposals to be made for the proposed residential units;
- Carry out preliminary risk assessment to establish the likely risks to future receptors,
- Identify likely feasible remediation options if risks are highlighted; and
- To outline proposals for further Phase 2 intrusive investigation, if required, the purpose of which would be to obtain information to test the conceptual model and assess the risks to receptors as well as to confirm the foundation proposals.

1.4 Scope of Investigation

Information regarding the current and former land uses both on and surrounding the site, as well as the environmental sensitivity of the site location as determined by factors including geology, hydrogeology and hydrology have been examined.

Information analysed in this section of the report has been obtained from a variety of sources and included the following:

- Aerial and street view imagery of the site;
- A Landmark Envirocheck Report;
- Geological Maps and associated geological memoirs; and
- A Coal Authority Mining Report.

1.5 Limitations of Investigation

This report is based on the assumption that the site will be developed with residential dwellings which will be low rise, and of conventional construction with private gardens as well as communal areas of hard and soft landscaping. It is assumed that existing ground levels will not alter significantly. If this is not the case, then the advice given in this report may not be appropriate. We have not visited the site prior to the preparation of this report.

Where assessments of site areas affected in particular ways are given, these are approximate. All information, comments and opinions given in this report are based on the documentary information examined.

This report considers the ground and groundwater and does not cover any buildings or their fabric. Risks to ecological receptors, such as bats, have not been considered.

The conclusions made in this report in relation to contamination are subject to agreement by the approving bodies and any warranty provider, and may be subject to confirmation by intrusive investigation.

2.0 THE SITE

2.1 Site Description

The site has an area of approximately 0.9 hectares and is located to the south of New Smithy Avenue in Thurlstone, near Penistone, South Yorkshire. The site is approximately rectangular on plan, with its long axis being orientated east to west, and is centred on National Grid Reference 423190, 403510.

The site is currently an undeveloped, grassed field, with a small separate grassed garden area in the south eastern corner, separated from the main site by a dry stone wall. It slopes down to the south east at a gradient of around 1 in 28 with a reduction in level of around 10 m from the north west to the south eastern corners. Trees and hedges are present along the site boundaries.

The site is bordered by residential properties to the north, east and south and by open fields to the west.

2.2 History

Historical Ordnance Survey maps, obtained as part of the Envirocheck Report, have been reviewed to assess the previous use of the site and surrounding area. Copies of the maps are presented in Appendix 1.

2.2.1 The Site

The earliest map reviewed is the 1851 1:10,560 scale map. This shows the site to occupy part of three fields.

By 1931, a rectangular building, possibly a barn or cottage, is shown in the north eastern part of the site. This remains until circa 1969.

No changes are then observed on the historical maps. Aerial imagery of the site shows the field boundaries were removed at some point between 2003 and 2009 and the site became one large field.

2.2.2 The Surrounding Area

The earliest map reviewed, dated 1851, shows the surrounding area to be predominantly agricultural, with residential properties, forming the village of Thurlstone located to the east and south of the site. A sandstone quarry is labelled approximately 150 m west of the site, the River Don

is present around 100 m south of the site and beyond this a railway line is present, around 200 m south of the site. Two mills are noted along the River Don, both around 250 m from the site.

The outline of the quarry is shown more clearly on the subsequent map of 1893 where its eastern extent can be seen to be adjacent to the south west corner of the site. A Blacking Works is also shown around 100 m south of the site along a mill race. Further south an old quarry is labelled approximately 180 m from the site. This is not shown on any subsequent maps. A timber yard is present approximately 80 m south of the site, adjacent to the River Don on the following map, dated 1906.

By 1931 the development of the surrounding area increases. This is predominantly small pockets of residential development, with associate infrastructure. Another quarry is identified approximately 300 m south of the site. A tank is shown associated with the farm buildings located adjacent to the eastern boundary of the site from 1960.

Residential development then increases in the 1960s and the site becomes enclosed on three sides with residential properties by the 1980s. No significant changes are then observed on the historical maps.

2.3 Geology

The geological maps for the area, Sheet 273 SE (1:10,560 scale) indicates the strata beneath the site to comprise strata of the Pennine Lower Coal Measures. In particular, the Grenoside Sandstone is indicated directly below the site. The strata are indicated to dip gently towards the north east at a very shallow angle.

No alluvial or other superficial deposits are indicated to be present on the site.

No faults or other lines of weakness are shown to cross the site. A fault is conjectured around 100 m to the east, however.

2.4 Hydrogeology

2.4.1 Groundwater Vulnerability

Under the Environment Agency's aquifer designations, the solid geology below the site is classified as a Secondary A Aquifer. This is defined as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers which were formerly classified as minor aquifers.

2.4.2 Groundwater Abstractions

There are no groundwater abstractions within 500 m of the site.

Information within the Envirocheck Report also states that the site does not lie within a groundwater Source Protection Zone.

2.5 Hydrology

The Envirocheck Report records the nearest surface water feature to be located around 69 m south of the site. This is a disused mill race. The nearest major surface watercourse is the River Don located approximately 80 m south of the site at its nearest point.

2.6 Mining

According to the geological maps, the nearest seam of coal recorded to outcrop is the Grenoside Sandstone Coal, around 220 m north of the site. However, the coal is stratigraphically above the Grenoside Sandstone, and therefore this seam will not be present below the site.

The shallowest coal anticipated to be present is the Upper Band Coal, which is expected at around 65 m below ground level. This seam is generally recorded as being thin and no records of workings are provided in the geological memoirs. Therefore, a significant risk is not considered to be presented to the proposed development.

A Coal Authority mining report has been obtained for the site, and this states that the site is not within a surface area that could be affected by past or present underground coal mining. No seams of coal are expected to be present at shallow depth.

The site is also not within an area where the Coal Authority is determining whether or not to grant a license to extract coal. However, reserves of coal exist in the local area which could be worked at some time in the future subject to planning consents. We consider this unlikely given the demise of the UK coal mining industry.

There are no mine shafts shown on or within 20 m of the site and there are no records of any past opencast workings having been undertaken on the site.

In conclusion, the site is not at risk from the effects of past mining activities.

2.7 Ground Gas

The Envirocheck report does not list any active or historical landfill sites within 250 m of the site.

The former quarry to west of the site is not recorded as a landfill site. The quarry does not appear to have been backfilled, as its outline can still be seen on modern mapping and imagery. Therefore this feature is not considered to pose a risk of ground gas generation or migration.

There are two other areas of potentially infilled land within 250 m of the site. Both are identified on the 1989 historical map. The first is 171 m south of the site and is believed to refer to a cutting in the now dismantled railway. As the cutting is still present on the most recent mapping (dated 2016) this is not believed to have been backfilled and thus does not pose a risk of gas migration onto the site. The second is 194 m west of the site and is believed to refer to a former quarry which was noted on the early historical maps. This was labelled as old by 1894, and was not shown after this time. Although this quarry is likely to have been backfilled, it is unlikely that biodegradable wastes were used within the fill at that time, and due to the age of the fill, any ongoing gas generation is likely to have subsided by now. At over 190 m from the site, the risk of gases migrating onto the development site is considered to be negligible.

The site is therefore not considered to be at risk from landfill gas migration.

Information contained within the Envirocheck Report also states that radon precautions will not be required for properties constructed at the site.

2.8 Pollution Incidents to Controlled Waters

The Envirocheck Report lists four pollution incidents within 250 m of the site. These are summarised in the table below:

Distance from site	Direction	Date	Pollutant	Receiving water	Category
96 m	SE	08/11/1992	Unknown	Stream/river	3 (minor)
155 m	SE	05/02/1996	Not Given	Stream/river	3 (minor)
159 m	SE	05/02/1996	Unknown	Stream/river	3 (minor)
182 m	S	21/09/1996	Sewage	Stream/river	2 (significant)

These are not expected to have significantly affected the ground/groundwater below the site.

2.9 Discharge Consents

The Envirocheck Report records two active discharge consents within 250 m of the site. These are located 196 m and 200 m south of the site and both are operated by Yorkshire Water for the discharge of sewage storm effluent to the River Don. These are not expected to affect the site.

2.10 Flooding

Information provided in the Envirocheck Report shows that the site does not lie within an indicative flood plain. A Zone 2 flood plain is located around 76 m south of the site, and a Zone 3 flood plain is around 78 m south. These both relate to the River Don.

2.11 Soil Geochemistry

The soil geochemistry maps included in the Envirocheck estimate the following concentrations of arsenic, cadmium, chromium, nickel and lead to be present in the natural soil at the site:

Contaminant	Estimated Concentration (mg/kg)	Assessment Value (mg/kg)
Arsenic	15-25	37
Cadmium	<1.8	11
Chromium	60-90	910
Lead	<150	200
Nickel	15-30	180

Concentrations of these contaminants are not therefore expected to be elevated within the natural ground.

3.0 EXPECTED GROUND CONDITIONS

On the basis of information presented on the historical Ordnance Survey Maps and geological and hydrogeological maps, it is anticipated that the natural ground at the site will comprise sandstone which is likely to have weathered to sand or clayey sand near to the surface. This is likely to be overlain by a layer of topsoil.

The only development on the site in the past was a single building, possibly a barn or farm cottage, in the east of the site. There may therefore be made ground present in the area around the former building, arising from its demolition. This is not anticipated to have spread over a large area of the site and is not expected to be of significant thickness, unless cellars are present.

The River Don is relatively close to the site. However, the river level is significantly lower than that of the site, and therefore there is not likely to be a continuity in the ground water level between the river and the strata beneath the site. Shallow groundwater is therefore not expected to be encountered.

4.0 GEOTECHNICAL APPRAISAL

4.1 General

The natural ground beneath the site is likely to comprise sand or clayey sand over sandstone. Made ground may be present overlying this in the eastern area of the site.

4.2 Foundations

It is anticipated that strip or trenchfill foundations taken through any made ground onto the underlying natural ground will be appropriate at a likely minimum depth of 750 mm below current or proposed ground level, whichever is the lower.

As the ground is expected to be granular over the majority of the site, deepening of the foundations due to the presence of trees should not be required in most cases. If clay is encountered however, and foundations are within this material, deepening and construction in accordance with NHBC Standards Chapter 4.2 will be necessary.

4.3 Ground Slabs

Where less than 600 mm of made ground is present, ground bearing slabs can be considered. Elsewhere, reinforced suspended slabs or precast concrete floors with a minimum 150 mm high ventilated void should be used.

If the footings require heave precautions due to trees, a precast concrete floor with a ventilated void will be required. The void height is dependent on the volume change potential of the clay. However, it is considered unlikely at this stage that cohesive soils will be encountered on the site.

4.4 Superstructure Precautions

It is not anticipated that any superstructure precautions will be required in the proposed buildings due to the ground conditions.

4.5 Roadworks

At this stage we anticipate that CBR values of at least 2% should be achieved, however due to the uncertainty of the strength and composition of any made ground a low CBR value should be assumed at this early stage. CBR testing should be allowed for along roadways prior to construction so that an accurate value can be obtained.

4.6 Problems Due To Past Development

As a building was located on the site previously, it is possible that the foundations remain in the ground. If this is the case these will need to be grubbed up and removed prior to development.

4.7 Excavation Problems

The stability of trenches at the site is unknown. Where excavations which workers are required to enter are over 1.2 m deep, or less where there is a risk of harm from collapse of the sides of the excavation, the sides should be supported or battered back to make them safe.

4.8 Surface Water Drainage

Soakaway drainage will be suitable for surface water dispersal. The results of infiltration testing which has been undertaken on the site will be reported on within our pending Phase 2 Site Investigation report.

4.9 Sulphate Attack of Buried Concrete

At this stage, it should be assumed that a Design Sulphate Class of DS-2 is required. This would necessitate the use of FND-2 or equivalent concrete for below ground structures at the site. Chemical testing may allow this classification to be downgraded.

5.0 CONTAMINATION APPRAISAL

5.1 Outline Conceptual Model

The development proposals for the site include outline permission for 21 residential properties with associated gardens and car parking. This is therefore a sensitive end use with respect to human health.

The site is currently an undeveloped field. Historical maps show the only development on the site was a single building, possibly a barn or cottage, in the east of the site.

The surrounding area has been a combination of agricultural, residential and commercial/industrial uses throughout its history. The commercial/industrial uses include quarries, mills, a blacking works and a timber yard. However, these were mostly downslope of the site, and therefore contamination is unlikely to have migrated onto the site.

The ground below the site is likely to be relatively permeable due to the presence of sandstone. However, the groundwater table is unlikely to be significantly shallow. The site overlies a Secondary A Aquifer, and does not lie within 500 m of a groundwater source protection zone.

The past uses of the site and surrounding area are not expected to have caused significant contamination at the site. However it is not uncommon to find slightly elevated levels of polycyclic aromatic hydrocarbons in near surface soils due to atmospheric fallout. In addition, elevated concentrations of heavy metals/metalloids or polycyclic aromatic hydrocarbons are also commonly associated with made ground, which is expected to be present over at least part of the site where the previous building was located.

Asbestos containing materials are often used in agricultural buildings, and therefore there is the potential that such materials will be present in any made ground associated with the demolition of the previous structure.

The natural ground is not expected to contain elevated levels of contamination.

No landfill sites were recorded within 250 m of the site and a significant risk of ground gas migration from the surrounding area is not expected. No radon precautions are required for properties constructed at this site.

5.2 Possible Pollutant Linkages

Contaminant	Pathways	Receptor
- Heavy metals/metalloids and PAHs in any made ground. - PAHs in near surface soils/Topsoil	- Ingestion, inhalation and dermal contact - Direct contact - Migration - Root uptake	- Future Residents and visitors to the site. - Groundworkers - Plants and vegetation - Groundwater aquifer
	Leaching and migration	Secondary A Aquifer and River Don
Asbestos containing materials within soils or demolition rubble	Inhalation of fibres	- Future Residents and visitors to the site. - Groundworkers
Sulphates within made ground or the natural ground.	Direct contact.	Below ground concrete.

5.3 Remediation

Significant contamination is not expected to be encountered across the majority of the site. At this stage it is considered that you make the following remedial allowances:

- A 600 mm thick capping layer wherever made ground is present. This may affect only a small areas in the north east of the site, where the former building was located, but this will be confirmed by an intrusive investigation. Chemical testing may allow the capping thickness to be downgraded, or omitted. Alternatively, it may be viable to remove the made ground where it is only of limited thickness/extent.
- Sulphate precautions in below ground concrete and protective water supply pipes in areas of made ground. At this stage we recommend that Class 2 precautions are allowed for as a minimum. Chemical testing of soil samples may allow this to be downgraded. However, higher resistance concrete may also be required.
- At this stage it is expected that the existing topsoil can be reused within gardens and areas of soft landscaping. This will be subject to testing of the materials, however.

6.0 RATIONALE FOR FURTHER INVESTIGATION

Before more definite information regarding the properties of the ground and any contamination present can be given, an intrusive ground investigation will be required. A trial pit investigation, involving the excavation of pits using a mechanical excavator will be the most suitable method as it provides the best method of inspecting shallow soils.

The use of trial pits to investigate the site will also allow the undertaking of infiltration tests, to determine the suitability of the ground for soakaway drainage.

The potential pollutant linkages presented in the Outline Conceptual Model will need to be investigated by means of soil analysis. The chemical testing suite should be chosen to cover the range of potential contaminants indicated above. If any elevated levels of contamination are identified the risks to receptors would need to be assessed and remediation considered. Geotechnical testing should be carried out where clay soils are encountered to determine their volume change potential.

Any recommendations made within this Phase 1 report should be treated as preliminary at this stage, pending confirmation by intrusive investigation. Our recommendations are also subject to approval by the regulators.

APPENDIX

Envirocheck Report
Coal Authority Report

273 15
1983
1,2,500

[illegible]

Order Number: 103468689_1_1
Customer Ref: 40630
National Grid Reference: 423190, 403510
Slice: A
Site Area (Ha): 0.95
Search Buffer (m): 100

11 New Smithy Avenue, Thurlstone, SHEFFIELD, S36 9QZ

273 15
1908
1.2, 500

The figure shows a 5x5 grid of nodes labeled A1 through A25. The nodes are arranged in rows and columns. The central node is A12. A thick black square highlights the central node A12. A purple oval also highlights the central node A12. A dashed line connects A12 to A18, and another dashed line connects A12 to A15.

Order Details

Order Number:	103468689_1_1
Customer Ref:	40630
National Grid Reference:	423190, 403510
Slice:	A
Site Area (Ha):	0.95
Search Buffer (m):	100

SITE DETAILS
11 New Smithy Avenue, Thurlstone, SHEFFIELD, S36 9QZ

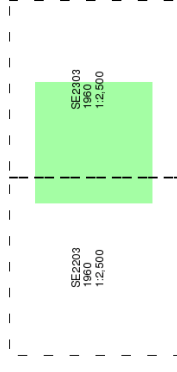
Ordnance Survey Plan

Published 1960

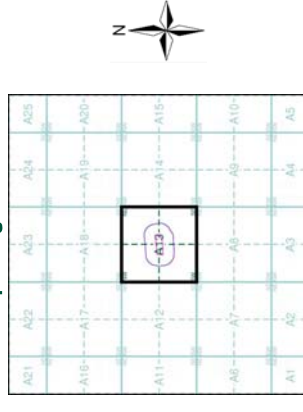
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840s. In 1864 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of Great Britain. The maps were compiled to be the definitive plan of the land. The maps were compiled from the original OS maps and the 1938 edition of the 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

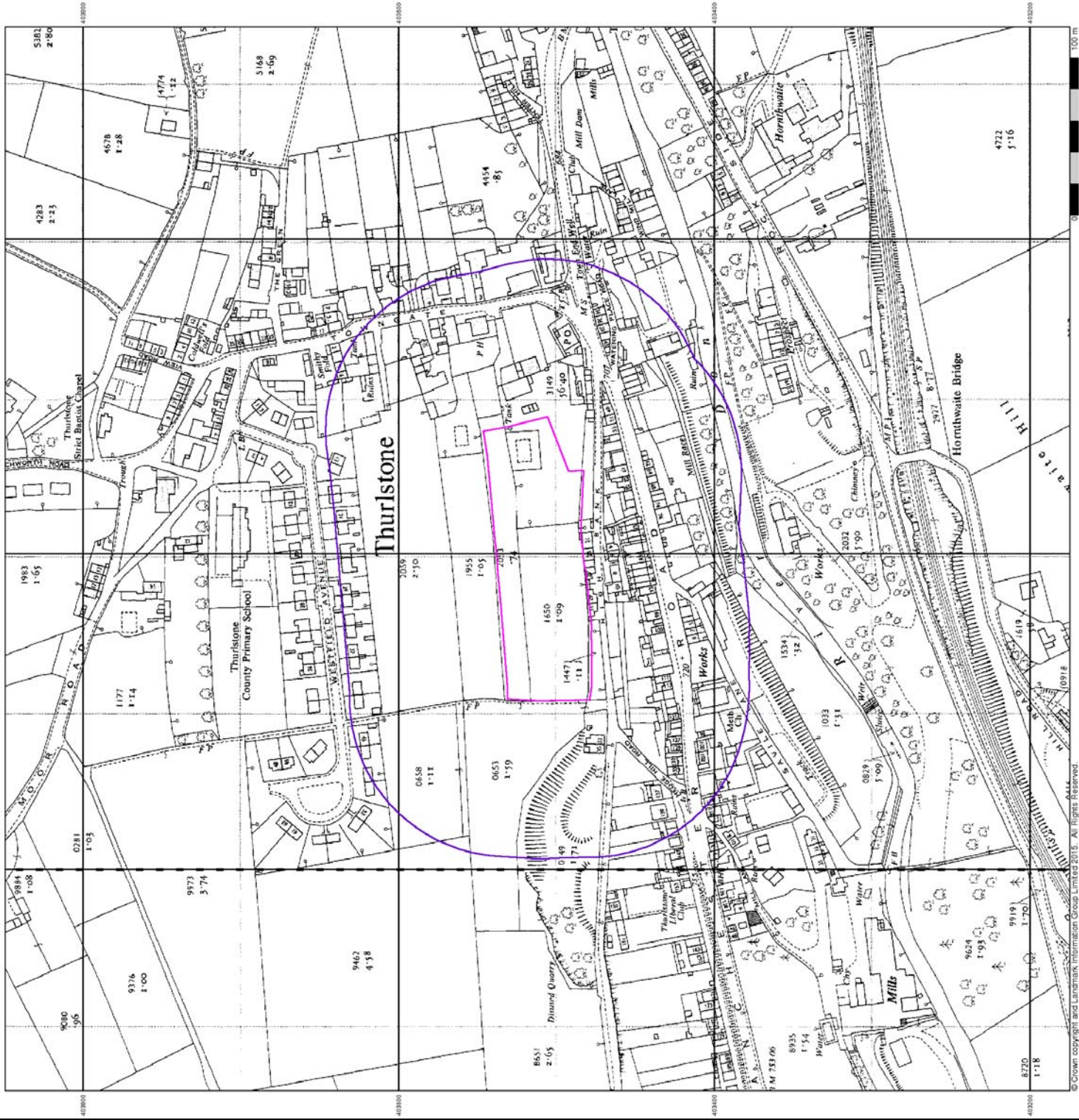


Order Details

Order Number: 103468689_1.1
Customer Ref: 40630
National Grid Reference: 423190, 403510
Slice: A
Site Area (Ha): 0.95
Search Buffer (m): 100

Site Details

11 New Smithy Avenue, Thurlstone, SHEFFIELD, S36 9QZ



A 10x10 grid with columns labeled A1 to A10 and rows labeled 1 to 10. A 3x3 square is highlighted in the center, with its center cell A3,3 circled in red.

Order Number: 103468689_1_1
Customer Ref: 40630
National Grid Reference: 423190, 403510
Slice: A
Site Area (Ha): 0.95
Search Buffer (m): 100

11 New Smithy Avenue, Thurlstone, SHEFFIELD, S36 9QZ

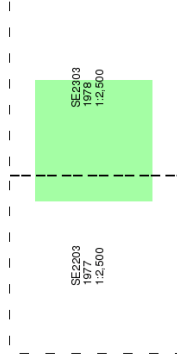
Additional SIMs

Published 1977 - 1978

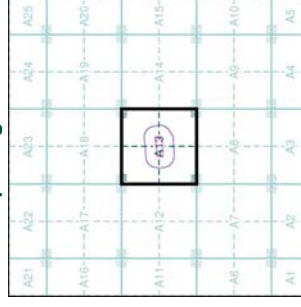
Source map scale - 1:2,500

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

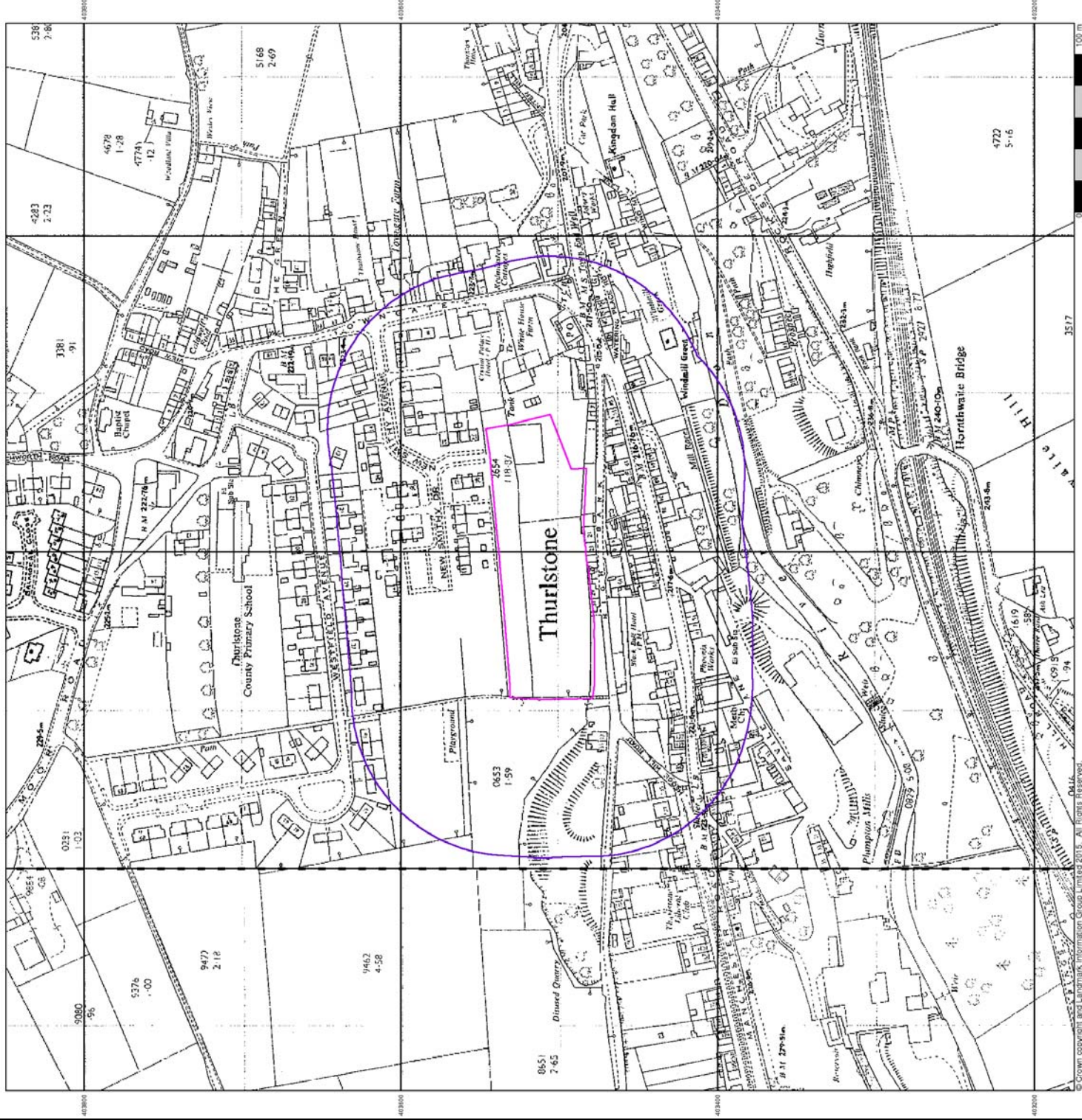


Order Details

Order Number: 103468689_1_1
 Customer Ref: 40630
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 Slice: A
 Site Area (Ha): 0.95
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Site Details

11 New Smyth Avenue, Thurlstone, SHEFFIELD, S36 9QZ



Additional SIMs

Published 1988

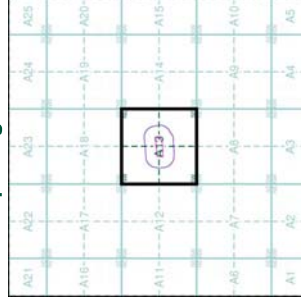
Source map scale - 1:2,500

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 1:12,500 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number: 103468689_1_1
 Customer Ref: 40630
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 Site Area (Ha): 0.95
 Search Buffer (m): 100

Site Details

11 New Smyth Avenue, Thurlstone, SHEFFIELD, S36 9QZ



Figure 1 shows a 2D coordinate system with a dashed horizontal line at $y=0$ and a dashed vertical line at $x=0$. A green shaded rectangular region is located in the upper-right quadrant. The region is labeled with "SE2203" and "12,500" in the top-left corner, and "SE2203" and "12,500" in the bottom-right corner.

A 10x10 grid with columns labeled A1 to A10 and rows labeled 1 to 10. Cell A3 is highlighted with a thick black border and a pink oval.

Site Details
11 New Smithy Avenue, Thurlstone, SHEFFIELD, S36 9QZ

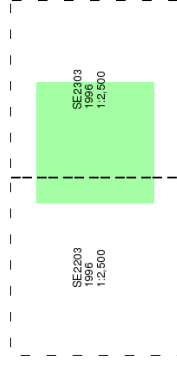
Large-Scale National Grid Data

Published 1996

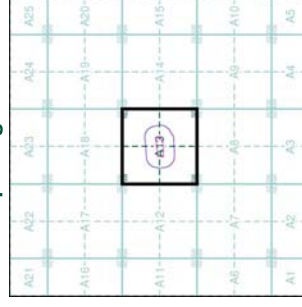
Source map scale - 1:2,500

Large Scale National Grid Data superseded SIM cards (Ordnance Survey's Survey of Information on Microfilm) in 1992, and continued to be produced until 1996. These maps were the forerunners of original mapping and so provide detailed information on houses and roads, but tend to show less detail than modern maps, 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: 103468689_1_1
Customer Ref: 40630
National Grid Reference: 423190, 403510
Slice: A
Site Area (Ha): 0.95
Search Buffer (m): 100

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11 New Smyth Avenue, Thurlstone, SHEFFIELD, S36 9QZ

