

Eccleston Homes

**Desk Study
&
Ground Investigation Report**

for

Mondi Site, Ramsbottom

August 2019

REPORT NO: 19ECH016/DSGI

- *Desk Studies and Site Walkovers*
- *Intrusive Contaminated Land Investigations*
- *Geotechnical Appraisals and Ground Investigations*
- *Landfill Gas Assessments and Remedial Design*
- *Remediation Design and Implementation*
- *Remediation Project Management and Supervision*
- *Site Abnormal Assessments (Foundations and Contaminated Land)*

GEOTECHNICAL - CONTAMINATED LAND- FLOOD RISK

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DOCUMENT ISSUE RECORD

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- (i) Conceptual Model

APPENDIX J

- (i) Notes on Ground Gas

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- (i) Notes on Limitations

1 EXECUTIVE SUMMARY

Note – The following summary is not exhaustive and is to be used for guidance purposes only. The full report should be consulted for full details.

1. Site Location

The site is located to the south of Bridge Street and north of Ramsbottom Cricket Club in Ramsbottom. The site has an approximate postcode of BL0 9AL, with coordinates on the British National Grid of 379433,416756. The proposed site is approximately 4.61 hectares in total.

2. Site Description

On Site

The site is currently an unused parcel of land with several derelict structures in the west. The structures comprise two very dilapidated buildings and a large chimney.

The site is predominantly flat and almost entirely covered in hardstanding formed by concrete slabs, with several large and small stockpiles located throughout the site area. Large areas of the centre of the site area heavily vegetated. A full waste container was also noted in the south adjacent to the Cricket Club. A culverted stream / race was noted in the western site area.

A leaking IBC was noted adjacent to the entrance off the lane leading to the sports clubs. The leaking substance was found to be brown and 'rubbery' in nature but was no longer migrating.

There are two 'mounded' areas of soft standing in southern spur with trees on their eastern boundary.

Surrounding Area

The River Irwell is located on the eastern boundary. The remaining area is mixed commercial and residential.

3. Proposed Development

The proposed construction of residential dwellings with associated infrastructure, gardens and public open space.

4. Site History

On Site

The earliest available map of site is the 1850-1851 1:10,560 map with shows the site to be largely undeveloped land with reservoirs in the west and southwest.

The site is first developed in 1891 and a paper mill is shown to occupy the majority of the site, reservoirs are still present in the southern spur area.

By 2014 the majority of the former mill has been destroyed and the reservoirs have now been removed.

Surrounding Area

Initially, much of the land was industrial which was slowly replaced with commercial and residential properties.

5. Published Geology

The BGS map shows the geology beneath the site as the following:

- **Artificial Ground** – Covers entirety of site
- **Superficial** – Alluvium – Clay, Sand and Silt
- **Bedrock** – Millstone Grit Group – Mudstone and Siltstone
 - Hazel Greave Grit – Sandstone

Radon

The Groundsure data states that the site is within a low probability radon area (<1% of properties above the action level), therefore no radon protection measures are required in the construction of new dwellings.

6. Hydrogeology and Hydrology

- The superficial deposits of the Alluvium are designated as Secondary A Aquifer (Moderate Permeability).
- The bedrock deposits of the Sandstone are designated as Secondary A aquifer (Moderate Permeability).
- The site does not lie within Groundwater Source Protection as defined by the Environment Agency.
- There are no potable water abstractions within 500m of site.
- Two groundwater abstractions located onsite, on the western boundary.
- There are two (7 no.) recorded surface water features on site and seven (9 no.) within 250m.
- Flooding – Zones 2 and 3 noted as onsite. Risk is noted as Very Low to High (RoFRaS).

7. Summary of Environmental Data

Possible Contamination Sources and risk levels are shown below;

- **Current Land Use On Site** – Possible – Localised
- **Historical Land Use On Site** – Yes
- **Surroundings Industrial Processes (Historic and Current)** – Possible

In this qualitative risk assessment, a **Low / Moderate - Moderate** risk for ground gas and contamination exists across the site. Some remedial action may be necessary at the site, however, the likes of which cannot be confirmed until the geotechnical and contamination ground investigation has been completed.

8. Scope of Investigation

The fieldwork was carried out between the 25th June – 2nd July 2019 and included the following:

- Eighteen (18 no.) machine excavated trial holes to between 0.60mbgl (TP16) and 3.50mbgl (TP10).
- Eleven (11no.) window sample boreholes to depths between 0.35mbgl (WS18) and 5.00mbgl.
 - o A further three (no.) locations were attempted but the concrete slabs were too robust to be cored.
- Four (4no.) rotary boreholes drilled to depths between 30mbgl (RO1) and 38mbgl (RO4).
- Six (6no.) ground gas monitoring visits over a period of at least three months with varying barometric pressures.
- Chemical analysis of forty-seven (47no.) samples.
- Analysis of forty-seven (47no.) samples for asbestos screening, with fifteen (15no.) samples for quantification.
- Analysis of three (3no.) water samples taken from WS1, WS8 and WS16.
- Analysis of four (4no.) surface water samples from the River Irwell and the onsite culverted stream.
- Collection and analysis of three (3no.) soil samples for geotechnical analysis.

9. Ground Conditions Encountered

Ground conditions typically consisted of a CONCRETE slab with reinforcement and a damp-proof course over either a very sandy GRAVEL or LIMESTONE or SANDSTONE, overlying a further CONCRETE slab and subbase. Some locations exhibited areas of possible reworked SAND and / or SILT.

The main site area was almost entirely covered by concrete slabs, and a number of locations showed secondary slabs at depth. Natural strata consisted of both granular and cohesive strata, as well as shale bedrock at depth.

Olfactory and Visual Contamination

Significant visual and olfactory contamination was identified in a number of locations, as well as significant depths of Made Ground.

Obstructions

Concrete slabs were noted at surface and also at depth, some of these slabs were recorded in excess of 600mm thick. A number of the slabs could not be cored and could not be broken out using a 13tonne machine, it is thought that these may be machine bases from the former paper mill.

The large hard slabs were noted around TP11, TP18, WS4, WS5 and WS19. It is likely that more of these slabs will be present at the site.

Groundwater Fieldwork

Groundwater was observed between 0.60 and 3.00mbgl during the site works.

10. Specialist Ground Gas Measures

The site can be classed as Amber 1 / CS2. The site will require low level gas protection measures to be installed. This would usually consist of a 150mm passively vented subfloor void and a taped and sealed gas resistant membrane.

A number of volatile odours and VOCs/SVOCs were noted within the Made Ground during the site investigation however were not substantiated in testing. As a result, a hydrocarbon vapour resistant membrane may be required across the site to mitigate nuisance risk

11. Contamination Assessment and Remedial Actions

A number of exceedances have been observed across the site within Made Ground strata, these are associated with various PAHs, TPH C16-C21, Lead, Arsenic and asbestos. PAHs include the SVOC, Naphthalene. Further to these, a number of VOCs / SVOCs have also been observed above detection limits.

A minimum thickness of 600mm of debris-free soil is required within garden areas and landscaped areas as a capping system to mitigate residual risk to site end users from the asbestos and remaining determinants. It is also anticipated that the secondary slabs will be containing further contamination not observed during the investigation due to plant access limitations within the exclusion zone. The capping is to be made up of imported topsoil and subsoil.

Several areas of hydrocarbon / volatile odours were noted across the site during investigation; however, these were not substantiated in testing. As a result, a hydrocarbon vapour resistant membrane may be required across the site to mitigate nuisance risk – this is to be reviewed following the site strip.

Groundwater and Aquifer Risk

Potential risks to groundwater and aquifers are anticipated given the ground investigation findings and soil analysis results.

12. Off-Site Disposal of Surplus Soil

If there is the need to remove soil / made ground off-site it is recommended that the results of the contamination testing (and possibly further testing) will be assessed by a suitably qualified person. The chemical laboratory data has been screened using the online Hazwaste™ software and the laboratory test results indicate that, generally, the materials onsite would be classified as Non-hazardous.

However, several samples across the site have been shown to be hazardous.

13. Foundations

Due to depths of Made Ground and saturated SILTS being identified at depth, the variable nature of the Made Ground, and the potential for secondary slabs and deep obstructions, a piled solution is advised. Given the generally granular nature of Made Ground and the both cohesive and granular nature of natural soils on site, a driven piled solution should be taken to the appropriate strata. Suitable strata applicable to piling is thought to be at least 20mbegl.

14. Concrete Design

Given the levels of 2:1 water soluble sulphate identified in the vicinity of TP1, TP3 and TP5, a design class of DS-2, an ACEC class of AC-2 and a designated concrete class of DC2 is recommended in this area.

The remainder of the site can be recommended for a design class of DS-1, an ACEC class of AC-1 and a designated concrete class of DC-1.

15. Heave / Shrinkage Potential

Significant shallow cohesive strata were not observed at the site, testing may be undertaken once site levels are confirmed and an assessment of the depth to cohesive strata can be made.

16. Ground Floor Construction

Suspended floor construction e.g. either in situ RC slabs or block and beam flooring is recommended as per NHBC guidance.

17. Control of Groundwater

Limited shallow groundwater was encountered on site however perched groundwater was encountered in several locations. It is likely that provision of pumping / shuttering will be necessary during excavation of foundation trenches during wet weather and to deeper excavations for sewers etc. It is good practice to have such equipment on standby in case of seasonal / abnormal weather conditions.

Should sewers/excavations deeper than the boreholes/trial pits undertaken be required, further SI will be needed.

18. Highway

According to the criteria of Highways Agency HD 25/95 Volume 7 Section 2 Part 2 HD 25/94, a CBR value of circa 3% on the Made Ground is anticipated, however confirming in-situ CBR's should be undertaken once final formation levels are available. Placement of geotextiles within the areas of roads / parking could also be designed to minimise the subgrade thickness.

2 SITE DESCRIPTION

2.1 Introduction

This investigation was carried out on the instruction of Eccleston Homes. The purpose of the work was to carry out a Desk Study and Ground Investigation to provide geotechnical and contamination risk information for the proposed construction of residential dwellings with associated infrastructure, gardens and public open space. The area to the east of the River Irwell is no longer be considered and will not be discussed in this report.

At the time of writing this report, a draft only layout was available. The layout is plan can be seen below;



2.2 Site Location

The site is located to the south of Bridge Street and north of Ramsbottom Cricket Club in Ramsbottom. The site has an approximate postcode of BL0 9AL, with coordinates on the British National Grid of 379433,416756. The proposed site is approximately 4.61 hectares in total. See Site Location Plan in Appendix A.

2.3 Site Description

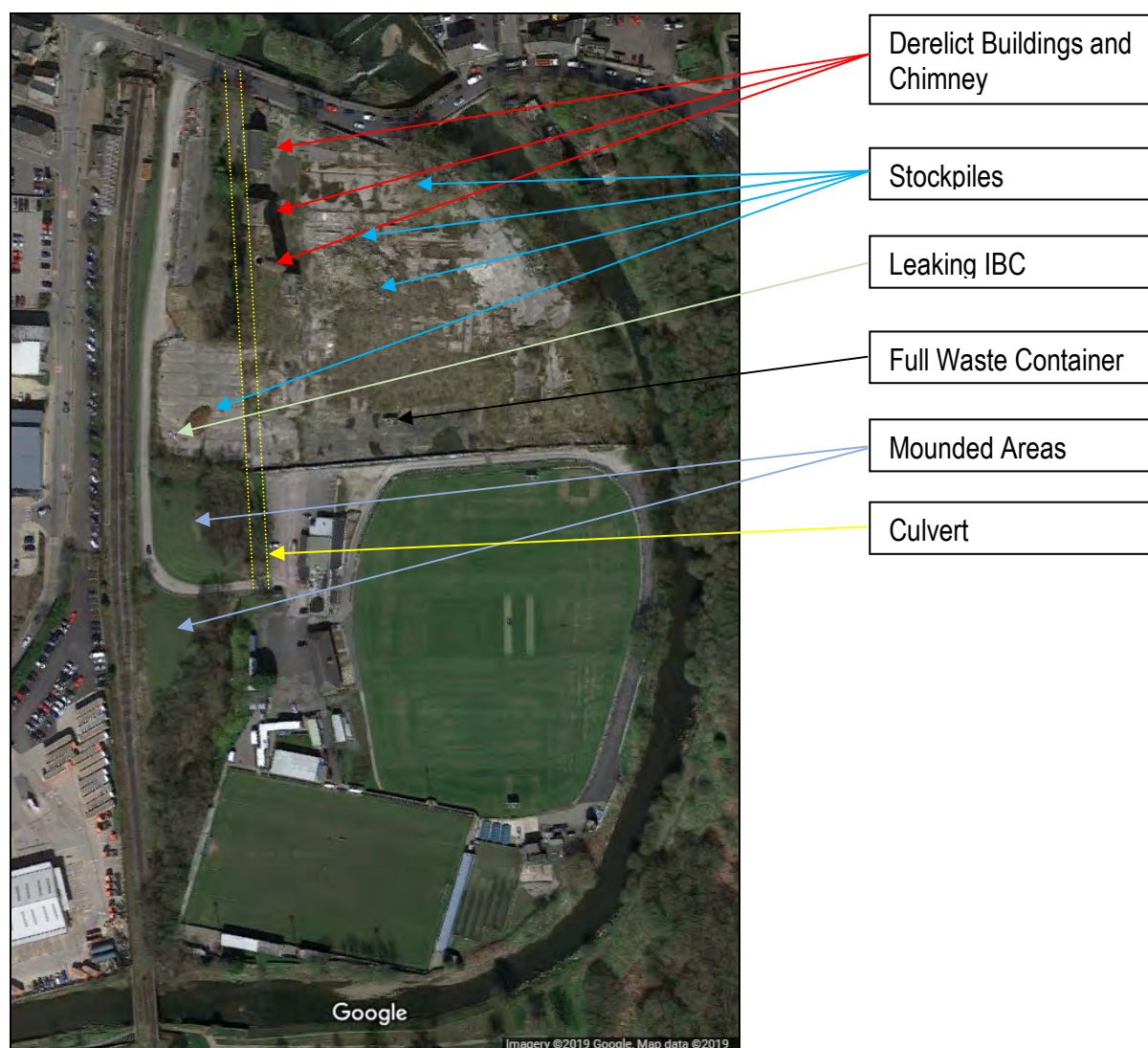
2.3.1 On Site

The site is currently an unused parcel of land with several derelict structures in the west. The structures comprise two very dilapidated buildings and a large chimney.

The site is predominantly flat and almost entirely covered in hardstanding formed by concrete slabs, with several large and small stockpiles located throughout the site area. Large areas of the centre of the site area heavily vegetated. A full waste container was also noted in the south adjacent to the Cricket Club. A culverted stream / race was noted in the western site area.

A leaking IBC was noted adjacent to the entrance off the lane leading to the sports clubs. The leaking substance was found to be brown and 'rubbery' in nature but was no longer migrating.

There are two 'mounded' areas of soft standing in southern spur with trees on their eastern boundary.



2.3.2 Surrounding Area

Surrounding land uses for the site are as follows:

- **North** – Bridge Street, the River Irwell and industrial / commercial buildings beyond.
- **East** – The River Irwell with a wooded area and residential beyond.
- **South** – Sports clubs with the River Irwell beyond.
- **West** – Railway line with Ramsbottom town beyond, mixed residential and commercial properites.

3 SITE HISTORY

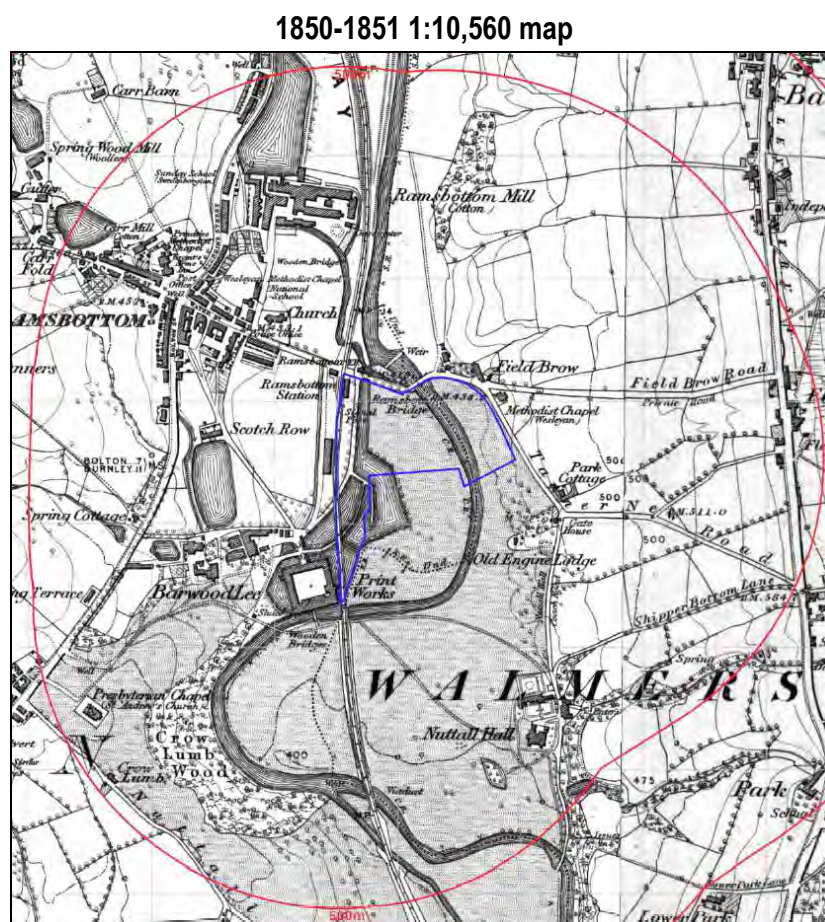
3.1 Site History from Ordnance Survey Maps

A search of available historic maps was undertaken to establish the land use history of the site. Extracts of the maps discussed below and can be found in full in Appendix F of this report. All maps are Ordnance Survey unless otherwise stated. All distances quoted on OS maps are taken from the site boundary, which is marked on the map.

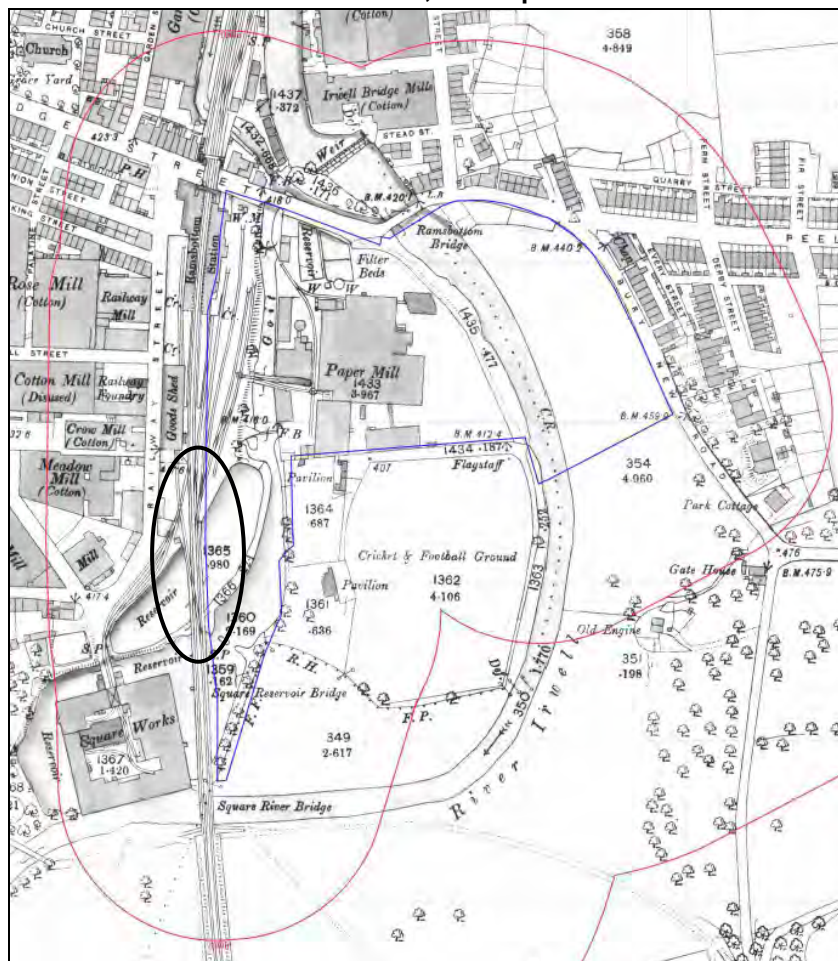
3.2 Summary of Site History

3.2.1 On Site

The earliest map, from 1850-1851, shows the site to be split between undeveloped land and the River Irwell in the east and reservoirs in the west. A small strip of land adjacent to the railway line is shown as a treelined road. An extract of the map is shown below;

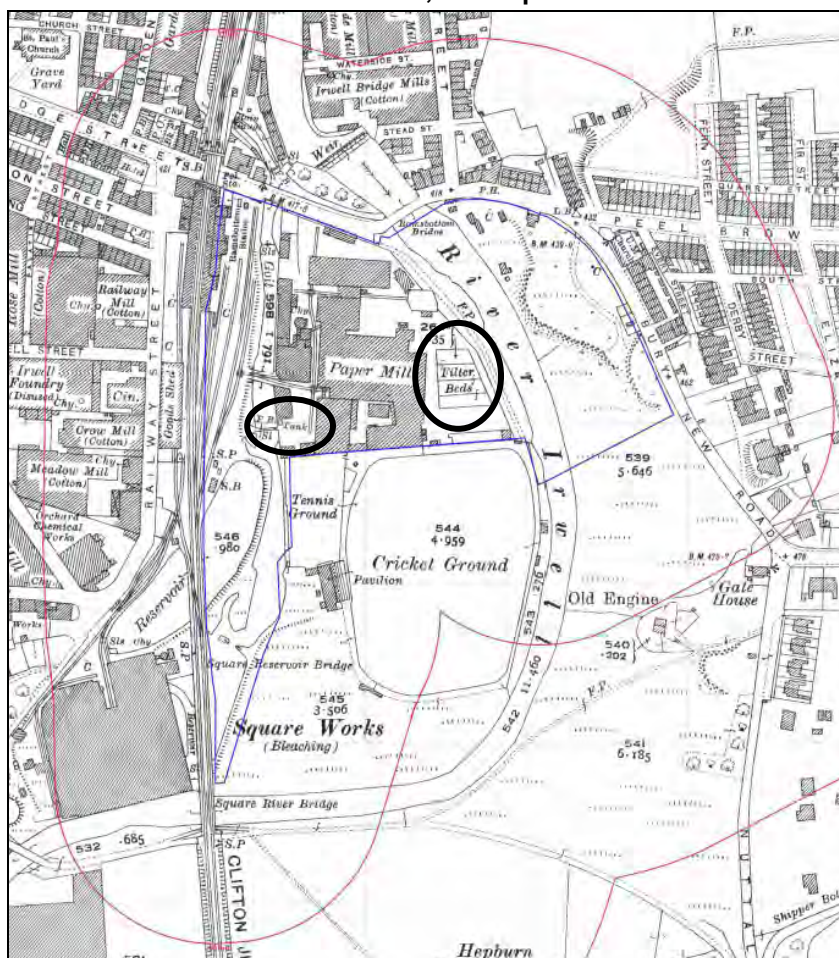


1891 1:2,500 map



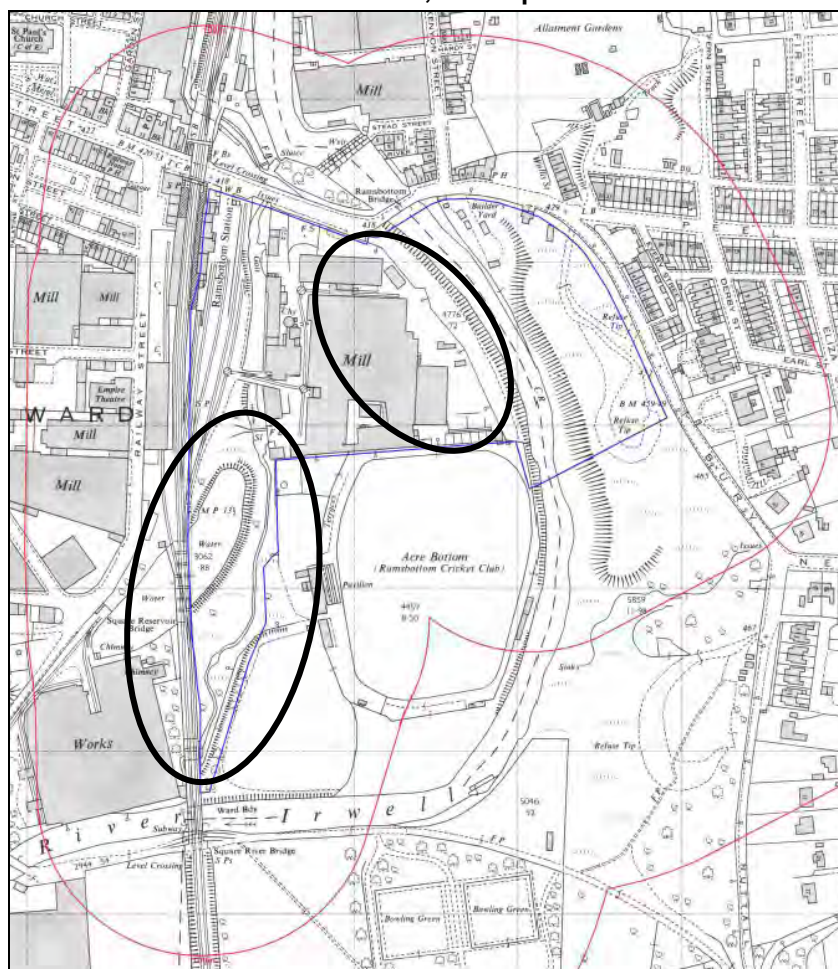
Mapping from 1929 shows a tank in the western area of the site and filter beds in the east of the site. There were also some minor configuration changes to the paper mill. An extract of the map is given below;

1929 1:2,500 map



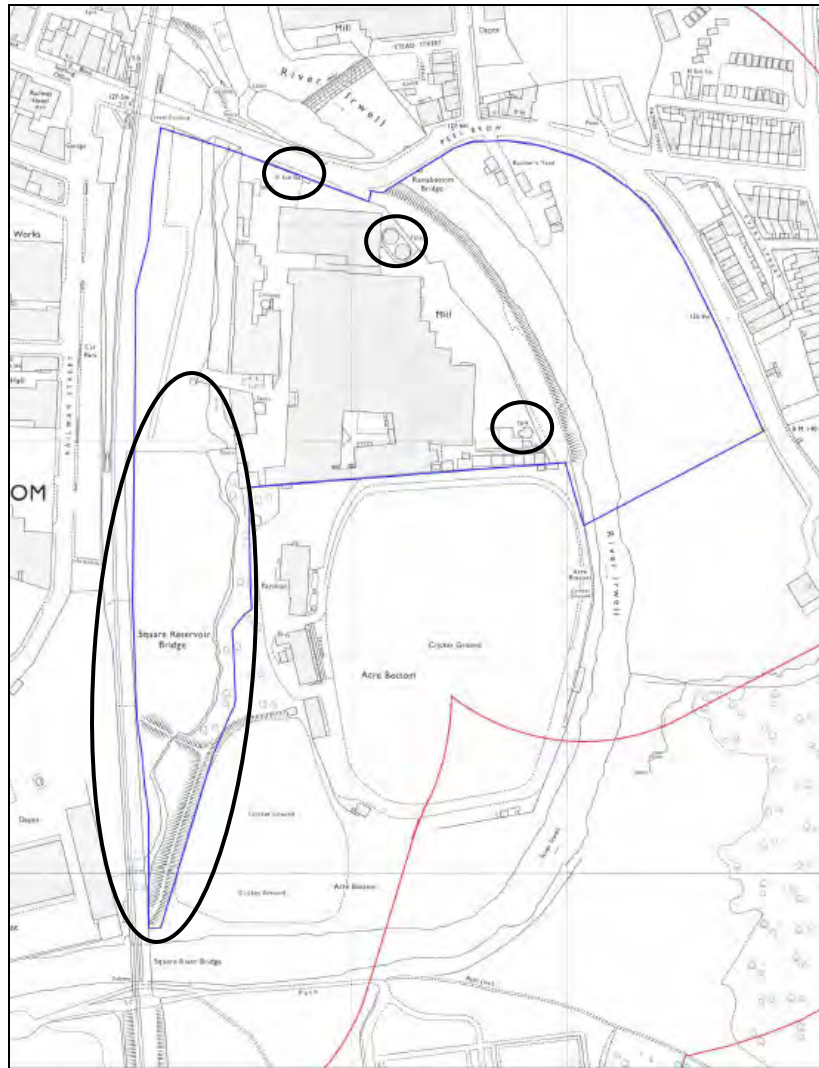
By 1962 the mill has been significantly extended, and a reservoir in the southern spur has been backfilled and a small stream has been created.

1962 1:2,500 map



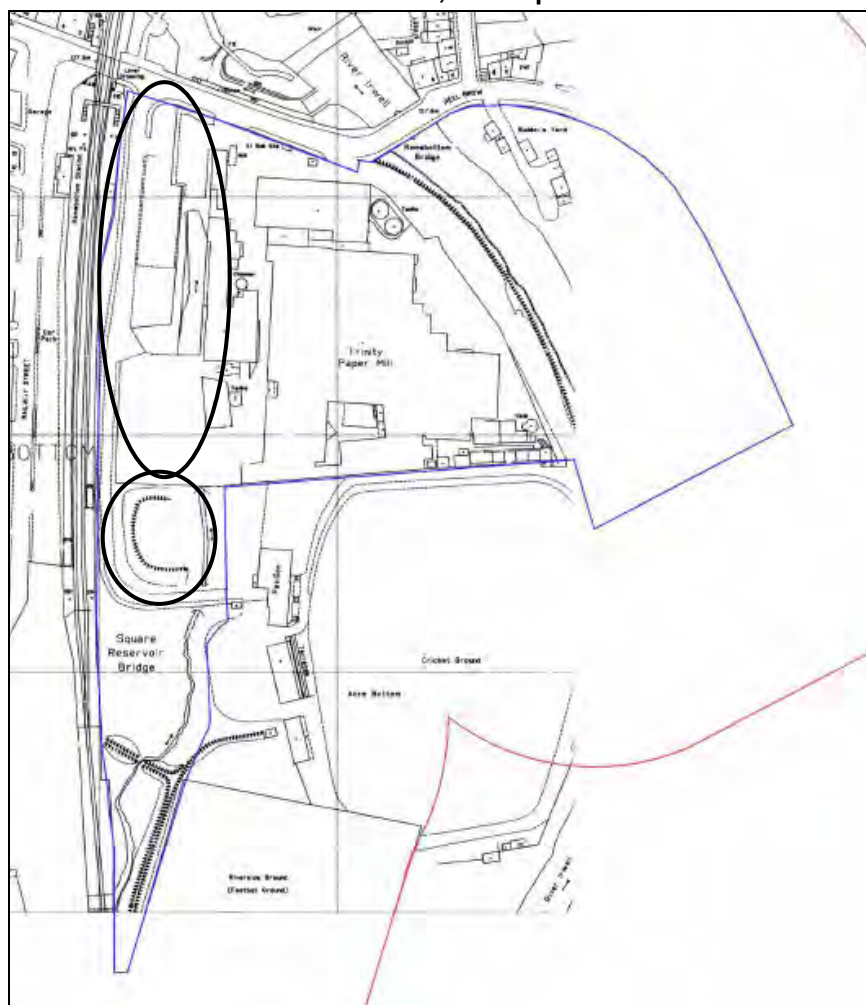
By 1978 the reservoirs in the west of the site have been backfilled. There are two new tank areas shown, the northern area shows two large tank, with one smaller tank in the southeast, and an electricity substation has been constructed on the northern boundary. An extract of the map is given below;

1978 1:1,250 map



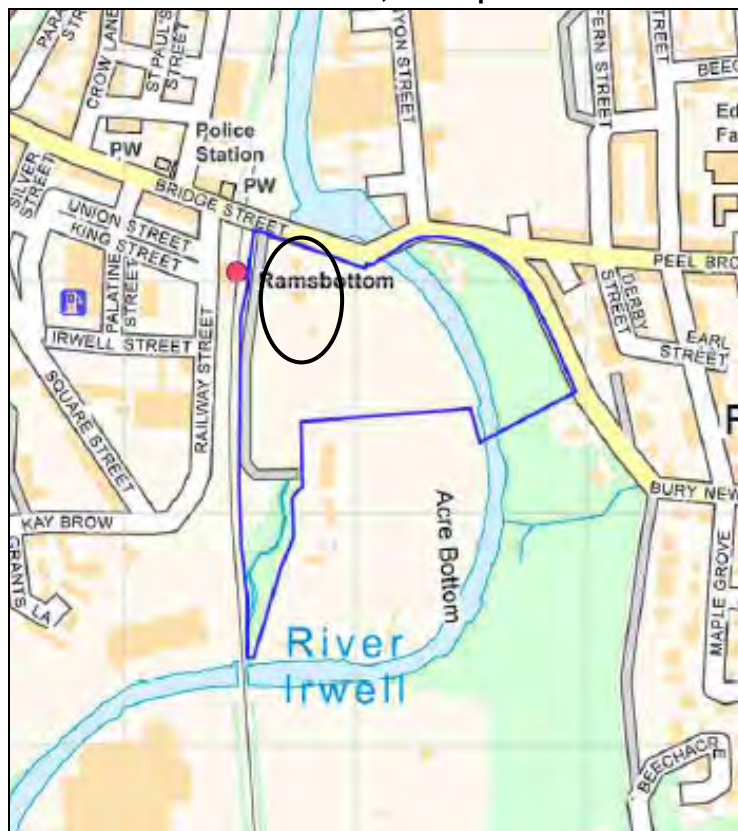
Mapping from 1994 shows a large area of hardstanding in the west has been constructed. The mill has also been extended slightly to the west. The first of the mounds in the southern spur has also been constructed.

1994 1:1,250 map



Historical mapping is inconsistent and often blank between 1994 and 2002. Between 2010 and 2014 the majority of the structures on site are demolished. However, some remain in the northwest of the site, it is assumed these are the structures remaining onsite currently. An extract of the map is shown below;

2014 1:10,000 map



3.2.2 Surrounding Area

The following table summarises the significant changes in historical use within 500m of the site boundary:

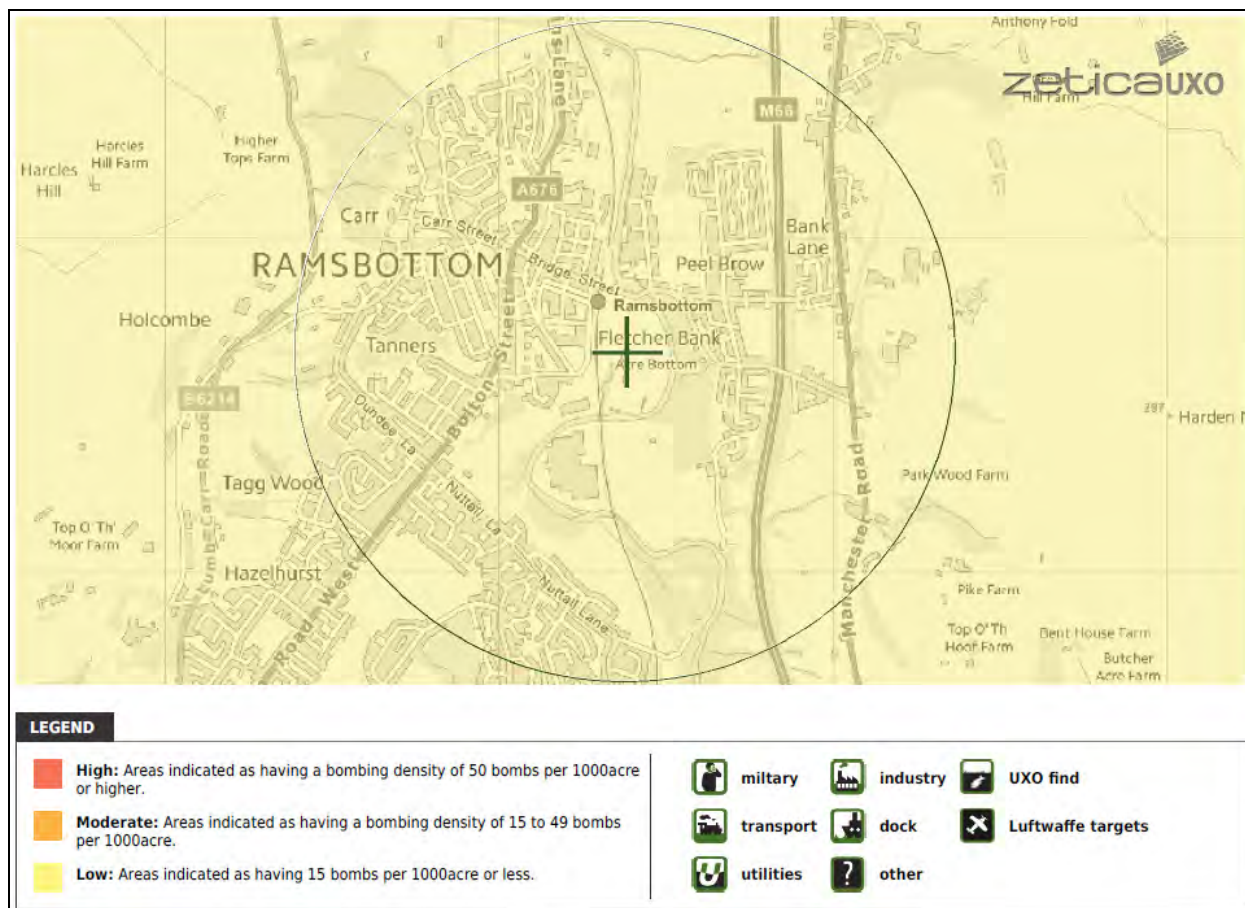
Date First Shown	Land Uses
1850-1851	River Irwell adjacent to the northern and eastern boundaries. Flows north to south. An 'old engine lodge' is shown 200m east. Sandstone quarry located 500m east. Large print works shown on western boundary of southern spur, later labelled as Square Works (bleaching). Series of small and one large reservoirs from 100m to the west. Ramsbottom train station is adjacent to western boundary. Ramsbottom town is shown approximately 200m northwest. Cotton mill with reservoir shown 400m northwest. Large cotton mill with large reservoir labelled as 'Ramsbottom Cotton Mill' detailed 400m north. Large areas are shown to be undeveloped.

1891	50-300m north collection of new mills and other industrial building constructed to the north. Large railway sidings shown 350m north. Large number of mills, works and foundry constructed 50m west of the site. Ramsbottom significantly expanded north, southwest and west. Residential homes constructed along Peel Brow to the east. Large areas to the northeast and southwest remain undeveloped.
1908-1910	Further, small-scale residential development east of the site. Tennis courts and cricket ground shown adjacent to southern boundary. Mill adjacent to southern spur now labelled as 'Square Bleaching Works'.
1927-1929	Soap works constructed 350m north of the site. Holme Mill constructed 75m southwest. Further small-scale residential development 100m southeast. Refuse destructor now constructed 400m north.
1938	Small-scale mapping largely blank. Iron foundry 60m west demolished.
1948	Nuttall Park now detailed south of the site, on the opposite bank of the Irwell.
1955	Large area of possible residential homes built 200m northeast.
1962	Small builders yard detailed 50m northeast. River Irwell banks appear to have been modified slightly. Refuse tip now labelled 200m southeast.
1967-1968	Continued expansion of Ramsbottom town.
1978	Number of mills and works to the west have been demolished, a depot has also been constructed to the west of the southern spur. Electrical substations are also shown. Another cricket ground has been created south of the previous one, with new 'clubhouses' also constructed.
1980	M66 constructed 325m east. Railway sidings to the north have not been reduced to a single line.
1992	Garage constructed 25m east.
1994	Configuration changes to existing mills / works. Southern most cricket club now shown as football club.
2002-2014	A number of works and mills remain to the north and southwest of the site. Two supermarkets were later constructed to the west of the site.

4 UNEXPLODED ORDNANCE (UXO)

A preliminary UXO has been made using online sources of information. The brief search has highlighted that no significant risks are present at the site. Further to this, the site had been developed prior to WWII and remained in use after, increasing the likelihood of any UXO items being recorded and removed.

On the basis of the site history and the online sources, the site is deemed to be at low risk from UXO.



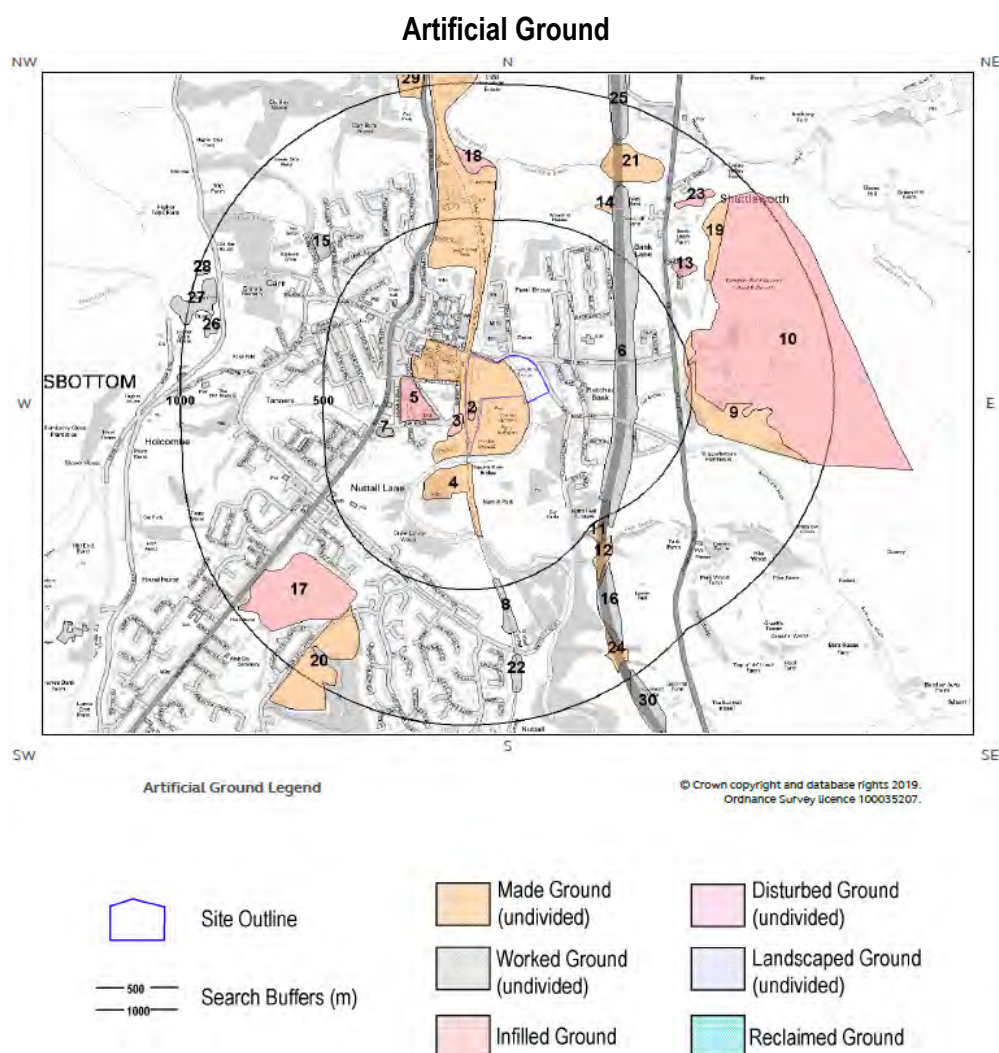
5 GEOLOGY

The following section details the published and available geological data available for the site and the surrounding area. All data is taken from the Groundsure report located in Appendix H unless otherwise stated. This report should be referred to for full details.

5.1 Published Geology

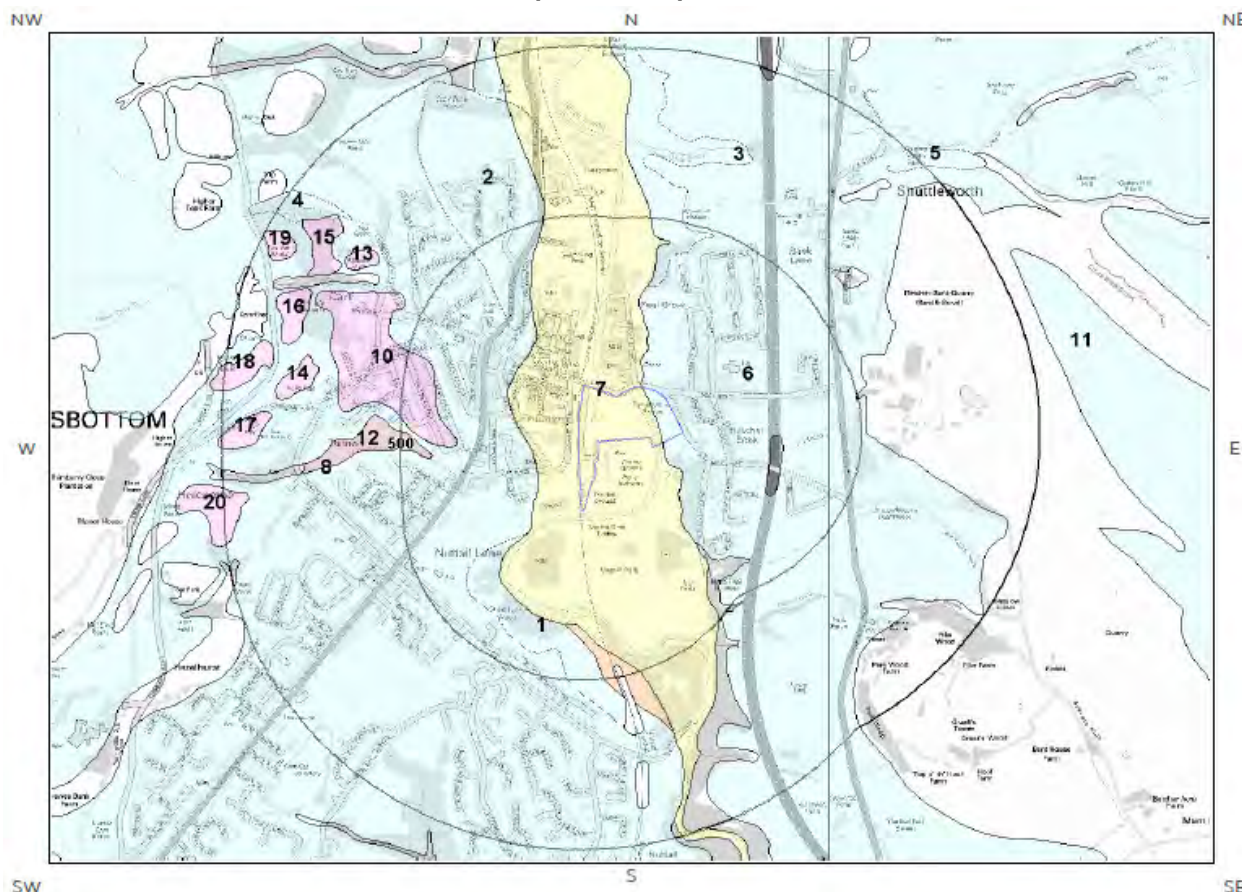
The documented geology of the site is summarised on the British Geological Survey map principally, with further site-specific details detailed below.

Geology	Artificial Ground and Land Slip	Drift	Solid
1:10,000	Made Ground & Infilled Land	Alluvium – Clay, Sand & Silt	Millstone Grit Group - Mudstone & Siltstone Hazel Greave Grit - Sandstone



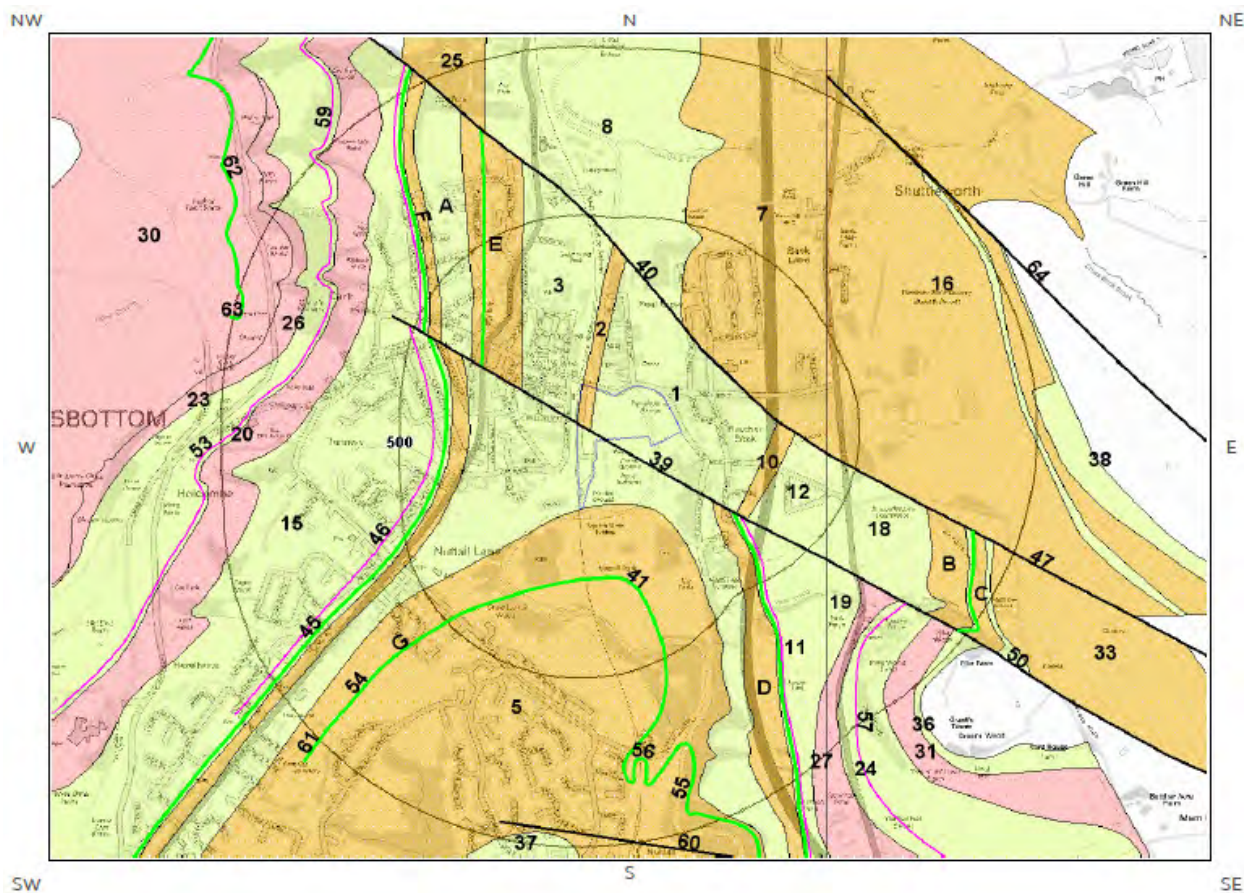
ID	Distance	Direction	LEX Code	Description	Rock Description
1	0.0	On Site	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit
2	0.0	On Site	WMGR-ARTDP	Infilled Ground	Artificial Deposit
3	11.0	W	WMGR-ARTDP	Infilled Ground	Artificial Deposit
4	33.0	S	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit
5	95.0	W	WMGR-ARTDP	Infilled Ground	Artificial Deposit
6	226.0	E	WGR-VOID	Worked Ground (Undivided)	Void
7	257.0	W	WGR-VOID	Worked Ground (Undivided)	Void
8	467.0	S	WGR-VOID	Worked Ground (Undivided)	Void
9	478.0	E	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit
10	495.0	E	WMGR-ARTDP	Infilled Ground	Artificial Deposit

Superficial Deposits



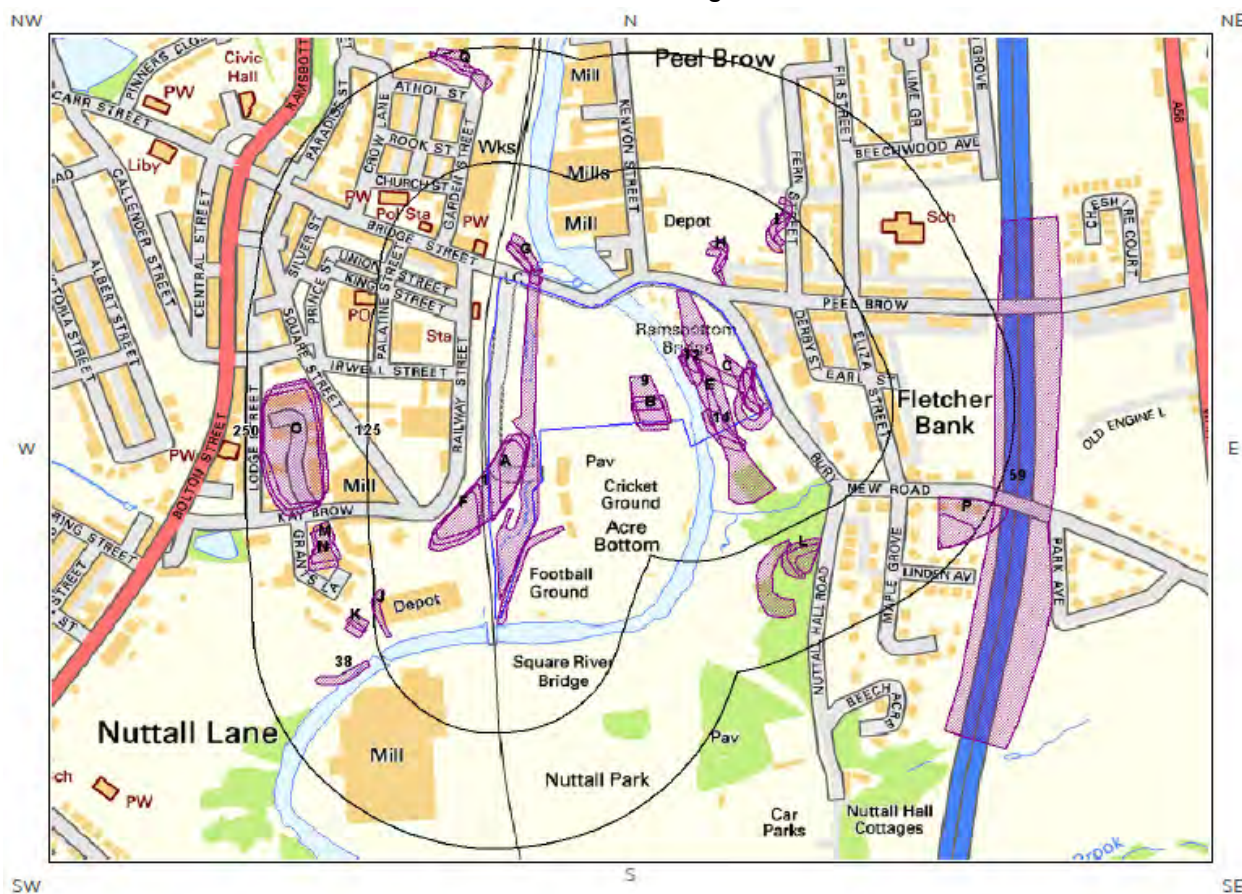
ID	Distance (m)	Direction	LEX Code	Description	Rock Description
6	0.0	On Site	TILLD-DMTN	Till, Devensian - Diamicton	Diamicton
7	0.0	On Site	ALV-XCZSV	Alluvium - Clay, Silt, Sand And Gravel	Clay, Silt, Sand And Gravel
8	118.0	W	TILLD-DMTN	Till, Devensian - Diamicton	Diamicton
9	334.0	S	RTD1-XSV	River Terrace Deposits, 1 - Sand And Gravel	Sand And Gravel
10	342.0	W	GFDUD-XSV	Glaciofluvial Deposits, Devensian - Sand And Gravel	Sand And Gravel
11	409.0	E	TILLD-DMTN	Till, Devensian - Diamicton	Diamicton
12	413.0	W	HEAD-DMTN	Head - Diamicton	Diamicton

Solid Deposits



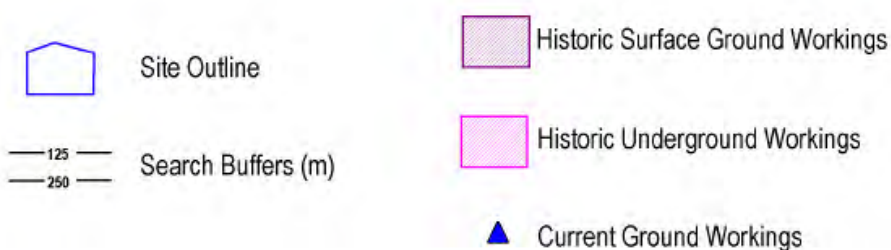
ID	Distance (m)	Direction	LEX Code	Description	Rock Age
1	0.0	On Site	MG-MDSI	Millstone Grit Group [see Also Migr] - Mudstone And Siltstone	Namurian Age
2	0.0	On Site	HZG-SDST	Hazel Greave Grit - Sandstone	Marsdenian Sub-age
3	0.0	On Site	MG-MDSI	Millstone Grit Group [see Also Migr] - Mudstone And Siltstone	Namurian Age
4	0.0	On Site	MG-MDSI	Millstone Grit Group [see Also Migr] - Mudstone And Siltstone	Namurian Age
5	0.0	S	BBS-SDST	Brooksbottoms Grit - Sandstone	Marsdenian Sub-age

Ground Workings



Ground Workings Legend

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The features recorded onsite are split between ponds, reservoirs, refuse heaps, filter beds and 'unspecified workings', as listed below;

ID	Distance (m)	Direction	NGR	Use	Date
1	0.0	On Site	379290 416615	Reservoir	1955
2	0.0	On Site	379339 416694	Ponds	1955
3A	0.0	On Site	379318 416624	Reservoir	1948
4A	0.0	On Site	379318 416624	Reservoirs	1891
5A	0.0	On Site	379318 416624	Pond	1908
6A	0.0	On Site	379318 416624	Reservoir	1927
7A	0.0	On Site	379326 416638	Pond	1968
8	0.0	On Site	379327 416522	Unspecified Ground Workings	1908
9	0.0	On Site	379463 416719	Filter Beds	1927
10B	0.0	On Site	379466 416696	Filter Beds	1948
11B	0.0	On Site	379468 416701	Filter Beds	1955
12	0.0	On Site	379507 416745	Refuse Heap	1948
13C	0.0	On Site	379559 416729	Refuse Heap	1927
14	0.0	On Site	379542 416679	Refuse Heap	1948
15D	0.0	On Site	379561 416721	Refuse Heap	1968
16C	0.0	On Site	379568 416722	Refuse Heap	1948
17D	0.0	On Site	379572 416729	Refuse Heap	1955
18E	0.0	On Site	379531 416715	Refuse Heap	1955
19E	0.0	On Site	379544 416715	Unspecified Ground Workings	1968

5.1.1 Linear Features

There is one linear feature located on site and a further 10no. features within 500m. The features within 250m are listed below;

ID	Distance (m)	Direction	Category Description	Feature Description
39	0.0	On Site	FAULT	Normal fault, inferred
40	176.0	NE	FAULT	Normal fault, inferred
41	207.0	S	ROCK	Coal seam, inferred

The feature identified on site is shown as a fault (inferred). Coal mining features are shown to 207m south of the site.

5.1.2 Historical Borehole Records

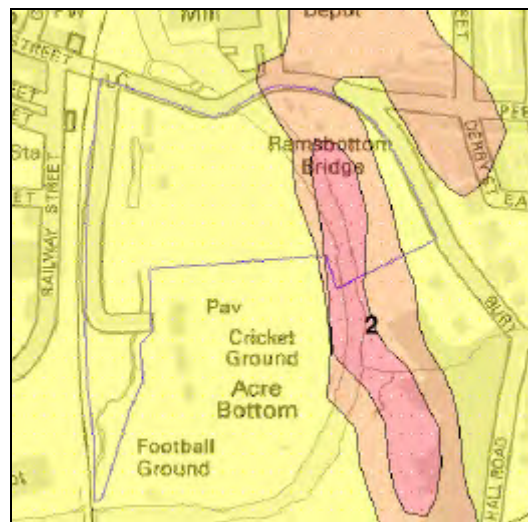
There are 3no. historic boreholes located onsite, that appear for have been used for wells, their succession can be summarised as below;

- Gravel
- Clay
- Conglomerate
- Clay and Gravel
- Rock from circa 19.00mbgl.

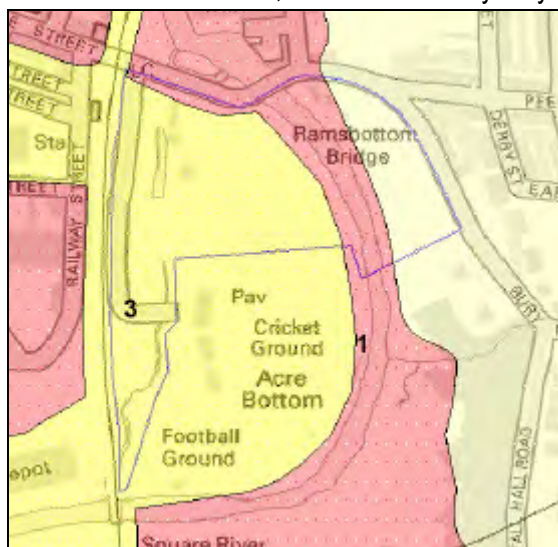
5.2 Ground Stability Issues

Potential risks due to ground stability according to the GroundSure report are listed below, along with maps where moderate risks may be present;

- Shrink-Swell Clay – Low Risk
- Landslide – Low to Moderate Risk, eastern boundary only (shown below)



- Ground Dissolution – Negligible
- Compressible Ground – Low to Moderate Risk, eastern boundary only (shown below)



- Collapsible Deposits – Negligible
- Running Sand – Low Risk

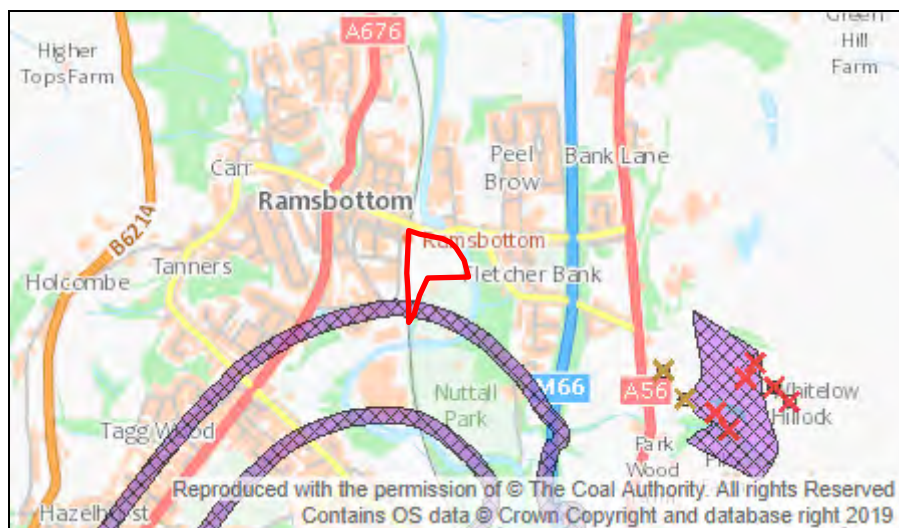
5.3 Geological Features

The table below summarises the presence/absence of recorded mining, extraction and natural cavities records within 500m of site. If entries are present within 250m, further details are provided in the relevant section below.

Data Type	On Site	0 – 250m	250 – 500m
Geological			
Historical Mining	-	-	-
Coal Mining	Yes	Yes	Yes
Non-Coal Mining	Yes	-	Yes
Non-Coal Mining Cavities	-	-	-
Natural Cavities	-	-	-
Brine Extraction	-	-	-

5.3.1 Coal Mining

The site is located within a coal mining area, and coal mining features exist to the south of the site, and as such, a Coal Authority Mining Report has been obtained. Online mapping has shown a possible coal seam to the south, which has further necessitated the Coal Authority report, and a Coal Mining Investigation. A plan showing mine features in the area is shown below;



The salient points of the Coal Authority Report are summarised below;

Section 1 – Mining activity and geology

Past Underground Mining

No past mining recorded.

Probable unrecorded shallow workings

None.

Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

Mine entries

None recorded within 100 metres of the enquiry boundary.

Abandoned mine plan catalogue numbers

None available.

Outcrops

Seam name	Mineral	Seam workable	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
LOWER HOLCOMBE BROOK	Coal	Yes	Within	N/A	100

Geological faults, fissures and breaklines

No faults, fissures or breaklines recorded.

Opencast mines

None recorded within 500 metres of the enquiry boundary.

Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

Section 2 – Investigative or remedial activity

Site investigations

None recorded within 50 metres of the enquiry boundary.

Remediated sites

None recorded within 50 metres of the enquiry boundary.

Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994. 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.

Mine gas

None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining

None recorded.

Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

Court orders

None recorded.

Section 46 notices

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence. The property is in an area where a notice to withdraw support was given in 1955. 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.

Withdrawal of support notices

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

5.3.2 Non-Coal Mining

One entry is recorded within 250m, and is noted as onsite as detailed below;

ID	Distance (m)	Direction	Name	Commodity	Assessment of likelihood
1	0.0	On Site	Not available	Vein Mineral	Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and <u>localised and are at a level where they need not be considered</u>

Vein minerals unlikely to have impact onsite.

5.3.3 Radon

The Groundsure data states that the site is within a low probability radon area (<1% of properties above the action level), therefore no radon protection measures are required in the construction of new dwellings.

5.4 Hydrogeological and Hydrological Features

The table below summarises the presence/absence of any hydrological licences and incidents within 500m of the proposed site. If entries are present within 250m, further details are provided in the relevant subsection below;

Data Type	On Site	0 – 250m	250 – 500m
Hydrogeology & Hydrology			
Licensed Discharge Consents	-	5	1
Red List Discharge Consents	-	-	-
Ground Water Abstraction Licences	2	-	-
Surface Water Abstraction Licences	-	6	8
Potable Water Abstraction Licences	-	-	-
Source Protection Zones	-	-	-
Ground Water Vulnerability & Soil Leaching Potential	1	1	1
Surface Water Features	2	7	Not Searched

5.4.1 Licensed Discharge Consents

There are five (5no.) entries located within 250m of the site, as detailed below;

ID	Distance (m)	Direction	NGR	Details
9	13	N	379348 416847	Address: CARR STREET CSO 099BP, 82 CARR STREET, RAMSBOTTOM, BURY, LANCASHIRE, BL0 9EG Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY Permit Number: 01BRY0001 Permit Version: 4 Receiving Water: RIVER IRWELL Status: VARIED UNDER EPR 2010 Issue date: 11/04/2018 Effective Date: 11-Apr-2018 Revocation Date: -
10B	38	E	379350 416470	Address: CARR STREET CSO 099BP, 82 CARR STREET, RAMSBOTTOM, BURY, LANCASHIRE, BL0 9EG Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY Permit Number: 01BRY0001 Permit Version: 2 Receiving Water: RIVER IRWELL Status: VARIED UNDER EPR 2010 Issue date: 03/09/2010 Effective Date: 03-Sep-2010 Revocation Date: 04/02/2016
11B	38	E	379350 416470	Address: CARR STREET CSO 099BP, 82 CARR STREET, RAMSBOTTOM, BURY, LANCASHIRE, BL0 9EG Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY Permit Number: 01BRY0001 Permit Version: 1 Receiving Water: RIVER IRWELL Status: VARIED UNDER EPR 2010 Issue date: - Effective Date: 01-Jan-1995 Revocation Date: 02/09/2010
12C	232	N	379419 417068	Address: BRITANNIA WORKS, KENYON ST, RAMSBOTTOM, BURY, LANCASHIRE Effluent Type: TRADE DISCHARGES - COOLING WATER Permit Number: 0165/76 Permit Version: 2 Receiving Water: RIVER IRWELL Status: SURRENDERED UNDER EPR 2010 Issue date: - Effective Date: 01-Jan-1995 Revocation Date: 15/08/2017
13C	232	N	379419 417068	Address: BRITANNIA WORKS, KENYON ST, RAMSBOTTOM, BURY, LANCASHIRE Effluent Type: SEWAGE DISCHARGES - FINAL/TREATED EFFLUENT - NOT WATER COMPANY Permit Number: 0165/76 Permit Version: 1 Receiving Water: RIVER IRWELL Status: REVOKED - UNSPECIFIED Issue date: - Effective Date: 01-Apr-1991 Revocation Date: 31/12/1994

5.4.2 Groundwater Abstraction Licenses

There are two (2no.) entries for groundwater abstraction licences, both are listed onsite, the extract is given below with approximate locations;

There are six (6no.) entries for surface water abstraction licences, the extract is given below;

ID	Distance (m)	Direction	NGR	Details
25B	7	W	379300 416800	Status: Historical Licence No: 2569001029 Details: Process water Direct Source: Surface, Non-Tidal - North West Region Point: R.IRWELL AT RAMSBOTTOM Data Type: Point Name: MONDI PAPER LIMITED Annual Volume (m³): - Max Daily Volume (m³): - Application No: - Original Start Date: 14/02/1966 Expiry Date: - Issue No: 102 Version Start Date: 11/09/2001 Version End Date: -
26B	7	W	379300 416800	Status: Historical Licence No: 2569001224 Details: Process Water Direct Source: Surface, Non-Tidal - North West Region Point: R.IRWELL AT RAMSBOTTOM Data Type: Point Name: MONDI HOLCOMBE LIMITED Annual Volume (m³): 90920 Max Daily Volume (m³): 1091.04 Application No: - Original Start Date: 12/04/1988 Expiry Date: - Issue No: 103 Version Start Date: 11/08/2008 Version End Date: -
27B	7	W	379300 416800	Status: Historical Licence No: 2569001029 Details: Process Water Direct Source: Surface, Non-Tidal - North West Region Point: GOIT FED BY SURFACE DRAINAGE AND RIVER IRWELL AT RAMSBOTTOM Data Type: Point Name: MONDI HOLCOMBE LIMITED Annual Volume (m³): 322766 Max Daily Volume (m³): 1637 Application No: - Original Start Date: 14/02/1966 Expiry Date: 31/03/2015 Issue No: 105 Version Start Date: 11/08/2008 Version End Date: -
28C	16	N	379350 416850	Status: Historical Licence No: 2569001246 Details: Supply to a Leat for Throughflow Direct Source: Surface, Non-Tidal - North West Region Point: RIVER IRWELL AT BRIDGE STREET, RAMSBOTTOM Data Type: Point Name: BURY METROPOLITAN BOROUGH COUNCIL Annual Volume (m³): - Max Daily Volume (m³): - Application No: - Original Start Date: 19/01/1994 Expiry Date: - Issue No: 100 Version Start Date: 11/08/2000 Version End Date: -
29C	16	N	379350 416850	Status: Historical Licence No: 2569001246 Details: Supply to a Leat for Throughflow Direct Source: "Surface, Non-Tidal - North West Region" Point: "RIVER IRWELL AT BRIDGE STREET, RAMSBOTTOM" Data Type: Point Name: BURY METROPOLITAN BOROUGH COUNCIL Annual Volume (m³): - Max Daily Volume (m³): - Application No: - Original Start Date: 19/01/1994 Expiry Date: - Issue No: 100 Version Start Date: 11/08/2000 Version End Date: -
30C	16	N	379350 416850	Status: Active Licence No: 2569001246 Details: Supply To A Leat For Throughflow Direct Source: Surface, Non-Tidal - North West Region Point: RIVER IRWELL AT BRIDGE STREET RAMSBOTTOM Data Type: Point Name: BURY METROPOLITAN BOROUGH COUNCIL Annual Volume (m³): 6.31152e+007 Max Daily Volume (m³): 172920 Application No: - Original Start Date: 19/01/1994 Expiry Date: - Issue No: 100 Version Start Date: 11/08/2000 Version End Date: -

5.4.4 Groundwater Vulnerability & Soil Leaching Potential

There are three (3no.) entries located within 250m of the site, one of which is located onsite, as detailed below;

Distance (m)	Direction	Classification	Soil Vulnerability Category	Description
0	On Site	Minor Aquifer/High Leaching Potential	HU	Soil information for urban areas and restored mineral workings. These soils are therefore assumed to be highly permeable in the absence of site-specific information.
15	E	Minor Aquifer/Low Leaching Potential	L	Soils in which pollutants are unlikely to penetrate the soil layer because either water movement is largely horizontal, or they have the ability to attenuate diffuse pollutants.
409	E	Minor Aquifer/High Leaching Potential	HU	Soil information for urban areas and restored mineral workings. These soils are therefore assumed to be highly permeable in the absence of site-specific information.

5.4.5 Surface Water Features

There are nine (9 no.) entries for surface water features within 250m, two of which are located onsite. Extract below;

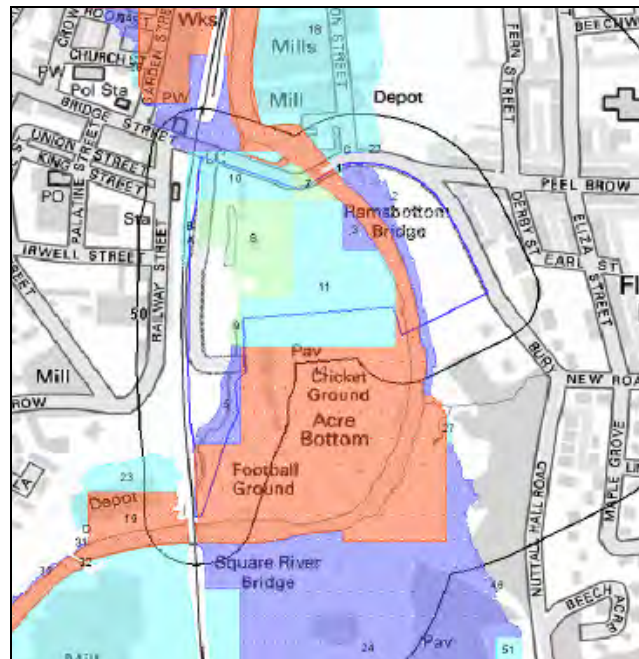
Distance (m)	Direction
0	On Site
0	On Site
10	SW
10	W
11	NW
72	S
86	SE
86	SE
119	SW

5.4.6 Hydrogeology and Hydrology

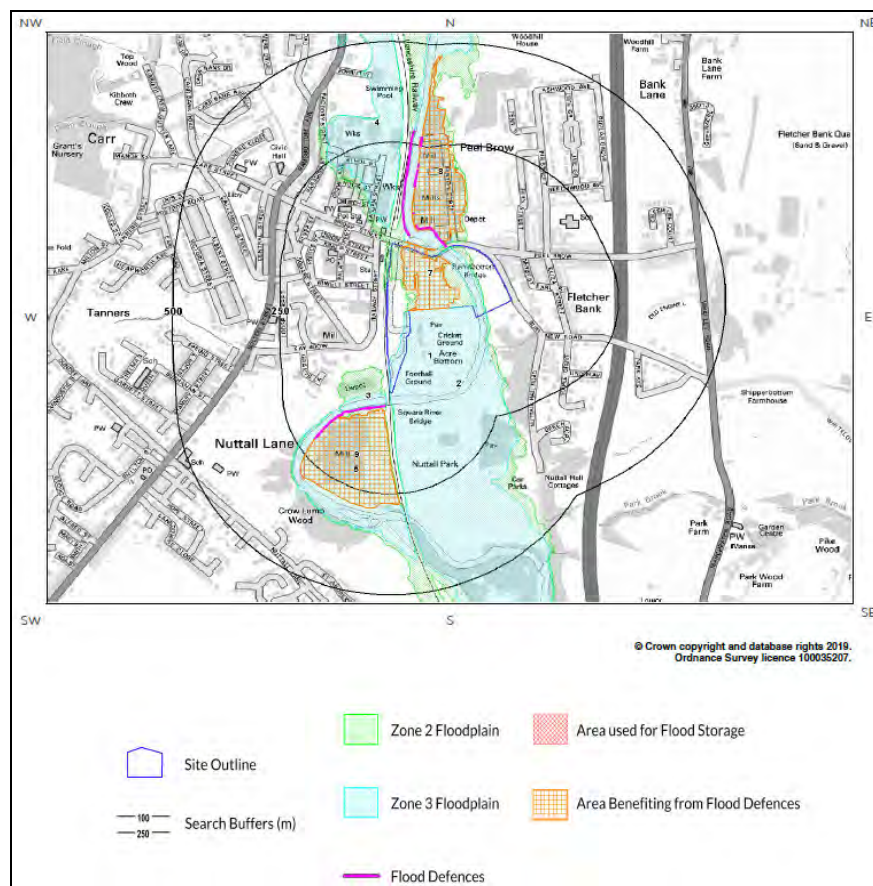
- The superficial deposits of the Alluvium are designated as Secondary A Aquifer (Moderate Permeability).
- The bedrock deposits of the Sandstone are designated as Secondary A aquifer (Moderate Permeability).
- The site does not lie within Groundwater Source Protection as defined by the Environment Agency.
- There are no potable water abstractions within 500m of site.
- Two groundwater abstractions located onsite, on the western boundary.
- There are two (7 no.) recorded surface water features on site and seven (9 no.) within 250m.
- Flooding – Zones 2 and 3 noted as onsite. Risk is noted as Very Low to High (RoFRaS). Map of risks given below;

5.4.7 Flood Risk Mapping

RoFRas



Environment Agency



6 ENVIRONMENTAL DATA

The following section details environmental data available for the site and the surrounding area. Full details can be found in the EnviroCheck Report by Landmark located in Appendix H.

The table below summarises the presence/absence of any waste, hazardous substance sites of industrial land uses within 500m of the proposed site. If entries are present within 250m, further details are provided in the relevant section below.

Data Type	On Site	0 – 250m	250 – 500m
Environmental Permits, Incidents & Registers			
Historic Integrated Pollution Control Authorisations	-	2	-
Integrated Pollution Prevention and Control Authorised Activities	2	1	-
Part A (2) & Part B Activities and Enforcements	-	3	-
Category 3 or 4 Radioactive Substances Authorisations	-	-	-
Water Industry Referrals	-	-	-
Hazardous Substance Consents & Enforcements	-	-	-
EA / NRW Recorded Pollution Incidents	-	4	-
Landfill & Other Waste Sites			
EA / NRW Registered Landfill Sites	-	-	-
EA / NRW Historic Landfill Sites	-	1	2
BGS / DoE Landfill Site Survey	-	-	-
Landfills in Local Authority & Historical Mapping Records	2	2	2
Operational & Non-operational Waste Treatment, Transfer & Disposal Sites	-	5	7
EA / NRW Licenced Waste Sites	-	6	-
Hazardous Sites			
COMAH and NIHS Sites	-	-	-
Historical Industrial Sites			
Potentially Contaminative Uses	32	89	75
Historical Tank Database	15	23	2
Historical Energy Features Database	3	15	20
Historical Petrol & Fuel Site Database	-	-	-
Historical Garage & Motor Vehicle Repair Database	-	7	-
Historical Military Sites	-	-	-
Potentially Infilled Land	19	40	55
Current Land Use			
Current Industrial Sites Data	1	39	Not Searched
Petrol & Fuel Sites	-	1	1
National Grid Underground Electricity Cables	-	-	-
National Grid Gas Transmission Pipelines	-	-	-
Designated Environmentally Sensitive Sites			
Sites of Special Scientific Interest (SSSI)	-	-	-
National Nature Reserves (NNR)	-	-	-
Special Areas of Conservation (SAC)	-	-	-
Special Protection Areas (SPA)	-	-	-
Areas of Outstanding Natural Beauty (AONB)	-	-	-
National Parks	-	-	-
Green Belt Land	-	-	-

6.1 Environmental Permits, Incidents & Registers

6.1.1 Historic Integrated Pollution Control Authorisations

There are two records for Historic IPC Authorisations within 250m of the site, an extract is given below;

ID	Distance (m)	Direction	NGR	Details
32D	7	W	379300 416800	Operator: Mondi Packaging Holcombe Ltd Address: Holcombe Mill, Bridge Street, Ramsbottom, Bury, Lancashire, BLO OBS Process: Paper And Pulp Manufacturing Processes Permit Number: AU7451 Original Permit Number: IPCAPP Date Approved: 27-1-1997 Effective Date: 29-1-1997 Status: Superseded By Variation
33D	7	W	379300 416800	Operator: Mondi Packaging Holcombe Ltd Address: Holcombe Mill, Bridge Street, Ramsbottom, Bury, Lancashire, BLO OBS Process: Paper And Pulp Manufacturing Processes Permit Number: BD4546 Original Permit Number: IPCMINVAR Date Approved: 24-11-1998 Effective Date: 30-11-1998 Status: Revoked - Now Ippc

6.1.2 Integrated Pollution Prevention and Control Authorised Activities

There are three records for IPPC Authorised Activities within 250m of the site, two of which are onsite. an extract is given below;

ID	Distance (m)	Direction	NGR	Details
26E	0	On Site	379400 416760	Operator: MONDI HOLCOMBE LTD Installation Name: DANISCO PAPER MILL EAEPRBJ6542IQS002 Process: PAPER, PULP AND BOARD; PRODUCING PAPER/BOARD >20T/D Permit Number: BJ6542IQ Original Permit Number: BJ6542IQ EPR Reference: - Issue Date: 09/01/2002 Effective Date: 09/01/2002 Last date noted as effective: 2019-01-31 Status: SUPERCEDED
27E	0	On Site	379400 416760	Operator: MONDI HOLCOMBE LTD Installation Name: DANISCO PAPER LIMITED Process: PAPER, PULP AND BOARD; PRODUCING PAPER/BOARD >20T/D Permit Number: KP3530KN Original Permit Number: BJ6542IQ EPR Reference: - Issue Date: - Effective Date: 25/06/2010 Last date noted as effective: 2019-01-31 Status: SURRENDER EFFECTIVE
28D	7	W	379300 416800	Operator: MONDI PAPER LTD Installation Name: - Process: PAPER, PULP & BOARD; PRODUCING PAPER/BOARD >20T/D Permit Number: BJ6542 Original Permit Number: BJ6542 EPR Reference: - Issue Date: 09/01/2002 Effective Date: 09/01/2002 Last date noted as effective: 2004-10-01 Status: SUPERSEDED BY PAS

A closure report should be requested / obtained from the Environment Agency.

6.1.3 Part A (2) & Part B Activities and Enforcements

There are three (3 No.) entry for Part A (2) & Part B Activities and Enforcements within 250m. The extract is shown extract below;

ID	Distance (m)	Direction	NGR	Details
23	49	W	379261 416836	Address: Station Garage, Railway Street, BLO 9AL Process: Petrol Vapour Recovery Status: Historical Permit Permit Type: Part B Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified
24	157	W	379163 416894	Address: First Impression, 44 Bridge Street, Ramsbottom, Bury, BLO 9AQ Process: Dry Cleaning Status: Current Permit Permit Type: Part B Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified
25	476	N	379221 417313	Address: Ramsbottom Service Station, Stubbins Road, Ramsbottom, BLO OPU Process: Unloading of Petrol into Storage at Service Stations Status: Current Permit Permit Type: Part B Enforcement: No Enforcements Notified Date of Enforcement: No Enforcements Notified Comment: No Enforcements Notified

6.1.4 EA / NRW Recorded Pollution Incidents

There are four (4no.) records for EA / NRW Recorded Pollution Incidents within 250m of the site, an extract of the records is given below;

ID	Distance (m)	Direction	NGR	Details
1	69	S	379512.0 416592.0	Incident Date: 17-Apr-2002 Incident Identification: 72361.0 Pollutant: Oils and Fuel Pollutant Description: Unidentified Oil Water Impact: Category 3 (Minor) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)
2	94	NW	379405.0 416919.0	Incident Date: 22-Jun-2014 Incident Identification: 1247989.0 Pollutant: Atmospheric Pollutants and Effects Pollutant Description: Smoke Water Impact: Category 3 (Minor) Land Impact: Category 3 (Minor) Air Impact: Category 2 (Significant)
3	132	E	379446.0 416462.0	Incident Date: 15-Apr-2002 Incident Identification: 71682.0 Pollutant: Oils and Fuel Pollutant Description: Unidentified Oil Water Impact: Category 3 (Minor) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)
4	197	SW	379133.0 416382.0	Incident Date: 13-Jun-2001 Incident Identification: 9000.0 Pollutant: Oils and Fuel Pollutant Description: Gas and Fuel Oils Water Impact: Category 3 (Minor) Land Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact)

6.2 Landfill & Other Waste Sites

6.2.1 EA / NRW Historic Landfill Sites

There is one (1no.) entry for an historic landfill site within 250m, an extract is given below;

ID	Distance (m)	Direction	NGR	Details
15	0	On Site		Site Address: Mill Lodge, Railway Street/Kenyon Street, Ramsbottom, Bury, Greater Manchester Waste Licence: Yes Site Reference: C013, RD/LIC/009/76 Waste Type: Inert, Industrial Environmental Permitting Regulations (Waste) Reference: - Licence Issue: 13-Dec-1977 Licence Surrendered: 08-May-1990 Licence Holder Address: Irwell Street, Ramsbottom Operator: - Licence Holder: Irwell Street Metal Company Limited First Recorded: 31-Dec-1977 Last Recorded: 31-Jul-1979

6.2.2 Landfills in Local Authority & Historical Mapping Records

There are four (4no.) entries for Landfills in Local Authority & Historical Mapping Records within 250m of site, two of which are located onsite, an extract of the record is below;

ID	Distance (m)	Direction	NGR	Site Address	Source	Data Type
47	0	On Site	379550 416786	Refuse Tip	1962 mapping	Polygon
48	0	On Site	379557 416719	Refuse Tip	1962 mapping	Polygon
49	136	SE	379581 416524	Refuse Tip	1962 mapping	Polygon
50	221	N	379565 417057	Refuse Tip	1962 mapping	Polygon

6.2.3 Operational & Non-operational Waste Treatment, Transfer & Disposal Sites

There are five (5no.) entries for Operational & Non-operational Waste Treatment, Transfer & Disposal Site records within 250m of site. The records within 100m are given below;

ID	Distance (m)	Direction	NGR	Details
3A	79	N	379463 416958	Type of Site: Scrap Yard Site Address: N/A Planning Application Reference: N/A Date: 1992 Further Details: N/A Data Source: Historic Mapping Data Type: Polygon
4A	79	N	379463 416958	Type of Site: Scrap Yard Site Address: N/A Planning Application Reference: N/A Date: 1994 Further Details: N/A Data Source: Historic Mapping Data Type: Polygon

6.2.4 Records of Environment Agency / Natural Resources Wales Licensed Waste Sites

There are six (6no.) Records of Environment Agency/Natural Resources Wales licensed waste sites within 250m of the site boundary, an extract of the records within 100m is given below;

ID	Distance (m)	Direction	NGR	Details
27F	91	N	379441 416928	Site Address: Waterside Mill & Peel Bridge Mill, Kenyon Street, Ramsbottom, Lancs, BLO 0AB Type: 75kte HCl Waste TS + treatment Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: AWR003 EPR reference: CP3897ES/A001 Operator: A W R Rent A Skip Ltd Waste Management licence No: 100969 Annual Tonnage: 0.0 Issue Date: 04/08/2009 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: A W R Rent A Skip Correspondence Address: -
28F	91	N	379441 416928	Site Address: Waterside Mill, Kenyon Street, Ramsbottom, Lancashire, BLO 0AB Type: 75kte HCl Waste TS + treatment Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: WHE032 EPR reference: EA/EPR/QP3092EN/T001 Operator: Wheeldon Brothers Waste Ltd Waste Management licence No: 100969 Annual Tonnage: 74999.0 Issue Date: 04/08/2009 Effective Date: 22/11/2010 Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Transferred Site Name: Waterside Mill & Peel Bridge Mill Correspondence Address: -
29F	98	N	379455 416937	Site Address: Land/premises At, Kenyon Street, Ramsbottom, Bury, Lancashire, BLO 0AB Type: Special Waste Transfer Station Size: >= 25000 tonnes < 75000 tonnes Environmental Permitting Regulations (Waste) Licence Number: ISM001 EPR reference: EA/EPR/MP3496CP/V002 Operator: Irwell Street Metal Co Ltd Waste Management licence No: 53695 Annual Tonnage: 6250.0 Issue Date: 05/01/1994 Effective Date: - Modified: 21/11/2002 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Modified Site Name: Irwell Street Metal Co Ltd Correspondence Address: -

6.3 Historical Industrial Sites

6.3.1 Potentially Contaminative Uses

There are One-hundred and twenty-one (121no.) records of Potentially Contaminative Uses within 250m of the site, 32 of which are located onsite, an extract of the records onsite is given below;

ID	Distance [m]	Direction	Use	Date
1D	0	On Site	Refuse Heap	1927
2BK	0	On Site	Refuse Heap	1948
3A	0	On Site	Refuse Heap	1968
4A	0	On Site	Refuse Heap	1948
5A	0	On Site	Refuse Heap	1955
6B	0	On Site	Paper Mill	1908
7B	0	On Site	Paper Mill	1948
8	0	On Site	Railway Sidings	1955
9BL	0	On Site	Unspecified Ground Workings	1908
10B	0	On Site	Paper Mill	1927
11B	0	On Site	Unspecified Mill	1891
12B	0	On Site	Paper Mill	1955
13B	0	On Site	Unspecified Mill	1968
14B	0	On Site	Unspecified Mill	1980
15C	0	On Site	Filter Beds	1927
16C	0	On Site	Filter Beds	1948
17C	0	On Site	Filter Beds	1955
18BJ	0	On Site	Unspecified Ground Workings	1968
19BI	0	On Site	Refuse Heap	1948
20D	0	On Site	Refuse Heap	1955
21AB	0	On Site	Railway Sidings	1968
22E	0	On Site	Railway Sidings	1948
23E	0	On Site	Railway Sidings	1927
24E	0	On Site	Railway Sidings	1891
25E	0	On Site	Railway Sidings	1908
26F	0	On Site	Railway Station	1927
27F	0	On Site	Railway Station	1908
28F	0	On Site	Railway Station	1891
29F	0	On Site	Railway Station	1948
30F	0	On Site	Railway Station	1955
31F	0	On Site	Railway Station	1968
32G	0	On Site	Bleaching Works	1955

6.3.2 Historical Tank Database

There are twenty-three (23no.) records of tank records within 250m of the site, fifteen of which are located onsite, an extract of the records onsite is given below;

ID	Distance (m)	Direction	Use	Date
197C	0	On Site	Unspecified Tank	1978
198C	0	On Site	Unspecified Tank	1992
199E	0	On Site	Unspecified Tank	1891
200E	0	On Site	Tanks	1992
201AS	0	On Site	Unspecified Tank	1938
202AS	0	On Site	Unspecified Tank	1910
203AS	0	On Site	Unspecified Tank	1929
204E	0	On Site	Tanks	1992
205E	0	On Site	Tanks	1978
206AT	0	On Site	Tanks	1992
207AT	0	On Site	Tanks	1978
208E	0	On Site	Tanks	1994
209E	0	On Site	Tanks	1994
210AT	0	On Site	Tanks	1994
211C	0	On Site	Unspecified Tank	1994

6.3.3 Historical Energy Features

There are fifteen (15no.) records in the historical energy database within 250m of the site, three of which are located onsite, an extract of the records onsite is given below;

ID	Distance (m)	Direction	Use	Date
222AW	0	On Site	Electricity Substation	1992
223AW	0	On Site	Electricity Substation	1978
224AW	0	On Site	Electricity Substation	1994

6.3.4 Historical Garage & Motor Vehicle Repair Database

There are seven (7no.) records in the historical garage & vehicle repair database within 250m of the site, an extract of the records onsite is given below;

ID	Distance (m)	Direction	Use	Date
260BG	41	W	Garage	1962
261BG	42	W	Garage	1992
262BG	42	W	Garage	1994
263BG	43	W	Garage	1978
264M	92	N	Depot and Destructor Works	1978
265BH	218	W	Garage	1992
266BH	218	W	Garage	1978

6.3.5 Potentially Infilled Lane

There are fifty-nine (59no.) records for potentially infilled land within 250m of the site, nineteen of which are located onsite, an extract of the records onsite is given below;

ID	Distance(m)	Direction	Use	Date
267BI	0	On Site	Refuse Heap	1948
268A	0	On Site	Refuse Heap	1927
269BJ	0	On Site	Refuse Heap	1955
270A	0	On Site	Unspecified Ground Workings	1968
271A	0	On Site	Refuse Heap	1955
272A	0	On Site	Refuse Heap	1948
273A	0	On Site	Refuse Heap	1968
274BK	0	On Site	Refuse Heap	1948
275BL	0	On Site	Unspecified Ground Workings	1908
276BM	0	On Site	Reservoir	1955
277BN	0	On Site	Reservoirs	1891
278BN	0	On Site	Reservoir	1948
279BN	0	On Site	Pond	1908
280BN	0	On Site	Reservoir	1927
281BN	0	On Site	Pond	1968
282C	0	On Site	Filter Beds	1955
283C	0	On Site	Filter Beds	1927
284AS	0	On Site	Ponds	1955
285C	0	On Site	Filter Beds	1948

6.4 Current Land Use

6.4.1 Current Industrial Sites

There forty (40no.) records for current industrial sites within 250m of the site, one of which is located onsite, an extract of the records within 100m are given below;

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
1	0	On Site	Chimney	379361 416764	Greater Manchester, BL0	Chimneys	Industrial Features
2	21	W	East Lancashire Railway (Ramsbottom Station)	379286 416809	Greater Manchester, BL0	Railways (Heritage, Steam and Miniature)	Tourism
3	46	W	TNT Express	379253 416647	Railway Street, Ramsbottom, Bury, Greater Manchester, BL0 9AL	Distribution and Haulage	Transport, Storage and Delivery
4A	47	W	Ramsbottom Metalwork	379253 416735	Empire Works, Railway Street, Ramsbottom, Bury, Greater Manchester, BL0 9AL	Metalworkers Including Blacksmiths	Construction Services
5C	48	W	Station Garage	379262 416837	Railway Street, Ramsbottom, Bury, Greater Manchester, BL0 9AL	Vehicle Repair, Testing and Servicing	Repair and Servicing
6A	50	W	Works	379250 416726	Greater Manchester, BL0	Unspecified Works Or Factories	Industrial Features
7A	56	W	Electricity Sub Station	379244 416737	Greater Manchester, BL0	Electrical Features	Infrastructure and Facilities
8B	56	NW	Booth King Partnership Ltd	379274 416887	Tollgate House 9c, Bridge Street, Ramsbottom, Bury, Greater Manchester, BL0 9AB	Civil Engineers	Engineering Services
9	57	NE	Electricity Sub Station	379560 416865	Greater Manchester, BL0	Electrical Features	Infrastructure and Facilities
10B	64	NW	Tank	379283 416902	Greater Manchester, BL0	Tanks (Generic)	Industrial Features
11	66	N	Depot	379465 416905	Greater Manchester, BL0	Container and Storage	Transport, Storage and Delivery
12C	67	W	Works	379241 416823	Greater Manchester, BL0	Unspecified Works Or Factories	Industrial Features
13	79	NW	Formulated Polymer Products Ltd	379267 416911	8, Garden Street, Ramsbottom, Bury, Greater Manchester, BL0 9BQ	Adhesives and Sealants	Industrial Products
14	81	W	Depot	379225 416492	Greater Manchester, BL0	Container and Storage	Transport, Storage and Delivery
15	89	N	I S M Waste & Recycling	379468 416928	Kenyon Street, Ramsbottom, Bury, Greater Manchester, BL0 0AB	Waste Storage, Processing and Disposal	Infrastructure and Facilities
16	95	W	Ramsbottom Paint & Bodyshop	379205 416584	Kay Brow Yard, Kay Brow, Ramsbottom, Bury, Greater Manchester, BL0 9AY	Vehicle Repair, Testing and Servicing	Repair and Servicing

6.4.2 Petrol & Fuel Sites

There two (2no.) records for petrol & fuel sites within 250m of the site, an extract of the record is given below;

ID	Distance (m)	Direction	NGR	Company	Address	LPG	Status
41B	49	W	379260 416837	UNBRANDED	Railway Street, Ramsbottom, Bury, Greater Manchester, BL0 9AL	No	Closed
42	498	N	379193 417329	ESSO	Stubbins Lane, Ramsbottom, Bury, Greater Manchester, BL0 0PU	No	Open

7 SUMMARY OF ENVIRONMENTAL SENSITIVITY

The following section is a review of the environmental sensitivity of the site as discussed in Sections 2 - 6. Significant potential risks are discussed in the following subsections and will then be evaluated as part of the Site Conceptual Model in Section 8.

Sources are defined as where pollution comes from, pathways are a route in which the pollution travels and receptors are anything affected by a pollutant. Further details on Source-Pathway-Receptor methodology can be found in Appendix D.

The table below focuses on significant site-specific sources, pathways and receptors. More 'generic' pathways and receptors (such as site end uses) will be covered as part of the initial Site Conceptual Model in Section 8.

7.1 Sources

Source	Distance/ Direction	Details	Significant Risk
Current Site Use – derelict	On Site	No significant sitewide contamination anticipated onsite from current land use, due it being derelict, although leaking IBCs were noted during brief walkover. No contaminative processes anticipated ongoing onsite.	Possible - Localised
Historic Site Use – Paper Mill & associated infrastructure	On Site	The site has been occupied by a paper mill for much of its known history and has gone through several phases of extension prior to it being demolished. Potential contamination includes VOCs/SVOCs, heavy metals, PAH, TPH and asbestos. Potential biogenic ground gas source associated with demolition products and made ground on site. Possible redundant services in situ. Ground investigation and ground gas monitoring.	Yes
Surrounding Industrial Processes (Historical and Current)	Adjacent to Site	The site was set in a largely industrial setting with various works located to the north and west, these later became shops etc. Groundwater assumed to flow west to east across the site towards the Irwell. Possible contaminants from these historic uses include heavy metals, PAH, VOCs/SVOCs, TPHs and asbestos. Anticipated cohesive and granular strata across the site. Ground investigation and ground gas monitoring to confirm.	Possible

7.2 Pathways and Receptors

Pathways and Receptors	Distance/ Direction	Details	Significant Risk
Aquifers	Below Site	Potential for both cohesive and granular strata under the site. The site does not lie within a groundwater source protection zone and no potable water abstractions within 500m of site. Site history suggests contamination may be present.	Possible

8 INITIAL CONCEPTUAL SITE MODEL

For details on how the conceptual model is evaluated please refer to Appendix D.

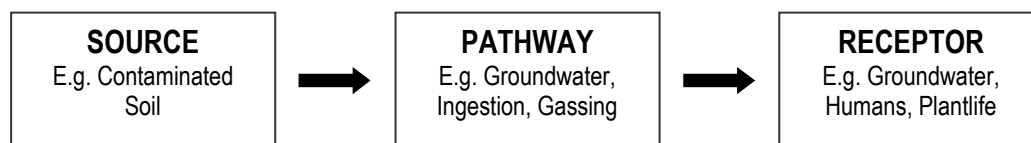
This section of the report aims to identify land which could potentially be affected by contamination, such that it could affect the value or re-use of the land, or such that mitigation would be required for certain proposed end uses of the land.

Potential contamination sources and environmentally sensitive receptors have been discussed in Section 7. Potentially significant risks are evaluated as part of the subsequent sub-sections.

8.1 Source-Pathway-Receptor Linkages

The risk assessment uses a 'Source-Pathway-Receptor' methodology for assessing whether a source of contamination could potentially lead to harmful consequences. This means that there needs to be a pollutant linkage from source to receptor for harm to be caused, this linkage consisting of a source of pollution; a pathway for the pollutant to move along; a receptor that is affected by the pollutant.

The current potential risks to site arising from various Source-Pathway-Receptor linkages are assessed below. A risk may be considered significant if all three of the stages are present and therefore providing a pollution linkage. The various sources, pathways and receptors are considered separately. The assessment is based on the future use, which is understood to be residential with home-grown produce.



Type of Contamination	Potential Sources	Potential Pathway	Potential Receptors	Pollution Linkage	Comment	Estimated Level of Risk
Ground Gas	Historical Land Use- On Site	Inhalation of Vapours	Construction/ Maintenance Workers	Potentially Active	Possible ground gas from deep made ground and areas of former industry. Ground investigation and ground gas monitoring to confirm. PPE to protect.	Low - Moderate
	Neighbouring Land Use Within 250m Of Site	Vapours Penetrating Unprotected Buildings	Future Site Users	Potentially Active	Possible ground gas from deep made ground and areas of former industry. Ground investigation and ground gas monitoring to confirm.	Moderate
Surface and Near Surface Contaminants Within Soils	Historical Land- Use On Site Neighbouring Land Use Within 250m Of Site	Ingestion, Inhalation, Dermal Contact	Current Site Users	Potentially Active	Potential for deep basements, foundations, pits and deep Made Ground. Potential determinants from historic site use and neighbouring land use comprise heavy metals, VOCs/SVOCs, PAH's, TPH's and asbestos. Site is currently derelict. Ground investigation to confirm and target.	Low - Moderate
			Construction Workers	Potentially Active	Potential for deep basements, foundations, pits and deep Made Ground. Potential determinants from historic site use and neighbouring land use comprise heavy metals, VOCs/SVOCs, PAH's, TPH's and asbestos. Ground investigation to confirm and target.	Moderate
			Future Site Users	Potentially Active	Potential for deep basements, foundations, pits and deep Made Ground. Potential determinants from historic site use and neighbouring land use comprise heavy metals, VOCs/SVOCs, PAH's, TPH's and asbestos. Ground investigation to confirm and target.	Moderate
			Adjacent Land Users	Potentially Active	Surrounding area is residential and commercial. Historically industrial.	Low - Moderate
		Direct Contact	Structures	Potentially Active	Potential sulphates onsite could be a risk to structural foundations. Ground investigation to confirm.	Low – Moderate
		Absorption in Root Zone	Plants	Potentially Active	Possible TPH, PAH, heavy metals and sulphates within the made ground demolition material and former industry on site/in immediate area.	Low – Moderate
Mobile Contaminants, Leachables e.g. from Pollution Sources Adjacent to Site/On Site	Historical Land- Use On Site	Leaching into Groundwater	Groundwater	Potentially Active	Potential for some migration due to anticipated cohesive and granular deposits.	Low
	Neighbouring Land Use Within 250m Of Site	Off-site Migration in Groundwater	Abstractions	Potentially Active	No current potable groundwater abstractions. Not in a Groundwater Source Protection Zone. Historic boreholes noted onsite.	Moderate
			Controlled Waters	Potentially Active	Surface water located on site, and adjacent to the eastern boundary. No water quality data for Irwell within GroundSure report.	Moderate
Organic and Inorganic Contaminants Within Soils / Groundwater	Historical Land- Use On Site Neighbouring Land Use Within 250m Of Site	Potable Water Supply Pipes	Utilities Workers	Potentially Active	Potential for lighter end hydrocarbon contamination including PAHs and TPHs. Ground investigation to confirm, then liaise with local water authority supplier.	Low – Moderate

8.2 Contamination Summary

In this qualitative risk assessment, a **Low / Moderate - Moderate** risk for ground gas and contamination exists across the site. Some remedial action may be necessary at the site, however, the likes of which cannot be confirmed until the geotechnical and contamination ground investigation has been completed.

8.3 Geotechnical Constraints

- Existing and redundant services across site.
- Potential tree heave as cohesive stratum anticipated (anticipated).
- Shallow groundwater.
- Depth of Made Ground / former foundations within the vicinity of former buildings and possible basements.
- Large buried structures.
- Culvert crosses site.
- Erosion of the riverbanks.
- Potential for deep saturated SILT deposits.
- Potential for coal workings in the south of the site.
- Former extraction wells onsite.

9 FIELDWORK

9.1 Fieldwork Objectives

The objectives of the intrusive ground investigation will be to:

- Clarify the 'Initial Contamination Conceptual Model'.
- Clarify the Initial Risk Assessment.
- Benchmark the contamination status of the site.
- Provide data for the design of any remedial works that may be required.
- Provide a geotechnical appraisal for the site.

9.2 Fieldwork Scope

The fieldwork was carried out between the 25th June – 2nd July 2019 and included the following:

- Eighteen (18 no.) machine excavated trial holes to between 0.60mbgl (TP16) and 3.50mbgl (TP10).
- Eleven (11no.) window sample boreholes to depths between 0.35mbgl (WS18) and 5.00mbgl.
 - A further three (3no.) locations were attempted but the concrete slabs were too robust to be cored.
- Four (4no.) rotary boreholes drilled to depths between 30mbgl (RO1) and 38mbgl (RO4).
- Six (6no.) ground gas monitoring visits over a period of at least three months with varying barometric pressures.
- Chemical analysis of forty-seven (47no.) samples.
- Analysis of forty-seven (47no.) samples for asbestos screening, with fifteen (15no.) samples for quantification.
- Analysis of three (3no.) water samples taken from WS1, WS8 and WS16.
- Analysis of four (4no.) surface water samples from the River Irwell and the onsite culverted stream.
- Collection and analysis of three (3no.) soil samples for geotechnical analysis.

The exploratory hole positions were selected and set out by Betts Geo Environmental Ltd (BGE) as shown on the Exploratory Hole Location Plan in Appendix B.

Surface water sampling locations were specified by Ecclestone Homes.

Services are present onsite, and are known to cross areas of planned investigation, however, the majority of services are located within the roads and footpaths. Prior to any intrusive works, each location was checked for services using a cable avoidance tool (CAT) and review of statutory service plans.

Rotary boreholes were targeted to the south of the site where coal mining was thought to be present.

Access was made via a gate on the small lane leading to the sports clubs. No access was allowed within the 60m exclusion zone for heavy plant (JCB & 13T excavator).

10 GROUND CONDITIONS

10.1 General

The exploratory holes were logged by an Engineer in general accordance with the recommendations of BS5930:1999+A2:2010. Detailed descriptions, together with relevant comments, are given in the Exploratory Hole Logs included in Appendix C.

Ground conditions typically consisted of a CONCRETE slab with reinforcement and a damp-proof course over either a very sandy GRAVEL of LIMESTONE or SANDSTONE, overlying a further CONCRETE slab and subbase. Some locations exhibited areas of possible reworked SAND and / or SILT.

The main site area was almost entirely covered by concrete slabs, and a number of locations showed secondary slabs at depth.

Natural strata consisted of both granular and cohesive strata, as well as shale bedrock at depth.

Excavation in TP16 showed significant amounts of water and potential contamination. Materials excavated were similar to those expected from the buildings strip and demolition (SAND to BOULDER graded materials).

The full logs should be consulted in conjunction with this summary.

10.2 Ground Conditions Summary

Strata	Description	Thickness (m)	
		Top	Base
TOPSOIL	Maintained grass over brown clayey gravelly occasionally cobbly fine to coarse SAND. Gravel and cobbles are fine to coarse angular to subangular of rootlets, brick, concrete, metal, timber, paper and textiles.	0.00	0.20
CONCRETE	Reinforced concrete slab with DPC. Often noted as 200mm thick at varying depths across the site. In-situ slabs occasionally noted as +600mm thick.	0.00	1.65
MADE GROUND - Granular	Made ground granular materials consisted largely of either a subbase such as limestone or sandstone gravel or a demolition type waste. Demolition wastes comprised mixed brick, concrete and sandstone, as well as metals, textile, plastic, papers, ash and glass. Granular made ground was prevalent across the site from shallow depth.	0.00	2.85
MADE GROUND - Cohesive	Cohesive made ground as identified as either reworked CLAY or SILT and was occasionally noted as having hydrocarbon or organic odours.	0.90	4.50
NATURAL - Cohesive	Cohesive strata were recorded as either CLAY and SILT and were often sandy. CLAY was noted as often having a significant granular content which became coarse with depth.	0.60	23.00
NATURAL -	Natural granular deposits were noted to be SAND, GRAVEL	1.35	9.50

Granular	and SANDS & GRAVELS. Coarse grained granular materials were usually recorded at a greater depth when compared to SAND.		
Bedrock	Dark grey shale with occasional sandstone bands	23.00	38.00

10.3 Visual and Olfactory Contamination

Significant visual and olfactory contamination was identified in a number of locations, as well as significant depths of Made Ground mentioned above. Notes on observed contamination are as detailed in the table below;

Exploratory Hole	Depth (mbgl)	Strata	Remark
TP1	1.00	MADE GROUND	Hydrocarbon odour
TP2	1.00		
TP5	2.25	Possible MADE GROUND	Slight organic odour
TP8	1.20	MADE GROUND	Black water with sheen and strong hydrocarbon odour.
TP16	0.60		Strong hydrocarbon and 'waste' type odour
WS1	2.75		Slight hydrocarbon odour
WS16	1.95		Hydrocarbon odour
	2.20		Slight organic odour

10.4 Obstructions

Concrete slabs were noted at surface and also at depth, some of these slabs were recorded in excess of 600mm thick.

A number of the slabs could not be cored and could not be broken out using a 13tonne machine, it is thought that these may be machine bases from the former paper mill.

The large hard slabs were noted around TP11, TP18, WS4, WS5 and WS19. It is likely that more of these slabs will be present at the site.

10.5 Groundwater – Fieldwork

Exploratory Hole	Depth (mbgl)	Strata	Remark
TP2	1.70	MADE GROUND:	Seepage
TP4	2.65	GRAVEL	Water Strike
TP5	2.25	MADE GROUND	
TP8	2.10		
TP10	1.75	MG / SILT	Damp
	3.50		Water Strike
TP11	1.35 – 3.00	SAND	Slightly Damp
TP13	1.80	SILT	Damp
TP16	0.60	MADE GROUND	Standing Water – with sheen and hydrocarbon odour
TP18	1.30	SILT	Slightly Damp

Exploratory Hole	Depth (mbgl)	Strata	Remark
WS1	2.75	MADE GROUND	Wet from 2.75mbgl
WS7	3.70 – 3.85	SAND	Water Strike
WS8	4.00	SAND	Water Strike
WS9	2.60	MADE GROUND	Water Strike
WS15	0.90	MADE GROUND	Standing Water
WS16	3.00	SILT	Water Strike

10.6 Groundwater – Post-Fieldwork Monitoring

The table below indicates groundwater encountered during the monitoring post fieldwork (1/6 visits have been undertaken);

Exploratory Hole	Depth to Water (mbgl)	Initial Depth to Base of Well (mbgl)
WS1	3.13	4.15
WS7	3.38	4.15
WS8	1.93	3.50
WS16	1.15	2.85

11 COAL MINING INVESTIGATION

The site lies at the base of the Rossendale Coalfield, part of the Carboniferous Pennine Lower Coal Measures of Namurian age. The Geological Survey shows a possible outcrop of the thin Holcombe Brook Coal across the southern part of the site dipping north and overlain by the thick drift deposits of an infilled glacial meltwater channel.

There are no relevant collieries and shaft sections in Ramsbottom and evidence of the presence of the Holcombe Brook Mine is derived from hillside exposures on the valley sides east and west of the site. Evidence for shales possibly lying above the seam was encountered in water wells bored for the former paper works which occupied the site.

The Holcombe Brook Coal is a variable and impersistent coal seam of poor quality and interbedded with black shales. The seam was occasionally mined on the hills above Rossendale where it was occasionally worked at outcrop, and has a thickness thought to be up to 300mm. There are no shaft sections showing the seam and no deeper coal seams of workable thickness in this part of Lancashire. The Coal Authority have no records of any mineshafts on or within 20m of the site. Coal mining in Rossendale is first recorded in 1612 at Gambleside on the eastern slope of the valley 3km north of the site where the Upper and Lower Mountain Mines outcrop. Four (4no.) rotary holes were sunk to depths between 30mbgl (RO1) and 38mbgl (RO4) and was undertaken with a Coal Authority Permit.

Rockhead is weathered and comprised of dark grey shales and sandstones at depths greater than 20m. Drilling did not show any workings or seams of coal. It is therefore deemed that the site is at Low Risk from Coal Mining.

12 LABORATORY TESTING

12.1 General

An assessment of potential determinants associated with the current/former site uses has been undertaken. Determinants originating from the current/former site uses may include metals, polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPHs) and asbestos. A general suite of testing should detect most potential contaminants.

Test	No. of Tests	Description
pH Values	50	Determination of pH (using Cyberscan pH meter).
Sulphate - Soluble 2:1 Extract	50	Dionex.
Arsenic, Cadmium, Chromium VI, Chromium III, Total Chromium, Lead, Mercury, Selenium, Copper, Nickel, Complex and Free Cyanide and Zinc.	50	Soil samples were analysed in accordance with UKAS/MCERTS standards Inductively coupled plasma atomic emission spectroscopy (ICP-OES)
Speciated Polycyclic Aromatic Hydrocarbons (PAH),	47	Determination of Polycyclic Aromatic Hydrocarbons by GC-MS. End/end extraction using DCM on as received sample. In house method modified USEPA 8270. Include coronene if required.
TPH CWG	47	TPH CWG (Aliphatics C5-6,>6-8,>8-10,>10-12,>12-16,>16-21,>2-35) (aromatics >C5-7,>7-8,>8-10,>10-12,>12-16,>16-21,>21-35) C5-8 fractions by Headspace GC-MS (003S). C8-35 fractions on as received sample extracted with hexane/acetone, aliphatic/aromatic splits run by GC-FID (005S), banded as listed above.
GRO/BTEX/MTBE by GC-FID (C5-10; C10-C12)	47	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12).
Organic Matter	47	Determination of Organic Matter by combustion.
Asbestos Screen	47	Visual Screening for Fibres.
Atterberg's	3	BS1377 Part 2. 1990, 4.3,5.3,5.4
Moisture Content	3	BS1377 Part 2. 1990, 3.2

13 CONTAMINATION ASSESSMENT

13.1 General

Contaminants of concern recorded at concentrations above relevant screening values are summarised below. For ease of description, the identification of contaminant sources and possible re-use of material, Topsoil, Made Ground, Natural Strata and Groundwater will be dealt with in separate sub-headings in this section of the report where required.

Our assessment is based on the following assumptions:

- The proposed site end use is of a high-risk rating (residential housing with gardens). For analysis purposes, 'residential with home grown produce' is deemed most appropriate end use.
- The superficial Alluvial deposits are classed as a Secondary A Aquifer (Moderate Permeability).
- The bedrock deposits of the Mudstone & Sandstone are classed as a Secondary A Aquifer (Moderate Permeability).
- It is deemed that some statistical analysis is appropriate. Where sample data numbers are low and/or targeted, each determinant result is reviewed further as an individual result as opposed to an average across the site.
- Site history has indicated a **Low - Moderate** risk of contamination and ground gas.
- Statistical analysis of the chemical test results has been undertaken in general accordance with Environment Agency 2009 SGV Guidance and AtRisk 2017 using the combined assessment criterion given by CLEA (Note: all SSVs for EA derivation are for a SOM of 6%, in line with Environment Agency Report SC050021/SR4 – this figure is deemed representative as an average value for a sandy loam soil). AtRisk 2017 are used to the nearest SOM percentage deemed appropriate.
- Potential free product was identified in TP16.
- Following the withdrawal of CLR 7-10 Guidance documents by the Environment Agency, statistical analysis has been undertaken in accordance with the CIEH/CL:AIRE 'Guidance on Comparing Soil Contamination Data with a Critical Concentration' (May 2008). As such, the use of the mean value test alone is not considered.

A full risk assessment is detailed within Section 13 of this report.

13.2 Soils Contamination Summary

13.2.1 Made Ground

Made Ground was encountered across site and comprised various heterogenous materials such as brick, concrete, metal and plastic etc and a sandy topsoil. Details of the exceedances are provided in the table below:

Location	Depth (mbgl)	Determinant	Soil Organic Matter Content (SOM) (%)	Observed Concentration (mg/kg)	Threshold Concentration (mg/kg)
TP1	0.10	Lead Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Dibenzo(ah)anthracene	7	290 16 15 17 2.4	200 8.54 2.05 9.86 1
	1.00	Lead Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Dibenzo(ah)anthracene Naphthalene Chrysotile & Amosite	5.3	280 12 10 13 1.4 1.3 <0.001 %	200 4.52 1.5 7.72 0.838 0.829 <0.001 %
TP2	0.50	Lead Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Dibenzo(ah)anthracene Naphthalene Chrysotile & Amosite	5.2	260 9.6 9.3 13 1.5 1 <0.001 %	200 4.52 1.5 7.72 0.838 0.829 <0.001 %
TP3	0.15	Lead Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Dibenzo(ah)anthracene Naphthalene Chrysotile & Amosite	5.9	250 25 23 28 3 9.7 <0.001 %	200 4.52 1.51 7.72 0.838 0.829 <0.001 %
	1.50	Lead TPH C16-C21 Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Dibenzo(ah)anthracene Indeno(123-cd pyrene) Naphthalene Chrysotile & Amosite	4.4	220 400 25 23 28 3 9.7 3.5 <0.001 %	200 319 4.52 1.5 7.72 0.838 7.31 0.829 <0.001 %
TP4	0.50	Chrysotile	0.8	<0.001 %	<0.001 %
TP5	1.70	Arsenic Chrysotile	6.2	46 <0.001 %	37 <0.001 %
TP6	0.50	Lead	7.8	970	200

TP9	0.20	Lead Chrysotile	4.4	430 0.001 %	200 <0.001 %
TP10	0.50	Chrysotile	2.7	<0.001 %	<0.001 %
TP11	0.50	Chrysotile	1.1	<0.001 %	<0.001 %
TP12	0.45	Chrysotile	2.6	0.095	<0.001 %
TP14	0.50	Chrysotile & Amosite	2.9	<0.001 %	<0.001 %
TP15	1.00	Chrysotile	3.7	<0.001 %	<0.001 %
TP16	0.60	Chrysotile	4.5	0.002 %	<0.001 %
TP17	0.60	Amosite	4.9	<0.001 %	<0.001 %
TP18	1.00	Lead	4.1	240	200
WS1	0.55	Arsenic Lead Chrysotile	6.3	67 670 0.002	37 200 <0.001 %
WS7	0.95	Arsenic Lead Benzo(a)pyrene Naphthalene	2.4	43 1100 2.8 0.94	37 200 1.51 0.829
WS8	0.50	Benzo(a)anthracene Benzo(a)pyrene Naphthalene	4.6	6.5 4.9 0.89	4.52 1.51 0.826
WS11	0.50	Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene	8.2	8.1 7.2 8.3	8.54 2.05 9.86
WS12	0.35	Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Dibenzo(ah)anthracene Naphthalene	2.9	8.5 7.2 7.8 0.88 13	4.52 1.5 7.72 0.838 0.829
WS16	0.75	Arsenic Lead	2.2	140 470	37 200
	2.00	Arsenic Lead	5	160 1100	37 200

13.2.2 Possible Made Ground / Natural

Possible MADE GROUND / natural strata was recorded in a number of locations and was commonly observed as a soft greyish brown / grey and black SILT.

Location	Depth (mbgl)	Determinant	Soil Organic Matter Content (%)	Observed Concentration (mg/kg)	Threshold Concentration (mg/kg)
TP5	2.25	Arsenic Benzo(a)pyrene	5.1	53 1.8	37 1.51
WS1	2.75	Lead	7.1	200	200

13.2.3 Naphthalene and VOCs / SVOCs

Naphthalene was recorded above the most stringent 1% SOM thresholds in a number of locations and may pose a risk to end users through volatilisation and ingress into the new structures. The list below highlights areas potentially at risk;

Location	Depth (mbgl)	Observed Concentration (mg/kg)	1% SOM Threshold Concentration (mg/kg)
TP1	0.10	1.1	0.829
	1.00	1.3	
TP2	0.50	1	
TP3	0.15	3.5	
	1.50	8.6	
TP5	1.00	0.84	
WS1	2.75	5.3	
WS7	0.95	0.94	
WS8	0.50	0.89	
WS11	0.50	7.7	
WS12	0.35	13	

Further to the above, positive detections of VOCs / SVOCs have also been observed in the locations detailed below;

Location	Depth (mbgl)	Determinant	Observed Concentration (mg/kg)	1% SOM AtRisk Threshold Concentration (mg/kg)
VOCs				
WS1	2.75	Ethylbenzene	0.001	-
		p & m-Xylene	0.015	-
		o-Xylene	0.011	-
		1,3,5-Trimethylbenzene	0.001	-
		1,2,4-Trimethylbenzene	0.037	-
SVOCs				
TP1	1.00	2-Methylnaphthalene	1.20	-
		Dibenzofuran	1.60	-
		Carbazole	1.50	-
		Anthraquinone	0.80	-
TP3	1.50	2-Methylnaphthalene	6.30	-
		Dibenzofuran	6.50	-
		Carbazole	6.00	-
		Anthraquinone	1.50	-
TP5	1.70	2-Methylnaphthalene	0.80	-
		Dibenzofuran	1.10	-
		Carbazole	0.80	-
		Anthraquinone	0.80	-
WS1	2.75	2-Methylnaphthalene	3.30	-
		Dibenzofuran	1.60	-
		Carbazole	1.00	-
		Anthraquinone	0.50	-
WS7	0.95	4-Chloroaniline	0.40	-
		2-Methylnaphthalene	0.70	-
		Dibenzofuran	0.80	-
		Carbazole	0.80	-
		Anthraquinone	0.60	-

- No current guidance using AtRisk Thresholds

13.2.4 Natural Strata

Location	Depth (mbgl)	Determinant	Soil Organic Matter Content (%)	Observed Concentration (mg/kg)	Threshold Concentration (mg/kg)
WS10	1.00	Benzo(a)anthracene	4.2	20	4.52
		Benzo(a)pyrene		14	1.5
		Benzo(b)fluoranthene		12	7.72
		Dibenzo(ah)anthracene		1.5	0.838

13.2.5 Asbestos

Asbestos, of varying types, was detected in a number of locations as detailed in section 13.2.1, with quantification only showing four locations with concentrations above detection limits (0.001%), as shown below;

Location	Depth (mbgl)	Asbestos Type	Observed Concentration (%)
TP9	0.20	Chrysotile	0.001
TP12	0.45		0.095
TP16	0.60		0.002
WS1	0.55		0.002

13.3 Controlled Waters Contamination

Water samples were collected from boreholes onsite, the culvert and the River Irwell, as stated below;

- Samples of groundwater were collected from WS1, WS8 and WS16.
- Samples from the River Irwell were labelled as US1 (Upstream) and DS1 (Downstream).
- Samples from the Culvert were labelled as MS1, MS2 and MS3 (Midstream).

Analysis of the water results has shown that the majority of determinants were below detection. However, there were several exceedances, as detailed in the table below;

Location	Determinant	Observed Concentration (µg/l)	Threshold Freshwater Surface (FS) & General Quality of Groundwater (GQGW) (µg/l)
WS1	Cyanide Arsenic	14	5 (FS: short-term value)
		9.35	7.5 (GQGW)
MS1b	Zinc	14	5 (FS: short-term value)
DS1	Zinc	12 (visit 1) 11 (visit 2)	10.9 (FS: long-term value)
US1 MS1 MS1b MS2 MS3	Copper	6.2 – 12 5.6 – 6.8 10 3.4 – 6.1 1	1* (FS: long-term value)

Location	Determinant	Observed Concentration (µg/l)	Threshold Freshwater Surface (FS) & General Quality of Groundwater (GQGW) (µg/l)
DS1	Copper	6 - 11	1* (FS: long-term value)

* Dependant on bioavailability

14 ENVIRONMENTAL RISK ASSESSMENT

14.1 General

This section assesses likely risks to the identified receptors, arising from potential contamination sources. It provides a final qualitative assessment of the risks involved, indicating whether (where appropriate) any immediate action is required to mitigate certain risks.

In assessing the risk qualitatively, it is appropriate to use the methods outlined in the CIRIA document C552, "Contaminated Land Risk Assessment a Guide to Good Practice". It uses a classification of risk based on the magnitude of the potential consequence or severity of risk occurring, compared with the magnitude of the probability or likelihood of the risk occurring. These are indicated on the attached tables in Appendix J.

The superficial deposits are classed as Secondary Undifferentiated Aquifer (Low Permeability) and the Bedrock deposits are classed as a Secondary A Aquifer (Moderate Permeability). With respect to human health, the proposed end use (residential with home grown produce) is of high sensitivity. Therefore, the site's environmental setting is considered to be of a **Moderate to High** environmental sensitivity. Transient risks to construction workers can be addressed by the adoption of appropriate health and safety measures (see Section 15.2), therefore, the primary residual risks that require assessment are Site End Users. The following sections are split into soils and groundwater for clarity.

14.2 Assessment of Contamination Analytical Results

Soils

A number of exceedances have been observed across the site within Made Ground strata, these are associated with various PAHs, TPH C16-C21, Lead, Arsenic and asbestos. PAHs include the SVOC, Naphthalene. Further to these, a number of VOCs / SVOCs have also been observed above detection limits.

The Made Ground exceedances have been recorded at varying depths between 0.10mbgl and 2.00mbgl. With deeper exceedances at 2.25mbgl (TP5) and 2.75mbgl (WS1), within potential Made Ground strata.

Based on the locations of TP5 and WS1, in relation to the formerly existing reservoirs, it is now considered likely that these are Made Ground samples from backfill / basal reservoir materials. As shown in the sketch below;



Occurrences of Dibenzo(ah)anthracene and Naphthalene are hotspots and statistically significant, and will therefore require further works, such as delineation, to mitigate the risk they pose to human health.

Double Ratio Plot analysis identified the source of the elevated benzo(a)pyrene in TP7 and TP8 to be coal derived. As the source is coal derived, the values may be compared against the DEFRA C4SL 2017 value of 4.95mg/kg due to a reduced bioavailability. Given that the results are below this threshold, minimal risk is anticipated from this source and it is deemed below residential thresholds in TP7 and TP8. The remaining benzo(a)pyrene exceedances are shown to likely sourced from Coal Tar / Creosote and cannot be discounted on this basis.

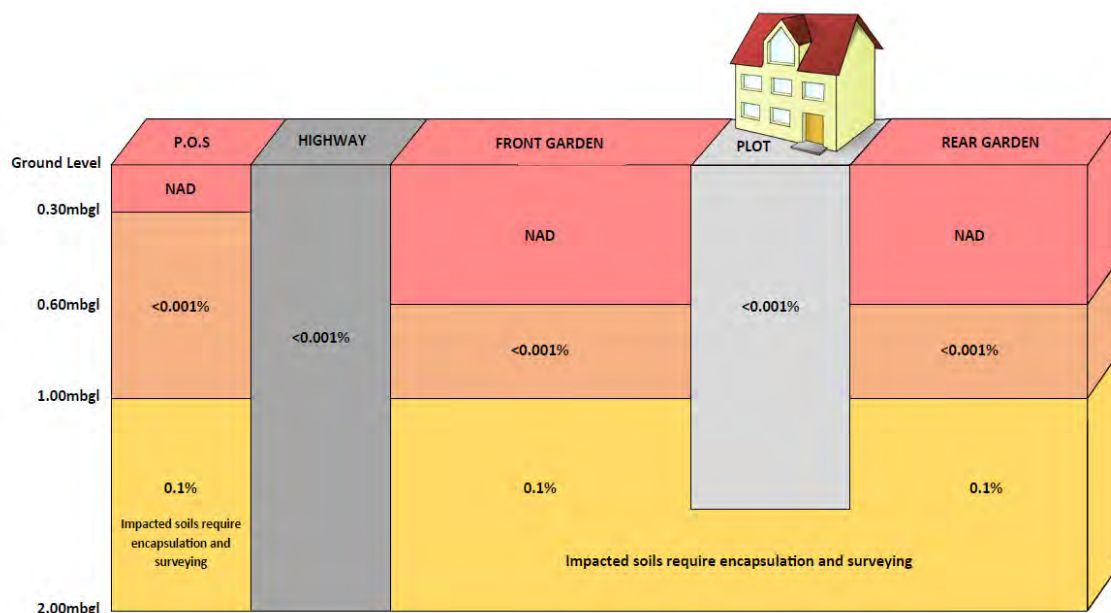
Statistical analysis of the Arsenic exceedances has shown that they are statistically significant and should be treated as hotspots, where they exceed the threshold value of 37mg/kg. Similarly, the occurrences of Lead are also considered significant and will require further works or mitigation in locations where they exceed 200mg/kg.

Asbestos (Amosite and Chrysotile) was identified in a number of locations with quantification testing recording concentrations within soils ranging from 0.001% (TP9) to 0.095% (TP12).

The presence of asbestos within the Made Ground is likely due to poorly managed historical demolition which the fill is largely comprised of and the practice of incineration of waste materials without prior screening. ICRCL Guidance Note 64/85 "Asbestos on Contaminated Sites" (1990) is still the most current guidance for asbestos in soil and suggests asbestos fibres should be <0.001% w/w within soil. Dutch and Australian Guidance also suggest the use of a threshold of 0.001% as a threshold for asbestos in soil. The Dutch Guidelines consider the risk from Chrysotile to be ten times less than Amphibole asbestos but the HSE, WHO, the Australian DoH and the USEPA have chosen not to distinguish between different asbestos fibre types.

The concentration (0.095%) of Chrysotile asbestos within the ash fill in TP12 at 0.45m potentially poses a significant risk to end users and construction workers, if the material is exposed and soil and asbestos fibres allowed to become airborne. Groundworks should follow CAR-SOIL™ Guidance. Given that the material used to back fill comprises a high percentage of demolition waste, the presence of further asbestos is likely. Detections of asbestos are also likely to occur the demolition waste stockpiles that exist onsite.

Below is a sketch showing levels of asbestos concentrations and locations where they are commonly accepted / unacceptable. This should be confirmed with the Local Authority prior to implementation, and should therefore only be used as a guide;



Notes:

P.O.S - Public Open Space

NAD - No Asbestos Detected

0.001% - Soils may contain ≤0.001% using composite testing to ensure there is no potential risk to human health. Value is present where there may be short-term low level exposure of soils containing trace asbestos fibres by construction workers where an appropriate level of asbestos management is employed (e.g. dust suppression).

0.1% - Soils at depth of >1.00mbgl may contain <0.1% asbestos using composite testing where they will be not likely not be disturbed in the future and will therefore be in an area of Low Sensitivity. Risk assessment completed in accordance with the Asbestos JIWG Risk Assessment Tools.

Undefined - Dependant upon soils encountered during earthworks, which may be placed at depths to ensure no potential risk to human health.

Burial and encapsulation of asbestos should be agreed with regulators and consultant prior to the works being undertaken. Consideration should also be made to CAR-SOIL™.

In general, widespread contamination was observed across the site, in conjunction with several hotspots.

Further investigation into the stockpiles is advised. Movement of these materials should also be carried out using correct dampening down methods.

A minimum thickness of 600mm of debris-free soil is required within garden areas and landscaped areas as a capping system to mitigate residual risk to site end users from the asbestos and remaining determinants. It is also anticipated that the secondary slabs will be containing further contamination not observed during the investigation due to plant access limitations within the exclusion zone. The capping is to be made up of imported subsoil and topsoil.

Several areas of hydrocarbon odours were noted across the site during investigation; however, these were not substantiated in testing. As a result, a hydrocarbon vapour resistant membrane may be required across the site to mitigate nuisance risk – this is to be reviewed following the site strip.

Groundwater and Aquifer Risk

Various exceedances have been noted within surface and groundwater samples. As summarised below;

Location	Determinant	Observed Concentration (µg/l)	Threshold Freshwater Surface (FS) & General Quality of Groundwater (GQGW) (µg/l)
WS1	Cyanide Arsenic	14 9.35	5 (FS: short-term value) 7.5 (GQGW)
MS1b	Zinc	14	5 (FS: short-term value)
DS1	Zinc	12 (visit 1) 11 (visit 2)	10.9 (FS: long-term value)
US1 MS1 MS1b MS2 MS3	Copper	6.2 – 12 5.6 – 6.8 10 3.4 – 6.1 1	1* (FS: long-term value)
DS1	Copper	6 - 11	1* (FS: long-term value)

* Dependant on bioavailability

Exceedances for Copper have been noted in all holes. There is little to no variation between upstream and downstream samples, so the source is likely located upstream of the site. No elevated levels of copper were identified on site within the soils suggesting the source is on site.

The water sampled in WS1 are thought to be perched waters within the made ground strata it is therefore not considered representative of true groundwater at the site. Based on site history, the types of contamination and levels observed are considered typical of a site such as this. Downstream and midstream sampling has not showed correlating results, so the onsite perched waters are not considered to be in significant continuity with the River Irwell.

The downstream and midstream samples show a minor Zinc exceedance against the long-term mean threshold. On the basis, that this is a short sampling period with a minor exceedance, continued monitoring is likely to show mean concentrations below the threshold. No elevated levels of zinc were identified on site within the soils suggesting the source is on site.

No significant risks to sensitive water abstractions/controlled waters are anticipated due to the following: no groundwater abstractions within 500m of site, no significant link between onsite and River Irwell chemical concentrations.

The risk to groundwaters / aquifers is therefore deemed as Low.

15 GROUND GAS ASSESSMENT

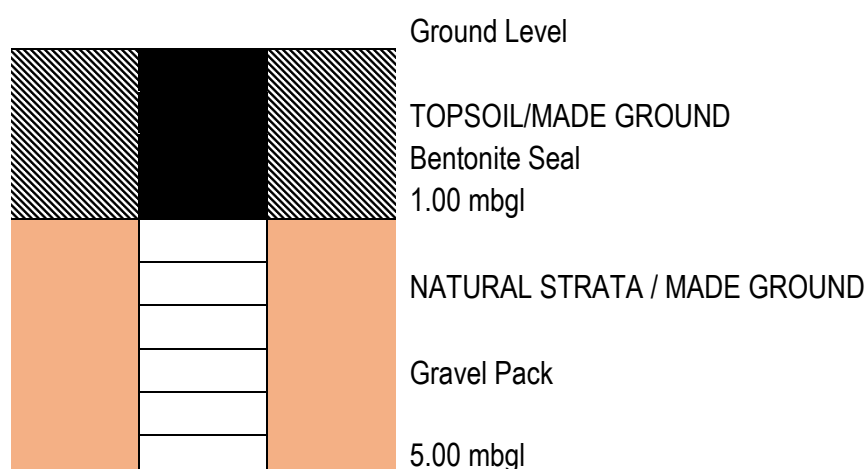
15.1 Ground Gas Requirements – Radon

The EnviroCheck data states that the site is within a low probability radon area (1-3% of properties above the action level).

15.2 Ground Gas Assessment

15.2.1 Ground Gas Boreholes Installations

The four (4 No.) boreholes were all installed up to 5.00 mbgl with 1.00 m of plain pipe and between 4.0 m of slotted pipe. A typical installation is shown below;



15.2.2 Summary of Results

Six out of six (6/6) ground gas visits have been undertaken, and gas monitoring is now completed, and the results are summarised below (see Appendix E for full details).

Location	Peak Gas Flow (l/h)	Atmospheric Pressure Range (mb)		Peak CH ₄ (%)	Peak CO ₂ (%)	Minimum O ₂ (%)	Gas Screening Value (GSV) (l/h)	
		Min	Max				CH ₄	CO ₂
WS1	<0.1	985	1006	0.10	4.30	16.70	0.0001	0.0043
WS7	0.1	985	1006	0.10	3.60	14.10	0.0001	0.0036
WS8	0.1	985	1006	0.10	9.70	14.10	0.0001	0.0097
WS16	0.1	985	1006	0.10	0.60	18.80	0.0001	0.0006

15.2.3 Guidance

Three recent publications are used for ground gas risk assessment:

- 'Guidance on Evaluation of Development Proposals on Sites Where Methane and Carbon Dioxide are Present', Report Edition No.04 March 2007 NHBC – designed for use with low rise residential properties.
- CIRIA C665 'Assessing risks posed by hazardous ground gases for buildings' 2007 - for high rise residential / flats.
- BS8485:2015 'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'.

Further details / accompanying notes for the following gas risk assessment are enclosed in Appendix G. The proposed development at the site is private residential two-storey houses, therefore assessments using the NHBC Guidance are deemed most appropriate.

15.2.4 Gas Recommendations

Elevated CO₂ has been observed in one location, WS8, which showed a maximum concentration of 9.70%. Whilst this is close to the suggested Amber 1 / Amber 2 threshold, it does not exceed it. Further to this, when taking gas flow into account, the calculated gas screening value (GSV) is significantly lower than the Amber 1 / 2 - threshold, showing there is little driving force to mobilise the ground gas.

From a review of the strata identified, the majority of made ground was granular in nature with no significant organic matter noted to suggest significant ground gas production or migration. Small pockets of organic material may be present within the alluvial material or other made ground on site. When alluvium or peat was deposited it contained organic material. Initially this would have degraded to produce methane gas. However, only the labile (easily degradable material) would have been used up. Old recalcitrant peat such as deep peat layers in alluvium generates very little new methane. As was generated it would have been emitted from the surface of the alluvium before being encased beneath made ground. Therefore, the ongoing risk from ground gas from this source is low.

On the basis of the above, the site can be classed as Amber 1 / CS2. The site will require low level gas protection measures to be installed.

A number of volatile odours and VOCs/SVOCs were noted within the Made Ground during the site investigation however were not substantiated in testing. A hydrocarbon vapour resistant membrane may be required across the site to mitigate nuisance risk – this is to be reviewed following the site strip and localised remediation.

16 REVISED CONCEPTUAL SITE MODEL

16.1 General

The Initial Conceptual Site Model has been amended in light of data obtained during the ground investigation, most notably the arsenic and lead contaminated soil in relation to the screening criteria for the proposed end use.

16.2 Final Conceptual Site Model

This section reassesses likely risks to the identified receptors, arising from potential contamination sources. It provides a final qualitative assessment of the risks involved, indicating whether (where appropriate) any immediate action is required to mitigate certain risks. It also discusses (where appropriate) what longer term measures or remedial works may be required in the future if the site were to be developed. It is considered that the site has not been assessed by the Local Authority as a contaminated site under the terms of the Environmental Protection Act 1990 Part IIa.

Target (Receptor)	Potential Source-Pathway Linkage	Remedial Action Required (where appropriate)	Est. Degree of Risk to Target Following Remedial Action Where Necessary
Site End Users	Inhalation of soil gases, odours or dust.	Site classed as Amber 1 / CS2. Low level gas protection measures required.	Low
Site End Users	Ingestion of, and skin contact with, contaminated soil.	Full 600mm clean and inert capping required across the site. No dig layer may be required due to presence of asbestos.	Low
Site End Users	Ingestion of contaminants in vegetables etc. or in soils adhering to vegetables, etc	Full 600mm clean and inert capping required across the site. No dig layer may be required due to presence of asbestos.	Low
Construction/ Maintenance Workers	Inhalation of soil gases, odours or dust.	PPE (gas monitoring data suggests ground gas will not affect construction workers; this is subject to further monitoring)	Low (assumed basic PPE is used)
Construction/ Maintenance Workers	Ingestion of, and skin contact with, contaminated soil.	PPE (gas monitoring data suggests ground gas will not affect construction workers; this is subject to further monitoring)	Low (assumed basic PPE is used)
Plants	Adverse effects on growth caused by presence of phytotoxic contaminants in soil.	Full 600mm capping required across the site.	Low
Buildings and Structures	Flow of ground gas into buildings. Asphyxiation, toxicity, explosion and fire hazards.	Site classed as Amber 1 / CS2. Low level gas protection measures required.	Low
Foundations	Sulphate attack of foundations	Foundations to be designed as per section 16.4.	Low
Water Supplies	Hydrocarbons penetrating plastic water supply pipes.	United Utilities pipeline risk assessment required. Protect-A-line to be allowed for in costings.	Low
Groundwater	Migration of soluble contaminants into	No sensitive receptors within influencing	Low

	groundwater on or off site.	distance.	
Surface Water	Migration of soluble contaminants and/or direct run-off of contaminants.	Limited impact on surface water from site, possible sources of contamination located upstream.	Low

17 OUTLINE STRATEGY FOR RISK REDUCTION / REMEDIATION STRATEGY

17.1 General

The following section details any recommendations to reduce risk on site and recommends remedial actions (as per the previous sections of this report). For clarity, the section is split into sub-sections as per the conceptual site model (Section 14).

17.2 Construction / Maintenance Workers

A number of exceedances have been observed across the site within Made Ground strata, these are associated with various PAHs, TPH C16-C21, Lead, Arsenic and asbestos. PAHs include the SVOC, Naphthalene. Further to these, a number of VOCs / SVOCs have also been observed above detection limits.

There are currently no assessment criteria for risks to construction workers, the following recommendations should be adhered to during site works:

- Site workers should wear gloves, boots and overalls and wash their hands before eating, drinking and smoking. Excessive dust generation should be avoided.
- It is recommended that during all excavations adequate ventilation should be maintained. If man entry into excavations is required, gas monitoring should be carried out as a precaution.
- If areas of suspected contamination are found then a suitably qualified person should undertake appropriate sampling, testing and further risk assessment.
- Although asbestos was not encountered on site, vigilance should be adhered, and any suspected asbestos should be notified, and a suitably qualified person appointed to inspect.

17.3 Site-End Users

A minimum thickness of 600mm of debris-free soil is required within garden areas and landscaped areas as a capping system to mitigate residual risk to site end users from the asbestos and remaining determinants. It is also anticipated that the secondary slabs will be containing further contamination not observed during the investigation due to plant access limitations within the exclusion zone. The capping is to be made up of imported topsoil and subsoil.

Several areas of hydrocarbon / volatile odours were noted across the site during investigation; however, these were not substantiated in testing. As a result, a hydrocarbon vapour resistant membrane may be required across the site to mitigate nuisance risk – this is to be reviewed following the site strip.

17.4 Ground Gas Protection Measures

As per Section 15.2.4, the site can be classed as Amber 1 / CS2. The site will require low level gas protection measures to be installed. This would usually consist of a 150mm passively vented subfloor void and a taped and sealed gas resistant membrane.

A number of volatile odours and VOCs/SVOCs were noted within the Made Ground during the site investigation however were not substantiated in testing. As a result, a hydrocarbon vapour resistant membrane may be required across the site to mitigate nuisance risk – this is to be reviewed following the site strip / Remediation.

17.5 Off-Site Disposal of Soils

Other than removal of hardstanding, no significant changes in site levels are understood to be proposed. However, any waste is likely to require excavation and offsite disposal and result in significant development costs.

The handling, re-use or disposal of waste is regulated by the Environment Agency. Any material excavated on-site may be classified as waste and it is the responsibility of the holder of a material to form their own view on whether or not it is waste. One of the ways this can be achieved is set out in the Development Industry Code of Practice (CoP; Ref. 13). This builds on the Environment Agency guidance document Definition of waste: developing greenfield and brownfield sites (2006). The Agency will take into account the use of the CoP in deciding whether to regulate materials as waste. If materials are dealt with in accordance with the CoP, the Agency considers that those materials are unlikely to be waste at the point when they are to be used for the purpose of land development.

All material proposed for off-site disposal (e.g. during future construction works) should be given a proper description and waste classification assessment as required by the Environmental Protection Duty of Care Regulations (Ref. 14), and in accordance with WM3 and the Environment Agency Technical Guidance on the assessment and classification of Hazardous Waste.

The chemical laboratory data has been screened using the online Hazwaste™ software and the laboratory test results indicate that, generally, the materials onsite would be classified as Non-hazardous.

However, several samples across the site have been shown to be hazardous, these are listed in the table below, these results should be read in conjunction with the Hazwaste™ report in in Appendix K.

Location	Depth (mbgl)	Comments
TP3	1.50	HP7 - Carcinogenic - TPH (C6 to C40) HP11 – Mutagenic - TPH (C6 to C40)
TP9	0.20	HP14 – Ecotoxic - Zinc sulphate
WS7	0.95	HP7 - Carcinogenic - Lead
WS6	0.55	HP8 - Corrosive - pH
WS16	2.00	HP7 - Carcinogenic - Lead

No allowance can be made for classification of materials between exploratory hole locations.

The recorded asbestos concentrations fall below the Hazardous Waste threshold (>0.1%) and no visible asbestos materials were observed.

It is recommended that the results of the contamination testing (including the history of the site) be

presented to the proposed landfills to obtain their acceptance of the information to date. However, further testing maybe required to fully assess the waste classification of the soils requiring offsite disposal. A copy of the Hazwaste™ summary report is presented in Appendix K. The results of these tests should be confirmed by the proposed waste receiver.

Segregation of the Topsoil, Made Ground and Natural Strata should be possible given the chemical analysis and very different visual identification.

17.6 Piped Drinking Water Supplies

The use of Protect-A-line is anticipated; however, a pipeline assessment should be undertaken to confirm.

18 GEOTECHNICAL ASSESSMENT

18.1 Introduction

It is understood that the proposed development will consist of construction of residential properties with associated rear gardens, associated infrastructure, public open space and new highway. Associated foundation loadings are anticipated to be low.

18.2 Site Preparation and Excavation

Excavations undertaken during site works were unstable within the made ground, all excavations should be planned, and due consideration should be given to providing temporary support or suitable battering. Excavations should be regularly inspected by a competent person to ensure continued safety. Further advice on the safety of excavations is given in *Health and Safety in Construction*. Shallow (<1.20mbgl) excavations for service trenches should be straight forward however, could be complicated by variable Made Ground on site.

18.3 Control of Groundwater

Limited shallow groundwater was encountered on site however perched groundwater was encountered in several locations. It is likely that provision of pumping / shuttering will be necessary during excavation of foundation trenches during wet weather and to deeper excavations for sewers etc. It is good practice to have such equipment on standby in case of seasonal / abnormal weather conditions.

Should sewers/excavations deeper than the boreholes/trial pits undertaken be required, further SI will be needed.

18.4 Foundations

Due to depths of Made Ground and saturated SILTS being identified at depth, the variable nature of the Made Ground, and the potential for secondary slabs and deep obstructions, a piled solution is advised.

Given the generally granular nature of Made Ground and the both cohesive and granular nature of natural soils on site, a driven piled solution should be taken to the appropriate strata.

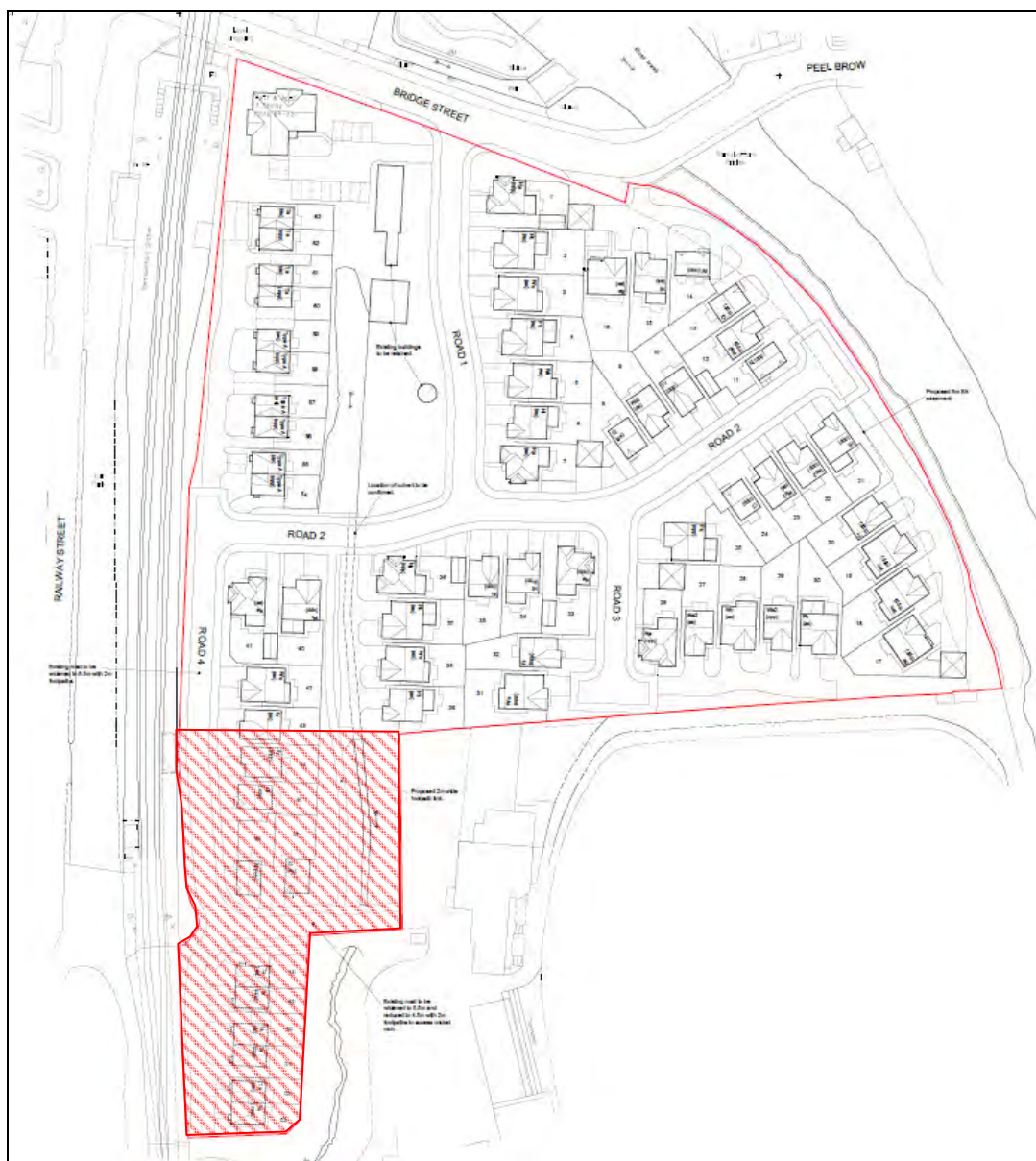
Suitable strata applicable to piling is thought to be at least 20mbegl.

A specialist piling foundation contractor should be consulted with regards to the design of the foundations, suitability of piled solution and provision for proof digging plots to remove obstructions.

The southern spur area, which is underlain by a landfill, has been shown to be heavily contaminated. Possible natural strata are located at 5.00-5.50mbgl, with bedrock noted at 21.00-23.00mbgl. Due to the levels of contamination observed in these areas a piled solution may pose a significant risk to groundwater, and another solution may be required. Additional investigation post water monitoring / risk assessment is advised in this locality.

Due to proximity of railway and possibly interconnected bodies of fill / water care must be taken when considering remedial work / foundations in this locality.

The anticipated impacted area is shown below;



18.5 Ground Floor Construction

Suspended floor construction e.g. either in-situ RC slabs or block and beam flooring is recommended as per NHBC guidance.

18.6 Soakaway

Soakaway tests were not undertaken due to anticipated contamination and depth of Made Ground.

18.7 Heave / Shrinkage Potential

Significant shallow cohesive strata were not observed at the site, testing may be undertaken once site levels are confirmed and an assessment of the depth to cohesive strata can be made.

18.8 Highway

According to the criteria of Highways Agency HD 25/95 Volume 7 Section 2 Part 2 HD 25/94, a CBR value of circa 3-5% on the Made Ground is anticipated, however confirming in-situ CBR's should be undertaken once layouts and levels are known.

Placement of geotextiles within the areas of roads / parking could also be designed to minimise the subgrade thickness.

18.9 Protection of Buried Concrete

It is considered for concrete design purposes that a brownfield site and mobile groundwater conditions are applicable.

Given the levels of 2:1 water soluble sulphate identified in the vicinity of TP1, TP3 and TP5, a design class of DS-2, an ACEC class of AC-2 and a designated concrete class of DC2 is recommended in this area.

The remainder of the site can be recommended for a design class of DS-1, an ACEC class of AC-1 and a designated concrete class of DC-1.

19 Further Works

19.1 Further Works Summary

The following works are required to adequately characterise the site and provide a basis to mitigate risk to human health and the environment;

- Sampling of stockpiles left onsite from demolition works.
 - Additional trial pitting and sampling post slab removal. Access issues within the 60m exclusion zone are likely to remain.

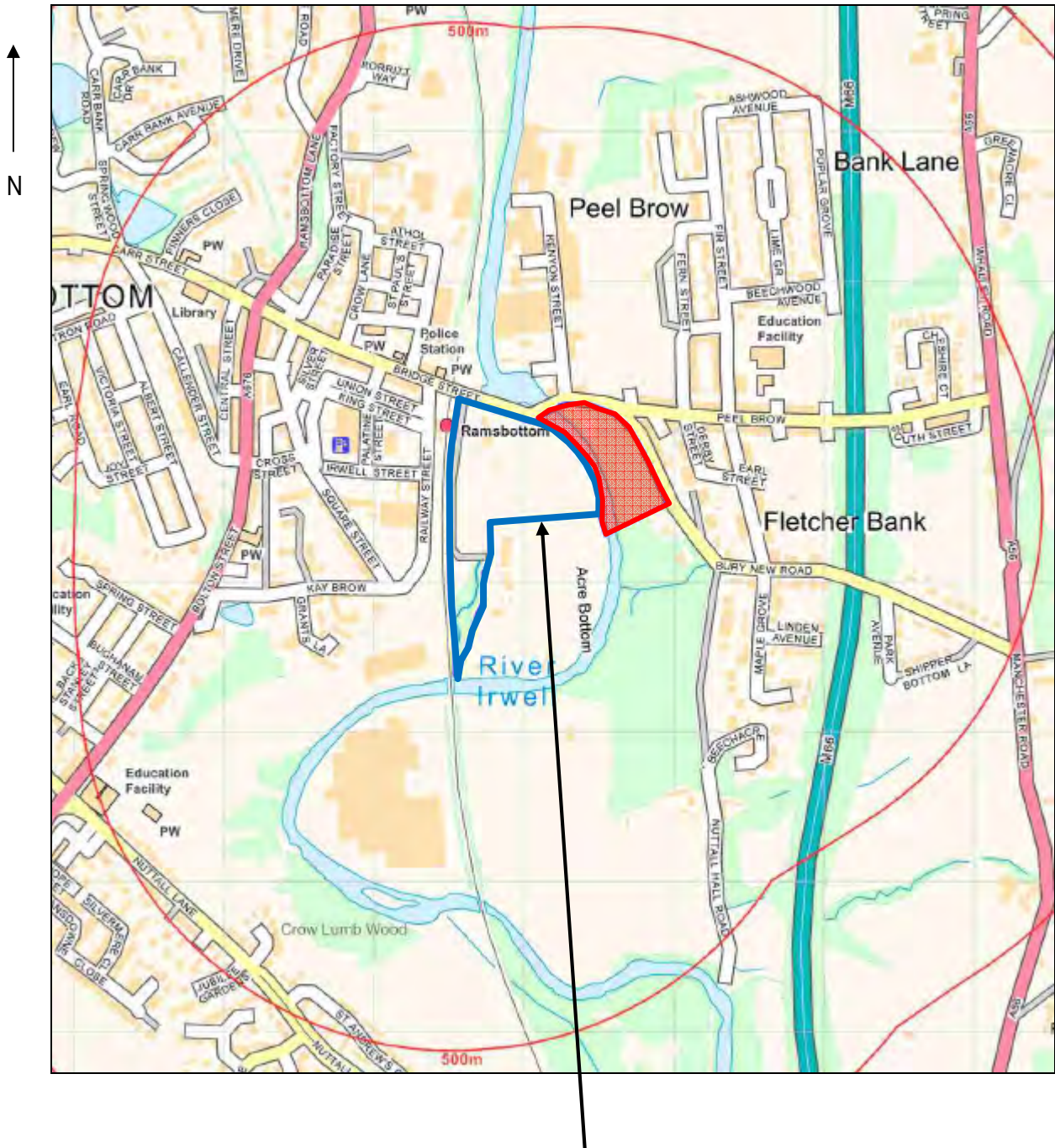
20 REFERENCES

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- 20.2** *BS 5930:2015 Code of Practice for Site Investigation.*
- 20.3** *BS1377: 2016 Methods of Test for Soils for Civil Engineering Purposes.*
- 20.4** *Assessment of risks to human health from land contamination: an overview of the development of guideline values and related research. EA, 2002.*
- 20.5** *Contaminated Land Risk Assessment; A Guide to Good Practice; CIRIA C552: 2001.*
- 20.6** *Health and Safety in Construction, HSG150, HSE, 1996.*
- 20.7** *Hazardous Waste: Interpretation of the Definition and Classification of Hazardous Waste, Environment Agency, WM2 Version 1.0, June 2003.*
- 20.8** *DoE (1991), The Building Regulations Approved Document C, Site Preparation and Resistance to Moisture, HMSO.*
- 20.9** *Baker W (1987), Investigation Strategy - lecture at City of Birmingham Development Department Symposium on Methane Generating Sites, 9 December 1987, Industrial Research Laboratories, Birmingham.*
- 20.10** *NHBC Standards, Chapter 4.2, 2017 Building Near Trees.*
- 20.11** *Highways Agency HD 25/95 volume 7 section 2 Part 2 HD 25/94.*
- 20.12** *Water Regulations Advisory Scheme (2002) The selection of materials for water supply pipes to be laid in contaminated land.*
- 20.13** *Anon (1997) Dutch in Policy Retreat on Contaminated Land ENDS (Environmental Data Services), 269, 46.*
- 20.14** *Piling In Layered Ground: Risks to Groundwater and Archaeology Science Report SC020074/SR Environment Agency October 2006.*
- 20.15** *Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention National Groundwater & Contaminated Land Centre report NC/99/73 F J Westcott, C M B Lean & M L Cunningham May 2001.*
- 20.16** *'Guidance on Evaluation of Development Proposals on Sites Where Methane and Carbon Dioxide are Present', Report Edition No.04 March 2007 NHBC – designed for use with low rise residential properties.*
- 20.17** *CIRIA C665 'Assessing risks posed by hazardous ground gases for buildings' 2007 - for high rise residential / flats.*
- 20.18** *BS8485:2015 'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'.*
- 20.19** *BRE 414 'Protective measures for housing on gas-contaminated land' Roger Johnson, Parkman Environment 2001.*

- 20.20** *BS 8500- 1:2006 'Concrete – Complementary British Standard to BS EN 206-1 – Part 1: Method of specifying and guidance for the specifier' November 2006.*
- 20.21** *'Planning Policy 23: Planning and Pollution Control' Office of the Deputy Prime Minister 2004.*
- 20.22** *CLR11 'Model Procedures for the Management of Land Contamination' DEFRA 2004.*
- 20.23** *BRE 465 'Cover Systems for Land Regeneration' 2004.*
- 20.24** *'The UK Approach for Evaluating the Human Health Risks from Petroleum Hydrocarbons in Soils, Environment Agency Science Report P5-080/TR3', Environment Agency (May 2005).*
- 20.25** *TOX12- Contaminants in Soil: Collation of Toxicological Data and Intake Values for Humans. Dioxins, Furans and Dioxin-like PCBs' Environment Agency 2003.*
- 20.26** *Atkins AtRisksoil.co.uk SSV's derived using CLEA for 1 or 6% SOM. Residential with home grown produce.2017*

APPENDIX A

(i) Site Location Plan



Site Location Plan

The site is located to the south of Bridge Street and north of Ramsbottom Cricket Club in Ramsbottom. The site has an approximate postcode of BL0 9AL, with coordinates on the British National Grid of 379433,416756. The proposed site is approximately 4.61 hectares in total.

APPENDIX B

(i) Exploratory Hole Location Plan



NOTES

DO NOT SCALE

THIS SKETCH SHOWS LOCATIONS OF EXPLORATORY HOLES UNDERTAKEN BY BETTS GEO IN JUNE 2019 AND INDICATIVE LOCATIONS OF SERVICES DIGITISED FROM SERVICE PLANS AND 60m EXCLUSION ZONE AROUND THE EXISTING CHIMNEY ON SITE OVERLAIN AN AERIAL IMAGE TAKEN FROM GOOGLE MAPS (IMAGERY ©2019 Google, MAP DATA ©2019 Google, www.google.co.uk/maps).

- SITE BOUNDARY
- POSSIBLE INVASIVE SPECIES
- NO ACCESS
- CHIMNEY
- 60m EXCLUSION ZONE
- WS1
- WATER SAMPLE [6]

- EXPLORATORY HOLES**
- TP1 TRIAL PIT [18]
 - BH1 ROTARY BOREHOLE [4]
 - WS2 WINDOW SAMPLE [12]
 - WS4 WINDOW SAMPLE - ABANDONED [3]
 - WS1 WINDOW SAMPLE WITH GAS INSTALL [4]

- SERVICES**
- SEWAGE
 - WATER
 - GAS
 - ELECTRICITY
 - TELECOMMUNICATIONS

A	12/07/19	RD	WATER SAMPLING LOCS ADDED	KR
---	----------	----	---------------------------	----

REV	DATE	BY	DESCRIPTION	CHK
-----	------	----	-------------	-----

DRAWING STATUS: **DRAFT**



BETTS GEO
CONSULTING ENGINEERS

Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 enquiries@betts-associates.co.uk



eccleston homes

PROJECT:

HOLCOMBE MILL
BRIDGE STREET
RAMSBOTTOM

TITLE:

EXPLORATORY HOLE
LOCATION PLAN

DATE: 12/07/19	SCALE @ SIZE: 1:1550 @ A3	DRAWN: RD	CHECKED: KR
PROJECT No: 19ECH016	DRAWING No: 1	REV: -	

APPENDIX C

(i) Historical Maps

Site Details:

HOLCOMBE MILL, BRIDGE STREET, RAMSBOTTOM, BLOBS

Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: County Series

Map date: 1850-1851

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1847
Revised N/A
Edition 1850
Copyright N/A
Levelled N/A

Surveyed 1848
Revised N/A
Edition 1851
Copyright N/A
Levelled N/A

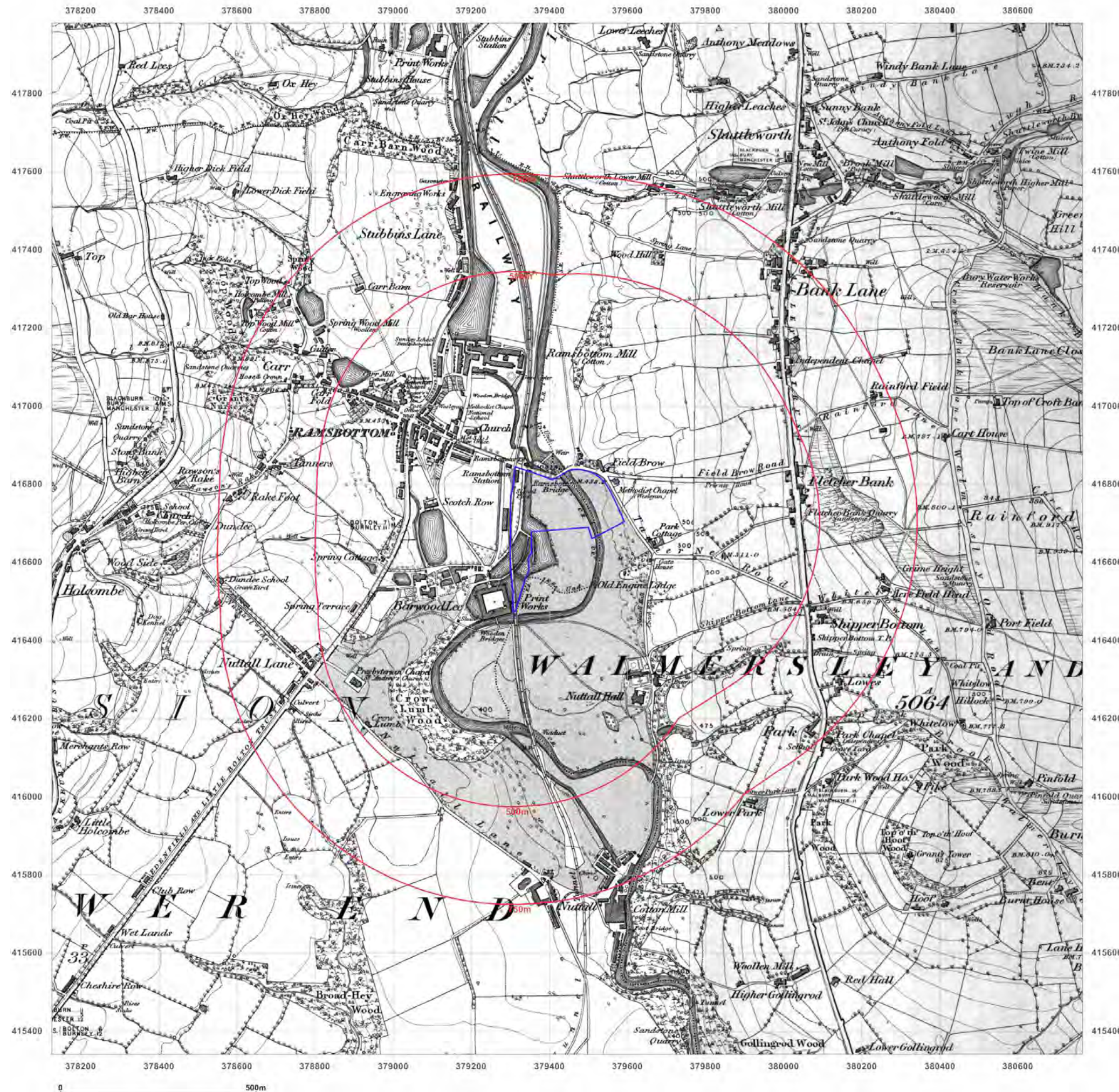


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Production date: 09 May 2019

Map legend available at:
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Site Details:

HOLCOMBE MILL, BRIDGE STREET, RAMSBOTTOM, BLO OBS

Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: County Series

Map date: 1891

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1891
Revised 1891
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1891
Revised 1891
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1891
Revised 1891
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1891
Revised 1891
Edition N/A
Copyright N/A
Levelled N/A

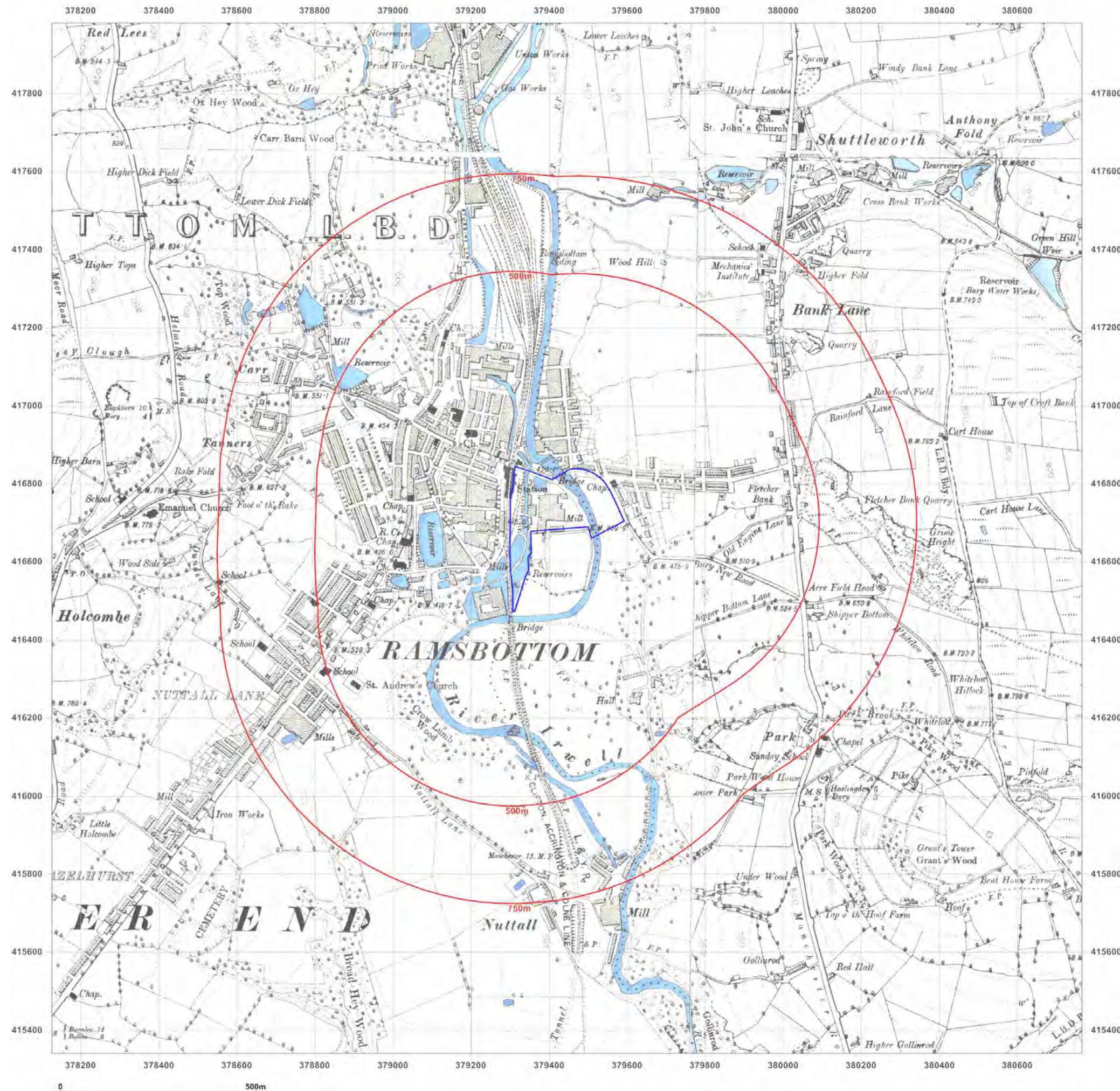


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Site Details:

HOLCOMBE MILL, BRIDGE STREET, RAMSBOTTOM, BLO
OBS

Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: County Series

Map date: 1908

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1847
Revised 1908
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1848
Revised 1908
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1848
Revised 1908
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1848
Revised 1908
Edition N/A
Copyright N/A
Levelled N/A

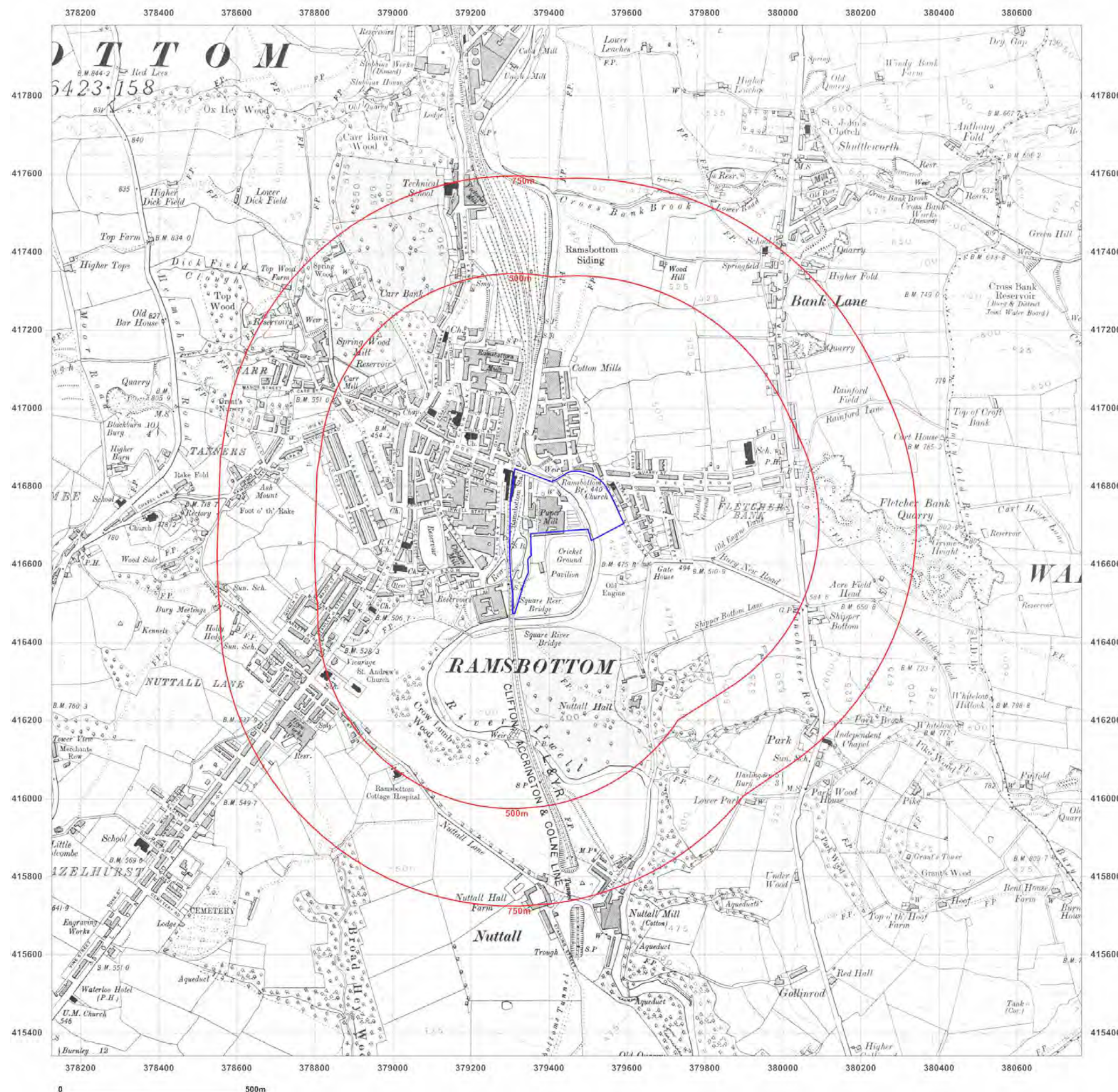


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Site Details:

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Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: County Series

Map date: 1927-1928

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1847
Revised 1927
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1848
Revised 1927
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1848
Revised 1927
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1848
Revised 1928
Edition N/A
Copyright N/A
Levelled N/A

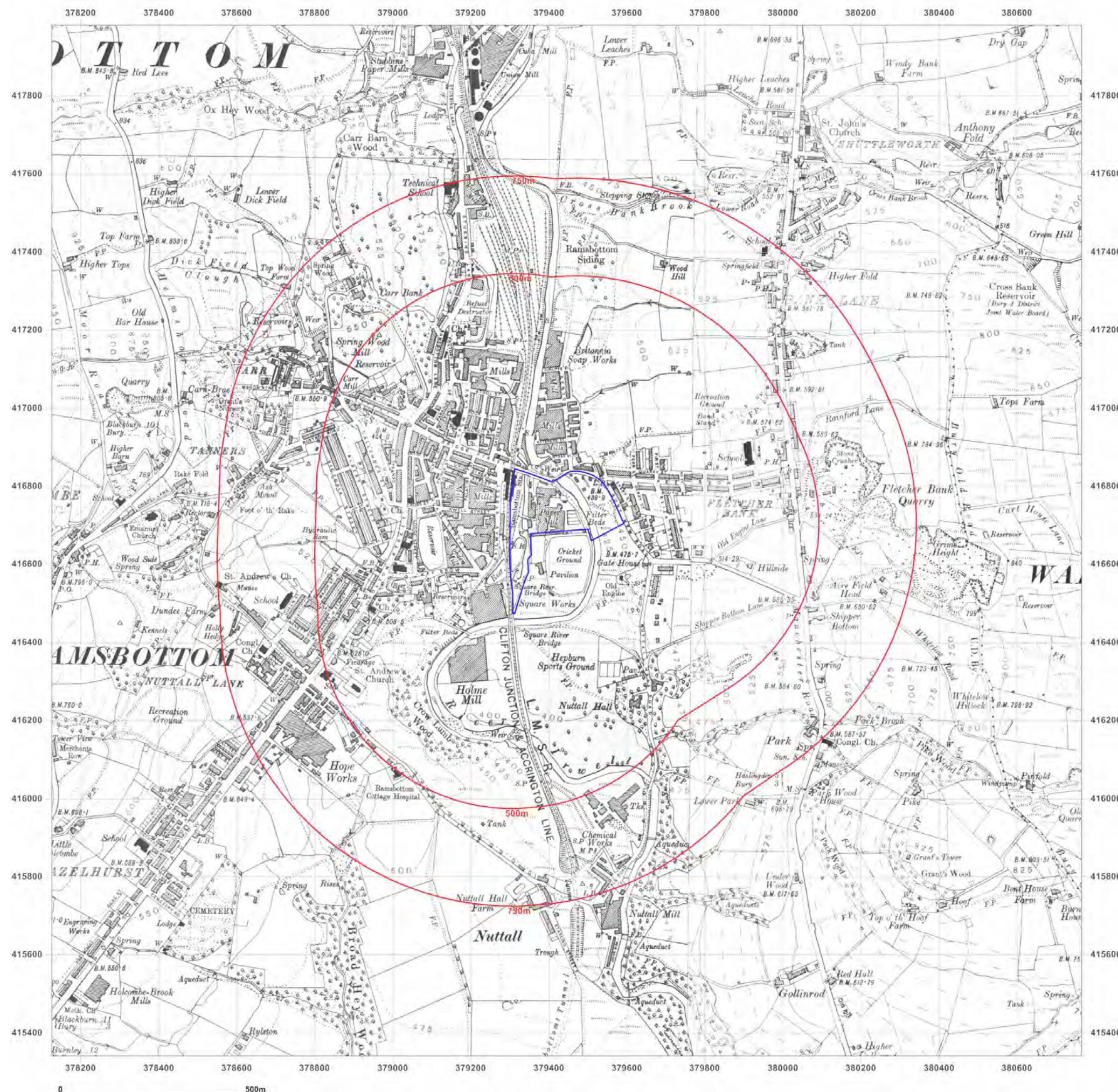


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Site Details:

HOLCOMBE MILL, BRIDGE STREET, RAMSBOTTOM, BLO OBS

Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: County Series

Map date: 1938

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1847
 Revised 1938
 Edition N/A
 Copyright N/A
 Levelled N/A

Surveyed 1848
 Revised 1938
 Edition N/A
 Copyright N/A
 Levelled N/A

Surveyed 1848
 Revised 1938
 Edition N/A
 Copyright N/A
 Levelled N/A

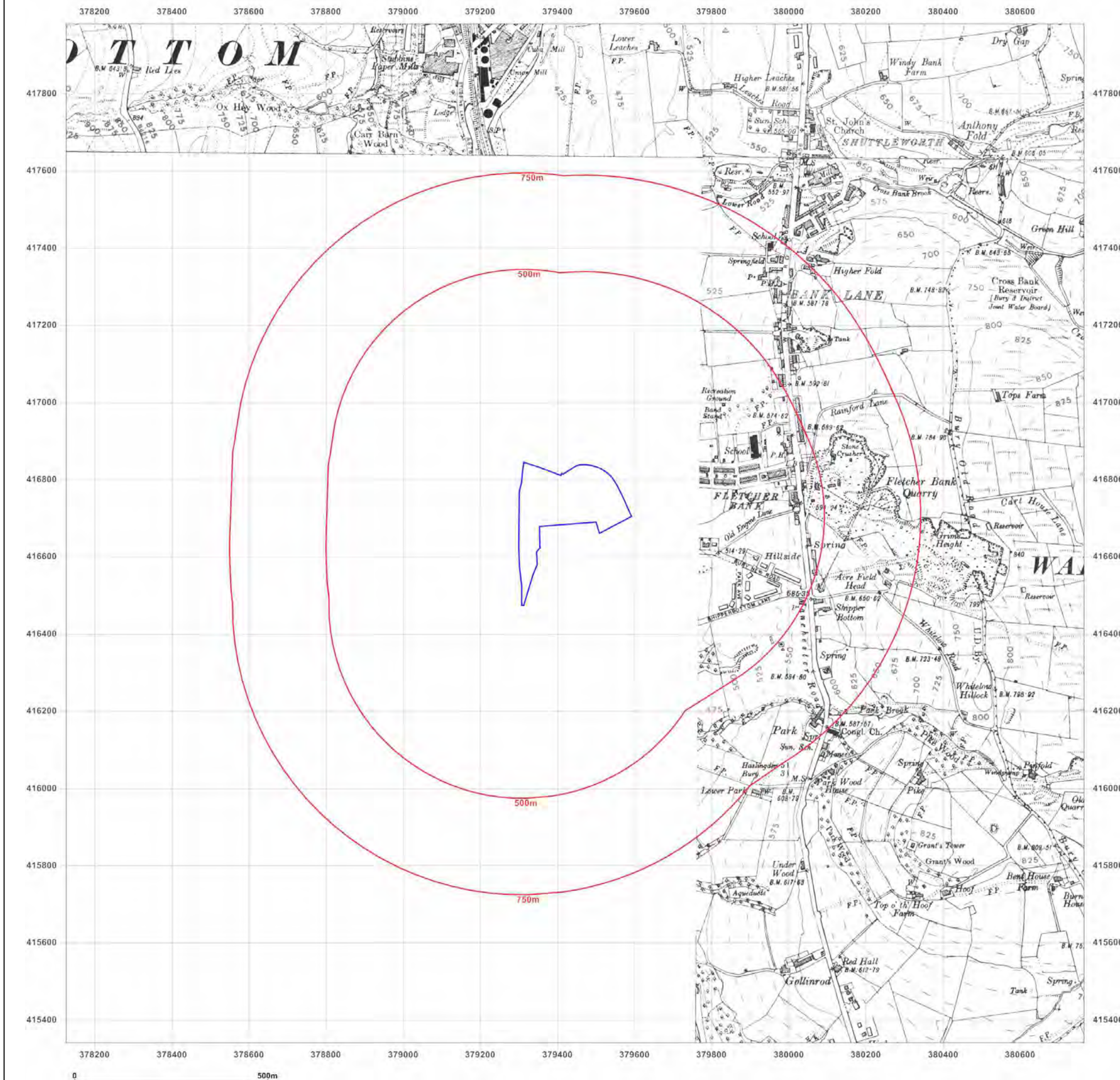


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Site Details:

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STREET, RAMSBOTTOM, BLO
OBS

Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: County Series

Map date: 1948

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1948
Revised 1948
Edition N/A
Copyright N/A
Levelled N/A

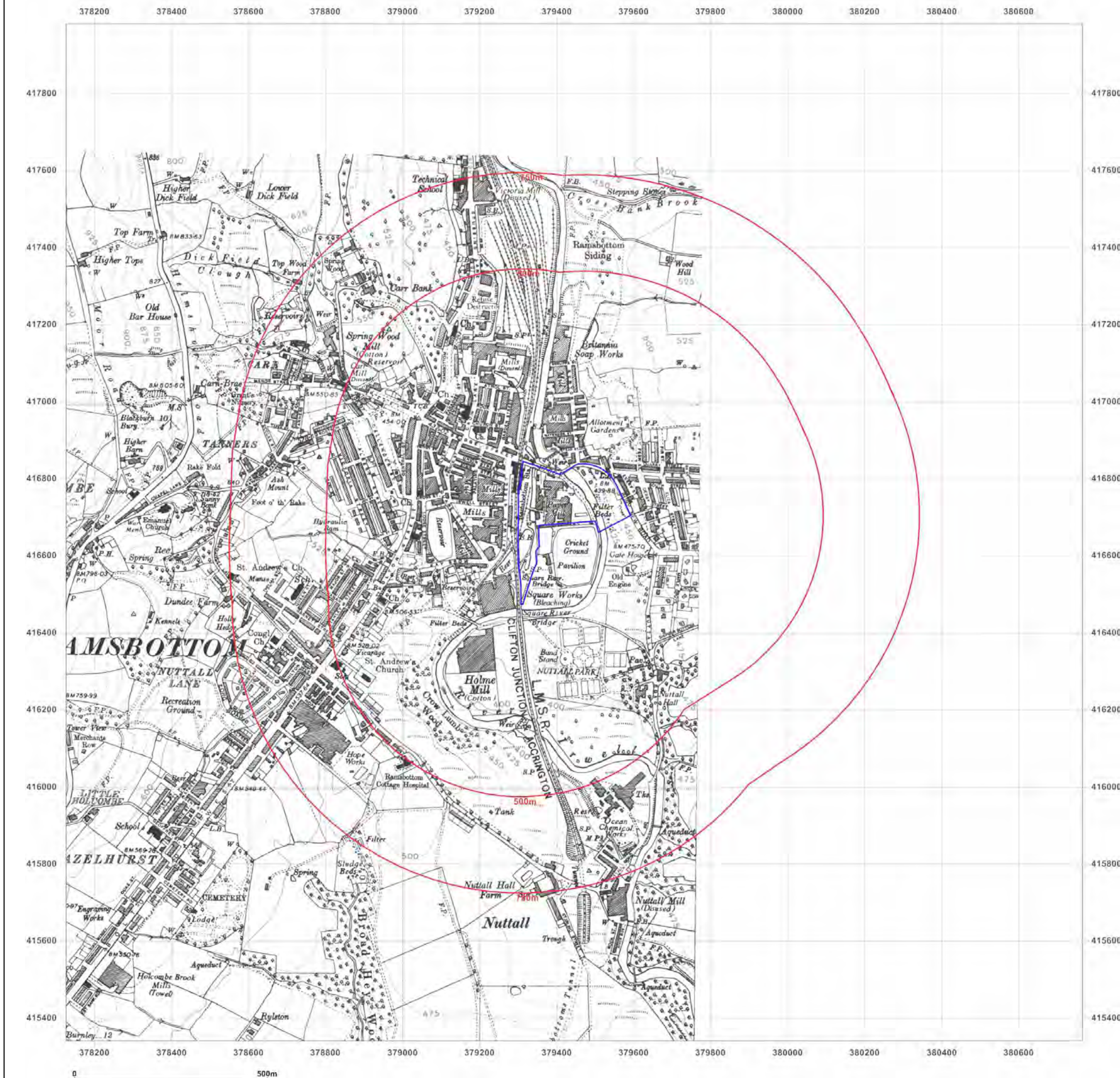


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OBS

Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: Provisional

Map date: 1949

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1949
Revised 1949
Edition N/A
Copyright N/A
Levelled N/A

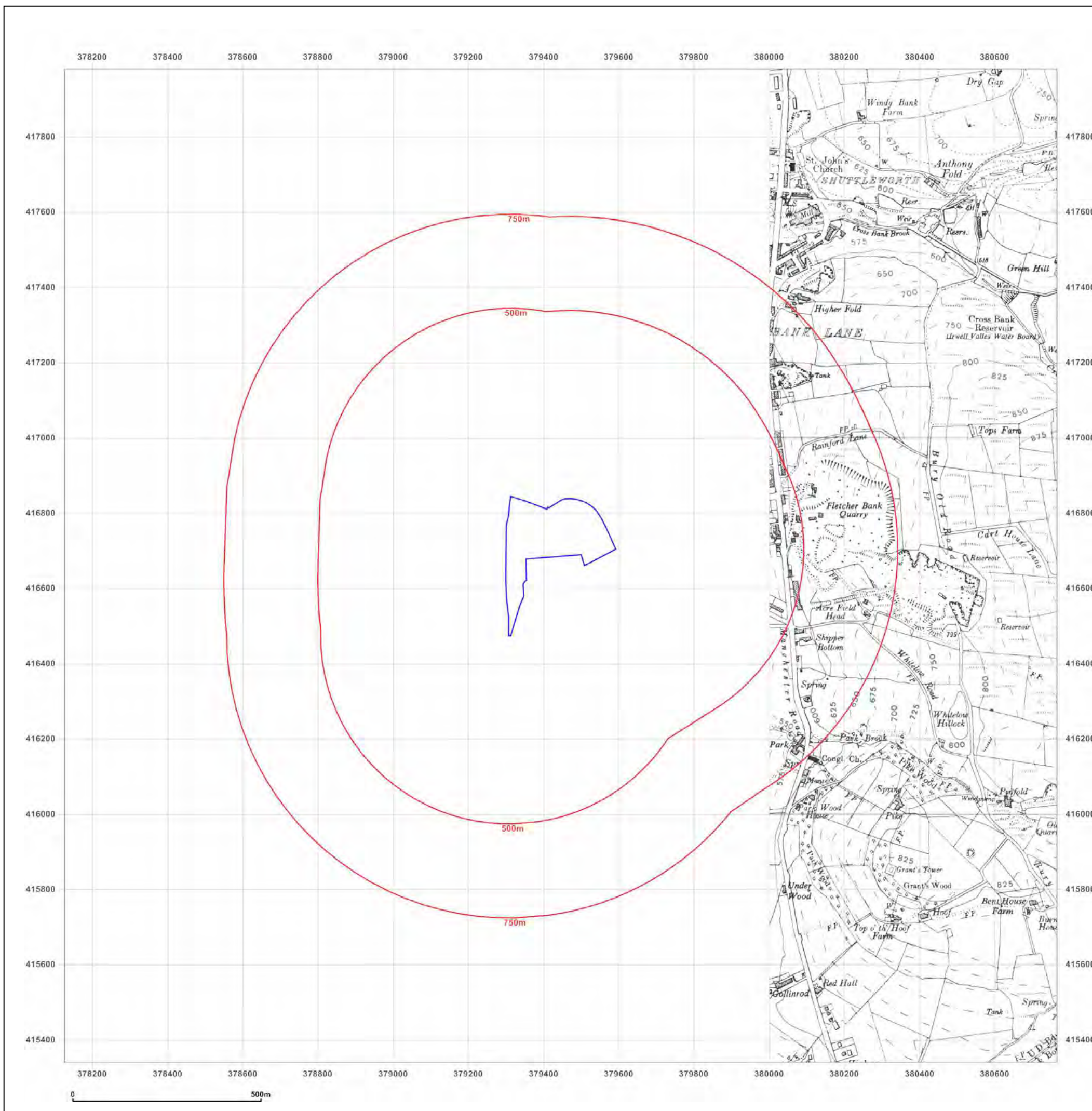


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Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: Provisional

Map date: 1967-1968

Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1968
 Revised 1968
 Edition N/A
 Copyright N/A
 Levelled N/A

Surveyed 1967
 Revised 1967
 Edition N/A
 Copyright N/A
 Levelled N/A

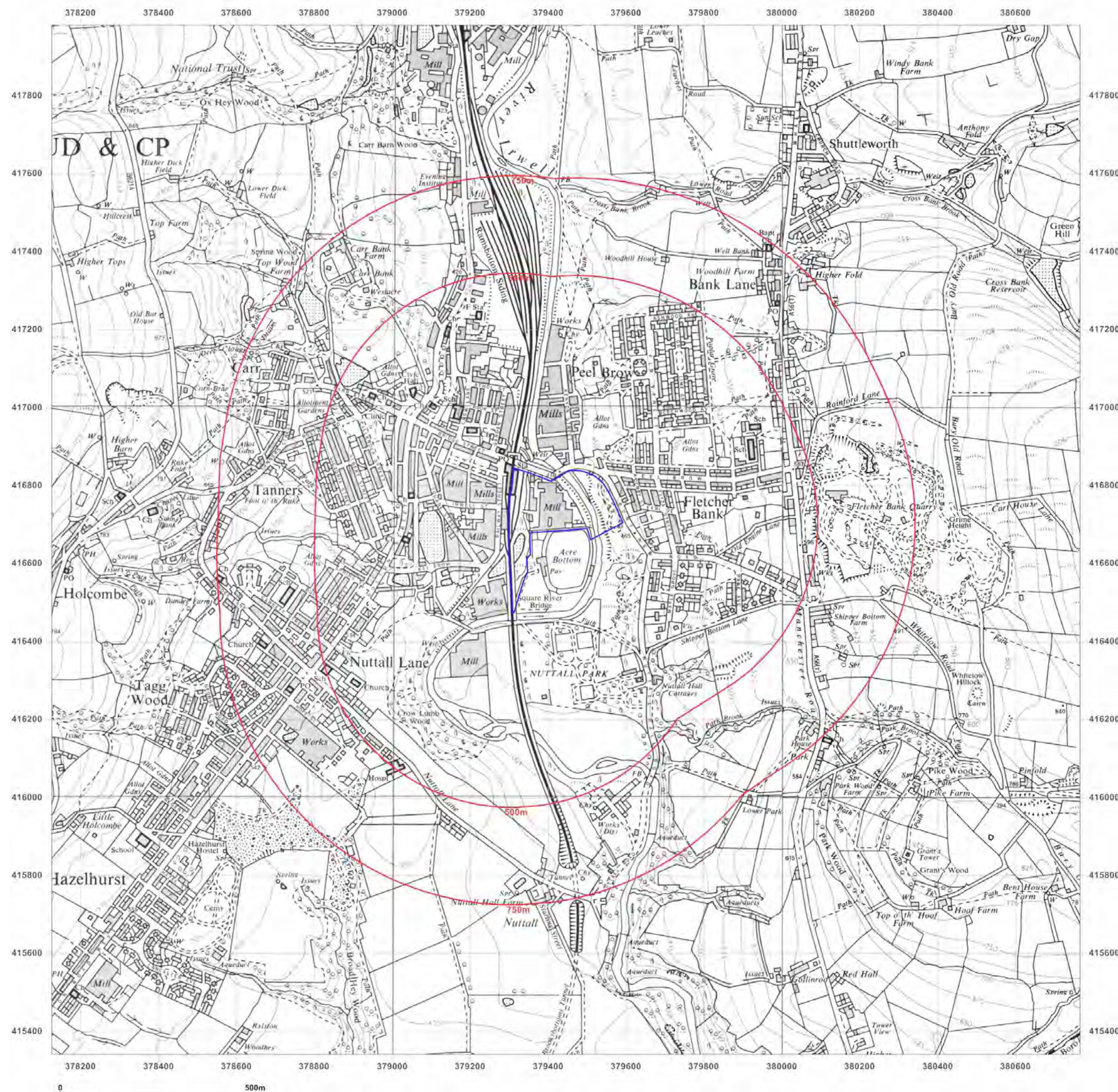


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OBS

Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: National Grid

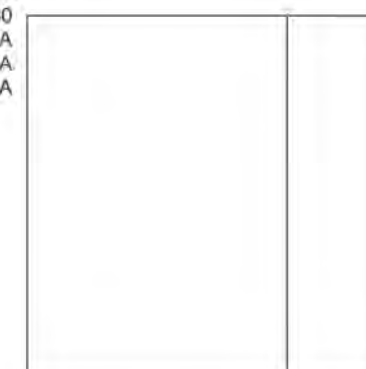
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Printed at: 1:10,000



Surveyed 1978
Revised 1980
Edition N/A
Copyright N/A
Levelled N/A

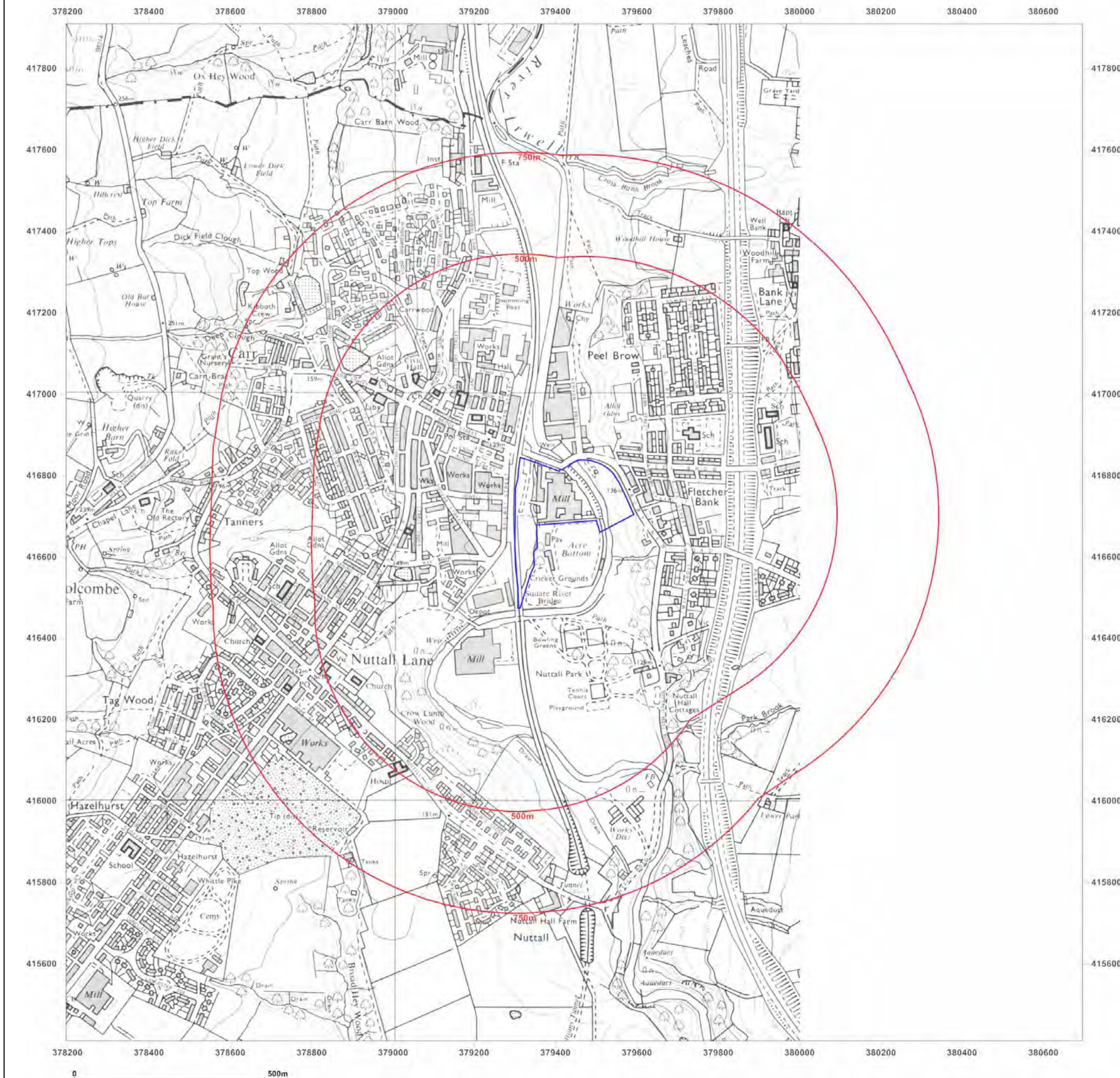


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Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: National Grid

Map date: 1987

Scale: 1:10,000

Printed at: 1:10,000



Surveyed 1962
 Revised 1987
 Edition N/A
 Copyright N/A
 Levelled N/A

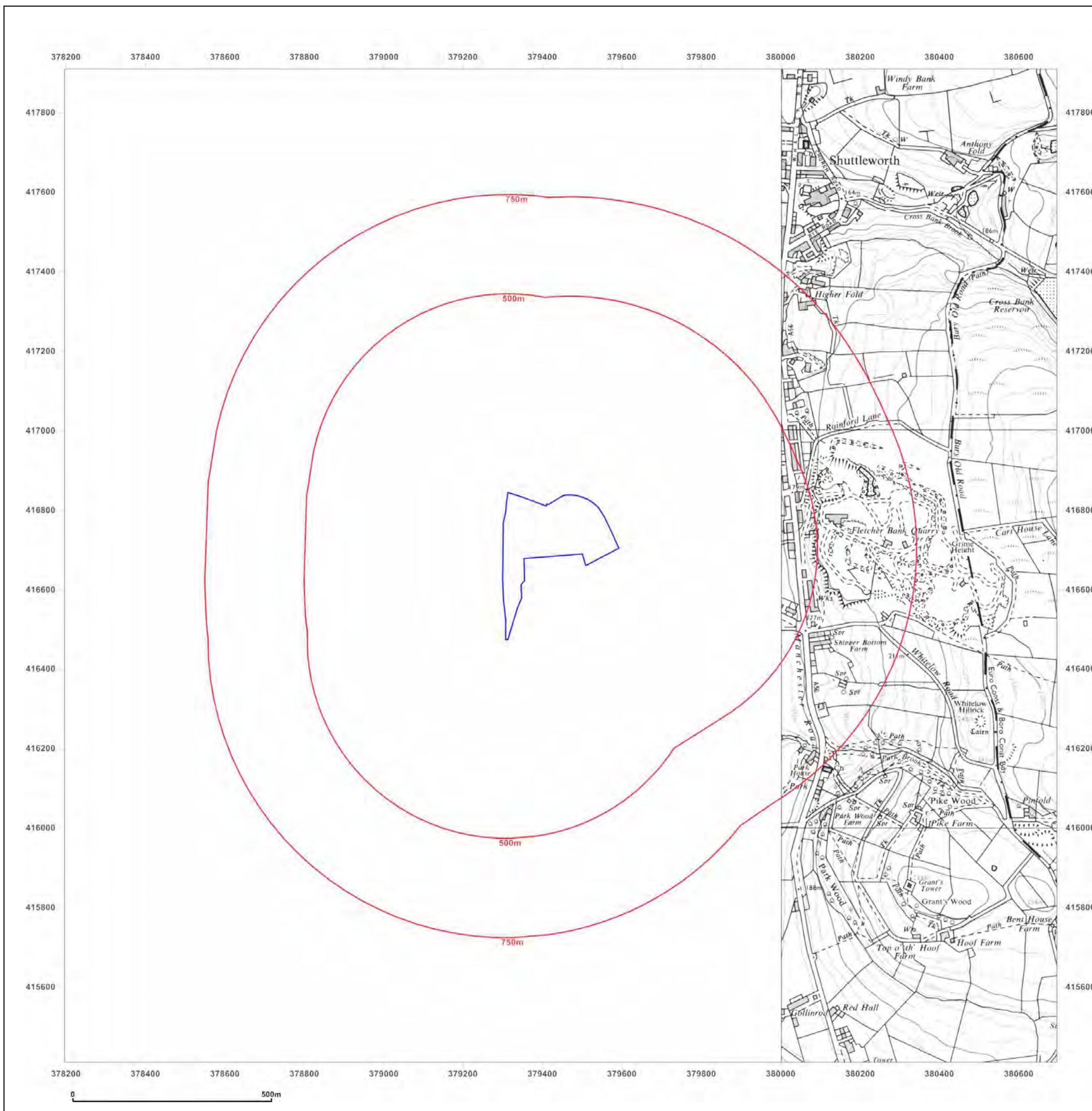


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OBS

Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: National Grid

Map date: 1992

Scale: 1:10,000

Printed at: 1:10,000



Surveyed 1962
Revised 1992
Edition N/A
Copyright N/A
Levelled N/A

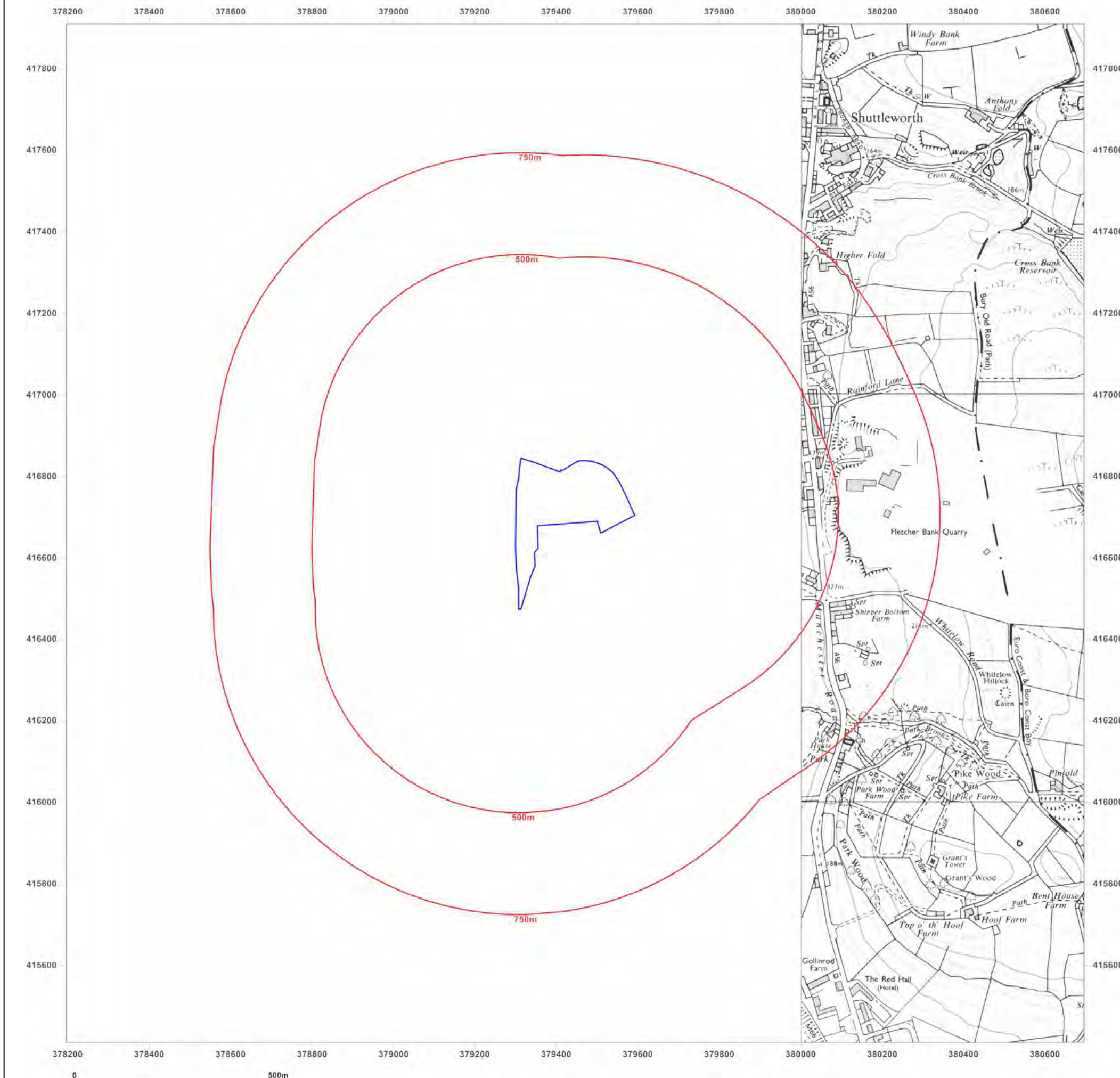


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Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: National Grid

Map date: 2010

Scale: 1:10,000

Printed at: 1:10,000

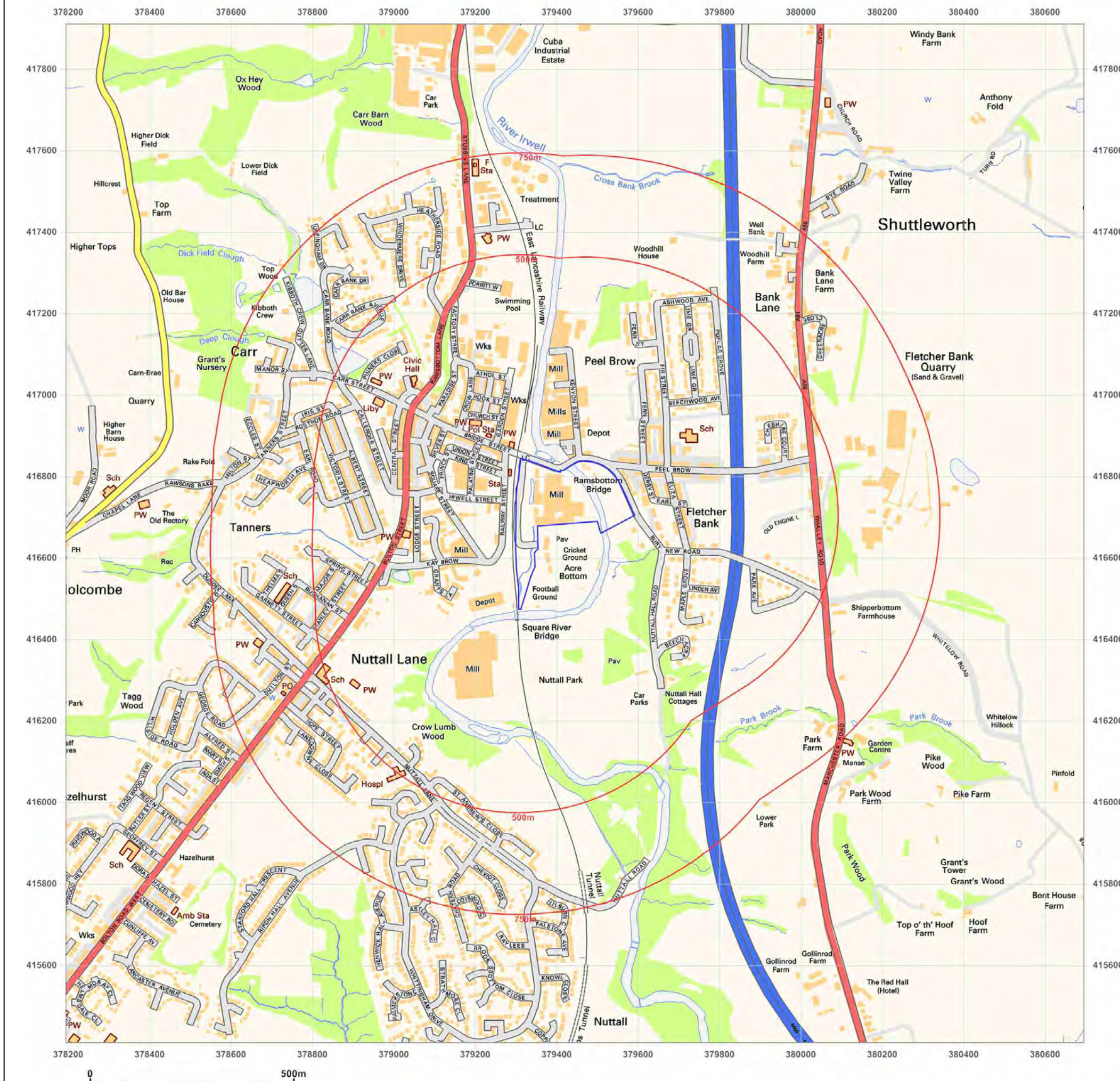


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Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: National Grid

Map date: 2014

Scale: 1:10,000

Printed at: 1:10,000

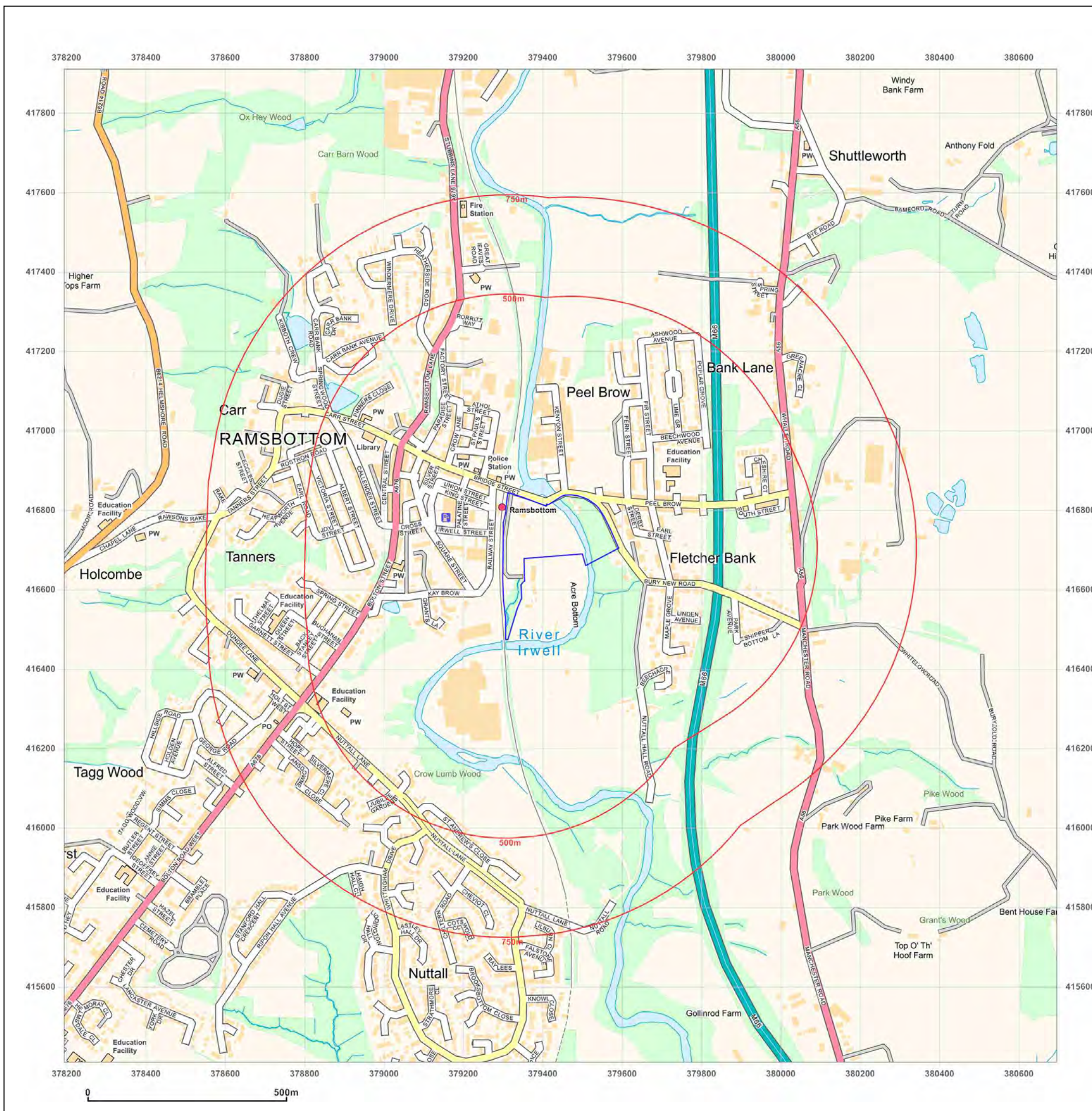


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Site Details:

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Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: County Series

Map date: 1891

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1891
Revised 1891
Edition N/A
Copyright N/A
Levelled N/A

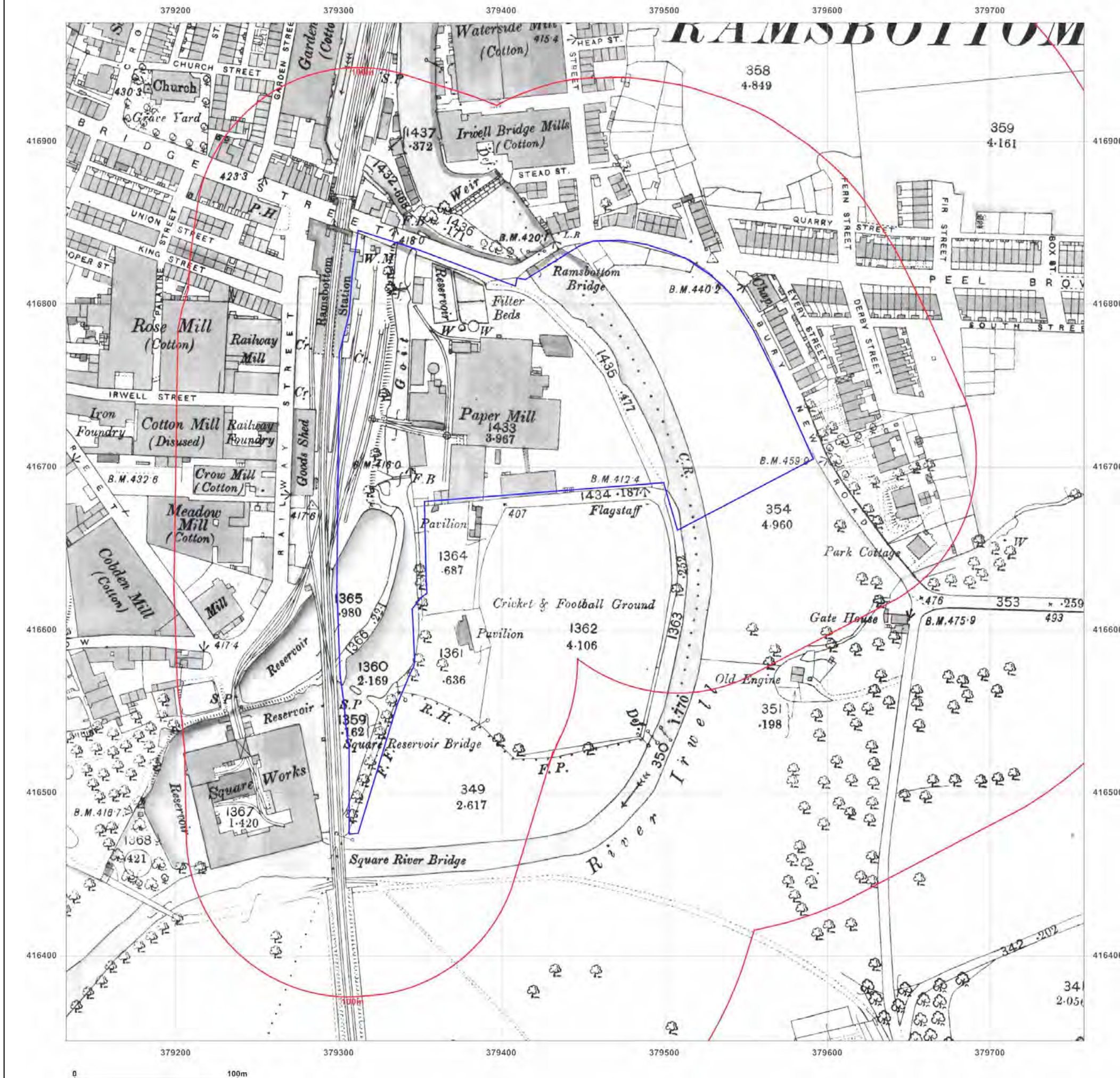


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Site Details:

HOLCOMBE MILL, BRIDGE
STREET, RAMSBOTTOM, BL0
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Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: County Series Town Plan

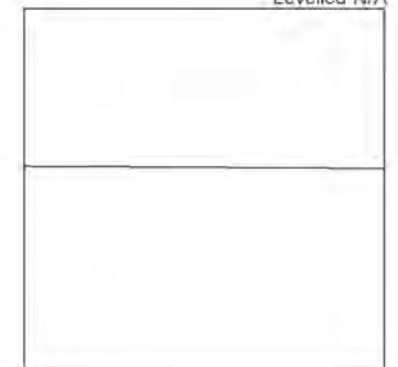
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Scale: 1:500

Printed at: 1:1,000



Surveyed 1892
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A



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Site Details:

HOLCOMBE MILL, BRIDGE STREET, RAMSBOTTOM, BLO OBS

Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: County Series

Map date: 1929

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1929
Revised 1929
Edition N/A
Copyright N/A
Levelled N/A

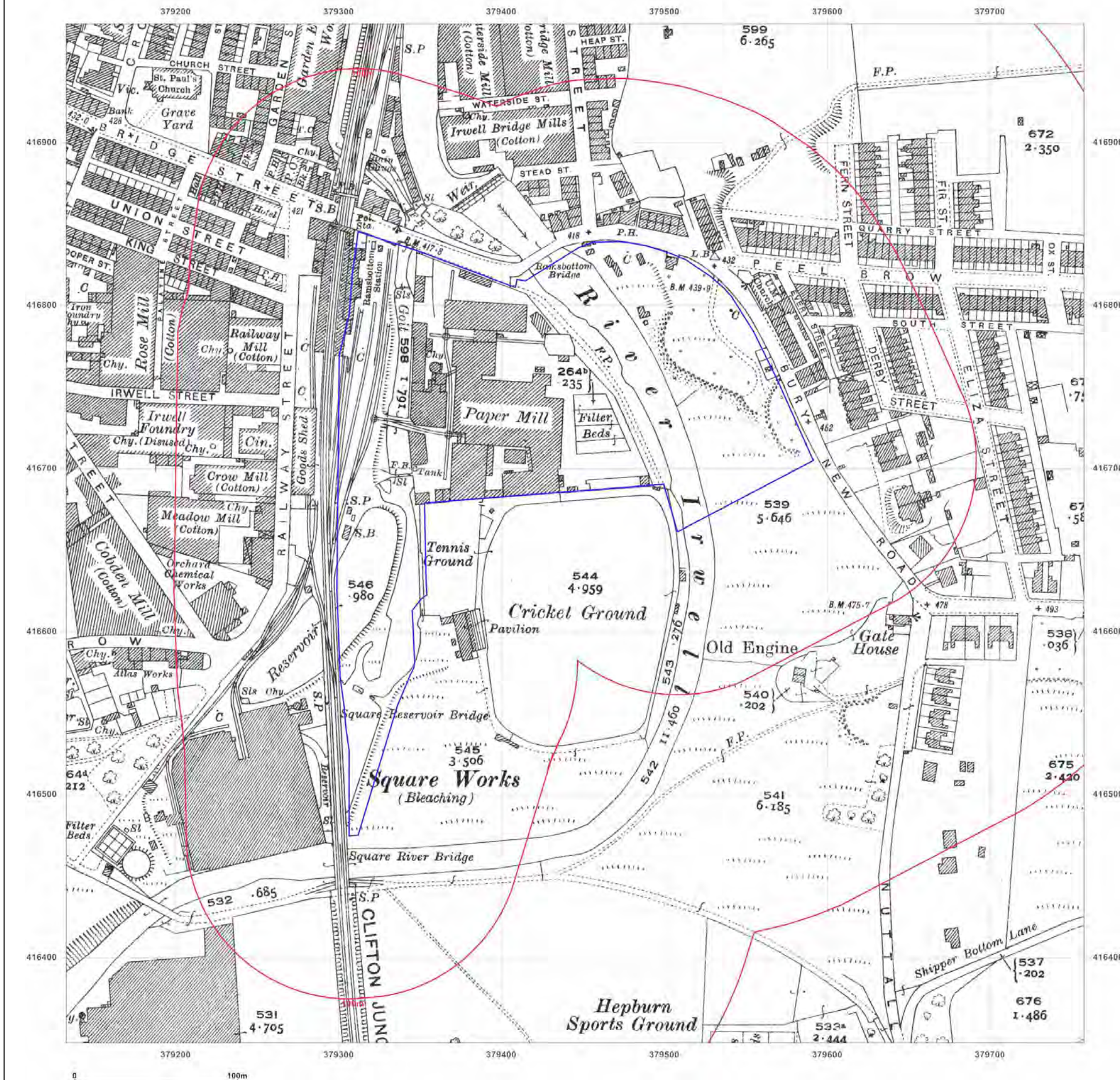


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Site Details:

HOLCOMBE MILL, BRIDGE STREET, RAMSBOTTOM, BLO
OBS

Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: County Series

Map date: 1938

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1938
Revised 1938
Edition N/A
Copyright N/A
Levelled N/A

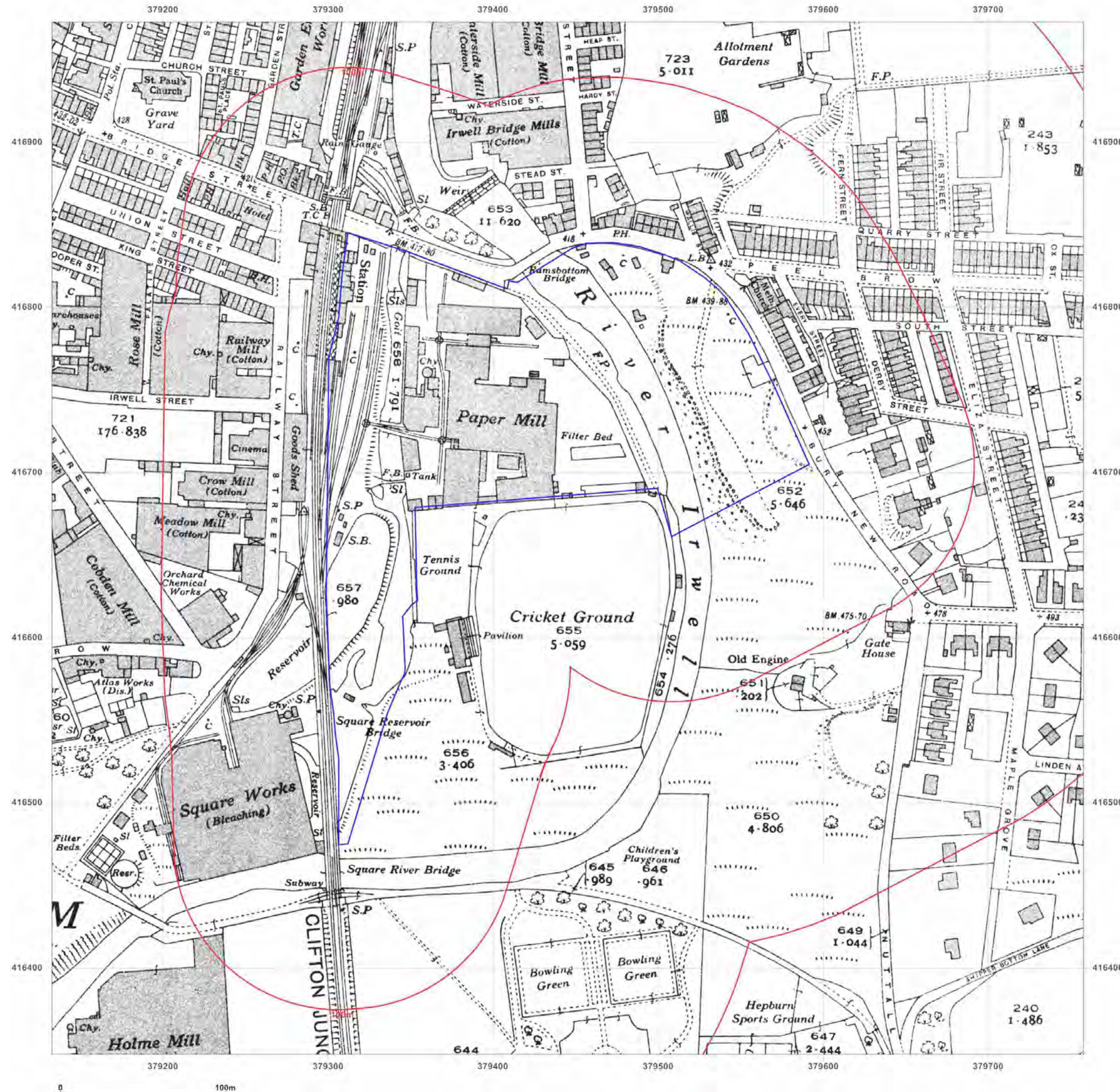


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Site Details:

HOLCOMBE MILL, BRIDGE STREET, RAMSBOTTOM, BLO
OBS

Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: National Grid

Map date: 1964

Scale: 1:2,500

Printed at: 1:2,500



Surveyed N/A
Revised N/A
Edition N/A
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Site Details:

HOLCOMBE MILL, BRIDGE STREET, RAMSBOTTOM, BLO OBS

Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: National Grid

Map date: 1978

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1977
 Revised 1977
 Edition N/A
 Copyright 1978
 Levelled 1960

Surveyed 1978
 Revised 1978
 Edition N/A
 Copyright 1978
 Levelled 1962

Surveyed 1977
 Revised 1977
 Edition N/A
 Copyright 1978
 Levelled 1957

Surveyed 1978
 Revised 1978
 Edition N/A
 Copyright 1978
 Levelled 1962

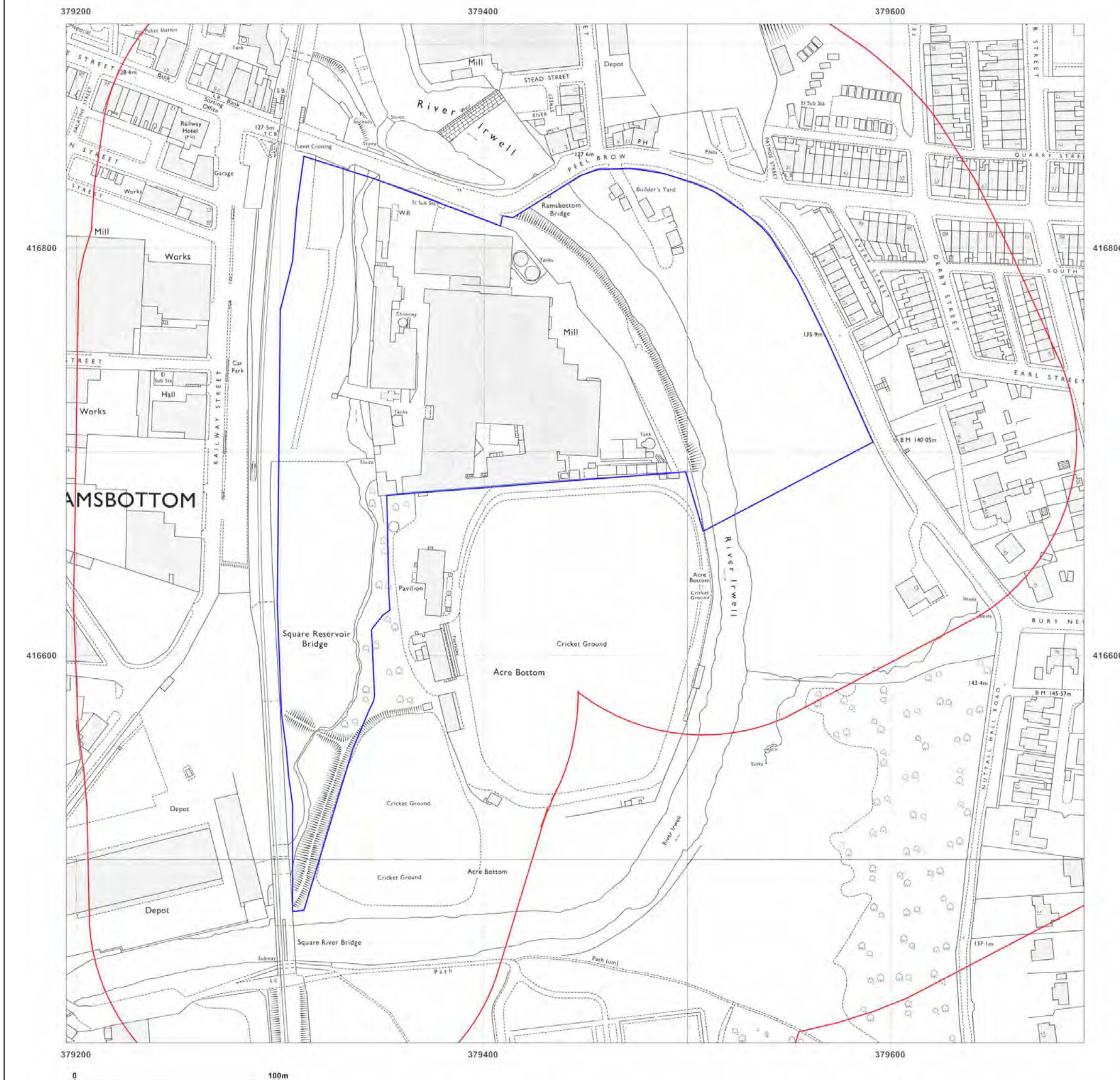


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Site Details:

HOLCOMBE MILL, BRIDGE STREET, RAMSBOTTOM, BLO
OBS

Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: National Grid

Map date: 1989-1992

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1992
Revised N/A
Edition N/A
Copyright 1992
Levelled N/A

Surveyed 1960
Revised 1978
Edition N/A
Copyright 1989
Levelled 1960

Surveyed 1992
Revised N/A
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Surveyed 1992
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Copyright N/A
Levelled N/A

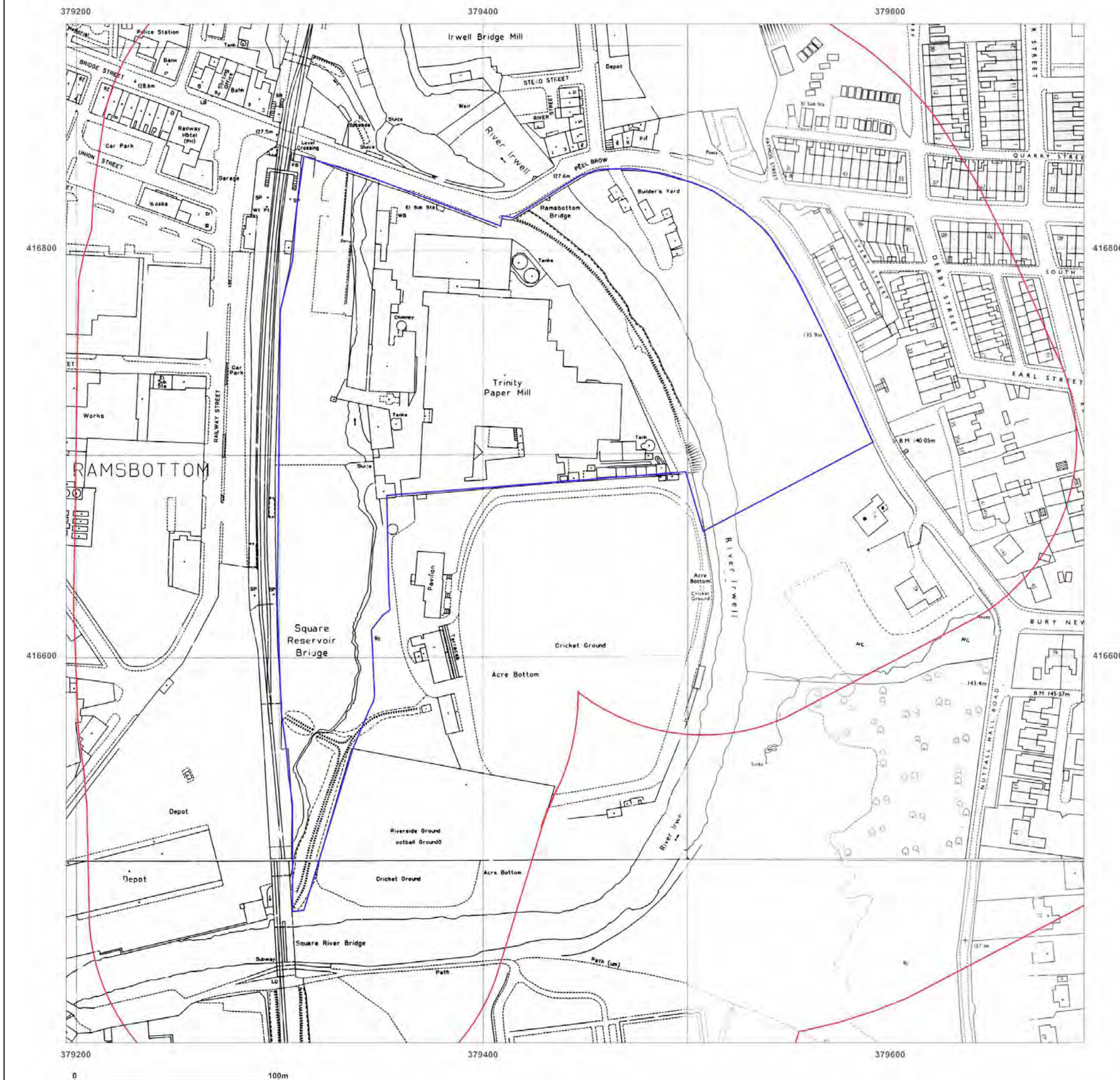


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Site Details:

HOLCOMBE MILL, BRIDGE STREET, RAMSBOTTOM, BLO
OBS

Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: National Grid

Map date: 1992

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1992
Revised N/A
Edition N/A
Copyright 1992
Levelled N/A

Surveyed 1992
Revised 1992
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1992
Revised N/A
Edition N/A
Copyright 1992
Levelled N/A



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Site Details:

HOLCOMBE MILL, BRIDGE STREET, RAMSBOTTOM, BLO OBS

Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: National Grid

Map date: 1992

Scale: 1:1,250

Printed at: 1:2,000



Surveyed N/A
 Revised N/A
 Edition N/A
 Copyright N/A
 Levelled N/A

Surveyed N/A
 Revised N/A
 Edition N/A
 Copyright 1992
 Levelled N/A



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Site Details:

HOLCOMBE MILL, BRIDGE STREET, RAMSBOTTOM, BLO
OBS

Client Ref: BG3315
Report Ref: GS-6015652
Grid Ref: 379445, 416660

Map Name: National Grid

Map date: 1994

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1994
Revised N/A
Edition N/A
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Levelled N/A



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APPENDIX D

- (i) GroundSure Report
- (ii) Coal Authority Report

The map highlights any specific surface or subsurface features within or near to the boundary of the site.

Key

Approximate position of the enquiry boundary shown 

Outcrop (Conjectured) 

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